

# **SPP Balanced Portfolio Report**

MAINTAINED BY  
Engineering/Planning

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## **Executive Summary**

The Balanced Portfolio is an SPP strategic initiative to develop a cohesive grouping of economic upgrades that benefit the SPP region and allocates the cost of those upgrades regionally. Projects in the Balanced Portfolio include transmission upgrades of 345 kV projects that will provide customers with potential savings that exceed project costs. These economic upgrades are intended to reduce congestion on the SPP transmission system, resulting in savings in generation production costs. Economic upgrades may provide other benefits to the power grid; i.e., increasing reliability and lowering required reserve margins, deferring reliability upgrades, and providing environmental benefits due to more efficient operation of assets and greater utilization of renewable resources.

The Cost Allocation Working Group (CAWG), of the Regional State Committee (RSC), has worked diligently over an extended period through a stakeholder process to identify upgrades for inclusion in a portfolio that will provide a balanced benefit to customers over the specified ten-year payback period. “Balanced” is defined by the SPP Regional Tariff in Attachment O, such that for each Zone, the sum of the benefits of the potential Balanced Portfolio must equal or exceed the sum of the costs. The Tariff allows for the adjustment of revenue requirements to achieve balance for the portfolio.

After development and review of the Balanced Portfolio, the CAWG endorsed Portfolio 3E “Adjusted” (without Chesapeake, without Reno Co – Summit). Portfolio 3E “Adjusted” provides a significant benefit vs. cost to the SPP region, and would require lower transfer requirements necessary to achieve balance. The CAWG along with the Economics Modeling and Methods Task Force (“EMMTF”, now called the Economic Studies Working Group “ESWG”) reviewed and approved the study assumptions used in the analysis of the Balanced Portfolio. These assumptions are listed in the appendix. Portfolio 3E “Adjusted” contains a diverse group of 345kV transmission projects addressing many of the top SPP flowgates. The projects associated with Portfolio 3E “Adjusted” are as follows:

- Tuco – Woodward District EHV, \$229M
- Iatan – Nashua, \$54M
- Swissvale – Stilwell tap at W. Gardner, \$2M
- Spearville – Knoll – Axtell, \$236M
- Sooner – Cleveland, \$34M
- Seminole – Muskogee, \$129M
- Anadarko Tap, \$8M
  
- Total E&C Costs: \$692M

The CAWG endorsed Balanced Portfolio was presented to the Markets and Operations Policy Committee (MOPC) on April 15<sup>th</sup>, 2009. The MOPC reviewed and discussed the portfolio options and the impact on the SPP footprint. After discussion, the MOPC endorsed the Balanced Portfolio 3E “Adjusted” pending issuance of the final report, according to SPP Tariff.

Portfolio 3E “Adjusted” provides substantial benefit to customers in the SPP footprint. Based on a 1,000 kWh/month usage of a residential customer, the Portfolio provides an estimated net benefit of \$0.78/month (\$1.66/mo on average versus a cost of \$0.88/mo). The existing transmission revenue requirements for the SPP region in this typical monthly residential customer bill are estimated to be \$7.58.

## SPP Balanced Portfolio Report

The following table demonstrates the full, 10 year portfolio analysis including reliability costs and benefits. These costs and benefits accrue in the years that the portfolio projects impact the reliability plan.

|                                     |                 | Million of Dollars |                     |                          |                  |                     |        |
|-------------------------------------|-----------------|--------------------|---------------------|--------------------------|------------------|---------------------|--------|
|                                     |                 | Total Benefit      | Incremental Benefit | Total Cost SPP OATT ATRR | Reliability Cost | Cost (E&C) \$       | 692    |
| <b>Portfolio 3-E<br/>"Adjusted"</b> |                 |                    |                     |                          |                  |                     |        |
| 2012                                |                 | \$ 131.2           |                     | \$ 93.73                 | \$ 0.03          | \$ 93.7             |        |
| 2017                                |                 | \$ 193.2           | \$ 12.4             | \$ 93.73                 | \$ 2.53          | Total Annual        |        |
| 2022                                |                 | \$ 239.0           | \$ 9.2              | \$ 93.73                 | \$ 2.53          | \$ 93.8             |        |
| Year                                | 8.00%<br>Year # | Discount<br>Factor | Annual<br>Benefits  | Discounted<br>Benefits   | Annual<br>Costs  | Discounted<br>Costs | B/C    |
| 2012                                | 1               | 1.00               | \$ 131              | \$ 131                   | \$ 94            | \$ 94               | 1.40   |
| 2013                                | 2               | 0.93               | \$ 144              | \$ 133                   | \$ 94            | \$ 87               | 1.53   |
| 2014                                | 3               | 0.86               | \$ 156              | \$ 134                   | \$ 94            | \$ 80               | 1.66   |
| 2015                                | 4               | 0.79               | \$ 168              | \$ 134                   | \$ 94            | \$ 74               | 1.80   |
| 2016                                | 5               | 0.74               | \$ 181              | \$ 133                   | \$ 94            | \$ 69               | 1.93   |
| 2017                                | 6               | 0.68               | \$ 193              | \$ 131                   | \$ 96            | \$ 66               | 2.01   |
| 2018                                | 7               | 0.63               | \$ 202              | \$ 128                   | \$ 96            | \$ 61               | 2.10   |
| 2019                                | 8               | 0.58               | \$ 212              | \$ 123                   | \$ 96            | \$ 56               | 2.20   |
| 2020                                | 9               | 0.54               | \$ 221              | \$ 119                   | \$ 96            | \$ 52               | 2.29   |
| 2021                                | 10              | 0.50               | \$ 230              | \$ 115                   | \$ 96            | \$ 48               | 2.39   |
| 2022                                | 11              | 0.46               | \$ 239              | \$ 111                   | \$ 96            | \$ 45               | 2.48   |
| <b>Ten Year Totals</b>              |                 | Yrs 1-10           | 7.25                | \$ 1,837                 | \$ 1,281         | \$ 950              | \$ 687 |
| <b>Per Year Levelized</b>           |                 |                    |                     | \$ 177                   |                  | \$ 95               | 1.87   |

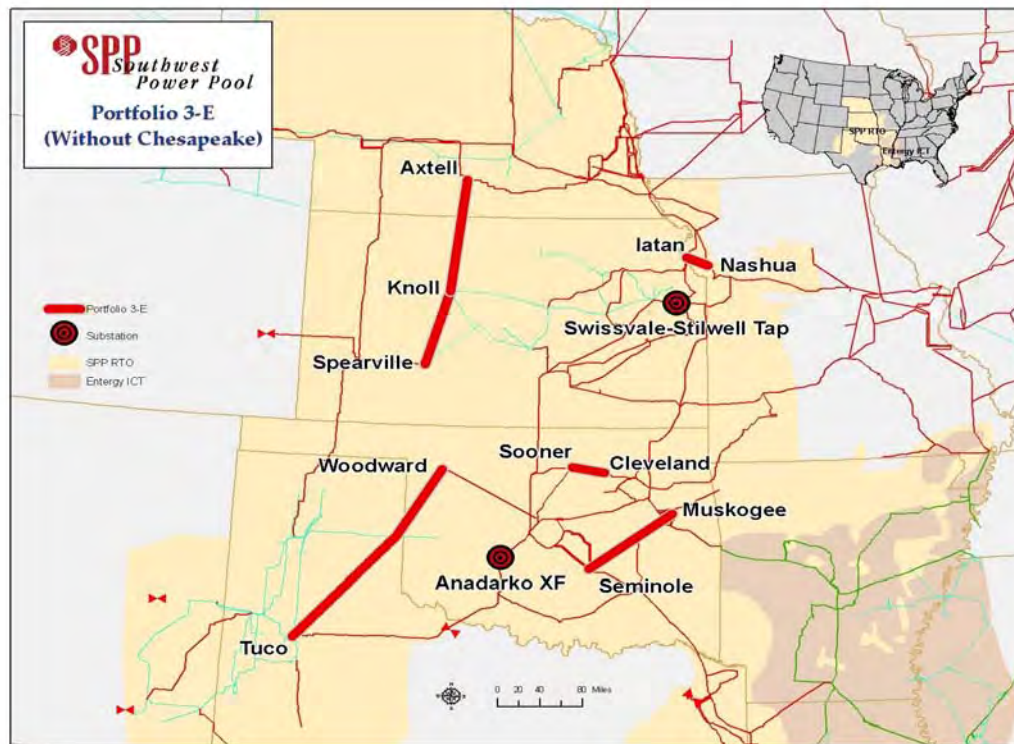
The table below outlines the benefits by zones for the 10 year analysis of Portfolio 3E "adjusted".

**Attachment H Transfer Adjustments - Portfolio 3E "Adjusted" - Annualized**

| #            | Zone | Portfolio Benefits | Portfolio Costs | Zonal ATRR Transfers Out (Col. 5 Attach H) | Regional Allocation of Zonal ATRR Transfers | Net of Zonal Transfers and Transfer Allocation | Net Benefit | B/C         |
|--------------|------|--------------------|-----------------|--------------------------------------------|---------------------------------------------|------------------------------------------------|-------------|-------------|
| 1            | AEPW | \$30.9             | \$21.3          | \$0.0                                      | \$7.0                                       | \$7.0                                          | \$2.6       | 1.1         |
| 2            | EMDE | (\$0.3)            | \$2.5           | (\$3.7)                                    | \$0.8                                       | (\$2.8)                                        | \$0.0       | 1.0         |
| 3            | GRDA | \$0.9              | \$1.9           | (\$1.6)                                    | \$0.6                                       | (\$1.0)                                        | \$0.0       | 1.0         |
| 4            | KCPL | \$8.4              | \$7.3           | (\$1.3)                                    | \$2.4                                       | \$1.1                                          | \$0.0       | 1.0         |
| 5            | MIDW | \$12.8             | \$0.7           | \$0.0                                      | \$0.2                                       | \$0.2                                          | \$11.9      | 14.1        |
| 6            | MIPU | (\$1.3)            | \$3.8           | (\$6.4)                                    | \$1.3                                       | (\$5.2)                                        | \$0.0       | 1.0         |
| 7            | MKEC | \$11.8             | \$1.1           | \$0.0                                      | \$0.3                                       | \$0.3                                          | \$10.4      | 8.3         |
| 8            | OKGE | \$26.6             | \$13.4          | \$0.0                                      | \$4.4                                       | \$4.4                                          | \$8.7       | 1.5         |
| 9            | SPRM | (\$0.1)            | \$1.5           | (\$2.1)                                    | \$0.5                                       | (\$1.6)                                        | \$0.0       | 1.0         |
| 10           | SUNC | \$3.7              | \$1.0           | \$0.0                                      | \$0.3                                       | \$0.3                                          | \$2.3       | 2.7         |
| 11           | SWPS | \$56.1             | \$10.9          | \$0.0                                      | \$3.6                                       | \$3.6                                          | \$41.5      | 3.9         |
| 12           | WEFA | \$8.0              | \$3.0           | \$0.0                                      | \$1.0                                       | \$1.0                                          | \$4.0       | 2.0         |
| 13           | WRI  | \$14.2             | \$11.0          | (\$0.4)                                    | \$3.6                                       | \$3.2                                          | \$0.0       | 1.0         |
| 14           | NPPD | \$5.5              | \$7.6           | (\$4.6)                                    | \$2.5                                       | (\$2.1)                                        | \$0.0       | 1.0         |
| 15           | OPPD | \$2.3              | \$5.9           | (\$5.6)                                    | \$1.9                                       | (\$3.6)                                        | \$0.0       | 1.0         |
| 16           | LES  | (\$3.1)            | \$1.8           | (\$5.5)                                    | \$0.6                                       | (\$4.9)                                        | \$0.0       | 1.0         |
| <b>Total</b> |      | <b>\$176</b>       | <b>\$95</b>     | <b>-\$31</b>                               | <b>\$31</b>                                 | <b>\$0</b>                                     | <b>\$81</b> | <b>1.86</b> |



**Portfolio 3-E “Adjusted”**



## Introduction

The Balanced Portfolio is an SPP strategic initiative to develop a cohesive grouping of economic upgrades that benefit the SPP region and allocates the cost of those upgrades regionally. Projects in the Balanced Portfolio include transmission upgrades of 345 kV\* projects that will provide customers with potential savings that exceed project costs. These economic upgrades are intended to reduce congestion on the SPP transmission system, resulting in savings in generation production costs. Economic upgrades may provide other benefits to the power grid; i.e. increasing reliability and lowering reserve margins, deferring reliability upgrades, and providing environmental benefits due to more efficient operation of assets and greater utilization of renewable resources.

The Cost Allocation Working Group (CAWG), of the Regional State Committee (RSC), has worked diligently over an extended period through a stakeholder process to identify upgrades for inclusion in a portfolio that will provide a balanced benefit to customers over the specified ten-year payback period. “Balanced” is defined by the SPP Regional Tariff in Attachment O, such that for each Zone, the sum of the benefits of the potential Balanced Portfolio must equal or exceed the sum of the costs. The Tariff allows for the adjustment of revenue requirements to achieve balance for the portfolio<sup>†</sup>.

### Economic Benefits: Adjusted Production Cost

Balanced Portfolio development began with an economic screening of projects identified by stakeholders and SPP staff. After receiving stakeholder feedback, SPP staff compiled a list of economic projects with potential for a positive return.

The first step is to conduct an economic analysis individually on each project considered for the Balanced Portfolio. This process is done by determining the adjusted production cost metric for each project in the screen. Adjusted production cost is defined as:

$$\text{Adj Prod Cost} = \text{Production Cost} - \text{Revenue from Sales} + \text{Cost of Purchases}$$

Where:

$$\text{Revenues from Sales} = \text{Export} \times \text{Zonal LMP}_{\text{Gen Weighted}}$$

and

$$\text{Cost of Purchases} = \text{Import} \times \text{Zonal LMP}_{\text{Load Weighted}}$$

Production cost for each unit is based on fuel, variable O&M costs, environmental costs and both scheduled and forced outages<sup>‡</sup>. Adjusted production cost savings account for the economy purchase and sale of power in the modeling footprint. This is important when benefits are being calculated for zones within the SPP as well as in differentiating overall benefits from the portfolio compared to the benefits accruing to SPP members.

To calculate adjustments to production costs due to an economic transmission project, commercial production cost analysis software is used to estimate hourly unit commitment and dispatch of modeled

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\* Upgrades of voltages less than 345 kV can be included if needed to deliver the benefits of the extra high voltage (EHV) upgrade, where the cost of the lower voltage facilities does not exceed the cost of the EHV facilities.

† The Tariff allows for deficient zones to be balanced by transferring a portion of the Base Plan Zonal Annual Transmission Revenue Requirement and/or the Zonal Annual transmission Revenue Requirement from the deficient Zone(s) to the Balanced Portfolio Region-wide Annual Transmission Revenue Requirement.

‡ SPP is currently using probabilistic techniques to simulate a single draw of outages to simulate forced outages

generators within a context of a modeled transmission system and load delivery points. The commitment and dispatch of the generators is constrained by the software to ensure that no overloads will occur on any monitored transmission element, typically referred to as the NERC book of flowgates, but can include additional congestion points of interest. The software produces a security constrained economic dispatch and unit commitment.

Adjusted Production Cost was the only benefit metric used in the economic analysis. There are other potential benefits which have not been directly quantified such as lowering reserve margins, reducing losses, and providing environmental benefits. For the purpose of this study, these benefit metrics are not used to determine overall portfolio benefits to the region.

## Balanced Portfolio Development

The following table provides a timeline for the development of the various candidate portfolios that were developed by the SPP staff and presented during the regularly scheduled CAWG meetings

**Table: CAWG Timeline for Balanced Portfolio Development**

| Months/Year   | Key Discussions at CAWG                                        |
|---------------|----------------------------------------------------------------|
| Aug-Nov 2007  | Screening of Candidate Upgrades for Portfolio                  |
| Feb –Apr 2008 | Initial Portfolios 1, 2, 3 and 4                               |
| May 2008      | Trapped Generation Issues Discussion Begins                    |
| Jun 2008      | Spearville-Knoll-Axtell Added to Portfolios 2 and 3            |
| Jul 2008      | Portfolios 2 and 3 at 2008 Wind Levels and Turk                |
| Aug 2008      | Portfolios 2 and 3: Firm Wind Sensitivities                    |
| Sep 2008      | Introduction of Portfolios 3-A and 3-B at 345 and 765 kV costs |
| Oct 2008      | Portfolio 3 (high wind) and 3-A (current wind) Analysis        |
| Dec 2008      | Portfolio 3-C (modify 3 for high wind)                         |
| Jan 2009      | Further Analysis of Portfolios 3-A and 3-C with Nebraska       |
| Feb 2009      | EMMTF Effort initiated to update and refine economic models    |
| Mar 2009      | Final Balanced Portfolio Analysis                              |
| Apr 2009      | Balanced Portfolio Summit & Balanced Portfolio Recommendation  |

### **August-November, 2007: Screening of Candidate Upgrades for Portfolios**

Over fifty candidate transmission upgrades for screening were gathered by SPP staff. As agreed by stakeholders, the initial screening analysis was performed based on using only the summer months. A discussion at the CAWG led to additional analyses to include spring-fall months in the calculations of adjusted production cost benefits. The screening analysis was then performed for the summer months and the spring-fall months starting with the spring of March 1, 2012. These estimates of annual benefits were compared to the estimates of engineering and construction (E&C) cost obtained by SPP staff from transmission owners. All projects screened were ranked from highest to lowest according to their benefit-to-cost (B/C) ratios. The SPP staff then used these rankings as a basis for developing a collection of economic upgrades as alternative portfolios<sup>s</sup>.

### **February-April, 2008: Initial Four Portfolios**

SPP staff developed four initial portfolios, labeled as Portfolios 1, 2, 3 and 4. Each portfolio had specific criteria for determining which projects to include.

1. Portfolio 1 was a collection of every project from the economic project screening process that had a B/C ratio greater than 1.0.

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<sup>s</sup> Note: Balanced Portfolio screening analysis considered assumptions for generation not contained in the subsequent portfolio analysis. Of note in the original analysis was the inclusion of Holcomb 2, Red Rock, Hugo 2 as well as 4,600 MW of generic wind capacity which affected the calculated benefits of certain projects.

## ***SPP Balanced Portfolio Report***

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2. Portfolio 2 was a subset of Portfolio 1 where projects with similar benefits were narrowed to remove upgrades that would not provide additional benefits.
3. Portfolio 3 was assembled with the intent of ensuring each Zone within the SPP region received a project (projects that crossed multiple zones were considered for each zone), with the most beneficial project chosen in each zone.
4. Portfolio 4 was a collection of projects that would be mutually beneficial, thereby raising the overall benefit of the entire portfolio.

These four portfolios, along with their B/C screening ratios, are shown in the following exhibits.

## SPP Balanced Portfolio Report

### Screening of Proposed Economic Upgrades

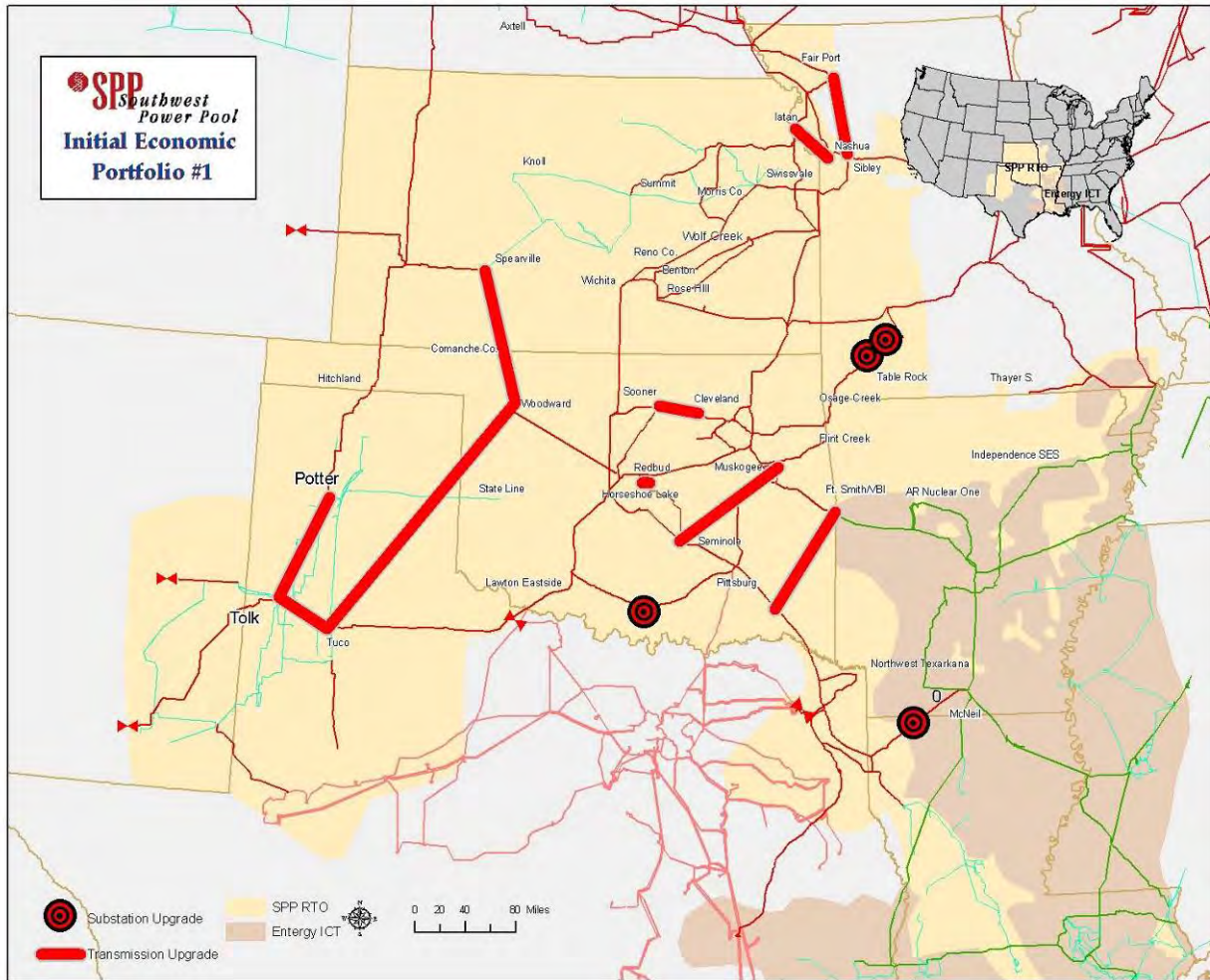
| Project                            | Screening<br>B/C Ratio | P1 | P2 | P3 | P4 |
|------------------------------------|------------------------|----|----|----|----|
| Tolk - Potter                      | 7.20                   |    |    | +  |    |
| El Dorado - Longwood               | 3.36                   | +  | +  | +  |    |
| Iatan - Nashua                     | 2.95                   | +  | +  | +  | +  |
| SWPS - Battlefield                 | 2.66                   | +  | +  |    |    |
| Chesapeake XF                      | 2.26                   | +  | +  | +  |    |
| Tuco - Tolk - Potter               | 1.73                   | +  | +  |    | +  |
| Fairport - Sibley                  | 1.31                   | +  |    |    | +  |
| Pittsburg - Ft Smith               | 1.17                   | +  | +  | +  |    |
| Spearville-Mooreland/Woodward-Tuco | 1.13                   | +  | +  | +  | +  |
| Seminole - Muskogee                | 1.08                   | +  |    |    |    |
| Monett XF                          | 1.04                   | +  |    |    |    |
| Redbud - Horseshoe Lake            | 1.01                   | +  |    |    |    |
| Cleveland - Sooner                 | 0.91                   | +  | +  | +  | +  |
| Sunnyside XF                       | 0.89                   | +  | +  |    |    |
| Northwest XF                       | 0.89                   | +  | +  |    | +  |
| Swissvale - Stilwell               | 0.67                   |    |    | +  |    |
| Anadarko XF                        | 0.48                   |    |    | +  |    |
| Turk - McNeil                      | 0.46                   |    |    |    | +  |
| Mooreland/Woodward - Wichita       | 0.14                   |    |    |    | +  |
| Mooreland/Woodward - Northwest     | (0.00)                 |    |    |    | +  |

**(NOTE: “Tolk – Potter” project is a subset of the “Tuco – Tolk – Potter” project.)**

The Balanced Portfolio screening analysis considered assumptions for generation not contained in the subsequent portfolio analysis. Of note was the inclusion of Holcomb 2, Red Rock, and Hugo 2 as well as 4,600 MW of generic wind capacity, each of which affected the calculated benefits of certain projects.

## SPP Balanced Portfolio Report

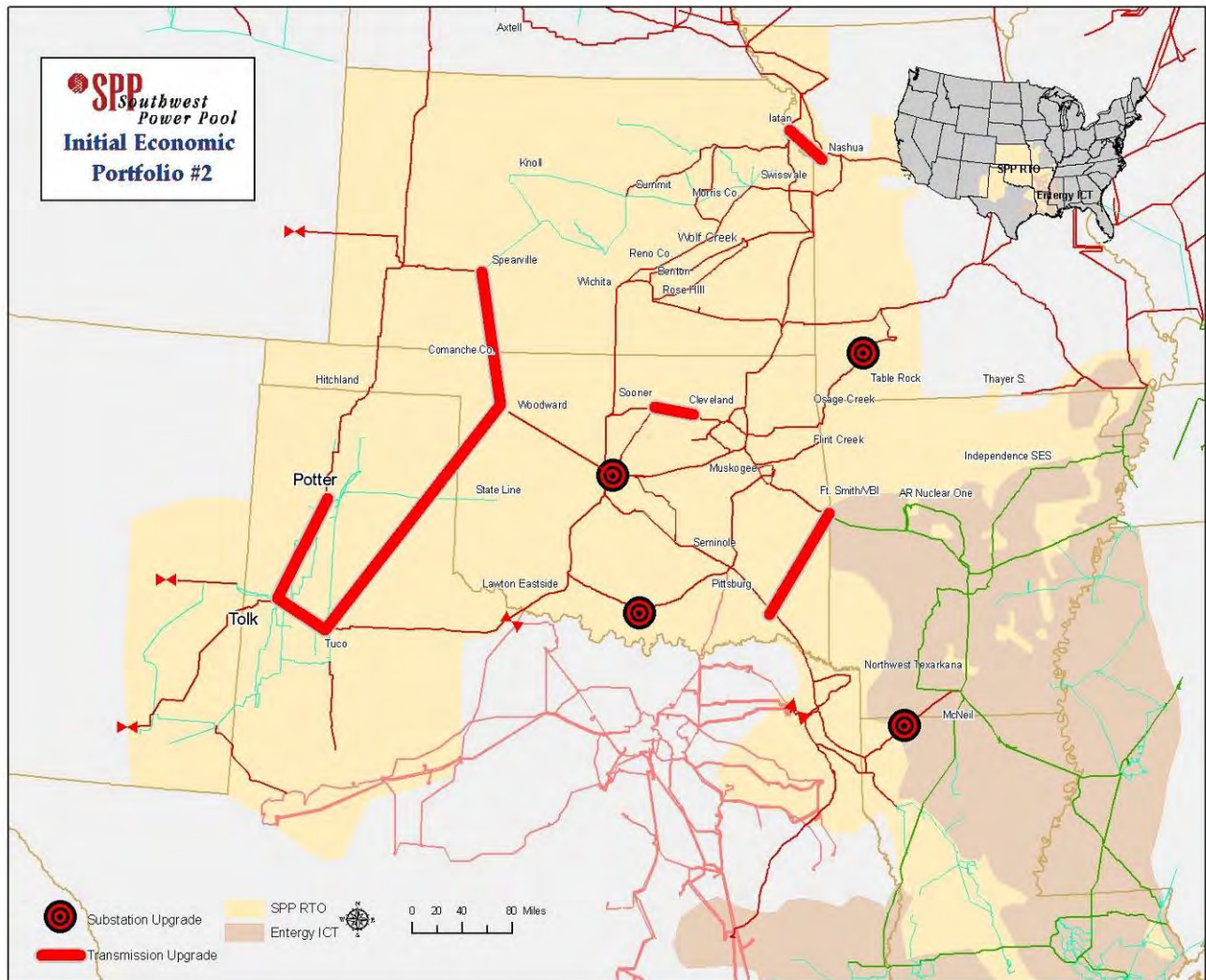
### Portfolio 1



Because Portfolio 2 eliminated duplicative upgrades from Portfolio 1, Portfolio 1 was not carried forward as a possible Balanced Portfolio candidate.

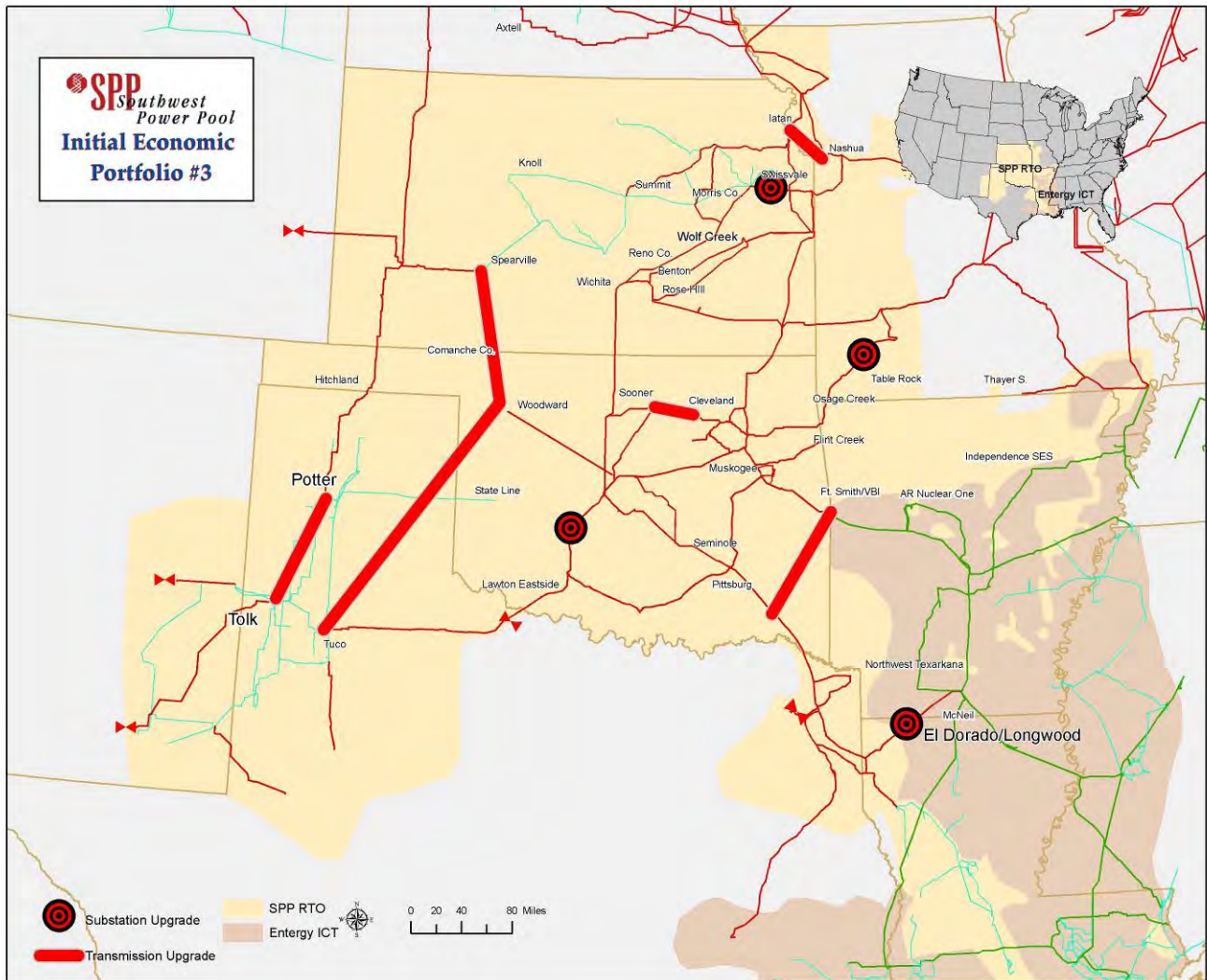


Portfolio 2

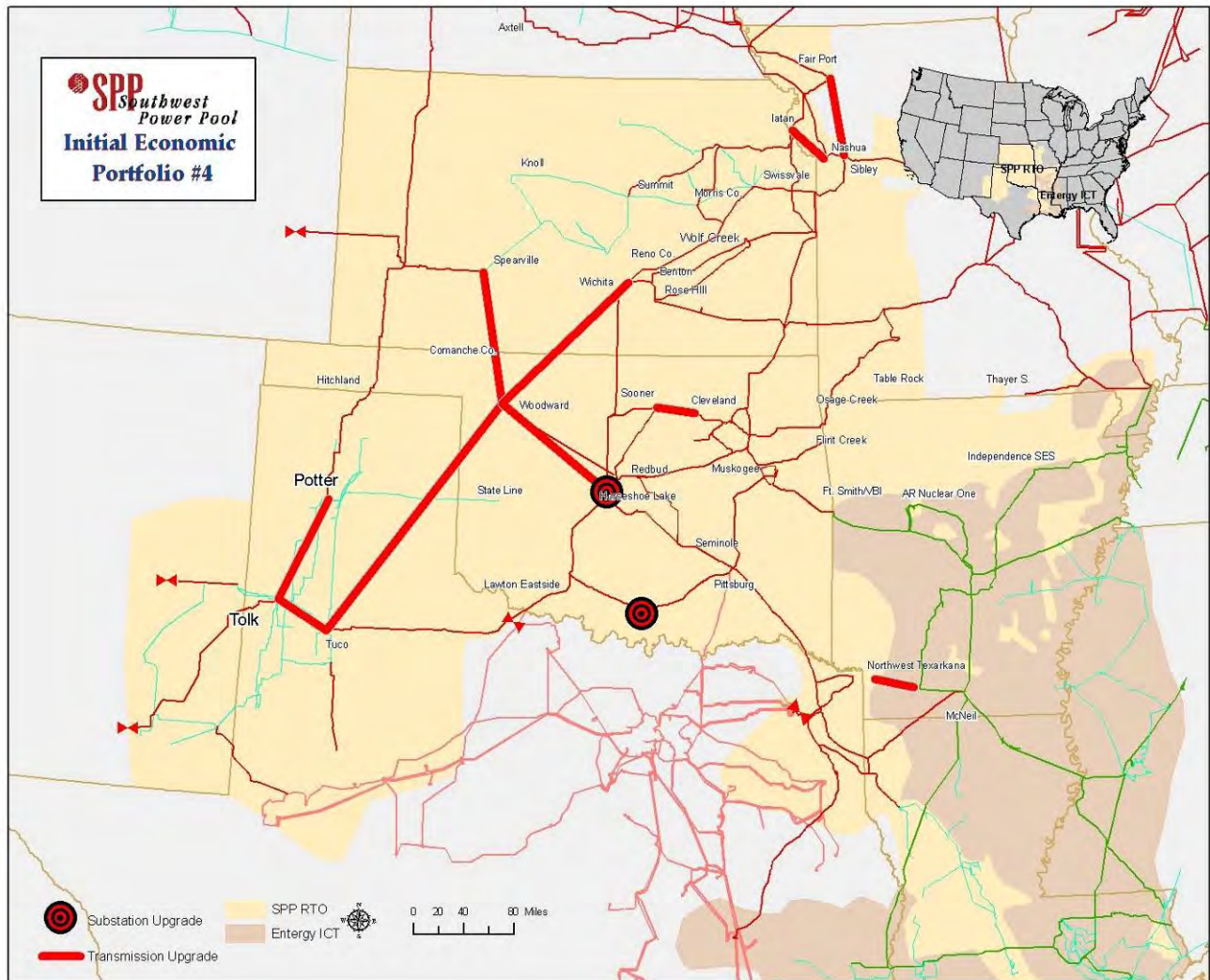




Portfolio 3



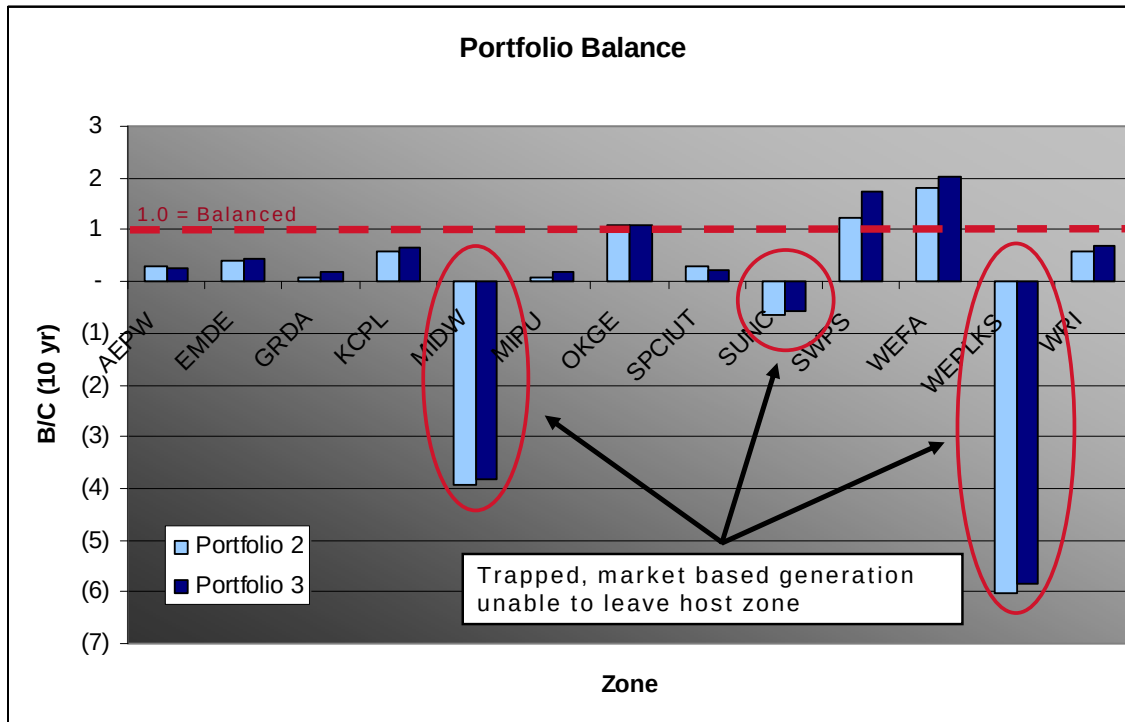
Portfolio 4



### **May 2008: Trapped Generation**

The CAWG review of the four portfolios, including high wind sensitivities, discovered that the production cost analysis contained significant levels of “trapped generation” (generation that cannot get power out of the host zone due to transmission constraints, significantly impacting the modeling results) related to wind generation. The CAWG initiated the Trapped Generation Task Force (TGTF) to address this issue. The following graph demonstrates effects of trapped generation on portfolio B/C ratios.

### **Trapped Generation in Economic Models**



The TGTF developed guidelines for including generation in the production cost modeling, that were reviewed by the Economic Modeling and Methods Task Force (“EMMTF”, now called the Economic Studies Working Group, “ESWG”). The TGTF decided that the base case models should contain wind levels consistent with current wind in service. These models contained 2,600 MW of nameplate wind,\*\* down from 4,600 MW of generic wind included in previous models. Change cases could include additional wind generation, but the TGTF recommended that the additional wind above existing levels must be matched with the transmission upgrades that would be needed to deliver the additional wind to the SPP energy market.

### **June 2008: Wind and Spearville-Knoll-Axtell (SKA)**

SPP staff updated the study models after the TGTF determined that 2,600 MW of wind should be used in the base case. The following table illustrates the resultant B/C ratios for Portfolios 2 through 4, where 2,600 MW of wind is also included in the change case. The adjusted production costs

\*\* This coincides with the amount of wind in the SPP footprint at the end of 2008, as well as the transmission upgrades required to delivery wind with firm service.

## SPP Balanced Portfolio Report

shown are changes in adjusted production costs. Therefore, a red parenthetical represents lower adjusted production costs after an upgrade takes place, and it is the estimate of overall benefit.

### Preliminary Portfolio Results, post-TGTF (June 26, 2008 CAWG Meeting)

| Project                        | Total Adjusted Production Cost | SPP            | TIER1          | Cost (\$M) | B/C  |
|--------------------------------|--------------------------------|----------------|----------------|------------|------|
| Economic Portfolio - P2_June08 | (\$50,482,000)                 | (\$41,409,000) | (\$9,073,000)  | \$ 371     | 0.92 |
| Economic Portfolio - P3_June08 | (\$53,325,000)                 | (\$42,060,000) | (\$11,266,000) | \$ 347     | 1.04 |
| Economic Portfolio - P4_June08 | (\$48,429,000)                 | (\$38,581,000) | (\$9,848,000)  | \$ 608     | 0.54 |

SPP staff conducted a sensitivity analysis of Spearville-Knoll-Axtell on the above portfolios to determine its impact. The Spearville-Knoll-Axtell (SKA) 345kV line is a transmission upgrade for which the Kansas Electric Transmission Authority (KETA) issued a Notice of Intent to Proceed with Construction on July 25, 2007. Additionally, the SPP Board of Directors approved this transmission upgrade for inclusion in the SPP Transmission Expansion Plan (STEP). The SPP Board of Directors requested that all projects of 345 kV and above approved for inclusion in the STEP also be considered candidates in the Balanced Portfolio analyses. It was found in the analyses that the SKA project uniformly raised the B/C ratios of all portfolios, and it appeared that the SKA project should be included for consideration, although a similar analysis was not conducted for other low B/C ratio projects that were not included in the original portfolios. The results are shown in the following table.

### Impact of Spearville – Knoll – Axtell

| Project                            | Total Adjusted Production Cost | SPP            | TIER1          | Cost (\$M) | B/C  |
|------------------------------------|--------------------------------|----------------|----------------|------------|------|
| Economic Portfolio - P2_SKA_June08 | (\$90,215,000)                 | (\$71,327,000) | (\$18,889,000) | \$ 539     | 1.13 |
| Economic Portfolio - P3_SKA_June08 | (\$92,307,000)                 | (\$72,235,000) | (\$20,072,000) | \$ 515     | 1.22 |
| Economic Portfolio - P4_SKA_June08 | (\$84,031,000)                 | (\$64,709,000) | (\$19,322,000) | \$ 776     | 0.73 |

Because Portfolio 4 had a B/C ratio well below one, it was not included in further analyses in the Balanced Portfolio development process.

### July 2008: Update Designated Resources

Portfolios 2 and 3 were updated to include the Turk Plant, a Designated Resource planned to be on line by 2012. This change lowered the benefit to cost ratios below one, as shown in the following table. These results were based on the 2008 wind levels in SPP (2,600 MW) but do not include the Spearville-Knoll-Axtell line.

### Impact of Updates on Portfolios 2 and 3

| Project               | Total Adjusted Production Cost | SPP            | TIER1         | Cost (\$M) | B/C  | SPP B/C |
|-----------------------|--------------------------------|----------------|---------------|------------|------|---------|
| Portfolio 2 - July 08 | (\$38,291,000)                 | (\$28,825,000) | (\$9,466,000) | \$ 371     | 0.70 | 0.53    |
| Portfolio 3 - July 08 | (\$42,033,000)                 | (\$32,281,000) | (\$9,751,000) | \$ 347     | 0.82 | 0.63    |

### August 2008: Firm Wind Sensitivities

Additional wind sensitivities were conducted for Portfolios 2 and 3 to determine the impact that the amount of wind assumed in the model would have on the benefits. Benefits were estimated for 700 MW of firm wind in the base case and an additional 1,900 MW of market-based wind in the change case. The results showed a significant increase in production cost savings for both Portfolios 2 and 3. The changes in benefits from adding the market-based wind without transmission upgrades were calculated to show the impact of trapped generation. Stakeholders supported the inclusion of all existing wind in the portfolios even though wind without firm transmission service would lower the B/C ratios.



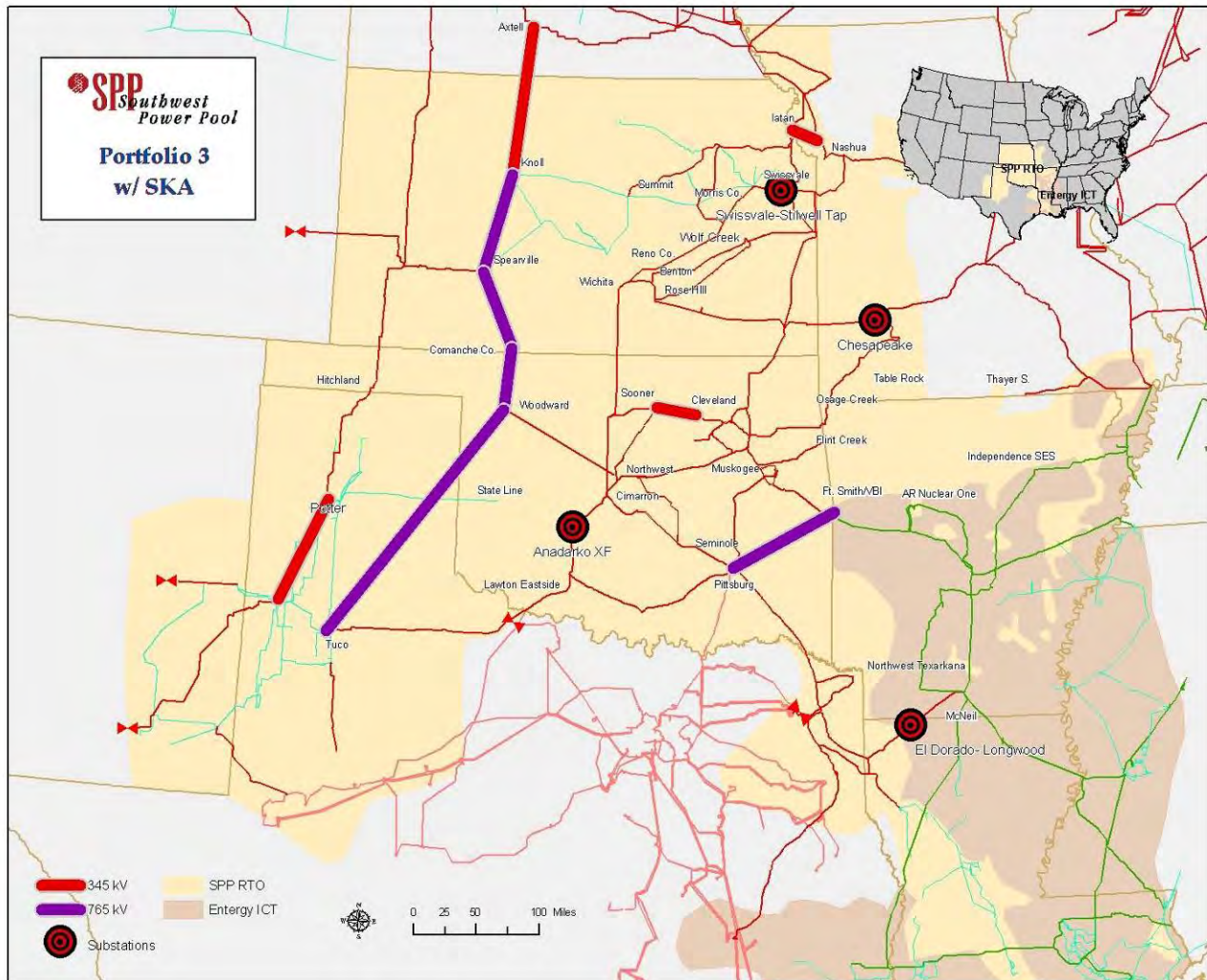
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### September 2008: Introduction of Portfolio Variations 3-A and 3-B

SPP staff developed two modified portfolios based on Portfolio 3. Adjustments to Portfolio 3 included an upgrade of the Wichita – Reno Co - Summit line and carried through the addition of Spearville-Knoll-Axtell. From this modification of Portfolio 3 two variations were developed and labeled 3-A and 3-B. These portfolios are shown pictorially below.

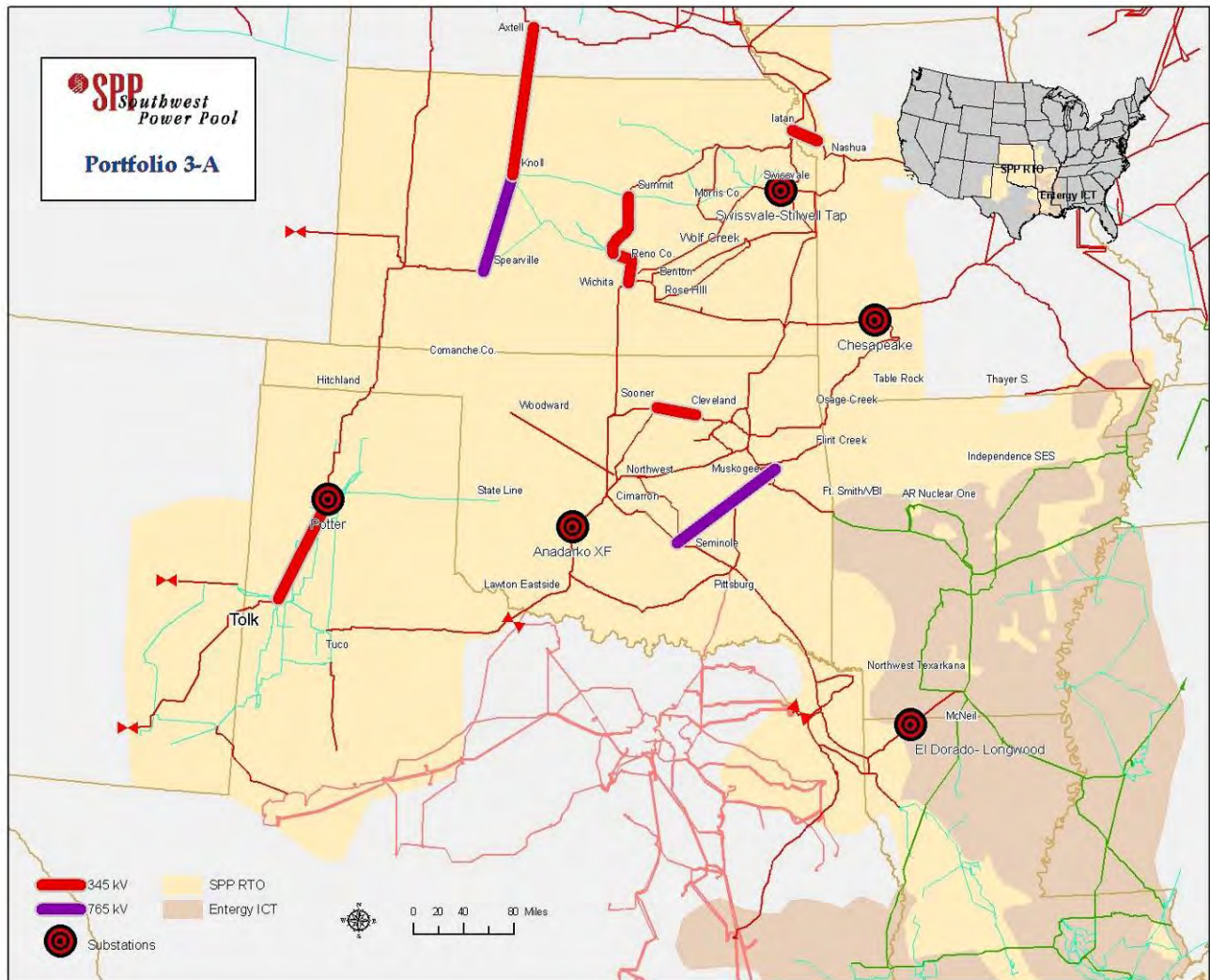
Since many sections of Portfolio 3 included transmission paths that are also in the proposed EHV Overlay Plan, the CAWG decided to consider these common corridor projects for 765 kV construction in the balanced portfolio. The purple lines in the following maps illustrate this construction.

#### **Portfolio 3, with Spearville – Knoll – Axtell (SKA)**



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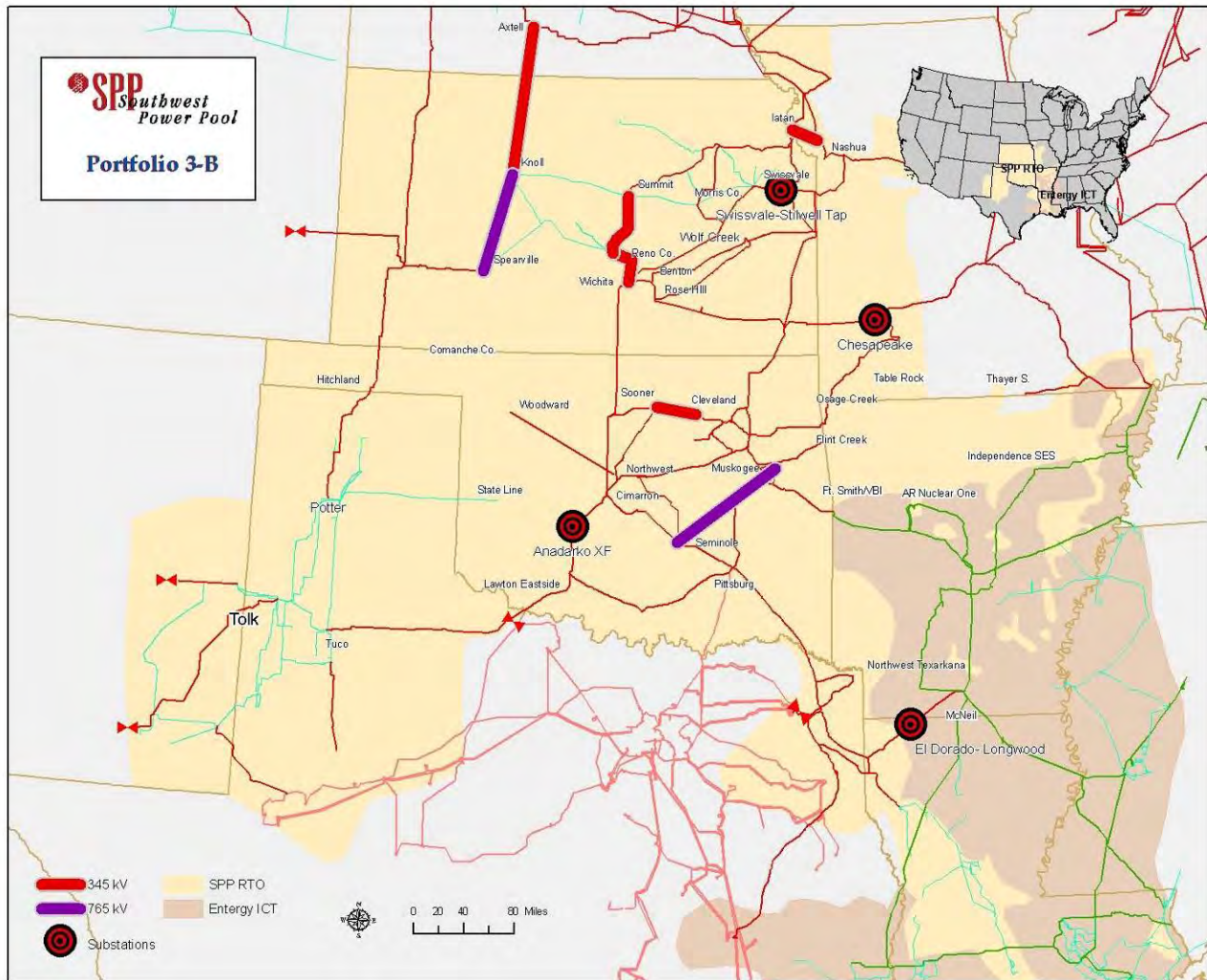
### Portfolio 3-A with Wichita - Reno Co - Summit





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### Portfolio 3-B with Wichita – Reno Co - Summit



## SPP Balanced Portfolio Report

Modeling assumptions for the dispatch of wind were still an issue in these results where SPP staff used a wind offer price of \$20/MWh. Given this caveat, the results showed that both Portfolios 3-A and 3-B had B/C ratios greater than one using 345 kV costs, but were marginal when 765 kV costs were used in the calculations. Portfolio 3-B is a sensitivity of Portfolio 3-A used to test whether or not the Tolk-Potter upgrades would increase the B/C ratio. Since they did, the SPP staff recommended going forward with Portfolio 3-A, as well as subsequent consideration of additional variations of Portfolio 3.

### Initial Results for Portfolios 3-A and 3-B

| Project                    | Cost (\$M) | Proj 10 Year<br>SPP Benefit (\$M) | SPP B/C |
|----------------------------|------------|-----------------------------------|---------|
| <b>345 kV Construction</b> |            |                                   |         |
| Portfolio 3-A              | \$585      | \$776                             | 1.33    |
| Portfolio 3-B              | \$545      | \$693                             | 1.27    |
| <b>765 kV Construction</b> |            |                                   |         |
| Portfolio 3-A              | \$761      | \$776                             | 1.02    |
| Portfolio 3-B              | \$721      | \$693                             | 0.96    |

### October 2008: Portfolio 3 (High Wind) and 3-A (Current Wind)

Two different types of analyses were considered for Portfolios 3 and 3-A. Since Portfolio 3 has upgrades similar to those on the western portion of the proposed EHV system, the SPP staff evaluated Portfolio 3 using a high wind (7 GW) scenario with specific wind locations for wind capacity above the current 2008 level of 2.6 GWs. In particular, the B/C ratio was calculated for both 345 kV and 765 kV costs to get a feel for whether or not Portfolio 3 could support a portion of the EHV upgrades in the western SPP region.

### High Wind (7 GW) for Portfolio 3

| Scenario               | SPP 10 Yr Benefit | Cost (\$M) | B/C  |
|------------------------|-------------------|------------|------|
| Portfolio 3 - 345 kV   | \$ 1,920,593,438  | 829        | 2.32 |
| Portfolio 3 - 765 kV * | \$ 1,920,593,438  | 1,213      | 1.58 |

SPP staff used Portfolio 3-A to test the sensitivity of a carbon tax on the estimate of benefits from savings in the adjusted production costs. The results indicated that keeping wind at its current levels and imposing a carbon tax would, as expected, result in a significant decrease in benefits for Portfolio 3-A.

### Carbon Tax Sensitivity Results for Portfolio 3-A at Current Wind (2.6 GW)

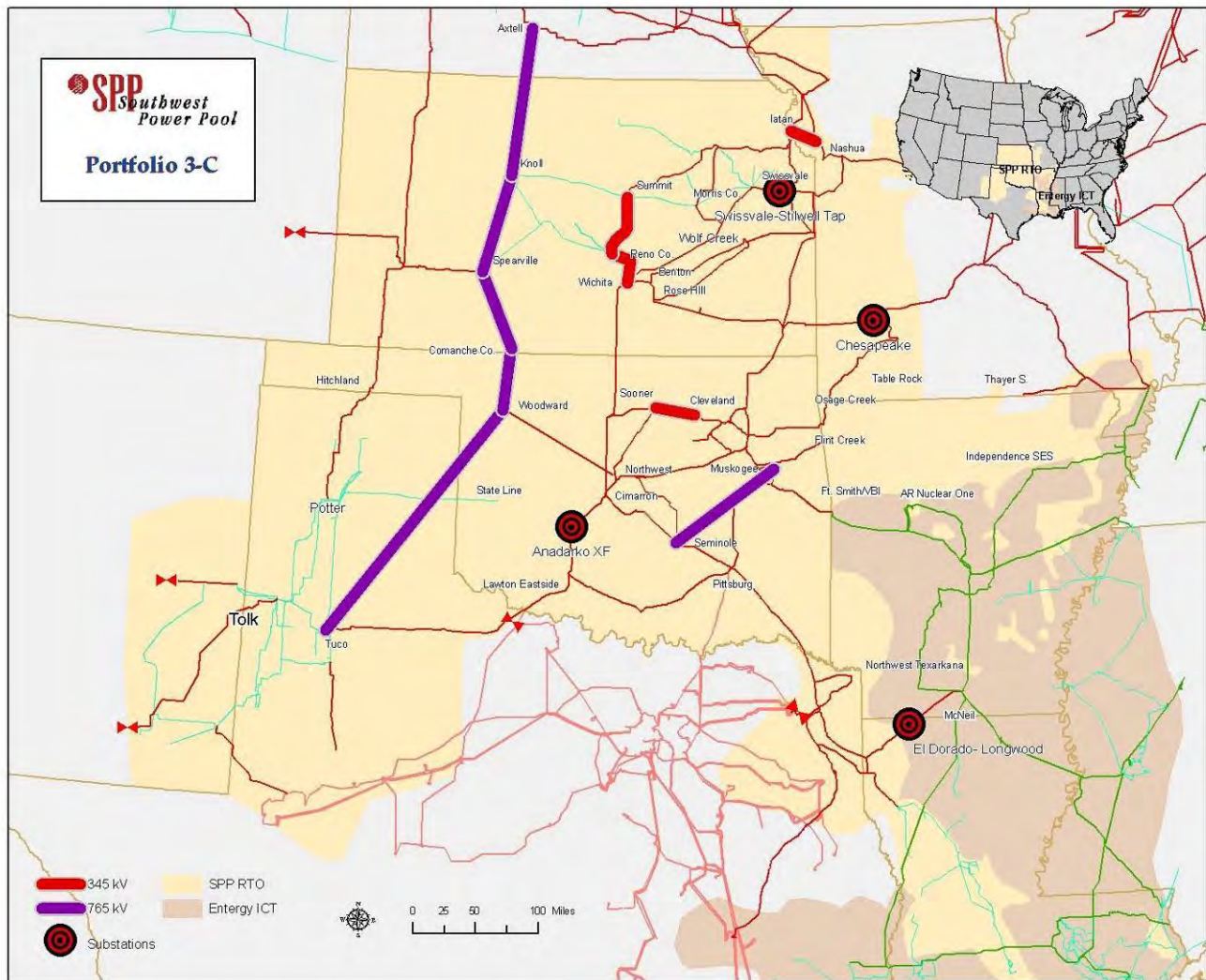
| Project                           | Total Adjusted<br>Production Cost | SPP NON-OATT  | SPP OATT        | TIER1         | Cost   | SPP B/C |
|-----------------------------------|-----------------------------------|---------------|-----------------|---------------|--------|---------|
| Portfolio - P3A - Base            | (\$119,180,000)                   | (\$2,454,920) | (\$111,931,080) | (\$4,794,000) | \$ 597 | 1.27    |
| Portfolio - P3A - \$15 Carbon Tax | (\$60,140,000)                    | (\$4,000)     | (\$52,699,000)  | (\$5,543,000) | \$ 597 | 0.60    |
| Portfolio - P3A - \$40 Carbon Tax | (\$17,992,000)                    | (\$317,000)   | (\$16,926,000)  | (\$1,630,000) | \$ 597 | 0.19    |



### December 2008: Portfolio 3-C (Modify Portfolio 3)

Portfolio 3-C was developed as a hybrid of Portfolios 3 and 3-A by removing the Tolk - Potter upgrades but adding the Spearville – Knoll - Axtell and Wichita – Reno Co - Summit lines. The following graph pictorially represents Portfolio 3-C.

#### Portfolio 3-C



It should be noted that by this time SPP staff had resolved a problem with its application of the PROMOD that had resulted in dispatching wind on a small number of days, resulting in what appeared to be a significant “trapped generation” problem. With the resolution of that issue, wind was now being dispatched from specified injection points at \$0.05/MWh. Note that this was an offer price for the wind injection into the market since using an offer price of \$0/MWh which caused problems in the modeling. The final clearing price of wind is at the marginal zonal market price for each hour, which is significantly higher than the offer price; i.e. wind in the actual production cost models is priced at the marginal zonal market price.

## SPP Balanced Portfolio Report

SPP staff used Portfolio 3-C to perform an analysis of an integration plan for the EHV Overlay. For this effort, scenarios were conducted at 3,300 MW of wind injection in 2012, 7,000 MW of wind injection in 2017, and 13,500 MW of wind injection in 2023, with 765 kV transmission being added to the analysis to accommodate the higher wind levels assumed for wind. The following table shows the B/C ratio that would apply had the results of year 2012 been distributed uniformly over a ten-year period and compared to the ten-year cost. In addition, the results are shown using ten years of Annual Transmission Revenue Requirements (ATRR) for the EHV projects contained in the study periods 2012, 2017 and 2023.

| Portfolio 3-C + EHV Build Out          |           |         |
|----------------------------------------|-----------|---------|
| Benefit - Cost                         | Total B/C | SPP B/C |
| 10 yr vs E&C (P3-C)                    | 0.74      | 0.66    |
| 10 yr vs E&C (P3-C+West EHV)           | 0.79      | 0.72    |
| 10 yr vs E&C (P-3C+West & Central EHV) | 2.43      | 1.45    |
| 10 yr vs ATRR                          | 0.71      | 0.49    |
| Annual B/C (final year)                | 1.99      | 1.19    |

SPP staff reran portfolio 3-A at 3,300 MW of wind to determine the impact of adding 700 MW of market-based wind to the benefits of this portfolio. The following table gives the results for Portfolio 3-A using 765 kV costs.

| Portfolio 3-A           |           |         |
|-------------------------|-----------|---------|
| Benefit - Cost          | Total B/C | SPP B/C |
| 10 yr vs E&C            | 1.46      | 1.30    |
| 10 yr vs ATRR           | 1.19      | 1.06    |
| Annual B/C (final year) | 1.46      | 1.29    |

In addition to the adjusted production cost and cost benefit analysis, SPP Staff analyzed the impacts of the portfolio options on basic reliability. Portfolios 3-C and 3-A were considered in this analysis. The results of the total Engineering and Construction (E&C) cost impacts on regional reliability are shown in the table below with 3-C yielding the greatest benefits by reducing reliability needs to a net amount of \$31M. More detailed impacts are shown in Appendix D.

### P3-A and 3-C impact on STEP reliability assessment

| Project       | New Violations | Solved Violations | Net          |
|---------------|----------------|-------------------|--------------|
| Portfolio 3-A | \$4,385,000    | \$4,004,900       | -\$380,100   |
| Portfolio 3-C | \$4,585,000    | \$35,265,250      | \$30,680,250 |

### January 2009: Further Analysis of Portfolios 3-A and 3-C With Nebraska

At the December 2008 CAWG meeting, further analysis of Portfolios 3-A and 3-C was requested, including the addition of the three pricing zones in Nebraska as a result of the Nebraska entities decision to join the Southwest Power Pool. The emphasis on Portfolio 3-A was in regard to the balance of this portfolio when the Nebraska zones were added, and to compare this balance when Portfolio 3-A upgrades are priced at 345 kV versus 765 kV costs. With the addition of Nebraska, the B/C ratio for Portfolio 3-A at 765 kV increased from 1.06 to 1.11, and at 345 kV from 1.27 to 1.50. The higher costs at 765 kV resulted in significant levels of cost transfers needed to balance the portfolio compared to the lower costs at 345 kV.

## SPP Balanced Portfolio Report

### Portfolio Balance With Transfers for Portfolio 3-A at 345 KV Costs

| #     | Zone | Benefits      | Costs         | Transfer Allocation | Transfer Out  | Transfer Net | Net Benefit  | B/C  | Original B/C |
|-------|------|---------------|---------------|---------------------|---------------|--------------|--------------|------|--------------|
| 1     | AEPW | \$20,880,672  | \$24,939,597  | \$14,640,350        | -\$18,699,275 | -\$4,058,925 | \$0          | 1.00 | 0.84         |
| 2     | EMDE | \$5,828,820   | \$2,923,755   | \$1,716,339         | \$0           | \$1,716,339  | \$1,188,726  | 1.26 | 1.99         |
| 3     | GRDA | \$1,797,527   | \$2,170,293   | \$1,274,032         | -\$1,646,798  | -\$372,766   | \$0          | 1.00 | 0.83         |
| 4     | KCPL | \$8,337,354   | \$8,571,771   | \$5,031,907         | -\$5,266,324  | -\$234,417   | \$0          | 1.00 | 0.97         |
| 5     | MIDW | \$1,590,879   | \$798,241     | \$468,593           | \$0           | \$468,593    | \$324,045    | 1.26 | 1.99         |
| 6     | MIPU | \$1,598,074   | \$4,491,010   | \$2,636,368         | -\$5,529,303  | -\$2,892,935 | \$0          | 1.00 | 0.36         |
| 7     | MKEC | \$5,294,897   | \$1,243,893   | \$730,206           | \$0           | \$730,206    | \$3,320,798  | 2.68 | 4.26         |
| 8     | OKGE | \$44,982,968  | \$15,731,003  | \$9,234,607         | \$0           | \$9,234,607  | \$20,017,358 | 1.80 | 2.86         |
| 9     | SPRM | -\$29,773     | \$1,719,556   | \$1,009,435         | -\$2,758,764  | -\$1,749,329 | \$0          | 1.00 | -0.02        |
| 10    | SUNC | \$389,069     | \$1,185,151   | \$695,722           | -\$1,491,804  | -\$796,082   | \$0          | 1.00 | 0.33         |
| 11    | SWPS | \$43,102,775  | \$12,809,661  | \$7,519,685         | \$0           | \$7,519,685  | \$22,773,429 | 2.12 | 3.36         |
| 12    | WEFA | \$11,792,345  | \$3,508,023   | \$2,059,323         | \$0           | \$2,059,323  | \$6,224,999  | 2.12 | 3.36         |
| 13    | WRI  | \$23,072,688  | \$12,818,241  | \$7,524,722         | \$0           | \$7,524,722  | \$2,729,725  | 1.13 | 1.80         |
| 14    | NPPD | -\$608,956    | \$8,896,109   | \$5,222,303         | -\$14,727,368 | -\$9,505,065 | \$0          | 1.00 | -0.07        |
| 15    | OPPD | -\$472,047    | \$6,896,029   | \$4,048,192         | -\$11,416,267 | -\$7,368,075 | \$0          | 1.00 | -0.07        |
| 16    | LES  | -\$145,808    | \$2,130,072   | \$1,250,421         | -\$3,526,301  | -\$2,275,880 | \$0          | 1.00 | -0.07        |
| Total |      | \$167,411,485 | \$110,832,404 | \$65,062,205        | -\$65,062,205 | \$0          | \$56,579,080 | 1.51 | 1.51         |

All numbers in the above table represent annualized costs for Portfolio 3-A over a ten-year period.

Transfers out of a zone represent the dollars that must be moved from the zonal rates to a region-wide rate in order to achieve balance. Two measures of the degree of balance of a portfolio include: a) the number of zones with positive net benefits after the transfers (in this case: 7 of 16 total zones); and b) the ratio of the transfers out to the costs of the upgrades (in this case: 58.7%).

Additional analysis of the EHV upgrades in Portfolio 3-C were performed with and without Portfolio 3-A to determine whether or not portfolio 3-A added more benefits than costs to a zone that would include parts of the EHV (765 kV) overlay. The results indicated that Portfolio 3-A did add more benefits than costs.

Analysis of Portfolio 3-C showed a B/C ratio of 0.58 using 765kV costs and a ratio of 0.94 using 345 kV costs.

### CAWG Response

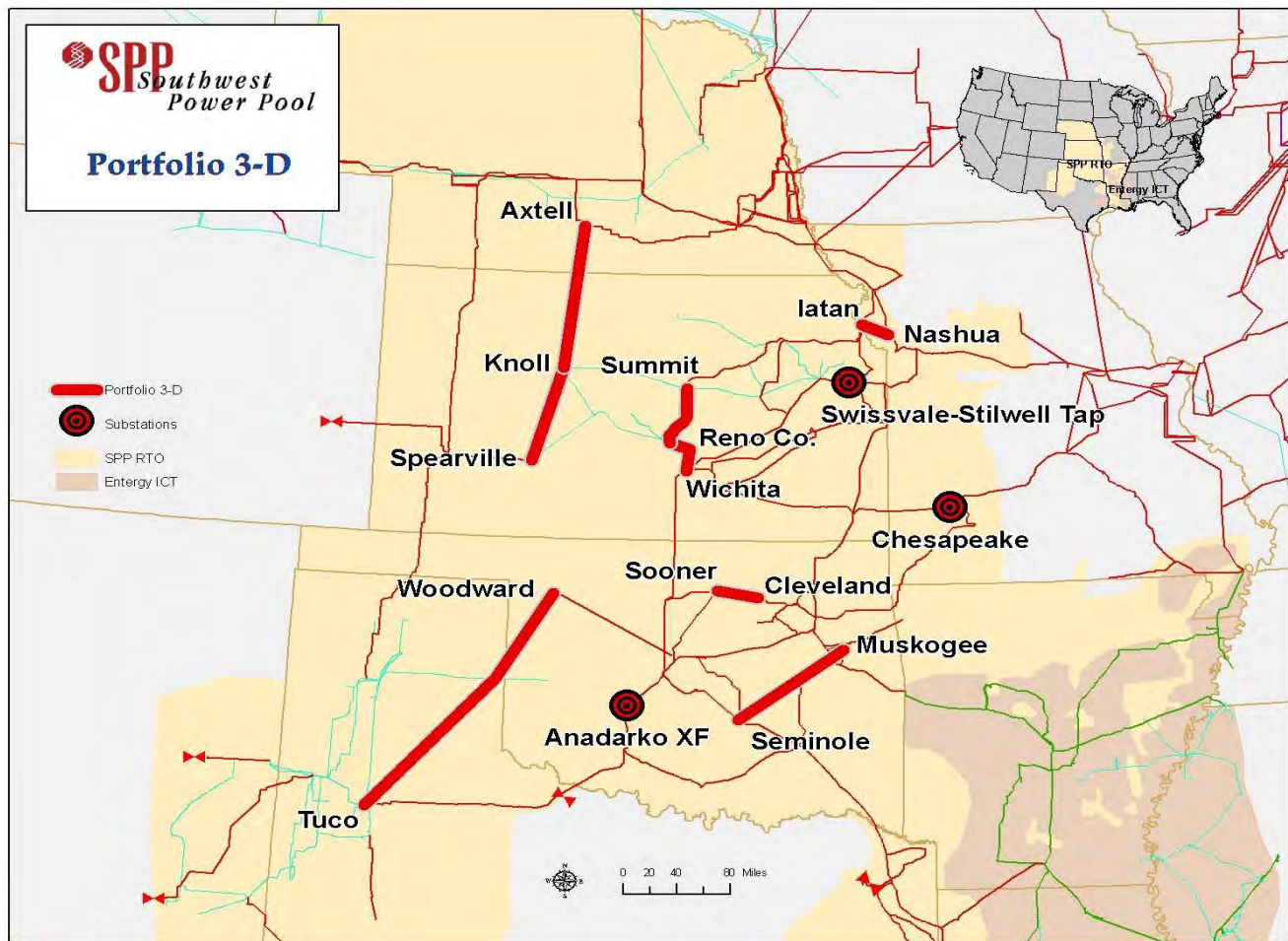
Due to the difficulty in balancing a portfolio that includes 765 kV projects, as well the high level of uncertainty concerning the level of wind available to the SPP footprint on the planning horizon, it was decided in February 2009 that the Balanced Portfolio should include only existing wind generation in service or under construction. The CAWG directed SPP staff to update the economic models to reflect these changes and to work through the EMMTF to ensure that the models were vetted through the stakeholder process to ensure that all member data was represented accurately. Additionally, the CAWG requested that the Nebraska modeling parameters be updated to include a better, more expansive representation for utilities beyond Nebraska to better account for the economic interchange of energy beyond the Nebraska zones. Lastly, the CAWG requested that SPP Staff work with the EMMTF to update all costs associated with the construction of portfolio projects. The E&C costs had shown a significant degree of variability throughout the course of the Balanced Portfolio effort to date due to changes in the economic climate, leading the CAWG to seek an accurate, updated account of these associated construction costs from each respective constructing member.



## **SPP Staff Action Plan**

SPP staff, in response to the CAWG, developed an action plan to address the issues raised and also developed a timeline for the completion of the Balanced Portfolio analysis that would conclude with a staff recommendation in April 2009. This action plan detailed how SPP staff would work with the EMMTF to address any outstanding modeling and cost issues for the simulation of the Balanced Portfolio. Additionally, the action plan, corresponding to the suggestion by the CAWG, defined that the analysis would consider only existing wind resources. SPP staff worked with stakeholders to determine the exact levels of existing wind resources on the system in the process of facilitating the modeling refinements through the EMMTF. Also, as the RSC directed, Portfolios 3, 3-A and 3-C were used as a starting point for these additional analyses. Lastly, Portfolio 3-D (shown below) was developed and included in the analysis. This action plan was presented to the CAWG at the end of January 2009.

## **Portfolio 3-D**



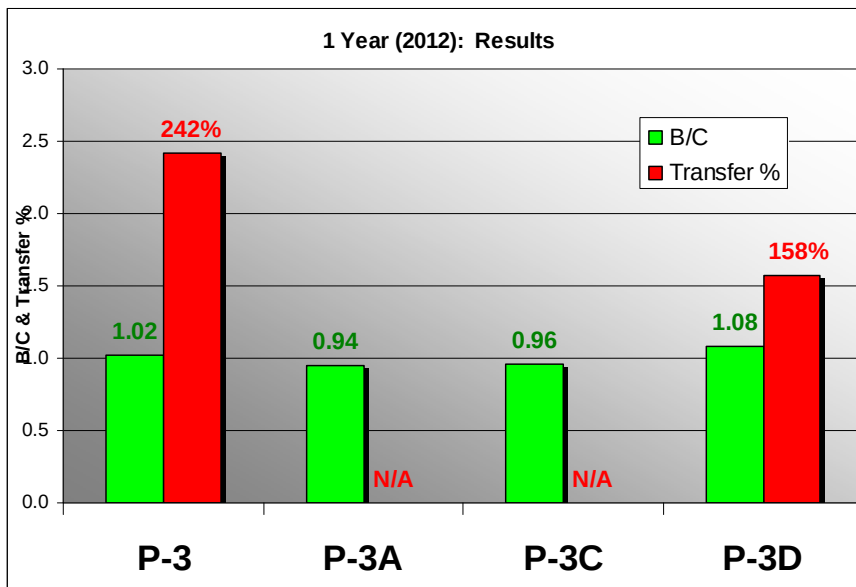
**March 2009: Final Balanced Portfolio Analysis**

Further material pertaining to the Balanced Portfolio was not presented until the March 2009 CAWG meeting. staff and stakeholders spent the majority of February working through the EMMTF on updating process and refining the engineering models used for the analysis. Additionally, the EMMTF members reviewed their respective output data and provided feedback to SPP staff. The data was checked for the reasonableness of the output results as well as the accuracy of the input into the production cost modeling. These changes were included in the Balanced Portfolio analysis.

During the March 2009 CAWG meeting, the results from the analysis described above were presented. SPP staff started with a screening analysis on Portfolios 3, 3-A, 3-C, and 3-D. This analysis was conducted on the 2012 model and taken as an annual benefit to cost basis. The results are shown in the following exhibits.

**1 Year (2012) Screening Results**

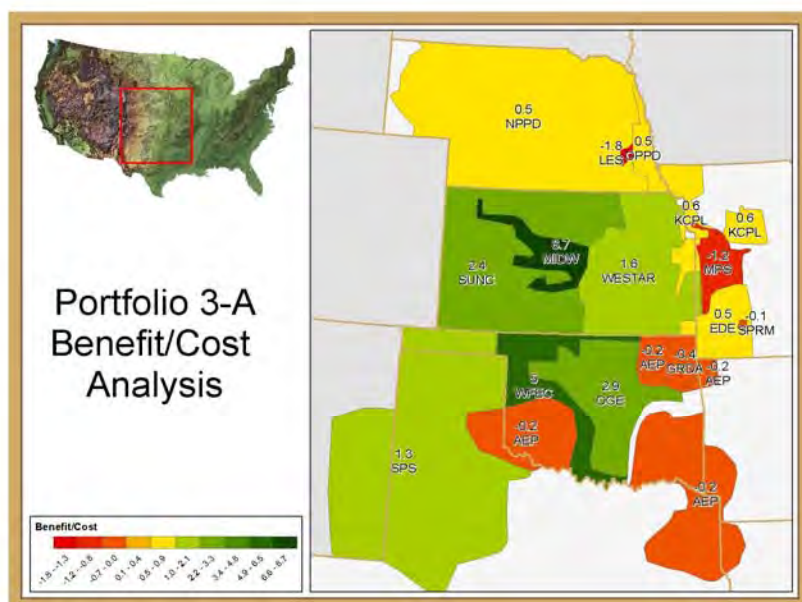
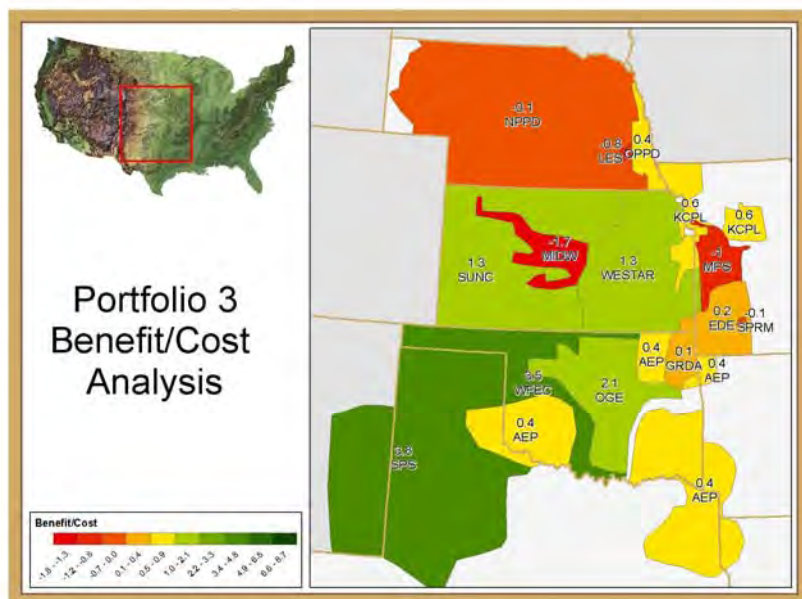
| Project | Total APC Benefit (\$M) | SPP OATT Benefit (\$M) | Tier 1 Benefit (\$M) | Annual Total Portfolio Cost (\$M) | B/C  | Transfer % |
|---------|-------------------------|------------------------|----------------------|-----------------------------------|------|------------|
| P-3     | \$124                   | \$122                  | \$2.6                | \$ 120                            | 1.02 | 242%       |
| P-3A    | \$117                   | \$114                  | \$2.7                | \$ 121                            | 0.94 | n/a        |
| P-3C    | \$159                   | \$159                  | (\$0.4)              | \$ 166                            | 0.96 | n/a        |
| P-3D    | \$148                   | \$149                  | (\$1.3)              | \$ 139                            | 1.08 | 158%       |

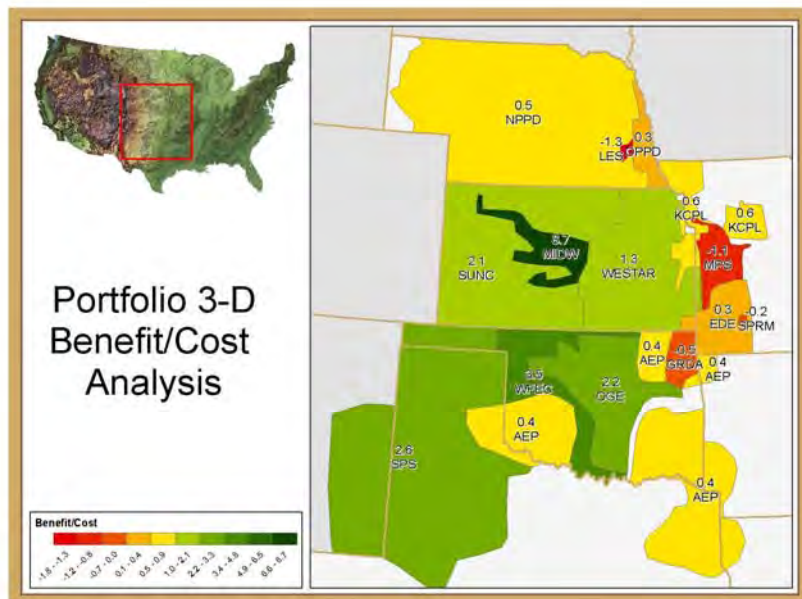
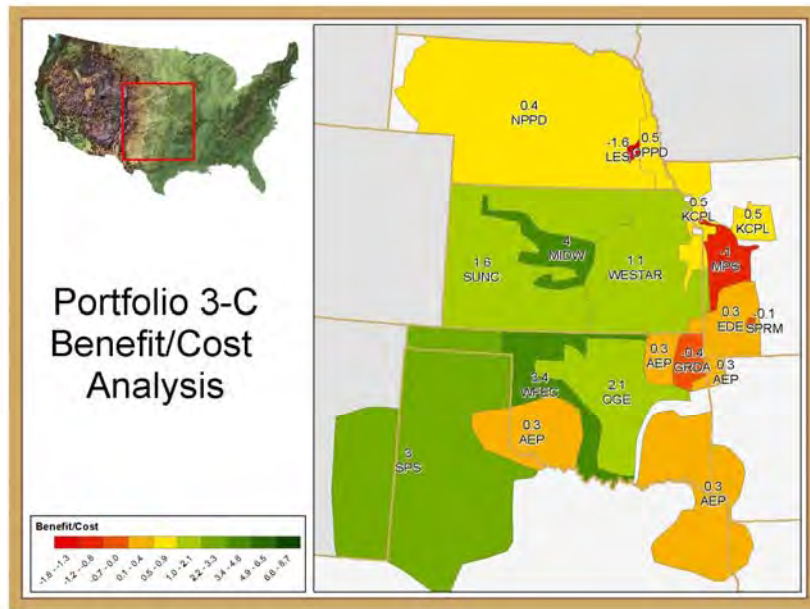




## SPP Balanced Portfolio Report

The Benefit to Cost ratio per zone is shown for the respective portfolios in the following pictures. The B/Cs shown here are before transfers have been conducted to balance the respective portfolios.





Portfolio 3-D had the highest B/C ratio of the four portfolios screened and was selected for further development. In this analysis, each of the individual projects in the Portfolio was removed to determine the impact of the project on the portfolio as a whole. These results are shown in the following table. The table is divided into total Adjusted Production Cost (APC) benefit, benefit for SPP Open Access Transmission Tariff (OATT) members as well as benefits to areas outside the region, shown here as Tier 1 benefits. The transfer percentage (%) shown is the percentage of the total portfolio cost in dollars that must be transferred, following tariff provisions, to balance the respective portfolios shown below. Ideally, the goal is a lower transfer percentage is desirable with a higher B/C.

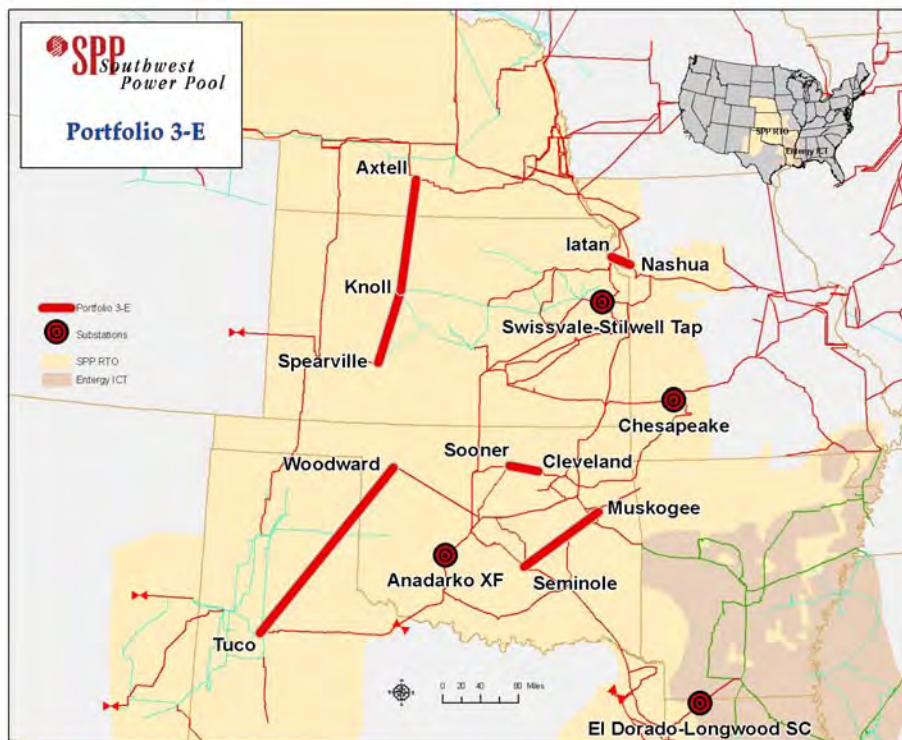
## SPP Balanced Portfolio Report

### Portfolio 3-D Refinement Analysis

| Project                           | Total APC Benefit (\$M) | SPP Benefit (\$M) | Tier 1 Benefit (\$M) | Annual Total Portfolio Cost (\$M) | B/C         | Transfer %  |
|-----------------------------------|-------------------------|-------------------|----------------------|-----------------------------------|-------------|-------------|
| <b>P-3D</b>                       | <b>\$148</b>            | <b>\$149</b>      | <b>(\$1.3)</b>       | <b>\$ 139</b>                     | <b>1.08</b> | <b>158%</b> |
| <b>Portfolio 3D sensitivities</b> |                         |                   |                      |                                   |             |             |
| <b>no WRS (P-3E)</b>              | <b>\$137</b>            | <b>\$132</b>      | <b>\$4.3</b>         | <b>\$ 107</b>                     | <b>1.24</b> | <b>121%</b> |
| <b>no SKA</b>                     | <b>\$127</b>            | <b>\$128</b>      | <b>(\$0.8)</b>       | <b>\$ 114</b>                     | <b>1.12</b> | <b>111%</b> |
| <b>no TW</b>                      | <b>\$121</b>            | <b>\$116</b>      | <b>(\$1.1)</b>       | <b>\$ 105</b>                     | <b>1.10</b> | <b>324%</b> |
| <b>no Ches</b>                    | <b>\$146</b>            | <b>\$148</b>      | <b>(\$1.4)</b>       | <b>\$ 136</b>                     | <b>1.09</b> | <b>156%</b> |
| <b>no SM</b>                      | <b>\$116</b>            | <b>\$122</b>      | <b>(\$6.6)</b>       | <b>\$ 115</b>                     | <b>1.06</b> | <b>183%</b> |
| <b>no IN</b>                      | <b>\$143</b>            | <b>\$142</b>      | <b>\$0.5</b>         | <b>\$ 132</b>                     | <b>1.08</b> | <b>168%</b> |
| <b>no WGard</b>                   | <b>\$152</b>            | <b>\$149</b>      | <b>(\$1.6)</b>       | <b>\$ 138</b>                     | <b>1.08</b> | <b>160%</b> |
| <b>no ADK</b>                     | <b>\$146</b>            | <b>\$147</b>      | <b>(\$0.9)</b>       | <b>\$ 137</b>                     | <b>1.07</b> | <b>159%</b> |
| <b>no SC</b>                      | <b>\$120</b>            | <b>\$122</b>      | <b>(\$1.2)</b>       | <b>\$ 135</b>                     | <b>0.90</b> | <b>n/a</b>  |

The projects that were the best candidates for removal from Portfolio 3-D were (1) Wichita – Reno Co. – Summit, (2) Spearville – Knoll – Axtell and (3) the Chesapeake Transformer. SPP staff recommended during the March 2009 CAWG meeting that the Wichita – Reno Co. – Summit line be removed from the portfolio, but also recommended Spearville – Knoll – Axtell and Chesapeake stay in the portfolio to maintain balance. This Portfolio was labeled Portfolio 3-E and is shown in the following map.

### Portfolio 3-E



## SPP Balanced Portfolio Report

Portfolio 3-D and 3-E were selected as the candidates for the full 10-year analysis of portfolios as required by the Tariff. The following tables demonstrate the results of the 10-year analysis, with interpolation between simulated years, 2012, 2017 and 2022. The results are discounted back to present worth, using an 8% discount rate. Levelized annual values were also calculated. The annual cost of the each portfolio is given such that the host utility carrying charge rate is assumed to be used for the construction of the project.

### Portfolio 3-D: 10 Year Benefit vs. Costs

| Portfolio 3-D      |              |                 | Million of Dollars |                     |                     |                  |            |      |       |        |
|--------------------|--------------|-----------------|--------------------|---------------------|---------------------|------------------|------------|------|-------|--------|
|                    |              |                 | Total Benefit      | Incremental Benefit | Total Cost SPP OATT | Incremental Cost | Cost (E&C) |      |       |        |
|                    |              |                 |                    |                     | ATRR                |                  |            |      |       |        |
|                    |              |                 |                    |                     |                     |                  |            |      |       |        |
| 2012               |              | \$              | 149.0              |                     |                     | \$               | 138.55     |      | 826.4 |        |
| 2017               |              | \$              | 208.5              | \$                  | 11.904              | \$               | 138.55     | \$   | -     | Annual |
| 2022               |              | \$              | 260.3              | \$                  | 10.364              | \$               | 138.55     | \$   | -     | 138.5  |
| Year               | 8.00% Year # | Discount Factor | Annual Benefits    | Discounted Benefits | Annual Costs        | Discounted Costs | B/C        |      |       |        |
| 2012               | 1            | 1.00            | \$ 149             | \$ 149              | \$ 139              | \$ 139           | 1.08       |      |       |        |
| 2013               | 2            | 0.93            | \$ 161             | \$ 149              | \$ 139              | \$ 128           | 1.16       |      |       |        |
| 2014               | 3            | 0.86            | \$ 173             | \$ 148              | \$ 139              | \$ 119           | 1.25       |      |       |        |
| 2015               | 4            | 0.79            | \$ 185             | \$ 147              | \$ 139              | \$ 110           | 1.33       |      |       |        |
| 2016               | 5            | 0.74            | \$ 197             | \$ 145              | \$ 139              | \$ 102           | 1.42       |      |       |        |
| 2017               | 6            | 0.68            | \$ 209             | \$ 142              | \$ 139              | \$ 94            | 1.50       |      |       |        |
| 2018               | 7            | 0.63            | \$ 219             | \$ 138              | \$ 139              | \$ 87            | 1.58       |      |       |        |
| 2019               | 8            | 0.58            | \$ 229             | \$ 134              | \$ 139              | \$ 81            | 1.65       |      |       |        |
| 2020               | 9            | 0.54            | \$ 240             | \$ 129              | \$ 139              | \$ 75            | 1.73       |      |       |        |
| 2021               | 10           | 0.50            | \$ 250             | \$ 125              | \$ 139              | \$ 69            | 1.80       |      |       |        |
| 2022               | 11           | 0.46            | \$ 260             | \$ 121              | \$ 139              | \$ 64            | 1.88       |      |       |        |
| Ten Year Totals    |              | Yrs 1-10        | 7.25               | \$ 2,010            | \$ 1,405            | \$ 1,385         | \$ 1,004   | 1.40 |       |        |
| Per Year Levelized |              |                 |                    | \$ 194              |                     | \$ 139           |            | 1.40 |       |        |

## SPP Balanced Portfolio Report

### Portfolio 3-DE: 10 Year Benefit vs. Costs

| Portfolio 3-E      |              |                 | Million of Dollars |                     |              |                  |            |       |   |        |
|--------------------|--------------|-----------------|--------------------|---------------------|--------------|------------------|------------|-------|---|--------|
|                    |              |                 | Total Benefit      | Incremental Benefit | Total Cost   | Incremental Cost | Cost (E&C) |       |   |        |
|                    |              |                 |                    |                     | SPP OATT     |                  |            |       |   |        |
|                    |              |                 |                    |                     | ATRR         |                  |            |       |   |        |
| 2012               |              | \$              | 132.3              |                     | \$           | 106.63           |            | 657.4 |   |        |
| 2017               |              | \$              | 181.2              | \$                  | 9.786        | \$               | 106.63     | \$    | - | Annual |
| 2022               |              | \$              | 229.5              | \$                  | 9.652        | \$               | 106.63     | \$    | - | 106.6  |
| Year               | 8.00% Year # | Discount Factor | Annual Benefits    | Discounted Benefits | Annual Costs | Discounted Costs | B/C        |       |   |        |
| 2012               | 1            | 1.00            | \$ 132             | \$ 132              | \$ 107       | \$ 107           | 1.24       |       |   |        |
| 2013               | 2            | 0.93            | \$ 144             | \$ 133              | \$ 107       | \$ 99            | 1.35       |       |   |        |
| 2014               | 3            | 0.86            | \$ 156             | \$ 134              | \$ 107       | \$ 91            | 1.46       |       |   |        |
| 2015               | 4            | 0.79            | \$ 168             | \$ 133              | \$ 107       | \$ 85            | 1.58       |       |   |        |
| 2016               | 5            | 0.74            | \$ 180             | \$ 132              | \$ 107       | \$ 78            | 1.69       |       |   |        |
| 2017               | 6            | 0.68            | \$ 181             | \$ 123              | \$ 107       | \$ 73            | 1.70       |       |   |        |
| 2018               | 7            | 0.63            | \$ 192             | \$ 121              | \$ 107       | \$ 67            | 1.80       |       |   |        |
| 2019               | 8            | 0.58            | \$ 202             | \$ 118              | \$ 107       | \$ 62            | 1.89       |       |   |        |
| 2020               | 9            | 0.54            | \$ 212             | \$ 115              | \$ 107       | \$ 58            | 1.99       |       |   |        |
| 2021               | 10           | 0.50            | \$ 223             | \$ 111              | \$ 107       | \$ 53            | 2.09       |       |   |        |
| 2022               | 11           | 0.46            | \$ 229             | \$ 106              | \$ 107       | \$ 49            | 2.15       |       |   |        |
| Ten Year Totals    | Yrs 1-10     | 7.25            | \$ 1,790           | \$ 1,253            | \$ 1,066     | \$ 773           | 1.62       |       |   |        |
| Per Year Levelized |              |                 |                    | \$ 173              |              | \$ 107           | 1.62       |       |   |        |

A reliability impact analysis was conducted on the portfolio projects to determine the impact of the Balanced Portfolio on the STEP reliability analysis as well as on Tier 1 entities, third parties to SPP. This analysis was conducted in the same manner and with the same methodologies used in the 2008 STEP 10 year reliability analysis. The analysis was conducted for the entire collection of portfolio projects considered for the March CAWG meeting. The results are broken into (1) advanced projects, those projects that would be moved up in the reliability timeline due to the Balanced Portfolio; (2) new projects, projects which are now needed that were not identified in the original 10 year reliability planning horizon, but may have been needed beyond that horizon; (3) third party impacts or projects needed on neighboring systems due to the Balanced Portfolio; and (4) deferred projects, projects which are either deferred beyond the planning horizon or mitigated entirely due to the portfolio. A summary of these results is shown in the table below.

### Reliability Impact (E&C Dollars)

| <b>Portfolio</b> | <b>Advanced Projects</b> | <b>New Projects</b> | <b>3rd Party Impacts</b> | <b>Deferred Projects</b> | <b>Net Benefit</b> |
|------------------|--------------------------|---------------------|--------------------------|--------------------------|--------------------|
| P-3              | \$ 1.0                   | \$ 3.4              | \$ 10.2                  | \$ 42.1                  | \$ 27.5            |
| P-3A             | \$ 1.0                   | \$ 3.4              | \$ 10.2                  | \$ 27.7                  | \$ 13.1            |
| P-3C             | \$ 1.0                   | \$ 3.4              | \$ 10.2                  | \$ 42.1                  | \$ 27.5            |
| P-3D             | \$ 1.0                   | \$ 19.2             | \$ 10.2                  | \$ 42.1                  | \$ 11.7            |
| P-3E             | \$ 1.0                   | \$ 19.2             | \$ 10.2                  | \$ 42.1                  | \$ 11.7            |



## SPP Balanced Portfolio Report

### April 2009: Balanced Portfolio Summit

The material from the March 2009 CAWG meeting was presented at an open meeting in Dallas, TX, April 1, 2009 as an SPP open stakeholder summit. Stakeholder comments and feedback were collected during this summit and incorporated in the final analysis used in the subsequent recommendation to the CAWG on an April 10<sup>th</sup> conference call.

Feedback from stakeholders and the CAWG included a request to consider the inclusion of a portion of the Wichita – Reno Co – Summit in the final recommendation, if it was feasible, and to include the project given its benefit and costs. Additionally, Empire District Electric Company staff requested that the Chesapeake transformer project be removed from the Balanced Portfolio recommendation due to the complex nature of the project and the associated third party impacts. Also, the CAWG directed SPP to further refine cost estimates of the projects in the portfolio to include greater granularity in the itemization of project costs associated with the portfolio projects, including but not limited to material costs, right of way requirements, labor, etc. Lastly, SPP staff was directed to determine the appropriate carrying charge rates to be used for each host zone to ensure that consistent values were being applied to all projects so that they could be considered on a consistent and reasonable basis.

### April 2009: CAWG Conference Call

The work presented during the April SPP open stakeholder summit was refined to reflect the stakeholder feedback and comments and presented to the CAWG on April 10 via conference call.

The first portfolio change was to consider the removal of the Chesapeake transformer. The results are shown in the following tables.

#### Portfolio 3-E No Chesapeake: 10 Year Benefit vs. Costs

| <b>Portfolio 3-E<br/>No Ches</b> |                         |                            | Million of Dollars         |                                |                            |                             |             | <b>Cost (E&amp;C)</b> |
|----------------------------------|-------------------------|----------------------------|----------------------------|--------------------------------|----------------------------|-----------------------------|-------------|-----------------------|
|                                  |                         |                            | <b>Total Benefit</b>       | <b>Incremental Benefit</b>     | <b>Total Cost SPP OATT</b> | <b>Incremental Cost</b>     | <b>ATRR</b> |                       |
| <b>2012</b>                      |                         |                            | \$ 132.3                   |                                | \$ 93.73                   |                             |             | 691.9                 |
| <b>2017</b>                      |                         |                            | \$ 181.2                   | \$ 9.79                        | \$ 93.73                   | \$ -                        |             | <b>Annual</b>         |
| <b>2022</b>                      |                         |                            | \$ 229.5                   | \$ 9.65                        | \$ 93.73                   | \$ -                        |             | 93.7                  |
| <b>Year</b>                      | <b>8.00%<br/>Year #</b> | <b>Discount<br/>Factor</b> | <b>Annual<br/>Benefits</b> | <b>Discounted<br/>Benefits</b> | <b>Annual<br/>Costs</b>    | <b>Discounted<br/>Costs</b> | <b>B/C</b>  |                       |
| 2012                             | 1                       | 1.00                       | \$ 132                     | \$ 132                         | \$ 94                      | \$ 94                       | <b>1.41</b> |                       |
| 2013                             | 2                       | 0.93                       | \$ 145                     | \$ 134                         | \$ 94                      | \$ 87                       | 1.55        |                       |
| 2014                             | 3                       | 0.86                       | \$ 158                     | \$ 135                         | \$ 94                      | \$ 80                       | 1.68        |                       |
| 2015                             | 4                       | 0.79                       | \$ 171                     | \$ 136                         | \$ 94                      | \$ 74                       | 1.82        |                       |
| 2016                             | 5                       | 0.74                       | \$ 184                     | \$ 135                         | \$ 94                      | \$ 69                       | 1.96        |                       |
| 2017                             | 6                       | 0.68                       | \$ 181                     | \$ 123                         | \$ 94                      | \$ 64                       | <b>1.93</b> |                       |
| 2018                             | 7                       | 0.63                       | \$ 191                     | \$ 120                         | \$ 94                      | \$ 59                       | 2.04        |                       |
| 2019                             | 8                       | 0.58                       | \$ 201                     | \$ 117                         | \$ 94                      | \$ 55                       | 2.14        |                       |
| 2020                             | 9                       | 0.54                       | \$ 210                     | \$ 114                         | \$ 94                      | \$ 51                       | 2.24        |                       |
| 2021                             | 10                      | 0.50                       | \$ 220                     | \$ 110                         | \$ 94                      | \$ 47                       | 2.35        |                       |
| 2022                             | 11                      | 0.46                       | \$ 229                     | \$ 106                         | \$ 94                      | \$ 43                       | <b>2.45</b> |                       |
| <b>Ten Year Totals</b>           | <b>Yrs 1-10</b>         | <b>7.25</b>                | <b>\$ 1,792</b>            | <b>\$ 1,257</b>                | <b>\$ 937</b>              | <b>\$ 679</b>               | <b>1.85</b> |                       |
| <b>Per Year Levelized</b>        |                         |                            |                            | <b>\$ 173</b>                  |                            | <b>\$ 94</b>                | <b>1.85</b> |                       |

## SPP Balanced Portfolio Report

The transfer analysis for portfolio 3-E without Chesapeake is shown in the following table. The analysis concluded that \$32M of transfers were required to balance this portfolio.

Attachment H Transfer Adjustments - **Portfolio 3E no Ches** - Annualized

| #     | Zone | Portfolio Benefits | Portfolio Costs | Zonal ATRR Transfers Out (Col. 5 Attach H) | Regional Allocation of Zonal ATRR Transfers | Net of Zonal Transfers and Transfer Allocation | Net Benefit | B/C  |
|-------|------|--------------------|-----------------|--------------------------------------------|---------------------------------------------|------------------------------------------------|-------------|------|
| 1     | AEPW | \$30.8             | \$21.1          | \$0.0                                      | \$7.2                                       | \$7.2                                          | \$2.5       | 1.1  |
| 2     | EMDE | (\$0.4)            | \$2.5           | (\$3.7)                                    | \$0.8                                       | (\$2.8)                                        | \$0.0       | 1.0  |
| 3     | GRDA | \$0.8              | \$1.8           | (\$1.6)                                    | \$0.6                                       | (\$1.0)                                        | \$0.0       | 1.0  |
| 4     | KCPL | \$8.3              | \$7.2           | (\$1.4)                                    | \$2.5                                       | \$1.1                                          | \$0.0       | 1.0  |
| 5     | MIDW | \$12.8             | \$0.7           | \$0.0                                      | \$0.2                                       | \$0.2                                          | \$11.9      | 14.1 |
| 6     | MIPU | (\$1.6)            | \$3.8           | (\$6.7)                                    | \$1.3                                       | (\$5.4)                                        | \$0.0       | 1.0  |
| 7     | MKEC | \$11.7             | \$1.1           | \$0.0                                      | \$0.4                                       | \$0.4                                          | \$10.2      | 8.3  |
| 8     | OKGE | \$26.5             | \$13.3          | \$0.0                                      | \$4.6                                       | \$4.6                                          | \$8.6       | 1.5  |
| 9     | SPRM | (\$0.2)            | \$1.5           | (\$2.1)                                    | \$0.5                                       | (\$1.6)                                        | \$0.0       | 1.0  |
| 10    | SUNC | \$3.2              | \$1.0           | \$0.0                                      | \$0.3                                       | \$0.3                                          | \$1.9       | 2.4  |
| 11    | SWPS | \$56.0             | \$10.8          | \$0.0                                      | \$3.7                                       | \$3.7                                          | \$41.5      | 3.9  |
| 12    | WEFA | \$7.9              | \$3.0           | \$0.0                                      | \$1.0                                       | \$1.0                                          | \$3.9       | 2.0  |
| 13    | WRI  | \$14.2             | \$10.8          | (\$0.4)                                    | \$3.7                                       | \$3.4                                          | \$0.0       | 1.0  |
| 14    | NPPD | \$5.5              | \$7.5           | (\$4.6)                                    | \$2.6                                       | (\$2.0)                                        | \$0.0       | 1.0  |
| 15    | OPPD | \$2.2              | \$5.8           | (\$5.7)                                    | \$2.0                                       | (\$3.7)                                        | \$0.0       | 1.0  |
| 16    | LES  | (\$3.5)            | \$1.8           | (\$5.9)                                    | \$0.6                                       | (\$5.3)                                        | \$0.0       | 1.0  |
| Total |      | \$174              | \$94            | -\$32                                      | \$32                                        | \$0                                            | \$80        | 1.9  |

Next, the inclusion of the Reno Co – Summit portion of the Wichita – Reno Co. – Summit Project was considered for inclusion after the removal of the Chesapeake transformer. These results are shown below.

### Portfolio 3-E No Chesapeake, with Reno Co. - Summit: 10 Year Benefit vs. Costs

|                                           |                 | Million of Dollars |                     |                          |                  |                     |        |      |
|-------------------------------------------|-----------------|--------------------|---------------------|--------------------------|------------------|---------------------|--------|------|
|                                           |                 | Total Benefit      | Incremental Benefit | Total Cost SPP OATT ATRR | Incremental Cost | Cost (E&C)          |        |      |
| <b>Portfolio 3-E<br/>No Ches, With RS</b> |                 |                    |                     |                          |                  |                     |        |      |
| 2012                                      |                 | \$ 178.0           |                     | \$ 105.56                |                  | 789.0               |        |      |
| 2017                                      |                 | \$ 242.1           | \$ 12.816           | \$ 105.56                | \$ -             | Annual              |        |      |
| 2022                                      |                 | \$ 290.4           | \$ 9.658            | \$ 105.56                | \$ -             | 105.6               |        |      |
| Year                                      | 8.00%<br>Year # | Discount<br>Factor | Annual<br>Benefits  | Discounted<br>Benefits   | Annual<br>Costs  | Discounted<br>Costs | B/C    |      |
| 2012                                      | 1               | 1.00               | \$ 178              | \$ 178                   | \$ 106           | \$ 106              | 1.69   |      |
| 2013                                      | 2               | 0.93               | \$ 191              | \$ 177                   | \$ 106           | \$ 98               | 1.81   |      |
| 2014                                      | 3               | 0.86               | \$ 204              | \$ 175                   | \$ 106           | \$ 90               | 1.93   |      |
| 2015                                      | 4               | 0.79               | \$ 216              | \$ 172                   | \$ 106           | \$ 84               | 2.05   |      |
| 2016                                      | 5               | 0.74               | \$ 229              | \$ 169                   | \$ 106           | \$ 78               | 2.17   |      |
| 2017                                      | 6               | 0.68               | \$ 242              | \$ 165                   | \$ 106           | \$ 72               | 2.29   |      |
| 2018                                      | 7               | 0.63               | \$ 252              | \$ 159                   | \$ 106           | \$ 67               | 2.38   |      |
| 2019                                      | 8               | 0.58               | \$ 261              | \$ 153                   | \$ 106           | \$ 62               | 2.48   |      |
| 2020                                      | 9               | 0.54               | \$ 271              | \$ 146                   | \$ 106           | \$ 57               | 2.57   |      |
| 2021                                      | 10              | 0.50               | \$ 281              | \$ 140                   | \$ 106           | \$ 53               | 2.66   |      |
| 2022                                      | 11              | 0.46               | \$ 290              | \$ 135                   | \$ 106           | \$ 49               | 2.75   |      |
| Ten Year Totals                           |                 | Yrs 1-10           | 7.25                | \$ 2,325                 | \$ 1,632         | \$ 1,056            | \$ 765 | 2.13 |
| Per Year Levelized                        |                 |                    |                     | \$ 225                   |                  | \$ 106              |        | 2.13 |

## SPP Balanced Portfolio Report

The transfer analysis for portfolio 3-E without Chesapeake but including with Reno Co. - Summit is shown in the following table. The analysis concluded that \$62M of transfers were required to balanced this portfolio

Attachment H Transfer Adjustments - **Portfolio 3E no Ches with RS** - Annualized

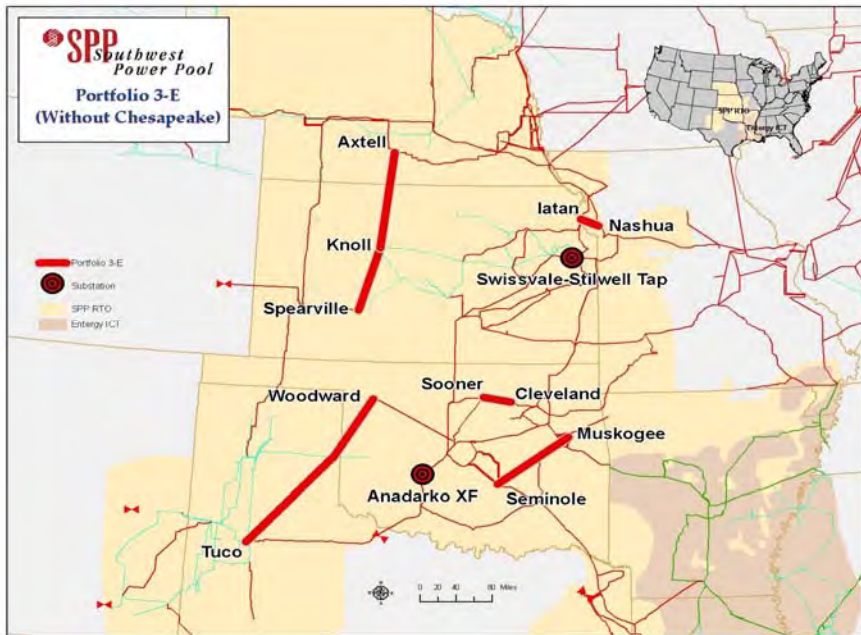
| #     | Zone | Portfolio Benefits | Portfolio Costs | Zonal ATRR Transfers Out (Col. 5 Attach H) | Regional Allocation of Zonal ATRR Transfers | Net of Zonal Transfers and Transfer Allocation | Net Benefit | B/C  |
|-------|------|--------------------|-----------------|--------------------------------------------|---------------------------------------------|------------------------------------------------|-------------|------|
| 1     | AEPW | \$25.8             | \$23.7          | (\$11.8)                                   | \$13.9                                      | \$2.1                                          | \$0.0       | 1.0  |
| 2     | EMDE | (\$0.1)            | \$2.8           | (\$4.5)                                    | \$1.6                                       | (\$2.9)                                        | \$0.0       | 1.0  |
| 3     | GRDA | \$0.1              | \$2.1           | (\$3.2)                                    | \$1.2                                       | (\$1.9)                                        | \$0.0       | 1.0  |
| 4     | KCPL | \$8.7              | \$8.2           | (\$4.2)                                    | \$4.8                                       | \$0.5                                          | \$0.0       | 1.0  |
| 5     | MIDW | \$12.8             | \$0.8           | \$0.0                                      | \$0.4                                       | \$0.4                                          | \$11.6      | 10.7 |
| 6     | MIPU | (\$5.6)            | \$4.3           | (\$12.4)                                   | \$2.5                                       | (\$9.9)                                        | \$0.0       | 1.0  |
| 7     | MKEC | \$11.3             | \$1.2           | \$0.0                                      | \$0.7                                       | \$0.7                                          | \$9.4       | 6.0  |
| 8     | OKGE | \$36.8             | \$15.0          | \$0.0                                      | \$8.8                                       | \$8.8                                          | \$13.0      | 1.5  |
| 9     | SPRM | (\$0.3)            | \$1.6           | (\$2.9)                                    | \$1.0                                       | (\$1.9)                                        | \$0.0       | 1.0  |
| 10    | SUNC | \$3.6              | \$1.1           | \$0.0                                      | \$0.7                                       | \$0.7                                          | \$1.8       | 2.0  |
| 11    | SWPS | \$55.9             | \$12.2          | \$0.0                                      | \$7.1                                       | \$7.1                                          | \$36.6      | 2.9  |
| 12    | WEFA | \$11.8             | \$3.3           | \$0.0                                      | \$2.0                                       | \$2.0                                          | \$6.5       | 2.2  |
| 13    | WRI  | \$59.9             | \$12.2          | \$0.0                                      | \$7.1                                       | \$7.1                                          | \$40.6      | 3.1  |
| 14    | NPPD | \$5.4              | \$8.5           | (\$8.0)                                    | \$5.0                                       | (\$3.0)                                        | \$0.0       | 1.0  |
| 15    | OPPD | \$2.7              | \$6.6           | (\$7.7)                                    | \$3.8                                       | (\$3.8)                                        | \$0.0       | 1.0  |
| 16    | LES  | (\$3.9)            | \$2.0           | (\$7.1)                                    | \$1.2                                       | (\$5.9)                                        | \$0.0       | 1.0  |
| Total |      | \$225              | \$106           | -\$62                                      | \$62                                        | \$0                                            | \$120       | 2.1  |

An analysis was conducted to determine the impact on total Annual Transmission Revenue Requirement (ATRR) for each zone in the tariff. The results are shown for portfolio 3-E, “3-E no Chesapeake” and “3-E no Chesapeake with Reno Co – Summit”. These results are shown in the following table.

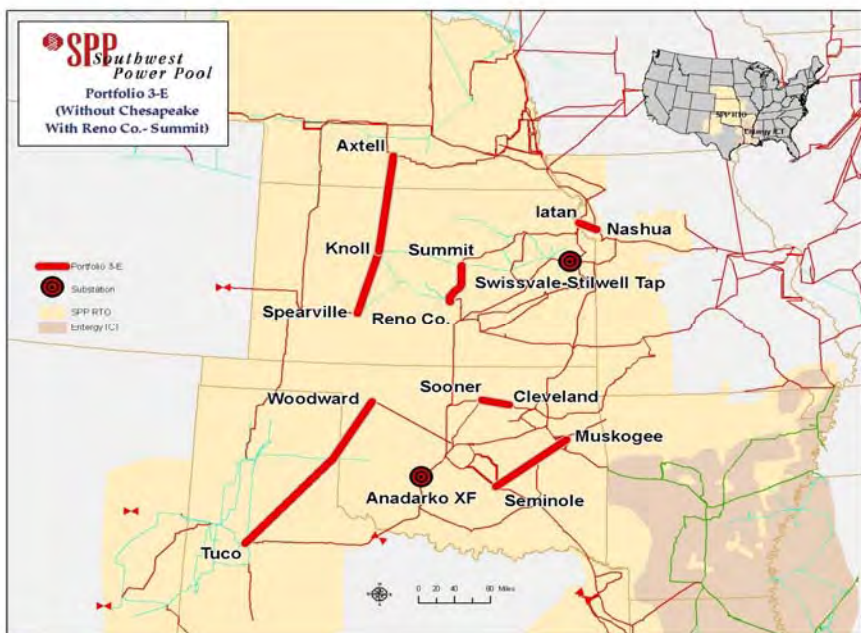
**Total ATRR for Proposed Balanced Portfolios**

|      | BP 3E                                                               | 3E no Ches                                                          | BP 3E no Ches w RS                                                  |
|------|---------------------------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|
| Zone | Annual Zonal plus Annual Base Plan Zonal plus Annual Region Wide RR | Annual Zonal plus Annual Base Plan Zonal plus Annual Region Wide RR | Annual Zonal plus Annual Base Plan Zonal plus Annual Region Wide RR |
| AEPW | \$ 175,484,688                                                      | \$ 177,104,393                                                      | \$ 174,641,806                                                      |
| SPRM | \$ 8,934,262                                                        | \$ 8,659,884                                                        | \$ 8,524,079                                                        |
| EMDE | \$ 14,660,746                                                       | \$ 14,007,997                                                       | \$ 14,294,209                                                       |
| GRDA | \$ 25,891,875                                                       | \$ 26,032,862                                                       | \$ 25,312,950                                                       |
| KCPL | \$ 43,661,239                                                       | \$ 44,709,872                                                       | \$ 45,060,781                                                       |
| OKGE | \$ 118,952,010                                                      | \$ 116,849,771                                                      | \$ 122,735,245                                                      |
| MIDW | \$ 5,277,346                                                        | \$ 5,170,672                                                        | \$ 5,469,320                                                        |
| MIPU | \$ 19,618,726                                                       | \$ 19,420,118                                                       | \$ 15,471,824                                                       |
| SWPA | \$ 9,431,500                                                        | \$ 9,431,500                                                        | \$ 9,431,500                                                        |
| SWPS | \$ 104,700,870                                                      | \$ 102,989,030                                                      | \$ 107,781,536                                                      |
| SUNC | \$ 16,092,722                                                       | \$ 15,934,343                                                       | \$ 16,377,746                                                       |
| WEFA | \$ 25,545,806                                                       | \$ 25,077,005                                                       | \$ 26,389,469                                                       |
| WRI  | \$ 128,845,823                                                      | \$ 129,135,340                                                      | \$ 134,286,149                                                      |
| MKEC | \$ 7,723,354                                                        | \$ 7,557,124                                                        | \$ 8,022,505                                                        |
| LES  | \$ 8,877,057                                                        | \$ 8,718,252                                                        | \$ 8,313,564                                                        |
| NPPD | \$ 53,140,390                                                       | \$ 53,181,895                                                       | \$ 53,125,563                                                       |
| OPPD | \$ 38,645,990                                                       | \$ 38,661,265                                                       | \$ 39,227,136                                                       |
|      | \$ 805,484,404                                                      | \$ 802,641,325                                                      | \$ 814,465,382                                                      |

Portfolio 3-E “Adjusted”



Portfolio 3-E with Reno Co – Summit, without Chesapeake



## Recommendation

The CAWG endorsed portfolio 3-E “Adjusted” (without Chesapeake, without Reno Co – Summit). Portfolio 3-E “Adjusted” provides a significant benefit vs. cost to the SPP region, as well as having lower balance transfer requirements. Portfolio 3-E “Adjusted” contains a comprehensive group of economic projects addressing many of the top constraints in the SPP. The projects associated with portfolio 3-E “Adjusted” are as follows:

- Tuco – Woodward District EHV, \$229M
- Iatan – Nashua, \$54M
- Swissvale – Stilwell tap at W. Gardner, \$2M
- Spearville – Knoll – Axtell, \$236M
- Sooner – Cleveland, \$34M
- Seminole – Muskogee, \$129M
- Anadarko Tap, \$8M
  
- Total E&C Costs: \$692M

The supporting material for portfolio 3-E was presented to the Markets and Operations Policy Committee (MOPC) in April 2009. The MOPC reviewed and discussed the portfolio options and the impact on the footprint. After discussion, the MOPC endorsed the recommendation for Balanced Portfolio 3-E “Adjusted” pending issuance of the final report, according to the SPP Tariff.

Portfolio 3-E “Adjusted” provides substantial benefit to customers in the SPP footprint. Based on a 1,000 kWh/month usage of a residential customer, the Portfolio provides an estimated net benefit of \$0.78/month (\$1.66/mo on average versus a cost of \$0.88/mo). The existing transmission revenue requirements for the SPP region in this typical monthly residential customer bill are estimated to be \$7.58. Additionally, it should be noted that the Portfolio could incur a construction cost increase of up to 113%, or more than double the estimated construction cost, and still provide a benefit to cost ratio of 1.0 for the region. Therefore, the Balanced Portfolio could have a total E&C final cost of over \$1.4B and still provide benefits greater than costs.

### Estimated SPP average customer impact (based on 1,000 kWh/month usage)

| Existing Zonal ATRR                             | Base Plan |       | New Base Plan NTCs |       | P-3E Costs  |
|-------------------------------------------------|-----------|-------|--------------------|-------|-------------|
|                                                 | 1/3       | 2/3   | 1/3                | 2/3   | Annual      |
| \$688M                                          | \$7M      | \$14M | \$33M              | \$66M | \$106 M     |
| Total: \$808M                                   |           |       |                    |       | 13%         |
| <b>Avg. Cost Per Customer Per Month: \$7.58</b> |           |       |                    |       | <b>88 ¢</b> |

**P-3E "Adjusted" Benefit = \$1.66**

The CAWG and MOPC recommendation of Portfolio 3-E “Adjusted” was presented to the SPP Regional State Committee (RSC) during their April 27, 2009 meeting in Oklahoma City where Portfolio 3-E “Adjusted” was endorsed by the RSC. Staff then presented to the MOPC and RSC the recommended Portfolio during the SPP Board of Directors meeting on April 28<sup>th</sup>. The SPP Board approved the projects in Balanced Portfolio 3-E “Adjusted” for inclusion in the SPP Transmission Expansion Plan. The SPP Board went on to direct staff to finalize the Balanced Portfolio Report in accordance with the SPP tariff. Furthermore, the Board directed that Notification To Construct letters for the Projects in the Balanced Portfolio be issued once the required Balanced Portfolio Report is



finalized after CAWG review and MOPC approval.

**Balanced Portfolio Stakeholder Process**

The SPP Regional State Committee (**RSC**) requested the Cost Allocation Working Group (CAWG) to consider alternative cost allocations for economic upgrades.

**Cost Allocation Working Group (CAWG)**

The CAWG has been the primary stakeholder group overseeing development of the Balanced Portfolio. The CAWG created the Economic Concepts whitepaper. Many representatives from other SPP stakeholder groups attend the CAWG's monthly meetings.

**Trapped Generation Task Force (TGTF)**

This CAWG Task Force determined wind assumptions in the Adjusted Production Cost (**APC**) models.

**Economic Modeling and Methods Task Force (EMMTF)**

The EMMTF focused on the planning process and development of additional economic benefit metrics. It initially worked to acquire detailed data on generation units in the model. The EMMTF addressed confidential issues. The EMMTF is currently the Economic Studies Working Group (ESWG)

**Regional Tariff Working Group (RTWG)**

The RTWG facilitated acquiring FERC approval of Attachment O language for the Balanced Portfolio process.

**Markets and Operations Policy Committee (MOPC), Board of Directors (BOD), Regional State Committee (RSC)**

These groups will review and approve the Balanced Portfolio.

**Planning Summits**

Proposed Balanced Portfolios and related concepts were shared at planning summits in May and August.

**Posting**

Portfolios and associated information are posted on SPP.org:  
<http://www.spp.org/section.asp?pageID=120>

## Appendix

### Final Benefit to Cost Results for the Balanced Portfolio

The following table demonstrates the full, 10 year portfolio analysis including reliability costs and benefits. These costs and benefits accrue in the years that the portfolio projects impact the reliability plan.

#### Portfolio 3-E "Adjusted" 10 yr B/C with Reliability Impact

| <b>Portfolio 3-E<br/>"Adjusted"</b> |  |  | <b>Million of Dollars</b> |                            |                            |                         |            | <b>Cost (E&amp;C)</b> |
|-------------------------------------|--|--|---------------------------|----------------------------|----------------------------|-------------------------|------------|-----------------------|
|                                     |  |  | <b>Total Benefit</b>      | <b>Incremental Benefit</b> | <b>Total Cost SPP OATT</b> | <b>Reliability Cost</b> | <b>ATR</b> |                       |
| <b>2012</b>                         |  |  | \$ 131.2                  |                            | \$ 93.73                   | \$ 0.03                 |            | <b>Annual</b> 93.7    |
| <b>2017</b>                         |  |  | \$ 193.2                  | \$ 12.4                    | \$ 93.73                   | \$ 2.53                 |            | <b>Total Annual</b>   |
| <b>2022</b>                         |  |  | \$ 239.0                  | \$ 9.2                     | \$ 93.73                   | \$ 2.53                 |            | \$ 93.8               |

| <b>Year</b>               | <b>8.00%<br/>Year #</b> | <b>Discount<br/>Factor</b> | <b>Annual<br/>Benefits</b> | <b>Discounted<br/>Benefits</b> | <b>Annual<br/>Costs</b> | <b>Discounted<br/>Costs</b> | <b>B/C</b>  |
|---------------------------|-------------------------|----------------------------|----------------------------|--------------------------------|-------------------------|-----------------------------|-------------|
| 2012                      | 1                       | 1.00                       | \$ 131                     | \$ 131                         | \$ 94                   | \$ 94                       | <b>1.40</b> |
| 2013                      | 2                       | 0.93                       | \$ 144                     | \$ 133                         | \$ 94                   | \$ 87                       | 1.53        |
| 2014                      | 3                       | 0.86                       | \$ 156                     | \$ 134                         | \$ 94                   | \$ 80                       | 1.66        |
| 2015                      | 4                       | 0.79                       | \$ 168                     | \$ 134                         | \$ 94                   | \$ 74                       | 1.80        |
| 2016                      | 5                       | 0.74                       | \$ 181                     | \$ 133                         | \$ 94                   | \$ 69                       | 1.93        |
| 2017                      | 6                       | 0.68                       | \$ 193                     | \$ 131                         | \$ 96                   | \$ 66                       | <b>2.01</b> |
| 2018                      | 7                       | 0.63                       | \$ 202                     | \$ 128                         | \$ 96                   | \$ 61                       | 2.10        |
| 2019                      | 8                       | 0.58                       | \$ 212                     | \$ 123                         | \$ 96                   | \$ 56                       | 2.20        |
| 2020                      | 9                       | 0.54                       | \$ 221                     | \$ 119                         | \$ 96                   | \$ 52                       | 2.29        |
| 2021                      | 10                      | 0.50                       | \$ 230                     | \$ 115                         | \$ 96                   | \$ 48                       | 2.39        |
| 2022                      | 11                      | 0.46                       | \$ 239                     | \$ 111                         | \$ 96                   | \$ 45                       | <b>2.48</b> |
| <b>Ten Year Totals</b>    | <b>Yrs 1-10</b>         | <b>7.25</b>                | <b>\$ 1,837</b>            | <b>\$ 1,281</b>                | <b>\$ 950</b>           | <b>\$ 687</b>               | <b>1.87</b> |
| <b>Per Year Levelized</b> |                         |                            |                            | <b>\$ 177</b>                  |                         | <b>\$ 95</b>                | <b>1.87</b> |

The following three tables break out the benefits from the economic analysis. These tables do not include the reliability benefits. The numbers represent a change between the change and base cases, with the change case including the Balanced Portfolio. A negative number denotes a reduction in cost which is considered a benefit. Likewise a positive number is a cost increase.

## SPP Balanced Portfolio Report

### 2012 Balanced Portfolio 3E "Adjusted" Benefits

| Zone | SumOfChange in Production Cost | SumOfDelta Purchases | SumOfDelta Sales | Adjusted Production Cost |
|------|--------------------------------|----------------------|------------------|--------------------------|
| AEPW | \$21,285,000                   | (\$14,003,000)       | \$31,439,000     | (\$24,155,000)           |
| EMDE | \$2,990,000                    | (\$2,096,000)        | \$207,000        | \$687,000                |
| GRDA | \$72,000                       | \$159,000            | \$982,000        | (\$751,000)              |
| KCPL | \$4,273,000                    | (\$637,000)          | \$9,994,000      | (\$6,358,000)            |
| LES  | \$1,297,000                    | \$1,226,000          | \$0              | \$2,523,000              |
| MIDW | (\$350,000)                    | (\$8,783,000)        | \$0              | (\$9,133,000)            |
| MIPU | \$6,027,000                    | (\$3,968,000)        | (\$5,000)        | \$2,064,000              |
| MKEC | (\$7,563,000)                  | (\$2,015,000)        | (\$925,000)      | (\$8,653,000)            |
| NPPD | \$6,519,000                    | (\$28,000)           | \$11,726,000     | (\$5,235,000)            |
| OKGE | (\$85,787,000)                 | \$52,737,000         | (\$9,386,000)    | (\$23,664,000)           |
| OPPD | \$2,165,000                    | \$160,000            | \$4,247,000      | (\$1,922,000)            |
| SPRM | \$734,000                      | (\$42,000)           | \$668,000        | \$24,000                 |
| SUNC | (\$5,206,000)                  | (\$2,096,000)        | (\$5,171,000)    | (\$2,131,000)            |
| SWPS | (\$70,516,000)                 | \$31,769,000         | (\$519,000)      | (\$38,228,000)           |
| WEFA | (\$13,163,000)                 | \$4,105,000          | (\$375,000)      | (\$8,682,000)            |
| WRI  | (\$5,257,000)                  | (\$359,000)          | \$2,131,000      | (\$7,747,000)            |

### 2017 Balanced Portfolio 3E "Adjusted" Benefits

| Zone | SumOfChange in Production Cost | SumOfDelta Purchases | SumOfDelta Sales | Adjusted Production Cost |
|------|--------------------------------|----------------------|------------------|--------------------------|
| AEPW | \$55,943,000                   | (\$17,738,000)       | \$71,548,000     | (\$33,344,000)           |
| EMDE | \$3,525,000                    | (\$3,272,000)        | \$100,000        | \$153,000                |
| GRDA | (\$28,000)                     | \$163,000            | \$889,000        | (\$754,000)              |
| KCPL | \$6,229,000                    | (\$3,576,000)        | \$11,897,000     | (\$9,244,000)            |
| LES  | \$2,019,000                    | \$1,970,000          | \$0              | \$3,989,000              |
| MIDW | (\$764,000)                    | (\$14,046,000)       | \$0              | (\$14,810,000)           |
| MIPU | \$5,483,000                    | (\$3,915,000)        | \$79,000         | \$1,489,000              |
| MKEC | (\$10,893,000)                 | (\$2,667,000)        | (\$793,000)      | (\$12,767,000)           |
| NPPD | \$5,842,000                    | (\$779,000)          | \$10,741,000     | (\$5,678,000)            |
| OKGE | (\$129,794,000)                | \$88,180,000         | (\$14,032,000)   | (\$27,582,472)           |
| OPPD | \$3,030,000                    | \$276,000            | \$5,663,000      | (\$2,357,000)            |
| SPRM | \$603,000                      | (\$60,000)           | \$251,000        | \$292,000                |
| SUNC | (\$7,575,000)                  | (\$2,386,000)        | (\$6,776,000)    | (\$3,185,000)            |
| SWPS | (\$80,497,000)                 | \$18,914,000         | (\$924,000)      | (\$60,659,000)           |
| WEFA | (\$22,863,000)                 | \$14,785,000         | (\$468,000)      | (\$7,610,000)            |
| WRI  | (\$14,392,000)                 | (\$1,073,000)        | \$1,674,000      | (\$17,139,000)           |

## SPP Balanced Portfolio Report

### 2022 Balanced Portfolio 3E "Adjusted" Benefits

| Zone | SumOfChange in Production Cost | SumOfDelta Purchases | SumOfDelta Sales | Adjusted Production Cost |
|------|--------------------------------|----------------------|------------------|--------------------------|
| AEPW | \$67,322,000                   | (\$22,618,000)       | \$83,884,000     | (\$39,181,000)           |
| EMDE | \$4,703,000                    | (\$4,421,000)        | \$91,000         | \$191,000                |
| GRDA | (\$480,000)                    | \$123,000            | \$1,003,000      | (\$1,360,000)            |
| KCPL | \$6,624,000                    | (\$2,828,000)        | \$14,974,000     | (\$11,178,000)           |
| LES  | \$2,249,000                    | \$2,150,000          | \$0              | \$4,399,000              |
| MIDW | (\$736,000)                    | (\$14,659,000)       | \$0              | (\$15,395,000)           |
| MIPU | \$2,680,000                    | (\$1,044,000)        | (\$19,000)       | \$1,655,000              |
| MKEC | (\$14,429,000)                 | (\$1,525,000)        | (\$287,000)      | (\$15,667,000)           |
| NPPD | \$6,488,000                    | (\$1,250,000)        | \$10,748,000     | (\$5,510,000)            |
| OKGE | (\$138,499,000)                | \$85,998,000         | (\$22,388,000)   | (\$30,113,000)           |
| OPPD | \$3,787,000                    | \$378,000            | \$6,258,000      | (\$2,093,000)            |
| SPRM | \$637,000                      | (\$317,000)          | \$301,000        | \$19,000                 |
| SUNC | (\$7,360,000)                  | (\$2,495,000)        | (\$3,923,000)    | (\$5,932,000)            |
| SWPS | (\$89,381,000)                 | \$2,205,000          | (\$1,184,000)    | (\$85,992,000)           |
| WEFA | (\$20,837,000)                 | \$13,197,000         | (\$575,000)      | (\$7,065,000)            |
| WRI  | (\$11,595,000)                 | (\$6,705,000)        | \$2,730,000      | (\$21,030,000)           |

The following table demonstrates the benefits, costs and transfers on an annualized basis after the resulting reliability impacts, both the advancement and deferral, are accounted for. The net B/C impact of the reliability projects was an approximate marginal increase of .01 of the total Portfolio.

### Portfolio 3-E "Adjusted" Annualized Benefits, Costs and Transfers, including Reliability Impacts

#### Attachment H Transfer Adjustments - Portfolio 3E "Adjusted" - Annualized

| #     | Zone | Portfolio Benefits | Portfolio Costs | Zonal ATRR Transfers Out (Col. 5 Attach H) | Regional Allocation of Zonal ATRR Transfers | Net of Zonal Transfers and Transfer Allocation | Net Benefit | B/C  |
|-------|------|--------------------|-----------------|--------------------------------------------|---------------------------------------------|------------------------------------------------|-------------|------|
| 1     | AEPW | \$30.9             | \$21.3          | \$0.0                                      | \$7.0                                       | \$7.0                                          | \$2.6       | 1.1  |
| 2     | EMDE | (\$0.3)            | \$2.5           | (\$3.7)                                    | \$0.8                                       | (\$2.8)                                        | \$0.0       | 1.0  |
| 3     | GRDA | \$0.9              | \$1.9           | (\$1.6)                                    | \$0.6                                       | (\$1.0)                                        | \$0.0       | 1.0  |
| 4     | KCPL | \$8.4              | \$7.3           | (\$1.3)                                    | \$2.4                                       | \$1.1                                          | \$0.0       | 1.0  |
| 5     | MIDW | \$12.8             | \$0.7           | \$0.0                                      | \$0.2                                       | \$0.2                                          | \$11.9      | 14.1 |
| 6     | MIPU | (\$1.3)            | \$3.8           | (\$6.4)                                    | \$1.3                                       | (\$5.2)                                        | \$0.0       | 1.0  |
| 7     | MKEC | \$11.8             | \$1.1           | \$0.0                                      | \$0.3                                       | \$0.3                                          | \$10.4      | 8.3  |
| 8     | OKGE | \$26.6             | \$13.4          | \$0.0                                      | \$4.4                                       | \$4.4                                          | \$8.7       | 1.5  |
| 9     | SPRM | (\$0.1)            | \$1.5           | (\$2.1)                                    | \$0.5                                       | (\$1.6)                                        | \$0.0       | 1.0  |
| 10    | SUNC | \$3.7              | \$1.0           | \$0.0                                      | \$0.3                                       | \$0.3                                          | \$2.3       | 2.7  |
| 11    | SWPS | \$56.1             | \$10.9          | \$0.0                                      | \$3.6                                       | \$3.6                                          | \$41.5      | 3.9  |
| 12    | WEFA | \$8.0              | \$3.0           | \$0.0                                      | \$1.0                                       | \$1.0                                          | \$4.0       | 2.0  |
| 13    | WRI  | \$14.2             | \$11.0          | (\$0.4)                                    | \$3.6                                       | \$3.2                                          | \$0.0       | 1.0  |
| 14    | NPPD | \$5.5              | \$7.6           | (\$4.6)                                    | \$2.5                                       | (\$2.1)                                        | \$0.0       | 1.0  |
| 15    | OPPD | \$2.3              | \$5.9           | (\$5.6)                                    | \$1.9                                       | (\$3.6)                                        | \$0.0       | 1.0  |
| 16    | LES  | (\$3.1)            | \$1.8           | (\$5.5)                                    | \$0.6                                       | (\$4.9)                                        | \$0.0       | 1.0  |
| Total |      | \$176              | \$95            | -\$31                                      | \$31                                        | \$0                                            | \$81        | 1.86 |

The spreadsheet which was used to calculate the transfers in the above table can be found on the [Balanced Portfolio section of the SPP Website](http://www.spp.org/section.asp?pageID=120).<sup>††</sup>

<sup>††</sup> <http://www.spp.org/section.asp?pageID=120>



## SPP Balanced Portfolio Report

The table shown below demonstrates the MW-mi impact of the deferred reliability projects. This impact is used to determine who receives the benefit for the deferral of each reliability project from the portfolio.

### Portfolio 3-E – Reliability Impact MW-mi analysis

|      | HUNTSVILLE - HEC<br>115KV CKT 1 -<br>Rebuild | HUNTSVILLE -<br>ST_JOHN 115KV<br>CKT 1 - Rebuild | CLEARWATER-GILL<br>ENERGY CENTER<br>WEST 138KV CKT 1 -<br>Rebuild | EL RENO- EL RENO<br>SW 69KV CKT 1 -<br>Upgrade | LONGVIEW-<br>WESTERN<br>ELECTRIC 161KV<br>CKT 1 - Replace<br>Wavetraps |
|------|----------------------------------------------|--------------------------------------------------|-------------------------------------------------------------------|------------------------------------------------|------------------------------------------------------------------------|
| Date | 2015                                         | 2015                                             | 2016                                                              | 2017                                           | 2018                                                                   |
| AEPW |                                              | 1.6%                                             |                                                                   |                                                |                                                                        |
| EMDE |                                              |                                                  |                                                                   |                                                |                                                                        |
| GRDA |                                              |                                                  |                                                                   |                                                |                                                                        |
| KCPL |                                              |                                                  |                                                                   |                                                |                                                                        |
| MIDW | 46.7%                                        | 16.2%                                            |                                                                   |                                                |                                                                        |
| MIPU |                                              |                                                  |                                                                   |                                                | 100.0%                                                                 |
| MKEC | 19.4%                                        | 36.0%                                            |                                                                   |                                                |                                                                        |
| OKGE | 1.3%                                         | 5.3%                                             |                                                                   | 24.7%                                          |                                                                        |
| SPRM |                                              |                                                  |                                                                   |                                                |                                                                        |
| SUNC | 9.9%                                         | 10.9%                                            |                                                                   |                                                |                                                                        |
| SWPS |                                              | 4.4%                                             |                                                                   |                                                |                                                                        |
| WEFA |                                              |                                                  |                                                                   | 75.3%                                          |                                                                        |
| WRI  | 22.6%                                        | 22.1%                                            | 100.0%                                                            |                                                |                                                                        |
| NPPD |                                              | 3.6%                                             |                                                                   |                                                |                                                                        |
| OPPD |                                              |                                                  |                                                                   |                                                |                                                                        |
| LES  |                                              |                                                  |                                                                   |                                                |                                                                        |
|      | 100.0%                                       | 100.0%                                           | 100.0%                                                            | 100.0%                                         | 100.0%                                                                 |

## SPP Balanced Portfolio Report

### Reliability Results

The reliability results for the Portfolio 3E “Adjusted” are shown in the following table. The projects are broken into “deferred” and “mitigated” issues and “new” issues. Additionally, projects are shown for potential third party impacts. Note that a project highlighted in yellow (e.g. EARLSBORO – FIXICO) indicates that the project is merely advanced in time and not an entirely new issue.

#### Portfolio 3e without Chesapeake

Costs of STEP Projects Solved by Portfolio 3e, with STEP date

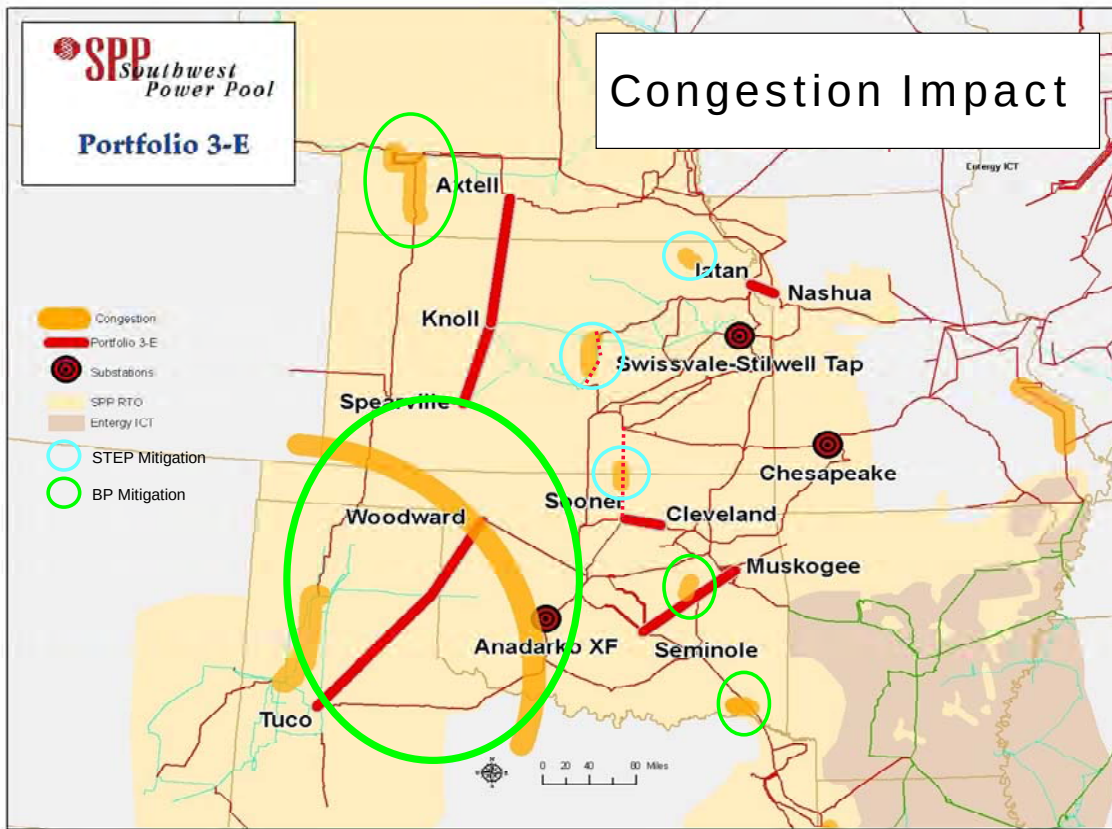
| Issue Type | Project Name                                                | Area | STEP Date | Deferred costs to TO: STEP projects solved by BP |
|------------|-------------------------------------------------------------|------|-----------|--------------------------------------------------|
| Overload   | CLEARWATER - GILL ENERGY CENTER WEST 138KV CKT 1 - Rebuild  | WERE | 16SP      | \$3,324,375                                      |
| Overload   | EL RENO - EL RENO SW 69KV CKT 1 - Upgrade                   | WFEC | 17SP      | \$1,950,000                                      |
| Overload   | HUNTSVILLE - HEC 115KV CKT 1 - Rebuild                      | WERE | 15SP      | \$12,487,500                                     |
| Overload   | HUNTSVILLE - ST_JOHN 115KV CKT 1 - Rebuild                  | MIDW | 15SP      | \$7,965,000                                      |
| Overload   | LONGVIEW - WESTERN ELECTRIC 161KV CKT 1 - Replace Wavetraps | MIPU | 18SP      | \$50,000                                         |
| Voltages   | None                                                        |      |           |                                                  |
| Totals     |                                                             |      |           | \$25,776,875                                     |

Cost of potential mitigation for New issues due to implementation of portfolio improvements

| Description                 | Project Name                                                     | Area      | Date of Needed Mitigation | SPP New Issues, Cost | Third Party Issues: Cost |
|-----------------------------|------------------------------------------------------------------|-----------|---------------------------|----------------------|--------------------------|
| Overloads-SPP               | EARLSBORO - FIXICO 69KV CKT 1 - Increase limits (trap, CT ratio) | OKGE      | 13SP                      | \$150,000            |                          |
| Overloads-SPP               | MED LODGE-PRATT, ST.JOHN-GREATBENDTAP 115 KV LINE REBUILD        | MKEC      | 18SP                      | \$15,840,000         |                          |
| Overloads-Third Party       | PLATTE CITY 161/69KV TRANSFORMER CKT 1 - Replace AECI XFMR       | MIPU-AECI | 13WP                      |                      | \$7,500,000              |
| Voltages                    | None                                                             |           |                           |                      |                          |
| Totals                      |                                                                  |           |                           | \$15,990,000         | \$7,500,000              |
| Grand Total                 |                                                                  |           |                           | \$23,490,000         |                          |
| Net: Solved Minus SPP New   |                                                                  |           |                           | \$9,786,875          |                          |
| Net: Solved Minus Total New |                                                                  |           |                           | \$2,286,875          |                          |

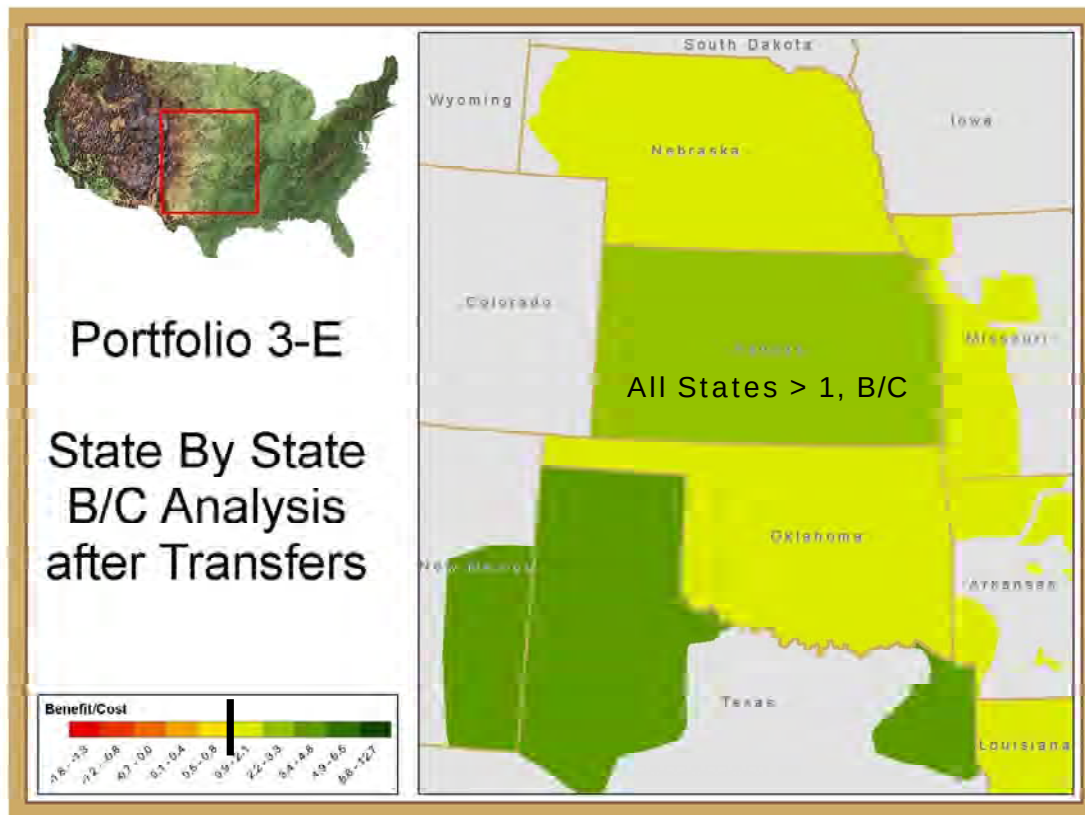
It should be noted that the third party impact of Platte City 161/69 kV transformer was coordinated with Associated Electric Cooperative, Inc. (AECI) staff. AECI staff did not see the same issue in their analysis.

## Congestion Impact



The graphic shown above represents the top flowgates in the SPP EIS Market as they exist today. Congestion here is shown as an orange highlight. Portfolio projects, shown on the map as bold red highlight lines, relieve or mitigate much of the congestion that exists today. The congestion relief provided by the portfolio is shown as a green circle. Projects in the 10-year STEP plan that provide additional congestion relief are shown in light blue.

**B/C by State**



The diagram above demonstrates the B/C ratio of the Balanced Portfolio divided by state boundaries. While it should be noted that the portfolio of projects provides broad, regional benefits to all SPP members, this diagram is a good representation of the balance aspect of the portfolio broken into the respective state boundaries. This picture represents the balance of the portfolio after transfers have taken place in order to balance all zones. As can be seen from the diagram, all states have a B/C ratio greater than 1

## SPP Balanced Portfolio Report

|                                            | Zone                      | OKGE                                | OKGE                                                | OKGE                                | SPS                                                                     | KCPL                                         | NPPD                                                                  | ITC                                             | KCPL                                         | OKGE                 |
|--------------------------------------------|---------------------------|-------------------------------------|-----------------------------------------------------|-------------------------------------|-------------------------------------------------------------------------|----------------------------------------------|-----------------------------------------------------------------------|-------------------------------------------------|----------------------------------------------|----------------------|
|                                            | Project                   | Sooner - Cleveland                  | Seminole - Muskogee                                 | Tuco - Woodward                     | Tuco - Woodward                                                         | Iatan - Nashua                               | Knoll - Axtell                                                        | Spearville - Knoll - Axtell                     | Swissvale - Stilwell Tap                     | Andadarko Sub        |
|                                            | Projected In-Service Date | 12/31/2012                          | 12/31/2013                                          | 5/19/2014                           | 5/19/2014                                                               | 6/1/2015                                     | 6/1/2013                                                              | 6/1/2013                                        | 6/1/2012                                     | 12/31/2011           |
| Cost                                       | Total Cost                | \$33,530,000                        | \$129,000,000                                       | \$79,000,000                        | \$148,727,500                                                           | \$54,444,000                                 | \$71,377,015                                                          | \$165,180,000                                   | \$2,00,000                                   | \$8,000,000          |
|                                            | Cost Per Mile             | \$900,000                           | \$1,250,000                                         | \$900,000                           | \$688,750                                                               | \$1,214,800                                  | \$1,416,667                                                           | \$846,000                                       |                                              | \$666,666            |
|                                            | Miles                     | 36                                  | 100                                                 | 72                                  | 178                                                                     | 30                                           | 45                                                                    | 170                                             |                                              | 3                    |
|                                            | Substation Cost           | \$1,130,000                         | \$4,000,000                                         | \$15,000,000                        | \$26,130,000                                                            | \$18,000,000                                 | \$6,827,000                                                           | \$16,800,000                                    |                                              |                      |
|                                            | Fixed Charge Rates        | 15.1%                               | 15.1%                                               | 15.1%                               | 12.1%                                                                   | 15.1%                                        | 13.5%                                                                 | 12.0%                                           | 15.1%                                        | 15.1%                |
| Conductor                                  | Size                      | 2 Conductor Bundle 795 ACSR         | 2 Conductor Bundle 1590 ACSR                        | 2 Conductor Bundle 795 ACSR         | 2 Conductor Bundle 795 ACSR                                             | 2 Conductor Bundle 1192.5, 38/19 Grackle TW  | 2 Conductor Bundle 477 T2 Hawk                                        | 2 Conductor Bundle 1590 ACSR                    | 2 Conductor Bundle 795 ACSR                  | 138 kV line          |
|                                            | Design                    | Single Circuit                      | Single Circuit                                      | Single Circuit                      | Single Circuit                                                          | Single Circuit                               | Single Circuit                                                        | Single Circuit                                  |                                              |                      |
|                                            | Electrical Capacity       | 2578 Amps 1540 MVA at 345kV         | 3000 Amps 1800 MVA at 345kV                         | 2578 Amps 1540 MVA at 345kV         | 2468 Amps Normal                                                        | 4,100A                                       | 2,324 amps per bundle                                                 | 3,000 amps                                      |                                              |                      |
|                                            | Other                     | Fiber-optic Shield wire             | Fiber-optic Shield wire                             | Fiber-optic Shield wire             | Fiber-optic Shield wire                                                 |                                              |                                                                       |                                                 |                                              |                      |
|                                            | Type                      | H-frame                             | Single Pole                                         | H-frame                             | H-frame                                                                 | H-frame                                      | Single Pole                                                           | H-frame                                         |                                              |                      |
| Structure                                  | Materials                 | Steel                               | Steel                                               | Steel                               | Steel                                                                   | Steel                                        | Steel                                                                 | Steel                                           |                                              |                      |
|                                            | Base                      | Direct buried w/ aggregate backfill | Steel base plate reinforced concrete                | Direct buried w/ aggregate backfill | Direct buried with aggregate or natural backfill                        | Direct Embed                                 | Poured concrete anchor bolt                                           | Direct embed concrete piers                     |                                              |                      |
|                                            | NESC Assumption           | Heavy                               | Heavy                                               | Heavy                               | Heavy                                                                   | Heavy                                        | Heavy, 1.5 inch ice load                                              |                                                 |                                              |                      |
|                                            | Dead Ends                 | Unknown                             | Unknown                                             | Unknown                             | Unknown @ \$65,000 each                                                 | 16 @ \$50,000 each                           | 20 @ \$140,000 each                                                   | 60 @ \$50,000 each                              | 2 to 3 Deadends                              |                      |
|                                            | Under build               | No                                  | No                                                  | No                                  | No                                                                      | No                                           | No                                                                    | No                                              |                                              |                      |
| Substations                                | Transformers              | Breakers and Relays                 | Two 345/138kV                                       | 345/138kV 50 MVAR reactor bank      | 345/230kV 560 MVA                                                       | 600 MVA                                      | None                                                                  | 345/230kV 200 MVA                               |                                              | 345/138 kV           |
|                                            | Breaker Scheme            | Ring-bus                            | Ring-bus, replace 2 2,000 A breakers                | Ring-bus                            | 345kV Ring                                                              | Ring-bus                                     | Ring-bus                                                              | Ring-bus                                        | 2 breakers, breaker disconnects, line panels |                      |
|                                            | Protection Scheme         | included in sub cost                | included in sub cost                                | included in sub cost                | \$1,000,000                                                             | \$400,000                                    | \$156,000                                                             | \$220,000                                       |                                              | included in sub cost |
|                                            | Voltage Control           |                                     |                                                     | +/- 50 MVAR                         |                                                                         |                                              |                                                                       |                                                 |                                              |                      |
|                                            | Cost (millions)           | \$1                                 | \$4                                                 | \$15                                | \$26                                                                    | \$18                                         | \$4                                                                   | \$14                                            |                                              |                      |
| Construction Labor                         | Amount                    | 1/3 of line construction            | 1/3 of line construction                            | 1/3 of line construction            |                                                                         |                                              |                                                                       |                                                 |                                              |                      |
|                                            | Cost (millions)           | \$14                                | \$52                                                | \$27                                | \$18                                                                    | \$7                                          | \$17                                                                  | \$49                                            |                                              |                      |
| Eng Design, Project Management, Permitting | ROW                       | 150ft @\$5,500 an acre              | 200ft @\$5,500 an acre                              | 150ft @ \$5,500 an acre             | 150ft                                                                   | 160ft                                        | 200ft                                                                 | 150ft                                           |                                              |                      |
|                                            | ROW Condition             | rural, pasture                      | rural, pasture, hill, rock, high tree clearing cost | rural, pasture                      | Farmland and Pasture                                                    | 50% Urban 50% Rural                          | rural farmland rainwater basin                                        | rural, agri, pasture, range land                | No ROW acquisition required                  |                      |
|                                            | Permitting/Certifications | RR and Highway                      | RR and Highway                                      | RR and Highway                      | Texas CCN, Highway, storm water, RR, County roads                       | Yes                                          | NE Power Review Board, NPSC, RR, Airport, etc                         | Included                                        |                                              |                      |
|                                            | Escalation Rate           | 2.5% per year                       | 2.5% per year                                       | 2.5% per year                       |                                                                         | 2.5% per year                                | 3% per year                                                           | 0% for 2 years                                  |                                              |                      |
|                                            | Eng. Design / Proj. Mang. |                                     |                                                     |                                     | Included                                                                | \$349,000                                    | \$8,798,000                                                           | \$13,770,000                                    |                                              |                      |
| Loadings and Overheads                     | Total Cost (millions)     | cost included                       | cost included                                       | cost included                       | \$15                                                                    | \$26                                         | \$18                                                                  | \$24                                            |                                              |                      |
|                                            | Type 1                    | Included in total cost              | Included in total cost                              | Included in total cost              | Included in total cost                                                  | \$123,000                                    | Included in total cost                                                | 20% of line and substation work, \$26.7 million |                                              |                      |
| Other Cost Factors and Notes               |                           |                                     | \$25,000/ mile cost included for tree clearing      |                                     | Included in substation cost is \$6.52 mil for mid-point reactor station | Large portion involves developed urban areas | Environmentally sensitive areas, possible double-circuit for 10 miles | \$4.56 mil addition contingency added           |                                              |                      |



## **Study Assumptions**

**Fuel Price Assumptions** – Fuel price assumptions are taken from EIA forecasts and updated according to member specific data for particular plants. For the purpose of this study, the average gas price is \$6.50/MMBtu starting in 2012. The price is then escalated for inflation for the years 2017 and 2022 at the rate of 1.81%.

**Environmental Costs** - Carbon sensitivities have been conducted, but were not included in the portfolio selection process. A price of \$15 and \$40 per metric ton was used in these sensitivities. No sensitivity analysis was conducted for higher SO<sub>2</sub> or NO<sub>x</sub> prices. SO<sub>2</sub> and NO<sub>x</sub> were priced at \$466.50 and \$1742.16 per ton respectively.

**Plant Outages** – Stakeholders provided outage and maintenance rates to SPP staff through the EMMTF data collection effort. Forced outages were taken as a single draw and locked for the change and the base case. Similarly, maintenance outages were also locked down from a single scheduled pattern. These outage rates were plant specific and provided by each member.

**Load Forecast** – Load forecasts for the region were provided by each stakeholder in early 2009 for the projected years of 2012, 2017 and 2022 through the EMMTF update effort. These non coincident peak loads for the region were, in aggregate, as follows: 2012 - 43,068MW, 2017 – 47,109 MW, 2022 – 51,530 MW. The zonal shares of the 2012 load submittals were used to allocate the costs on a load ratio share basis.

**Resource Forecast** – The CAWG and EMMTF determined the criteria for inclusion of new resources into the Balanced Portfolio analysis. It was determined that only plants with firm transmission service and signed agreements or plants that were currently under construction would be included in the analysis. The following units are those which were included as a future resource.

- Turk (618 MW)
- Whelan Energy Center 2 (220 MW)
- Iatan 2 (900 MW)
- Central Plains (99 MW)
- Cloud County (201 MW)
- Flat Ridge (100 MW)
- Red Hills (120 MW)
- Smoky Hills (359 MW)

**Hurdle Rates** – A dispatch hurdle rate of \$5/MW and a commit hurdle rate of \$8/MW was used to commit resources across regional boundaries.

**Demand Side Management** – Interruptible load was modeled as supplied by the LSE's.

**Market Structure** – The simulation was conducted considering a single balancing authority and a day-ahead market structure for the SPP region.

**Flowgate Assumptions** – The NERC Book of Flowgates was used as the source for flowgates used in the analysis.

**DC Tie Profiles** - Historical DC Tie profiles were used to simulate best known profiles for all DC Ties in the SPP region.

**Wind Profiles** – Historical wind profiles were used to simulate the wind output at each wind farm.

**Load Profiles** – Load profiles were simulated as supplied by each LSE through the EMMTF effort.

**RMR Requirements** – Each Balancing Authority submitted their respective Reliability Must Run (RMR) requirements to be simulated in the analysis.

**Operating Reserves** – SPP's current reserve sharing program (as of 2008) was used in the simulation for operating reserves.

# **SPP Priority Projects Phase II Final Report**

MAINTAINED BY  
SPP Engineering/Planning

SPP Board Approved  
April 27, 2010

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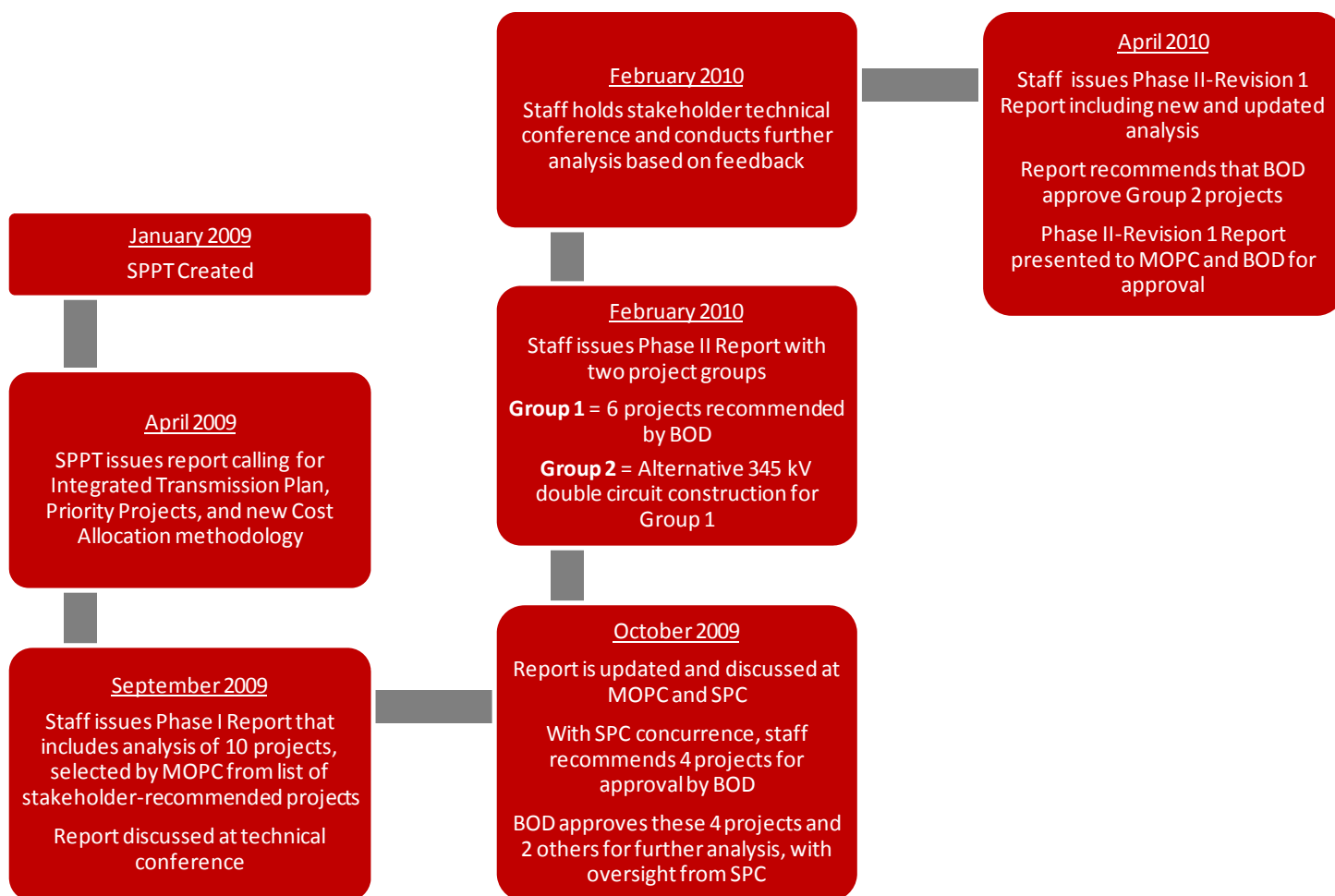
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## Executive Summary

In April 2009, SPP was directed by the SPP Board of Directors to implement the Synergistic Planning Project Team's (SPPT) recommendations for creating a robust, flexible, and cost-effective transmission system for the region, large enough in both scale and geography to meet SPP's future needs. Development of Priority Projects was one major recommendation; the others were to develop an Integrated Transmission Planning process that improves and integrates SPP's existing planning processes, and to implement a new cost allocation methodology.

SPP was charged with identifying, evaluating, and recommending Priority Projects that will improve the SPP transmission system and benefit the region, specifically projects that will reduce grid congestion, improve the Generation Interconnection and Aggregate Study processes, and better integrate SPP's east and west regions. This report, Priority Projects Report Phase II - Revision 1, is the third in a series of Priority Projects reports that have been completed by SPP staff with input from stakeholders and the Transmission Working Group (TWG), Economic Studies Working Group (ESWG), Cost Allocation Working Group (CAWG), Markets and Operations Policy Committee (MOPC), Strategic Planning Committee (SPC), and Board of Directors (BOD). The following timeline illustrates the iterative development of the reports:

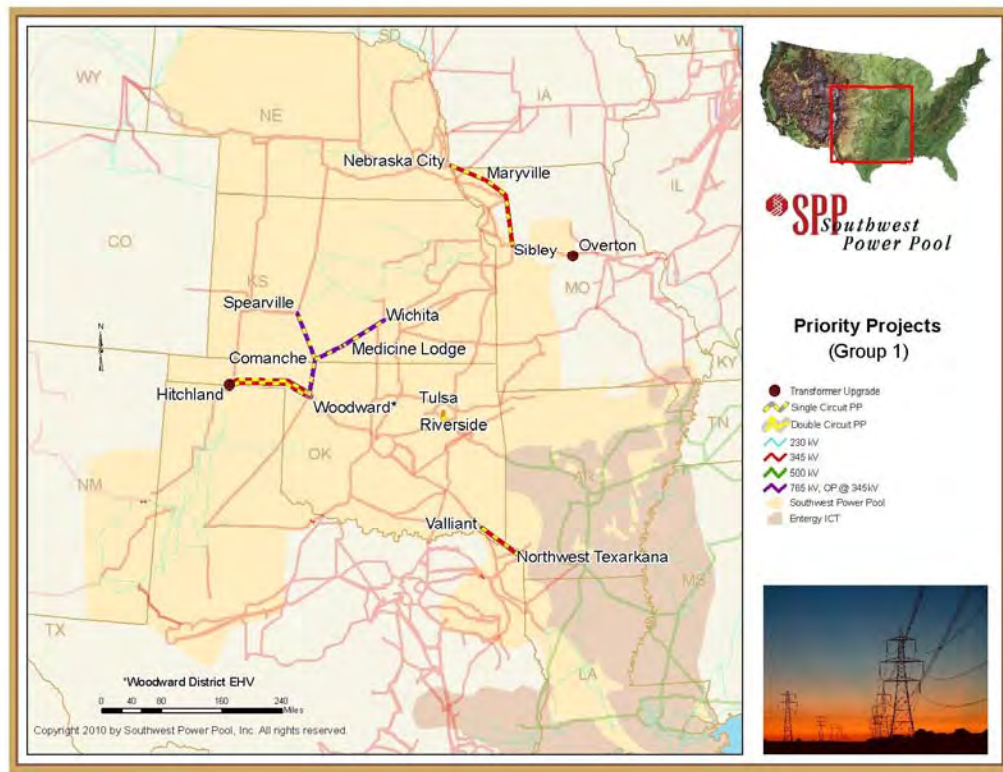




For the Phase I Report, SPP staff and outside consultants performed engineering and economic analyses to assess a number of metrics, including adjusted production costs (APC), system losses, impacts to reliability projects, local and environmental impacts, and deliverability of capacity and energy to load. The Phase I Report included two future scenarios in which either 10% (7 GW) or 20% (14 GW) of the SPP region's energy needs would be served by wind.

This Phase II Report-Revision 1 analysis includes two Priority Project groups with future wind levels of 7 GW and 11 GW.<sup>1</sup> The same projects were studied in both groups; however, in Group 1, Spearville-Comanche-Medicine Lodge-Wichita and Comanche-Woodward District EHV are constructed at 765 kV, while in Group 2 these two lines are constructed at double-circuit 345 kV.

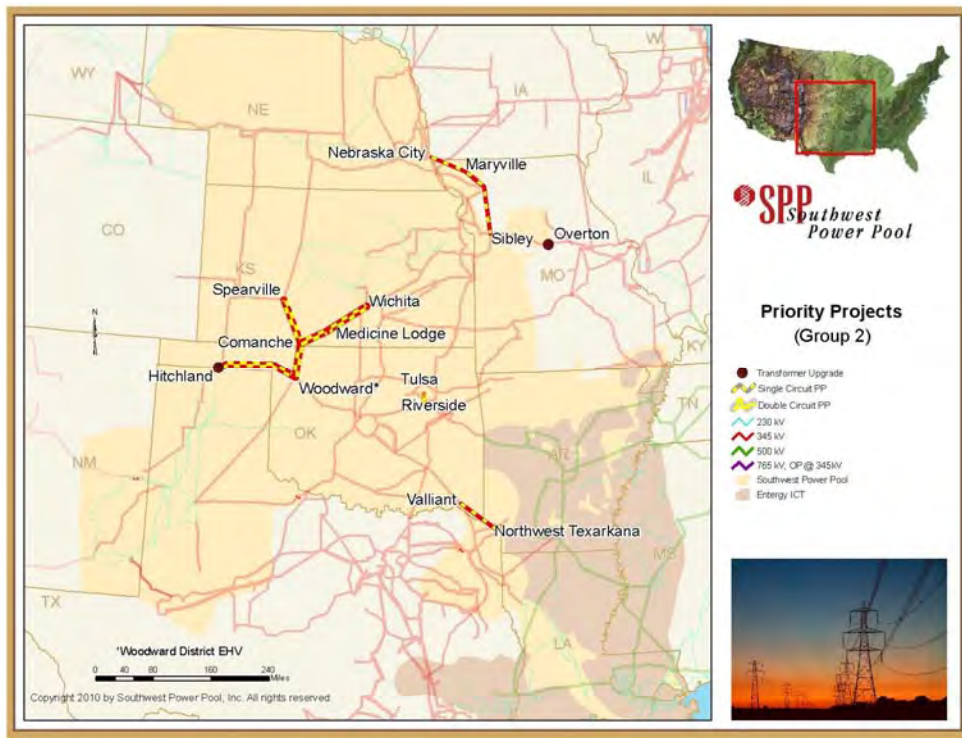
Group 1 has estimated engineering and construction costs of \$1.26 billion:



1. Spearville – Comanche – Medicine Lodge – Wichita (765 kV construction and 345 kV operation)
2. Comanche – Woodward District EHV (765 kV construction and 345 kV operation)
3. Hitchland – Woodward District EHV (345 kV double circuit construction)
4. Valiant – NW Texarkana (345 kV)
5. Nebraska City – Maryville – Sibley (345 kV)
6. Riverside – Tulsa Reactor (138 kV)

<sup>1</sup> The 11 GW wind level was chosen based on a CAWG survey sent to SPP members to determine what levels of renewable resources are needed to meet state mandates or voluntary targets.

Group 2 has estimated costs of \$1.11 billion:



1. Spearville – Comanche – Medicine Lodge – Wichita (345 kV double circuit)
2. Comanche – Woodward District EHV (345 kV double circuit)
3. Hitchland – Woodward District EHV (345 kV double circuit)
4. Valiant – NW Texarkana (345 kV)
5. Nebraska City – Maryville – Sibley (345 kV)
6. Riverside – Tulsa Reactor (138 kV)

For Priority Projects Report Phase II - Revision 1, The Brattle Group revised its analysis based on the alternative project groups and wind levels, and KEMA updated its analysis with the most recent SPP economic model outputs. Other additions to this version: inclusion of BOD-approved projects from the 2009 SPP Transmission Expansion Plan, an additional transformer needed at Hitchland to accommodate Priority Projects, changing the Cooper-Maryville-Sibley 345 kV project to terminate at Nebraska City, an updated coal price forecast, the addition of the 11 GW wind analysis, additional constraint identification, and updated load ratio share numbers (see Revision 1 Modifications section).

Revision 1 analysis demonstrates that Group 2 has a greater Benefit to Cost (B/C) ratio: a combined 1.78 quantitative and qualitative B/C for the SPP region. Group 2 has a quantitative B/C ratio of 1.12 and a qualitative B/C of 0.66. Quantitative benefits were determined based on analysis of APC; APC adjustment due to wind revenue; transmission system losses; reduction in gas prices (Attachment 6, KEMA report); and impact on reliability project advancement, deferrals, and additions. Qualitative benefits were based on the economic output (jobs, goods/services, taxes, etc.) from the construction and operation of the projects

and the operation of an additional 3.2 GW of wind (Attachment 4, The Brattle Group analysis).<sup>2</sup>

These Priority Projects achieve the strategic goals identified in the April 2009 SPPT report. They will reduce congestion, as demonstrated in the APC analysis and by the levelization of Locational Marginal Prices (LMPs) across the SPP footprint. The average LMP price differential reduces from +/- 35% for the base case to +/- 28% for Group 2. Priority Projects will improve the Aggregate Study process by creating additional transfer capability and allowing additional transmission service requests to be enabled. The addition of 3,000-5,000 MW of wind energy as well as new non-renewable generation will result from these projects. First Contingency Incremental Transfer Capability calculations determined that Priority Projects would increase the ability to transfer power in an eastward direction for two-thirds of the eastward paths by connecting SPP's western and eastern areas (see Attachment 5).

Staff is recommending that the Board of Directors approve Priority Projects Group 2 for construction, based on the projects' compatibility and consistency with the SPPT goals while demonstrating a calculated B/C ratio of 1.78. SPP recognizes these are only a portion of the benefits that will be attained as a result of these projects. Other benefits, which are not measured, include but are not limited to: enabling future SPP energy markets, dispatch savings, reduction in carbon emissions and required operating reserves, storm hardening, meeting future reliability needs, improving operating practices/maintenance schedules, lowering reliability margins, improving dynamic performance and grid stability during extreme events, and additional societal economic benefits.

These Priority Projects are incremental to the substantial progress SPP members have already made in expanding transmission for reliability and economic needs. The Report of the Synergistic Planning Project stated, "The SPPT believes that the region should quickly identify, review, and construct, with haste, projects that continue to show up in multiple system evaluations as needed to relieve congestion on existing flowgates and to tie the eastern and western sections of the region together". After 11 months of analysis and review, SPP staff believes the projects in Group 2 clearly meet the goals stated in the SPPT report, and requests the Board of Director's approval in taking the next step in creating regional transmission solutions to address SPP's unique challenges and opportunities.

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<sup>2</sup> The Brattle Group studied the benefits of an additional 3.2 GW of wind (combined with SPP's existing 3.8 GW, this comprises the 7 GW scenario). The 0.66 B/C represents a conservative 25% of the \$1.6 billion in benefits from the operation of 3.2 GW of wind; benefits from the construction phase were not included in the B/C.

**Group 2 Benefits at a Glance**

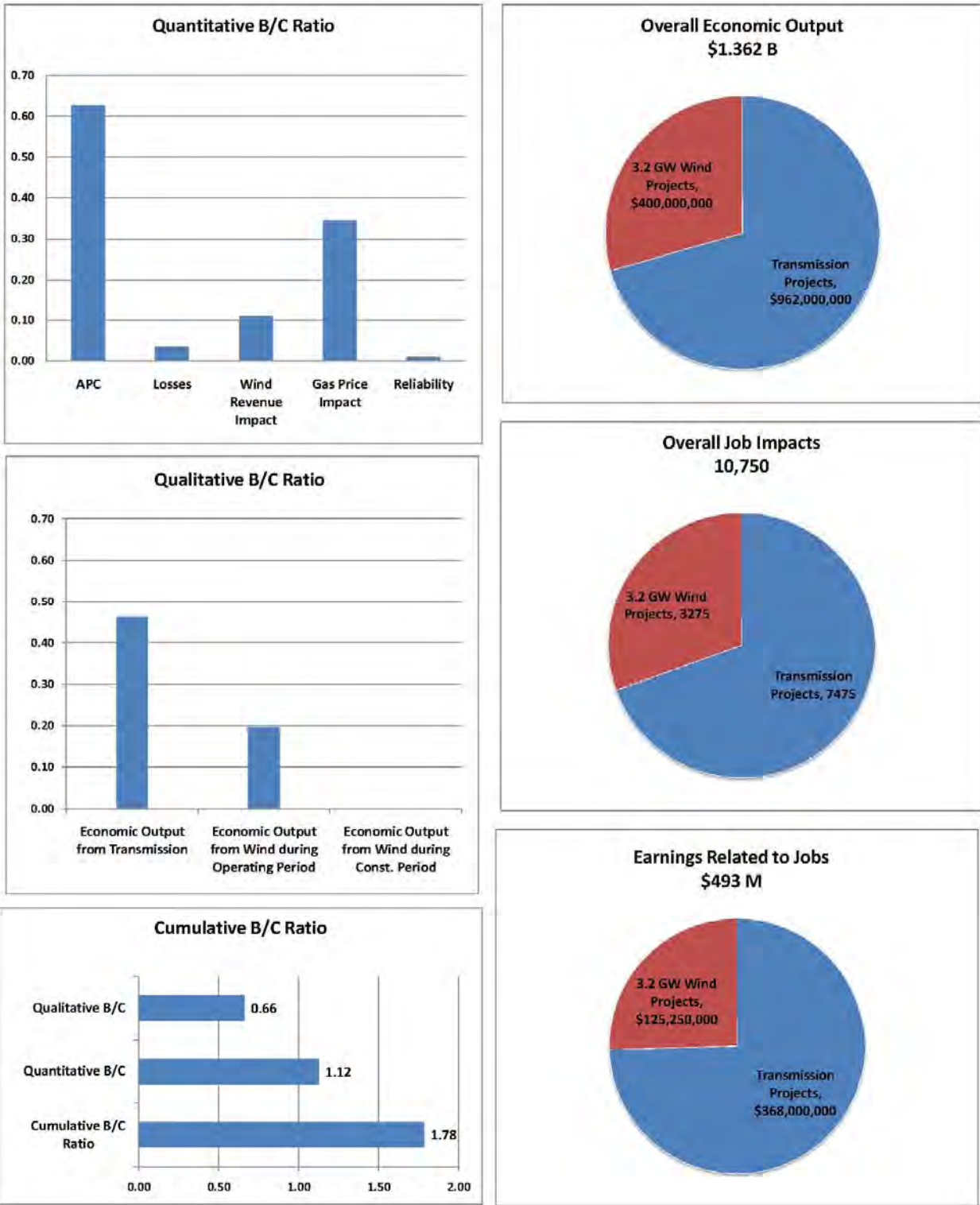


Figure 1



## Revision 1 Modifications

SPP released the Priority Projects Phase II draft report on February 2, 2010, and on February 10 facilitated a stakeholder technical conference to discuss the report. Based on feedback received at the conference, SPP made several modifications to the Priority Project analysis. Many of the changes are explained in greater detail throughout this report, but a summary of the major modifications follows:

- **Inclusion of 2009 STEP Projects:** At its January 2010 meeting, the Board of Directors approved a subset of the projects included in Appendix B of the 2009 SPP Transmission Expansion Plan (STEP). SPP modified the Priority Project reliability and economic analysis to include the recently approved 2009 STEP projects; this report now includes all projects that have been issued Notifications to Construct (NTCs).
- **Previously-Identified Reliability Projects:** On January 19, 2010 the TWG endorsed with comment the TWG Reliability Report that analyzed the reliability impact of adding Priority Projects to the transmission system (see Attachments 2 and 3). The report identified an additional 345/230 kV transformer was needed at Hitchland to accommodate Priority Projects. Because this transformer is shown as needed solely due to Priority Projects, the study has been modified to consider it as part of the Priority Projects package (change case project).
- **Nebraska City-Maryville-Sibley 345 kV Project:** At the February 10 technical conference, Nebraska Public Power District (NPPD) presented its analysis of the Cooper South flowgate and potential solutions the organization considered for improving congestion. Based on discussion at the conference and NPPD's analysis and recommendation, SPP modified the termination point of the previously proposed Cooper-Maryville-Sibley 345 kV project to the Nebraska City substation rather than the Cooper substation.
- **Coal Prices:** Discussions with stakeholders identified the need for SPP to better understand the fuel price assumptions being used in the economic modeling. As explained in this report, gas prices are taken from the NYMEX exchange projections. Staff received the coal forecast from the economic modeling software vendor. The forecast used in previous Priority Project analyses indicated coal prices decreasing over time. In preparing Revision 1 analysis, staff asked several member companies what they were using for their own assumptions regarding coal prices and compared these results with the forecast previously used in the study of the Priority Projects. For this Revision 1 analysis, the software vendor provided its most recently updated coal price forecast. This updated forecast showed coal prices increasing over time which is consistent with information provided by stakeholders.

- **11GW Wind Level:** After Priority Project Phase II Report assumptions were finalized and the study began, the Cost Allocation Working Group surveyed SPP members to determine what levels of renewable resources each state was either mandated to meet or were voluntarily targeting by 2030. The results of this survey indicated approximately 11.3 GW of wind would be needed to satisfy these mandates or targets. To give stakeholders as much information as possible, SPP analyzed Priority Projects using approximately 11.3 GW as an additional analysis to the 7 GW study.
- **Additional PAT Analysis:** After performing each study, SPP attempts to improve its study methods. Based on results of previous analysis and discussions with stakeholders, staff performed additional analysis to help identify constraints that should be used in economic modeling. After this additional analysis was completed, the ESWG reviewed the constraints used in the economic modeling. Some additional modifications were made to the constraints based on this review.
- **Updated Load Ratio Share (LRS):** For this report and the calculation of benefit to cost ratios, Priority Projects costs are allocated to each zone based on LRS. LRS numbers used in the previous Priority Project reports were based on numbers used in the Balanced Portfolio analysis approved in 2009. Stakeholders had questions about LRS numbers in previous Priority Project reports since they did not correspond to the LRS numbers used in the recently approved 2009 STEP report. This report uses LRS numbers based on member data received by SPP's Settlements Department as recent as March 2010.



## Scope of Priority Projects Phase II, Rev. 1 Analysis

### Study Assumptions

Assumptions used in Priority Projects modeling and analysis were vetted through the SPP stakeholder process and amended by the Strategic Planning Committee (SPC) at its November 19 meeting. The majority of assumptions were developed by the Benefits Analysis Techniques Task Force (BATTF), approved by the Economic Studies Working Group (ESWG), and reviewed by the Markets and Operations Policy Committee (MOPC). For the Priority Projects analysis, PROMOD software was used to model 8,760 hours representing a full year of system-wide commitment and dispatch of resources.

- **Time Frame** – The BATTF directed use of a ten-year time frame to analyze Priority Project benefits. Three years throughout the ten-year planning horizon were modeled - 2009, 2014, and 2019 - and benefits for the years in-between were calculated using a linear progression. The total of the ten-year benefit was used to create the Net Present Value (NPV). A terminal value was used to represent the final B/C of the project from the last year of analysis (i.e. 2019). Considering the scope and lifetime of some of the projects, a 20- and 40-year financial result is extrapolated from data used in the 10-year analysis.
- **Fuel Prices** – The gas price was determined by using the Henry Hub NYMEX ten-year forecast with an additional adder for fuel distribution differences across the footprint. SPP used the 2010 forecast as the starting point since it was the first year in which an entire year's forecast was available. The starting price for the 2009 model runs was \$5.20/MMBtu. The coal price forecast was provided by the economic modeling software vendor and was updated for this analysis. Other fossil fuel prices used generic assumptions and publicly-available data.
- **Wind Modeling** – SPP was directed by the SPC to study Priority Projects using 7 GW of nameplate wind generation in the SPP footprint, and to study the same wind in both the base and change cases. The Priority Projects model contained 3.8 GW of existing wind that was identified as in-service or under construction. Wind plants with a signed interconnection agreement (IA) and that have given SPP authorization to proceed with the construction of the required network upgrades were considered "under construction". To reach the 7 GW target, staff added an additional 3.2 GW of generic wind generation.

In addition to the 7 GW study, staff assessed 11.3 GW of wind in the SPP footprint based on results of a Cost Allocation Working Group (CAWG) survey, which assessed the renewables needed to meet state mandates or targets in the SPP region. Data provided in the CAWG survey was reported in MWh. To determine what the necessary wind capacity would be to meet mandates/targets, SPP used a 40% capacity factor for Texas, Oklahoma, New Mexico, Kansas, and Nebraska. For Missouri and Arkansas, a 30% capacity factor was used. In the economic analysis, the wind profiles for wind farms in Missouri and Arkansas will represent this lower capacity factor.

Using the Generation Interconnection (GI) queue as a guide, SPP staff, with the help of the ESWG, recognized the significant amount of GI requests in the relative locations of Spearville and Hitchland. SPP staff worked in conjunction with the ESWG to modify the wind injection placement points. The results are listed below:

**Wind Added to Reach 7 GW**

|                 |          |
|-----------------|----------|
| Fairport (MO)   | 600 MW   |
| Hitchland (OK)  | 1,077 MW |
| Hoskins (NE)    | 196 MW   |
| Gentlemen (NE)  | 196 MW   |
| Spearville (KS) | 605 MW   |
| Woodward (OK)   | 522 MW   |

**Wind Added to Reach 11.3 GW**

|                        |          |
|------------------------|----------|
| Washington County (AR) | 197.5 MW |
| Fairport (MO)          | 33 MW    |
| Spearville (KS)        | 1,500 MW |
| Knoll (KS)             | 200 MW   |
| Hoskins (NE)           | 157 MW   |
| Gentlemen (NE)         | 157 MW   |
| Potter (TX)            | 600 MW   |
| Broken Bow (NE)        | 80 MW    |
| Albion (NE)            | 120 MW   |
| Roosevelt (NM)         | 300 MW   |
| Grapevine (TX)         | 50 MW    |
| Hitchland (OK)         | 1,025 MW |

| State      | Current Wind | Additional to 7GW | Additional to 11GW | Total Wind |
|------------|--------------|-------------------|--------------------|------------|
| Arkansas   | 0            | 0                 | 198                | 198        |
| Kansas     | 960          | 605               | 1,700              | 3,265      |
| Louisiana  | 0            | 0                 | 0                  | 0          |
| Missouri   | 0            | 600               | 33                 | 633        |
| Nebraska   | 243          | 392               | 514                | 1,149      |
| New Mexico | 204          | 0                 | 300                | 504        |
| Oklahoma   | 1,367        | 1,599             | 1,025              | 3,991      |
| Texas      | 904          | 0                 | 650                | 1,554      |
| Total      | 3,677        | 3,196             | 4,420              | 11,292     |

**Table 1: Wind Injection Amounts (MW)**

Values in the table above do not represent any other renewable resources such as solar, hydroelectric, or biomass which may be used to meet a Renewable Portfolio Standard. Wind allocation and placement are estimates and represent reasonable approximations for the future development of wind resources within SPP as discussed by the ESWG.

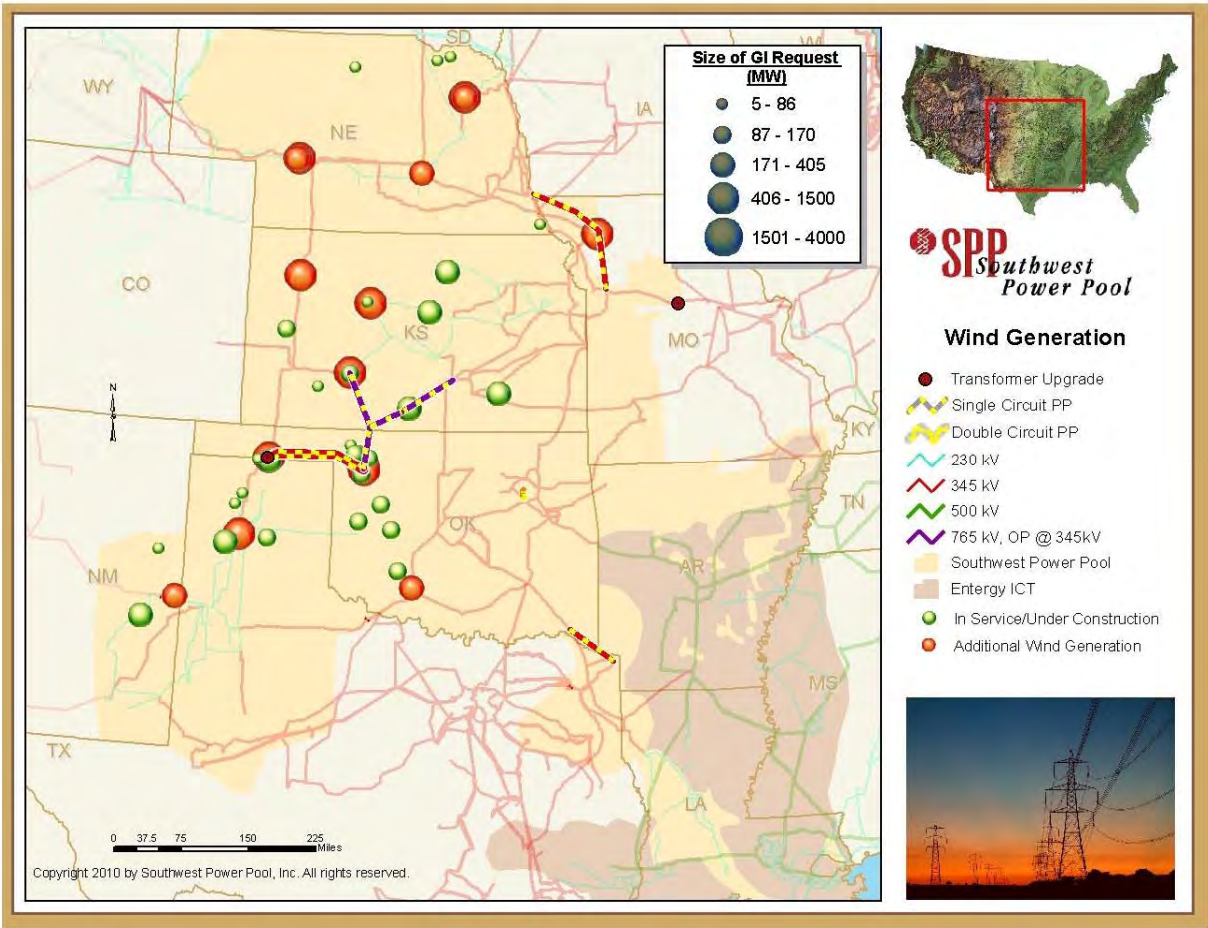


Figure 2: Wind Generation Modeled at 7 GW

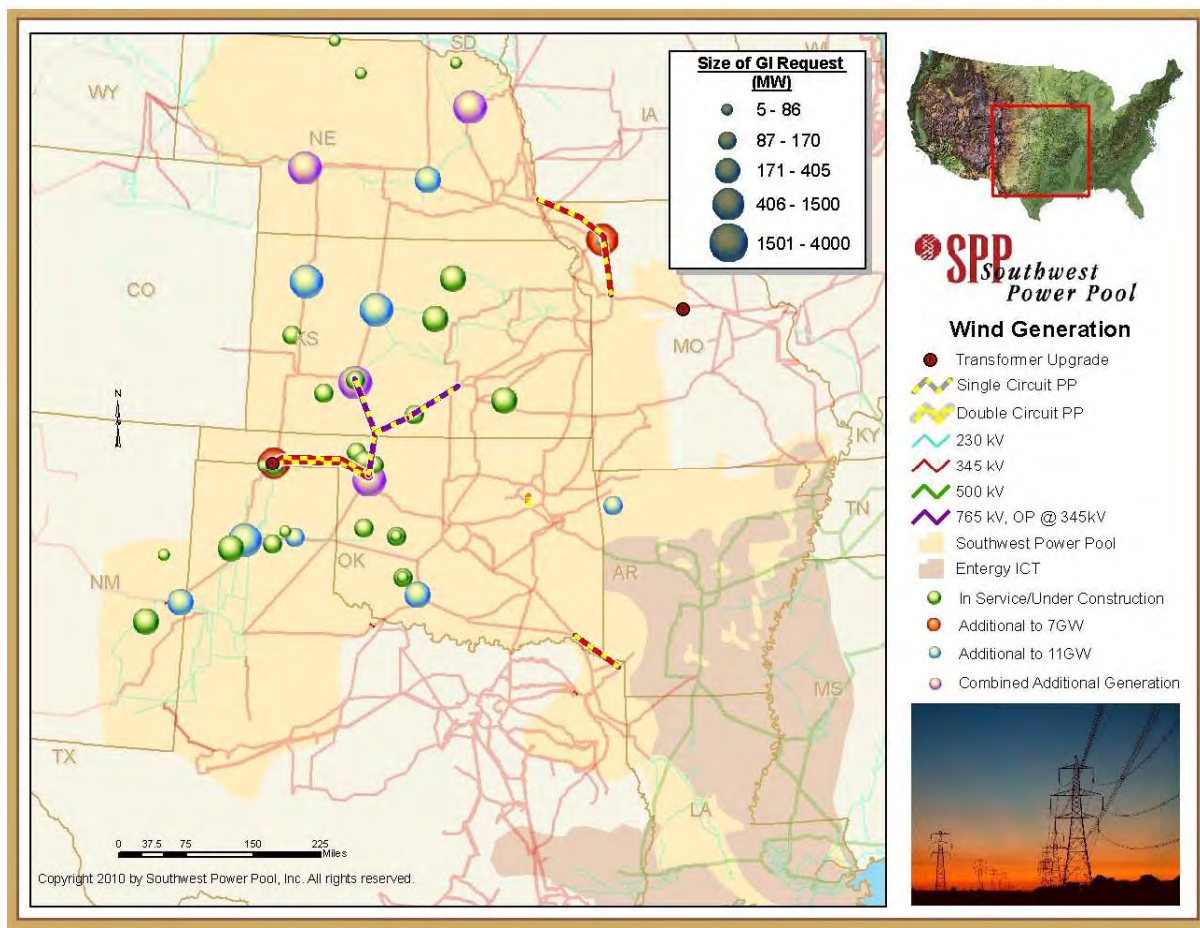


**Figure 3: Wind Generation Modeled at 11 GW**

- **Study Footprint** – The study footprint contains SPP, Entergy, TVA, MAPP, MISO (Ameren, MEC, et al), PJM, Southern Companies, WAPA, Basin Electric, Big Rivers Electric Company, Associated Electric Cooperative Inc. (AECI), E.ON, and East Kentucky Power Cooperative.
- **DC Ties** – Historical DC Tie profiles were used to simulate profiles for all DC Ties in the SPP region. DC ties modeled<sup>3</sup> for the SPP region are located at:
  - Oklaunion
  - Welsh
  - Lamar
  - Eddy County
  - Blackwater
  - Sidney

<sup>3</sup> The Stegall DC tie in Nebraska was not modeled in this planning assessment because Tri-State/Basin did not grant SPP permission to use the historical data.



- **Environmental Costs** – Estimates of emission costs for SO<sub>2</sub> and NO<sub>x</sub> were approximated using data from the Chicago Climate Exchange. CO<sub>2</sub> was not explicitly priced in the economic modeling due to the uncertainty of future climate policy. Mercury was not addressed due to the lack of valid market information.
- **Non-Wind Resource Model Additions** – Only plants with a signed interconnection agreement (IA) and that have given SPP authorization to proceed with the construction of the required network upgrades were considered “under construction”.
- **Plant Outages** – Data for outages and maintenance was taken from the ESWG’s 2009 data collection and review process that was used for Balanced Portfolio and Priority Projects Phase I efforts. This data was originally provided by stakeholders, and stakeholders had the opportunity to provide updated outage and maintenance information in October and November 2009. Forced outage rates were taken as a single draw and locked for the change and the base cases to eliminate biased results due to different outage schedules. Similarly, maintenance outages were also locked from a single scheduled pattern. These outages were plant-specific.
- **Operating Reserves** – SPP’s current reserve sharing program (as of 2009) was used in the operating reserves simulation.
- **Hurdle Rates** – Hurdle rates are rates that are applied to ensure a minimum price differential is in place before an exchange is made. Specific hurdle rates are applied in the modeling for both generating unit commitment and security-constrained economic dispatch. SPP attempts to quantify the hurdle rates within the base models to reasonably represent transactions that have occurred or will occur in the SPP market.

A dispatch hurdle rate of \$5/MW and a commit hurdle rate of \$8/MW were used to commit resources across regional boundaries. These values are similar to values applied within various studies of the Eastern Interconnection and represent recommended rates as described in the Transmission Network Economic Modeling and Methods document prepared by the Economic Modeling and Methods Task Force in 2006. There were no hurdle rates for internal SPP market transactions.

- **Load Forecasts** – In early 2009, stakeholders submitted load forecasts for 2012, 2017, and 2022. To determine load for the study years of 2009, 2014, and 2019, an escalation rate of 1.29% per year was used. This escalation rate is the default used in PROMOD and represents a reasonable approximation of load growth within SPP.
- **Market Structure** – The simulation was conducted considering a consolidated balancing authority and a day-ahead market structure for the SPP region. The economic model simulates a consolidated balancing authority by economically dispatching all resources within the SPP footprint. The day-ahead market is the PROMOD default operation and means that resources in the footprint are dispatched economically based on the calculated future prices for each resource. This market

structure is very different from the way SPP currently operates, so the study results should not be compared to how each individual balancing authority currently operates.

### **Stakeholder Data Review Process**

Data used in Priority Projects analysis went through an extensive data review process. The ESWG determined that certain data fields would be reviewed and updated by stakeholders while other data fields would use only publicly available data. The publicly available data included any generation cost data as well as heat rate information. By using only publicly available data, the ESWG attempted to ensure that Tier 1 entities were treated the same as SPP members in the model and to limit the amount of proprietary information contained in the model.

The following data fields were reviewed by the SPP RTO Tariff members: Maximum Capacity, Unit Type, Commission Date, Retirement Date, Bus, Minimum Capacity, Maintenance Required Hours, Forced Outage Rate, Forced Outage Duration, Minimum Downtime, Minimum Run Time, Must Run Status, Ramp Rates, and demand data. The members also reviewed the data to ensure all units were being accounted for and were being modeled in the correct zone.

The data review process included two iterations. After the initial PROMOD run, the stakeholders were provided the model inputs as well as load and generation output data. At this time they were able to update the inputs to correct any errors which caused their units to dispatch unrealistically. Once these corrections were applied to the model, staff ran PROMOD again to produce new dispatch results and to provide members with an opportunity to review how their changes impacted unit dispatch. Members were again able to suggest changes to the model for the second iteration. Once the PROMOD run for the second iteration was complete, staff provided this data to stakeholders for approval. All Transmission Owners indicated their approval on the input and output data by Thursday, January 14, 2010.

In Revision 1 stakeholders were given the opportunity to review both the Event File and the Powerflow Branch data. If a stakeholder replied during the timeframe with additional flowgates that SPP should monitor, staff reviewed those suggestions and the flowgates were added to the event file.

### **Value Metrics**

The BATTF developed or approved use of the following quantifiable value metrics to be used in the calculation of financial benefit from the Priority Projects analysis:

#### **Adjusted Production Cost**

Adjusted Production Cost (APC) is a measure of the impact on production cost savings by Locational Marginal Price (LMP), accounting for purchases and sales of economic energy interchange. This benefit metric is typically simulated by a production cost modeling tool accounting for 8,760 hourly profiles yearly of commitment and dispatch modeling, taken over the course of the study period.



Nodal modeling is aggregated on a zonal basis using weighted LMPs. There is concern that modeling the border points will not be accurate without additional Eastern Interconnection points. For example, the border LMPs will have significant impact on the APC within SPP. If there are lower LMP prices outside SPP, there will be no transfers from the western portion of SPP. The BATTF recommended the modeled footprint be broadened to include Southern Companies, Basin Electric, WAPA, TVA, PJM, MISO (Ameren, MEC, et al), and the DC ties (using the recent historic patterns) at a minimum when running the model to assess the impact on the borders.

The nodal analysis was aggregated on a zonal basis using the following formulation. The calculation, performed on an hourly basis:

**Adj Prod Cost** = Production Cost - Revenue from Sales + Cost of Purchases

Where:

**Revenues from Sales** = MW Export x Zonal LMP<sub>Gen Weighted</sub>  
and

**Cost of Purchases** = MW Import x Zonal LMP<sub>Load Weighted</sub>

The tools used for this analysis include standard assumptions and modeling utilizing PROMOD.

The rationale for using this methodology is as follows:

- This formula was previously used by stakeholders, the MOPC, RSC, and BOD as part of the approval of the Balanced Portfolio analysis.
- The formulation represents the broad impact of new transmission projects in changing LMP costs (energy, congestion and losses cost) to rate payers within the SPP footprint. It represents much of the savings/benefits or additional cost to rate payers for specific transmission projects.

The total APC for the projects was calculated using the APC value for the projects in three different years. The years that were studied, and subsequently had an APC value, are 2009, 2014, and 2019. Benefits of the in-between years (i.e. 2010, 2011, etc.) were calculated linearly using the benefit values from the two years that were studied (i.e. 2009 and 2014). The sum of the APC benefits for each of the 10 years is the total APC. This same methodology was utilized in the recently adopted Balanced Portfolio.

### **Impact on Losses - Energy**

Lower impedance transmission lines provide a loss savings to the transmission grid. The energy component of the loss savings is captured as part of the APC analysis. It is possible that losses will increase since generation sources could be located further from load centers.

### **Impact on Losses – Capacity**

While the energy component of losses is captured in the APC analysis, the capacity component is not. Capacity savings associated with a loss change are determined by looking at the selected hourly loadflow models to determine the loss change associated with a transmission upgrade. The BATTf established standard capacity prices to capture capacity savings. Calculations were based on a Combustion Turbine (CT) replacement, currently priced at \$750 per kW installed (based on the expected cost to install various types of machines used by BATTf members).

There is a fixed Operations and Maintenance (O&M) cost component base of \$650,000 per year (average expected cost experienced by BATTf members). This is an additive benefit for capturing the capacity component of that energy typically passed on to ratepayers through Ancillary Service charges. This is the variance in quantity of energy (capacity). The capacity component of losses is captured in the formulation below:

- Capacity Savings at Coincidental Peak = ((Capacity requirement at Peak (base case) – Capacity requirement at Peak (with projects upgrades included)) x (CT replacement cost)).

This would be a savings estimate of the capacity, since the CT installation would be a one-time cost when the upgrade was energized.

- There is a fixed O&M cost savings associated with this calculation, captured in the Ancillary Services fee.

It is calculated as Fixed Cost Benefit = (Capacity savings (as determined from above per 150 MW) x \$ 650,000/yr), escalated by the rate of inflation as reported by the Bureau of Economic Analysis.

- The price differential was calculated on an annual basis from the point the proposed upgrade is energized to the end of the defined 20-year period. There were no additional accommodations for savings after 20 years, because a CT has an estimated 20-year life span.
- This formulation is the estimated benefit or cost impact of losses.

### **Environmental Impacts**

Initially, analysis of carbon benefits was to be conducted; however, the prescribed method of modeling the same level of wind in the base and change cases does not support the previously developed calculations needed for carbon benefit estimates. The ESWG is discussing methods to explicitly model the impacts of carbon for use in the Integrated Transmission Planning process. SPP acknowledges a great deal of additional benefit will be realized by enabling higher amounts of renewable resources to interconnect to SPP's transmission system, thereby reducing the level of carbon being emitted. Not assessing the

benefits of reduced carbon emissions provides much more conservative results for the Priority Project analysis.

### **Reliability Impact**

In the Phase I evaluation, 11 potential Priority Projects and three additional Priority Projects groups were evaluated for their impacts on the SPP Transmission Expansion Plan (STEP) Reliability Assessment. Priority Project impacts include net, new needed projects, and STEP projects that could be deferred or advanced. As part of Phase II evaluation, the list of Priority Projects was refined to two groups of projects that are electrically similar, and their impact on the STEP Reliability Assessment and on first tier parties to SPP was evaluated. This Priority Project reliability analysis was conducted in the same manner and with the same methodologies used in the STEP Reliability Assessment.

The Priority Project Reliability Report (Attachment 2) is not intended to justify any Priority Project based on deferred project cost alone; it is only intended to show the effects of Priority Projects on the STEP Reliability Assessment. At this time, in-service dates for Priority Projects are not definite. For this study the projects are included in the 2014 models. If a project identified for deferment has a STEP date before 2014 it may or may not actually be deferred. It may be possible to mitigate these issues for the short period of time before a specific Priority Project(s) is in service.

### **APC Adjustment Due to Wind Revenue Impact**

Conventional thermal generation is modeled explicitly based on ownership or designation for each unit. This explicitly modeled generation is then factored into APC calculations through each resource's cost to produce energy as well as determining whether a zone has excess energy each hour (revenues from sales) or lacks sufficient generation to serve its load (costs from purchases).

Traditionally, SPP's APC calculations have not considered the revenues paid to wind resources because they must be modeled as a transaction rather than a conventional generating unit. The wind must be modeled as a transaction so the variability of the wind can be taken into account. Staff does this by profiling the wind based on historical output patterns for each wind resource. Wind generation's impact on *production costs* can be thought of as subtracting the dispatched wind generation from the load that is met from other generation sources. Because of the different modeling method for wind resources, the impact of wind generation on *revenues from sales* and *costs from purchases* was not included in the initial calculation of APC and must be added to obtain a corrected overall measure of these components.

To illustrate this calculation, consider the following simplified example, in which it is assumed that price differences between load and generation assigned to the same zone are zero. A zone's revenues from sales or costs from purchases can then be determined by taking the difference between what loads in a zone pay and what the generation attributed to that zone is paid. For example, if in an hour, a zone has excess generation, it will receive *revenues from sales* in the amount of the number of MWhrs in excess times the gen-weighted LMP for that hour. However, if a zone is deficient in generation for the hour, it will pay *costs from*

purchases in the amount of the number of MWhrs deficient times the load-weighted LMP for that hour.

Revenues paid to wind resources were excluded from the initial calculation of *revenues from sales* and *costs of purchases*. For the above scenarios, if wind attributed to the zone is paid \$1,000, then to correctly calculate APC, this \$1,000 needs to be added to *revenues from sales* or subtracted from *costs for purchases* for that zone in that hour.

What is important in calculating the overall benefit from APC is the difference between APC in the change case compared to the base case. To correctly adjust APC, the Wind Revenue Impacts are calculated by subtracting the base case wind revenues from the change case wind revenues and adding the impacts back to the initial calculation of APC to correct for the initial exclusion of the revenues of these resources. The CAWG developed the methodology used to allocate the wind revenues to each zone. The allocation was calculated using the need of each zone for renewable energy to meet its renewable energy targets as determined from a CAWG survey on renewable energy targets.

### **SEAMS Coordination**

A letter was sent to AECI, CLECO, ERCOT, ESI, MISO, TVA, and WECC on December 16, 2009 to inform them of the projects being proposed as Priority Projects. The letter also encouraged the organizations to engage in the Priority Project stakeholder process through SPP's organizational groups.

### **Breakeven Analysis**

The ESWG met on November 3, 2009 to provide its recommendations to the Strategic Planning Committee regarding Priority Projects. One of the recommendations was for SPP to determine what level of wind would be required to produce a benefit to cost ratio (B/C) of 1 for Priority Projects. Staff agreed this analysis would be performed as time permitted, but the results of this Revision 1 analysis achieved a B/C greater than 1.0.

## Economic Modeling Tools

### PROMOD

PROMOD IV is a detailed nodal and zonal market simulation tool offered by Ventyx. It provides users a way to assess the economic impacts of changes to the transmission system. For the Priority Projects study, staff primarily utilized the Locational Marginal Price (LMP) forecasting and unit dispatch capabilities of PROMOD IV.

The Transmission Analysis Module (TAM) utilized by PROMOD IV performs a detailed simulation of market operations considering any inefficiencies across seams. PROMOD IV TAM is an hourly chronological simulation of electric market operations using a detailed transmission grid topology which can include up to 46,000 buses and 56,000 transmission lines. PROMOD IV TAM uses an hourly forecast of loads at each bus, along with detailed descriptions of generators to commit and dispatch under an LMP market.

LMPs are calculated for both the generation-weighted and load-weighted average hub LMPs for the footprint. Prices are provided in full hourly detail (8760 hours) and can be summarized into monthly periods. The net production cost is calculated hour-by-hour, and the formula is variable generation costs (fuel costs, variable O&M costs, emission costs, startup-costs), plus the cost of external purchases (if generation is less than demand) minus external sales revenues (if generation exceeds load) on an hourly basis. The cost of external purchases is computed as the MW purchase level times the load-weighted sub-region's LMP. The external sales' revenues are computed as the MW sale level times the generation-weighted sub-region's LMP.

The Adjusted Production Cost (APC) benefit of a project is determined by using the metrics described above. PROMOD IV also provides detailed price components of transmission congestion for market hubs while identifying areas of potential improvement.

PROMOD IV LMP utilizes a Security-Constrained Unit Commitment (SCUC) algorithm, recognizing the following bids and constraints:

- Generation:
  - Minimum capacity with no-load energy bid
  - Segmented energy bids with ramp up and ramp down limits
  - Startup cost bid
  - Minimum runtime and minimum downtime (hours)
  - Operating reserve contribution
- Transmission:
  - Individual transmission flow limits (including DC ties)
  - Flowgate limits on interfaces
  - Phase Angle Regulator (PAR) angle limits
  - Dynamically determined transmission loss penalty factors



- Market:
  - Load balance with market net interchange limits and hurdle rates
  - Regional operating reserves (both spinning and non-spinning)

LMP is calculated for individual nodes and hubs with congestion price (broken out by flowgate) and loss price components.

### **PROMOD Analysis Tool (PAT)**

The PAT (also known as the PROMOD Analysis Tool) is an interactive program that forms and solves a transmission-constrained economic dispatch model. All of the input data for the PAT analysis for Priority Projects comes from Ventyx's PROMOD program, which is a large, complex batch program used by SPP for long-term transmission and generation planning studies. The PAT uses the same mathematical model, and provides an intuitive tool for studying and temporarily modifying the underlying details of the transmission and generation systems, and computing the resulting changes in dispatch and locational bus pricing information that result from the optimization. PAT specifically in Priority Projects analysis to research congested bottlenecks and identify their causes. This provided staff with additional contingencies which were added for PROMOD to monitor.

## Priority Projects Phase II, Rev. 1 Analysis Results

### Synergistic Planning Project Team Recommendation Impacts

The Synergistic Planning Project Team (SPPT) recommended that Priority Projects should:

1. Reduce grid congestion
2. Improve the Aggregate Study and Generation Interconnection study queues
3. Integrate SPP's east and west transmission systems

### Reduce Congestion

The impact of reducing congestion is primarily captured through APC modeling. Another indicator of reduced congestion is the levelization of Locational Marginal Prices (LMPs) across the footprint. As a robust transmission system is constructed and congestion reduced, the differential between the minimum and maximum LMP is reduced, resulting in lower energy costs to consumers. The difference between the average minimum and maximum LMP price for 7 GW and 11 GW wind levels is depicted in the following charts. The LMP price differential reduces from +/- 35% for the base case to +/- 28% for Group 2. Averages were calculated across the 2009, 2014, and 2019 data points.

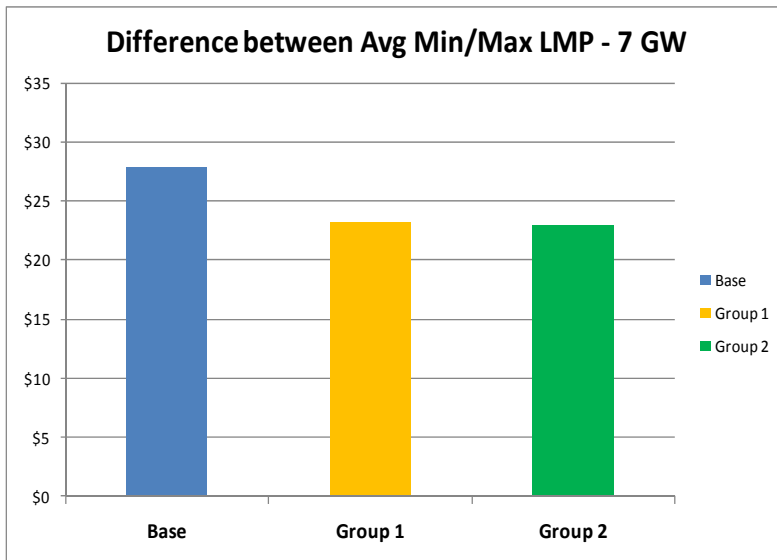


Figure 4: Spread of Avg Min/Max LMPs - 7 GW

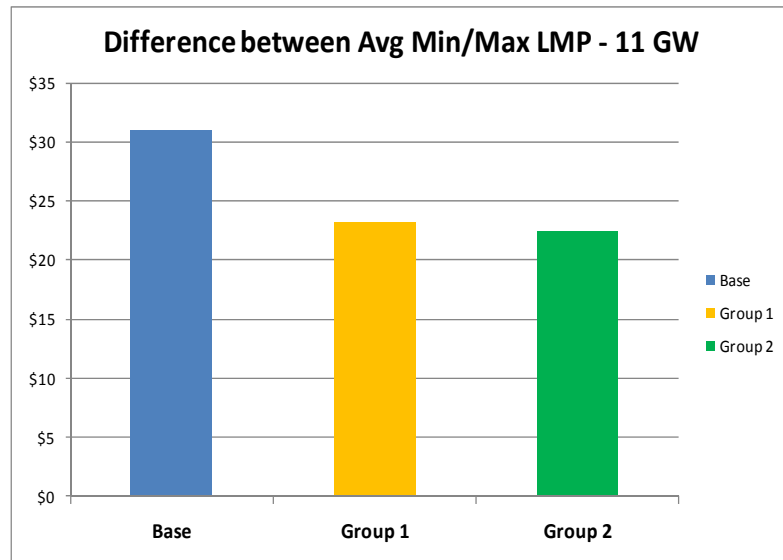


Figure 5: Spread of Avg Min/Max LMPs - 11 GW

## Improve Aggregate Study and Generation Interconnection Queues

The SPPT's criteria for Priority Projects included projects that repeatedly appear in the Aggregate Study process as a known and needed upgrade to deliver transmission service for multiple parties. The Priority Projects studied in this report will create additional transfer capability across the SPP footprint. They will also relieve congestion on lower-voltage facilities for local delivery of energy, allowing additional transmission service requests to be enacted. The map below depicts Priority Projects relative to previously identified points of receipt (POR) and points of delivery (POD) taken from Aggregate Studies 2007-AG1, 2007-AG2, and 2006-AG3.

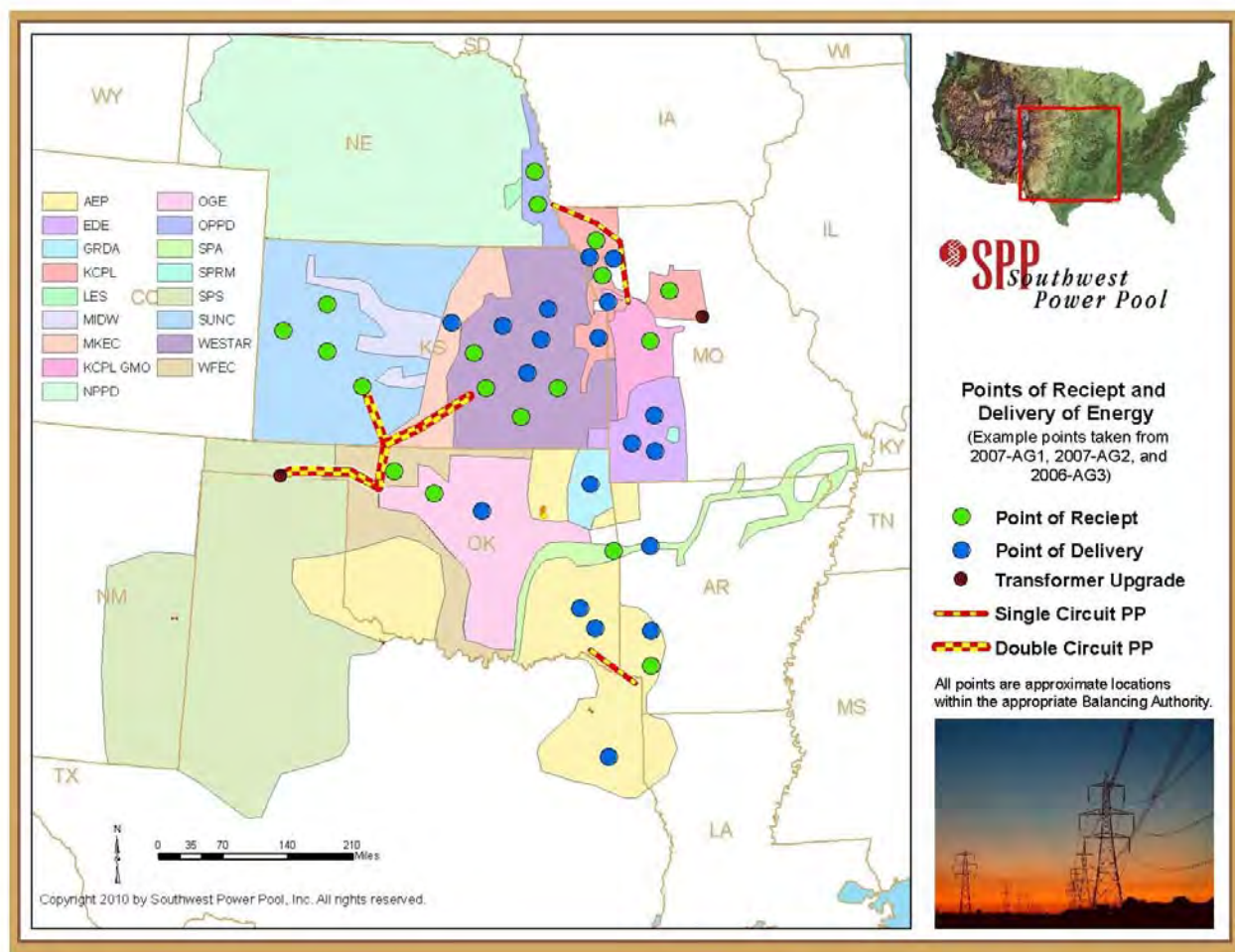


Figure 6

The SPPT stated that Priority Projects should improve the Generation Interconnection (GI) process by enabling the addition of more new generation to the grid. GI study FCS-2008-001 determined the additional transmission needed to interconnect 3,000 – 5,000 MW of additional wind. The transmission identified included a portion of the Priority Projects.

These Priority Projects will also facilitate the addition of other types of generation. Data taken from the GI queue on 2/3/2010 shows that new non-renewable generation is in close proximity to the proposed Priority Projects:

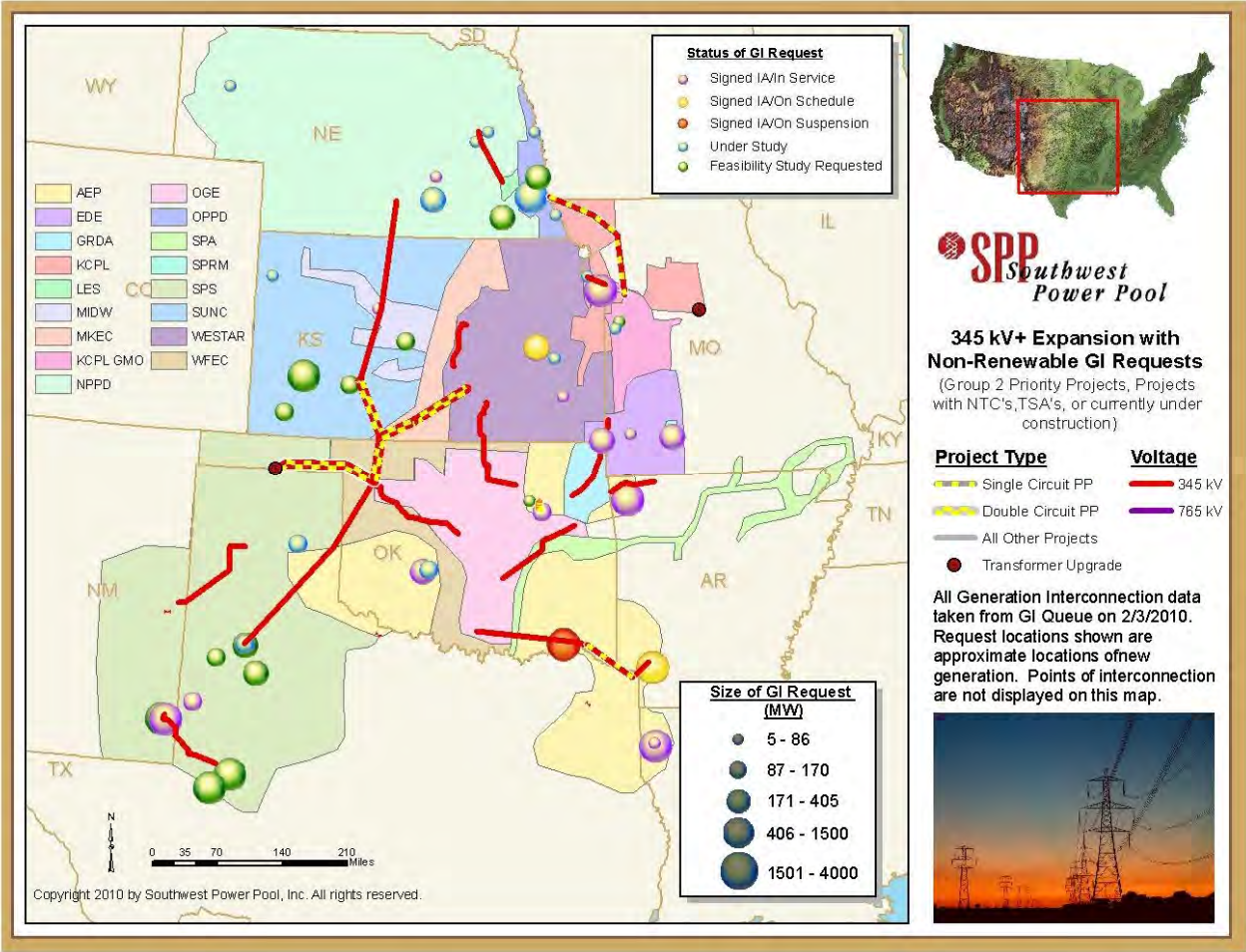


Figure 7: Non-Renewable GI Requests

Loads from multiple major cities within the SPP footprint will be positively impacted by Priority Projects. Improving the transmission system will improve congestion, allowing these cities to be served more efficiently. The figure below depicts Priority Projects and other approved extra high voltage transmission lines in relation to SPP's major load centers:



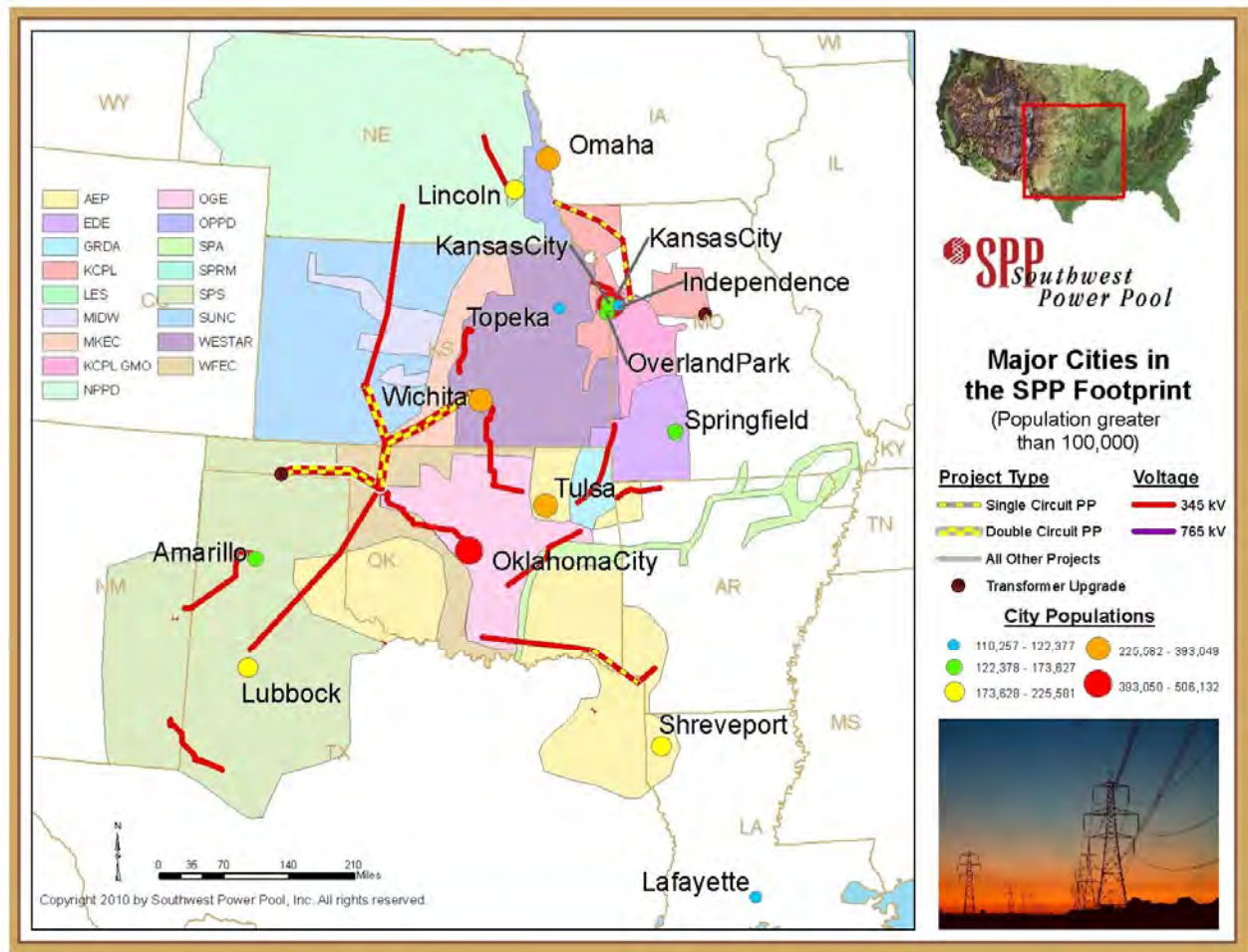


**Figure 8: Major Cities in the SPP Footprint**

### Improve West to East Transfers

Analysis was conducted to measure enhancements to the interface between the SPP footprint's western and eastern regions as a result of Priority Projects. This analysis evaluated the support provided by the projects to power transfers originating in the western part of SPP and terminating in the eastern part. The analysis used a novel approach that geographically divided the SPP footprint into ten sections, then performed First Contingency Incremental Transfer Capability (FCITC) calculations to determine the transfer capability with and without Priority Projects.

The calculations show the Priority Projects increase the ability to transfer power in an eastward direction by connecting the western and eastern areas. This detailed analysis indicates that the greatest rewards will be gained in the future, as more of the underlying limitations are mitigated. The increase in transfer capability correlates exactly with the SPPT's stated goal; that Priority Projects should enhance the interface between SPP's western and eastern transmission systems. See Attachment 5 for this analysis.



## Summary of Economic Results

Multi-faceted and detailed analysis was performed using the study assumptions and definitions of the value metrics to derive APC, impact on losses (capacity), reliability (deferral and advancement of STEP projects with Notifications to Construct), gas price impact, and an APC adjustment due to revenues from wind plants.

This report describes the value metric results related to the two project study groups and wind levels. According to the CAWG member survey, the 7 GW wind level is not enough for each member to meet its existing renewable mandates/targets. For this reason, SPP performed supplemental analysis on Priority Projects considering approximately 11.3 GW wind.

The financial analysis is provided in three timeframes including the first ten years, the second ten years, and the last twenty years based on the projects' scope and lifetime.

The impact of transmission expansion on a typical residential customer electric bill is approximately 33.5 cents per kW/month of demand per \$1 billion of investment. At the August 26, 2009 CAWG meeting, there was general consensus among regulators, transmission owners, marketers, and wind developers that there is a customer impact of approximately \$1/month per \$1 billion of transmission investment assuming a residential demand of 3 kW. Additional detail on calculating Priority Projects' impact on customer bills is in Appendix H.

| <b>7 GW</b> |                 |              |              |                     |                  |                            |                         |                      |             |
|-------------|-----------------|--------------|--------------|---------------------|------------------|----------------------------|-------------------------|----------------------|-------------|
| Study Group | APC             | Reliability  | Losses       | Wind Revenue Impact | Gas Price Impact | Total Benefit (Years 1-40) | Total Cost (Years 1-40) | Net Benefit (B - C)  | B/C         |
| Group 1     | \$1,309,997,915 | \$13,318,645 | \$67,763,548 | \$209,902,141       | \$708,295,867    | <b>\$2,309,278,116</b>     | <b>\$2,316,856,640</b>  | <b>(\$7,578,523)</b> | <b>1.00</b> |
| Group 2     | \$1,301,191,318 | \$20,813,781 | \$70,570,431 | \$230,924,482       | \$718,066,058    | <b>\$2,341,566,071</b>     | <b>\$2,082,298,794</b>  | <b>\$259,267,277</b> | <b>1.12</b> |

**Table 2: Benefits and Costs Summary – 7 GW**

| <b>11 GW</b> |                 |              |              |                     |                  |                            |                         |                        |             |
|--------------|-----------------|--------------|--------------|---------------------|------------------|----------------------------|-------------------------|------------------------|-------------|
| Study Group  | APC             | Reliability  | Losses       | Wind Revenue Impact | Gas Price Impact | Total Benefit (Years 1-40) | Total Cost (Years 1-40) | Net Benefit (B - C)    | B/C         |
| Group 1      | \$1,979,862,546 | \$13,318,645 | \$67,763,548 | \$2,005,193,986     | \$1,006,676,089  | <b>\$5,072,814,813</b>     | <b>\$2,316,856,640</b>  | <b>\$2,755,958,174</b> | <b>2.19</b> |
| Group 2      | \$2,053,031,037 | \$20,813,781 | \$70,570,431 | \$2,202,758,931     | \$1,043,516,243  | <b>\$5,390,690,423</b>     | <b>\$2,082,298,794</b>  | <b>\$3,308,391,629</b> | <b>2.59</b> |

**Table 3: Benefits and Costs Summary – 11 GW**

### Adjusted Production Cost

The tables below indicate the results of the adjusted production cost (APC) analysis. For each group of projects studied, the APC was calculated between the base and change case for each specific study year. The results for 2009, 2014, and 2019 were then linearly interpolated between the years and extrapolated for the next ten years. After the twentieth year, benefits were held constant until the fortieth year at which time benefits were assumed to cease. Finally, a net present value (NPV) was calculated for each study group using the full forty years of benefits and an 8% discount rate. This is the value shown in the benefits summary tables above.

|         | 2009         | 2014         | 2019          |
|---------|--------------|--------------|---------------|
| Group 1 | \$32,476,000 | \$81,119,000 | \$104,576,000 |
| Group 2 | \$32,681,000 | \$80,700,000 | \$103,914,000 |

**Table 4: Regional APC Results – 7 GW**

|         | 2009         | 2014          | 2019          |
|---------|--------------|---------------|---------------|
| Group 1 | \$69,219,000 | \$132,958,000 | \$158,293,000 |
| Group 2 | \$60,892,000 | \$141,205,000 | \$160,502,000 |

**Table 5: Regional APC Results – 11 GW**

### Impact on Losses – Capacity

Capacity savings and fixed cost benefits were calculated using methods suggested by the Benefit Analysis Techniques Task Force (BATTF) in the Benefit Analysis for Priority Projects Report (Attachment 1). The change in losses was calculated for each study period and interpolated between each year. Results were extrapolated to capture the last ten years of benefits. Per the BATTF recommendations, loss savings were assumed to terminate after twenty years due to the expected life of a combustion turbine. A net present value was then calculated for the losses, and the results are provided in the table below. Loss savings were calculated using the same powerflow models as used in the reliability assessment, and do not include additional wind above existing levels. These projected loss savings figures are the same for both the 7 GW and 11 GW study scenarios.

| <b>Group 1</b> |                        |                        |                     |
|----------------|------------------------|------------------------|---------------------|
| <b>Zone</b>    | <b>2010 - 2019 NPV</b> | <b>2020 - 2029 NPV</b> | <b>Total</b>        |
| AEPW           | \$26,179,331           | \$466,105              | \$26,645,436        |
| EMDE           | \$451,662              | \$7,521                | \$459,183           |
| GMO            | \$343,443              | \$1,905                | \$345,348           |
| GRDA           | (\$225,831)            | (\$3,760)              | (\$229,592)         |
| KCPL           | \$2,151,017            | \$41,329               | \$2,192,347         |
| LES            | (\$147,456)            | (\$1,884)              | (\$149,340)         |
| MIDW           | \$5,315,808            | \$95,844               | \$5,411,653         |
| MKEC           | \$10,553,494           | \$195,421              | \$10,748,915        |
| NPPD           | \$1,577,665            | \$24,453               | \$1,602,117         |
| OKGE           | (\$8,569,222)          | (\$141,025)            | (\$8,710,247)       |
| OPPD           | \$1,162,154            | \$24,411               | \$1,186,565         |
| SPRM           | \$148,480              | \$1,884                | \$150,363           |
| SUNC           | \$301,052              | \$3,767                | \$304,820           |
| SWPS           | \$17,228,076           | \$283,926              | \$17,512,002        |
| WEFA           | \$9,257,033            | \$154,175              | \$9,411,209         |
| WRI            | \$862,125              | \$20,644               | \$882,769           |
| <b>Total</b>   | <b>\$66,588,831</b>    | <b>\$1,174,716</b>     | <b>\$67,763,548</b> |

Table 6: Impact on Losses - Group 1

| <b>Group 2</b> |                        |                        |                     |
|----------------|------------------------|------------------------|---------------------|
| <b>Zone</b>    | <b>2010 - 2019 NPV</b> | <b>2020 - 2029 NPV</b> | <b>Total</b>        |
| AEPW           | \$27,993,228           | \$498,058              | \$28,491,286        |
| EMDE           | \$451,662              | \$7,521                | \$459,183           |
| GMO            | \$581,638              | \$7,535                | \$589,173           |
| GRDA           | (\$226,855)            | (\$3,760)              | (\$230,615)         |
| KCPL           | \$2,455,224            | \$46,966               | \$2,502,190         |
| LES            | (\$147,456)            | (\$1,884)              | (\$149,340)         |
| MIDW           | \$5,620,015            | \$101,481              | \$5,721,496         |
| MKEC           | \$10,846,359           | \$199,188              | \$11,045,548        |
| NPPD           | \$1,438,479            | \$24,439               | \$1,462,918         |
| OKGE           | (\$7,136,883)          | (\$116,586)            | (\$7,253,469)       |
| OPPD           | \$1,296,223            | \$24,425               | \$1,320,648         |
| SPRM           | \$148,480              | \$1,884                | \$150,363           |
| SUNC           | \$222,677              | \$1,891                | \$224,568           |
| SWPS           | \$17,377,579           | \$285,810              | \$17,663,389        |
| WEFA           | \$9,932,480            | \$165,457              | \$10,097,937        |
| WRI            | (\$1,500,397)          | (\$24,446)             | (\$1,524,843)       |
| <b>Total</b>   | <b>\$69,352,453</b>    | <b>\$1,217,978</b>     | <b>\$70,570,431</b> |

Table 7: Impact on Losses - Group 2

### Reliability Impact

SPP will work with Ameren as a potentially affected system in accordance with existing agreements to resolve the Overton impacts identified in the reliability assessment. The reliability analysis is summarized in the table below showing revenue requirements associated with advancements, deferments, and overall net impact for the Priority Project study groups. Results are categorized into:

1. Advanced: Projects that would be moved up in the reliability timeline due to the Priority Project
2. New: Projects which are now needed that were not identified in the original 10-year STEP reliability planning horizon, but may have been needed beyond that horizon
3. New third-party: Projects needed on neighboring systems due to the Priority Projects
4. Deferred: Projects which are either deferred beyond the planning horizon or mitigated entirely due to Priority Projects
5. Net Impact – Net cost or benefit of STEP reliability projects related to Priority Projects. Amounts shown for reliability impact in the overall benefits and costs summary tables are in terms of NPV of the Annual Transmission Revenue Requirements. This Net Present Value is limited to a 40-year project life.

| Priority Project Group                                  | Advanced Projects | New SPP Projects | New 3 <sup>rd</sup> Party Projects | Deferred Projects | Net Impact |
|---------------------------------------------------------|-------------------|------------------|------------------------------------|-------------------|------------|
| <b>Group 1</b>                                          |                   |                  |                                    |                   |            |
| Hitchland – Woodward District EHV Double 345 kV         |                   |                  |                                    |                   |            |
| Spearville – Cmche – Med. Ldg – Wichita 765 kV @ 345 kV |                   |                  |                                    |                   |            |
| Comanche – Woodward District EHV 765 kV @ 345 kV        | \$0M              | \$4.5M           | \$0M                               | \$17.8M           | \$13.3M    |
| Nebraska City – Maryville – Sibley 345 kV               |                   |                  |                                    |                   |            |
| Valliant – NW Texarkana 345 kV                          |                   |                  |                                    |                   |            |
| Riverside Station – Tulsa Power Station 138 kV Reactor  |                   |                  |                                    |                   |            |
| <b>Group 2</b>                                          |                   |                  |                                    |                   |            |
| Hitchland – Woodward District EHV Double 345 kV         |                   |                  |                                    |                   |            |
| Spearville – Cmche – Med. Ldg – Wichita Double 345 kV   |                   |                  |                                    |                   |            |
| Comanche – Woodward District EHV Double 345 kV          | \$0M              | \$16.8M          | \$0M                               | \$37.6M           | \$20.8M    |
| Nebraska City – Maryville – Sibley 345 kV               |                   |                  |                                    |                   |            |
| Valliant – NW Texarkana 345 kV                          |                   |                  |                                    |                   |            |
| Riverside Station – Tulsa Power Station 138 kV Reactor  |                   |                  |                                    |                   |            |

**Table 8: Reliability Impact Results**

### APC Adjustment Due to Wind Revenue Impact

Traditionally, SPP's APC calculations have not considered revenues paid to wind resources because they must be modeled as a transaction rather than a conventional generating unit. The wind must be modeled as a transaction so the variability of the wind can be taken into account. SPP does this by profiling wind based on historical output patterns for each wind resource.

Wind generation's impact on *production costs* can be thought of as subtracting the dispatched wind generation from the load that is met from other generation sources. Because of the different modeling method for wind resources, the impact of wind generation on *revenues from sales* and *costs from purchases* was not included in the initial calculation of APC and must be added to obtain a corrected overall measure of these components. A more detailed explanation of this adjustment is provided in the description of value metrics in the Scope of Priority Projects Phase II, Rev. 1 Analysis section of this report.

|         | 2009          | 2014          | 2019          |
|---------|---------------|---------------|---------------|
| Group 1 | \$ 15,188,839 | \$ 10,211,826 | \$ 19,712,918 |
| Group 2 | \$ 15,524,748 | \$ 10,602,407 | \$ 21,706,821 |

**Table 9: Increased Revenues from Wind – 7 GW**

|         | 2009          | 2014           | 2019           |
|---------|---------------|----------------|----------------|
| Group 1 | \$ 87,442,443 | \$ 110,493,011 | \$ 179,939,488 |
| Group 2 | \$ 93,394,239 | \$ 115,558,315 | \$ 191,136,602 |

**Table 10: Increased Revenues from Wind – 11 GW**



The following charts depict the percentage change in MW-hour output between each group of Priority Projects and the base case. The columns displayed are aggregates of the three study years 2009, 2014, and 2019.

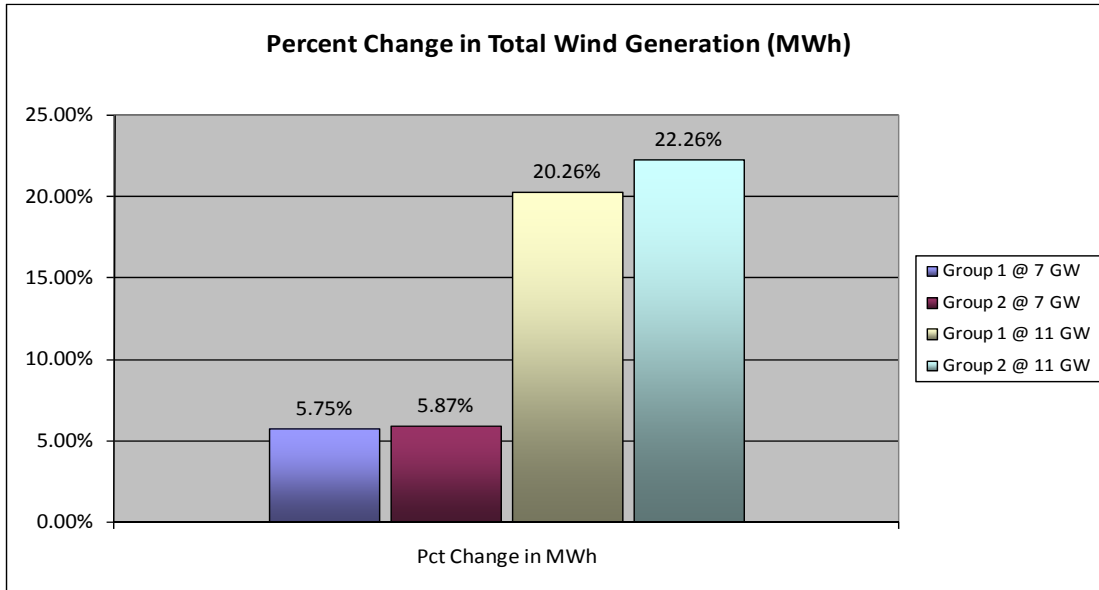


**Figure 9: % Change in Total Wind Generation**

Related to the above chart above, the following charts show the percentage of dispatched wind generation relative to maximum capacity of the wind generators. The potential capacity factor column indicates how much wind energy would be dispatched without any curtailment. The next three columns are the total capacity factor percentages for each of the study groups. The columns displayed are aggregates of the three study years 2009, 2014, and 2019.

As expected, the addition of the two study groups resulted in less wind curtailment in comparison to the base case model. While study Group 1 produces fewer additional wind revenues than Group 2 due to lower LMP prices, Group 1 allows more wind to be dispatched.

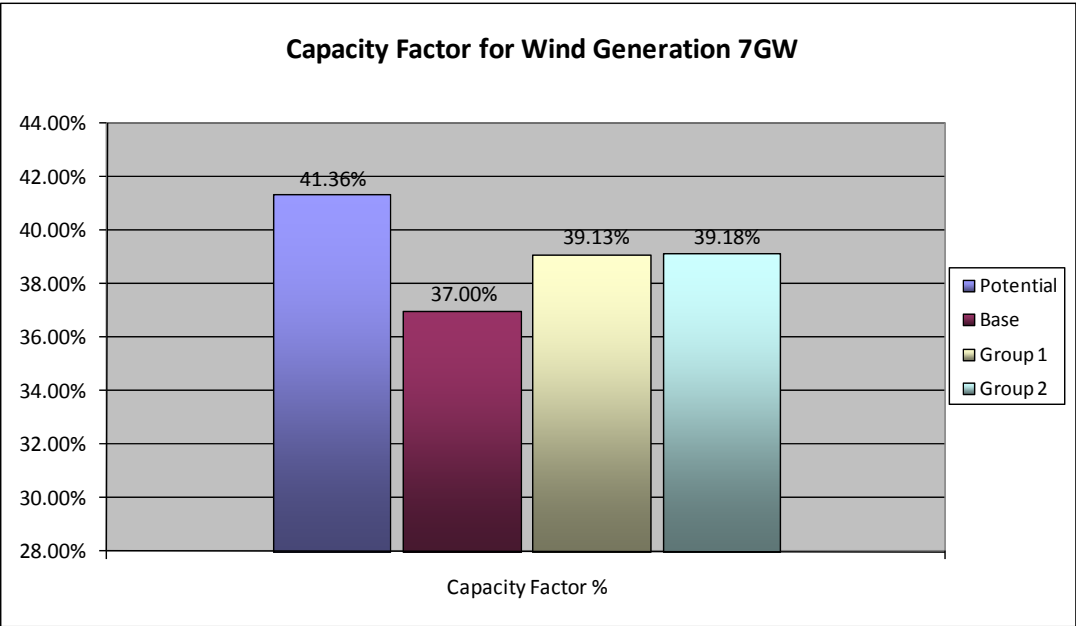


Figure 10: Wind Capacity Factor Changes – 7 GW

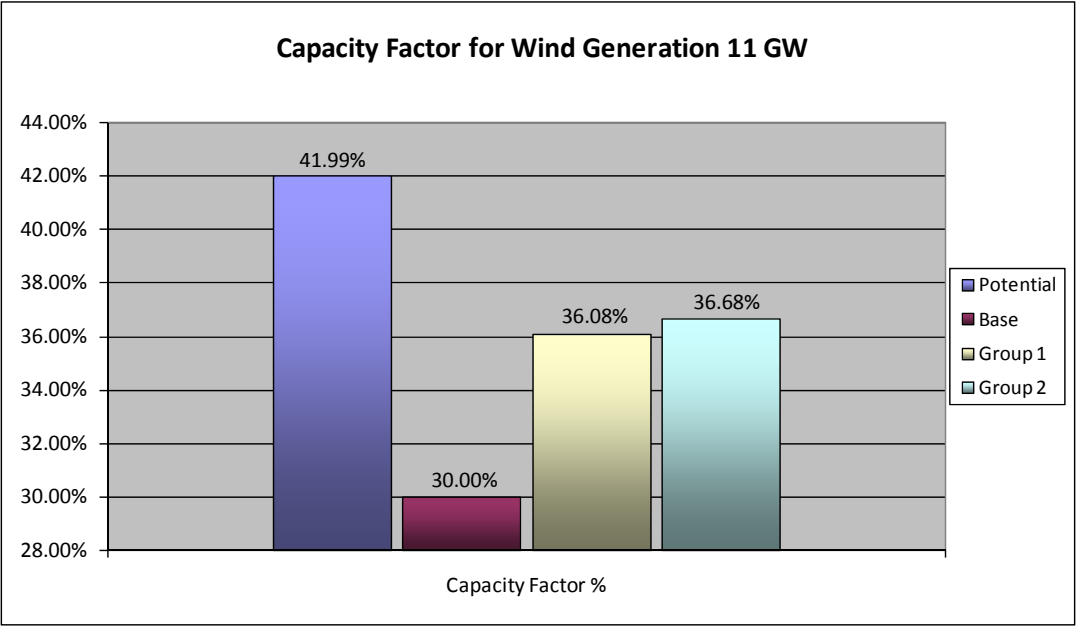


Figure 11: Wind Capacity Factor Changes – 11 GW

The above charts illustrate the change in wind output and wind capacity factor at the regional level. While it is important to see regional impact, the charts do not depict impact on the wind resources located near Priority Projects. The following charts illustrate the MW-hour and capacity factor changes of wind resources near select locations situated near Priority Projects.

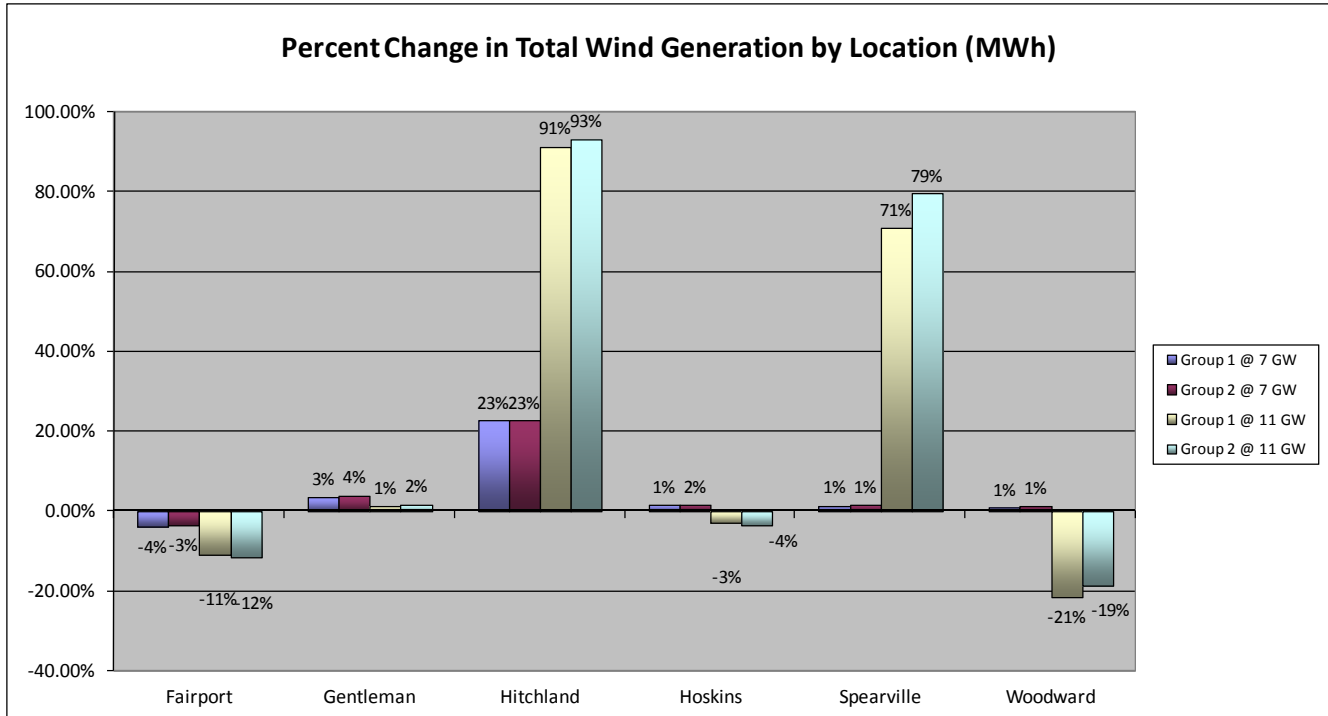


**Figure 12: % Change in Wind Generation by Location**

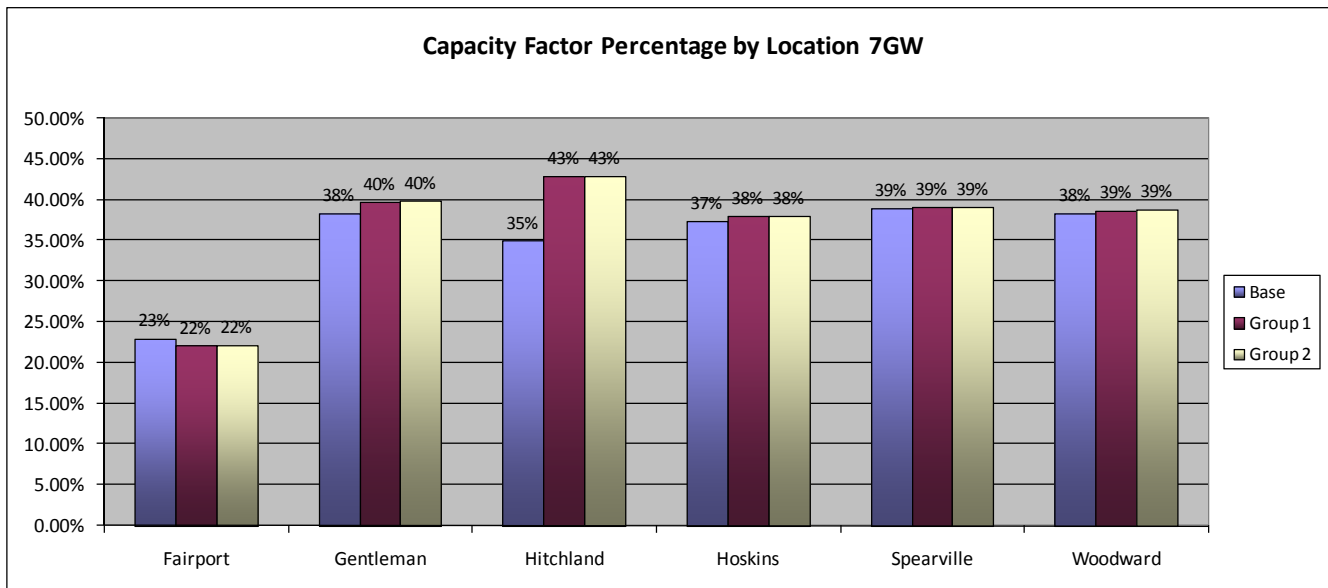


**Figure 13: Capacity Factor by Location - 7 GW**

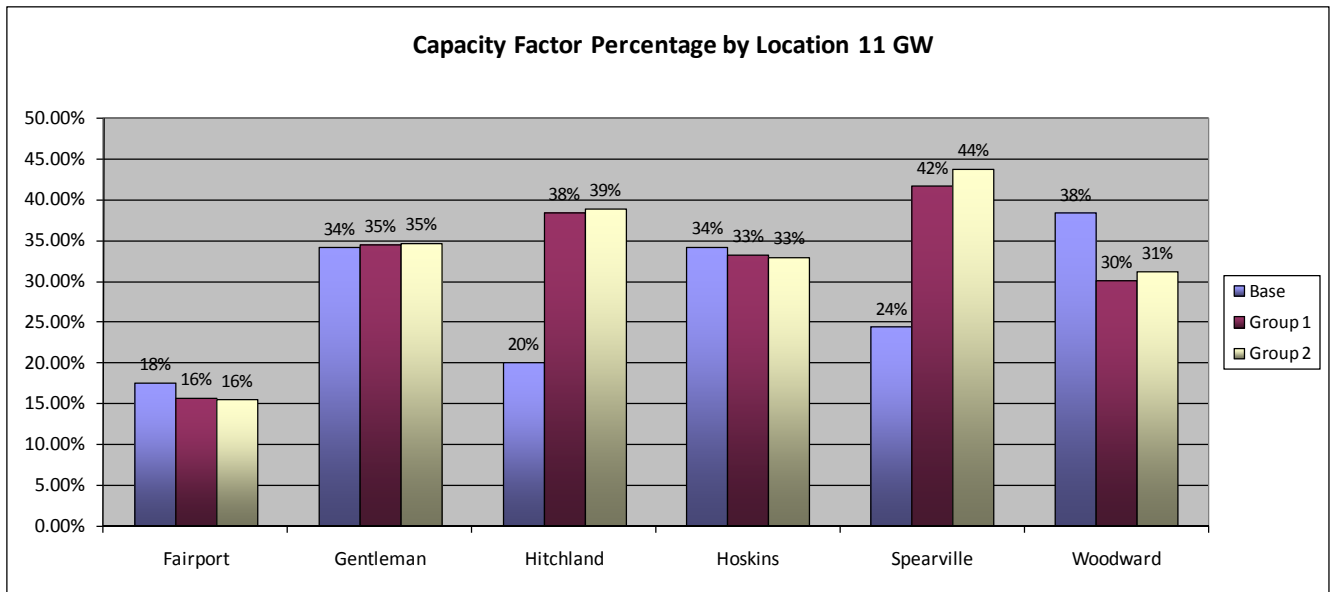


**Figure 14: Capacity Factor by Location - 11 GW**

Because SPP was asked to model the same level of wind in the base and change case, existing buses in the model were chosen as locations to place the wind. For Missouri, Fairport was the only 345 kV bus on the SPP system in which it was reasonable to place the Missouri wind. However, the proposed 345 kV line Nebraska City – Maryville – Sibley does not have a termination point at Fairport. This modeling nuance likely contributes to the reduced output shown at Fairport.

## Priority Project Cost Calculations

The following tables show the Annual Transmission Revenue Requirement (ATRR) by project for Groups 1 and 2. The Engineering and Construction (E&C) cost estimates were provided by the Transmission Owners (TOs). The ATRR for each transmission line was calculated by multiplying the Engineering E&C cost estimates by the levelized Fixed Charged Rate (FCR) for each company. The ATRR was carried out for 40 years (the assumed life of the projects) and a net present value was determined by discounting the ATRR back using 8%. These NPV costs are represented in the summary benefit and cost tables above.

| Project                                                                                | Voltage      | Breakout of project by TO                                                                                                           | Owner        | Levelized FCR       | E & C Cost             | ATRR         |
|----------------------------------------------------------------------------------------|--------------|-------------------------------------------------------------------------------------------------------------------------------------|--------------|---------------------|------------------------|--------------|
| Spearville (ITC GP) - Comanche (ITC GP) - Medicine Lodge (ITC GP)/ (WR) - Wichita (WR) | 765 @ 345 kV | Spearville-Comanche-Medicine Lodge                                                                                                  | ITC          | 12.0%               | \$301,003,320          | \$36,120,398 |
|                                                                                        |              | Wichita - Medicine Lodge                                                                                                            | Prairie Wind | 12.2%               | \$177,000,000          | \$21,552,693 |
| Comanche (ITC GP)- Woodward District EHV (OGE)                                         | 765 @ 345 kV | Comanche - KS/OK border towards WD EHV                                                                                              | Westar       | 12.2%               | \$12,500,000           | \$1,522,083  |
|                                                                                        |              | WD EHV- KS/OK border towards Comanche                                                                                               | OGE          | 15.1%               | \$119,647,059          | \$18,066,706 |
| Hitchland (SPS) - Woodward District EHV (OGE)                                          | 345 kV DCT   | OK Stateline - Woodward District EHV                                                                                                | OGE          | 15.1%               | \$233,026,000          | \$35,186,926 |
|                                                                                        |              | Hitchland - OK Stateline                                                                                                            | SPS          | 12.1%               | \$5,096,033            | \$ 616,620   |
| Valliant - NW Texarkana (AEP)                                                          | 345 kV       | 100% AEP                                                                                                                            | AEP          | 14.7%               | \$131,451,250          | \$19,297,044 |
| Nebraska City (NPPD) - Maryville (KCPL) - Sibley (KCPL)                                | 345 kV       | Nebraska City-NE/MO border towards Maryville (NPPD), Maryville-NE/MO border towards Nebraska City and Maryville - Sibley (KCPL-GMO) | KCPL         | 15.1%               | \$301,029,091          | \$45,455,393 |
| Riverside Station - Tulsa Power Station (Reactor) (AEP)                                | 138 kV       | 100% AEP                                                                                                                            | AEP          | 14.7%               | \$842,847              | \$123,730    |
| Hitchland 345/230 kV Xfmr                                                              | 345/230 kV   | 100% SPS                                                                                                                            | SPS          | 12.1%               | 8,883,760              | \$1,074,935  |
| Overton 345/161 kV Xfmr <sup>4</sup>                                                   | 345/161 kV   | 100% AMMO                                                                                                                           | AMMO         | 13.09% <sup>5</sup> | 6,750,000 <sup>6</sup> | \$883,446    |

**Table 11: Project Cost Calculations – Group 1**

<sup>4</sup> According to the reliability assessment, loading on the existing transformer increased from 99.8% to 100.6%.

This project is not presented for approval as part of the Priority Projects.

<sup>5</sup> Estimated by averaging the levelized FCR for SPP members

<sup>6</sup> Staff estimate



| Project                                                                                | Voltage    | Breakout of project by TO                                                                                                           | Owner        | Levelized FCR       | E & C Cost             | ATRR         |
|----------------------------------------------------------------------------------------|------------|-------------------------------------------------------------------------------------------------------------------------------------|--------------|---------------------|------------------------|--------------|
| Spearville (ITC GP) - Comanche (ITC GP) - Medicine Lodge (ITC GP)/ (WR) - Wichita (WR) | 345 kV DCT | Spearville-Comanche-Medicine Lodge                                                                                                  | ITC          | 12.0%               | \$205,600,000          | \$24,672,000 |
|                                                                                        |            | Wichita - Medicine Lodge                                                                                                            | Prairie Wind | 12.2%               | \$150,700,000          | \$18,350,231 |
| Comanche (ITC GP)- Woodward District EHV (OGE)                                         | 345 kV DCT | Comanche - KS/OK border towards WD EHV                                                                                              | Westar       | 12.2%               | \$10,800,000           | \$1,315,080  |
|                                                                                        |            | WD EHV- KS/OK border towards Comanche                                                                                               | OGE          | 15.1%               | \$97,427,500           | \$14,711,553 |
| Hitchland (SPS) - Woodward District EHV (OGE)                                          | 345 kV DCT | OK Stateline - Woodward District EHV                                                                                                | OGE          | 15.1%               | \$233,026,000          | \$35,186,926 |
|                                                                                        |            | Hitchland - OK Stateline                                                                                                            | SPS          | 12.1%               | \$5,096,033            | \$616,620    |
| Valliant - NW Texarkana (AEP)                                                          | 345 kV     | 100% AEP                                                                                                                            | AEP          | 14.7%               | \$131,451,250          | \$19,297,044 |
| Nebraska City (NPPD) - Maryville (KCPL) - Sibley (KCPL)                                | 345 kV     | Nebraska City-NE/MO border towards Maryville (OPPD), Maryville-NE/MO border towards Nebraska City and Maryville - Sibley (KCPL-GMO) | KCPL         | 15.1%               | \$301,029,091          | \$45,455,393 |
| Riverside Station - Tulsa Power Station (Reactor) (AEP)                                | 138 kV     | 100% AEP                                                                                                                            | AEP          | 14.7%               | \$842,847              | \$123,730    |
| Hitchland 345/230 kV Xfmr                                                              | 345/230 kV | 100% SPS                                                                                                                            | SPS          | 12.1%               | 8,883,760              | \$1,074,935  |
| Overton 345/161 kV Xfmr <sup>7</sup>                                                   | 345/161 kV | 100% AMMO                                                                                                                           | AMMO         | 13.09% <sup>8</sup> | 6,750,000 <sup>9</sup> | \$883,446    |

Table 12: Project Cost Calculations – Group 2

<sup>7</sup> According to the reliability assessment, loading on the existing transformer increased from 99.8% to 100.6%.

This project is not presented for approval as part of the Priority Projects.

<sup>8</sup> Estimated by averaging the levelized FCR for SPP members

<sup>9</sup> Staff estimate

## KEMA Analysis

The Priority Project economic assessment focuses on APC savings and impact on losses, reliability projects, and the impact from wind revenue. These metrics do not capture the value of transmission as enabling assets that facilitate markets and help maintain reliability. Some of the strategic and other benefits of EHV transmission which are difficult to quantify include:

- Enabling future markets
- Storm hardening
- Improving operating practices/maintenance schedules
- Lowering reliability margins
- Improving dynamic performance and grid stability during extreme events
- Societal economic benefits

The ESWG discussed many of these metrics and generally agreed that the above benefits, while at this time difficult to quantify, have the potential to provide significant value for the region. It is anticipated that further development of these metrics for the Integrated Transmission Plan will result in quantifiable benefits resulting from a robust transmission system.

### KEMA Assumptions and Application to Priority Projects

KEMA was contracted to estimate the impact of Priority Projects on overall natural gas consumption and the affect this impact may have on regional gas prices. KEMA assumptions for fuel price impacts in SPP are based on PROMOD results for the Priority Projects with the two wind levels in the base and change cases. SPP was asked to study certain wind levels in the base and change case related to state renewable targets/mandates; the KEMA study assumes similar renewable targets across the country due to federal or state requirements. This assumption means that similar gas usage reductions will also be seen across the country as is measured for the SPP region.

Recent research by the Lawrence Berkeley National Laboratory and the RAND Corporation provide similar results regarding the 0.9 to 1.2 range of inverse supply price elasticity that can be expected for natural gas consumption. RAND found a value of 0.97; KEMA proposed that SPP use 1.2 in the economic analysis associated with gas price impacts of Priority Projects. Additional detail on KEMA's analysis of reduced natural gas prices can be found in Attachment 6.

The PROMOD results with 7 GW of wind in the base and change cases indicate the addition of Priority Projects will reduce natural gas consumption as a boiler fuel by 5.08 – 5.15%, which equates to a lower gas price in the range of 1.1 – 1.5%. While these price elasticity impacts are small, the resulting impact to gas costs is large in SPP. The following table shows the expected savings associated with 7 GW of wind in the base and change cases:

|         | 2009    | 2014    | 2019    |
|---------|---------|---------|---------|
| Group 1 | \$15.2M | \$31.7M | \$55.7M |
| Group 2 | \$15.4M | \$32.1M | \$56.4M |

**Table 13: Expected Savings from Reduced Natural Gas Prices – 7 GW**

Results with 11 GW of wind in the base and change cases indicate the addition of Priority Projects will reduce natural gas consumption as a boiler fuel by 7.7 – 8%. The expected savings as a result of this price change are shown in the following table.

|         | 2009    | 2014    | 2019    |
|---------|---------|---------|---------|
| Group 1 | \$21.7M | \$45.2M | \$79.1M |
| Group 2 | \$22.5M | \$46.7M | \$81.9M |

**Table 14: Expected Savings from Reduced Natural Gas Prices – 11 GW**

## Brattle Group Analysis

In 2009, The Brattle Group estimated the potential economic benefits associated with building a set of transmission projects and expanding the build-out of wind power generation in the SPP region. For this Revision 1 report, SPP asked The Brattle Group to update its report using the most recent wind level assumptions and transmission projects under consideration. The Brattle Group uses the Minnesota IMPLAN model to estimate the potential economic impact of building a set of transmission projects. As a result of constructing the Group 2 set of projects, the Brattle Group estimated the following economic benefits:

- Overall economic output: ~ \$962 million
- Overall job impacts: ~ 7,475 full-time equivalent-years
- Additional earnings related to the jobs impact: ~ \$368 million
- State and local government tax impacts: ~ \$34.4 million

The Brattle Group also used the Job and Economic Development Impact (JEDI) Wind model developed for the U.S. Department of Energy to estimate the potential economic impact of wind projects in the SPP footprint. The JEDI Wind model separates a wind project's life into construction and operation phases. In each phase, the model estimates direct, indirect, and induced job and economic impacts. Direct jobs construct or operate the wind facilities. Indirect jobs provide services or materials to enable construction or operation. Induced jobs provide food, housing, day care, etc. to direct and indirect employees. The Brattle Group analysis found that investment of 3.2 GW of wind projects would have the following economic benefits:

- Overall economic output during construction: ~ \$1.8 billion
- Overall jobs impact during construction: ~ 17,000 full-time equivalent-years
- Additional earnings related to construction jobs impact: ~ \$577 million
- Overall economic output during operation: ~ \$1.6 billion
- Overall jobs impact during operation: ~ 13,100 full-time equivalent-years
- Additional earnings related to operation jobs impact: ~ \$501 million

Staff recommends including all of the \$962 million in transmission-related benefits identified by the IMPLAN model in evaluating Priority Projects. To the extent the transmission projects enable the interconnection of the additional wind, some of the benefits related to the continued operation of that additional wind should also be considered while evaluating Priority Projects. Staff recommends a conservative 25% of the \$1.6 billion of estimated benefits from wind operation be considered. Because SPP was directed to study the same level of wind capacity in the base and change case, it is not appropriate to consider any of the benefits related to wind construction in directly evaluating Priority Projects.

In addition to the above results, The Brattle Group estimated benefits resulting from constructing 7.6 GW of additional wind above SPP's existing 3.8 GW. The results summarized above do not include any in-region manufacturing of materials needed to build transmission or wind infrastructure. The Brattle Group performed a sensitivity by considering

50% of the transmission and wind-related materials being manufactured within the SPP region. The details of the additional wind and higher in-region manufacturing sensitivity can be found in the complete Brattle Group report in Attachment 4.

## Future Considerations and Next Steps

Traditional resource planning tools do not capture the entire value of enabling assets such as extra high voltage transmission. They are limited due to factors such as the use of normalized, typical, and synchronized load profiles; standardized profiles for key variables such as HVDC ties or intermittent resources such as wind plants; optimized generation maintenance schedules; and no planned or forced outages of transmission facilities.

While APC savings are determined based on a set of assumptions, they can be considered conservative projections of the value of a transmission system. Man-made and natural events happen that drastically affect grid topology and resource availability. For instance, extreme cold weather in early 2010 set peak demand for some SPP members and neighboring systems, which traditionally occurs in the summer months. This weather event also affected the availability and performance of 17 thermal units in SPP due to equipment problems or fuel supply disruptions. Although these unusual and extreme events happen with regularity, they are difficult to predict. The value of enabling infrastructure such as a robust EHV network, which provides competitive options in resource procurement and delivery during unusual and extreme events, can be very high. As we transition to value-based planning concepts with long horizons, the option to address unusual and extreme events will provide tremendous benefits above the minimum capacity/capability based on historical standards and markets.

The value of a robust EHV transmission network that facilitates competition provides significant benefits over the long-term as market participants reposition themselves to capitalize on new opportunities that arise as a result of enabling infrastructure. The long lead time for EHV transmission assets is a challenge and barrier which impedes optimizing resource planning decisions which are not available due to constraints. It is paramount to capture the value of a robust and flexible EHV transmission network that enables markets in terms of unusual and extreme events, as well as competitive markets and future resource options.



## Other Supporting Information

### WITF Results

The SPP Wind Integration Task Force (WITF) Wind Penetration study's purpose was to determine the operational and reliability impacts of wind integration into the SPP transmission system and energy markets. Three wind penetration levels were studied (10%, 20%, and 40%) and compared to a base case (current system conditions) of approximately 4% wind penetration. Because SPP wind generation resources are largely located in the western portion of the SPP footprint in transmission-constrained locations away from load generation centers, an increase in wind penetration level causes changes in the power flow patterns requiring upgrades or reconfigurations to the transmission system. The power flows from western SPP to eastern SPP are increased significantly.

To meet the reliability standards of the SPP criteria and to accommodate the increased west-to-east flows, a number of transmission expansions were required. These included new transmission lines totaling 1,260 miles of 345 kV and 40 miles of 230 kV lines for the 10% case, and for the 20% case an additional 485 miles of 765 kV, 766 miles of 345 kV, 205 miles of 230 kV, and 25 miles of 115 kV lines.

WITF Study recommendations:

- Major transmission reinforcements are needed to accommodate increased wind penetration levels, starting as low as 10%
- Considering lead times of transmission projects, it is recommended that SPP take definitive steps to reinforce its transmission network, especially west to east
- The addition of high voltage lines requires the installation of voltage control devices to prevent over-voltages under low-flow conditions due to contingencies or low wind power availability
- Dynamic voltage support becomes increasingly important for higher wind penetration levels in which several conventional generators may become displaced in the dispatch order by wind generators
- Add new reactive capability of the same nature as that provided by the displaced thermal units (i.e., continuously and instantaneously controllable) as wind penetration increases

With all needed transmission upgrades in place, the study found that integrating the levels of wind in the 10% and 20% cases could be attained without adversely impacting SPP system reliability. Some localized voltage issues and transmission congestion were observed, but on average, they were around 1% for both the 10% and 20% cases.

### CAWG Survey

On November 6, 2009 the Cost Allocation Working Group (CAWG) distributed a survey to the state commission representatives within SPP requesting information on each state's renewable energy and energy conservation targets. The 7 GW of wind studied in the Priority Project analysis is not enough to meet each state's current mandate or target. The results of the survey indicate that over 11 GW of wind is already targeted for the SPP footprint in the next 20 years, even without a federal renewable energy mandate. Each state's target for wind energy is included in the table below. With a lower wind unit capacity factor, the amount of installed wind would increase.

| <i>State</i> | <i>State Target</i> | <i>Energy Targets<br/>(MWh)</i> | <i>Capacity Assuming<br/>40% CF (MW)</i> |
|--------------|---------------------|---------------------------------|------------------------------------------|
| TX           | MW Target           | 6,517,491                       | 1,860                                    |
| MO           | 15%                 | 3,881,404                       | 1,108                                    |
| KS           | 20%                 | 9,342,546                       | 2,666                                    |
| OK           |                     | 12,523,041                      | 3,574                                    |
| NE           | 10%                 | 4,023,427                       | 1,148                                    |
| NM           | 10%                 | 473,040                         | 135                                      |
| AR           |                     | 1,241,108                       | 354                                      |
| LA           |                     | 1,697,000                       | 484                                      |
| <b>Total</b> |                     | <b>39,699,057</b>               | <b>11,330</b>                            |

**Table 15: State Renewable Targets for SPP Footprint (No Federal RPS)**

## Conclusion and Recommendations

The Synergistic Planning Project Team report concluded that Priority Projects should improve congestion, improve SPP's current Aggregate Study and Generation Interconnection study processes, and integrate SPP's west and east transmission systems. SPP staff confirms that the benefits provided for Group 2 are consistent with the SPPT's requirements and recommends the following Priority Projects for approval and subsequent construction:

1. Spearville – Comanche – Medicine Lodge – Wichita, double circuit construction and operated at 345 kV
2. Comanche – Woodward District EHV, double circuit construction and operated at 345 kV
3. Hitchland – Woodward District EHV, double circuit construction and operated at 345 kV
4. Valliant – NW Texarkana, constructed and operated at 345 kV
5. Nebraska City – Maryville – Sibley, constructed and operated at 345 kV
6. Riverside Station – Tulsa Power Station 138 kV reactor addition

Prior to construction of projects #1 and #2 above, staff recommends that Priority Projects be evaluated with results of the Integrated Transmission Plan (ITP) study scheduled to be completed in January 2011. The ITP process will result in the development of a 20-year plan for transmission expansion. The outcome of the ITP analysis should determine if the proposed construction and voltage operation of Priority Projects is consistent with 20-year plan requirements.

## Appendix A – Priority Project Cost Estimates (E&C)

|                                             | Zone                       | OG&E                                                             | SPS                                                                                     | WERE                                             | ITC GP                                              | WERE                                             | ITC GP                                           |
|---------------------------------------------|----------------------------|------------------------------------------------------------------|-----------------------------------------------------------------------------------------|--------------------------------------------------|-----------------------------------------------------|--------------------------------------------------|--------------------------------------------------|
|                                             | Project                    | Hitchland - Woodward                                             | Hitchland - Woodward                                                                    | Spearville - Comanche - Medicine Lodge - Wichita | Spearville - Comanche - Medicine Lodge - Wichita    | Spearville - Comanche - Medicine Lodge - Wichita | Spearville - Comanche - Medicine Lodge - Wichita |
|                                             | Voltage                    | Double Circuit 345 kV                                            | Double Circuit 345 kV                                                                   | 765 kV Operated at 345 kV                        | 765 kV Operated at 345 kV                           | Double Circuit 345 kV                            | Double Circuit 345 kV                            |
| Cost                                        | Total Cost                 | \$233,026,000                                                    | \$13,979,793                                                                            | \$177,000,000                                    | \$301,003,320                                       | \$150,700,000                                    | \$205,600,000                                    |
|                                             | Total Material Cost        | \$98,154,000                                                     | \$1,830,000                                                                             | \$175,000,000                                    | \$174,416,660                                       | \$28,000,000                                     | \$66,000,000                                     |
|                                             | Cost Per Mile              | \$817,950                                                        | \$1,076,471                                                                             | \$2,500,000                                      | \$1,585,606                                         | \$400,000                                        | \$600,000                                        |
|                                             | Miles                      | 120                                                              | 1.7                                                                                     | 70                                               | 110                                                 | 70                                               | 110                                              |
|                                             | Substation Cost            | \$4,000,000                                                      | \$12,047,793                                                                            | \$2,000,000                                      | \$26,000,000                                        | \$2,000,000                                      | \$34,000,000                                     |
| Conductor                                   | Size                       | 2-1590 ACSR                                                      | 2-795 ACSS                                                                              | 6 x 795 kcmil ACSR                               | 6x954 ACSR/phase                                    | 3 x 954 kcmil ACSR                               | 2-1590 ACSR per phase                            |
|                                             | Design                     | Single with R/W for future twin or single and one 795 kV circuit | Single Circuit <sup>10</sup>                                                            | Single Circuit                                   | Single Circuit                                      | Double Circuit                                   | double circuit                                   |
|                                             | Electrical Capacity (amps) | 3000                                                             | 3000                                                                                    | 4000                                             | 4000                                                | 3000                                             | 3000                                             |
|                                             | Other                      |                                                                  |                                                                                         |                                                  |                                                     |                                                  |                                                  |
| Structure                                   | Cost                       | \$32,718,000                                                     |                                                                                         |                                                  |                                                     | \$42,000,000                                     |                                                  |
|                                             | Type                       | Single Pole                                                      | H-frame                                                                                 |                                                  | Lattice/H-Frame                                     |                                                  | single-pole                                      |
|                                             | Material                   | Steel                                                            | Steel                                                                                   | Steel                                            | Steel                                               | Steel                                            | Steel                                            |
|                                             | Base                       | Reinforced Concrete Foundation                                   | Tangents are direct bury, and others in concrete foundation                             |                                                  | concrete foundation                                 |                                                  | concrete foundation                              |
|                                             | NESC Assumption            | Heavy                                                            | Heavy                                                                                   | Heavy                                            | Heavy                                               | Heavy                                            | Heavy                                            |
|                                             | Dead Ends                  |                                                                  |                                                                                         |                                                  | 36                                                  |                                                  | 36                                               |
|                                             | Underbuild                 | No                                                               |                                                                                         | None                                             | None                                                | None                                             | None                                             |
| Sub                                         | Transformers               |                                                                  | 345/230 kV                                                                              | none                                             | 2- 1000MVA at Spearville; 400 MVA at Medicine Lodge | none                                             | 400 MVA at Medicine Lodge                        |
|                                             | Breaker Scheme             | 1.5 Breaker                                                      | 1.5 Breaker                                                                             | 1.5 Breaker                                      | Ring                                                | 1.5 Breaker                                      | Ring                                             |
|                                             | Protection Scheme          | 2 line terminal relay panels                                     |                                                                                         | Fiber & Double Primary                           | fiber/double primary                                | Fiber & Double Primary                           | fiber/double primary                             |
|                                             | Voltage Control            |                                                                  |                                                                                         |                                                  |                                                     |                                                  |                                                  |
|                                             | Cost                       |                                                                  | \$12,047,793                                                                            | \$2,000,000                                      | \$26,000,000                                        | \$2,000,000                                      | \$34,000,000                                     |
| Construction Labor                          | Amount                     |                                                                  |                                                                                         |                                                  |                                                     |                                                  |                                                  |
|                                             | Cost                       | \$93,480,000                                                     |                                                                                         |                                                  | \$93,920,000                                        | \$37,000,000                                     | \$99,000,000                                     |
| Eng. Design, Project Management, Permitting | ROW                        | 150                                                              | 150                                                                                     | 200ft                                            | 250ft                                               | 150                                              | 150                                              |
|                                             | ROW Condition              | rural                                                            |                                                                                         |                                                  | rural, combination pasture and cultivated           |                                                  | rural, combination pasture and cultivated        |
|                                             | Permitting/Certifications  |                                                                  |                                                                                         |                                                  |                                                     |                                                  |                                                  |
|                                             | Escalation Rate            | 2%                                                               |                                                                                         | 5% per year                                      |                                                     | 5% per year                                      |                                                  |
|                                             | Eng. Design/ Proj. Mang.   | \$17,704,500                                                     |                                                                                         |                                                  |                                                     |                                                  |                                                  |
|                                             | Total Cost                 | \$37,392,000                                                     | 102,000                                                                                 |                                                  | \$6,666,660                                         | \$14,000,000                                     | \$6,666,660                                      |
| Loadings and Overheads                      | Type 1                     |                                                                  |                                                                                         |                                                  |                                                     | \$18,500,000                                     |                                                  |
|                                             | Type 2                     |                                                                  |                                                                                         |                                                  |                                                     | \$9,200,000                                      |                                                  |
| Other Cost Factors and Notes                |                            |                                                                  | Includes 2 <sup>nd</sup> Hitchland 345/230 kV Xfmr identified in Reliability Assessment |                                                  |                                                     |                                                  |                                                  |

<sup>10</sup> This estimate is for building approximately two 0.85 mile lines between the existing Hitchland 345 kV Station and the OGE 765/345 kV Stateline Station. These lines are designed for 125 °C operation, and considerations are given for other line crossings. The estimate is in 2009 dollars.

## Project cost estimates (cont'd)

|                                             | Zone                       | WERE                             | OG&E                             | WERE                             | OG&E                                                             | AEP                                  |
|---------------------------------------------|----------------------------|----------------------------------|----------------------------------|----------------------------------|------------------------------------------------------------------|--------------------------------------|
|                                             | Project                    | Comanche - Woodward District EHV | Comanche - Woodward District EHV | Comanche - Woodward District EHV | Comanche - Woodward District EHV                                 | Valiant - NW Texarkana               |
|                                             | Voltage                    | 765 kV Operated at 345 kV        | 765 kV Operated at 345 kV        | Double Circuit 345 kV            | Double Circuit 345 kV                                            | 345 kV                               |
| Cost                                        | Total Cost                 | \$12,500,000                     | \$119,647,059                    | \$10,800,000                     | \$97,427,500                                                     | \$131,451,250                        |
|                                             | Total Material Cost        | \$12,500,000                     |                                  |                                  | \$40,897,500                                                     | \$53,375,000                         |
|                                             | Cost Per Mile              | \$2,500,000                      |                                  |                                  | \$817,950                                                        | \$700,000                            |
|                                             | Miles                      | 5                                | 50                               | 5                                | 50                                                               | 76.25                                |
|                                             | Substation Cost            | \$0                              | \$2,000,000                      | \$0                              | \$200,000                                                        | \$2,800,000                          |
| Conductor                                   | Size                       | 6 x 795 kcmil ACSR               |                                  | 3 x 954 kcmil ACSR               | 2-1590 ACSR                                                      | 2-954 ACSR                           |
|                                             | Design                     | Single Circuit                   |                                  | Double Circuit                   | Single with R/W for future twin or single and one 795 kV circuit | Double Ckt                           |
|                                             | Electrical Capacity (amps) | 4000                             |                                  | 3000                             | 3000                                                             | 2236/3204 (N/E)                      |
|                                             | Other                      |                                  |                                  |                                  |                                                                  |                                      |
| Structure                                   | Cost                       |                                  |                                  |                                  | \$13,632,500                                                     |                                      |
|                                             | Type                       |                                  |                                  |                                  | single-pole                                                      | Lattice Tower                        |
|                                             | Material                   | Steel                            |                                  | Steel                            |                                                                  | Steel                                |
|                                             | Base                       |                                  |                                  |                                  | Reinforced Concrete Foundation                                   | Concrete                             |
|                                             | NESC Assumption            | Heavy                            |                                  | Heavy                            | Heavy                                                            | Heavy                                |
|                                             | Dead Ends                  |                                  |                                  |                                  |                                                                  |                                      |
|                                             | Underbuild                 | None                             |                                  | None                             | No                                                               | No                                   |
| Sub                                         | Transformers               | none                             | none                             | none                             | none                                                             | none                                 |
|                                             | Breaker Scheme             |                                  |                                  |                                  | 1.5 Breaker                                                      | ring                                 |
|                                             | Protection Scheme          |                                  |                                  |                                  | 2 line terminal relay panels                                     | high speed                           |
|                                             | Voltage Control            |                                  |                                  |                                  |                                                                  |                                      |
|                                             | Cost                       | \$0                              |                                  | \$0                              | \$2,000,000                                                      | \$2,800,000                          |
| Construction Labor                          | Amount                     |                                  |                                  |                                  | \$38,950,000                                                     |                                      |
|                                             | Cost                       |                                  |                                  |                                  |                                                                  | \$44,780,000                         |
| Eng. Design, Project Management, Permitting | ROW                        | 200ft                            |                                  | 150                              | 150                                                              | 150 ft                               |
|                                             | ROW Condition              |                                  |                                  |                                  | rural                                                            | rural and forested with some pasture |
|                                             | Permitting/Certifications  |                                  |                                  |                                  |                                                                  | CCN                                  |
|                                             | Escalation Rate            | 5% per year                      |                                  | 5% per year                      | 2%                                                               | 5%                                   |
|                                             | Eng. Design/ Proj. Mang.   |                                  |                                  |                                  | \$7,376,875                                                      | Included in Construction Cost        |
|                                             | Total Cost                 |                                  |                                  |                                  | \$15,580,000                                                     | \$11,056,250                         |
| Loadings and Overheads                      | Type 1                     |                                  |                                  |                                  |                                                                  | \$19,440,000                         |
|                                             | Type 2                     |                                  |                                  |                                  |                                                                  |                                      |
| Other Cost Factors and Notes                |                            |                                  |                                  |                                  |                                                                  |                                      |

## Project cost estimates (cont'd)

|                                             | Zone                       | OPPD - KCPL                                                             | AEP                           |
|---------------------------------------------|----------------------------|-------------------------------------------------------------------------|-------------------------------|
|                                             | Project                    | Nebraska City - Maryville - Sibley                                      | Tulsa Power Station Reactor   |
|                                             | Voltage                    | 345 kV                                                                  | 138 kV                        |
| Cost                                        | Total Cost                 | \$301,029,091 <sup>11</sup>                                             | \$842,847                     |
|                                             | Total Material Cost        |                                                                         |                               |
|                                             | Cost Per Mile              | \$1,467,857                                                             |                               |
|                                             | Miles                      | 175                                                                     |                               |
|                                             | Substation Cost            | \$10,072,689                                                            | \$448,153                     |
| Conductor                                   | Size                       | 2 - 1192 38/19 ACSS                                                     |                               |
|                                             | Design                     | Single Circuit                                                          |                               |
|                                             | Electrical Capacity (amps) | 4178 @200degC                                                           |                               |
|                                             | Other                      |                                                                         |                               |
| Structure                                   | Cost                       | Included in material                                                    |                               |
|                                             | Type                       | H-frame                                                                 |                               |
|                                             | Material                   | steel                                                                   |                               |
|                                             | Base                       | direct-embedded                                                         |                               |
|                                             | NESC Assumption            | Heavy                                                                   |                               |
|                                             | Dead Ends                  | 32                                                                      |                               |
| Sub                                         | Underbuild                 | no                                                                      |                               |
|                                             | Transformers               | none                                                                    | none                          |
|                                             | Breaker Scheme             | Breaker and ½ (OPPD), ring (KCPL)                                       |                               |
|                                             | Protection Scheme          | included                                                                |                               |
|                                             | Voltage Control            |                                                                         |                               |
| Construction Labor                          | Cost                       | \$10,072,689                                                            | \$448,153                     |
|                                             | Amount                     |                                                                         |                               |
| Eng. Design, Project Management, Permitting | Cost                       | \$1,508,000 (OPPD)                                                      | \$140,180                     |
|                                             | ROW                        | 160ft                                                                   |                               |
|                                             | ROW Condition              | Mostly rural, some urban near Kansas City, two Missouri River crossings |                               |
|                                             | Permitting/Certifications  |                                                                         |                               |
|                                             | Escalation Rate            | 3%                                                                      |                               |
|                                             | Eng. Design/ Proj. Mang.   | \$100,000 (OPPD)                                                        | Included in Construction Cost |
| Loadings and Overheads                      | Total Cost                 |                                                                         | \$110,765                     |
|                                             | Type 1                     | \$ 119,473 (P&G)                                                        | \$143,749                     |
| Other Cost Factors and Notes                | Type 2                     | \$1,325,276 (General)                                                   |                               |
|                                             |                            |                                                                         |                               |

<sup>11</sup> 10% contingency for line construction (\$23M), OPPD estimates 35% contingency adder (\$3.12M), KCPL estimates river crossing at Sibley (\$2M).



## Appendix B – STEP Model Construction

The reliability analysis uses 2014 Summer Peak, 2014/15 Winter Peak and 2019 Summer Peak cases with updates from nearby regions and entities. The STEP load flow cases were built using the 2009 series MDWG Models On Demand (MOD) process. The load and capacity forecast for the load flow cases have included the impact on load of the existing and planned demand response resources. Due to the recent economic downturn, SPP provided an opportunity for its members to update their load forecast information. The 2009 STEP Build 3 models were created to include this new forecast information. These models were completed in June 2009

- Treatment of Transmission Owner-Initiated Projects
  - o Transmission Owner-Initiated Projects as determined by the Transmission Owner were included.
    - MOD Type – Reliability
    - MOD Status STEP (with Notification to Construct (NTC)
    - Planned Projects
- Treatment of previous SPP Transmission Expansion Plan Projects
  - o All projects that have either a Letter of Authorization (LOA) or NTC are included in the model except projects requested for removal through the stakeholder review process.
    - MOD Type- Reliability
    - MOD Status STEP (with NTC)
    - TO Planned
  - o Due to the economic downturn requiring new load forecast and a short lead time to complete the STEP, stakeholders could request projects with NTC letters to be re-evaluated if the request was received by June 1, 2009.
  - o Balanced Portfolio projects with NTC letters were included in the June models. Projects with NTC letters that have been identified as impacted by the Balanced Portfolio were re-evaluated.
- Treatment of SPP Aggregate Study (Attachment Z) Projects
  - o All projects that have an LOA/NTC are included in the model except projects requested for removal through the stakeholder review process.
    - MOD Type TSR
    - MOD Status w/NTC (Approved)
- Treatment of transmission interconnection facilities of new generation
  - o Include the interconnection facilities with executed agreements not on suspension
  - o MOD Type LGIP
    - MOD status GIP.
- Include all MOD projects that have been energized
  - o MOD Type Network
  - o MOD type Energized
- Include all MOD projects that change network topology status

- o Constructed facilities that are out-of-service or normally open
    - MOD Type Outage
    - MOD Status Outage
- Include all MOD projects that update network data
  - o MOD Type Network
  - o MOD Status Update.
- Scenario cases
  - o SPP developed six scenario cases for each season for the steady state evaluation
    - The “Zero case” had the same dispatch as the MDWG cases with the exception that generation that does not have a signed interconnection agreement and generation that does not have transmission service is also removed. The exception to this is in later years when generation load and interchange does not match the shortfall is made up of units that are in-service.
    - The “West to East” scenario 1 case is the same as the zero scenario case with the dispatch changed to capture transmission service that has been sold that impact West to East flowgates with ERCOTN HVDC Tie South to North, ERCOTE HVDC Tie East to West, SPS exporting, and SPS exporting from the Lamar HVDC Tie.
    - The “East to West” scenario 2 case is the same as the zero scenario case with the dispatch changed to capture transmission service that has been sold that impact East to West flowgates with ERCOTN HVDC tie North to South, ERCOTE HVDC tie East to West, SPS importing, and SPS importing from the Lamar HVDC Tie.
    - The “South to North” (Scenario 3) scenario case is the same as the zero scenario case with the dispatch changed to capture transmission service that has been sold that impact South to North flowgates with ERCOTN HVDC tie South to North, ERCOTE HVDC tie East to West, SPS exporting, and SPS exporting to the Lamar HVDC Tie.
    - The “North to South” (Scenario 4) scenario case is the same as the zero scenario case with the dispatch changed to capture transmission service that has been sold that impact North to South flowgates with ERCOTN HVDC tie North to South, ERCOTE HVDC tie East to West, SPS importing, and SPS importing from the Lamar HVDC tie.
    - The “All transactions” scenario 5 case is the same as the zero scenario case with the dispatch changed to include all transmission service sold with ERCOTN North to South, ERCOTE East to West, SPS importing and SPS exporting to the Lamar HVDC tie
- Use of Transmission Operating Directives (TOD)
  - o The Steady State analysis will identify all violations without the use of TODs.
  - o TODs may be used as alternatives to planned projects. Load flow analysis will be performed to determine the effectiveness of the TOD in alleviating the violation(s).

- o SPP will determine all reinforcements that are needed to eliminate TODs used in alleviating violation(s). A list of reinforcements that are not required due to TODs will be included in the report.

## Appendix C – MUST Settings and Procedures for FCITC Analysis

### MUST Solution Settings

- CONSTRAINTS/CONTINGENCY INPUT OPTIONS
  - o AC Mismatch Tolerance – 2 MW
  - o Base Case Rating – Rate A
  - o Base Case % of Rating – 100%
  - o Contingency Case Rating – Rate B
  - o Contingency Case % of Rating – 100%
  - o Base Case Load Flow – PSS/E
  - o Convert branch ratings to estimated MW ratings – No
  - o Contingency ID Reporting – Labels + Events
  - o Maximum number of contingencies to process – 50000
- MUST CALCULATION OPTIONS
  - o Phase Shifters Model for DC Linear Analysis – Constant Flow for Base Case and Contingencies
  - o Report Base Case Violations with FCITC – Yes
  - o Maximum number of violations to report in FCITC table – 50000
  - o Distribution Factor (OTDF and PTDF) Cutoff – 0.03
  - o Maximum times to report the same elements – 1 {eliminate voluminous repeats}
  - o Apply Distribution Factor to Contingency Analysis – Yes
  - o Apply Distribution Factor to FCITC Reports – Yes
  - o Minimum Contingency Case flow change – 1 MW
  - o Minimum Contingency Case Distribution Factor change – 0.0
  - o Minimum Distribution Factor for Transfer Sensitivity Analysis – 0.0

### Voltage Monitoring

- MUST does not do voltage monitoring for transfer analysis.

### Contingency

- Outage of all single branches and ties in the SPP (Area 502-546, 640-650) and NON-SPP (EES,AECI) above 100 kV
- Multi-terminal/Special Contingency Outage

### Exclude

- Exclude outage of all invalid single outages. Single outages may be invalid due to system configuration. For example, a breaker to breaker outage may result in

multiple elements being removed from service, so testing the loss of the single element is not valid.

- Operating guides implementation

#### Monitor

- Monitor branches and ties in SPP above 100 kV

#### Transfer Directions/Transfer Level

- 600 MW transfer from all PORs to PODs (PORs/PODs consist of all zones in SPP's OASIS, excluding IPPs)

## Appendix D – Priority Project Benefits and Costs by Zone

For the zonal benefits below, the calculated NPV costs for each project grouping was allocated using load ratio share. The “Net Benefit” column is calculated as “Total Benefit” minus “Total Cost” and is indicative of the level of benefits that zone is either short or long relative to a B/C ratio of 1.

| Area          | 7 GW<br>Study Group 1 (765 kv @ 345 kv) |                                 |                        |                     |                     |                        |                      |                               |             |
|---------------|-----------------------------------------|---------------------------------|------------------------|---------------------|---------------------|------------------------|----------------------|-------------------------------|-------------|
|               | Total Cost<br>(Years 0 - 40)            | Total Benefit<br>(Years 0 - 40) | APC                    | Reliability         | Losses              | Wind Revenue<br>Impact | Gas Price<br>Impact  | Net Benefit<br>(Years 0 - 40) | B/C         |
| AEPW          | \$521,766,717                           | \$350,396,168                   | (\$18,463,348)         | \$999,807           | \$26,645,436        | \$61,308,936           | \$279,905,338        | (\$171,370,548)               | 0.67        |
| EMDE          | \$62,755,212                            | \$30,510,153                    | \$45,639,386           | \$120,251           | (\$229,592)         | (\$32,999,184)         | \$17,979,292         | (\$32,245,058)                | 0.49        |
| GMO           | \$99,357,682                            | \$74,710,207                    | \$57,431,014           | \$190,389           | \$304,820           | (\$5,497,032)          | \$22,281,017         | (\$24,647,475)                | 0.75        |
| GRDA          | \$45,780,155                            | (\$55,292,299)                  | (\$46,950,723)         | \$87,724            | (\$8,710,247)       | \$0                    | \$280,947            | (\$101,072,454)               | (1.21)      |
| KCPL          | \$188,419,476                           | \$124,391,181                   | \$51,084,106           | \$524,205           | \$9,411,209         | \$45,255,389           | \$18,116,272         | (\$64,028,296)                | 0.66        |
| LES           | \$56,153,701                            | (\$12,696,176)                  | (\$42,206,642)         | \$107,601           | \$17,512,002        | \$8,782,036            | \$3,108,827          | (\$68,849,876)                | (0.23)      |
| MIDW          | \$17,706,174                            | (\$11,578,263)                  | (\$26,967,987)         | \$6,458,029         | \$5,411,653         | \$2,022,614            | \$1,497,428          | (\$29,284,436)                | (0.65)      |
| MKEC          | \$32,480,443                            | (\$153,108,860)                 | (\$182,648,356)        | \$1,228,593         | \$882,769           | \$14,639,110           | \$12,789,025         | (\$185,589,303)               | (4.71)      |
| NPPD          | \$151,355,555                           | \$142,511,672                   | \$76,466,709           | \$290,027           | \$10,748,915        | \$50,332,198           | \$4,673,824          | (\$8,843,883)                 | 0.94        |
| OKGE          | \$334,260,179                           | \$432,666,250                   | \$376,232,416          | \$695,996           | \$345,348           | (\$59,356,915)         | \$114,749,405        | \$98,406,072                  | 1.29        |
| OPPD          | \$119,018,328                           | \$69,890,805                    | \$31,672,275           | \$228,062           | \$2,192,347         | \$33,389,979           | \$2,408,141          | (\$49,127,523)                | 0.59        |
| SPRM          | \$36,030,625                            | (\$25,343,109)                  | (\$25,860,766)         | \$69,042            | \$459,183           | (\$2,203,173)          | \$2,192,605          | (\$61,373,734)                | (0.70)      |
| SUNC          | \$25,377,319                            | (\$70,302,963)                  | (\$75,219,440)         | \$48,628            | \$150,363           | \$2,920,711            | \$1,796,775          | (\$95,680,282)                | (2.77)      |
| SWPS          | \$277,635,784                           | \$1,061,426,112                 | \$895,228,122          | \$317,399           | \$1,602,117         | (\$10,479,186)         | \$174,757,659        | \$783,790,328                 | 3.82        |
| WEFA          | \$76,344,246                            | \$169,989,187                   | \$184,741,100          | \$1,430,892         | \$1,186,565         | (\$38,426,886)         | \$21,057,516         | \$93,644,941                  | 2.23        |
| WRI           | \$272,415,045                           | \$181,108,052                   | \$9,820,050            | \$522,000           | (\$149,340)         | \$140,213,544          | \$30,701,797         | (\$91,306,993)                | 0.66        |
| <b>Totals</b> | <b>\$2,316,856,640</b>                  | <b>\$2,309,278,116</b>          | <b>\$1,309,997,915</b> | <b>\$13,318,645</b> | <b>\$67,763,548</b> | <b>\$209,902,141</b>   | <b>\$708,295,867</b> | <b>(\$7,578,523)</b>          | <b>1.00</b> |

Figure 15: Zonal Benefits and Costs – 7 GW Group 1



| Area          | 7 GW<br>Study Group 2 (DCT 345 kV) |                                 |                        |                     |                     |                        |                      |                               |             |
|---------------|------------------------------------|---------------------------------|------------------------|---------------------|---------------------|------------------------|----------------------|-------------------------------|-------------|
|               | Total Cost<br>(Years 0 -40)        | Total Benefit<br>(Years 0 - 40) | APC                    | Reliability         | Losses              | Wind Revenue<br>Impact | Gas Price<br>Impact  | Net Benefit<br>(Years 0 - 40) | B/C         |
| AEPW          | \$468,943,217                      | \$346,457,986                   | (\$22,591,952)         | \$1,562,453         | \$28,491,286        | \$55,517,451           | \$283,478,749        | (\$122,485,230)               | 0.74        |
| EMDE          | \$56,401,893                       | \$31,094,170                    | \$52,722,617           | \$285,320           | (\$230,615)         | (\$39,842,207)         | \$18,159,054         | (\$25,307,724)                | 0.55        |
| GMO           | \$89,298,741                       | \$83,051,224                    | \$63,237,068           | \$297,531           | \$224,568           | (\$3,238,388)          | \$22,530,445         | (\$6,247,517)                 | 0.93        |
| GRDA          | \$41,145,386                       | (\$59,907,376)                  | (\$53,080,292)         | \$137,091           | (\$7,253,469)       | \$0                    | \$289,294            | (\$101,052,762)               | (1.46)      |
| KCPL          | \$169,343,947                      | \$122,074,061                   | \$41,514,135           | \$727,387           | \$10,097,937        | \$51,417,647           | \$18,316,954         | (\$47,269,886)                | 0.72        |
| LES           | \$50,468,717                       | (\$13,611,540)                  | (\$44,162,448)         | \$168,155           | \$17,663,389        | \$9,573,656            | \$3,145,708          | (\$64,080,258)                | (0.27)      |
| MIDW          | \$15,913,606                       | (\$16,478,987)                  | (\$31,877,191)         | \$6,477,123         | \$5,721,496         | \$1,629,544            | \$1,570,041          | (\$32,392,593)                | (1.04)      |
| MKEC          | \$29,192,133                       | (\$175,272,355)                 | (\$202,994,721)        | \$340,031           | (\$1,524,843)       | \$15,668,857           | \$13,238,321         | (\$204,464,488)               | (6.00)      |
| NPPD          | \$136,032,366                      | \$141,470,000                   | \$78,550,656           | (\$7,726,971)       | \$11,045,548        | \$54,827,306           | \$4,773,461          | \$5,437,634                   | 1.04        |
| OKGE          | \$300,419,782                      | \$454,153,298                   | \$401,503,058          | \$7,268,516         | \$589,173           | (\$72,083,006)         | \$116,875,557        | \$153,733,516                 | 1.51        |
| OPPD          | \$106,968,949                      | \$71,558,663                    | \$30,022,810           | \$356,406           | \$2,502,190         | \$36,246,480           | \$2,430,777          | (\$35,410,286)                | 0.67        |
| SPRM          | \$32,382,895                       | (\$8,159,430)                   | (\$8,760,963)          | \$107,895           | \$459,183           | (\$2,186,459)          | \$2,220,913          | (\$40,542,325)                | (0.25)      |
| SUNC          | \$22,808,127                       | (\$71,932,739)                  | (\$76,389,809)         | \$75,993            | \$150,363           | \$2,406,868            | \$1,823,845          | (\$94,740,866)                | (3.15)      |
| SWPS          | \$249,528,024                      | \$1,079,150,211                 | \$885,684,732          | \$7,484,288         | \$1,462,918         | \$8,316,588            | \$176,201,685        | \$829,622,187                 | 4.32        |
| WEFA          | \$68,615,179                       | \$175,295,359                   | \$186,025,261          | \$2,436,804         | \$1,320,648         | (\$36,068,675)         | \$21,581,320         | \$106,680,180                 | 2.55        |
| WRI           | \$244,835,830                      | \$182,623,526                   | \$1,788,355            | \$815,759           | (\$149,340)         | \$148,738,820          | \$31,429,933         | (\$62,212,304)                | 0.75        |
| <b>Totals</b> | <b>\$2,082,298,794</b>             | <b>\$2,341,566,071</b>          | <b>\$1,301,191,318</b> | <b>\$20,813,781</b> | <b>\$70,570,431</b> | <b>\$230,924,482</b>   | <b>\$718,066,058</b> | <b>\$259,267,277</b>          | <b>1.12</b> |

Figure 16: Zonal Benefits and Costs - 7 GW Group 2

| Area          | 11 GW<br>Study Group 1 (765 kv @ 345 kV) |                                 |                        |                     |                     |                        |                        |                               |             |
|---------------|------------------------------------------|---------------------------------|------------------------|---------------------|---------------------|------------------------|------------------------|-------------------------------|-------------|
|               | Total Cost<br>(Years 0 - 40)             | Total Benefit<br>(Years 0 - 40) | APC                    | Reliability         | Losses              | Wind Revenue<br>Impact | Gas Price<br>Impact    | Net Benefit<br>(Years 0 - 40) | B/C         |
| AEPW          | \$521,766,717                            | \$865,425,037                   | (\$75,464,533)         | \$999,807           | \$26,645,436        | \$502,806,055          | \$410,438,273          | \$343,658,320                 | 1.66        |
| EMDE          | \$62,755,212                             | \$26,761,814                    | \$71,522,347           | \$120,251           | (\$229,592)         | (\$70,838,728)         | \$26,187,535           | (\$35,993,398)                | 0.43        |
| GMO           | \$99,357,682                             | \$129,539,325                   | \$95,021,077           | \$190,389           | \$304,820           | \$2,229,166            | \$31,793,874           | \$30,181,643                  | 1.30        |
| GRDA          | \$45,780,155                             | (\$91,453,261)                  | (\$83,223,946)         | \$87,724            | (\$8,710,247)       | \$0                    | \$393,208              | (\$137,233,416)               | (2.00)      |
| KCPL          | \$188,419,476                            | \$304,126,283                   | (\$36,422,891)         | \$524,205           | \$9,411,209         | \$303,708,811          | \$26,904,950           | \$115,706,807                 | 1.61        |
| LES           | \$56,153,701                             | (\$13,139,193)                  | (\$41,996,690)         | \$107,601           | \$17,512,002        | \$6,758,077            | \$4,479,817            | (\$69,292,893)                | (0.23)      |
| MIDW          | \$17,706,174                             | \$72,772,637                    | (\$18,353,524)         | \$6,458,029         | \$5,411,653         | \$77,300,976           | \$1,955,504            | \$55,066,464                  | 4.11        |
| MKEC          | \$32,480,443                             | \$56,389,329                    | (\$82,706,402)         | \$1,228,593         | \$882,769           | \$117,831,044          | \$19,153,325           | \$23,908,885                  | 1.74        |
| NPPD          | \$151,355,555                            | \$122,282,641                   | \$47,455,125           | \$290,027           | \$10,748,915        | \$57,028,111           | \$6,760,464            | (\$29,072,914)                | 0.81        |
| OKGE          | \$334,260,179                            | \$671,812,937                   | \$420,171,043          | \$695,996           | \$345,348           | \$84,521,087           | \$166,079,463          | \$337,552,759                 | 2.01        |
| OPPD          | \$119,018,328                            | \$48,153,124                    | \$10,880,662           | \$228,062           | \$2,192,347         | \$31,362,275           | \$3,489,778            | (\$70,865,203)                | 0.40        |
| SPRM          | \$36,030,625                             | (\$37,338,815)                  | (\$40,583,648)         | \$69,042            | \$459,183           | (\$551,550)            | \$3,268,158            | (\$73,369,440)                | (1.04)      |
| SUNC          | \$25,377,319                             | \$66,924,360                    | (\$37,211,890)         | \$48,628            | \$150,363           | \$101,572,237          | \$2,365,022            | \$41,547,041                  | 2.64        |
| SWPS          | \$277,635,784                            | \$1,639,885,547                 | \$1,391,373,783        | \$317,399           | \$1,602,117         | \$16,660,158           | \$229,932,089          | \$1,362,249,763               | 5.91        |
| WEFA          | \$76,344,246                             | \$247,765,212                   | \$244,074,036          | \$1,430,892         | \$1,186,565         | (\$28,454,820)         | \$29,528,539           | \$171,420,965                 | 3.25        |
| WRI           | \$272,415,045                            | \$962,907,835                   | \$115,327,997          | \$522,000           | (\$149,340)         | \$803,261,088          | \$43,946,090           | \$690,492,791                 | 3.53        |
| <b>Totals</b> | <b>\$2,316,856,640</b>                   | <b>\$5,072,814,813</b>          | <b>\$1,979,862,546</b> | <b>\$13,318,645</b> | <b>\$67,763,548</b> | <b>\$2,005,193,986</b> | <b>\$1,006,676,089</b> | <b>\$2,755,958,174</b>        | <b>2.19</b> |

Figure 17: Zonal Benefits and Costs - 11 GW Group 1

| Area          | 11 GW<br>Study Group 2 (DCT 345 kV) |                                 |                        |                     |                     |                        |                        |                               |             |
|---------------|-------------------------------------|---------------------------------|------------------------|---------------------|---------------------|------------------------|------------------------|-------------------------------|-------------|
|               | Total Cost<br>(Years 0 -40)         | Total Benefit<br>(Years 0 - 40) | APC                    | Reliability         | Losses              | Wind Revenue<br>Impact | Gas Price<br>Impact    | Net Benefit<br>(Years 0 - 40) | B/C         |
| AEPW          | \$468,943,217                       | \$893,945,963                   | (\$111,622,742)        | \$1,562,453         | \$28,491,286        | \$549,729,067          | \$425,785,900          | \$425,002,746                 | 1.91        |
| EMDE          | \$56,401,893                        | \$46,402,700                    | \$82,845,213           | \$285,320           | (\$230,615)         | (\$63,294,000)         | \$26,796,781           | (\$9,999,193)                 | 0.82        |
| GMO           | \$89,298,741                        | \$144,173,087                   | \$118,310,273          | \$297,531           | \$224,568           | (\$7,159,736)          | \$32,500,452           | \$54,874,346                  | 1.61        |
| GRDA          | \$41,145,386                        | (\$105,131,998)                 | (\$98,418,805)         | \$137,091           | (\$7,253,469)       | \$0                    | \$403,186              | (\$146,277,384)               | (2.56)      |
| KCPL          | \$169,343,947                       | \$277,272,909                   | (\$56,403,301)         | \$727,387           | \$10,097,937        | \$295,322,030          | \$27,528,857           | \$107,928,962                 | 1.64        |
| LES           | \$50,468,717                        | (\$8,873,542)                   | (\$43,774,788)         | \$168,155           | \$17,663,389        | \$12,393,451           | \$4,676,252            | (\$59,342,259)                | (0.18)      |
| MIDW          | \$15,913,606                        | \$84,366,853                    | (\$10,953,963)         | \$6,477,123         | \$5,721,496         | \$81,163,399           | \$1,958,798            | \$68,453,247                  | 5.30        |
| MKEC          | \$29,192,133                        | \$98,194,763                    | (\$39,515,925)         | \$340,031           | (\$1,524,843)       | \$119,867,590          | \$19,027,909           | \$69,002,629                  | 3.36        |
| NPPD          | \$136,032,366                       | \$125,494,558                   | \$53,003,828           | (\$7,726,971)       | \$11,045,548        | \$62,144,128           | \$7,028,025            | (\$10,537,808)                | 0.92        |
| OKGE          | \$300,419,782                       | \$745,247,311                   | \$454,955,793          | \$7,268,516         | \$589,173           | \$109,278,903          | \$173,154,926          | \$444,827,529                 | 2.48        |
| OPPD          | \$106,968,949                       | \$56,309,803                    | \$10,198,076           | \$356,406           | \$2,502,190         | \$39,668,652           | \$3,584,479            | (\$50,659,146)                | 0.53        |
| SPRM          | \$32,382,895                        | (\$48,587,478)                  | (\$51,477,039)         | \$107,895           | \$459,183           | (\$1,068,468)          | \$3,390,950            | (\$80,970,373)                | (1.50)      |
| SUNC          | \$22,808,127                        | \$68,352,722                    | (\$41,060,385)         | \$75,993            | \$150,363           | \$106,718,973          | \$2,467,777            | \$45,544,595                  | 3.00        |
| SWPS          | \$249,528,024                       | \$1,658,598,854                 | \$1,338,518,101        | \$7,484,288         | \$1,462,918         | \$73,476,164           | \$237,657,382          | \$1,409,070,830               | 6.65        |
| WEFA          | \$68,615,179                        | \$234,887,856                   | \$232,423,531          | \$2,436,804         | \$1,320,648         | (\$32,890,211)         | \$31,597,084           | \$166,272,678                 | 3.42        |
| WRI           | \$244,835,830                       | \$1,120,036,062                 | \$216,003,169          | \$815,759           | (\$149,340)         | \$857,408,989          | \$45,957,486           | \$875,200,232                 | 4.57        |
| <b>Totals</b> | <b>\$2,082,298,794</b>              | <b>\$5,390,690,423</b>          | <b>\$2,053,031,037</b> | <b>\$20,813,781</b> | <b>\$70,570,431</b> | <b>\$2,202,758,931</b> | <b>\$1,043,516,243</b> | <b>\$3,308,391,629</b>        | <b>2.59</b> |

Figure 18: Zonal Benefits and Costs - 11 GW Group 2

## Appendix E – Calculation of Zonal Load Ratio Share

The Load Ratio Share (LRS) values in this revision of the Priority Projects analysis were updated to reflect the most up to date information. The figure below shows the monthly 12CP data for 2009 as submitted by stakeholders to the SPP Settlements group in early 2010. The LRS for each zone is calculated by dividing the zonal total load by the sum of all total load.

|              | January | February | March   | April   | May     | June    | July    | August  | September | October | November | December | Total             | LRS    |
|--------------|---------|----------|---------|---------|---------|---------|---------|---------|-----------|---------|----------|----------|-------------------|--------|
| CSWS         | 7448.00 | 6990.00  | 6668.00 | 6149.00 | 6995.00 | 9696.00 | 9840.44 | 9474.00 | 8173.01   | 6180.00 | 5794.00  | 7531.00  | 90,938.46         | 22.52% |
| EDE          | 1085.99 | 996.43   | 936.46  | 790.72  | 735.71  | 1089.33 | 1008.83 | 1032.22 | 815.12    | 637.77  | 745.00   | 1064.00  | 10,937.57         | 2.71%  |
| GRDA         | 675.00  | 638.00   | 581.00  | 547.00  | 606.00  | 839.00  | 808.00  | 812.00  | 670.00    | 564.00  | 568.00   | 671.00   | 7,979.00          | 1.98%  |
| KCPL         | 2825.30 | 2577.60  | 2419.00 | 2213.40 | 2531.90 | 3654.30 | 3394.74 | 3449.30 | 2583.50   | 2118.20 | 2255.40  | 2816.90  | 32,839.54         | 8.13%  |
| LES          | 799.00  | 768.00   | 753.00  | 714.00  | 719.00  | 1061.00 | 984.00  | 953.00  | 845.00    | 743.00  | 756.00   | 692.00   | 9,787.00          | 2.42%  |
| MIDW         | 229.00  | 210.00   | 210.00  | 199.00  | 234.00  | 344.00  | 358.00  | 342.00  | 262.00    | 217.00  | 232.00   | 249.00   | 3,086.00          | 0.76%  |
| MPS          | 1586.00 | 1427.00  | 1319.00 | 1166.00 | 1273.00 | 1951.00 | 1720.00 | 1769.00 | 1306.00   | 1080.00 | 1179.00  | 1541.00  | 17,317.00         | 4.29%  |
| NPPD         | 2340.46 | 2047.45  | 2186.52 | 1855.74 | 1915.70 | 2303.94 | 2614.88 | 2624.02 | 1960.56   | 1864.77 | 2174.29  | 2491.35  | 26,379.68         | 6.53%  |
| OKGE         | 4579.13 | 4211.53  | 3986.76 | 3949.83 | 4561.84 | 6310.87 | 6544.47 | 6136.71 | 5441.21   | 4004.86 | 3874.58  | 4656.24  | 58,258.04         | 14.43% |
| OPPD         | 1627.66 | 1507.00  | 1460.79 | 1502.28 | 1575.93 | 2349.12 | 2096.78 | 2160.00 | 1744.38   | 1452.81 | 1501.69  | 1765.21  | 20,743.64         | 5.14%  |
| SECI         | 320.00  | 311.00   | 330.00  | 312.00  | 375.00  | 469.00  | 478.00  | 465.00  | 386.00    | 319.00  | 317.00   | 341.00   | 4,423.00          | 1.10%  |
| SPRM         | 498.95  | 493.47   | 441.73  | 410.23  | 482.95  | 735.68  | 655.93  | 674.31  | 542.67    | 409.89  | 412.35   | 521.59   | 6,279.76          | 1.56%  |
| SPS          | 3511.00 | 3431.00  | 3275.00 | 3572.00 | 4264.00 | 4758.00 | 5036.00 | 5005.00 | 4670.00   | 3418.00 | 3488.00  | 3961.00  | 48,389.00         | 11.98% |
| WFEC         | 1173.00 | 1099.00  | 1029.00 | 962.00  | 1009.00 | 1288.00 | 1334.00 | 1282.00 | 1142.00   | 818.00  | 935.00   | 1235.00  | 13,306.00         | 3.30%  |
| WPEK/MKEC    | 433.00  | 413.00   | 398.00  | 386.00  | 434.00  | 622.00  | 618.00  | 611.00  | 471.00    | 400.00  | 419.00   | 456.00   | 5,661.00          | 1.40%  |
| WR           | 3956.59 | 3956.59  | 3956.59 | 3956.59 | 3956.59 | 3956.59 | 3956.59 | 3956.59 | 3956.59   | 3956.59 | 3956.59  | 3956.59  | 47,479.08         | 11.76% |
| <b>Total</b> |         |          |         |         |         |         |         |         |           |         |          |          | <b>403,803.77</b> |        |

Figure 19: 2009 12CP Data for LRS Calculations

## **Appendix F – Aggregated Zonal Output Results**

At the technical conference held on February 10, 2010 stakeholders requested to see additional detail on actual output results in order to better understand the benefits being presented. Staff also polled the ESWG on data that would help them better interpret the results as well. Stakeholders were particularly interested in how the model was altering the dispatch of thermal generation and how LMP prices were changing as a result of the Priority Projects. Below are a number of charts that illustrate the percent change in PROMOD output data between the respective base and change case by zone related to thermal generation levels and LMP prices.

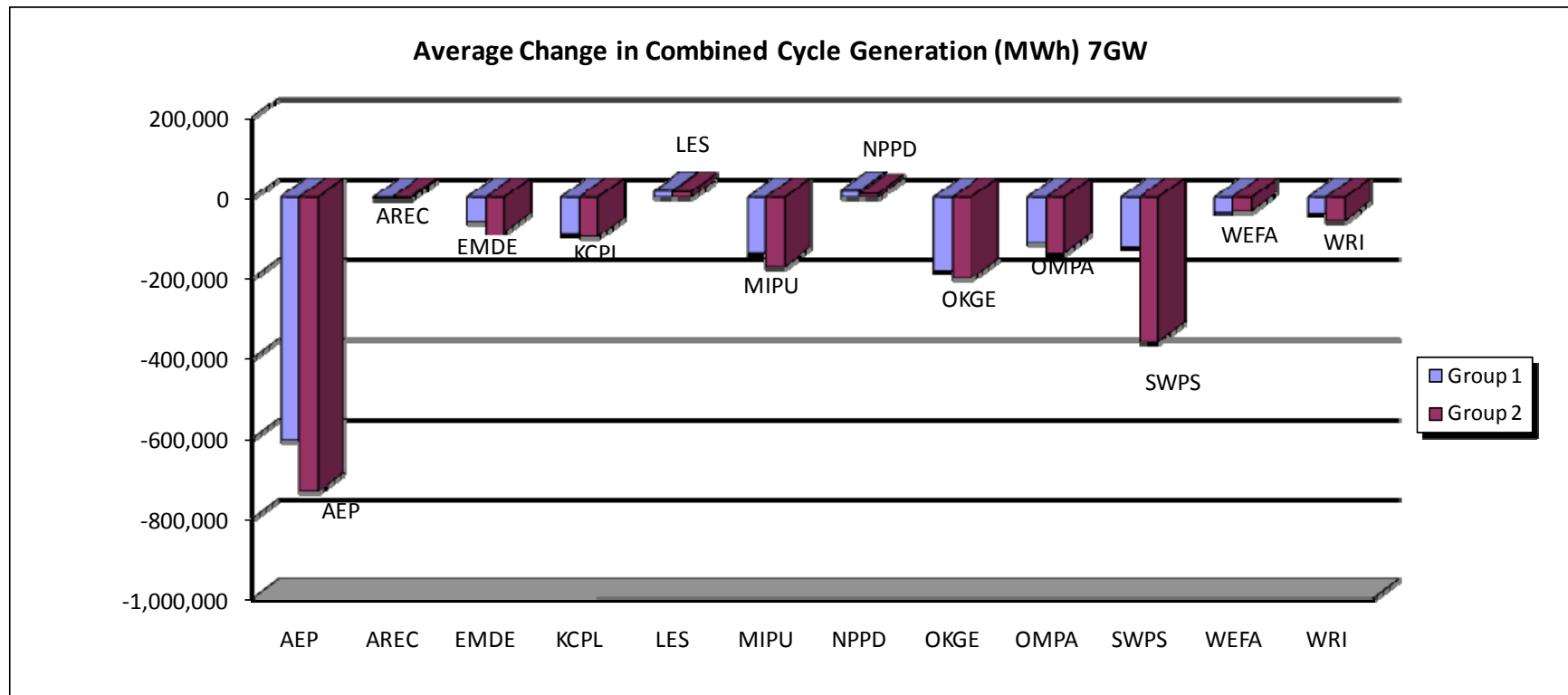


**Figure 20: Avg Change in Combined Cycle Generation - 7 GW**



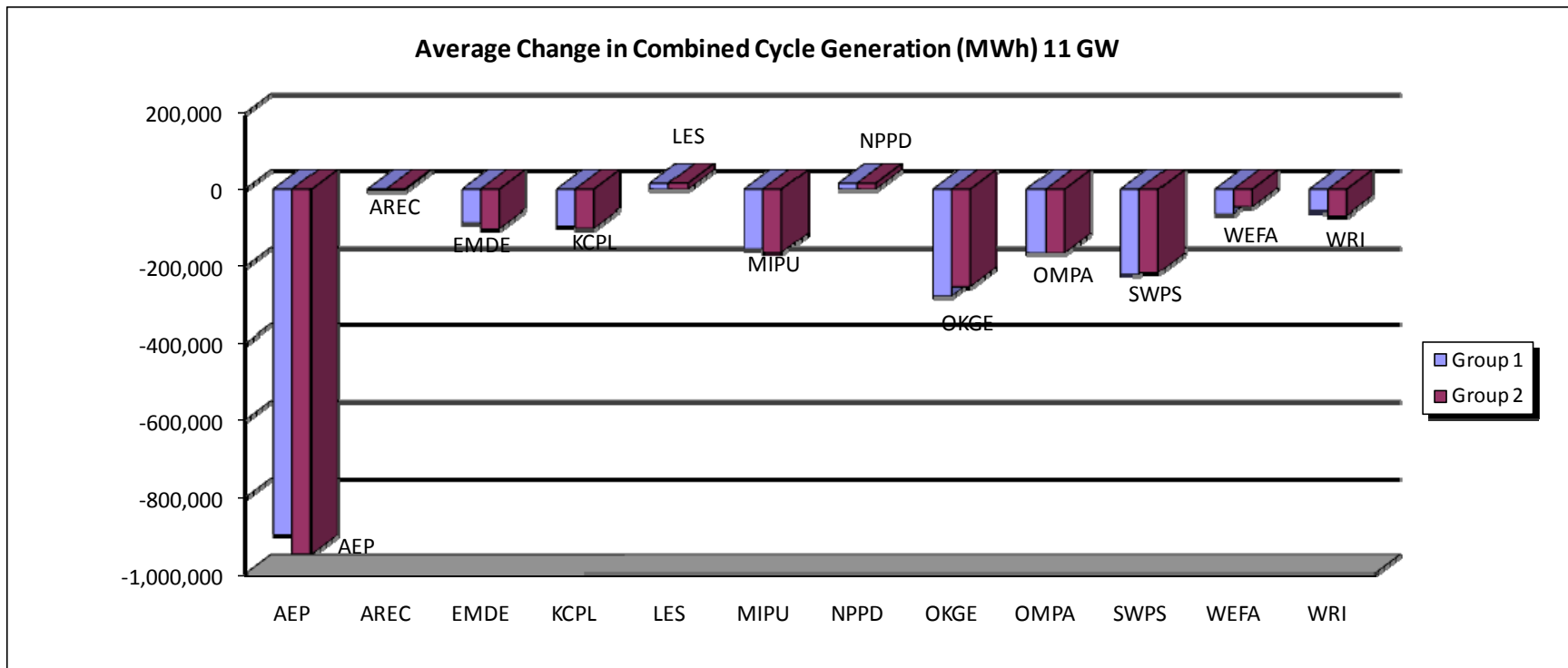


**Figure 21: Avg Change in Combined Cycle Generation - 11 GW**

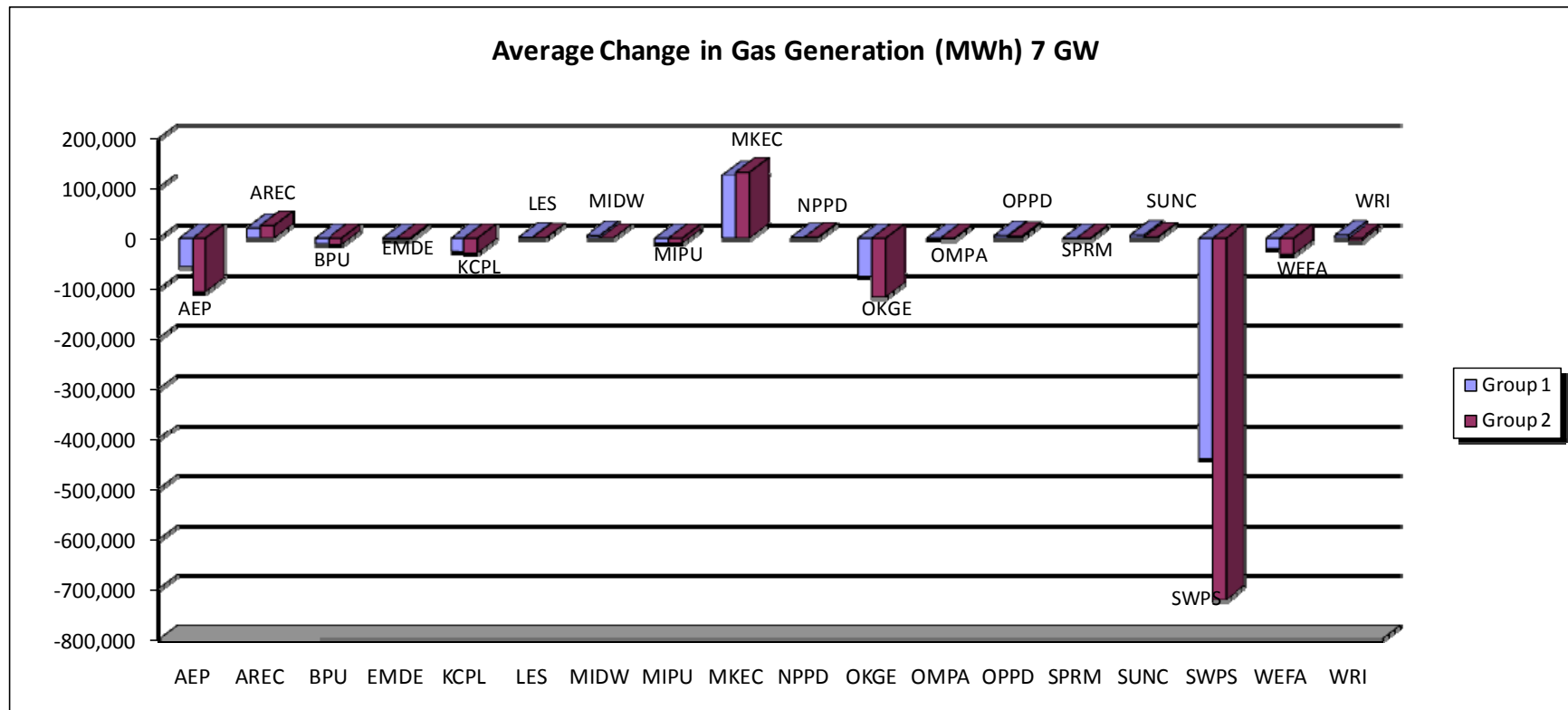


**Figure 22: Avg Change in Gas Generation - 7 GW**

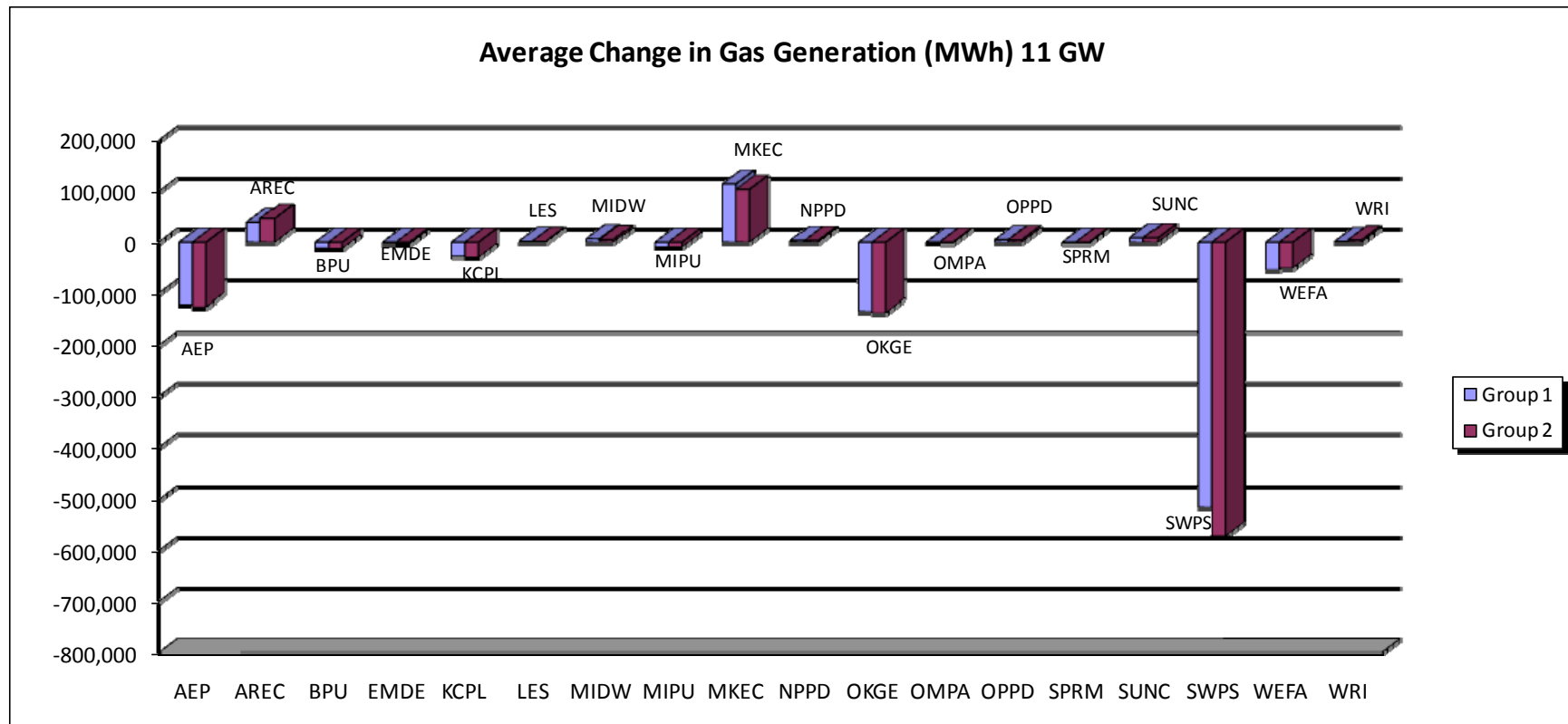


**Figure 23: Avg Change in Gas Generation - 11 GW**

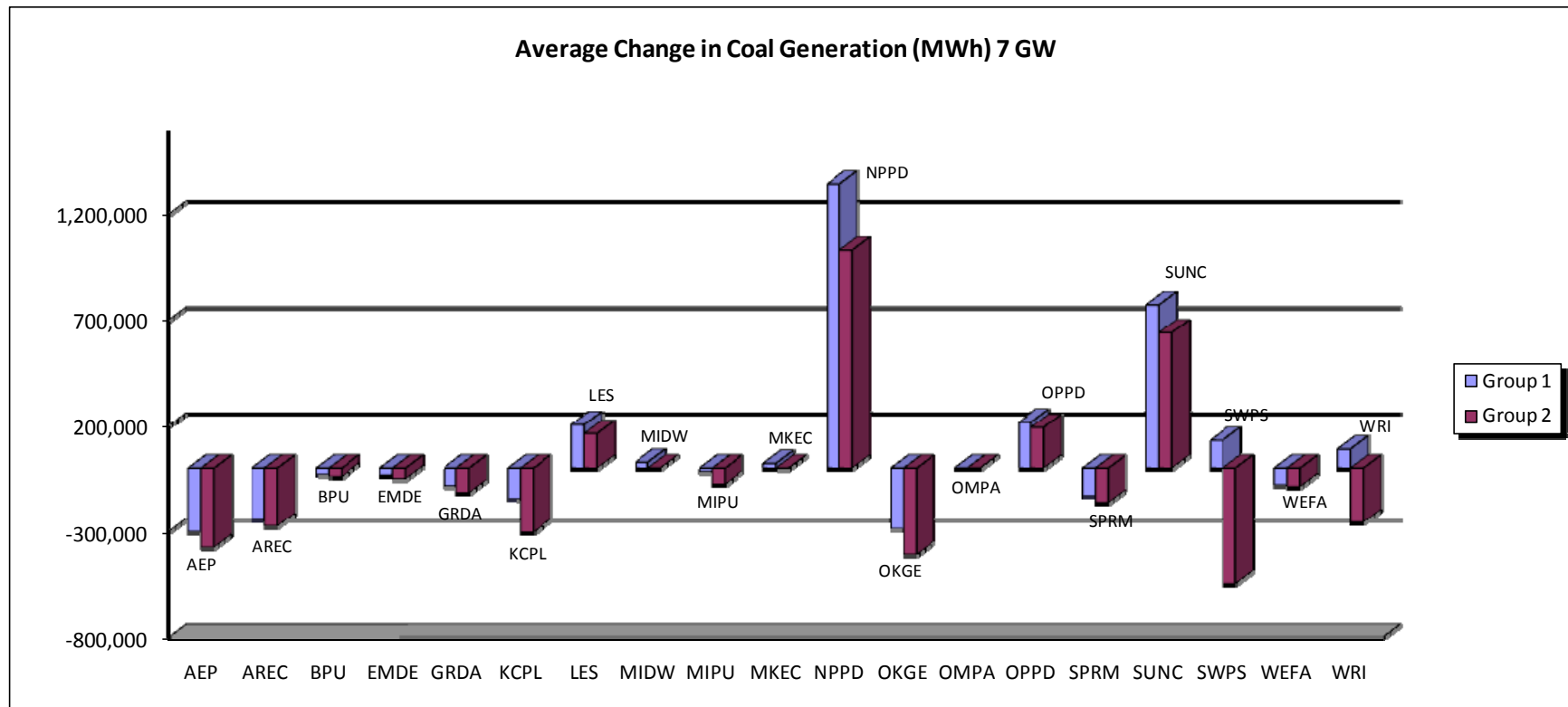


**Figure 24: Avg Change in Coal Generation - 7 GW**

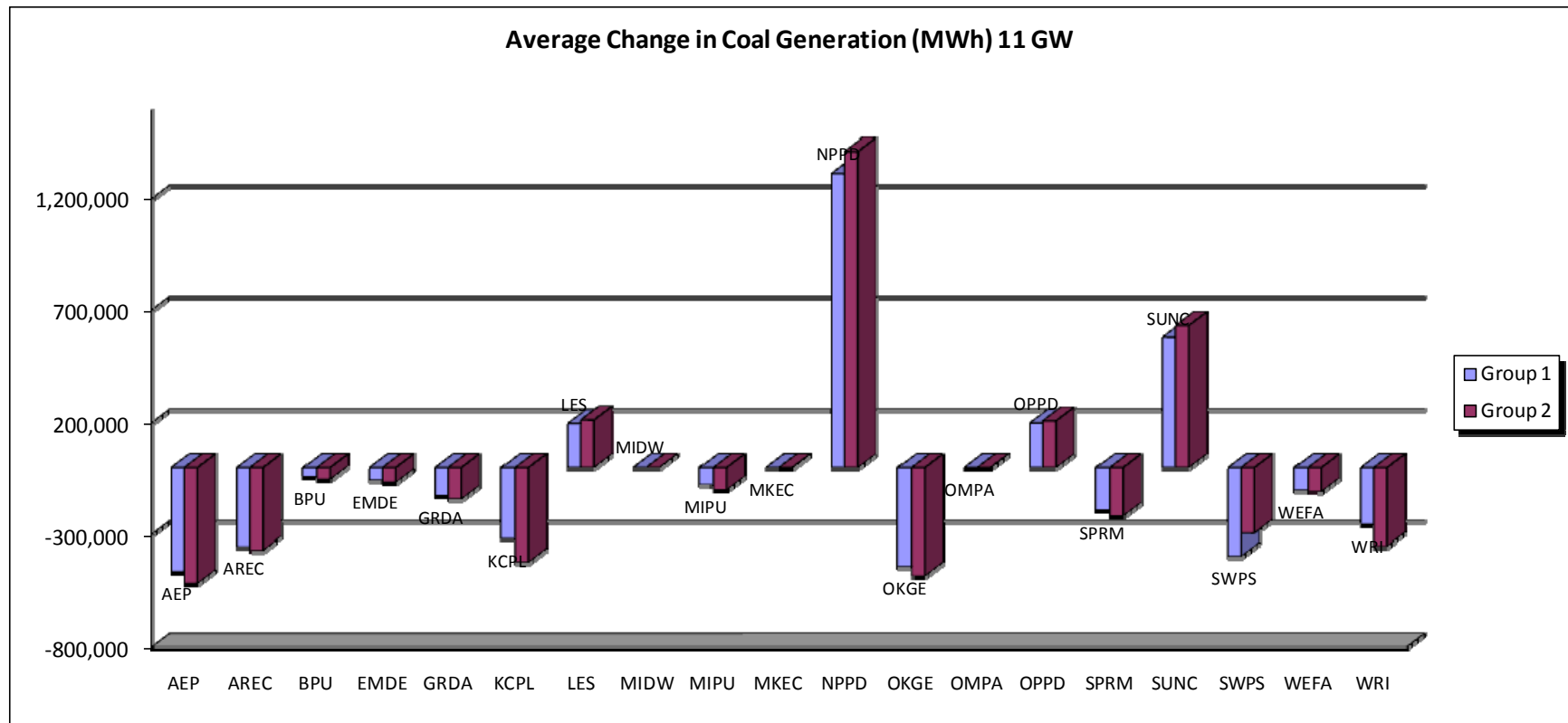


**Figure 25: Avg Change in Coal Generation - 11 GW**

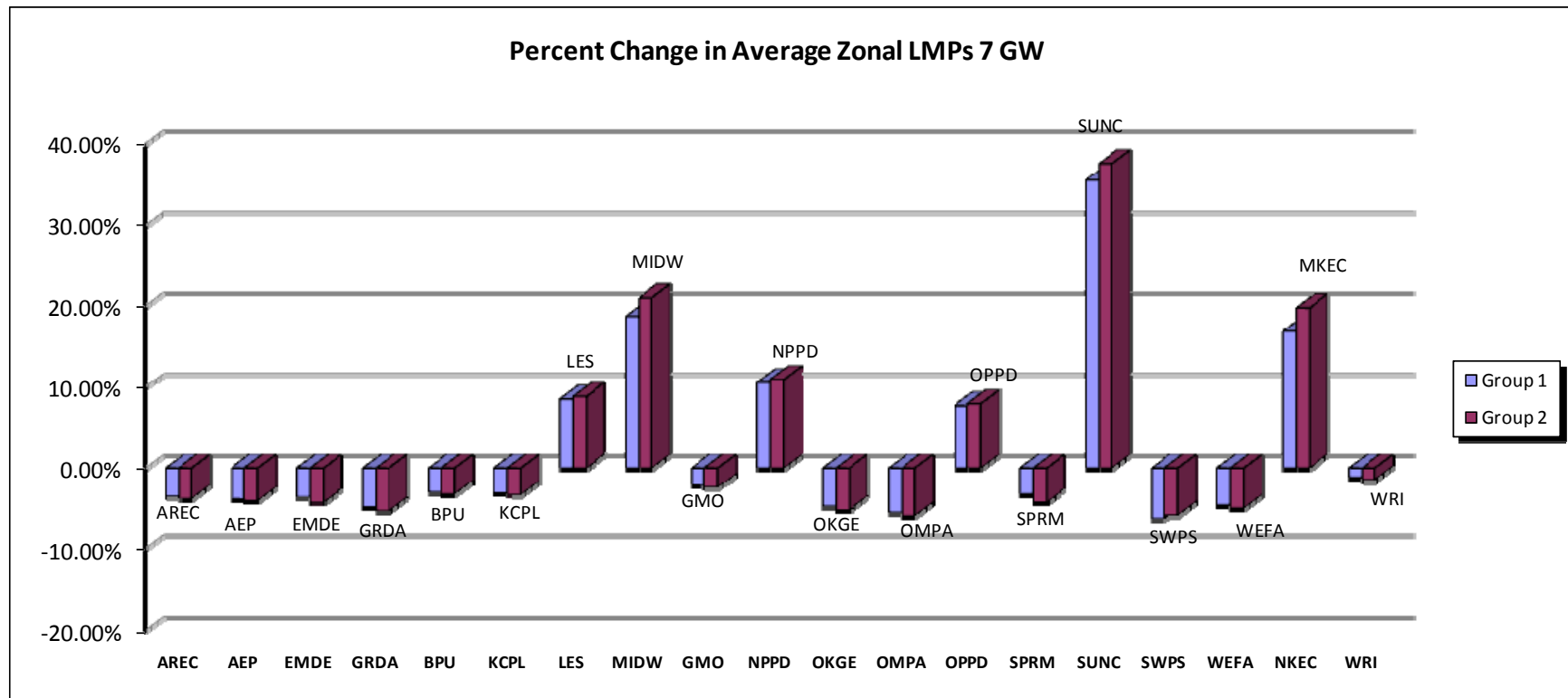


**Figure 26: % Change in Avg Zonal LMPs - 7 GW**



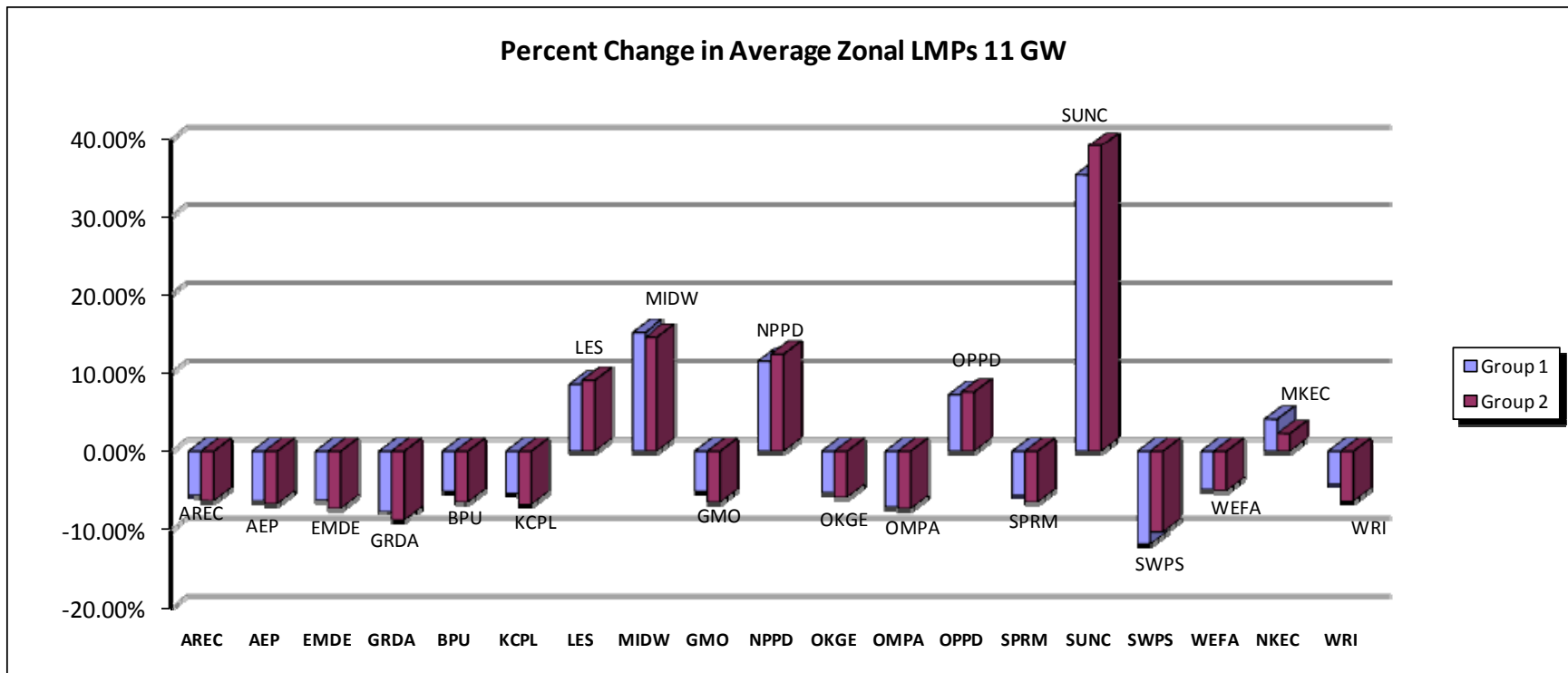


**Figure 27: % Change in Avg Zonal LMPs - 11 GW**

## Appendix G – Wind Revenue Impact Zonal Allocations

The change in wind revenue for all existing designated wind resources was assigned to the zone in which the resource was designated. The CAWG discussed methods for allocating the change in wind revenue for both existing non-designated wind resources and non-designated wind resources added to the model to reach the appropriate 7 GW or 11 GW study level. Consensus was reached by the CAWG on a method presented by Dr. Mike Proctor, consultant for the SPP Regional State Committee. The charts below reflect the allocations of those revenues as developed by Dr. Proctor.

| 7 GW Wind Benefits                          |                |                |                        |                            |                           |                           |
|---------------------------------------------|----------------|----------------|------------------------|----------------------------|---------------------------|---------------------------|
| Group 1 Results                             |                |                |                        |                            |                           |                           |
| Sign Convention: Benefits > 0 and Costs < 0 |                |                |                        |                            |                           |                           |
| 40 Year Levelized                           |                |                |                        |                            |                           | NPV                       |
| Zone                                        | Wind Capacity  |                | DR Wind<br>Net Benefit | Non-DR Wind<br>Net Benefit | Total Wind<br>Net Benefit | Total Wind<br>Net Benefit |
|                                             | DR             | Non-DR         |                        |                            |                           |                           |
| AEP                                         | 421.0          | 1,114.1        | (\$4,503,884)          | \$9,645,261                | \$5,141,377               | \$61,308,936              |
| EMDE                                        | 255.0          | 64.1           | (\$2,390,281)          | (\$377,036)                | (\$2,767,317)             | (\$32,999,184)            |
| GMO                                         | 61.0           | 265.4          | \$1,100,274            | (\$1,561,256)              | (\$460,982)               | (\$5,497,032)             |
| GRDA                                        | 0.0            | 0.0            | \$0                    | \$0                        | \$0                       | \$0                       |
| KCPL                                        | 125.0          | 451.6          | \$4,389,510            | (\$594,386)                | \$3,795,124               | \$45,255,389              |
| LES                                         | 6.0            | 52.3           | \$74,154               | \$662,309                  | \$736,463                 | \$8,782,036               |
| MIDW                                        | 49.2           | 54.8           | (\$73,763)             | \$243,380                  | \$169,617                 | \$2,022,614               |
| MKEC                                        | 75.0           | 77.3           | \$883,919              | \$343,719                  | \$1,227,638               | \$14,639,110              |
| NPPD                                        | 99.5           | 234.9          | \$1,244,883            | \$2,975,983                | \$4,220,866               | \$50,332,198              |
| OKGE                                        | 451.0          | 581.0          | (\$3,992,432)          | (\$985,249)                | (\$4,977,680)             | (\$59,356,915)            |
| OPPD                                        | 95.0           | 146.8          | \$940,810              | \$1,859,279                | \$2,800,089               | \$33,389,979              |
| SPRM                                        | 50.0           | 18.7           | (\$74,963)             | (\$109,796)                | (\$184,758)               | (\$2,203,173)             |
| SUNC                                        | 50.0           | 72.0           | (\$74,963)             | \$319,894                  | \$244,931                 | \$2,920,711               |
| SWPS                                        | 658.0          | 294.1          | (\$8,622,061)          | \$7,743,274                | (\$878,786)               | (\$10,479,186)            |
| WEFA                                        | 216.3          | 44.1           | (\$3,147,652)          | (\$74,833)                 | (\$3,222,485)             | (\$38,426,886)            |
| WRI                                         | 307.5          | 558.8          | \$9,274,879            | \$2,483,452                | \$11,758,330              | \$140,213,544             |
| <b>TOTAL</b>                                | <b>2,919.5</b> | <b>4,029.9</b> | <b>(\$4,971,569)</b>   | <b>\$22,573,996</b>        | <b>\$17,602,427</b>       | <b>\$209,902,141</b>      |
|                                             | <b>6,949.4</b> |                |                        |                            |                           |                           |

Figure 28: Zonal Wind Revenue Allocation - 7 GW Group 1

| 7 GW Wind Benefits                          |                |                |                      |                     |                     |                      |
|---------------------------------------------|----------------|----------------|----------------------|---------------------|---------------------|----------------------|
| Group 2 Results                             |                |                |                      |                     |                     |                      |
| Sign Convention: Benefits > 0 and Costs < 0 |                |                |                      |                     |                     |                      |
| 40 Year Levelized                           |                |                |                      |                     |                     | NPV                  |
| Zone                                        | Wind Capacity  |                | DR Wind              | Non-DR Wind         | Total Wind          | Total Wind           |
|                                             | DR             | Non-DR         | Net Benefit          | Net Benefit         | Net Benefit         | Net Benefit          |
| AEP                                         | 421.0          | 1,114.1        | (\$4,218,682)        | \$8,874,385         | \$4,655,702         | \$55,517,451         |
| EMDE                                        | 255.0          | 64.1           | (\$2,971,700)        | (\$369,474)         | (\$3,341,174)       | (\$39,842,207)       |
| GMO                                         | 61.0           | 265.4          | \$1,258,371          | (\$1,529,943)       | (\$271,572)         | (\$3,238,388)        |
| GRDA                                        | 0.0            | 0.0            | \$0                  | \$0                 | \$0                 | \$0                  |
| KCPL                                        | 125.0          | 451.6          | \$4,993,905          | (\$682,013)         | \$4,311,892         | \$51,417,647         |
| LES                                         | 6.0            | 52.3           | \$80,978             | \$721,870           | \$802,848           | \$9,573,656          |
| MIDW                                        | 49.2           | 54.8           | (\$74,551)           | \$211,205           | \$136,654           | \$1,629,544          |
| MKEC                                        | 75.0           | 77.3           | \$1,015,714          | \$298,279           | \$1,313,993         | \$15,668,857         |
| NPPD                                        | 99.5           | 234.9          | \$1,354,215          | \$3,243,611         | \$4,597,827         | \$54,827,306         |
| OKGE                                        | 451.0          | 581.0          | (\$4,461,810)        | (\$1,583,082)       | (\$6,044,893)       | (\$72,083,006)       |
| OPPD                                        | 95.0           | 146.8          | \$1,013,153          | \$2,026,482         | \$3,039,636         | \$36,246,480         |
| SPRM                                        | 50.0           | 18.7           | (\$75,763)           | (\$107,594)         | (\$183,357)         | (\$2,186,459)        |
| SUNC                                        | 50.0           | 72.0           | (\$75,763)           | \$277,603           | \$201,840           | \$2,406,868          |
| SWPS                                        | 658.0          | 294.1          | (\$7,011,501)        | \$7,708,931         | \$697,430           | \$8,316,588          |
| WEFA                                        | 216.3          | 44.1           | (\$2,904,484)        | (\$120,241)         | (\$3,024,725)       | (\$36,068,675)       |
| WRI                                         | 307.5          | 558.8          | \$10,318,126         | \$2,155,136         | \$12,473,261        | \$148,738,820        |
| <b>TOTAL</b>                                | <b>2,919.5</b> | <b>4,029.9</b> | <b>(\$1,759,792)</b> | <b>\$21,125,156</b> | <b>\$19,365,364</b> | <b>\$230,924,482</b> |
|                                             | <b>6,949.4</b> |                |                      |                     |                     |                      |

Figure 29: Zonal Wind Revenue Allocation - 7 GW Group 2

| 11 GW Wind Benefits                         |               |              |                       |                      |                      |                        |
|---------------------------------------------|---------------|--------------|-----------------------|----------------------|----------------------|------------------------|
| Group 1 Results                             |               |              |                       |                      |                      |                        |
| Sign Convention: Benefits > 0 and Costs < 0 |               |              |                       |                      |                      |                        |
| 40 Year Levelized                           |               |              |                       |                      |                      | NPV                    |
| Zone                                        | Wind Capacity |              | DR Wind               | Non-DR Wind          | Total Wind           | Total Wind             |
|                                             | DR            | Non-DR       | Net Benefit           | Net Benefit          | Net Benefit          | Net Benefit            |
| AEP                                         | 421           | 2,465        | (\$12,380,833)        | \$54,546,230         | \$42,165,397         | \$502,806,055          |
| EMDE                                        | 255           | 95           | (\$5,750,059)         | (\$190,488)          | (\$5,940,547)        | (\$70,838,728)         |
| GMO                                         | 61            | 393          | \$975,723             | (\$788,785)          | \$186,938            | \$2,229,166            |
| GRDA                                        | 0             | 0            | \$0                   | \$0                  | \$0                  | \$0                    |
| KCPL                                        | 125           | 815          | \$2,607,086           | \$22,861,984         | \$25,469,070         | \$303,708,811          |
| LES                                         | 6             | 111          | (\$391,336)           | \$958,069            | \$566,733            | \$6,758,077            |
| MIDW                                        | 49            | 121          | \$8,970               | \$6,473,502          | \$6,482,472          | \$77,300,976           |
| MKEC                                        | 75            | 171          | \$738,982             | \$9,142,349          | \$9,881,330          | \$117,831,044          |
| NPPD                                        | 100           | 498          | \$477,451             | \$4,304,935          | \$4,782,387          | \$57,028,111           |
| OKGE                                        | 451           | 1,285        | (\$19,793,620)        | \$26,881,573         | \$7,087,952          | \$84,521,087           |
| OPPD                                        | 95            | 311          | (\$59,511)            | \$2,689,556          | \$2,630,045          | \$31,362,275           |
| SPRM                                        | 50            | 28           | \$9,218               | (\$55,471)           | (\$46,253)           | (\$551,550)            |
| SUNC                                        | 50            | 159          | \$9,218               | \$8,508,646          | \$8,517,864          | \$101,572,237          |
| SWPS                                        | 658           | 651          | (\$15,821,703)        | \$17,218,827         | \$1,397,124          | \$16,660,158           |
| WEFA                                        | 216           | 98           | (\$4,427,976)         | \$2,041,750          | (\$2,386,226)        | (\$28,454,820)         |
| WRI                                         | 295           | 1,248        | \$657,286             | \$66,704,319         | \$67,361,605         | \$803,261,088          |
| <b>TOTAL</b>                                | <b>2,907</b>  | <b>8,449</b> | <b>(\$53,141,104)</b> | <b>\$221,296,996</b> | <b>\$168,155,892</b> | <b>\$2,005,193,986</b> |
|                                             | <b>11,356</b> |              |                       |                      |                      |                        |

Figure 30: Zonal Wind Revenue Allocation - 11 GW Group 1

| 11 GW Wind Benefits                         |               |              |                       |                      |                      |                        |
|---------------------------------------------|---------------|--------------|-----------------------|----------------------|----------------------|------------------------|
| Group 2 Results                             |               |              |                       |                      |                      |                        |
| Sign Convention: Benefits > 0 and Costs < 0 |               |              |                       |                      |                      |                        |
| 40 Year Levelized                           |               |              |                       |                      |                      | NPV                    |
| Zone                                        | Wind Capacity |              | DR Wind               | Non-DR Wind          | Total Wind           | Total Wind             |
|                                             | DR            | Non-DR       | Net Benefit           | Net Benefit          | Net Benefit          | Net Benefit            |
| AEP                                         | 421           | 2,465        | (\$11,155,560)        | \$57,255,929         | \$46,100,368         | \$549,729,067          |
| EMDE                                        | 255           | 95           | (\$5,038,811)         | (\$269,034)          | (\$5,307,845)        | (\$63,294,000)         |
| GMO                                         | 61            | 393          | \$513,618             | (\$1,114,035)        | (\$600,417)          | (\$7,159,736)          |
| GRDA                                        | 0             | 0            | \$0                   | \$0                  | \$0                  | \$0                    |
| KCPL                                        | 125           | 815          | \$958,034             | \$23,807,719         | \$24,765,753         | \$295,322,030          |
| LES                                         | 6             | 111          | \$39,067              | \$1,000,250          | \$1,039,317          | \$12,393,451           |
| MIDW                                        | 49            | 121          | (\$11,077)            | \$6,817,453          | \$6,806,376          | \$81,163,399           |
| MKEC                                        | 75            | 171          | \$424,015             | \$9,628,100          | \$10,052,115         | \$119,867,590          |
| NPPD                                        | 100           | 498          | \$716,950             | \$4,494,466          | \$5,211,417          | \$62,144,128           |
| OKGE                                        | 451           | 1,285        | (\$18,353,927)        | \$27,518,073         | \$9,164,146          | \$109,278,903          |
| OPPD                                        | 95            | 311          | \$518,652             | \$2,807,968          | \$3,326,620          | \$39,668,652           |
| SPRM                                        | 50            | 28           | (\$11,257)            | (\$78,345)           | (\$89,602)           | (\$1,068,468)          |
| SUNC                                        | 50            | 159          | (\$11,257)            | \$8,960,727          | \$8,949,470          | \$106,718,973          |
| SWPS                                        | 658           | 651          | (\$12,372,249)        | \$18,533,972         | \$6,161,723          | \$73,476,164           |
| WEFA                                        | 216           | 98           | (\$4,848,273)         | \$2,090,094          | (\$2,758,178)        | (\$32,890,211)         |
| WRI                                         | 295           | 1,248        | \$1,654,001           | \$70,248,455         | \$71,902,456         | \$857,408,989          |
| <b>TOTAL</b>                                | <b>2,907</b>  | <b>8,449</b> | <b>(\$46,978,073)</b> | <b>\$231,701,793</b> | <b>\$184,723,720</b> | <b>\$2,202,758,931</b> |
|                                             | <b>11,356</b> |              |                       |                      |                      |                        |

Figure 31: Zonal Wind Revenue Allocation - 11 GW Group 2

## Appendix H – Contour Maps of Priority Projects

The contour maps herein represent the absolute value of the difference in megawatt flow between a model without the identified projects and one with the identified projects. Values below the minimum level (10 MW) are not shown, and values above the maximum level (400 MW) are illustrated at the same color as the maximum level. The maps are generated based on the 2019 STEP models that were used for the reliability analysis of the Priority Projects. These models do not contain any additional wind generation.

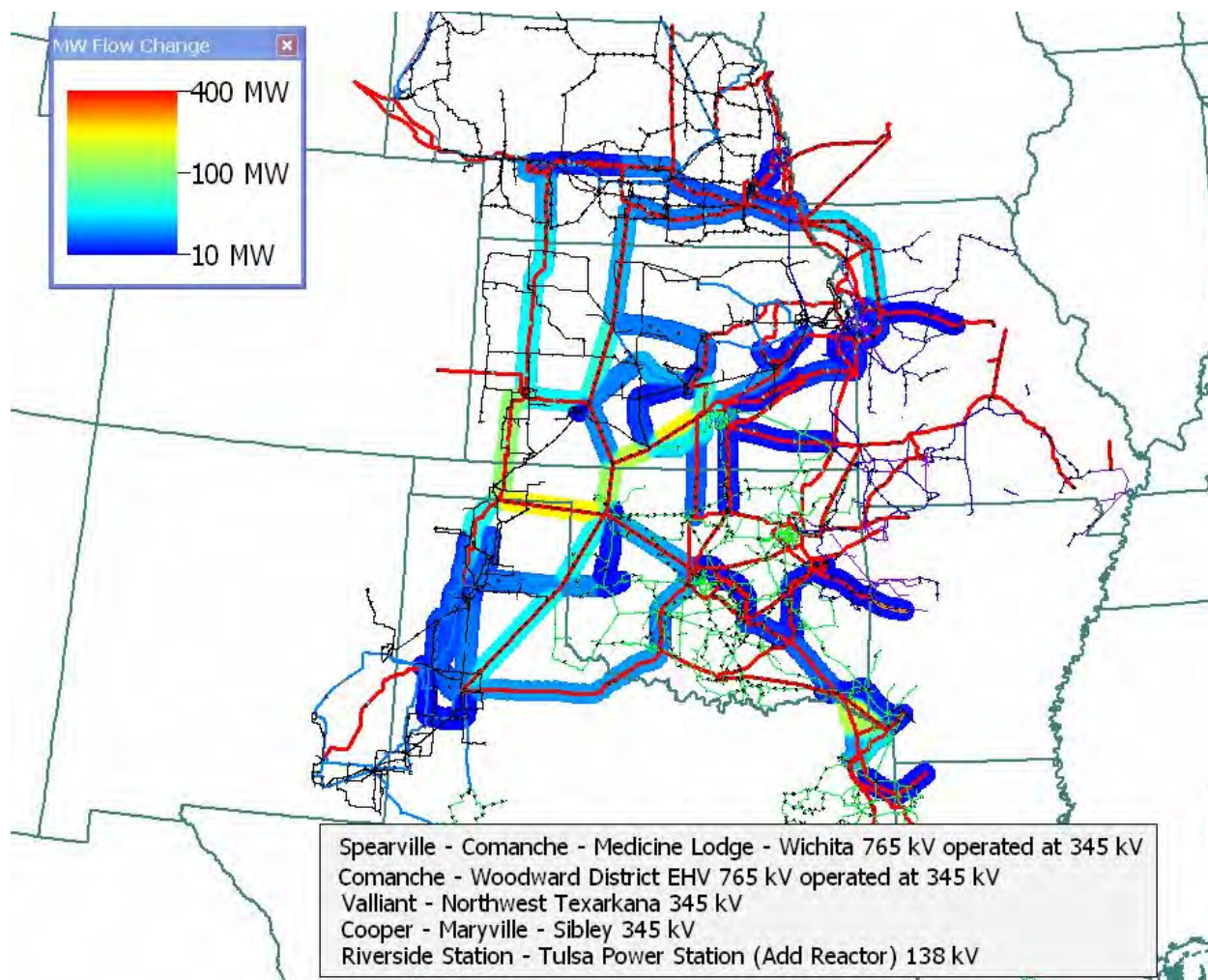


**Figure 32: Priority Projects Group 1**



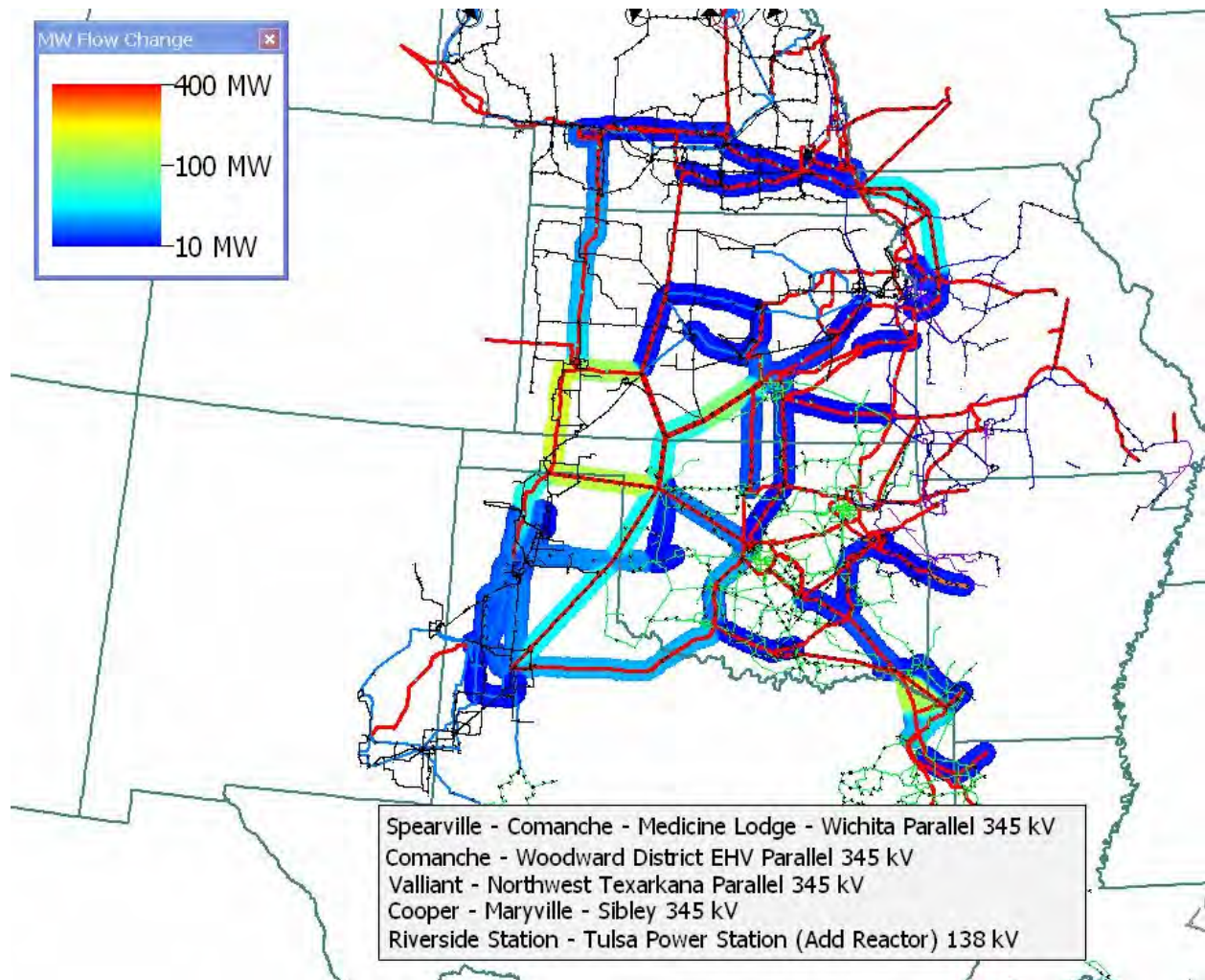


**Figure 33: Priority Projects Group 2**



## Appendix I – Calculating Impact for Average Residential Electric Bill

The cost of \$1 billion dollars of incremental transmission investment to the typical residential customer in the SPP transmission footprint may be estimated to be in the neighborhood of \$ 1.34 per customer per month. This estimation was performed by multiplying the \$1 billion assumed to be invested by a typical levelized fixed charge rate of 16%, generating an annual transmission revenue requirement (ATRR) of \$160 million per year. This ATRR is then multiplied by 85%, recognizing that 15% of the SPP transmission service revenue requirements are met by Point to Point Transmission Service sold on the system. This figure is then divided by the total monthly average coincident peak load of the system (12 CP Load) of 33,778 MW generating an indicative rate of \$4,026 per MW-year. This rate is divided by 1,000 kW/MW and 12 months/year, thus converting the rate to \$0.34 per kW-month. The \$0.34 per kW-month is then multiplied by an average residential consumption of 4 kW, generating the estimated increase of \$1.34 per month per \$1 billion of E&C investment. The actual cost to any residential customer depends upon their individual consumption and the rates approved by the appropriate regulatory authorities.

|  |               |                                               |  |
|--|---------------|-----------------------------------------------|--|
|  |               |                                               |  |
|  | \$160,000,000 | Levelized ATRR                                |  |
|  |               |                                               |  |
|  | 0.85          | ATRR Allocator for NITS                       |  |
|  |               |                                               |  |
|  | 33,778        | Current Total System Load (12 CP in MW)       |  |
|  |               |                                               |  |
|  | \$4,026.29    | Annual Cost per MW                            |  |
|  |               |                                               |  |
|  | \$0.34        | Cost per kW-month                             |  |
|  |               |                                               |  |
|  | 4.00          | Typical Res. Customer Diversified Demand (kW) |  |
|  |               |                                               |  |
|  | \$1.34        | Typical Res. Customer Billing Impact          |  |
|  |               |                                               |  |
|  |               |                                               |  |
|  |               |                                               |  |
|  |               |                                               |  |

## Appendix J – Frequently Asked Questions

1. Should all areas within SPP be modeled consistently? The DC ties will be modeled on some reasonable historical profile – What is that profile?

*Yes, to the extent possible all areas within SPP were modeled consistently. For the DC ties, SPP used 2008 actual historical data for each DC tie to represent the hourly-profiled flows across each tie. In cases where stakeholders did not feel 2008 data was a fair representation for a particular DC tie, they were allowed to submit another year's data that they did feel adequately represented the flows.*

2. Should the Priority Projects be studied as individual projects, rather than only groupings of projects?

*The current assessment was performed under the direction of the BOD and SPC.*

3. Were there any significant changes in the model validation process?

*During the stakeholder review process for the input and output data, there were a number of modifications to individual utility modeling parameters. Staff would not qualify the changes as significant.*

4. Will there be a technical conference to discuss the outcome of this analysis?

*There is a scheduled conference February 10, 2010 at the DFW Hyatt. WebEx will also be available for those unable to attend.*

5. Before going to the BOD in April, should we have a Priority Project review in March?

*Staff does intend to assess the need for another stakeholder review in March which will be based on the feedback received at the February 10 meeting.*

6. What transmission projects were included in the models? What models were used?

*Only previously BOD approved transmission projects were included in the analysis. As they were not yet approved, the 2009 STEP projects were not included in the analysis. The load flow models used were the most recent models utilized in the 2009 STEP process. See the report section Scope of Priority Projects Phase II Analysis for additional details.*

7. Do the wind locations match the WITF?

*The wind locations do not directly match those locations used in the WITF. The Priority Projects analysis approximated wind injection locations based on the location of the Priority Projects, the location of wind in the GI queue, and state renewable target and load information. See the report for additional information.*

8. Will a full N-1 reliability analysis be done on these Priority Projects? Will the wind be in the models?

*A full N-1 reliability analysis was performed on the Priority Projects, and the impact of this analysis is detailed in Attachment 2. Wind was not included in this reliability assessment.*

## **Attachments**

Click on the links below to see the attachments:

**[Attachment 1 – BATTF Report](#)**

**[Attachment 2 – TWG Reliability Report](#)**

**[Attachment 3 – TWG Comments to the Priority Project Reliability Report](#)**

**[Attachment 4 – Brattle Group Report](#)**

**[Attachment 5 – Improving the Eastward Transfer Capability](#)**

**[Attachment 6 – KEMA Report](#)**

# Benefit Analysis for Priority Projects

July 24, 2009

**Disclaimer:** This report is for Priority Project evaluation only. No reference for cost allocation is implied or intended.



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## Introduction

By recommendation of the Synergistic Planning Project Team (SPPT), the Economic Studies Working Group (ESWG) was asked to develop benefit analysis techniques for transmission planning with the goal of creating a robust, flexible, and cost-effective transmission system. The ESWG is currently developing the metrics to be used in the Integrated Transmission Planning (ITP) process.

The Benefit Analysis Techniques Task Force (BATTF) was created as a quick response team to address the immediate need to determine the formulation of the metrics to support Priority Project analysis, an interim measure specified by the SPPT until the ITP process is functional.

Significant time is required to fully develop the metrics for the ITP and integrate the existing transmission planning processes. This document and the metrics contained within will be a “living document”, subject to change as the process matures and develops.

This document is presented as a working draft of the benefit metrics to be used primarily for Priority Projects and as a starting point for the ITP benefit metrics calculations. The final list of Priority Projects and the ITP process will be presented to the SPP Board of Directors for approval in October 2009.



## Scope of Work and Metrics for Formulation

The scope of the BATTF effort is to standardize formulation and analysis techniques for SPP study metrics so Priority Projects are evaluated on a consistent basis. Another goal of the BATTF is to develop a standard reporting format to maximize market participants' and stakeholders' understanding of the results.

If approved by the ESWG, results of the BATTF's efforts will be utilized as a starting point for future ITP process evaluation and will be incorporated into the ESWG's Economic Studies Manual.

The BATTF was asked to consider and formulate for use with Priority Projects the following metrics:

1. **Adjusted Production Cost (APC)** – Projects will be screened to determine their individual APC benefit for SPP. This benefit metric is typically simulated using a production cost modeling tool accounting for 8760 yearly hourly profiles of system-wide commitment and dispatch modeling taken over the course of the study period.
2. **Environmental Impacts** – SO<sub>2</sub>, NO<sub>x</sub>, CO<sub>2</sub>, and mercury can be modeled in a study for the fuel type used in the generating units. Once stakeholders determine a value per ton for the emissions, the cost of emissions can be calculated for the units. Transmission upgrades can then be used to determine the net impact on emission pricing.
3. **Reliability Impact** – Economic transmission upgrades can have an impact on reliability. This benefit is seen when reliability projects are deferred or displaced through construction of more efficient, regional projects. The advancement of reliability projects must also be considered when determining the total overall impact of a collection of economic expansions.
4. **Deliverability of Capacity and Energy to Load** – Projects will be assessed on their ability to provide or act as enablers for power to be delivered from firm designated resources to respective loads. These projects are typically associated with transmission service requests for new designated resources, but could also be bulk EHV projects for regional transfer capability.
5. **Impact on Losses** – Lower impedance transmission lines provide a loss savings to the transmission grid. The energy component of the loss savings can be captured as part of a production cost analysis tool. Capacity savings associated with a loss reduction can be determined by looking at select hourly models to determine loss reduction.
6. **Local Economic Benefits** – Transmission construction provides local economic development and job creation benefits. These benefits will probably reside in the state where each project is constructed.

## Results of the BATTF Efforts

The BATTF recommends using the Net Present Value (NPV) over 10 years with a terminal value rather than a benefit to cost ratio for the Priority Projects. This rationale is based on the following:

- The time frame for determining the Priority Projects is very short and there is currently no existing model that has a greater than 10-year time frame. Unless the Board directs the ESWG and SPP staff to develop a 20-year or greater model, a current model must be used.
- A positive NPV over 10 years is a fair indicator of determining a project's priority. This is not a decision to implement a project, just an indicator of the priority of a project. A project with a higher NPV may have a higher cost, so other metrics should be used when evaluating whether a Priority Project should be implemented. Conversely, if a project has a negative NPV, it can be eliminated from the list.
- The logical assumption is that after 10 years, if there is a positive NPV, then a BC ratio of more than 1.0 is more probable.
- If a cost benefit indicator over 10 years is used, the ESWG will need to determine what assumptions should be addressed beyond the 10-year horizon. This will require additional study and will not meet the projected delivery date of October 2009.
- The BATTF is unsure whether the cases for evaluation have adequate data and background beyond 10-year analysis, or whether or not they should be vetted with stakeholders before implementing them into a long-term model.
- The BATTF is assuming there is a limit on the amount of money for Priority Projects and will have to choose from projects with positive NPVs (the "low hanging fruit" projects). Other indicators will need to be used to adequately pick the best projects based on the metrics that the group has identified below.

Based on conversations with the ESWG, the BATTF has been asked to concentrate its efforts on the following metrics:

### **Adjusted Production Cost**

Adjusted production cost is a measure of the impact on production cost savings by node (LMP), accounting for purchases and sales of economic energy interchange. This benefit metric is typically simulated by a production cost modeling tool accounting for 8760 yearly hourly profiles of commitment and dispatch modeling, taken over the course of the study period.

Nodal modeling is aggregated on a zonal basis using weighted LMPs. There is concern that modeling the border points will not be accurate without additional Eastern Interconnection

points. For example, the border LMPs will have significant impact on the Adjusted Production Cost within SPP. If there are lower LMP prices outside SPP there will be no transfers from the western portion of SPP. Therefore, the BATTF recommends the model should broaden the footprint to include Southern Companies, Ameren, Basin, WAPA, TVA, PJM, MISO, and the DC ties (using the recent historic patterns) at a minimum when running the model to assess the impact on the borders. The group recognizes the increased run time required and the short time for analysis of the Priority Projects.

The BATTF recommends that gas prices should be based on Henry Hub NYMEX ten-year, plus a Panhandle basis difference. For other fossil fuel prices, publicly-available data should be used.

The BATTF recommends that wind in the models be at a rate of \$6.00 per MWH, based on the variable Operation and Maintenance (O&M) cost of a wind farm for the first three years of operation. The BATTF recommends using the same rate for other renewables that was used in the Balanced Portfolio analysis.

A nodal analysis will be completed that aggregates on a zonal basis using the following formulation highlighted. The calculation, performed on an hourly basis, will be:

**Adj Prod Cost** = Production Cost - Revenue from Sales + Cost of Purchases

Where:

**Revenues from Sales** = MW Export x Zonal LMP<sub>Gen Weighted</sub>

and

**Cost of Purchases** = MW Import x Zonal LMP<sub>Load Weighted</sub>

Tools used for this analysis will include standard assumptions and modeling using PROMOD, PowerWorld, or equivalent production cost software.

The rationale for using this methodology is as follows:

- This formula was previously approved by stakeholders, the Market and Operating Policy Committee, and the SPP Board as part of the Balanced Portfolio analysis.
- The formulation represents the broad impact of new transmission projects in changing LMP costs (energy, congestion and losses cost) to rate payers within the SPP footprint. It therefore represents much of the savings/benefits or additional cost to rate payers for specific transmission projects.

## **Impact on Losses**

Lower impedance transmission lines provide a loss savings to the transmission grid. The energy component of the loss savings is captured as part of the above production cost analysis tool. It is possible that losses will increase since generation sources will be remotely located from load centers.

Capacity savings associated with a loss change are determined by looking at the selected hourly loadflow models to determine the loss change associated with a transmission upgrade. The BATTTF has established standard capacity prices to capture capacity savings. Formulation will be based on an aeroderivative Combustion Turbine (CT) replacement, currently priced around \$750 per kW installed (based on the expected cost to install of various types of machines used by BATTTF members).

There is a fixed O&M cost component based on \$650,000 per year (average expected cost experienced by BATTTF members). The energy component of losses is captured in the formulation above. This an additive benefit component for capturing the capacity component of that energy typically passed on to rate payers through Ancillary Service charges. This is variance in quantity of energy (capacity).

The calculation:

- Capacity Savings at Coincidental Peak = ((Capacity requirement at Peak (base case) – Capacity requirement at Peak (with projects upgrades included)) x (CT replacement cost)).

This would be a straight savings estimate of the capacity, since the CT installation would be a one-time cost when the upgrade was energized.

- There is a fixed O&M cost savings associated with this calculation, usually captured in the Ancillary Services fee.

It should be calculated as Fixed Cost Benefit = (Capacity savings (as determined from above per 150 MW) x \$ 650,000/yr), escalated by the rate of inflation as reported in Bureau of Economic Analysis.

- The price differential would be calculated on an annual basis from the point the proposed upgrade would be energized to the end of the defined 20-year period. There should be no additional accommodation for savings after 20 years, because a CT has an estimated 20-year life span.
- This formulation is the estimated benefit or cost Impact of Losses.

## **Environmental impacts**

The BATTF's primary assumption is that SO<sub>2</sub> and NO<sub>x</sub> will be approximated using pricing curves from the Chicago Climate Exchange; this represents our best estimate of current market prices. Mercury will not be addressed in this metric due to the lack of valid market information. The BATTF discussed at length the merits for CO<sub>2</sub>; our assumption is that the high price in the long term (20 years) is determined by 100% sequestration currently valued at between \$80 and \$102 per ton (\$91 per ton average) from the Mountain Air Plant DOE project. The low price is based on the current price of CO<sub>2</sub> from the Chicago Climate Exchange.

Our assumption is to escalate the current price up to \$91 per ton in year 20, based on unknowns with government regulation. Emissions values should be based in a range that reflects the maximum and minimum from various sources, using a high case and low case probability. Example: the high case could be current prices times 3 and the low case could be current prices times 0.5. The base case should be established using the ESWG's opinion of future scenarios (based on current information). Therefore, the reference future will be based on the latest information from sources such as legislative outlooks, technology improvements, state regulations, and other data sources.

The BATTF determined that this calculation is viewed as a less definitive, but still quantitative, formulation. Since Cap and Trade legislation is under discussion and there is no clear direction - but a higher probability - that a higher price bias exists, we recommend using a 60-40 weighting. The BATTF believes there will be federal legislation; there is a 40% chance the lower case will happen and 60% chance the high price case will happen. (There is also the possibility of the federal government spearheading transmission construction.) Using this formula, we get  $(60\% \times \$91/\text{ton}) + (40\% \times \$0/\text{ton}) = \$54/\text{ton}$

The BATTF discussed whether modeling should reflect year 1, year 5, and year 10 evaluation points. It is the BATTF's opinion that as carbon prices increase, wind resources will increase. Therefore, a linear interpretation of the carbon cost curve is a reasonable cost curve. The BATTF discussed running two carbon scenarios with a low and a high carbon value; we need both of these to see what the impact will be on generation dispatch to provide the best determination of the impact of carbon on transmission projects. Without this type of modeling run, the CO<sub>2</sub> benefits for transmission projects will cause any transmission project to have benefits in excess of its cost if it displaces coal or gas generation. Due to the time constraints for this type of modeling and runs, and given the current state of the model and the input and model development required, this analysis will not be delivered by October 2009. An approximation for the impact of CO<sub>2</sub> can be to have the model produce the amount of tons of CO<sub>2</sub> from the Base Case minus the amount of tons saved from the addition of the transmission projects and show a potential range of CO<sub>2</sub> prices for comparative purposes. A table can be calculated as follows:

| Case Description      | Tons of CO <sub>2</sub> Produced | Reduction from Base Case at \$15/Ton | Reduction from Base Case at \$54/ton |
|-----------------------|----------------------------------|--------------------------------------|--------------------------------------|
| Base Case             |                                  | N/A                                  | N/A                                  |
| All Priority Projects |                                  |                                      |                                      |

|                     |  |  |  |
|---------------------|--|--|--|
| Priority Project 1  |  |  |  |
| Priority Project 2  |  |  |  |
| Priority Project 3  |  |  |  |
| Priority Project 4  |  |  |  |
| Priority Project 5  |  |  |  |
| Priority Project 6  |  |  |  |
| Priority Project 7  |  |  |  |
| Priority Project 8  |  |  |  |
| Priority Project 9  |  |  |  |
| Priority Project 10 |  |  |  |

Based on the above discussion, the BATTf recommends that SO<sub>2</sub> and NO<sub>x</sub> be evaluated for Priority Projects and CO<sub>2</sub> be evaluated as a post analysis based on tons of CO<sub>2</sub> produced at \$15 and \$54 per ton.

## **Increased Reliability**

The advancement/expedition of SPP Board-approved reliability projects must be considered to determine the total overall impact of economic upgrades. The formula would be based on SPP Transmission Expansion Plan (STEP) reliability projects deferred or advanced, and the benefit would be linked to the dollar impact on the NPV of Annual Transmission Revenue Requirements (ATRR) savings for the deferral/advancement.

The recommended benefit calculation should be:

$\sum$  (STEP Projects Deferred ATRR - STEP Projects Advanced ATRR), taken for years deferred/advanced

Note: If a STEP Project is eliminated, the ATRR for the 40-year life of the asset would be calculated based on the year in which the upgrade was scheduled to go into service.

## **Local Economic Benefits**

Local economic development, job creation, etc. fall under the umbrella of local economic benefits. These benefits will most likely reside in the state where the each project is constructed. The task force recommends using an SPP or consultant model for economic studies to describe local economic impact, which can then be endorsed by the ESWG for ITP benefit analysis. Preliminary discussion suggests this calculation will be difficult to qualify on a multi-county or multi-jurisdictional basis. Historically, economic analysis for local economic benefits has taken 7-10 days per construction project. A more realistic calculation would be a formula based on standard economic impact analysis to provide analysis for the SPP region.

The BATTF recommends not using a detailed local economic impact calculation for Priority Project evaluation. The economic impact calculation should be part of the ITP process. This metric should be developed in conjunction with economic experts/consultants to provide the true local economic impact. For Priority Projects, the BATTF recommends using project construction costs instead of the full local economic impact on the project's location. The cost of the project needs to be framed and explained to avoid cost allocation issues.



## **Deliverability of Capacity and Energy to Load**

A change in deliverability should be reflected in more or less variation in the LIP or LMP prices across the SPP footprint. If deliverability is improved, it would be reflected as a decrease in variation. Since variation and its statistical metrics are difficult to explain, the following metric has been developed using the capabilities of ProMod or a similar nodal modeling tool.

The LMP price at each node is the sum of three price components:

- (1) the energy price component
- (2) the price component for losses
- (3) the congestion price component

All of these component prices are added to make the LMP price at each node. During each hour of the year, each node across the SPP footprint has an associated LMP price and quantity of energy injected (generation) or withdrawn (load) from the system. Generation or injected energy carries a positive sign (+) and loads or withdrawn energy is negative (-).

The congestion component of those LMP nodes will change as a new transmission line is added to relieve congestion. The sum congestion cost within the region will change as new transmission lines are added, providing an effective measure of the impact on deliverability. If the assumption is made that deliverability is the inverse of congestion, we now have a way to measure deliverability in dollars rather than using statistical terminology. These dollars are not additive to the APC metric, since doing so would mean congestion costs are being double counted.

The metric will determine which lines reduce the most congestion. It can also be seen as a variance in price.

The BATTF recommends capture deliverability using the following formulation:

$$\text{Congestion Cost at baseline} - \text{Congestion Cost with new project} = \text{Improved Deliverability Benefit}^1$$

An alternative formulation:

$$\text{Total System Congestion}^2 \text{ Before Upgrade} - \text{Total System Congestion After Upgrade}$$

SPP's PROMOD function has the capability to divide LMP points into energy, congestion, and loss components. The focus of this metric would be on the congestion component.

---

<sup>1</sup> losses must be fixed and captured separately before congestion cost can be calculated

<sup>2</sup> potentially shown as shadow prices

## Additional Recommendations

1. The ESWG needs to determine the assumptions to be used in developing a 20-year model.
2. The ESWG needs to develop, with support of SPP staff, a 20-year model for the ITP Process.
3. To meet the October 2009 deadline for recommending Priority Projects, assumptions in the modeling and analysis need to be simplified:
  - a. Use the existing Balanced Portfolio model as the primary model for benefit analysis.
  - b. Assumptions used in the Balanced Portfolio for wind generation, or as recommended by the ESWG, should be used for analysis. This is a critical piece of data to begin modeling.
4. Another possible metric for consideration by the ESWG would be a Return on Investment (ROI) to capture those projects that yield better returns for the footprint.
5. Value at risk concepts can be applied directly to hourly LMP time series. We cannot use this metric to produce a dollar value that has value at risk meaning in a traditional sense. We would need to use Monte Carlo simulation and look at the problem hourly for this to work. However, we can still get a good look at the standard deviation, and make an ordinal decision regarding which project provides more benefit along the variance dimension. Here is how we would work the mathematics:
  - a. Calculate LMP's for both the base case and change cases (e.g., run the cases).
  - b. Calculate the LOAD weighted LMP for these cases for the entire SPP region for each hour. This will give us 8760 load weighted observations for each case.
  - c. Calculate the natural log differences between the sequential hourly weighted LMPs for each case. That is,  $\text{LN}(\text{HR2}) - \text{LN}(\text{HR1})$ , etc.
  - d. Calculate the standard deviation of these log differences for each case.
  - e. If a project reduces congestion, the standard deviation of the change case will be lower than the base case. The greater the difference, the better the project is.

We are already using "other" metrics to evaluate our positive NPV projects given a budget constraint. This would be another good one.

***Disclaimer: This report is for Priority Project evaluation only. No reference for cost allocation is implied or intended.***

# **SPP Priority Projects Phase II Reliability Report**

PUBLISHED: 12/04/2009  
LATEST REVISION: 3/19/2010

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# Revision History

| <u>Version</u> | <u>Date</u> | <u>Description</u>                                                                                                                       |
|----------------|-------------|------------------------------------------------------------------------------------------------------------------------------------------|
| 1              | 12/04/09    | Document Creation; Submitted to TWG                                                                                                      |
| 2              | 12/21/09    | Added Reactive Requirements and revised STEP date of Huntsville – St. John 115kV line                                                    |
| 3              | 1/5/10      | Revised based on TWG comments. Approved by TWG on 1/19/10<br>For reliability analysis only:                                              |
| 4              | 3/19/10     | Updated models with 2009 NTC and TSR projects and incorporated the Hitchland and Overton transformer projects into the Priority Projects |

## Reliability Analysis

In the Phase I evaluation, eleven potential Priority Projects and three additional Priority Projects groupings were evaluated for impacts on the reliability plan on the SPP system. As part of Phase II evaluation, the list of Priority Projects was refined to two groups of projects that are electrically similar. SPP conducted a study to evaluate the impact of the Priority Projects on the reliability plan of the SPP transmission system. The following section summarizes the findings of this study.

An analysis was conducted on two groups of proposed projects to determine the impact of these projects on the SPP reliability plan and on first tier third parties to SPP. This analysis was conducted in the same manner and with the same methodologies used in SPP's 2009 STEP 10 year reliability analysis.

This study is not intended to justify any Priority Project based on deferred project cost alone; it is only intended to show the effects of the Priority Projects on the SPP reliability plan. At this time the in-service dates for the Priority Projects are not definite. For this study the projects are included in the 2014 models. If a project identified for deferment has a STEP date before 2014 it may or may not actually be deferred. It may be possible to mitigate these issues for the short period of time before the Priority Project is in service. Therefore, these projects and their costs are provided for assessment purposes only.

The two groups of proposed projects are composed of the following projects:

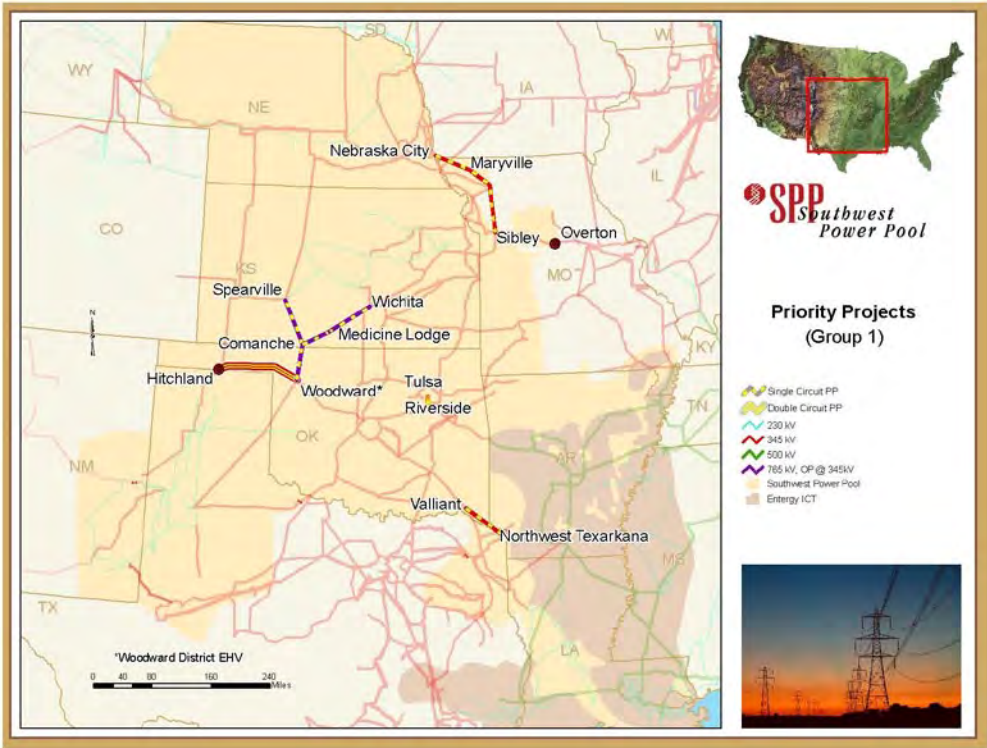
### Group 1:

1. Spearville – Comanche – Medicine Lodge – Wichita 765 kV Operated at 345 kV
2. Comanche – Woodward District EHV 765 kV Operated at 345 kV
3. Hitchland – Woodward District EHV Double Circuit 345 kV
4. Valliant – NW Texarkana 345 kV
5. Nebraska City – Maryville – Sibley 345 kV
6. Riverside Station – Tulsa Power Station 138 kV Reactor
7. Hitchland 345/230 kV Transformer #2
8. Overton 345/161 kV Transformer #2

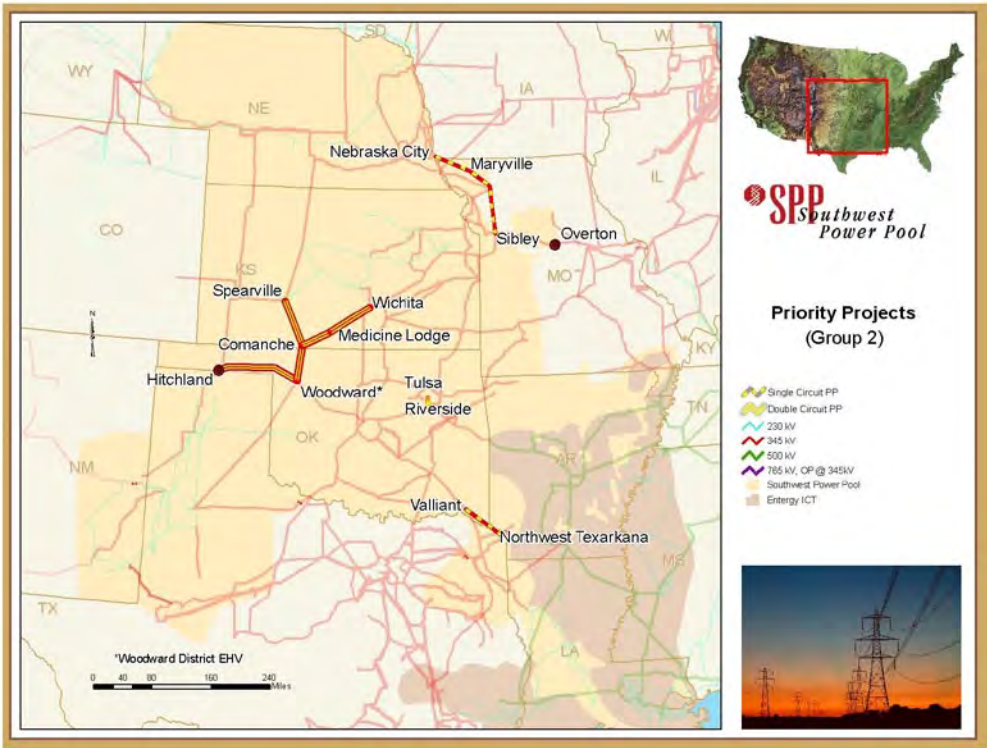
### Group 2:

1. Spearville – Comanche – Medicine Lodge – Wichita Double Circuit 345 kV
2. Comanche – Woodward District EHV Double Circuit 345 kV
3. Hitchland – Woodward District EHV Double Circuit 345 kV
4. Valliant – NW Texarkana 345 kV
5. Nebraska City – Maryville – Sibley 345 kV
6. Riverside Station – Tulsa Power Station 138 kV Reactor
7. Hitchland 345/230 kV Transformer #2
8. Overton 345/161 kV Transformer #2

Group 1 Map



Group 2 Map





## Study Scope

An AC N-1 contingency analysis was performed using PSS/E. The analysis was performed using the 2009 STEP Build 3 models. Details of these models can be found in the Study Assumptions section. Details of the analysis are as follows:

- Monitoring of Facilities
  - o All facilities in the SPP footprint were monitored at 69 kV and above.
  - o EES and AECl facilities were monitored at 100 kV and above.
  - o All other first tier control areas were monitored at 230 kV and above.
- Cases
  - o 2014 Summer Peak
  - o 2014/15 Winter Peak
  - o 2019 Summer Peak
  - o Including all transaction cases
- Normal conditions and contingency analysis
  - o Normal conditions
  - o All N-1 single-element contingencies 69 kV and above in the SPP footprint were evaluated. These contingencies did not include manual transfer of load or manual switching.
  - o All N-1 single-element contingencies 100 kV and above in EES, AECl, and all other first-tier control areas were evaluated.
  - o SPP verified that all normal conditions and N-1 violations identified have corrective plans
- Use of Transmission Operating Directives (TOD)
  - o Transmission Operating Directives were applied in the same manner they have been applied in the 2009 STEP

The analysis was performed using the 2009 STEP Build 3 models. Build 3 models were created in July 2009 to include revised load forecast information due to the recent economic downturn. Using the STEP models allows re-evaluation of STEP projects to determine if they can be deferred or eliminated due to the Priority Projects. These models are different from the models used in the economic analysis though, since they do not include the anticipated wind generation. As a result, this study did not address the additional resources and load that are evaluated in the economic portion of the Priority Projects Report.

## Stakeholder Process

The STEP 10 year reliability analysis is an open and transparent process allowing for stakeholder input. This analysis of Priority Projects shares the study results in stakeholder public meetings using the same methodologies used in the 2009 STEP.

The scope used in this analysis originated from the 2009 STEP scope. The STEP scope was initially approved by the TWG in November 2008 then later updated in May 2009 to allow for changes related to the economic downturn and other developments. These changes included updated load forecasts and incorporation of Balanced Portfolio projects.



The contingency analysis results for the Priority Projects are evaluated using input provided by stakeholders for the 2009 STEP. This allows projects to be evaluated in the same manner as the STEP. Projects are deferred based on the same justification as their original need. Similarly, mitigations are handled in the same manner as the STEP.

### Primary Analysis

The analysis was conducted for two groups of Priority Projects. The Priority Project groups can either cause new reliability issues or they can relieve issues that have been identified in either the 2009 or earlier STEP analyses. Therefore, the results are in terms of additions or deferments of reliability projects and the revenue requirements associated with those projects. Results are broken into (1) advanced projects—projects that would be moved up in the reliability timeline due to the Priority Project; (2) new SPP projects—projects which are now needed that were not identified in the original 10 year reliability planning horizon, but may have been needed beyond that horizon; (3) new third party projects—projects needed on neighboring systems due to the Priority Projects; and (4) deferred projects—projects which are either deferred beyond the planning horizon or mitigated entirely due to the Priority Projects. For projects which are deferred past the planning horizon, linear extrapolation of loading was used to estimate how far the project might be deferred. Then, for projects which are not either completely new or completely deferred, the value shown is the Net Present Value of Annual Transmission Revenue Requirements. This Net Present Value is limited to a 40 year project life. The following tables and maps illustrate the reliability projects changed by the Priority Project groups. New or advanced projects are shown in red while deferred projects are shown in green.

## Impact on Reliability Plan

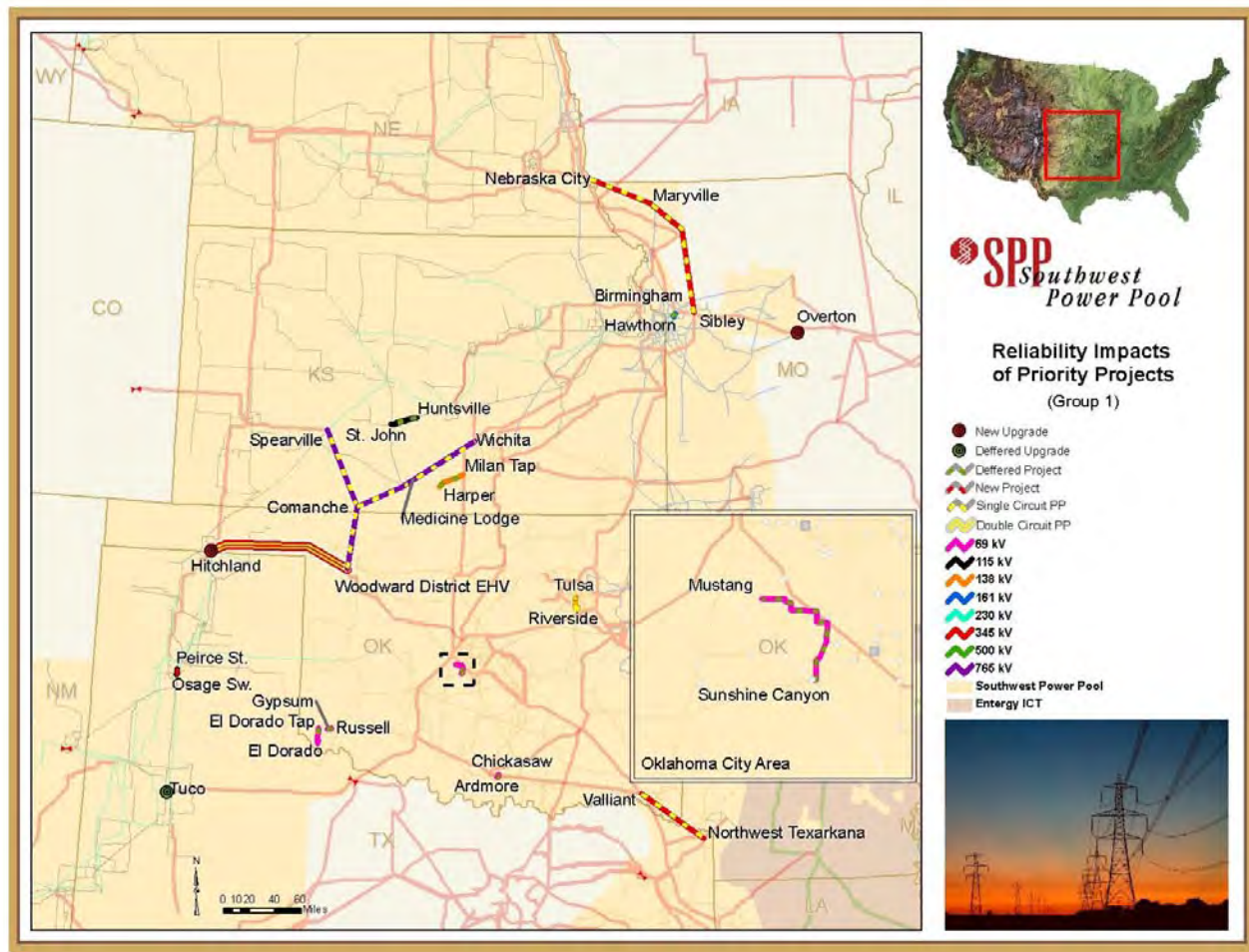
Red = New or Advanced  
Green = Deferred

### Group 1

Hitchland – Woodward District EHV Double 345 kV  
Spearville – Comanche – Medicine Lodge – Wichita 765 kV Operated at 345 kV  
Comanche – Woodward District EHV 765 kV Operated at 345 kV  
Nebraska City – Maryville – Sibley 345 kV  
Valliant – NW Texarkana 345 kV  
Riverside Station – Tulsa Power Station 138 kV (Add Reactor)  
Hitchland 345/230 kV Transformer #2  
Overton 345/161 kV Transformer #2

| Project Name                                                        | Area | E&C Cost     | Date Needed | STEP Date | Advanced ATRR Cost | New SPP ATRR Cost | New Third Party ATRR Cost | Deferred ATRR Cost |
|---------------------------------------------------------------------|------|--------------|-------------|-----------|--------------------|-------------------|---------------------------|--------------------|
| RECONDUCTOR OSAGE SWITCHING STATION - PIERCE STREET TAP 115KV CKT 1 | SPS  | \$2,250,000  | 19SP        | None      |                    | \$4,489,642       |                           |                    |
| CT RATIOS ON ARDMORE - CHICKASAW 69KV CKT 1                         | OKGE | \$450,000    | 20SP        | 19SP      |                    |                   |                           | \$83,233           |
| RECONDUCTOR BIRMINGHAM - HAWTHORN 161KV CKT 1                       | KCPL | \$1,670,625  | 20SP        | 19SP      |                    |                   |                           | \$244,735          |
| RECONDUCTOR ELDORADO - ELDORADO JCT 69KV CKT 1                      | WFEC | \$3,881,250  | 22SP        | 16SP      |                    |                   |                           | \$1,609,400        |
| RECONDUCTOR GYPSUM - RUSSELL 69KV CKT 1**                           | WFEC | \$900,000    | 19SP        | 14SP      |                    |                   |                           | \$317,502          |
| REPLACE WAVETRIP ON HARPER - MILAN TAP 138KV CKT 1                  | MKEC | \$225,000    | 58SP        | 19SP      |                    |                   |                           | \$364,150          |
| REBUILD MUSTANG - SUNSHINE CANYON 69KV CKT 1                        | WFEC | \$3,341,000  | 22SP        | 16SP      |                    |                   |                           | \$1,385,380        |
| ADD TUCO INTERCHANGE 230/115KV TRANSFORMER CKT 3                    | SPS  | \$13,500,000 | 20SP        | 18SP      |                    |                   |                           | \$4,167,735        |
| REBUILD HUNTSVILLE - ST. JOHN 115KV CKT 1**                         | MIDW | \$7,965,000  | 39SP        | 14SP      |                    |                   |                           | \$9,636,151        |
| <b>Totals</b>                                                       |      |              |             |           | \$0                | \$4,489,642       | \$0                       | \$17,808,287       |
| <b>Net</b>                                                          |      |              |             |           |                    |                   |                           | \$13,318,645       |

\*\*Timing for this project is very close to the the Priority Project in-service date, therefore it may be needed before Priority Projects are in service



### Group 2

Hitchland – Woodward District EHV Double 345 kV  
 Spearville – Comanche – Medicine Lodge – Wichita Double 345 kV  
 Comanche – Woodward District EHV Double 345 kV  
 Nebraska City – Maryville – Sibley 345 kV  
 Valliant – NW Texarkana 345 kV  
 Riverside Station – Tulsa Power Station 138 kV (Add Reactor)  
 Hitchland 345/230 kV Transformer #2  
 Overton 345/161 kV Transformer #2

| Project Name                                                         | Area | E&C Cost     | Date Needed | STEP Date | Advanced ATRR Cost | New SPP ATRR Cost | New Third Party ATRR Cost | Deferred ATRR Cost |
|----------------------------------------------------------------------|------|--------------|-------------|-----------|--------------------|-------------------|---------------------------|--------------------|
| RECONDUCTOR MAXWELL - NORTH PLATTE 115KV CKT 1                       | NPPD | \$7,875,000  | 19SP        | None      |                    | \$12,270,317      |                           |                    |
| RECONDUCTOR OSAGE SWITCHING STATION - PIERCE STREET TAP 115KV CKT 1  | SPS  | \$2,250,000  | 19SP        | None      |                    | \$4,489,642       |                           |                    |
| ADD ARCADIA 345/138/13.8KV TRANSFORMER CKT 3                         | OKGE | \$12,000,000 | 20SP        | 15SP      |                    |                   |                           | \$9,318,107        |
| CT RATIOS ON ARDMORE - CHICKASAW 69KV CKT 1                          | OKGE | \$450,000    | 20SP        | 19SP      |                    |                   |                           | \$83,233           |
| RECONDUCTOR BIRMINGHAM - HAWTHORN 161KV CKT 1                        | KCPL | \$1,670,625  | 20SP        | 19SP      |                    |                   |                           | \$244,735          |
| RECONDUCTOR ELDORADO - ELDORADO JCT 69KV CKT 1                       | WFEC | \$3,881,250  | 22SP        | 16SP      |                    |                   |                           | \$1,609,400        |
| RECONDUCTOR GYPSUM - RUSSELL 69KV CKT 1**                            | WFEC | \$900,000    | 19SP        | 14SP      |                    |                   |                           | \$317,502          |
| REPLACE WAVETRAN ON HARPER - MILAN TAP 138KV CKT 1                   | MKEC | \$225,000    | 58SP        | 19SP      |                    |                   |                           | \$364,150          |
| REBUILD MUSTANG - SUNSHINE CANYON 69KV CKT 1                         | WFEC | \$3,341,000  | 22SP        | 16SP      |                    |                   |                           | \$1,385,380        |
| BUILD TUCO - JONES 345KV CKT 1 and JONES 345/230KV TRANSFORMER CKT 1 | SPS  | \$33,367,500 | 20SP        | 18SP      |                    |                   |                           | \$10,301,251       |
| ADD TUCO INTERCHANGE 230/115KV TRANSFORMER CKT 3                     | SPS  | \$13,500,000 | 20SP        | 18SP      |                    |                   |                           | \$4,167,735        |
| REBUILD HUNTSVILLE - ST. JOHN 115KV CKT 1**                          | MIDW | \$7,965,000  | 39SP        | 14SP      |                    |                   |                           | \$9,636,151        |
| REPLACE JUMPERS BOSTON EAST - JASPER WEST TAP 69KV CKT 1**           | EMDE | \$100,000    | 39SP        | 14SP      |                    |                   |                           | \$146,096          |
| <b>Totals</b>                                                        |      |              |             |           | \$0                | \$16,759,959      | \$0                       | \$37,573,741       |
| <b>Net</b>                                                           |      |              |             |           |                    |                   |                           | \$20,813,781       |

\*\*Timing for this project is very close to the the Priority Project in-service date, therefore it may be needed before Priority Projects are in service



Some facilities have been filtered from the results above. Cutoff levels are used to filter these facilities out of the results because they have very little relation to the Priority Projects. The cutoff filters used are: a normal to N-1 change of 1MW, a normal to N-1 change of 0.005puV, and a base case to change case flow difference of 2%.

## Results and Conclusions

The reliability analysis can be summarized into the following table showing the revenue requirements associated with advancements, deferments and overall net impact for each of the Priority Project groups. Results are broken into (1) advanced projects — projects that would be moved up in the reliability timeline due to the Priority Project; (2) new SPP projects — projects which are now needed that were not identified in the original 10 year reliability planning horizon, but may have been needed beyond that horizon; (3) new third party projects — projects needed on neighboring systems due to the Priority Projects; (4) deferred projects — projects which are either deferred beyond the planning horizon or mitigated entirely due to the Priority Projects; and (5) Net Impact – the net cost or benefit of reliability projects related to the Priority Projects. Amounts shown are in terms of Net Present Value of Annual Transmission Revenue Requirements. This Net Present Value is limited to a 40 year project life.

| Priority Project Group                                  | Advanced Projects | New SPP Projects | New 3 <sup>rd</sup> Party Projects | Deferred Projects | Net Impact |
|---------------------------------------------------------|-------------------|------------------|------------------------------------|-------------------|------------|
| <b>Group 1</b>                                          |                   |                  |                                    |                   |            |
| Hitchland – Woodward District EHV Double 345 kV         |                   |                  |                                    |                   |            |
| Spearville – Cmche – Med. Ldg – Wichita 765 kV @ 345 kV |                   |                  |                                    |                   |            |
| Comanche – Woodward District EHV 765 kV @ 345 kV        |                   |                  |                                    |                   |            |
| Nebraska City – Maryville – Sibley 345 kV               | \$0.0M            | \$4.5M           | \$0.0M                             | \$17.8M           | \$13.3M    |
| Valliant – NW Texarkana 345 kV                          |                   |                  |                                    |                   |            |
| Riverside Station – Tulsa Power Station 138 kV Reactor  |                   |                  |                                    |                   |            |
| Hitchland 345/230 kV Transformer #2                     |                   |                  |                                    |                   |            |
| Overton 345/161 kV Transformer #2                       |                   |                  |                                    |                   |            |
| <b>Group 2</b>                                          |                   |                  |                                    |                   |            |
| Hitchland – Woodward District EHV Double 345 kV         |                   |                  |                                    |                   |            |
| Spearville – Cmche – Med. Ldg – Wichita Double 345 kV   |                   |                  |                                    |                   |            |
| Comanche – Woodward District EHV Double 345 kV          |                   |                  |                                    |                   |            |
| Nebraska City – Maryville – Sibley 345 kV               | \$0.0M            | \$16.8M          | \$0.0M                             | \$37.6M           | \$20.8M    |
| Valliant – NW Texarkana 345 kV                          |                   |                  |                                    |                   |            |
| Riverside Station – Tulsa Power Station 138 kV Reactor  |                   |                  |                                    |                   |            |
| Hitchland 345/230 kV Transformer #2                     |                   |                  |                                    |                   |            |
| Overton 345/161 kV Transformer #2                       |                   |                  |                                    |                   |            |

Note that these are groupings of projects with common components; therefore, the net impacts cannot be added together. In addition, none of the likely new STEP projects have been included in these models; therefore, it is possible that the Priority Projects could interact with future STEP projects. Such issues can be addressed in future STEP studies as needed.

The results of the study show limited opportunities to defer existing reliability based projects which were previously identified through STEP. However, this list of deferrals is not complete. This study only covers a 10 year period. Reliability projects that would have been proposed (without the Priority Projects) in the 10-20 year period were not identified or checked for

deferrals. One must also keep in mind that this study only evaluates the impact to the STEP 10 year reliability process; it is expected that the Priority Projects may have a greater impact on the Generation Interconnection and Aggregate Study processes as additional generation resources and transmission service are added to the system. Ultimately, the intent of this study is not to justify any Priority Project based on deferred project cost alone; it is only intended to show the effects of the Priority Projects on the SPP reliability plan and to incorporate known costs or benefits into the overall Priority Project costs.



## FCITC Analysis

As part of Phase II evaluation of Priority Projects, SPP conducted an FCITC analysis to determine impacts of the Priority Projects on the SPP transmission system. Using a DC transfer analysis, FCITC values were first calculated on each base SPP model without the Priority Projects then calculated on upgraded models containing Priority Project Group 1 upgrades then calculated on a third set of models containing Priority Project Group 2 upgrades. The models used were:

- 2014 Summer, Scenario 0
- 2014 Winter, Scenario 0
- 2019 Summer, Scenario 0

The cases include approved expansion plan upgrades from the 2008 STEP and Balanced Portfolio.

Below are the MUST settings and procedures for the FCITC analysis:

### MUST Solution Settings

- CONSTRAINTS/CONTINGENCY INPUT OPTIONS
  - o AC Mismatch Tolerance – 2 MW
  - o Base Case Rating – Rate A
  - o Base Case % of Rating – 100%
  - o Contingency Case Rating – Rate B
  - o Contingency Case % of Rating – 100%
  - o Base Case Load Flow – PSS/E
  - o Convert branch ratings to estimated MW ratings – No
  - o Contingency ID Reporting – Labels + Events
  - o Maximum number of contingencies to process – 50000
- MUST CALCULATION OPTIONS
  - o Phase Shifters Model for DC Linear Analysis – Constant Flow for Base Case and Contingencies
  - o Report Base Case Violations with FCITC – Yes
  - o Maximum number of violations to report in FCITC table – 50000
  - o Distribution Factor (OTDF and PTDF) Cutoff – 0.03
  - o Maximum times to report the same elements – 1 {eliminate voluminous repeats}
  - o Apply Distribution Factor to Contingency Analysis – Yes
  - o Apply Distribution Factor to FCITC Reports – Yes
  - o Minimum Contingency Case flow change – 1 MW
  - o Minimum Contingency Case Distribution Factor change – 0.0
  - o Minimum Distribution Factor for Transfer Sensitivity Analysis – 0.0

### Voltage Monitoring

- MUST does not do voltage monitoring for transfer analysis. All transfers are done using DC load flow and then AC verified.

### Contingency

- Outage of all single branches and ties in the SPP (Area 502-546, 640-650) and NON-SPP (EES,AECl) above 100 kV

- Multi-terminal/Special Contingency Outage

Exclude

- Exclude outage of all invalid single outages
- Operating guides implementation

Monitor

- Monitor branches and ties in SPP above 100 kV

Transfer Directions/Transfer Level

- 600 MW transfer from all PORs to PODs (PORs/PODs consist of all zones in SPP's OASIS, excluding IPPs)

The Excel document embedded below summarizes the findings of this study. There were a few instances when the addition of the Priority Projects caused the FCITC values to change from positive to negative; this is denoted by a “True” statement in the first column of each workbook. However, the FCITC results found in this study may not be the same as the Available Transfer Capability on the SPP system. All of the positive to negative changes in FCITC occur on facilities that were overloaded prior to the upgrades.

Priority Projects  
FCITC\_20091201.xls



## Reactive Requirements

The consideration of long distance EHV transmission upgrades (i.e. > 50 miles) may require additional reactive compensation to maintain voltage during normal operating conditions and reduce voltage rise during line switching. During light load conditions the high voltage issue may exacerbate as there are less transmission line inductive power losses to offset capacitive line charging. The additional line charging increases voltage on the Bulk Electric System. In order to address this issue, shunt line reactors are typically used to counter or offset excessive line charging during light load conditions.

This high level screening study provides a calculated value for line shunt reactors required to support the addition of EHV transmission in Priority Project groups 1 and 2 under normal (no outage) and selected single contingency events.

The study method determines Reactive power (Q) requirements for different line voltages (V) to determine the magnitude of reactive compensation to maintain system voltages within acceptable limits. This analysis technique is commonly called "QV Analysis".

A QV, reactive compensation verses voltage analysis was conducted on each proposed grouping of Priority Projects to determine the impact of these projects on the SPP interconnection points and the amount of shunt compensation each segment of the project would require to maintain acceptable transmission voltages.

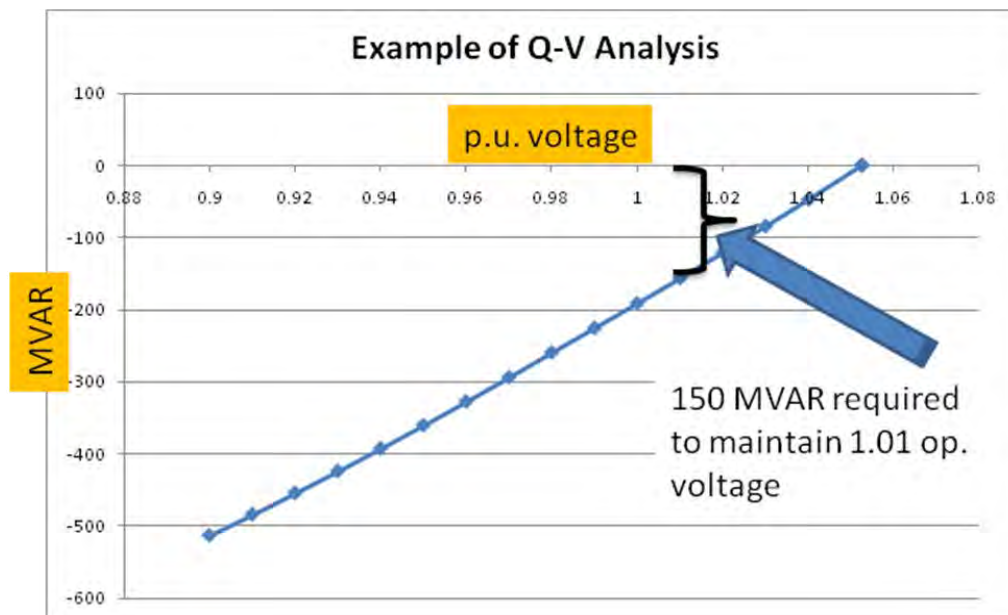
### Study Scope

The study base case representing 2014 light load condition was prepared using PSS/E. The steps to build each model are in **Table 1**.

#### **Table 1: Model building steps**

1. Add Balanced Portfolio Projects to the base case
2. Add Priority Project group
3. Add line breakers as needed
4. Solve model

PowerWorld Corporation Simulator was used to perform an AC QV analysis. The total amount of line reactance to keep the system voltages around 1.01 p.u.<sup>1</sup> was determined for each project group line segment. The base case was analyzed. Each line segment of a project was also tested for voltage rise at the open end while the other end remained closed into the network.



### Key Study Assumptions

1. This study does not include the effects of subsynchronous resonance (SSR). SSR is an electric power system condition where the electric network exchanges energy with a turbine generator at one or more of the natural frequencies of the combined system below the synchronous frequency of the system<sup>2</sup>.
2. A light load condition is the worst case scenario for high voltage.
3. The July 2009 created STEP 2010 Spring Peak model was used as a starting point and modified to represent a 2014 light load case.
4. Balanced Portfolio Projects are added to the base case.
5. Priority Project groups 1 and 2 are analyzed to determine the amount of line shunts per line segment.
6. Line reactors are sized by opening one end of line segment to determine reactive support to keep line end voltage around 1.01 p.u.
7. Actual line reactors may be a combination of smaller units or Flexible AC Transmission System (FACTS) devices to cover multiple system load conditions and operating points.

<sup>1</sup> EHV lines (>300 kV) are typically operated between 0.98 and 1.04 p.u. For the study purpose, an average 1.01 pu operating voltage was chosen.

<sup>2</sup> Subsynchronous Resonance in Power Systems, Paul M. Anderson, B. L. Agrawal, J. e. Van Ness, IEEE Press, 1990

8. The study has not included additional shunts required to maintain safe voltage levels on locations other than the priority project group line segments.
9. The study is not a short circuit analysis and does not include the effects of reactors on line switching.
10. The study does not consider the effect of unapproved 2009 STEP projects.

## Results and Conclusions

Project group line reactors are listed in Table 2. The average line reactor compensation for 345 kV is 1.17 Mvar/mile and 1.28 Mvar/mile in Groups 1 and 2 respectively. The average line reactor compensation for 765 kV operated at 345 kV is 1.77 Mvar/mile in Group 1. Total estimated cost for the line reactor compensation is in the range of \$20-\$30 million.

A preliminary cost estimate for 100 Mvar reactors is in the range of \$2 million to \$3 million for 345 kV. A detailed facility study will allow us to determine the location, size, and cost estimate of the final reactive requirements.

Future studies should include a more detailed system voltage scan under N-1 analysis with the selected line reactors included in each project.

**Table 2** lists the approximate amount of line reactance needed to limit system voltage to around 1.01 p.u. This table also lists the line Mvar compensation required for each section of the Priority Project along with an average compensation determined per mile for 345 kV.

**Table 2: Project Group Line Reactors**

| Project | Circuit                                                      | From Bus Shunt (Mvar) | To Bus Shunt (Mvar) | Total Circuit Shunt (Mvar) | Line Miles | Line kV    |
|---------|--------------------------------------------------------------|-----------------------|---------------------|----------------------------|------------|------------|
| Group 1 | Hitchland-Woodward 1                                         | -71                   | -71                 | -142                       | 123.2      | 345        |
|         | Hitchland-Woodward 2                                         | -71                   | -71                 | -142                       | 123.2      | 345        |
|         | Spearville-Comanche                                          | -40                   | -40                 | -80                        | 71.5       | 765 at 345 |
|         | Comanche-Med Lodge                                           | -39                   | -39                 | -78                        | 42.9       | 765 at 345 |
|         | Med Lodge-Wichita                                            | -30                   | -30                 | -60                        | 73.7       | 765 at 345 |
|         | Comanche-Woodward                                            | -105                  | -105                | -210                       | 53.9       | 765 at 345 |
|         | Cooper-Maryville                                             | -34                   | -34                 | -68                        | 44.9       | 345        |
|         | Maryville-Sibley                                             | -55                   | -55                 | -110                       | 102.1      | 345        |
|         | Valliant-NW Texarkana                                        | 0                     | 0                   | 0                          | 66.0       | 345        |
|         | Total Shunt (Mvar)                                           |                       |                     | -890                       |            |            |
|         | Total Shunt (Mvar)/mile (avg.) for 345 kV                    |                       |                     |                            | -1.01      |            |
|         | Total Shunt (Mvar)/mile (avg.) for 765 kV operated at 345 kV |                       |                     |                            | -1.77      |            |
| Group 2 | Hitchland-Woodward 1                                         | -70                   | -70                 | -140                       | 123.2      | 345        |
|         | Hitchland-Woodward 2                                         | -70                   | -70                 | -140                       | 123.2      | 345        |
|         | Spearville-Comanche 1                                        | -27                   | -27                 | -54                        | 71.5       | 345        |
|         | Spearville-Comanche 2                                        | -27                   | -27                 | -54                        | 71.5       | 345        |
|         | Comanche-Med Lodge 1                                         | -21                   | -21                 | -42                        | 42.9       | 345        |
|         | Comanche-Med Lodge 2                                         | -21                   | -21                 | -42                        | 42.9       | 345        |
|         | Med Lodge-Wichita 1                                          | -26                   | -26                 | -52                        | 73.7       | 345        |
|         | Med Lodge-Wichita 2                                          | -26                   | -26                 | -52                        | 73.7       | 345        |
|         | Comanche-Woodward 1                                          | -92                   | -92                 | -184                       | 53.9       | 345        |
|         | Comanche-Woodward 2                                          | -92                   | -92                 | -184                       | 53.9       | 345        |
|         | Cooper-Maryville                                             | -34                   | -34                 | -68                        | 44.9       | 345        |
|         | Maryville-Sibley                                             | -55                   | -55                 | -110                       | 102.1      | 345        |
|         | Valliant-NW Texarkana                                        | 0                     | 0                   | 0                          | 66.0       | 345        |
|         | Total Shunt (Mvar)                                           |                       |                     | -1122                      |            |            |
|         | Total Shunt (Mvar)/mile (avg.) for 345 kV                    |                       |                     |                            | -1.19      |            |

**SPS Concerns and reason for “no” vote**

SPS opposed the SPP Priority Projects Phase II Reliability Report because of several factors, which became apparent through the review of the document and associated discussions. SPS's Transmission Asset Management Department is concerned the reliability analyses were not constructed appropriately and are showing disturbing results.

1. The Reliability Analysis looks for reliability problems caused by the addition of the Priority Projects themselves. It doesn't examine the addition of the proposed Priority Projects with the accompanying incremental wind generation that is being reflected in the economic studies to determine if the proposed Priority Projects are really the best transmission reliability choice to support wind injection at the locations assumed or simulated in the economic models.

2. A FCITC (First Contingency Incremental Transfer Capability) study was conducted to help quantify any potential impacts on inter-area transfer capability between SPP balancing areas. SPS understands it was not a definitive study on import and export capability. This study was extremely helpful, but also disturbing. It can be observed from the studies that minimal transfer capability increases seem to occur from western Kansas to eastern Kansas with the addition of the proposed Priority Projects. For the SPS area, it appeared that SPS import capability may have decreased with the addition of the proposed Priority Projects and SPS export capability saw small or minimal increase. There are clearly existing problems in the models caused by the load growth in the SPS area, and these models do not contain the SPP staff recommended upgrades found in the 2009 STEP. It may be that those upgrades should have been included in the analysis since load increases are reflected in the model. While the FCITC studies were a 'first cut' at this area of study, they raise disturbing questions as to the overall transmission capability that may be a result of the proposed Priority Projects. For example, it seems strange that adding another tie-line (the Hitchland-Woodward double-circuit 345 kV line) to the SPS area as a proposed Priority Project would negatively or minimally impact SPS's transfer capabilities.

Considering the cost of the proposed Priority Projects to ratepayers, SPS felt the reliability analysis raised more questions than it answered and felt compelled to vote no due to the results provided.

**NPPD Concerns and reason for abstention**

Nearly all of the FCITC limiters flagged in the NPPD system are localized load-serving issues and are not considered valid constraints from a regional transfer capability perspective. Due to these localized load-serving issues, the tested incremental transfer levels were too low to uncover any impacts to existing NPPD flowgates or produce any new potential NPPD regional limiters. Based on the FCITC Analysis results, it is not possible for NPPD to ascertain whether the Priority Project grouping will have an adverse or beneficial impact on transfer capability across the NPPD system.

NPPD also objects to the two alternative Priority Project groups which were chosen to be studied as they had no significant differences from a topology or electrical characteristic perspective. A reliability comparison of double circuit 345 kV to 765 kV operated at 345 kV is a fundamentally flawed exercise which, as shown in the report, yielded no comparison value. NPPD has continually supported the review of competing alternatives in the Priority Project analysis especially regarding the chosen Cooper – Maryville – Sibley project versus Nebraska City - Stranger and the evaluation of 345 kV single circuit versus 765 kV for the Kansas / Oklahoma projects.

**KCPL reason for abstention**

Harold Wyble, KCPL, has concern that considering all of the investment to be made in the Priority Projects, TWG should be able to have the necessary amount of time and effort to prepare a thorough FCITC analysis of the Priority Projects. He doesn't feel that TWG has had that opportunity due to SPP Staff's work load and aggressive schedule to complete the Priority Project analysis.

**EDE reason for “no” vote**

Previously stated in TWG minutes (excerpt): “Sam McGarrah, Empire District Electric, expressed concern that the reliability study scope does not allow the results of this study to be combined into the cost benefit analysis of the Priority Projects assessments. He stated ‘since the economic assessments considered several levels of wind generation in SPP, the reliability analysis should include these levels of wind to adequately assess benefits of the Priority Projects. The reliability study was not based on similar system conditions as the other economic studies; therefore, the reliability issues associated with these conditions may not be adequately captured. It is likely that the results of this report will be summarized in the Priority Projects Report; consequently, the limitations of the results of the reliability study may not be properly characterized in the summary.’”

# *The Brattle Group*

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## Job and Economic Benefits of Transmission and Wind Generation Investments in the SPP Region

March 2010

Johannes Pfeifenberger  
Judy Chang  
Delphine Hou  
Kamen Madjarov

**Prepared for**

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## **JOB AND ECONOMIC BENEFITS OF TRANSMISSION AND WIND GENERATION INVESTMENTS IN THE SPP REGION**

### **EXECUTIVE SUMMARY**

This study is an update to the work presented in Attachments 5 and 6 of the February 1, 2010, *SPP Priority Projects Phase II Report*, which analyzed the job and economic stimulus benefits of wind development and transmission investment in the SPP footprint. This update analyzes the impact on jobs, earnings, and economic output from two groups of transmission investments (Group 1 and Group 2, consisting of 345 kV transmission lines and 765 kV lines operated at 345 kV) in combination with the investment of an additional 3,196 MW and 7,616 MW of wind farms.

To perform our economic impact analysis, we measure the direct impacts on jobs, earnings, and economic activity in SPP member states stimulated by the increased spending on transmission and wind generation. We also measure the indirect impacts that arise as in-region suppliers to the transmission and wind generation industries, as well as other upstream producers, benefit from the increased investment. Lastly, we measure the induced impacts that arise as the increased income from jobs created by the transmission and wind build-out is spent on services and other industry sectors and ripples through the regional economy. To quantify these impacts, we rely on two models—the Minnesota IMPLAN Group Model and the Department of Energy’s (“DOE”) Job and Economic Development Impact (“JEDI”) Model—that are widely used by economists and policy analysts to estimate how specified investments affect every sector of a state’s or region’s economy.

Our analysis only focuses on the job and economic activity stimulated by the transmission and wind generation investment. It does not address the economic impacts associated with the recovery of investment costs through utility rates, does not analyze the potential effects of additional renewable generation on other existing generating sources, and does not quantify any other economic benefits of transmission investments—such as improved reliability, reduced power prices and production costs, or increased competition and power market liquidity.

Table A below summarizes our findings regarding the overall (*i.e.*, direct, indirect, and induced) employment and economic impacts during the transmission and wind plant construction cycle (*e.g.*, over the next 5 to 10 years) as well as a 20-year wind plant operating period. The combination of the transmission build-out and 3,196 MW of wind development in SPP are estimated to support in-region jobs accounting for approximately 38,000 full-time-equivalent years (“FTE-years”) of employment. This impact is associated with approximately \$1.5 billion in earnings by employees, which is supported by and paid from over \$4.4 billion in increased economic activity within the SPP footprint. This economic activity (*i.e.*, the stimulated “economic output”) is measured as the sum of all increased sales and resale revenues within each state of the SPP region.

**Table A**  
**Employment and Economic Impacts of Transmission and Wind Investments**  
(Combined construction and 20-year wind-operation period impacts;  
without in-region manufacturing of transmission and wind plant components)

|                                     | Employment                   |                                          | Overall<br>Economic Output<br>(2010\$ Million) |
|-------------------------------------|------------------------------|------------------------------------------|------------------------------------------------|
|                                     | Earnings<br>(2010\$ Million) | Full-Tme-Equivalent<br>Years (FTE-years) |                                                |
| <b>3,196 MW of New Wind</b>         |                              |                                          |                                                |
| Wind Plant Construction             | \$577                        | 17,072                                   | \$1,826                                        |
| Wind Plant Operation                | \$501                        | 13,163                                   | \$1,633                                        |
| Transmission Construction (Group 1) | \$421                        | 8,482                                    | \$1,095                                        |
| Transmission Construction (Group 2) | \$368                        | 7,475                                    | \$962                                          |
| Combined (Group 1)                  | \$1,499                      | 38,717                                   | \$4,554                                        |
| Combined (Group 2)                  | \$1,446                      | 37,710                                   | \$4,421                                        |
| <b>7,616 MW of New Wind</b>         |                              |                                          |                                                |
| Wind Plant Construction             | \$1,389                      | 40,207                                   | \$4,355                                        |
| Wind Plant Operation                | \$1,221                      | 31,361                                   | \$3,991                                        |
| Transmission Construction (Group 1) | \$421                        | 8,482                                    | \$1,095                                        |
| Transmission Construction (Group 2) | \$368                        | 7,475                                    | \$962                                          |
| Combined (Group 1)                  | \$3,031                      | 80,050                                   | \$9,441                                        |
| Combined (Group 2)                  | \$2,978                      | 79,043                                   | \$9,308                                        |

Similarly, the combination of the analyzed transmission build-out with 7,616 MW wind power development is estimated to support over 79,000 FTE-years of employment, approximately \$3.0 billion in earnings, and over \$9.3 billion in overall economic activity within the region.

These results conservatively assume that none of the components used in the construction of transmission lines and wind power plants (*e.g.*, transmission wire, towers, circuit breakers, wind turbine blades, and transformers) would be manufactured within the SPP footprint.

Additional jobs and overall economic benefits will be stimulated if some of the transmission wire, towers, circuit breakers wind turbine blades, and transformers used in the construction of these transmission and wind generation facilities are manufactured within the SPP region—which is a highly likely outcome considering the existing manufacturing capabilities within the SPP footprint. Increasing the in-region manufacturing of these components from 0% to 50% is estimated to increase the number of construction-period jobs supported through the transmission and wind investments by approximately 40%, increase earnings by approximately 50%, and magnify SPP-wide overall economic activity by up to 80% compared to the construction-period results shown in Table A. Under this higher in-region manufacturing scenario, the combined investment of the Group 1 transmission projects and 7,616 MW of new wind generation would—over the course of both the construction and operating phases of the facilities—support approximately 100,000 FTE-years of employment, \$3.9 billion of earnings by SPP-region employees, and over \$13 billion of total economic activity (*i.e.*, sales and resale revenues) within the SPP member states.

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## I. INTRODUCTION

This report updates our prior analysis of the job and economic benefits of transmission and wind generation investments to the region served by the Southwest Power Pool (“SPP”). The previous analysis was included as Attachments 5 and 6 of the February 1, 2010, *SPP Priority Projects Phase II Report*, which was prepared by the SPP Engineering/Planning group. SPP staff has since provided us with updated investment scenarios for both transmission and wind generation investments within the SPP footprint, which is reflected in this report.

Our prior analysis and the base case of this updated analysis conservatively assumed that transmission line and wind plant components would all be imported from regions outside the SPP footprint. Because some of these components can be and, in fact, are manufactured within the SPP member states, we also estimate the additional job and economic benefits that would accrue to the region if some of these wind power and transmission line components used in the construction of these facilities are manufactured within the SPP footprint.

The approach and models employed in this update are the same as those in our prior analysis. To measure the impact on jobs, income, and overall economic activity stemming from investments in electric transmission and wind generation, we rely on a class of models known as *input-output* models. Input-output models utilize detailed production data to estimate the economic impact associated with particular investment projects, based on the nature of the local (*e.g.*, region-wide) economy. An input-output model “rebalances” the overall economy after an increase in expenditures on particular types of products (*e.g.*, electric transmission, wind generation), so that the quantity produced again equals the quantity consumed for every industry. Input-output models, therefore, use multipliers and consumption patterns that are computed from detailed national and regional economic and demographic data to represent the extent to which increases in demand lead to changes in employment, output, and earnings. This is a standard approach for assessing the economic impacts of specific investment projects, which takes into account the nature of production within the SPP footprint, including the import of goods and services sourced outside of SPP member states.

To estimate the economic impact from transmission investments, we rely on the well-known and widely-used IMPLAN<sup>®</sup> Model of the Minnesota IMPLAN Group. This model specifically considers how much of the consumed products and services are supplied from each sector of a given state or regional economy. Only activities that occur in that state or region are counted towards the measured economic impact.

The effects of increased development of wind generation are derived using the Department of Energy's ("DOE") Job and Economic Development Impact ("JEDI") Wind Energy model. Developed specifically for DOE as a tool for measuring the economic impact of generation investment, JEDI provides estimates of the increased jobs, income, and economic activity that result from developing specified wind power projects within a specific state. JEDI relies on IMPLAN<sup>®</sup> data, making the results from both models comparable and complementary.

Both IMPLAN<sup>®</sup> and JEDI quantify economic impacts in three categories: (i) number of jobs created in the region (in full-time-equivalent years of employment or "FTE-years");<sup>1</sup> (ii) the resulting personal income earned by employees in the region (*i.e.*, "earnings"); and, (iii) the economic activity generated in the region (*i.e.*, increased "economic output" as measured in total sales and resale revenues of businesses in SPP member states). Income (*i.e.*, earnings) refers to the compensation for workers in all of the directly or indirectly affected industry categories as supported by the stimulated increased output of goods and services. Since these models report economic activity as the sum of the values of all goods and services sold at each level of the supply chain (*i.e.*, sales and resale revenues), the reported economic output refers to the total flow of money that occurs throughout the local economy. The measured impact is the cumulative (undiscounted) amount of jobs (FTE-years), earnings by employees (in 2010 dollars), and overall economic activity (also in 2010 dollars) associated with investing in the assumed

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<sup>1</sup> JEDI and IMPLAN<sup>®</sup> job impacts are reported as full-time-equivalents ("FTE") employment years, that is, 2,080 hour units of employment. For example, reporting 100 jobs could mean 200 workers supported for 6 months, 100 workers supported for a year, or 10 workers supported for 10 years. Operations period job impact is also reported in FTE-year terms, but since those jobs are reported as annual impacts, they can be interpreted as long-term jobs. See also: [http://apps1.eere.energy.gov/wip/pdfs/tap\\_webcast\\_20090729\\_jedi.pdf](http://apps1.eere.energy.gov/wip/pdfs/tap_webcast_20090729_jedi.pdf).

investment in transmission and wind generation projects over the entire construction phase and subsequent operational period.

It is important to understand that the quantified economic stimulus benefits do not consider the economic costs of recovering this investment through utility rates or taxes, nor do these benefits reflect any potential impact that the additional wind development may have on other segments of the energy industry (*e.g.*, decreased coal and natural gas-fired generation). This analysis only quantifies the jobs, earnings, and overall economic activity related to the assumed level of wind generation and transmission investments.

Similarly, our study also does not quantify other economic benefits provided by these investments in transmission and wind generation assets, which directly offset investment-related costs. These other benefits include the following:

- increased power system reliability, reduced transmission congestion, and lower transmission losses;
- environmental benefits associated with reduced emissions (*e.g.*, SO<sub>x</sub>, NO<sub>x</sub>, CO<sub>2</sub>, Mercury, particulates, reduced water use and discharge) due to increased renewable power generation;
- possible reductions in fuel prices due to a lower demand for fossil fuels;
- reductions in electric wholesale power market prices and generation costs associated with higher renewable generation and possible reduction of fuel prices;
- increased liquidity and fuel diversity of power markets due to the transmission investments' expansion of the geographic region in which different suppliers compete; and
- reduced ancillary costs of integrating mandated renewable resources (*i.e.*, the costs of providing backup generation capacity, regulation, and load-following services, as well as costs associated with resolving over-generation conditions) due to the transmission investments' expansion of the relevant geographic footprint.



The remainder of this report is organized as follows. Section II presents our estimates of job and economic benefits associated with the updated transmission investment. Section III presents our job and economic benefits estimates for the updated wind generation development assumptions. Section IV then quantifies the additional job and economic benefits of manufacturing transmission line and wind generation components within the SPP footprint.

## **II. ESTIMATING JOB AND ECONOMIC IMPACTS OF TRANSMISSION INVESTMENT IN SPP MEMBER STATES**

### **A. THE IMPLAN<sup>®</sup> MODEL**

The IMPLAN<sup>®</sup> (IMpact analysis for PLANing) economic impact modeling system is developed and maintained by the Minnesota IMPLAN Group (“MIG”), which has continued the original work on the system done at the University of Minnesota in close partnership with the U.S. Forest Service’s Land and Management Planning Unit. IMPLAN<sup>®</sup> divides the economy into 440 sectors and allows the user to specify the expenditure allocations associated with a given expansion in demand to all relevant parts of the local economy in order to derive the economic impacts—changes in employment, earnings, and economic output. According to the U.S. Department of Agriculture, currently “over 1,500 clients across the country use the IMPLAN<sup>®</sup> model, making the results acceptable in inter-agency analysis.”<sup>2</sup> In 2009, the U.S. Army Corps of Engineers Civil Works program utilized IMPLAN<sup>®</sup> employment multipliers “to estimate the potential number of jobs preserved or created” by the American Recovery and Reinvestment Act of 2009.<sup>3</sup> In addition, the U.S. Department of Commerce, the Bureau of Economic Analysis, the U.S. Department of Interior, the Bureau of Land Management, and the Federal Reserve System member banks are also among the agencies that utilize IMPLAN<sup>®</sup> for economic impact analysis.

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<sup>2</sup> <http://www.economics.nrcs.usda.gov/technical/implan/implanmodel.html> (last accessed: March 5, 2010).

<sup>3</sup> [http://www.usace.army.mil/cecw/planningcop/documents/pa\\_newsletter/v12i3.pdf](http://www.usace.army.mil/cecw/planningcop/documents/pa_newsletter/v12i3.pdf) (last accessed: March 5, 2010).

## B. SPECIFIC ASSUMPTIONS AND MODELING APPROACH

We use the IMPLAN<sup>®</sup> model to estimate the direct, indirect, and induced impacts on employment, earnings, and overall economic activity (“economic output”), and local tax impacts that will be stimulated by the investments related to transmission line construction in the SPP footprint.<sup>4</sup>

We evaluate the impacts of two build-out scenarios: (i) “Group 1” projects which includes a portfolio of 345 kV single- and double-circuit lines plus two 765 kV lines operated at 345 kV; and (ii) “Group 2” projects which includes the same portfolio of 345 kV single- and double-circuit projects plus an alternative build-out to the 765 kV lines mentioned above as two 345 kV double-circuit lines. The results are broken out by project into direct, indirect, and induced effects within the state in which the expenditures occur. We do not measure the spill-over effects outside of the state in which the expenditure is made.

As noted previously, the IMPLAN<sup>®</sup> model divides the economy into 440 sectors. For the base case analyses, which does not consider the benefits of manufacturing any of the materials used in the construction of transmission facilities (*e.g.*, towers, wires, and circuit breakers) within the SPP footprint, we rely on the same six sectors selected in our previous analysis to allocate costs associated with construction labor and design work. In other words, we distribute the construction labor and design costs of transmission projects across the six economics sectors shown in Table 1. In addition, when we analyze the additional benefits of manufacturing some transmission materials in the SPP footprint (Section IV), we distribute the costs of those materials across four additional sectors, as also shown in Table 1.

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<sup>4</sup> Note that the “direct” impact reported by IMPLAN includes the economic impacts from purchasing transmission equipment and materials. This standard convention differs from the model (“JEDI”) used to estimate economic impacts from wind development, which reports the direct economic impact associated with equipment purchases only in combination with other indirect supply-chain impacts.

**Table 1**  
**IMPLAN® Cost Categories**

|    |                                                                              |                     |
|----|------------------------------------------------------------------------------|---------------------|
| 1  | Electric power generation, transmission, and distribution                    | Construction        |
| 2  | Construction of other new nonresidential structures                          | Construction        |
| 3  | Maintenance and repair construction of nonresidential maintenance and repair | Construction        |
| 4  | Architectural, engineering, and related services                             | Construction/Design |
| 5  | Environmental and other technical consulting services                        | Design              |
| 6  | Scientific research and development services                                 | Design              |
| 7  | Aluminum product manufacturing from purchased aluminum                       | Materials*          |
| 8  | Plate work and fabricated structural product manufacturing                   | Materials*          |
| 9  | Switchgear and switchboard apparatus manufacturing                           | Materials*          |
| 10 | Wiring device manufacturing                                                  | Materials*          |

Source: [www.implan.com](http://www.implan.com)

\* Sectors identified as materials are included only for in-state manufacturing sensitivities.

Table 2 below shows the total cost of transmission lines by project and state. We apply the expenditures by category associated with the proposed investments at the state level and aggregate the impacts for all Group 1 and Group 2 projects.

**Table 2**  
**Total Cost of Transmission Lines by Project and State**  
(2010\$, Millions)

| Transmission Projects                      | Capacity         | Arkansas | Kansas | Missouri | Nebraska | Oklahoma | Texas | Total   |
|--------------------------------------------|------------------|----------|--------|----------|----------|----------|-------|---------|
| <b>Both Transmission Groups:</b>           |                  |          |        |          |          |          |       |         |
| Hitchland-Woodward                         | 2 - 345 kV       |          |        |          |          | \$238    |       | \$238   |
| Valiant-NW Texarkana                       | 1 - 345 kV       | \$13     |        |          |          | \$105    | \$13  | \$131   |
| Nebraska City-Maryville-Sibley             | 1 - 345 kV       |          |        | \$289    | \$12     |          |       | \$301   |
| Tulsa-Riverside 138 kV Reactor             |                  |          |        |          |          | \$1      |       | \$1     |
| <b>Group 1:</b>                            |                  |          |        |          |          |          |       |         |
| Comanche-Woodward District EHV             | 765 kV at 345 kV |          | \$13   |          |          | \$119    |       | \$132   |
| Spearville-Comanche-Medicine Lodge-Wichita | 765 kV at 345 kV |          | \$478  |          |          |          |       | \$478   |
| <b>Group 2:</b>                            |                  |          |        |          |          |          |       |         |
| Comanche-Woodward District EHV             | 2 - 345 kV       |          | \$11   |          |          | \$97     |       | \$108   |
| Spearville-Comanche-Medicine Lodge-Wichita | 2 - 345 kV       |          | \$356  |          |          |          |       | \$356   |
| Group 1 Transmission Lines Total           |                  | \$13     | \$491  | \$289    | \$12     | \$463    | \$13  | \$1,282 |
| Group 2 Transmission Lines Total           |                  | \$13     | \$367  | \$289    | \$12     | \$442    | \$13  | \$1,136 |

### C. SCOPE AND INTERPRETATION OF TRANSMISSION RESULTS

The economic stimulus from a given expenditure is reported by IMPLAN<sup>®</sup> as direct, indirect, and induced effects. Direct effects represent the changes in employment, earnings and overall economic activity in the industries which directly benefit from the investment (*i.e.*, construction, materials, and design services). Indirect effects measure the changes in the supply chain and inter-industry purchases generated from the new demand (*e.g.*, suppliers to transmission towers manufacturers). Induced effects reflect changes in spending resulting from increased earnings generated by the direct and indirect effects (*e.g.*, spending on restaurants and groceries by the projects' workers).<sup>5</sup> The impacts on employment, earnings, output, and tax are reported by state in Table 3 for Group 1 and Group 2 projects.

For Group 1 projects (under the base-case assumption that none of the transmission-related materials are manufactured in the region), the transmission investment would support approximately 8,500 FTE-years of employment (*e.g.*, 850 full time jobs each year over a 10 year construction period) producing \$421 million in earnings from these jobs. Overall, the transmission investment is estimated to stimulate \$1.1 billion in economic activity (*i.e.*, “economic output” measured as the sum of stimulated sales and resale revenues) within the SPP footprint. In addition to any property and right-of-way lease payments directly paid by the transmission owners (which are not quantified in our study), this level of economic activity is estimated to generate approximately \$39 million in additional local tax revenue. As Table 3 shows, the economic stimulus impacts for Group 2 projects are slightly smaller due to the lower investments associated with the Group 2 projects.

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<sup>5</sup> We do not capture trade flows between states. For example, an expenditure made in Texas could produce trade flows that result in jobs in New Mexico (*i.e.*, in another state in our study) or elsewhere, neither of which are captured.

**Table 3**

**GROUP 1 TRANSMISSION LINES: ECONOMIC OUTPUT AND EMPLOYMENT EFFECTS**

| Transmission Project                                  | Capacity         | State | Earnings<br>(2010\$ Millions) | Full-Time Equivalent Years<br>(FTE-Years) |              |              |              | Economic Output<br>(2010\$ Millions) |              |              |                | Tax Impact<br>(2010\$ Millions) |
|-------------------------------------------------------|------------------|-------|-------------------------------|-------------------------------------------|--------------|--------------|--------------|--------------------------------------|--------------|--------------|----------------|---------------------------------|
|                                                       |                  |       | Total                         | Direct                                    | Indirect     | Induced      | Total        | Direct                               | Indirect     | Induced      | Total          | Total                           |
| Hitchland - Woodward                                  | 2 - 345 kV       | OK    | \$66                          | 902                                       | 263          | 311          | 1,477        | \$102                                | \$40         | \$40         | \$181          | \$6.02                          |
| Spearville - Comanche - Medicine Lodge - Wichita      | 765 kV at 345 kV | KS    | \$150                         | 1,675                                     | 480          | 729          | 2,885        | \$215                                | \$74         | \$94         | \$383          | \$14.07                         |
| Comanche-Woodward District EHV                        | 765 kV at 345 kV | KS    | \$4                           | 46                                        | 12           | 19           | 79           | \$6                                  | \$2          | \$3          | \$11           | \$0.39                          |
| Comanche-Woodward District EHV                        | 765 kV at 345 kV | OK    | \$34                          | 476                                       | 139          | 161          | 776          | \$53                                 | \$21         | \$21         | \$95           | \$3.16                          |
| Valliant - NW Texarkana                               | 1 - 345 kV       | OK    | \$36                          | 492                                       | 143          | 169          | 806          | \$56                                 | \$22         | \$22         | \$99           | \$3.29                          |
| Valliant - NW Texarkana                               | 1 - 345 kV       | AR    | \$4                           | 63                                        | 16           | 18           | 98           | \$7                                  | \$2          | \$2          | \$12           | \$0.40                          |
| Valliant - NW Texarkana                               | 1 - 345 kV       | TX    | \$5                           | 63                                        | 15           | 19           | 98           | \$7                                  | \$3          | \$3          | \$13           | \$0.40                          |
| Riverside Station - Tulsa Power Station (Add Reactor) |                  | OK    | \$0                           | 4                                         | 1            | 1            | 6            | \$0                                  | \$0          | \$0          | \$1            | \$0.03                          |
| Nebraska City - Maryville-Sibley                      | 1 - 345 kV       | NE    | \$4                           | 51                                        | 14           | 20           | 86           | \$6                                  | \$2          | \$3          | \$11           | \$0.39                          |
| Nebraska City - Maryville-Sibley                      | 1 - 345 kV       | MO    | \$116                         | 1,176                                     | 399          | 595          | 2,172        | \$153                                | \$57         | \$79         | \$290          | \$10.99                         |
| <b>Total</b>                                          |                  |       | <b>\$421</b>                  | <b>4,949</b>                              | <b>1,480</b> | <b>2,041</b> | <b>8,482</b> | <b>\$606</b>                         | <b>\$223</b> | <b>\$266</b> | <b>\$1,095</b> | <b>\$39.14</b>                  |

Source and Notes: Results generated using IMPLAN Professional v3.0

**GROUP 2 TRANSMISSION LINES: ECONOMIC OUTPUT AND EMPLOYMENT EFFECTS**

| Transmission Project                                  | Capacity   | State | Earnings<br>(2010\$ Millions) | Full-Time Equivalent Years<br>(FTE-Years) |              |              |              | Economic Output<br>(2010\$ Millions) |              |              |              | Tax Impact<br>(2010\$ Millions) |
|-------------------------------------------------------|------------|-------|-------------------------------|-------------------------------------------|--------------|--------------|--------------|--------------------------------------|--------------|--------------|--------------|---------------------------------|
|                                                       |            |       | Total                         | Direct                                    | Indirect     | Induced      | Total        | Direct                               | Indirect     | Induced      | Total        | Total                           |
| Hitchland - Woodward                                  | 2 - 345 kV | OK    | \$66                          | 902                                       | 263          | 311          | 1,477        | \$102                                | \$40         | \$40         | \$181        | \$6.02                          |
| Spearville - Comanche - Medicine Lodge - Wichita      | 2 - 345 kV | KS    | \$106                         | 1,208                                     | 339          | 513          | 2,062        | \$153                                | \$54         | \$66         | \$273        | \$10.08                         |
| Comanche-Woodward District EHV                        | 2 - 345 kV | KS    | \$3                           | 37                                        | 9            | 15           | 61           | \$5                                  | \$2          | \$2          | \$8          | \$0.31                          |
| Comanche-Woodward District EHV                        | 2 - 345 kV | OK    | \$27                          | 376                                       | 107          | 125          | 608          | \$42                                 | \$17         | \$16         | \$74         | \$2.49                          |
| Valliant - NW Texarkana                               | 1 - 345 kV | OK    | \$36                          | 492                                       | 143          | 169          | 806          | \$56                                 | \$22         | \$22         | \$99         | \$3.29                          |
| Valliant - NW Texarkana                               | 1 - 345 kV | AR    | \$4                           | 63                                        | 16           | 18           | 98           | \$7                                  | \$2          | \$2          | \$12         | \$0.40                          |
| Valliant - NW Texarkana                               | 1 - 345 kV | TX    | \$5                           | 63                                        | 15           | 19           | 98           | \$7                                  | \$3          | \$3          | \$13         | \$0.40                          |
| Riverside Station - Tulsa Power Station (Add Reactor) |            | OK    | \$0                           | 4                                         | 1            | 1            | 6            | \$0                                  | \$0          | \$0          | \$1          | \$0.03                          |
| Nebraska City - Maryville-Sibley                      | 1 - 345 kV | NE    | \$4                           | 51                                        | 14           | 20           | 86           | \$6                                  | \$2          | \$3          | \$11         | \$0.39                          |
| Nebraska City - Maryville-Sibley                      | 1 - 345 kV | MO    | \$116                         | 1,176                                     | 399          | 595          | 2,172        | \$153                                | \$57         | \$79         | \$290        | \$10.99                         |
| <b>Total</b>                                          |            |       | <b>\$368</b>                  | <b>4,373</b>                              | <b>1,305</b> | <b>1,785</b> | <b>7,475</b> | <b>\$531</b>                         | <b>\$198</b> | <b>\$233</b> | <b>\$962</b> | <b>\$34.40</b>                  |

Source and Notes: Results generated using IMPLAN Professional v3.0

The reported employment estimates represent the amount of labor (measured in full-time-equivalent years of 2,080 hours per year) that would be required to meet the demand created by the construction expenditures and is based on the output-to-worker relationship in the study area for the particular industry. Whether or not these employment estimates represent a net increase in employment depends in part on whether or not these resources (people) would be employed elsewhere in the absence of the projects analyzed. To the extent that the construction activities and indirect and induced economic activities use labor that would otherwise be idle, the employment effects reported here represent a net increase in employment. To the extent that these labor resources would be employed elsewhere absent the analyzed projects, the net effects on employment would be smaller than the gross effect reported here. Similarly, the estimates of gross economic impact and indirect tax revenues make no assumptions about how much money would be spent or how that money would be spent otherwise.

### **III. ESTIMATING JOB AND ECONOMIC IMPACTS OF WIND POWER DEVELOPMENT IN SPP MEMBER STATES**

#### **A. THE JEDI MODEL**

To estimate the economic stimulus impact of wind generation development, we utilize the Job and Economic Development Impact (“JEDI”) model, which is based on and consistent with IMPLAN<sup>®</sup>. JEDI is a computational tool specifically calibrated for the estimation of the economic impacts of developing and operating wind power projects at the state level. It was developed in 2002 for the U.S. Department of Energy’s National Renewable Energy Laboratory (“NREL”) to demonstrate the state and local economic development impacts associated with developing wind power plants in the United States.<sup>6</sup> The JEDI model is considered “the standard when analyzing the economic impacts of wind project development.”<sup>7</sup> JEDI has been frequently

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<sup>6</sup> U.S Department of Energy, “20% Wind Energy by 2030: Increasing Wind Energy’s Contribution to U.S. Electricity Supply,” July 2008. JEDI was originally developed and is currently maintained by Marshall Goldberg of MRG & Associates under contract from NREL.

<sup>7</sup> Reategui, et al. “Generating Economic Development from a Wind Power Project in Spanish Fork Canyon, Utah: A Case Study and Analysis of State-Level Economic Impacts,” January, 2009.



utilized by the U.S. Department of Energy, state and county policy-makers, public utility commissions, potential project developers, and others focused on examining the economic impacts from new wind project construction and operation.<sup>8</sup>

JEDI allows the user to enter project-specific information on capacity size, turbine size and quantity, location, and all levels and types of development costs. The model allocates those expenditures across 14 major industry types<sup>9</sup> to estimate the economic impacts in terms of jobs, earnings, and economic output. It is important to note that JEDI comes with pre-populated state-specific cost data for wind projects of a given size, which are continually updated by NREL. As a result, JEDI allows estimation of economic impacts even when the researcher does not have access to all aspects of a potential wind project's cost data.<sup>10</sup> JEDI allows users to adjust the local supply of total project construction, design and materials manufacturing activities (which ultimately drive the local economic impacts) to specify the proportion of the project cost spent locally.

The JEDI model is designed to estimate the job and economic impact of wind developments for individual states based on IMPLAN<sup>®</sup> “multipliers” used to simulate how investments affect a state's economic activities. This also means that when a wind project is sited in one state, even though some jobs and economic activities might be created in (*i.e.*, “spill over” into) a neighboring state, the model does not estimate these “spill-over” benefits. Therefore, similar to our IMPLAN<sup>®</sup> analysis of transmission investments, our wind generation economic impact estimates are conservative because they do not include the potential job and economic impact of

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<sup>8</sup> [http://www.nrel.gov/analysis/jedi/about\\_jedi\\_wind.html](http://www.nrel.gov/analysis/jedi/about_jedi_wind.html) (last accessed: March 5, 2010). A current list of U.S. DOE studies utilizing the JEDI model is posted at <http://www.nrel.gov/analysis/jedi/publications.html>.

<sup>9</sup> JEDI models the economic effects of expenditures related to building wind farms to flow through 14 industries: agriculture, mining, construction, manufacturing, fabricating metals, machinery, electrical equipment, transportation/communication/public utilities, wholesale trade, retail trade, finance/insurance/real estate, other miscellaneous services, professional services, and government.

<sup>10</sup> It is often the case that such project-specific detailed information is considered proprietary information by private developers, which makes obtaining it difficult.

each wind project on the economies of neighboring states. This omission might create the impression that each project only benefits the state in which it resides, when in fact, the region as a whole would experience additional benefits. For example, wind projects located in Oklahoma, Kansas, and Missouri may create jobs in Arkansas but this effect has not been captured directly. Economic theory and intuition, however, suggest that, given its geographical proximity to numerous potential wind projects, Arkansas also will benefit from such economic development, both in terms of jobs supported directly or indirectly by construction activities as well as, additionally, from the manufacturing activities analyzed in Section IV below.

Our results of employment effects estimated with the JEDI model are also reported in full-time-equivalent years (“FTE-years”). A FTE-year corresponds to 2,080 hours of work. As noted earlier, the employment impacts associated with the wind projects are net job gains if the labor force is not being utilized elsewhere in the economy absent the projects. If the rate of unemployment is low, these jobs would not necessarily be new and additional. Instead, employees might simply be shifting jobs from other sectors or other projects to support the wind projects under study.

Depending on how project development is implemented, there might be some economies of scale associated with larger projects. For example, if two or more projects are undertaken in close proximity or as a combined venture, some savings in labor, expertise and resources might be achieved, which would reduce the aggregate employment and economic impact compared to undertaking the two projects independently. In our analysis, we have assumed each project in the list provided in the assumption table is a stand-alone project, and have not captured any economies of scale. Thus, the estimated job and economic impact is greater than if the projects are developed in larger aggregations.

## **B. SPECIFIC ASSUMPTIONS AND MODELING APPROACH**

The JEDI model utilizes data on project-specific characteristics and costs to estimate the direct, induced, and indirect effects on employment, earnings, and output from developing and operating the project. Consequently, the JEDI wind model requires three general groups of input

data—project description, project cost, and wind farm annual operating and maintenance costs. The categories of input assumptions are summarized in Table 4 below.

**Table 4**  
**Assumption Categories for the JEDI Wind Model**

|                                                                                                                                                                                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Project Descriptive Data</b>                                                                                                                                                      |
| Project Location<br>Total Project Size - Nameplate Capacity (MW)<br>Turbine Size (KW)                                                                                                |
| <b>Project Cost Data</b>                                                                                                                                                             |
| Construction Costs<br>Equipment Costs<br>Turbines, Blades, Towers, Transportation<br>Balance of Plant<br>Materials, Labor, Development, Engineering, Legal, and Other Costs<br>Labor |
| <b>Wind Farm Annual Operating and Maintenance Costs</b>                                                                                                                              |
| Labor<br>Personnel<br>Materials and Services                                                                                                                                         |
| <b>Other Parameters</b>                                                                                                                                                              |
| Financial Parameters<br>Tax Parameters<br>Land Lease Parameters<br>Payroll Parameters                                                                                                |

To estimate the job and economic activity stimulated by the wind generation development, we used project-specific data for all wind projects designated as part of two wind investment levels to be analyzed. Specifically, we have been asked to evaluate two wind development scenarios: a “Level 1” scenario of 3,196 MW of new wind projects to reach a total of 7,000 MW and a “Level 2” scenario of 7,616 MW of new wind investment to reach a total of 11,300 MW of wind in the SPP footprint. The specific projects comprising the two levels of wind development are summarized in Table 5 and Table 6 below.

**Table 5**  
**Level 1 - 3,196 MW of Wind Projects Added in SPP**  
**(To Reach a Total of 7,000 MW)**

| project unique name | MAX CAPACITY (MW) | Location   | STATE |
|---------------------|-------------------|------------|-------|
| Fairport_MO_1       | 300               | Fairport   | MO    |
| Fairport_MO_2       | 150               | Fairport   | MO    |
| Fairport_MO_3       | 150               | Fairport   | MO    |
| Hitchland_OK_4      | 192               | Hitchland  | OK    |
| Hitchland_OK_5      | 335               | Hitchland  | OK    |
| Hitchland_OK_6      | 100               | Hitchland  | OK    |
| Hitchland_OK_7      | 300               | Hitchland  | OK    |
| Hitchland_OK_8      | 150               | Hitchland  | OK    |
| Hoskins_NE_9        | 196               | Hoskins    | NE    |
| Gentlemen_NE_10     | 100               | Gentlemen  | NE    |
| Gentlemen_NE_11     | 96                | Gentlemen  | NE    |
| Spearville_KS_12    | 55                | Spearville | KS    |
| Spearville_KS_13    | 100               | Spearville | KS    |
| Spearville_KS_14    | 150               | Spearville | KS    |
| Spearville_KS_15    | 300               | Spearville | KS    |
| Woodward_OK_16      | 300               | Woodward   | OK    |
| Woodward_OK_17      | 150               | Woodward   | OK    |
| Woodward_OK_18      | 72                | Woodward   | OK    |
| <b>Total</b>        | <b>3,196.00</b>   | <b>MW</b>  |       |

**Table 6**  
**Level 2 - 7,616 MW of Wind Projects Added in SPP**  
**(To Reach a Total of 11,300 MW)**

| project unique name  | MAX<br>CAPACITY<br>(MW) | Location       | STATE |
|----------------------|-------------------------|----------------|-------|
| Fairport_MO_1        | 300                     | Fairport       | MO    |
| Fairport_MO_2        | 150                     | Fairport       | MO    |
| Fairport_MO_3        | 150                     | Fairport       | MO    |
| Fairport_MO_4        | 33                      | Fairport       | MO    |
| Hitchland_OK_5       | 192                     | Hitchland      | OK    |
| Hitchland_OK_6       | 360                     | Hitchland      | OK    |
| Hitchland_OK_7       | 300                     | Hitchland      | OK    |
| Hitchland_OK_8       | 100                     | Hitchland      | OK    |
| Hitchland_OK_9       | 300                     | Hitchland      | OK    |
| Hitchland_OK_10      | 150                     | Hitchland      | OK    |
| Hitchland_OK_11      | 300                     | Hitchland      | OK    |
| Hitchland_OK_12      | 400                     | Hitchland      | OK    |
| Hoskins_NE_13        | 200                     | Hoskins        | NE    |
| Hoskins_NE_14        | 100                     | Hoskins        | NE    |
| Hoskins_NE_15        | 53                      | Hoskins        | NE    |
| Gentlemen_NE_16      | 100                     | Gentlemen      | NE    |
| Gentlemen_NE_17      | 100                     | Gentlemen      | NE    |
| Gentlemen_NE_18      | 75                      | Gentlemen      | NE    |
| Gentlemen_NE_19      | 78                      | Gentlemen      | NE    |
| Spearville_KS_20     | 400                     | Spearville     | KS    |
| Spearville_KS_21     | 300                     | Spearville     | KS    |
| Spearville_KS_22     | 200                     | Spearville     | KS    |
| Spearville_KS_23     | 200                     | Spearville     | KS    |
| Spearville_KS_24     | 150                     | Spearville     | KS    |
| Spearville_KS_25     | 100                     | Spearville     | KS    |
| Spearville_KS_26     | 100                     | Spearville     | KS    |
| Spearville_KS_27     | 100                     | Spearville     | KS    |
| Spearville_KS_28     | 100                     | Spearville     | KS    |
| Spearville_KS_29     | 100                     | Spearville     | KS    |
| Spearville_KS_30     | 100                     | Spearville     | KS    |
| Spearville_KS_31     | 100                     | Spearville     | KS    |
| Spearville_KS_32     | 100                     | Spearville     | KS    |
| Spearville_KS_33     | 55                      | Spearville     | KS    |
| Woodward_OK_34       | 300                     | Woodward       | OK    |
| Woodward_OK_35       | 150                     | Woodward       | OK    |
| Woodward_OK_36       | 72                      | Woodward       | OK    |
| Washington Cty_AR_37 | 197.5                   | Washington Cty | AR    |
| Knoll_KS_38          | 200                     | Knoll          | KS    |
| Potter_TX_39         | 400                     | Potter         | TX    |
| Potter_TX_40         | 200                     | Potter         | TX    |
| Broken Bow_NE_41     | 80                      | Broken Bow     | NE    |
| Albion_NE_42         | 120                     | Albion         | NE    |
| Roosevelt_NM_43      | 300                     | Roosevelt      | NM    |
| Grapevine_TX_44      | 50                      | Grapevine      | TX    |
| <b>Total</b>         | <b>7,615.50</b>         | <b>MW</b>      |       |

While these projects would likely be developed over the course of the next decade and the job and economic benefits would accrue to the SPP footprint spread out over the entire construction cycle, our analysis treats these projects as if they were built in 2010, with an on-line date of 2011, and an operating life of 20 years. If, in reality, these investments are spread out evenly over a 10-year construction cycle, the *average annual impact* of the construction activity would be one-tenth of the reported total construction-related impact.

The most recent version of the JEDI model available publicly from NREL<sup>11</sup> incorporates recent changes in capital costs, productivity improvements, and changing industry practices. The model now contains updated construction and operating and maintenance (“O&M”) labor ratios (number of workers) based on current industry averages. The multiplier data is 2006 data from the Minnesota IMPLAN Group, reflecting the most recent data available from the Bureau of Economic Analysis.<sup>12</sup> We have updated the equipment cost assumptions, which reflect an average overnight project cost for the portfolio of wind projects of approximately \$2,011/kW for the Level 1 (3,196 MW) wind development scenario and \$2,014/kW for the Level 2 (7,616 MW) scenario. Average annual O&M costs are approximately \$19/kW-year.

As in our previous analysis (and consistent with JEDI default assumptions), our base case analysis assumes that none of the wind turbines, blades, towers, and transformers associated with the wind generation development would be manufactured by suppliers within the SPP footprint. This yields a conservative estimate of regional jobs and economic stimulus impacts. The additional economic benefits of such manufacturing activity within the SPP footprint are discussed in Section IV of this report.

Economic impact estimates from the JEDI model are reported separately for the construction period and the operational phase of the wind project. We have reported the employment effects during both the construction and operating period in FTE-years, recognizing that, given a 20-year operating life, 20 FTE-years during the operating phase are equivalent to one full-time job

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<sup>11</sup> <http://www.nrel.gov/analysis/jedi/>

<sup>12</sup> [http://www.windpoweringamerica.gov/filter\\_detail.asp?itemid=707](http://www.windpoweringamerica.gov/filter_detail.asp?itemid=707)

that lasts 20 years. In addition, all jobs, earnings, and economic output estimates for the operating period are reported as the simple sum over the 20-year lifecycle of the wind assets and have not been discounted for the time value net of inflation.<sup>13</sup>

### C. SCOPE AND INTERPRETATION OF WIND MODELING RESULTS

The job and economic stimulus benefits of wind generation for the Level 1 and Level 2 investment scenarios are reported in Table 7 and Table 8. These impacts represent the direct, indirect, and induced impacts associated with the wind investment, which JEDI reports as “project development and on-site labor impacts,” “turbine and supply-chain impacts,” and “induced” impacts.<sup>14</sup>

Table 7 summarizes the economic stimulus impact in the SPP region by state for the Level 1 investment scenario (3,196 MW of new wind generation). As shown, the construction phase of this wind power expansion scenario is estimated to support jobs with approximately 17,000 FTE-years of employment in the SPP region (*e.g.*, an average of 1,700 full time jobs each year over a 10-year wind construction cycle, if the entire group of projects will take 10 years to complete). This produces \$0.6 billion in income by in-region employees over the course of the construction period. The associated overall SPP economic activity (*i.e.*, economic output measured as the total revenues associated with stimulated sales and resale revenues) supported by the wind generation investment is estimated to be \$1.8 billion.

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<sup>13</sup> Given the fact that both Level 1 and Level 2 scenarios are assumed to complete construction in 2010 and have an equal operating period of 20 years, discounting the earnings and economic output streams would not change the relative comparisons between the two levels.

<sup>14</sup> Note that the “direct” impact reported in Tables 7 and 8 based on JEDI simulations include only the direct impacts associated with the on-site construction activity of the wind power plant. The economic impacts from purchasing the wind turbines and related equipment are reported as in combination with other indirect supply-chain impacts, the sum of which is reported here as “indirect” effects. In this regard JEDI deviates from the general convention used in models such as IMPLAN, which would report the economic impacts associated with purchasing wind turbines and related power plant equipment as “direct” impacts, while reporting as “indirect” only the economic effects on suppliers to the construction firms and turbine manufacturers. Due to this difference in reporting convention, the ratio of direct to indirect economic impacts differs for the transmission- and wind-related economic impacts. This difference in reporting conventions, however, neither affect estimates of induced effects nor overall (*i.e.*, the sum of direct, indirect and induced) impacts.



As Table 7 also shows, the cumulative economic benefits during the 20-year operation of an additional 3,196 MW of wind capacity are estimated at approximately 13,000 FTE-years of employment across the SPP region (*i.e.*, 650 full-time jobs lasting 20 years each), producing \$0.5 billion in earnings by those employees. The associated economic activity over this 20-year operating period is approximately \$1.6 billion in total sales and resale revenues.

Adding the construction and operating phase impacts shown in Table 7, the addition of 3,196 MW of wind generation (assuming no in-region manufacturing of plant components) would support 30,000 FTE-years of employment in the SPP region, \$1.1 billion in additional income earned by employees across the SPP region, and \$3.4 billion of economic activities.

The results in Table 8 show the economic impacts of 7,616 MW of new wind generation development in the SPP footprint (again conservatively assuming that none of the turbines, blades, towers, and transformers would be manufactured in SPP states). In this “Level 2” investment scenario, a total of 40,000 FTE-years of employment would be supported during the construction phase, producing \$1.4 billion of income by employees over the course of the construction period. The corresponding economic activity (total sales and resale revenues) is estimated to be \$4.4 billion.

In addition, the aggregate economic benefits during the 20-year operation of the additional 7,616 MW of wind capacity are estimated to support 31,000 FTE-years of employment across the SPP region (*i.e.*, 1,550 full-time jobs lasting 20 years), providing approximately \$1.2 billion of additional income and an overall economic activity of \$4.0 billion.

Combining construction and operating phase impacts, the addition of 7,616 MW of wind generation (assuming no in-region manufacturing of plant components) would support 71,000 FTE-years of employment, \$2.6 billion in income earned by employees, and \$8.4 billion of economic activities within the SPP footprint.

**Table 7**  
**3,196 MW of New Wind Constructed, Lifespan of 20 Years**

| EMPLOYMENT STIMULATED<br>BY WIND PROJECTS DURING CONSTRUCTION PERIOD |                                                                           |                                      |               |              |               | EMPLOYMENT STIMULATED<br>BY WIND PROJECTS DURING 20-YEAR OPERATING PERIOD |                                                                           |                                      |              |              |               |
|----------------------------------------------------------------------|---------------------------------------------------------------------------|--------------------------------------|---------------|--------------|---------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------|--------------------------------------|--------------|--------------|---------------|
| STATE                                                                | Earnings<br>(2010\$ million)                                              | Full-Time Equivalent Years (FTE-ysr) |               |              |               | STATE                                                                     | Earnings<br>(2010\$ million)                                              | Full-Time Equivalent Years (FTE-ysr) |              |              |               |
|                                                                      |                                                                           | Direct                               | Indirect      | Induced      | Total         |                                                                           |                                                                           | Direct                               | Indirect     | Induced      | Total         |
| Arkansas                                                             | <i>Positive indirect effects from neighboring projects not quantified</i> |                                      |               |              |               | Arkansas                                                                  | <i>Positive indirect effects from neighboring projects not quantified</i> |                                      |              |              |               |
| Oklahoma                                                             | \$261                                                                     | 894                                  | 5,706         | 1,986        | <b>8,586</b>  | Oklahoma                                                                  | \$233                                                                     | 1,717                                | 2,550        | 2,494        | <b>6,761</b>  |
| Kansas                                                               | \$115                                                                     | 366                                  | 2,049         | 748          | <b>3,163</b>  | Kansas                                                                    | \$92                                                                      | 640                                  | 950          | 629          | <b>2,219</b>  |
| Texas                                                                | <i>Positive indirect effects from neighboring projects not quantified</i> |                                      |               |              |               | Texas                                                                     | <i>Positive indirect effects from neighboring projects not quantified</i> |                                      |              |              |               |
| Missouri                                                             | \$127                                                                     | 323                                  | 2,028         | 874          | <b>3,225</b>  | Missouri                                                                  | \$112                                                                     | 648                                  | 988          | 953          | <b>2,589</b>  |
| New Mexico                                                           | <i>Positive indirect effects from neighboring projects not quantified</i> |                                      |               |              |               | New Mexico                                                                | <i>Positive indirect effects from neighboring projects not quantified</i> |                                      |              |              |               |
| Nebraska                                                             | \$74                                                                      | 238                                  | 1,333         | 528          | <b>2,099</b>  | Nebraska                                                                  | \$64                                                                      | 445                                  | 665          | 484          | <b>1,594</b>  |
| SPP Total                                                            | <b>\$577</b>                                                              | <b>1,821</b>                         | <b>11,116</b> | <b>4,136</b> | <b>17,072</b> | SPP Total                                                                 | <b>\$501</b>                                                              | <b>3,451</b>                         | <b>5,154</b> | <b>4,559</b> | <b>13,163</b> |

| ECONOMIC OUTPUT STIMULATED<br>BY WIND PROJECTS DURING CONSTRUCTION PERIOD |                                                                           |              |                |              | ECONOMIC OUTPUT STIMULATED<br>BY WIND PROJECTS DURING 20-YEAR OPERATING PERIOD |                                                                           |              |              |              |
|---------------------------------------------------------------------------|---------------------------------------------------------------------------|--------------|----------------|--------------|--------------------------------------------------------------------------------|---------------------------------------------------------------------------|--------------|--------------|--------------|
| STATE                                                                     | Increased Economic Output (2010\$ million)                                |              |                |              | STATE                                                                          | Increased Economic Output (2010\$ million)                                |              |              |              |
|                                                                           | Total                                                                     | Direct       | Indirect       | Induced      |                                                                                | Total                                                                     | Direct       | Indirect     | Induced      |
| Arkansas                                                                  | <i>Positive indirect effects from neighboring projects not quantified</i> |              |                |              | Arkansas                                                                       | <i>Positive indirect effects from neighboring projects not quantified</i> |              |              |              |
| Oklahoma                                                                  | \$880                                                                     | \$50         | \$631          | \$198        | Oklahoma                                                                       | \$838                                                                     | \$76         | \$513        | \$249        |
| Kansas                                                                    | \$346                                                                     | \$25         | \$243          | \$78         | Kansas                                                                         | \$260                                                                     | \$38         | \$157        | \$65         |
| Texas                                                                     | <i>Positive indirect effects from neighboring projects not quantified</i> |              |                |              | Texas                                                                          | <i>Positive indirect effects from neighboring projects not quantified</i> |              |              |              |
| Missouri                                                                  | \$369                                                                     | \$24         | \$250          | \$96         | Missouri                                                                       | \$345                                                                     | \$41         | \$199        | \$104        |
| New Mexico                                                                | <i>Positive indirect effects from neighboring projects not quantified</i> |              |                |              | New Mexico                                                                     | <i>Positive indirect effects from neighboring projects not quantified</i> |              |              |              |
| Nebraska                                                                  | \$231                                                                     | \$15         | \$161          | \$55         | Nebraska                                                                       | \$190                                                                     | \$25         | \$115        | \$50         |
| SPP Total                                                                 | <b>\$1,826</b>                                                            | <b>\$115</b> | <b>\$1,285</b> | <b>\$426</b> | SPP Total                                                                      | <b>\$1,633</b>                                                            | <b>\$180</b> | <b>\$984</b> | <b>\$469</b> |

**Sources:** Results generated with JEDI Model Ver. 01D\_Wind\_Model\_rel\_W1.09.03e.

Construction and operating jobs are in full-time equivalent years (1 FTE = 2,080 hours).

State-level economic impacts do not consider "spillover" benefits associated with investments in neighboring states.

Analysis assumes none of the major components (e.g. turbines, towers, blades, transformers) are purchased in-state.

Economic output and earnings during operating period represent the cumulative effect over the full operating lifespan of the facilities and have not been discounted.

**Table 8**  
**7,616 MW of New Wind Constructed, Lifespan of 20 Years**

| EMPLOYMENT STIMULATED<br>BY WIND PROJECTS DURING CONSTRUCTION PERIOD |                              |                                      |               |              |               | EMPLOYMENT STIMULATED<br>BY WIND PROJECTS DURING 20-YEAR OPERATING PERIOD |                              |                                      |               |               |               |
|----------------------------------------------------------------------|------------------------------|--------------------------------------|---------------|--------------|---------------|---------------------------------------------------------------------------|------------------------------|--------------------------------------|---------------|---------------|---------------|
| STATE                                                                | Earnings<br>(2010\$ million) | Full-Time Equivalent Years (FTE-yrs) |               |              |               | STATE                                                                     | Earnings<br>(2010\$ million) | Full-Time Equivalent Years (FTE-yrs) |               |               |               |
|                                                                      |                              | Direct                               | Indirect      | Induced      | Total         |                                                                           |                              | Direct                               | Indirect      | Induced       | Total         |
| Arkansas                                                             | \$32                         | 108                                  | 728           | 240          | <b>1,076</b>  | Arkansas                                                                  | \$31                         | 218                                  | 323           | 379           | <b>920</b>    |
| Oklahoma                                                             | \$426                        | 1,419                                | 9,363         | 3,253        | <b>14,034</b> | Oklahoma                                                                  | \$379                        | 2,770                                | 4,172         | 4,081         | <b>11,022</b> |
| Kansas                                                               | \$436                        | 1,372                                | 7,805         | 2,848        | <b>12,025</b> | Kansas                                                                    | \$361                        | 2,571                                | 3,640         | 2,426         | <b>8,637</b>  |
| Texas                                                                | \$124                        | 363                                  | 1,948         | 713          | <b>3,023</b>  | Texas                                                                     | \$121                        | 681                                  | 887           | 1,132         | <b>2,700</b>  |
| Missouri                                                             | \$136                        | 369                                  | 2,140         | 928          | <b>3,437</b>  | Missouri                                                                  | \$120                        | 699                                  | 1,051         | 1,012         | <b>2,762</b>  |
| New Mexico                                                           | 59                           | 155                                  | 1,053         | 462          | <b>1,671</b>  | New Mexico                                                                | \$58                         | 308                                  | 544           | 730           | <b>1,582</b>  |
| Nebraska                                                             | \$175                        | 625                                  | 3,084         | 1,231        | <b>4,940</b>  | Nebraska                                                                  | \$152                        | 1,044                                | 1,561         | 1,133         | <b>3,738</b>  |
| SPP Total                                                            | <b>\$1,389</b>               | <b>4,412</b>                         | <b>26,120</b> | <b>9,675</b> | <b>40,207</b> | SPP Total                                                                 | <b>\$1,221</b>               | <b>8,291</b>                         | <b>12,177</b> | <b>10,894</b> | <b>31,361</b> |

| ECONOMIC OUTPUT STIMULATED<br>BY WIND PROJECTS DURING CONSTRUCTION PERIOD |                                            |              |                |                | ECONOMIC OUTPUT STIMULATED<br>BY WIND PROJECTS DURING 20-YEAR OPERATING PERIOD |                                            |              |                |                |
|---------------------------------------------------------------------------|--------------------------------------------|--------------|----------------|----------------|--------------------------------------------------------------------------------|--------------------------------------------|--------------|----------------|----------------|
| STATE                                                                     | Increased Economic Output (2010\$ million) |              |                |                | STATE                                                                          | Increased Economic Output (2010\$ million) |              |                |                |
|                                                                           | Total                                      | Direct       | Indirect       | Induced        |                                                                                | Total                                      | Direct       | Indirect       | Induced        |
| Arkansas                                                                  | \$106                                      | \$6          | \$77           | \$23           | Arkansas                                                                       | \$120                                      | \$9          | \$74           | \$37           |
| Oklahoma                                                                  | \$1,441                                    | \$81         | \$1,036        | \$325          | Oklahoma                                                                       | \$1,370                                    | \$123        | \$840          | \$407          |
| Kansas                                                                    | \$1,315                                    | \$93         | \$926          | \$296          | Kansas                                                                         | \$1,006                                    | \$154        | \$600          | \$252          |
| Texas                                                                     | 381                                        | 27           | 265            | 89             | Texas                                                                          | \$467                                      | \$44         | \$282          | \$142          |
| Missouri                                                                  | \$392                                      | \$27         | \$264          | \$101          | Missouri                                                                       | \$367                                      | \$44         | \$212          | \$111          |
| New Mexico                                                                | \$180                                      | \$11         | \$125          | \$45           | New Mexico                                                                     | \$214                                      | \$18         | \$125          | \$70           |
| Nebraska                                                                  | \$540                                      | \$40         | \$372          | \$128          | Nebraska                                                                       | \$447                                      | \$59         | \$270          | \$118          |
| SPP Total                                                                 | <b>\$4,355</b>                             | <b>\$284</b> | <b>\$3,064</b> | <b>\$1,007</b> | SPP Total                                                                      | <b>\$3,991</b>                             | <b>\$451</b> | <b>\$2,403</b> | <b>\$1,137</b> |

**Sources:** Results generated with JEDI Model Ver. 01D\_Wind\_Model\_rel\_W1.09.03e.

Construction and operating jobs are in full-time equivalent years (1 FTE = 2,080 hours).

State-level economic impacts do not consider "spillover" benefits associated with investments in neighboring states.

Analysis assumes none of the major components (e.g. turbines, towers, blades, transformers) are purchased in-state.

Economic output and earnings during operating period represent the cumulative effect over the full operating lifespan of the facilities and have not been discounted.

## **IV. ADDITIONAL ECONOMIC BENEFITS FROM LOCAL MANUFACTURING**

### **A. LOW AND HIGHER IN-REGION MANUFACTURING SCENARIOS**

The base case results discussed above assumed that all transmission-related materials and wind components are manufactured outside the SPP footprint. We consider this base case to be a very conservative “low in-region supply” scenario. We have developed as a comparison, a “higher in-region” supply scenario assuming that 50% of all transmission-related materials and 50% of certain wind plant components (blades, towers, and transformers) would be manufactured within the SPP footprint. Significant in-region manufacturing of transmission and wind plant components is a highly likely outcome considering even preexisting manufacturing capabilities within the SPP footprint. For example, a number of wind-generation-related manufacturing facilities are already located in Arkansas, Kansas, Missouri, Nebraska and Oklahoma. They are reported to include LM Glasfiber, Mitsubishi Power Systems, Nordex, Emergya Wind Technologies, Siemens, DMI Industries, Bergey WindPower, Katana Summit, and NorthStar Wind Towers.<sup>15</sup> Higher levels of in-region manufacturing capability will be stimulated by additional transmission and wind generation investment, thereby magnifying the economic stimulus benefits of the investments to the region.

The following tables compare the total investment costs allocated by broad input categories and the associated in-region share for the low and higher in-region supply scenarios. Table 9 lists the broad cost categories in IMPLAN<sup>®</sup> with the breakdown for each spending category as a percentage of total transmission construction costs. The table shows that the Group 1 set of transmission projects at a total investment cost of \$1.3 billion consists of the following cost components: 38% for construction labor, 53% for materials; and 10% for design work. Group 2, at a total cost of \$1.1 billion, has a slightly different allocation of 39% for construction labor, 53% for materials; and 8% for design work.

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<sup>15</sup> SPP Economic Development Presentation, February 10, 2010, slides 50-57.

As also shown on the right side of Table 9, the low in-region scenario assumes that all transmission construction and design activities are provided by in-region suppliers (*e.g.*, SPP transmission owners and local construction companies) while all materials are provided by suppliers from outside the SPP member states. For the higher in-region scenario, we assume that 50% of all transmission materials such as towers, wire, circuit breakers, and other hardware are manufactured in the region. As shown in Table 9, this means that only 47% of the total transmission project costs (including materials and construction services) are provided by in-region suppliers in the base case, whereas in the higher in-region scenario, that overall in-region cost share increases to 74%.

**Table 9**  
**IMPLAN<sup>®</sup> Construction Cost Allocation and Share of In-Region Supply**  
**for Group 1 and Group 2 Transmission Projects**

|                                        | Total Cost<br>(2010\$ Millions) |             |                |             | Share of In-Region Supply |            |            |            |
|----------------------------------------|---------------------------------|-------------|----------------|-------------|---------------------------|------------|------------|------------|
|                                        | Group 1                         |             | Group 2        |             | Low                       |            | High       |            |
|                                        | Group 1                         | %           | Group 2        | %           | Group 1                   | Group 2    | Group 1    | Group 2    |
| <b>Transmission Cost Allocations</b>   |                                 |             |                |             |                           |            |            |            |
| Construction Labor                     | \$481                           | 38%         | \$442          | 39%         | 100%                      | 100%       | 100%       | 100%       |
| Materials                              | \$676                           | 53%         | \$605          | 53%         | 0%                        | 0%         | 50%        | 50%        |
| Design                                 | \$124                           | 10%         | \$89           | 8%          | 100%                      | 100%       | 100%       | 100%       |
| <b>Total</b>                           | <b>\$1,282</b>                  | <b>100%</b> | <b>\$1,136</b> | <b>100%</b> |                           |            |            |            |
| <b>In-Region Share of Expenditures</b> |                                 |             |                |             | <b>47%</b>                | <b>47%</b> | <b>74%</b> | <b>73%</b> |

Tables 10 and 12 list the broad construction-phase cost categories for wind generation. Tables 11 and 13 list the cost categories and percentage of total O&M costs during the operating phase of the wind projects. As shown, the overall construction-phase project spending consists of approximately: 45% for turbines; 30% for blades, towers, and related transportation; 16% for other supplies; and 9% for on-site labor, project design, and management. Accompanying these cost allocation percentages are the low and higher in-region shares where it is assumed that either zero or 50% of certain wind components (blades, towers, and transformers) are manufactured in the SPP footprint. JEDI default assumptions are used for the in-region supply share for all other wind generation cost components.

**Table 10**  
**JEDI Construction Cost Allocation and Share of In-Region Supply**  
**for 3,196 MW Wind Portfolio**

| Project Construction Cost Inputs for JEDI | Costs        | Percent of Total | Low In-Region Share | High In-Region Share |
|-------------------------------------------|--------------|------------------|---------------------|----------------------|
| (Millions 2010\$)                         |              | (%)              | (%)                 | (%)                  |
| Equipment Costs                           |              |                  |                     |                      |
| Turbines                                  | 2,925        | 46%              | 0%                  | 0%                   |
| Blades, Towers, Transportation            | 1,956        | 30%              | 0%                  | 50%                  |
| Materials                                 |              |                  |                     |                      |
| Construction (concrete, rebar, site prep) | 693          | 11%              | 90%                 | 90%                  |
| Transformer                               | 78           | 1%               | 0%                  | 50%                  |
| Wire/Electrical/Other                     | 233          | 4%               | 81%                 | 81%                  |
| Labor                                     |              |                  |                     |                      |
| Foundation, Erection, Electrical          | 100          | 2%               | 78%                 | 78%                  |
| Management/Supervision/Other              | 264          | 4%               | 46%                 | 46%                  |
| Development/Other                         |              |                  |                     |                      |
| Interconnection                           | 62           | 1%               | 71%                 | 71%                  |
| Engineering                               | 65           | 1%               | 0%                  | 0%                   |
| Siting                                    | 52           | 1%               | 100%                | 100%                 |
| <b>Total</b>                              | <b>6,427</b> | <b>100%</b>      | <b>17%</b>          | <b>33%</b>           |

**Table 11**  
**JEDI Annual O&M Cost Allocation and Share of In-Region Supply**  
**for 3,196 MW Wind Portfolio**

| Project Annual Operation Cost Inputs for JEDI | Costs     | Percent of Total | Low In-Region Share | High In-Region Share |
|-----------------------------------------------|-----------|------------------|---------------------|----------------------|
| (Millions 2010\$)                             |           | (%)              | (%)                 | (%)                  |
| Labor Costs                                   | 10        | 16%              | 100%                | 100%                 |
| Materials                                     |           |                  |                     |                      |
| Site Maintenance/Parts/Other                  | 37        | 61%              | 13%                 | 13%                  |
| Fees, Permits, Licenses, Insurance            | 11        | 19%              | 3%                  | 3%                   |
| Other                                         | 3         | 5%               | 100%                | 100%                 |
| <b>Total</b>                                  | <b>62</b> | <b>100%</b>      | <b>29%</b>          | <b>29%</b>           |

**Table 12**  
**JEDI Construction Cost Allocation and Share of In-Region Supply**  
**for 7,616 MW Wind Portfolio**

| Project Construction Cost Inputs for JEDI | Costs         | Percent of Total | Low In-Region Share | High In-Region Share |
|-------------------------------------------|---------------|------------------|---------------------|----------------------|
| (Millions 2010\$)                         |               | (%)              | (%)                 | (%)                  |
| Equipment Costs                           |               |                  |                     |                      |
| Turbines                                  | 6,966         | 45%              | 0%                  | 0%                   |
| Blades, Towers, Transportation            | 4,662         | 30%              | 0%                  | 50%                  |
| Materials                                 |               |                  |                     |                      |
| Construction (concrete, rebar, site prep) | 1,655         | 11%              | 90%                 | 90%                  |
| Transformer                               | 187           | 1%               | 0%                  | 50%                  |
| Wire/Electrical/Other                     | 558           | 4%               | 81%                 | 81%                  |
| Labor                                     |               |                  |                     |                      |
| Foundation, Erection, Electrical          | 251           | 2%               | 78%                 | 78%                  |
| Management/Supervision/Other              | 633           | 4%               | 46%                 | 46%                  |
| Development/Other                         |               |                  |                     |                      |
| Interconnection                           | 149           | 1%               | 71%                 | 71%                  |
| Engineering                               | 155           | 1%               | 0%                  | 0%                   |
| Siting                                    | 124           | 1%               | 100%                | 100%                 |
| <b>Total</b>                              | <b>15,339</b> | <b>100%</b>      | <b>17%</b>          | <b>33%</b>           |

**Table 13**  
**JEDI Annual O&M Cost Allocation and Share of In-Region Supply**  
**for 7,616 MW Wind Portfolio**

| Project Annual Operation Cost Inputs for JEDI | Costs      | Percent of Total | Low In-Region Share | High In-Region Share |
|-----------------------------------------------|------------|------------------|---------------------|----------------------|
| (Millions 2010\$)                             |            | (%)              | (%)                 | (%)                  |
| Labor Costs                                   | 24         | 16%              | 100%                | 100%                 |
| Materials                                     |            |                  |                     |                      |
| Site Maintenance/Parts/Other                  | 89         | 60%              | 13%                 | 13%                  |
| Fees, Permits, Licenses, Insurance            | 27         | 18%              | 3%                  | 3%                   |
| Other                                         | 8          | 5%               | 100%                | 100%                 |
| <b>Total</b>                                  | <b>148</b> | <b>100%</b>      | <b>30%</b>          | <b>30%</b>           |



Overall, only 17% of the total construction, development and materials for the wind power portfolio are assumed to be provided by in-region suppliers in the low in-region share scenario (or base case). In the higher in-region scenario, that in-region expenditure share increases to 33% of total wind project expenditure. This differentiation of in-region manufacturing shares does not impact the operations-phase expenditures of the wind plants shown in Table 11 and Table 13.

#### **B. ECONOMIC BENEFITS FROM HIGHER IN-REGION MANUFACTURING OF WIND GENERATION AND TRANSMISSION COMPONENTS**

Tables 14 and 15 summarize the estimated construction-period impact of increasing from 0% to 50% the in-region manufacturing share of transmission materials and certain wind generation components. The estimated additional benefits from higher in-region manufacturing are summarized in Table 14 for the Group 1 transmission projects and the two wind development scenarios (3,196 MW and 7,616 MW). Table 15 reports the additional benefits for the Group 2 transmission build-out and the two wind development scenarios.

For 3,196 MW of wind development, increasing the in-region manufacturing of selected components and materials from 0% to 50% yields construction-period economic impacts that are approximately 40% higher in terms of employment (for a total of 34,000 FTE-years), approximately 50% higher in terms of earnings by employees (for a total of \$1.4 billion), and up to 80% higher in terms of overall economic output (sales and resale revenues; for a total of approximately \$4.8 billion). The percentage increase in benefits from higher in-region manufacturing is similar for the 7,616 MW wind portfolio.

**Table 14**  
**Employment and Economic Output Impacts of Higher In-Region Manufacturing of Wind and Group 1 Transmission Components**

**3,196MW of New Wind Constructed**

**EMPLOYMENT AND ECONOMIC OUTPUT STIMULATED  
DURING CONSTRUCTION PERIOD**

|                                                              | Employment                   |                                            |                                                  |
|--------------------------------------------------------------|------------------------------|--------------------------------------------|--------------------------------------------------|
|                                                              | Earnings<br>(2010\$ million) | Full-Time<br>Equivalent Years<br>(FTE-yrs) | Increased<br>Economic Output<br>(2010\$ million) |
| <b>SPP Impact with 0% In-Region Manufacturing</b>            |                              |                                            |                                                  |
| Wind Generation                                              | \$577                        | 17,072                                     | \$1,826                                          |
| Transmission (Group 1)                                       | \$421                        | 8,482                                      | \$1,095                                          |
| Combined                                                     | \$998                        | 25,554                                     | \$2,921                                          |
| <b>SPP Impact with 50% In-Region Manufacturing</b>           |                              |                                            |                                                  |
| Wind Generation                                              | \$910                        | 24,645                                     | \$3,360                                          |
| Transmission (Group 1)                                       | \$532                        | 10,571                                     | \$1,603                                          |
| Combined                                                     | \$1,442                      | 35,216                                     | \$4,964                                          |
| <b>SPP Incremental Impact of 50% In-Region Manufacturing</b> |                              |                                            |                                                  |
| Percentage                                                   | <b>44%</b>                   | <b>38%</b>                                 | <b>70%</b>                                       |

**7,616MW of New Wind Constructed**

**EMPLOYMENT AND ECONOMIC OUTPUT STIMULATED  
DURING CONSTRUCTION PERIOD**

|                                                              | Employment                   |                                            |                                                  |
|--------------------------------------------------------------|------------------------------|--------------------------------------------|--------------------------------------------------|
|                                                              | Earnings<br>(2010\$ million) | Full-Time<br>Equivalent Years<br>(FTE-yrs) | Increased<br>Economic Output<br>(2010\$ million) |
| <b>SPP Impact with 0% In-Region Manufacturing</b>            |                              |                                            |                                                  |
| Wind Generation                                              | \$1,389                      | 40,207                                     | \$4,355                                          |
| Transmission (Group 1)                                       | \$421                        | \$8,482                                    | \$1,095                                          |
| Combined                                                     | \$1,810                      | 48,689                                     | \$5,450                                          |
| <b>SPP Impact with 50% In-Region Manufacturing</b>           |                              |                                            |                                                  |
| Wind Generation                                              | \$2,172                      | 57,786                                     | \$7,993                                          |
| Transmission (Group 1)                                       | \$532                        | \$10,571                                   | \$1,603                                          |
| Combined                                                     | \$2,705                      | 68,357                                     | \$9,596                                          |
| <b>SPP Incremental Impact of 50% In-Region Manufacturing</b> |                              |                                            |                                                  |
| Percentage                                                   | <b>49%</b>                   | <b>40%</b>                                 | <b>76%</b>                                       |

**Manufacturing Assumptions:**

For wind construction impacts, the "base" case (0% in-region manufacturing) assumes no local expenditures on blades, towers, transportation, and transformers, while the "high" case (50% in-region manufacturing) assumes 50% of expenditures on the above components are directed to local sources.

For transmission construction impacts, the "base" case (0% in-region manufacturing) assumes no local expenditures on any transmission materials and components, while the "high" case (50% in-region manufacturing) assumes 50% of all transmission materials and components are purchased locally.

**Table 15**  
**Employment and Economic Output Impacts of Higher In-Region Manufacturing of Wind and Group 2 Transmission Components**

**3,196MW of New Wind Constructed**

**EMPLOYMENT AND ECONOMIC OUTPUT STIMULATED  
DURING CONSTRUCTION PERIOD**

|                                                              | Employment                   |                                           |                                                  |
|--------------------------------------------------------------|------------------------------|-------------------------------------------|--------------------------------------------------|
|                                                              | Earnings<br>(2010\$ million) | Full-Tme<br>Equivalent Years<br>(FTE-yrs) | Increased<br>Economic Output<br>(2010\$ million) |
| <b>SPP Impact with 0% In-Region Manufacturing</b>            |                              |                                           |                                                  |
| Wind Generation                                              | \$577                        | 17,072                                    | \$1,826                                          |
| Transmission (Group 2)                                       | \$368                        | 7,475                                     | \$962                                            |
| Combined                                                     | \$945                        | 24,547                                    | \$2,788                                          |
| <b>SPP Impact with 50% In-Region Manufacturing</b>           |                              |                                           |                                                  |
| Wind Generation                                              | \$910                        | 24,645                                    | \$3,360                                          |
| Transmission (Group 2)                                       | \$468                        | 9,345                                     | \$1,417                                          |
| Combined                                                     | \$1,378                      | 33,990                                    | \$4,778                                          |
| <b>SPP Incremental Impact of 50% In-Region Manufacturing</b> |                              |                                           |                                                  |
| Percentage                                                   | <b>46%</b>                   | <b>38%</b>                                | <b>71%</b>                                       |

**7,616MW of New Wind Constructed**

**EMPLOYMENT AND ECONOMIC OUTPUT STIMULATED  
DURING CONSTRUCTION PERIOD**

|                                                              | Employment                   |                                            |                                                  |
|--------------------------------------------------------------|------------------------------|--------------------------------------------|--------------------------------------------------|
|                                                              | Earnings<br>(2010\$ million) | Full-Time<br>Equivalent Years<br>(FTE-yrs) | Increased<br>Economic Output<br>(2010\$ million) |
| <b>SPP Impact with 0% In-Region Manufacturing</b>            |                              |                                            |                                                  |
| Wind Generation                                              | \$1,389                      | 40,207                                     | \$4,355                                          |
| Transmission (Group 2)                                       | \$368                        | \$7,475                                    | \$962                                            |
| Combined                                                     | \$1,757                      | 47,682                                     | \$5,317                                          |
| <b>SPP Impact with 50% In-Region Manufacturing</b>           |                              |                                            |                                                  |
| Wind Generation                                              | \$2,172                      | 57,786                                     | \$7,993                                          |
| Transmission (Group 2)                                       | \$468                        | \$9,345                                    | \$1,417                                          |
| Combined                                                     | \$2,640                      | 67,131                                     | \$9,410                                          |
| <b>SPP Incremental Impact of 50% In-Region Manufacturing</b> |                              |                                            |                                                  |
| Percentage                                                   | <b>50%</b>                   | <b>41%</b>                                 | <b>77%</b>                                       |

**Manufacturing Assumptions:**

For wind construction impacts, the "base" case (0% in-region manufacturing) assumes no local expenditures on blades, towers, transportation, and transformers, while the "high" case (50% in-region manufacturing) assumes 50% of expenditures on the above components are directed to local sources.

For transmission construction impacts, the "base" case (0% in-region manufacturing) assumes no local expenditures on any transmission materials and components, while the "high" case (50% in-region manufacturing) assumes 50% of all transmission materials and components are purchased locally.

As shown in Tables 14 and 15, the transmission investment combined with the higher level of wind development would support 67,000 FTE-years of total employment, \$2.6 billion in earnings, and approximately \$9.5 billion in total economic output (sales and resale revenues) over the course of the *construction period* of the transmission and wind facilities. When the wind projects' economic impact during the *operational period* is added to that, the combined investment of the Group 1 transmission projects and 7,616 MW of new wind generation would—over the course of both the construction and operating phases of the facilities—support approximately 100,000 FTE-years of employment, \$3.9 billion of earnings by SPP-region employees, and over \$13 billion of total economic activity (*i.e.*, sales and resale revenues) within the SPP member states.

### **C. SALES INCREASES FOR LOCAL ELECTRIC AND NATURAL GAS UTILITIES**

This section analyzes the extent to which the increased economic activity associated with transmission and wind plant construction also increases revenues of electric and natural gas utilities in the SPP footprint. These additional utility revenues, as reported in Table 16, are a portion of the indirect and induced economic output effects reported for transmission construction activities in Sections II and IV above. As Table 16 shows, the Group 1 set of transmission projects provides between \$14.0 and \$22.7 million in revenues (from indirect and induced economic output) by electric and natural gas utilities in the SPP footprint, depending on the in-region manufacturing share. For the Group 2 set of transmission projects, between \$12.3 and \$20.0 million in additional electricity and gas sales revenues are associated with the higher economic activity within the SPP footprint. Increased natural gas sales account for approximately 20% to 22% of the combined impact on electric and natural gas utilities.

**Table 16**  
**Impact of Transmission Investments**  
**on SPP Electric and Natural Gas Utility Revenues**

| Transmission Projects | Low In-Region Manufacturing |                |              | Higher In-Region Manufacturing |                |              |
|-----------------------|-----------------------------|----------------|--------------|--------------------------------|----------------|--------------|
|                       | <i>Indirect</i>             | <i>Induced</i> | <i>Total</i> | <i>Indirect</i>                | <i>Induced</i> | <i>Total</i> |
|                       | <i>(2010\$ Millions)</i>    |                |              | <i>(2010\$ Millions)</i>       |                |              |
| Group 1               | \$4.8                       | \$9.2          | \$14.0       | \$10.9                         | \$11.8         | \$22.7       |
| Group 2               | \$4.3                       | \$8.0          | \$12.3       | \$9.7                          | \$10.3         | \$20.0       |

*Source and Notes:*

*The impact on electricity and gas revenues is captured through the indirect and induced impacts from expenditures in each set of transmission line buildouts. The impacts affect the following IMPLAN sectors: electric power generation, transmission, and distribution; natural gas distribution; federal electric utilities; and state and local government electric utilities.*

While the analysis above is based on our IMPLAN<sup>®</sup> modeling results and was undertaken only for transmission investments, we estimate that approximately the same ratio of utility sales increases to total in-region supply of transmission development would also apply to wind development. This implies that every \$1 billion of in-region spending from wind and transmission investment activities is estimated to generate \$23 million to \$24 million in additional electric and natural gas utility sales within the SPP footprint. As a result, under the higher in-region manufacturing scenario, the combined in-region supply activities associated with Group 1 transmission projects and Level 2 wind generation development would stimulate approximately \$140 million in additional electric and natural gas utility retail revenues during the construction phase of these projects. This estimate of utility retail sales increases captures only the impact of transmission and wind construction activities. It does not reflect the extent to which increases in supply options and reliability resulting from transmission investments or reductions in local wholesale power prices resulting from wind development may be able to attract new businesses to the SPP footprint. On the other hand, it does not account for any potential impact of changes in retail electricity prices on SPP's ability to attract businesses or residents.

## Improving the Eastward Transfer Capability

### Abstract

This analysis evaluates the support provided by the Priority Projects to power transfers originating in the western sections of the SPP footprint and terminating in the eastern sections of the SPP footprint. The results of the analysis indicate that the Priority Projects support two-thirds of all eastward transfers immediately upon their completion and that transfers in the subsequent years are even more supported.

### Background

The Synergistic Project Planning Team identified that the future transmission backbone should join the western and eastern sections of the SPP footprint.

*“The proposed transmission backbone should connect transmission in SPP between the west and the east, strengthen existing ties to the Eastern Interconnection, and be strong enough to provide the option of connecting to the Western grid at some point in the future.” – Report of the Synergistic Planning Project*

This core principle required a new approach to the study of the projects under consideration. The interconnections between SPP’s western and eastern regions needed to be identified in a non-arbitrary way that fairly encompassed all parts of the SPP footprint. This analysis answers the questions raised by such a challenge: “What is western?”, “What is eastern?” and “What impact do the Priority Projects have upon the interconnection between SPP’s western and eastern regions?”

### West to East Regions

The SPP footprint contains a spread of shareholders’ holdings that occupy a diverse geographical range. The footprint encompasses 370,000 square miles of territory. The correct identification of the western and eastern sections of this footprint and the measurement of the “inter-connectiveness” is a daunting task. To address this challenge, the SPP footprint was divided geographically into ten equal geographic sections. These sections are shown superimposed upon a map of SPP in Figure 1. The ten regions are each roughly 100 miles wide and follow a North-South orientation. The lines separating each section can be likened to the Lines of Longitude on an atlas.

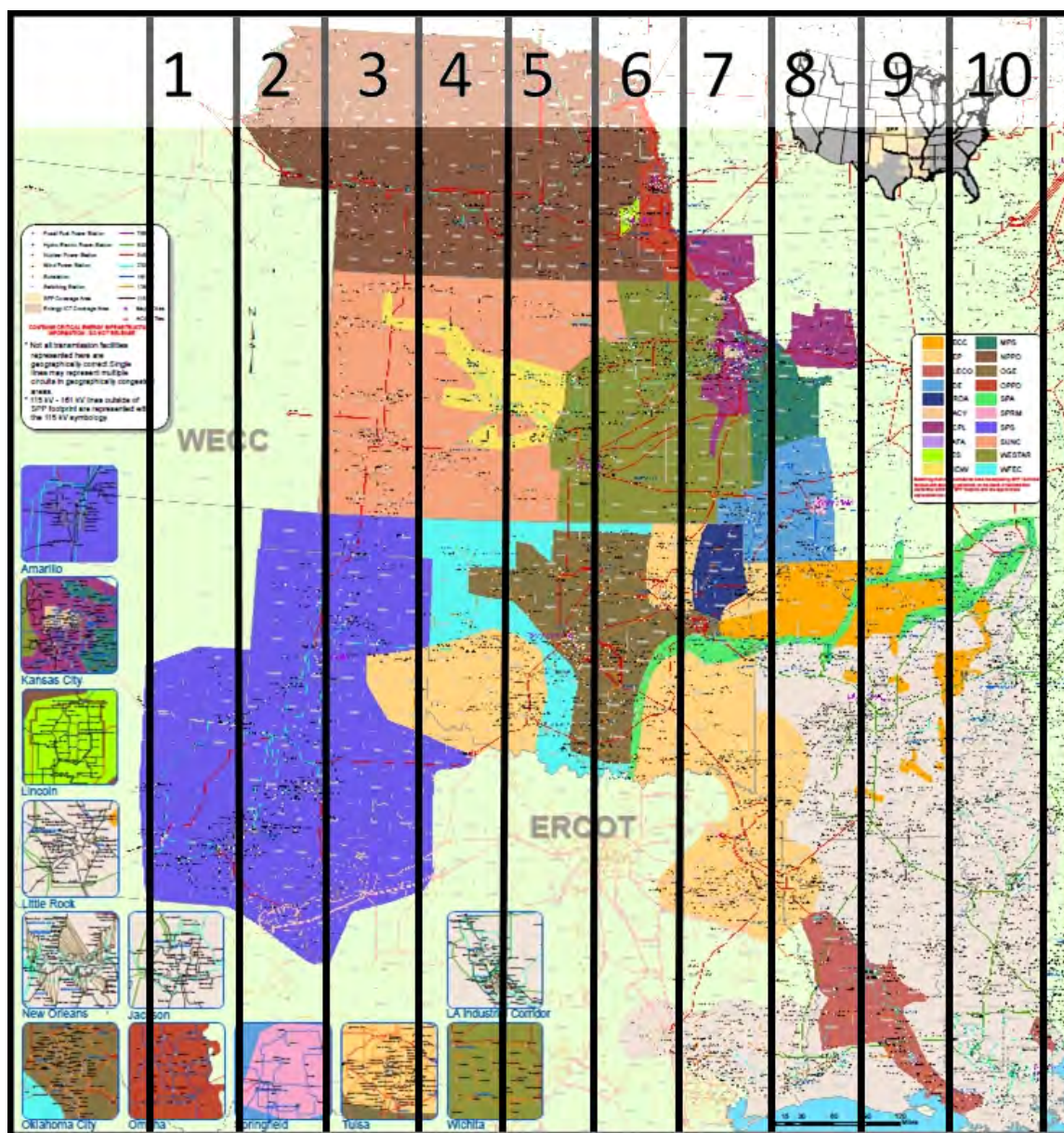


Figure 1: SPP Split into ten equal geographic sections

This method of identifying specific regions allows the quantification of transmission characteristics within a geographic region and improves upon the standard use of stakeholder boundaries. The background map in Figure 1 shows the territories overseen by each of SPP's Balancing Authorities. The non-rectangular characteristic of each area makes it difficult to evaluate the ability for the systems western and eastern sides to work together. The diagram shown in Figure 2 reiterates that the Balancing Authority boundaries do not represent the system's eastern or western sections. The ten west to east regions are shown at the top of the diagram. The Balancing Authorities are listed below the region names and spread over the regions in which they are found. The vast spread of many of the areas strongly illustrates the need for a geographic analysis if any measure of the west to east support provided by the Priority Projects is to be pursued.

| 1   | 2 | 3                | 4    | 5    | 6    | 7    | 8    | 9 | 10 |  |  |
|-----|---|------------------|------|------|------|------|------|---|----|--|--|
|     |   |                  | AEPW |      |      |      |      |   |    |  |  |
|     |   | MIDW             | EMDE |      |      |      | CELE |   |    |  |  |
|     |   |                  |      | GRDA |      | SPRM | LEPA |   |    |  |  |
|     |   |                  |      | LES  | INDN |      |      |   |    |  |  |
|     |   | SUNC (with MKEC) |      |      |      | KACP |      |   |    |  |  |
|     |   |                  |      |      | BPU  |      |      |   |    |  |  |
|     |   |                  |      |      | OMPA | LAFA |      |   |    |  |  |
|     |   |                  |      |      | GMO  |      |      |   |    |  |  |
|     |   | NPPD             |      |      |      |      |      |   |    |  |  |
|     |   |                  |      | OKGE |      |      |      |   |    |  |  |
| SPS |   |                  |      | OPPD |      |      |      |   |    |  |  |
|     |   |                  |      |      | SWPA |      |      |   |    |  |  |
|     |   | WERE             |      |      |      |      |      |   |    |  |  |
|     |   | WFEC             |      |      |      |      |      |   |    |  |  |

Figure 2: SPP Balancing Authorities found in each geographic Region

To better understand the location of the pivotal features of the grid in a west to east manner, the demand and capacity were tabulated within each region and summed. The charts shown in Figure 3 and Figure 4 show that the load and generation are focused in regions 5, 6 and 7. The load and capacity values shown in these charts were obtained by summing the load and generation capacity of each of the buses within each region. The load was taken at 1400 hours on February 19<sup>th</sup>, 2010. The generation capacity was obtained from the Summer 2014 STEP powerflow model used in the analysis.



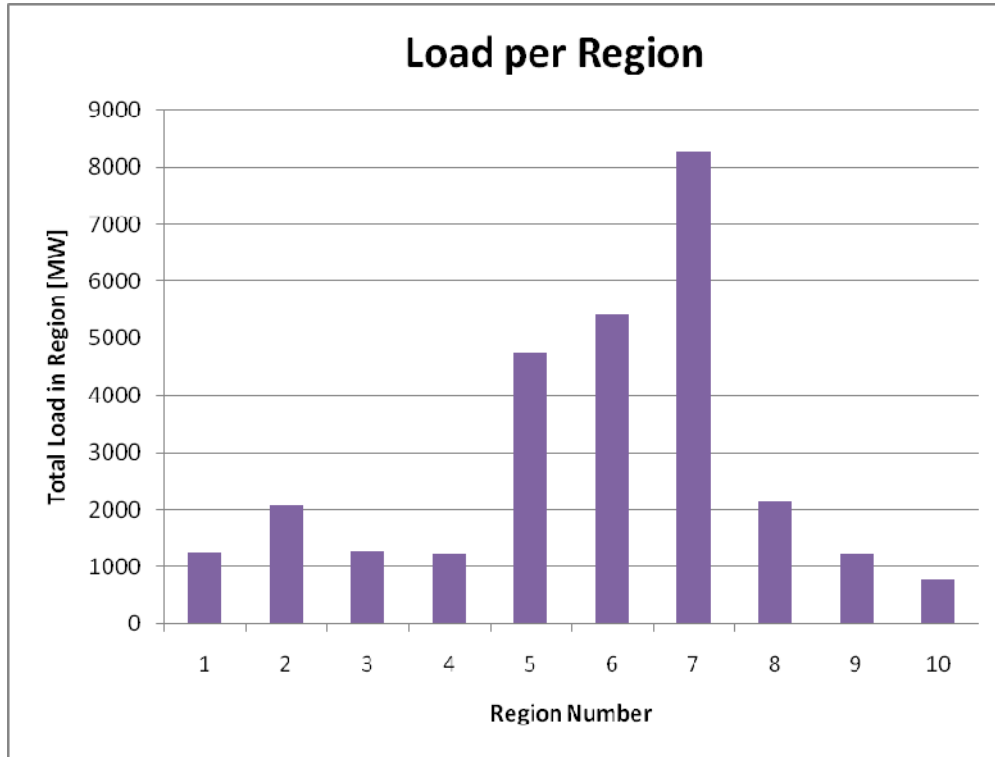


Figure 3: Load demand within each west to east region

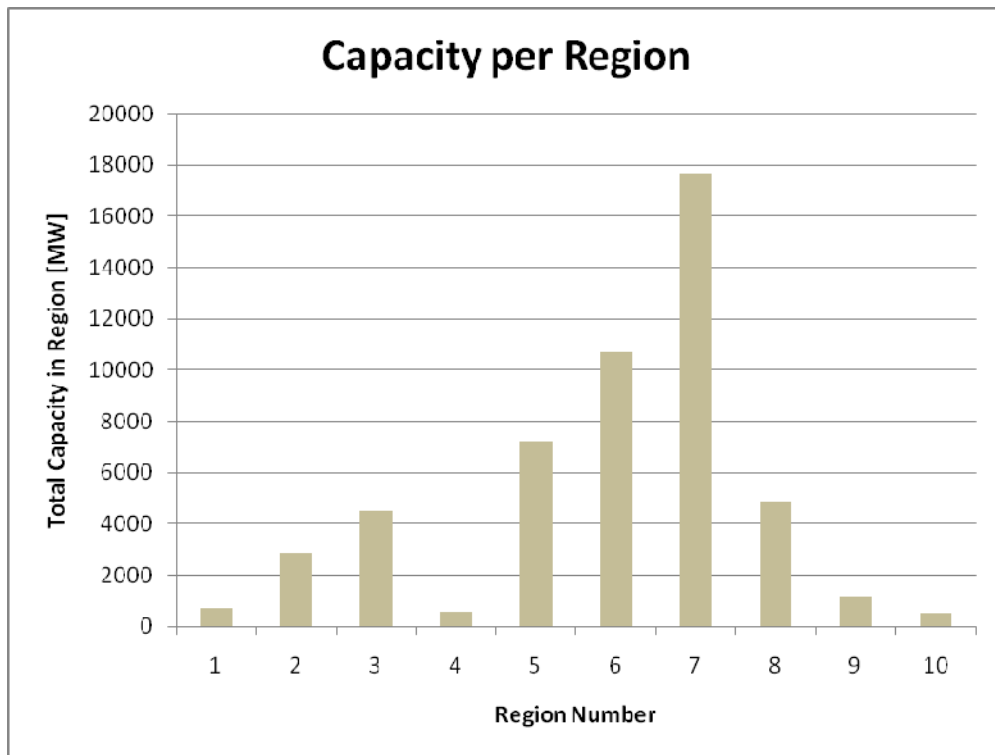


Figure 4: Generation capacity within each west to east region

The high concentration of demand and capacity within regions 5, 6 and 7 makes intuitive sense. The major load centers such as Oklahoma City, Tulsa, Kansas City, Omaha, the Missouri River and Northwest Arkansas are contained within regions 5, 6 and 7. Historically, generation sources have been sighted near those load centers; therefore the location of the generation makes intuitive sense as well.

The ten regions will be referred to by number throughout this report. Experimentally, regions 1, 2, 3 and 4 (super-region 1234) were grouped into a generic western case and a transfer was studied from that super-region to a super-region containing regions 5, 6, 7 and 8 (super-region 5678). This was done to see the impact upon the analysis when a larger geographic region was studied.

### Power Transfer and FCITC Analysis

Measuring the effectiveness of the Priority Projects at integrating the west and east portions of the SPP transmission system was accomplished by calculating the amount of power that can be transferred from each of the ten regions to each of the other regions to its east. The diagram in Figure 5 illustrates the four eastward transfers that source out of region 6. Each of the other regions (except for region 10 because it was the farthest east) were similarly treated.

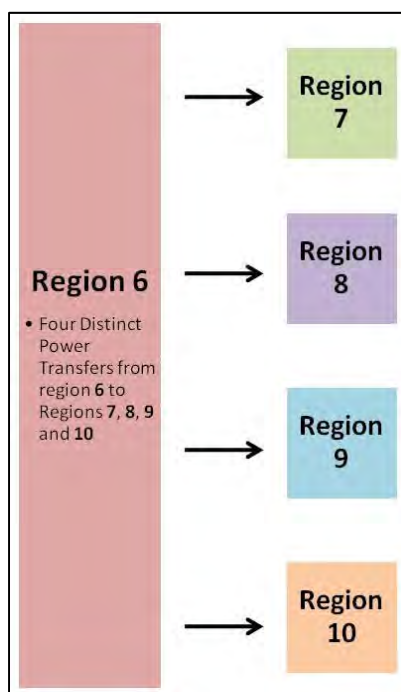


Figure 5: Eastward Transfers from Region 6 to Regions 7, 8, 9 and 10 as an example of eastward transfers

The analysis of each region and its easterly neighbors resulted in forty-five distinct transfers with various levels of allowable transfer power. The amount of power that can be transferred from one region to another was determined using the First Contingency Incremental Transfer Capability (FCITC) calculation. The FCITC calculation measures the amount of power that can be transferred in light of system contingencies. An increase in the power transfer capability (an increase in the FCITC values) from the west to the east indicates that the west and east transmission systems are more integrated.

The analysis looked at all SPP facilities above 100 kV and used a transfer magnitude of up to 50,000 MW to ensure that several limitations for each transfer would be encountered. The results of this analysis: the FCITC values, limiting elements and transfers are provided at the end of this report in Table 1 and Table 2.

### Models & Software

SPP utilizes SIEMENS PSS® MUST and standard models in this analysis to compute the FCITC values. The MUST tool allows the creation of the desired transfers from one area to another. SPP chooses certain settings that increases the generation in one area, while simultaneously decreasing generation in another area. For this analysis the generation was always raised in the western of the two selected regions. The nuclear plant outputs were not altered at the Fort Calhoun, Wolf Creek or Cooper plants.

### Analysis

The analysis involved five primary steps as shown in Figure 7. The 2014 Summer STEP model, with and without Priority Projects, was analyzed using the ten west to east geographic regions as subsystems within MUST. Forty-five eastward power transfers were studied and the resulting limiting elements and FCITC values were tabulated for each powerflow case (a basecase set of FCITC values and a change case set of FCITC values).

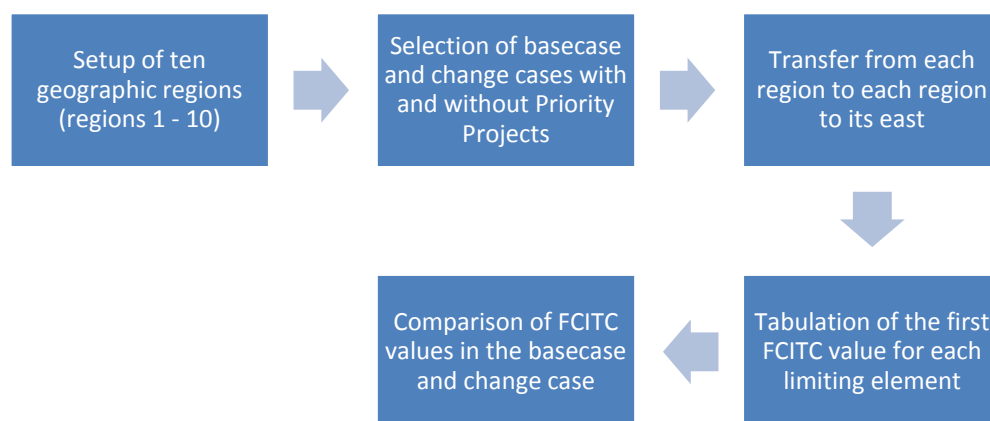


Figure 6: Five Primary Analysis Steps

The calculation of each FCITC value refers specifically to a limiting and contingent element pair. The overload of the limiting element for a given contingency causes the limitation on the transfer. Contingency elements were ignored in this analysis. The limiting element with the lowest FCITC value is the “most limiting element”, the next lowest FCITC value is the “second most limiting”, and so on. The transfers and limiting elements shown in Figure 8 give a sample of the way the FCITC is tied to a particular transfer and limiting element.

| From | To | FCITC | Limiting Constraint |
|------|----|-------|---------------------|
|------|----|-------|---------------------|

|                |            |      |                                             |
|----------------|------------|------|---------------------------------------------|
| <b>REGION3</b> | REGION5_I  | 3600 | 345 kV line from Gentleman to Sweetwater    |
| <b>REGION3</b> | REGION6_I  | 3300 | 345 kV line from Sweetwater to Grand Island |
| <b>REGION3</b> | REGION10_I | 3100 | 345 kV line from West Gardner to Stillwell  |

Figure 7: Sample of FCITC values and limiting elements

The FCITC values for all limiting elements for each transfer were tabulated and the difference between the FCITC found in the basecase and the FCITC found in the change case was calculated. The result is the improvement in the FCITC value for each transfer. Positive values indicate that the FCITC increased by a given magnitude (greater ability to transfer power), negative values indicate that the FCITC decreased (less ability to transfer power).

In addition to an computation of the improvement to the first limiting element, the subsequent limiting elements was studied. The capacity added to the system by the Priority Projects provides benefit to many of the system elements beyond the first limiting one. The diagram shown in Figure 6 reveals the improvements to the FCITC for a transfer from region 6 to region 7. The lines shown in the diagram includes a number indicating the ranking of the limiting element and the improvement to the FCITC value (FCITC with Priority Projects minus FCITC without Priority Projects). The charts shown in Figure 9, Figure 10, Figure 11 and Figure 12 show this data is summed form. The improvement shown to the first limiting element for this transfer in Figure 9 is from the first limiting element with a 126 MW improvement. The chart showing the improvement to the first four limiting elements is the sum of the first, second, third and fourth elements (126 MW + 2 MW + 221 MW + 50 MW = 399 MW). The charts for the first ten and twenty limiting elements continue in the same vein.

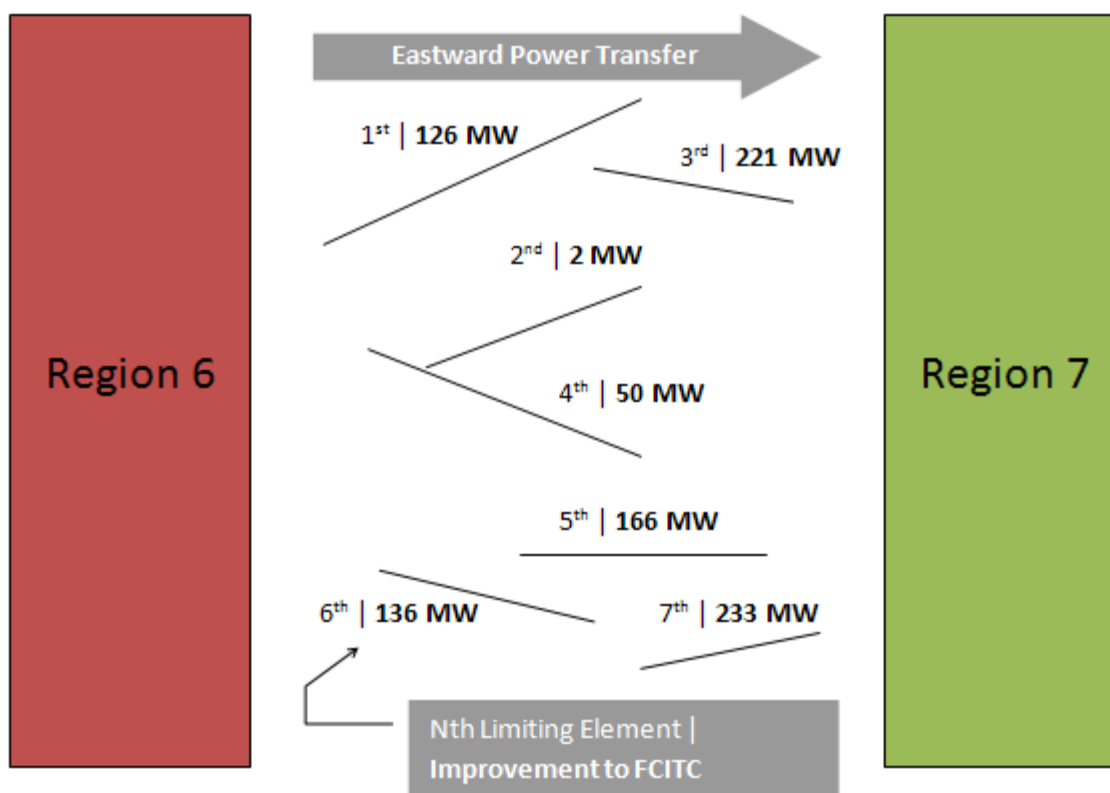


Figure 8: Improvements to Limiting Elements for Transfer from Region 6 to Region 7

Two categories of improvements were considered, near-term and far-term. The near-term analysis included a measure of the improvement in the FCITC for the most limiting element for a given transfer and the improvement in the FCITC of the first four limiting elements for a given transfer. Looking at the most limiting and the four most limiting elements shows the immediate benefits once the Priority Projects are in place and the continued short-term benefits as other immediate limitations are addressed. The far-term analysis included a measure of the improvement in the FCITC for the first ten limiting elements for a given transfer and the improvement in the FCITC of the first twenty limiting elements for a given transfer. The long-term analysis shows the future improvements to the FCITC that will be reaped as a result of the Priority Projects as more and more system limitations are upgraded in future years.

Some transfers never showed a violation, such as the experimental transfer from the super-regions 1234 and 5678. This resulted from a finite transfer magnitude of 50 GW not encountering a limitation. The charts show the first, first four, first ten and first twenty limiting transmission elements. A particular transfer may have only experience six limitations. In that case, the improvement to the first, first four, the first six and first six would be shown in the charts.

## Results

The improvement to the first limiting element was concentrated in the most western regions, regions 1 and 2. The transfers in regions 6 and 7 were mixed, showing great improvement from region 6 to region

7 but decreases for transfers into region 8. Thirty of the forty five transfers showed an improvement in the power transfer from the western regions. This data is shown in Figure 9.

The improvement to the transfer capability across the first four limiting elements continued to show the same trend indicated by the first limiting element. The transfers out of the most western regions continued to improve. The data indicates that 100 MW more could be transferred from region 2 to region 7 if the first three limiting elements were mitigated (a 100 MW limitation was encountered at the fourth element). This data is shown in Figure 10.

The improvement to the transfer capability across the first ten limiting elements continued to show the trend identified by the first and first four limiting elements. The data indicates that more than 1500 MW more could be transferred from region 6 to region 7 if the first three limiting elements were mitigated (a 1800 MW limitation was encountered at the fourth element). This data is shown in Figure 11.

The improvement to the transfer capability across the first twenty limiting elements shows that the trend continues. The data is noteworthy for its continuation of the trend, and provides a futuristic indicator of how the Priority Projects impact the transmission grid in the future. This data is shown in Figure 12.

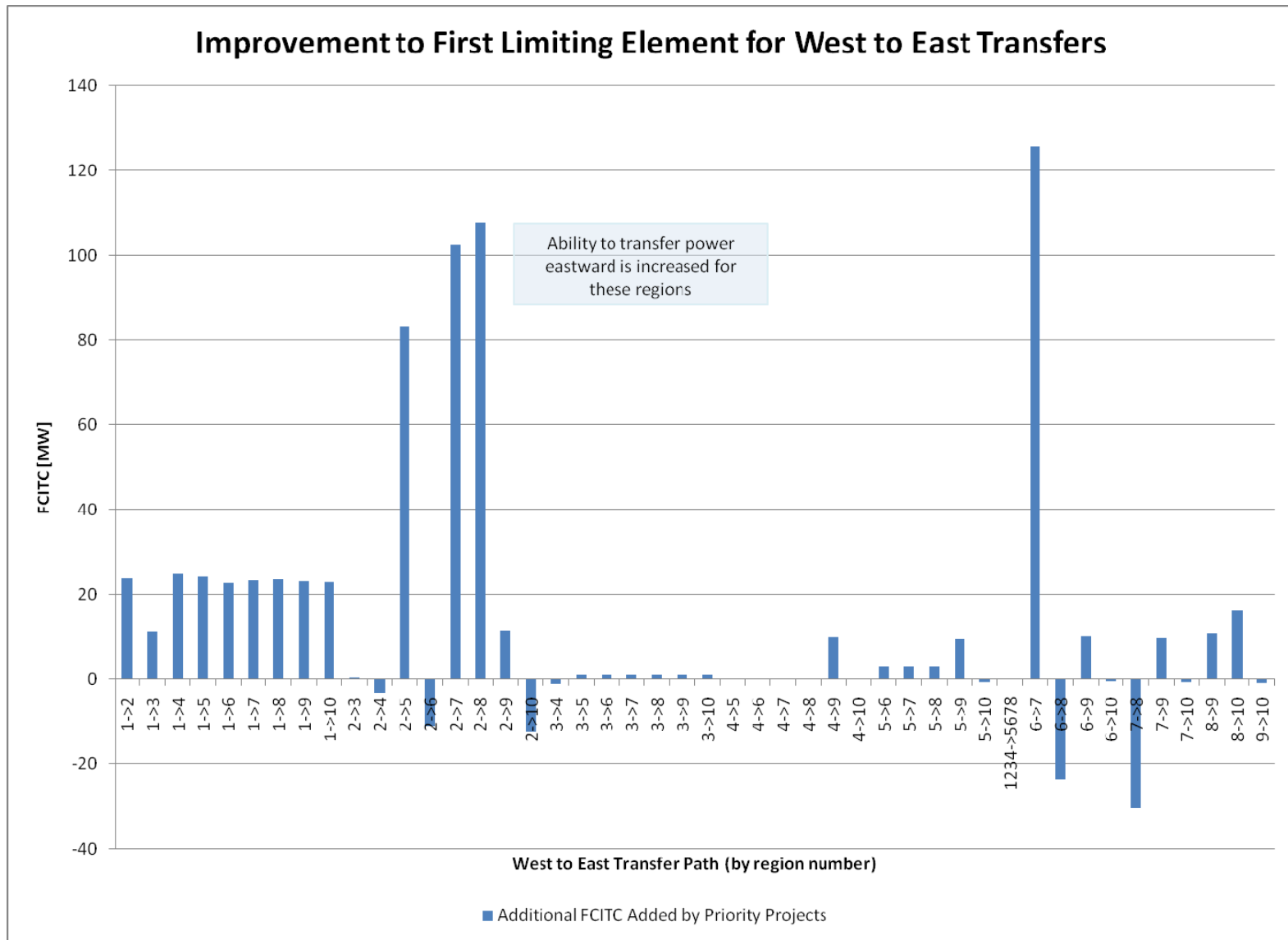


Figure 9: The immediate increase in the ability to transfer power eastward as a result of the Priority Projects

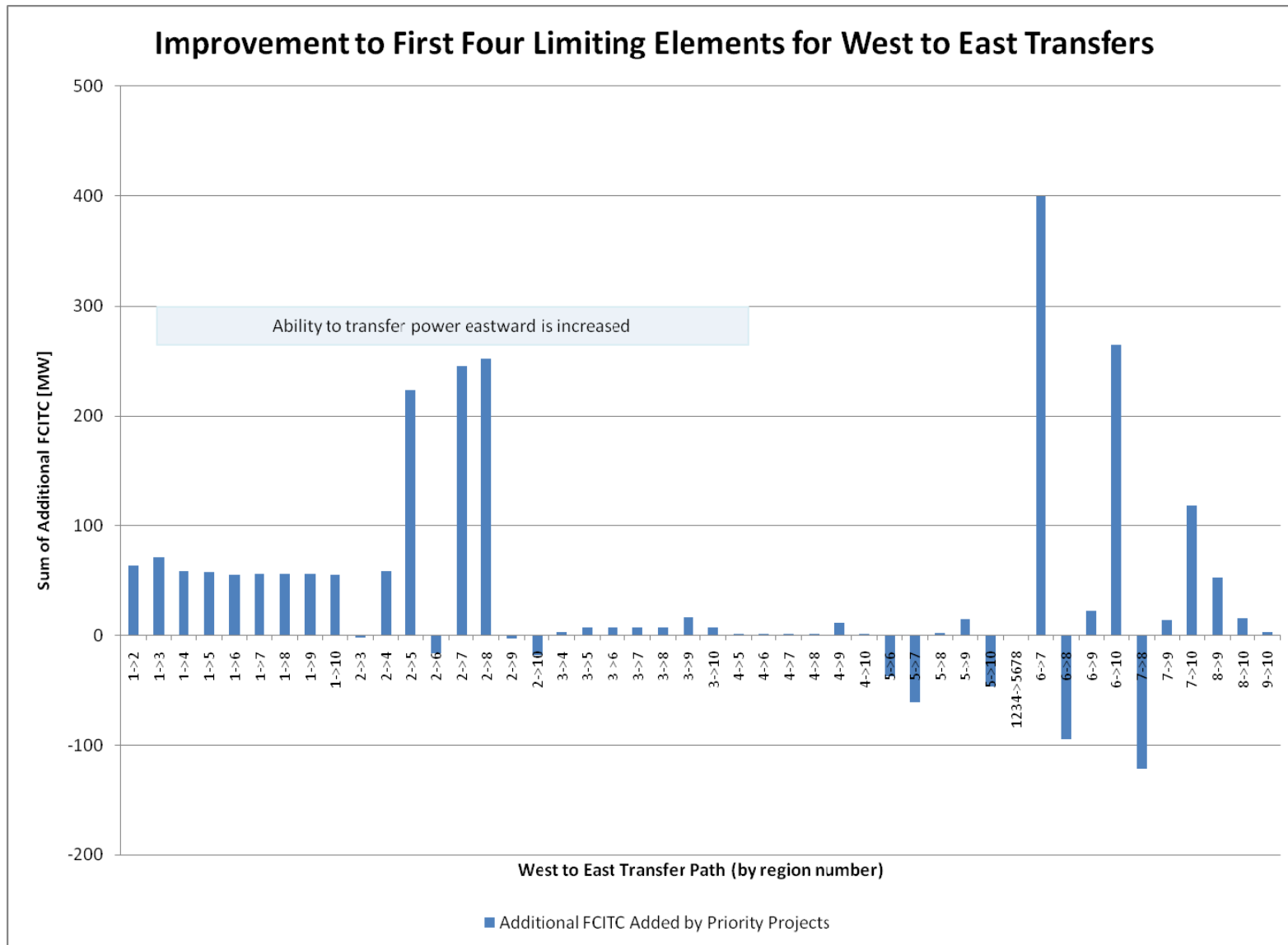


Figure 10: The near-term increase in the ability to transfer power eastward as a result of the Priority Projects



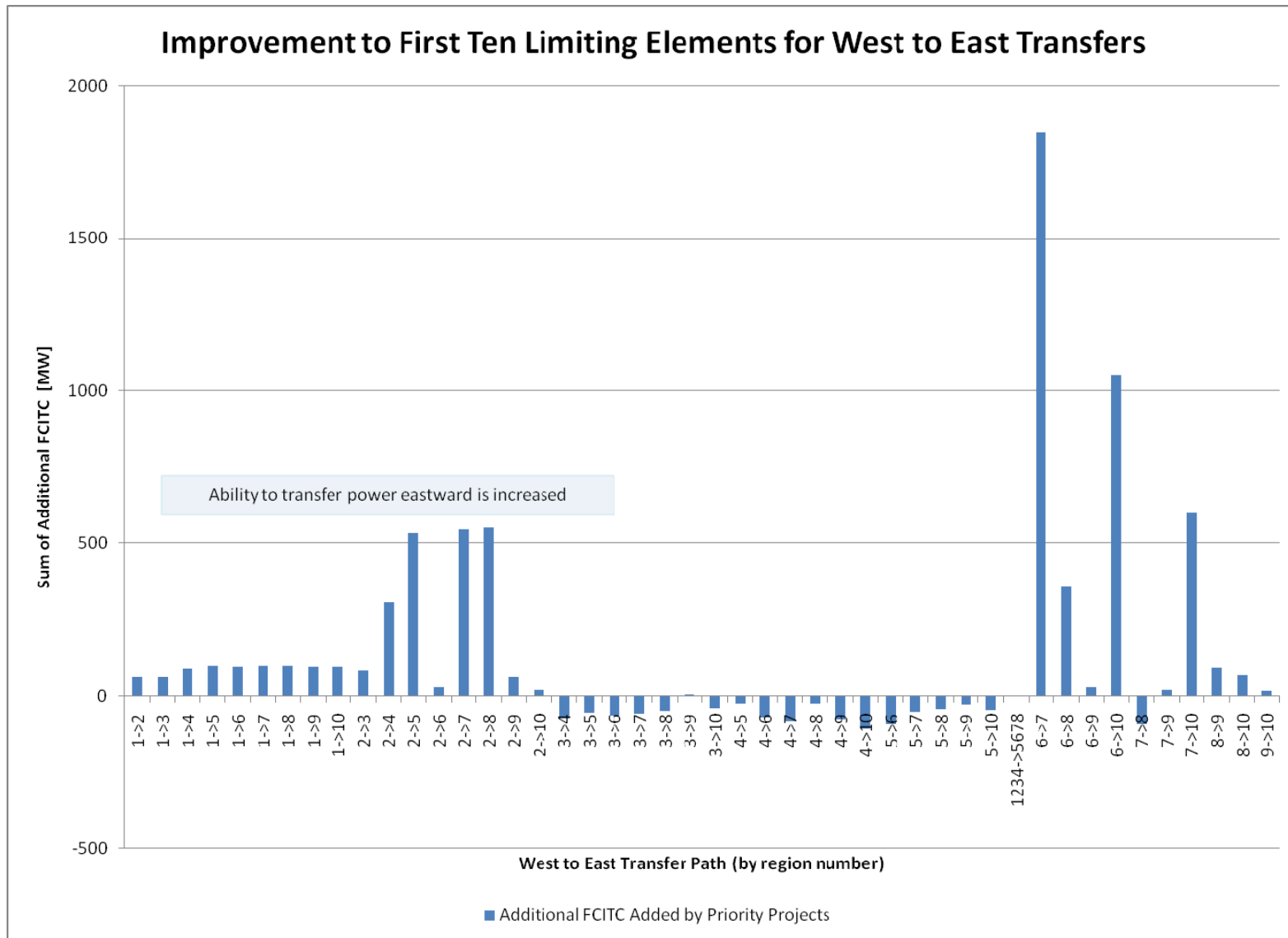


Figure 11: The long-term increase in the ability to transfer power eastward as a result of the Priority Projects for the first ten limiting elements

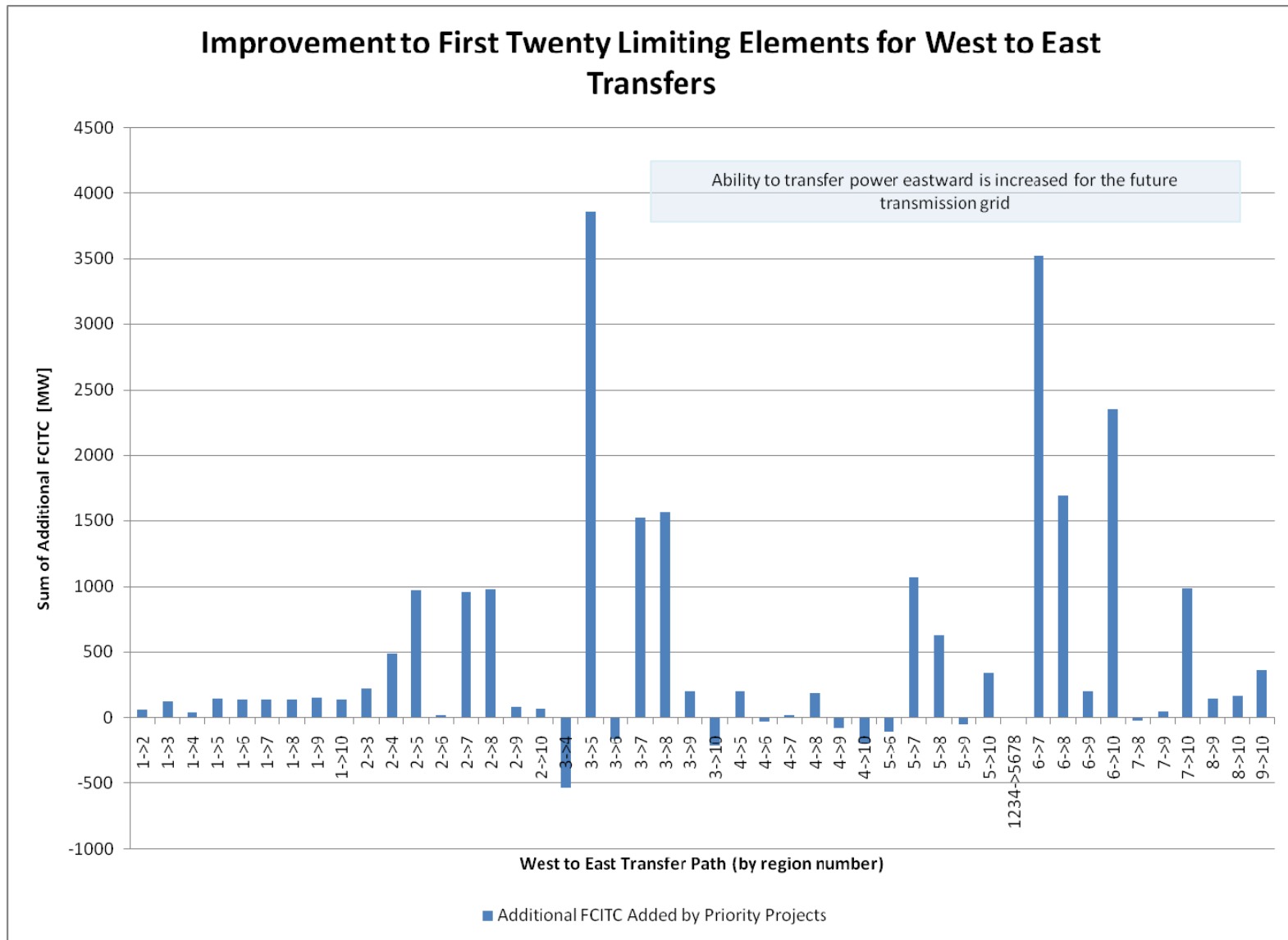


Figure 12: The long-term increase in the ability to transfer power eastward as a result of the Priority Projects for the first twenty limiting elements

## Conclusions

The calculations show that the Priority Projects immediately increase the ability to transfer power in two-thirds of the eastward paths by connecting the western and eastern areas. The analysis indicates on a detailed level that the greater rewards will be reaped in the future as more of the underlying limitations are mitigated. The increase in transfer capability correlates exactly with the stated goal; that the Priority Projects enhance the interface between the western and eastern transmission systems in SPP.

### FCITC Calculation Results

The following tables show the FCITC results for the basecase and the change case. The first thirty limiting elements are shown for each transfer. An “\_I” in the region name indicates that the region received the transfer.

| From    | To        | FCITC | TDF     | Limiting Constraint                               | Contingency                                        |
|---------|-----------|-------|---------|---------------------------------------------------|----------------------------------------------------|
| REGION1 | REGION2_I | -363  | -0.0435 | 524908 ROOSEVELT 3 115 524909 ROSEVELT_N 6 230 1  | C:524874 OASIS 3 115 524875 OASIS 6 230 1          |
| REGION1 | REGION2_I | -180  | -0.0575 | 524874 OASIS 3 115 524875 OASIS 6 230 1           | C:524908 ROOSEVELT 3 115 524909 ROSEVELT_N 6 230 1 |
| REGION1 | REGION2_I | -88   | -0.0356 | 524822 CURRY 3 115 524908 ROOSEVELT 3 115 2       | C:524874 OASIS 3 115 524875 OASIS 6 230 1          |
| REGION1 | REGION2_I | 158   | -0.0724 | 527482 CHAVES_CO 3 115 527483 CHAVES_CO 6 230 2   | C:527482 CHAVES_CO 3 115 527483 CHAVES_CO 6 230 1  |
| REGION1 | REGION2_I | 286   | 0.0746  | 527482 CHAVES_CO 3 115 527546 SAMSON3 115 1       | C:527482 CHAVES_CO 3 115 527501 URTON3 115 1       |
| REGION1 | REGION2_I | 301   | 0.0744  | 527482 CHAVES_CO 3 115 527501 URTON3 115 1        | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |
| REGION1 | REGION2_I | 340   | -1.0000 | 524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1      | C:524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1 |
| REGION1 | REGION2_I | 340   | 1.0000  | 524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1  | C:524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1     |
| REGION1 | REGION2_I | 424   | -1.0000 | 524885 SN_JUAN_TAP6 230 524889 SN_JUAN_WND6 230 1 | Base Case                                          |
| REGION1 | REGION2_I | 568   | 0.8708  | 524875 OASIS 6 230 524915 SW_4K33 6 230 1         | C:524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1 |
| REGION1 | REGION2_I | 582   | 0.0746  | 527546 SAMSON3 115 527564 ROSWLL_INT3 115 1       | C:527482 CHAVES_CO 3 115 527501 URTON3 115 1       |
| REGION1 | REGION2_I | 638   | 0.7977  | 527483 CHAVES_CO 6 230 527800 EDDY_CNTY 6 230 1   | C:524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1     |
| REGION1 | REGION2_I | 695   | 0.0744  | 527501 URTON3 115 527522 ROSWELL_CTY3 115 1       | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |
| REGION1 | REGION2_I | 783   | 0.0744  | 527534 BRASHER_TP 3 115 527564 ROSWLL_INT3 115 1  | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |
| REGION1 | REGION2_I | 825   | -0.0806 | 524669 DS-#20 3 115 524822 CURRY 3 115 1          | C:524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1 |
| REGION1 | REGION2_I | 909   | -0.0693 | 525480 PLANTX 3 115 525481 PLANTX 6 230 1         | C:525531 TOLK_WEST 6 230 525637 LAMB_CNTY 6 230 1  |
| REGION1 | REGION2_I | 926   | -0.0763 | 527482 CHAVES_CO 3 115 527483 CHAVES_CO 6 230 1   | C:527482 CHAVES_CO 3 115 527483 CHAVES_CO 6 230 2  |
| REGION1 | REGION2_I | 932   | 0.1921  | 524874 OASIS 3 115 524924 PORTALES 3 115 1        | C:524875 OASIS 6 230 524915 SW_4K33 6 230 1        |
| REGION1 | REGION2_I | 954   | -0.1727 | 524863 FE-CHZPLT 3 115 524874 OASIS 3 115 1       | C:524875 OASIS 6 230 524915 SW_4K33 6 230 1        |
| REGION1 | REGION2_I | 967   | 0.2024  | 527564 ROSWLL_INT3 115 527597 TWEEDY3 115 1       | C:524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1     |
| REGION1 | REGION2_I | 1036  | 0.2024  | 527597 TWEEDY3 115 527798 EDDY_CNTY 3 115 1       | C:524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1     |
| REGION1 | REGION2_I | 1067  | -0.1727 | 524764 NORRIS_TP 3 115 524863 FE-CHZPLT 3 115 1   | C:524875 OASIS 6 230 524915 SW_4K33 6 230 1        |
| REGION1 | REGION2_I | 1099  | -0.0806 | 524662 PARMER_CO 3 115 524669 DS-#20 3 115 1      | C:524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1 |
| REGION1 | REGION2_I | 1124  | -0.0806 | 524648 CARGILL 3 115 524662 PARMER_CO 3 115 1     | C:524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1 |
| REGION1 | REGION2_I | 1141  | 0.1727  | 524764 NORRIS_TP 3 115 524822 CURRY 3 115 1       | C:524875 OASIS 6 230 524915 SW_4K33 6 230 1        |

|         |           |      |         |                                                   |                                                     |
|---------|-----------|------|---------|---------------------------------------------------|-----------------------------------------------------|
| REGION1 | REGION2_I | 1218 | -0.3416 | 527849 LEA_CNTY 6 230 527865 CUNNINGHAM 6 230 1   | C:524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1      |
| REGION1 | REGION2_I | 1236 | 0.2885  | 511456 O.K.U.-7 345 525832 TUCO_INT 7 345 1       | C:524885 SN_JUAN_TAP6 230 524889 SN_JUAN_WND6 230 1 |
| REGION1 | REGION2_I | 1268 | -0.1047 | 528160 CARLSBAD 3 115 528178 PECOS 3 115 1        | C:524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1      |
| REGION1 | REGION2_I | 1304 | 0.0806  | 524648 CARGILL 3 115 524655 FRIONA 3 115 1        | C:524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1  |
| REGION1 | REGION2_I | 1333 | 0.0744  | 527522 ROSWELL_CTY3 115 527534 BRASHER_TP 3 115 1 | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1       |
| REGION1 | REGION3_I | -218 | -0.0722 | 524908 ROOSEVELT 3 115 524909 ROSEVELT_N 6 230 1  | C:524874 OASIS 3 115 524875 OASIS 6 230 1           |
| REGION1 | REGION3_I | -120 | -0.0858 | 524874 OASIS 3 115 524875 OASIS 6 230 1           | C:524908 ROOSEVELT 3 115 524909 ROSEVELT_N 6 230 1  |
| REGION1 | REGION3_I | -53  | -0.0592 | 524822 CURRY 3 115 524908 ROOSEVELT 3 115 2       | C:524874 OASIS 3 115 524875 OASIS 6 230 1           |
| REGION1 | REGION3_I | 135  | -0.0621 | 525056 BC-EARTH 3 115 525480 PLANTX 3 115 1       | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1      |
| REGION1 | REGION3_I | 174  | -0.0658 | 527482 CHAVES_CO 3 115 527483 CHAVES_CO 6 230 2   | C:527482 CHAVES_CO 3 115 527483 CHAVES_CO 6 230 1   |
| REGION1 | REGION3_I | 315  | 0.0678  | 527482 CHAVES_CO 3 115 527546 SAMSON3 115 1       | C:527482 CHAVES_CO 3 115 527501 URTON3 115 1        |
| REGION1 | REGION3_I | 331  | 0.0676  | 527482 CHAVES_CO 3 115 527501 URTON3 115 1        | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1       |
| REGION1 | REGION3_I | 340  | 1.0000  | 524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1  | C:524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1      |
| REGION1 | REGION3_I | 340  | -1.0000 | 524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1      | C:524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1  |
| REGION1 | REGION3_I | 359  | -0.0499 | 526475 YUMA_INTG 3 115 526524 WOLFFORTH 3 115 1   | C:525830 TUCO_INT 6 230 526161 CARLISLE 6 230 1     |
| REGION1 | REGION3_I | 424  | -1.0000 | 524885 SN_JUAN_TAP6 230 524889 SN_JUAN_WND6 230 1 | Base Case                                           |
| REGION1 | REGION3_I | 466  | -0.1104 | 524669 DS-#20 3 115 524822 CURRY 3 115 1          | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1      |
| REGION1 | REGION3_I | 575  | 0.8590  | 524875 OASIS 6 230 524915 SW_4K33 6 230 1         | C:524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1  |
| REGION1 | REGION3_I | 637  | 0.7992  | 527483 CHAVES_CO 6 230 527800 EDDY_CNTY 6 230 1   | C:524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1      |
| REGION1 | REGION3_I | 640  | 0.0678  | 527546 SAMSON3 115 527564 ROSWLL_INT3 115 1       | C:527482 CHAVES_CO 3 115 527501 URTON3 115 1        |
| REGION1 | REGION3_I | 664  | 0.2571  | 525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1    | C:526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1     |
| REGION1 | REGION3_I | 665  | -0.1104 | 524662 PARMER_CO 3 115 524669 DS-#20 3 115 1      | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1      |
| REGION1 | REGION3_I | 684  | -0.1104 | 524648 CARGILL 3 115 524662 PARMER_CO 3 115 1     | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1      |
| REGION1 | REGION3_I | 688  | -0.4201 | 525481 PLANTX 6 230 525531 TOLK_WEST 6 230 1      | C:525481 PLANTX 6 230 525524 TOLK_EAST 6 230 2      |
| REGION1 | REGION3_I | 698  | -0.4167 | 525481 PLANTX 6 230 525524 TOLK_EAST 6 230 2      | C:525481 PLANTX 6 230 525531 TOLK_WEST 6 230 1      |
| REGION1 | REGION3_I | 706  | -0.1265 | 526176 DOUD3 115 526475 YUMA_INTG 3 115 1         | C:526269 LUBBCK_STH6 230 526525 WOLFFORTH 6 230 1   |
| REGION1 | REGION3_I | 765  | 0.0676  | 527501 URTON3 115 527522 ROSWELL_CTY3 115 1       | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1       |
| REGION1 | REGION3_I | 780  | -0.0807 | 525480 PLANTX 3 115 525481 PLANTX 6 230 1         | C:525531 TOLK_WEST 6 230 525637 LAMB_CNTY 6 230 1   |
| REGION1 | REGION3_I | 781  | -0.0545 | 524863 FE-CHZPLT 3 115 524874 OASIS 3 115 1       | C:524822 CURRY 3 115 524908 ROOSEVELT 3 115 2       |
| REGION1 | REGION3_I | 815  | 0.1104  | 524648 CARGILL 3 115 524655 FRIONA 3 115 1        | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1      |

|         |           |      |         |                                                   |                                                    |
|---------|-----------|------|---------|---------------------------------------------------|----------------------------------------------------|
| REGION1 | REGION3_I | 829  | -0.1902 | 524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1      | C:525056 BC-EARTH 3 115 525480 PLANTX 3 115 1      |
| REGION1 | REGION3_I | 840  | -0.1101 | 524597 PANDAHFD 3 115 524606 HEREFORD 3 115 1     | C:524267 BUSHLAND 6 230 524623 DEAFSMITH 6 230 1   |
| REGION1 | REGION3_I | 862  | 0.0676  | 527534 BRASHER_TP 3 115 527564 ROSWLL_INT3 115 1  | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |
| REGION1 | REGION3_I | 905  | 0.1980  | 524874 OASIS 3 115 524924 PORTALES 3 115 1        | C:524875 OASIS 6 230 524915 SW_4K33 6 230 1        |
| REGION1 | REGION3_I | 923  | -0.1134 | 526524 WOLFFORTH 3 115 526736 TERRY 3 115 1       | C:526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1    |
| REGION1 | REGION4_I | -236 | -0.0667 | 524908 ROOSEVELT 3 115 524909 ROSEVELT_N 6 230 1  | C:524874 OASIS 3 115 524875 OASIS 6 230 1          |
| REGION1 | REGION4_I | -128 | -0.0805 | 524874 OASIS 3 115 524875 OASIS 6 230 1           | C:524908 ROOSEVELT 3 115 524909 ROSEVELT_N 6 230 1 |
| REGION1 | REGION4_I | -58  | -0.0547 | 524822 CURRY 3 115 524908 ROOSEVELT 3 115 2       | C:524874 OASIS 3 115 524875 OASIS 6 230 1          |
| REGION1 | REGION4_I | 173  | -0.0660 | 527482 CHAVES_CO 3 115 527483 CHAVES_CO 6 230 2   | C:527482 CHAVES_CO 3 115 527483 CHAVES_CO 6 230 1  |
| REGION1 | REGION4_I | 177  | -0.0475 | 525056 BC-EARTH 3 115 525480 PLANTX 3 115 1       | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION4_I | 234  | 0.0872  | 530553 S HAYS 3 115 530562 HAYS 3 115 1           | C:530558 KNOLL 6 230 530561 KNOLL 3 115 1          |
| REGION1 | REGION4_I | 296  | -0.1148 | 526475 YUMA_INTG 3 115 526524 WOLFFORTH 3 115 1   | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1   |
| REGION1 | REGION4_I | 314  | 0.0680  | 527482 CHAVES_CO 3 115 527546 SAMSON3 115 1       | C:527482 CHAVES_CO 3 115 527501 URTON3 115 1       |
| REGION1 | REGION4_I | 330  | 0.0678  | 527482 CHAVES_CO 3 115 527501 URTON3 115 1        | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |
| REGION1 | REGION4_I | 340  | 1.0000  | 524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1  | C:524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1     |
| REGION1 | REGION4_I | 340  | -1.0000 | 524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1      | C:524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1 |
| REGION1 | REGION4_I | 407  | 0.0872  | 530562 HAYS 3 115 530591 VINE 3 115 1             | C:530558 KNOLL 6 230 530561 KNOLL 3 115 1          |
| REGION1 | REGION4_I | 424  | -1.0000 | 524885 SN_JUAN_TAP6 230 524889 SN_JUAN_WND6 230 1 | Base Case                                          |
| REGION1 | REGION4_I | 515  | -0.0999 | 524669 DS-#20 3 115 524822 CURRY 3 115 1          | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION4_I | 543  | 0.3147  | 525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1    | C:526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1    |
| REGION1 | REGION4_I | 574  | 0.8614  | 524875 OASIS 6 230 524915 SW_4K33 6 230 1         | C:524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1 |
| REGION1 | REGION4_I | 589  | 0.2557  | 514785 WOODWRD4 138 515785 WINDFRM4 138 1         | C:3Wnd: OPEN B\$1035 WOODWRD2 1                    |
| REGION1 | REGION4_I | 593  | -0.1148 | 526176 DOUD3 115 526475 YUMA_INTG 3 115 1         | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1   |
| REGION1 | REGION4_I | 637  | 0.7992  | 527483 CHAVES_CO 6 230 527800 EDDY_CNTY 6 230 1   | C:524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1     |
| REGION1 | REGION4_I | 637  | -0.0872 | 530561 KNOLL 3 115 530581 N HAYS3 115 1           | C:530558 KNOLL 6 230 530561 KNOLL 3 115 1          |
| REGION1 | REGION4_I | 639  | 0.0680  | 527546 SAMSON3 115 527564 ROSWLL_INT3 115 1       | C:527482 CHAVES_CO 3 115 527501 URTON3 115 1       |
| REGION1 | REGION4_I | 736  | -0.0999 | 524662 PARMER_CO 3 115 524669 DS-#20 3 115 1      | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION4_I | 747  | -0.0842 | 525480 PLANTX 3 115 525481 PLANTX 6 230 1         | C:525531 TOLK_WEST 6 230 525637 LAMB_CNTY 6 230 1  |
| REGION1 | REGION4_I | 756  | -0.0999 | 524648 CARGILL 3 115 524662 PARMER_CO 3 115 1     | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION4_I | 763  | 0.0678  | 527501 URTON3 115 527522 ROSWELL_CTY3 115 1       | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |

|         |           |      |         |                         |                           |                           |                           |
|---------|-----------|------|---------|-------------------------|---------------------------|---------------------------|---------------------------|
| REGION1 | REGION4_I | 777  | -0.3723 | 525481 PLANTX 6 230     | 525531 TOLK_WEST 6 230 1  | C:525481 PLANTX 6 230     | 525524 TOLK_EAST 6 230 2  |
| REGION1 | REGION4_I | 787  | -0.3692 | 525481 PLANTX 6 230     | 525524 TOLK_EAST 6 230 2  | C:525481 PLANTX 6 230     | 525531 TOLK_WEST 6 230 1  |
| REGION1 | REGION4_I | 835  | -0.0510 | 524863 FE-CHZPLT 3 115  | 524874 OASIS 3 115 1      | C:524822 CURRY 3 115      | 524908 ROOSEVELT 3 115 2  |
| REGION1 | REGION4_I | 860  | 0.0678  | 527534 BRASHER_TP 3 115 | 527564 ROSWLL_INT3 115 1  | C:527482 CHAVES_CO 3 115  | 527546 SAMSON3 115 1      |
| REGION1 | REGION4_I | 869  | -0.1205 | 526524 WOLFFORTH 3 115  | 526736 TERRY 3 115 1      | C:526435 SUNDOWN 6 230    | 526525 WOLFFORTH 6 230 1  |
| REGION1 | REGION5_I | -239 | -0.0661 | 524908 ROOSEVELT 3 115  | 524909 ROSEVELT_N 6 230 1 | C:524874 OASIS 3 115      | 524875 OASIS 6 230 1      |
| REGION1 | REGION5_I | -129 | -0.0799 | 524874 OASIS 3 115      | 524875 OASIS 6 230 1      | C:524908 ROOSEVELT 3 115  | 524909 ROSEVELT_N 6 230 1 |
| REGION1 | REGION5_I | -58  | -0.0542 | 524822 CURRY 3 115      | 524908 ROOSEVELT 3 115 2  | C:524874 OASIS 3 115      | 524875 OASIS 6 230 1      |
| REGION1 | REGION5_I | 173  | -0.0660 | 527482 CHAVES_CO 3 115  | 527483 CHAVES_CO 6 230 2  | C:527482 CHAVES_CO 3 115  | 527483 CHAVES_CO 6 230 1  |
| REGION1 | REGION5_I | 184  | -0.0457 | 525056 BC-EARTH 3 115   | 525480 PLANTX 3 115 1     | C:524623 DEAFSMITH 6 230  | 525481 PLANTX 6 230 1     |
| REGION1 | REGION5_I | 292  | -0.1165 | 526475 YUMA_INTG 3 115  | 526524 WOLFFORTH 3 115 1  | C:525524 TOLK_EAST 6 230  | 525830 TUCO_INT 6 230 1   |
| REGION1 | REGION5_I | 313  | 0.0680  | 527482 CHAVES_CO 3 115  | 527546 SAMSON3 115 1      | C:527482 CHAVES_CO 3 115  | 527501 URTON3 115 1       |
| REGION1 | REGION5_I | 330  | 0.0679  | 527482 CHAVES_CO 3 115  | 527501 URTON3 115 1       | C:527482 CHAVES_CO 3 115  | 527546 SAMSON3 115 1      |
| REGION1 | REGION5_I | 340  | -1.0000 | 524875 OASIS 6 230      | 524885 SN_JUAN_TAP6 230 1 | C:524885 SN_JUAN_TAP6 230 | 527483 CHAVES_CO 6 230 1  |
| REGION1 | REGION5_I | 340  | 1.0000  | 524885 SN_JUAN_TAP6 230 | 527483 CHAVES_CO 6 230 1  | C:524875 OASIS 6 230      | 524885 SN_JUAN_TAP6 230 1 |
| REGION1 | REGION5_I | 424  | -1.0000 | 524885 SN_JUAN_TAP6 230 | 524889 SN_JUAN_WND6 230 1 | Base Case                 |                           |
| REGION1 | REGION5_I | 521  | -0.0986 | 524669 DS-#20 3 115     | 524822 CURRY 3 115 1      | C:524623 DEAFSMITH 6 230  | 525481 PLANTX 6 230 1     |
| REGION1 | REGION5_I | 533  | 0.3202  | 525524 TOLK_EAST 6 230  | 525830 TUCO_INT 6 230 1   | C:526435 SUNDOWN 6 230    | 526525 WOLFFORTH 6 230 1  |
| REGION1 | REGION5_I | 574  | 0.8616  | 524875 OASIS 6 230      | 524915 SW_4K33 6 230 1    | C:524885 SN_JUAN_TAP6 230 | 527483 CHAVES_CO 6 230 1  |
| REGION1 | REGION5_I | 584  | -0.1165 | 526176 DOUD3 115        | 526475 YUMA_INTG 3 115 1  | C:525524 TOLK_EAST 6 230  | 525830 TUCO_INT 6 230 1   |
| REGION1 | REGION5_I | 637  | 0.7992  | 527483 CHAVES_CO 6 230  | 527800 EDDY_CNTY 6 230 1  | C:524875 OASIS 6 230      | 524885 SN_JUAN_TAP6 230 1 |
| REGION1 | REGION5_I | 638  | 0.0680  | 527546 SAMSON3 115      | 527564 ROSWLL_INT3 115 1  | C:527482 CHAVES_CO 3 115  | 527501 URTON3 115 1       |
| REGION1 | REGION5_I | 743  | -0.0847 | 525480 PLANTX 3 115     | 525481 PLANTX 6 230 1     | C:525531 TOLK_WEST 6 230  | 525637 LAMB_CNTY 6 230 1  |
| REGION1 | REGION5_I | 745  | -0.0986 | 524662 PARMER_CO 3 115  | 524669 DS-#20 3 115 1     | C:524623 DEAFSMITH 6 230  | 525481 PLANTX 6 230 1     |
| REGION1 | REGION5_I | 762  | 0.0679  | 527501 URTON3 115       | 527522 ROSWELL_CTY3 115 1 | C:527482 CHAVES_CO 3 115  | 527546 SAMSON3 115 1      |
| REGION1 | REGION5_I | 766  | -0.0986 | 524648 CARGILL 3 115    | 524662 PARMER_CO 3 115 1  | C:524623 DEAFSMITH 6 230  | 525481 PLANTX 6 230 1     |
| REGION1 | REGION5_I | 787  | -0.3673 | 525481 PLANTX 6 230     | 525531 TOLK_WEST 6 230 1  | C:525481 PLANTX 6 230     | 525524 TOLK_EAST 6 230 2  |
| REGION1 | REGION5_I | 798  | -0.3642 | 525481 PLANTX 6 230     | 525524 TOLK_EAST 6 230 2  | C:525481 PLANTX 6 230     | 525531 TOLK_WEST 6 230 1  |
| REGION1 | REGION5_I | 842  | -0.0506 | 524863 FE-CHZPLT 3 115  | 524874 OASIS 3 115 1      | C:524822 CURRY 3 115      | 524908 ROOSEVELT 3 115 2  |
| REGION1 | REGION5_I | 857  | -0.1222 | 526524 WOLFFORTH 3 115  | 526736 TERRY 3 115 1      | C:526435 SUNDOWN 6 230    | 526525 WOLFFORTH 6 230 1  |

|         |           |      |         |                                                   |                                                    |
|---------|-----------|------|---------|---------------------------------------------------|----------------------------------------------------|
| REGION1 | REGION5_I | 859  | 0.0679  | 527534 BRASHER_TP 3 115 527564 ROSWLL_INT3 115 1  | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |
| REGION1 | REGION5_I | 882  | -0.1429 | 526160 CARLISLE 3 115 526176 DOUD3 115 1          | C:526269 LUBBCK_STH6 230 526525 WOLFFORTH 6 230 1  |
| REGION1 | REGION5_I | 902  | 0.2469  | 526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1     | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1   |
| REGION1 | REGION5_I | 903  | 0.1984  | 524874 OASIS 3 115 524924 PORTALES 3 115 1        | C:524875 OASIS 6 230 524915 SW_4K33 6 230 1        |
| REGION1 | REGION5_I | 913  | 0.0986  | 524648 CARGILL 3 115 524655 FRIONA 3 115 1        | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION6_I | -236 | -0.0667 | 524908 ROOSEVELT 3 115 524909 ROSEVELT_N 6 230 1  | C:524874 OASIS 3 115 524875 OASIS 6 230 1          |
| REGION1 | REGION6_I | -128 | -0.0805 | 524874 OASIS 3 115 524875 OASIS 6 230 1           | C:524908 ROOSEVELT 3 115 524909 ROSEVELT_N 6 230 1 |
| REGION1 | REGION6_I | -58  | -0.0547 | 524822 CURRY 3 115 524908 ROOSEVELT 3 115 2       | C:524874 OASIS 3 115 524875 OASIS 6 230 1          |
| REGION1 | REGION6_I | 173  | -0.0660 | 527482 CHAVES_CO 3 115 527483 CHAVES_CO 6 230 2   | C:527482 CHAVES_CO 3 115 527483 CHAVES_CO 6 230 1  |
| REGION1 | REGION6_I | 177  | -0.0474 | 525056 BC-EARTH 3 115 525480 PLANTX 3 115 1       | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION6_I | 296  | -0.1148 | 526475 YUMA_INTG 3 115 526524 WOLFFORTH 3 115 1   | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1   |
| REGION1 | REGION6_I | 314  | 0.0680  | 527482 CHAVES_CO 3 115 527546 SAMSON3 115 1       | C:527482 CHAVES_CO 3 115 527501 URTON3 115 1       |
| REGION1 | REGION6_I | 330  | 0.0678  | 527482 CHAVES_CO 3 115 527501 URTON3 115 1        | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |
| REGION1 | REGION6_I | 340  | -1.0000 | 524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1      | C:524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1 |
| REGION1 | REGION6_I | 340  | 1.0000  | 524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1  | C:524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1     |
| REGION1 | REGION6_I | 424  | -1.0000 | 524885 SN_JUAN_TAP6 230 524889 SN_JUAN_WND6 230 1 | Base Case                                          |
| REGION1 | REGION6_I | 515  | -0.0998 | 524669 DS-#20 3 115 524822 CURRY 3 115 1          | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION6_I | 542  | 0.3148  | 525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1    | C:526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1    |
| REGION1 | REGION6_I | 574  | 0.8614  | 524875 OASIS 6 230 524915 SW_4K33 6 230 1         | C:524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1 |
| REGION1 | REGION6_I | 593  | -0.1148 | 526176 DOUD3 115 526475 YUMA_INTG 3 115 1         | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1   |
| REGION1 | REGION6_I | 637  | 0.7992  | 527483 CHAVES_CO 6 230 527800 EDDY_CNTY 6 230 1   | C:524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1     |
| REGION1 | REGION6_I | 639  | 0.0680  | 527546 SAMSON3 115 527564 ROSWLL_INT3 115 1       | C:527482 CHAVES_CO 3 115 527501 URTON3 115 1       |
| REGION1 | REGION6_I | 736  | -0.0998 | 524662 PARMER_CO 3 115 524669 DS-#20 3 115 1      | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION6_I | 747  | -0.0842 | 525480 PLANTX 3 115 525481 PLANTX 6 230 1         | C:525531 TOLK_WEST 6 230 525637 LAMB_CNTY 6 230 1  |
| REGION1 | REGION6_I | 756  | -0.0998 | 524648 CARGILL 3 115 524662 PARMER_CO 3 115 1     | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION6_I | 763  | 0.0678  | 527501 URTON3 115 527522 ROSWELL_CTY3 115 1       | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |
| REGION1 | REGION6_I | 777  | -0.3722 | 525481 PLANTX 6 230 525531 TOLK_WEST 6 230 1      | C:525481 PLANTX 6 230 525524 TOLK_EAST 6 230 2     |
| REGION1 | REGION6_I | 788  | -0.3691 | 525481 PLANTX 6 230 525524 TOLK_EAST 6 230 2      | C:525481 PLANTX 6 230 525531 TOLK_WEST 6 230 1     |
| REGION1 | REGION6_I | 835  | -0.0510 | 524863 FE-CHZPLT 3 115 524874 OASIS 3 115 1       | C:524822 CURRY 3 115 524908 ROOSEVELT 3 115 2      |
| REGION1 | REGION6_I | 860  | 0.0678  | 527534 BRASHER_TP 3 115 527564 ROSWLL_INT3 115 1  | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |



|         |           |      |         |                                                   |                                                    |
|---------|-----------|------|---------|---------------------------------------------------|----------------------------------------------------|
| REGION1 | REGION6_I | 869  | -0.1205 | 526524 WOLFFORTH 3 115 526736 TERRY 3 115 1       | C:526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1    |
| REGION1 | REGION6_I | 895  | -0.1408 | 526160 CARLISLE 3 115 526176 DOUD3 115 1          | C:526269 LUBBCK_STH6 230 526525 WOLFFORTH 6 230 1  |
| REGION1 | REGION6_I | 901  | 0.0998  | 524648 CARGILL 3 115 524655 FRIONA 3 115 1        | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION6_I | 903  | 0.1984  | 524874 OASIS 3 115 524924 PORTALES 3 115 1        | C:524875 OASIS 6 230 524915 SW_4K33 6 230 1        |
| REGION1 | REGION6_I | 917  | 0.2428  | 526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1     | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1   |
| REGION1 | REGION7_I | -238 | -0.0664 | 524908 ROOSEVELT 3 115 524909 ROSEVELT_N 6 230 1  | C:524874 OASIS 3 115 524875 OASIS 6 230 1          |
| REGION1 | REGION7_I | -129 | -0.0802 | 524874 OASIS 3 115 524875 OASIS 6 230 1           | C:524908 ROOSEVELT 3 115 524909 ROSEVELT_N 6 230 1 |
| REGION1 | REGION7_I | -58  | -0.0544 | 524822 CURRY 3 115 524908 ROOSEVELT 3 115 2       | C:524874 OASIS 3 115 524875 OASIS 6 230 1          |
| REGION1 | REGION7_I | 173  | -0.0660 | 527482 CHAVES_CO 3 115 527483 CHAVES_CO 6 230 2   | C:527482 CHAVES_CO 3 115 527483 CHAVES_CO 6 230 1  |
| REGION1 | REGION7_I | 181  | -0.0466 | 525056 BC-EARTH 3 115 525480 PLANTX 3 115 1       | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION7_I | 294  | -0.1157 | 526475 YUMA_INTG 3 115 526524 WOLFFORTH 3 115 1   | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1   |
| REGION1 | REGION7_I | 314  | 0.0680  | 527482 CHAVES_CO 3 115 527546 SAMSON3 115 1       | C:527482 CHAVES_CO 3 115 527501 URTON3 115 1       |
| REGION1 | REGION7_I | 330  | 0.0678  | 527482 CHAVES_CO 3 115 527501 URTON3 115 1        | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |
| REGION1 | REGION7_I | 340  | -1.0000 | 524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1      | C:524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1 |
| REGION1 | REGION7_I | 340  | 1.0000  | 524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1  | C:524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1     |
| REGION1 | REGION7_I | 424  | -1.0000 | 524885 SN_JUAN_TAP6 230 524889 SN_JUAN_WND6 230 1 | Base Case                                          |
| REGION1 | REGION7_I | 518  | -0.0992 | 524669 DS-#20 3 115 524822 CURRY 3 115 1          | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION7_I | 538  | 0.3176  | 525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1    | C:526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1    |
| REGION1 | REGION7_I | 574  | 0.8615  | 524875 OASIS 6 230 524915 SW_4K33 6 230 1         | C:524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1 |
| REGION1 | REGION7_I | 588  | -0.1157 | 526176 DOUD3 115 526475 YUMA_INTG 3 115 1         | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1   |
| REGION1 | REGION7_I | 637  | 0.7992  | 527483 CHAVES_CO 6 230 527800 EDDY_CNTY 6 230 1   | C:524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1     |
| REGION1 | REGION7_I | 638  | 0.0680  | 527546 SAMSON3 115 527564 ROSWLL_INT3 115 1       | C:527482 CHAVES_CO 3 115 527501 URTON3 115 1       |
| REGION1 | REGION7_I | 741  | -0.0992 | 524662 PARMER_CO 3 115 524669 DS-#20 3 115 1      | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION7_I | 745  | -0.0844 | 525480 PLANTX 3 115 525481 PLANTX 6 230 1         | C:525531 TOLK_WEST 6 230 525637 LAMB_CNTY 6 230 1  |
| REGION1 | REGION7_I | 761  | -0.0992 | 524648 CARGILL 3 115 524662 PARMER_CO 3 115 1     | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION7_I | 762  | 0.0678  | 527501 URTON3 115 527522 ROSWELL_CTY3 115 1       | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |
| REGION1 | REGION7_I | 782  | -0.3697 | 525481 PLANTX 6 230 525531 TOLK_WEST 6 230 1      | C:525481 PLANTX 6 230 525524 TOLK_EAST 6 230 2     |
| REGION1 | REGION7_I | 793  | -0.3666 | 525481 PLANTX 6 230 525524 TOLK_EAST 6 230 2      | C:525481 PLANTX 6 230 525531 TOLK_WEST 6 230 1     |
| REGION1 | REGION7_I | 838  | -0.0507 | 524863 FE-CHZPLT 3 115 524874 OASIS 3 115 1       | C:524822 CURRY 3 115 524908 ROOSEVELT 3 115 2      |
| REGION1 | REGION7_I | 859  | 0.0678  | 527534 BRASHER_TP 3 115 527564 ROSWLL_INT3 115 1  | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |

|         |           |      |         |                                                   |                                                    |
|---------|-----------|------|---------|---------------------------------------------------|----------------------------------------------------|
| REGION1 | REGION7_I | 863  | -0.1214 | 526524 WOLFFORTH 3 115 526736 TERRY 3 115 1       | C:526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1    |
| REGION1 | REGION7_I | 888  | -0.1418 | 526160 CARLISLE 3 115 526176 DOUD3 115 1          | C:526269 LUBBCK_STH6 230 526525 WOLFFORTH 6 230 1  |
| REGION1 | REGION7_I | 903  | 0.1984  | 524874 OASIS 3 115 524924 PORTALES 3 115 1        | C:524875 OASIS 6 230 524915 SW_4K33 6 230 1        |
| REGION1 | REGION7_I | 907  | 0.0992  | 524648 CARGILL 3 115 524655 FRIONA 3 115 1        | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION7_I | 909  | 0.2449  | 526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1     | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1   |
| REGION1 | REGION8_I | -238 | -0.0662 | 524908 ROOSEVELT 3 115 524909 ROSEVELT_N 6 230 1  | C:524874 OASIS 3 115 524875 OASIS 6 230 1          |
| REGION1 | REGION8_I | -129 | -0.0801 | 524874 OASIS 3 115 524875 OASIS 6 230 1           | C:524908 ROOSEVELT 3 115 524909 ROSEVELT_N 6 230 1 |
| REGION1 | REGION8_I | -58  | -0.0543 | 524822 CURRY 3 115 524908 ROOSEVELT 3 115 2       | C:524874 OASIS 3 115 524875 OASIS 6 230 1          |
| REGION1 | REGION8_I | 173  | -0.0660 | 527482 CHAVES_CO 3 115 527483 CHAVES_CO 6 230 2   | C:527482 CHAVES_CO 3 115 527483 CHAVES_CO 6 230 1  |
| REGION1 | REGION8_I | 182  | -0.0462 | 525056 BC-EARTH 3 115 525480 PLANTX 3 115 1       | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION8_I | 293  | -0.1161 | 526475 YUMA_INTG 3 115 526524 WOLFFORTH 3 115 1   | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1   |
| REGION1 | REGION8_I | 313  | 0.0680  | 527482 CHAVES_CO 3 115 527546 SAMSON3 115 1       | C:527482 CHAVES_CO 3 115 527501 URTON3 115 1       |
| REGION1 | REGION8_I | 330  | 0.0678  | 527482 CHAVES_CO 3 115 527501 URTON3 115 1        | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |
| REGION1 | REGION8_I | 340  | -1.0000 | 524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1      | C:524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1 |
| REGION1 | REGION8_I | 340  | 1.0000  | 524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1  | C:524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1     |
| REGION1 | REGION8_I | 424  | -1.0000 | 524885 SN_JUAN_TAP6 230 524889 SN_JUAN_WND6 230 1 | Base Case                                          |
| REGION1 | REGION8_I | 520  | -0.0989 | 524669 DS-#20 3 115 524822 CURRY 3 115 1          | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION8_I | 536  | 0.3188  | 525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1    | C:526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1    |
| REGION1 | REGION8_I | 574  | 0.8616  | 524875 OASIS 6 230 524915 SW_4K33 6 230 1         | C:524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1 |
| REGION1 | REGION8_I | 586  | -0.1161 | 526176 DOUD3 115 526475 YUMA_INTG 3 115 1         | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1   |
| REGION1 | REGION8_I | 637  | 0.7992  | 527483 CHAVES_CO 6 230 527800 EDDY_CNTY 6 230 1   | C:524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1     |
| REGION1 | REGION8_I | 638  | 0.0680  | 527546 SAMSON3 115 527564 ROSWLL_INT3 115 1       | C:527482 CHAVES_CO 3 115 527501 URTON3 115 1       |
| REGION1 | REGION8_I | 743  | -0.0989 | 524662 PARMER_CO 3 115 524669 DS-#20 3 115 1      | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION8_I | 744  | -0.0845 | 525480 PLANTX 3 115 525481 PLANTX 6 230 1         | C:525531 TOLK_WEST 6 230 525637 LAMB_CNTY 6 230 1  |
| REGION1 | REGION8_I | 762  | 0.0678  | 527501 URTON3 115 527522 ROSWELL_CTY3 115 1       | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |
| REGION1 | REGION8_I | 763  | -0.0989 | 524648 CARGILL 3 115 524662 PARMER_CO 3 115 1     | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION8_I | 784  | -0.3686 | 525481 PLANTX 6 230 525531 TOLK_WEST 6 230 1      | C:525481 PLANTX 6 230 525524 TOLK_EAST 6 230 2     |
| REGION1 | REGION8_I | 795  | -0.3655 | 525481 PLANTX 6 230 525524 TOLK_EAST 6 230 2      | C:525481 PLANTX 6 230 525531 TOLK_WEST 6 230 1     |
| REGION1 | REGION8_I | 840  | -0.0507 | 524863 FE-CHZPLT 3 115 524874 OASIS 3 115 1       | C:524822 CURRY 3 115 524908 ROOSEVELT 3 115 2      |
| REGION1 | REGION8_I | 859  | 0.0678  | 527534 BRASHER_TP 3 115 527564 ROSWLL_INT3 115 1  | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |

|         |           |      |         |                                                   |                                                    |
|---------|-----------|------|---------|---------------------------------------------------|----------------------------------------------------|
| REGION1 | REGION8_I | 860  | -0.1218 | 526524 WOLFFORTH 3 115 526736 TERRY 3 115 1       | C:526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1    |
| REGION1 | REGION8_I | 885  | -0.1423 | 526160 CARLISLE 3 115 526176 DOUD3 115 1          | C:526269 LUBBCK_STH6 230 526525 WOLFFORTH 6 230 1  |
| REGION1 | REGION8_I | 903  | 0.1984  | 524874 OASIS 3 115 524924 PORTALES 3 115 1        | C:524875 OASIS 6 230 524915 SW_4K33 6 230 1        |
| REGION1 | REGION8_I | 906  | 0.2458  | 526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1     | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1   |
| REGION1 | REGION8_I | 910  | 0.0989  | 524648 CARGILL 3 115 524655 FRIONA 3 115 1        | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION9_I | -237 | -0.0664 | 524908 ROOSEVELT 3 115 524909 ROSEVELT_N 6 230 1  | C:524874 OASIS 3 115 524875 OASIS 6 230 1          |
| REGION1 | REGION9_I | -129 | -0.0802 | 524874 OASIS 3 115 524875 OASIS 6 230 1           | C:524908 ROOSEVELT 3 115 524909 ROSEVELT_N 6 230 1 |
| REGION1 | REGION9_I | -58  | -0.0545 | 524822 CURRY 3 115 524908 ROOSEVELT 3 115 2       | C:524874 OASIS 3 115 524875 OASIS 6 230 1          |
| REGION1 | REGION9_I | 173  | -0.0660 | 527482 CHAVES_CO 3 115 527483 CHAVES_CO 6 230 2   | C:527482 CHAVES_CO 3 115 527483 CHAVES_CO 6 230 1  |
| REGION1 | REGION9_I | 180  | -0.0467 | 525056 BC-EARTH 3 115 525480 PLANTX 3 115 1       | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION9_I | 294  | -0.1155 | 526475 YUMA_INTG 3 115 526524 WOLFFORTH 3 115 1   | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1   |
| REGION1 | REGION9_I | 314  | 0.0680  | 527482 CHAVES_CO 3 115 527546 SAMSON3 115 1       | C:527482 CHAVES_CO 3 115 527501 URTON3 115 1       |
| REGION1 | REGION9_I | 330  | 0.0678  | 527482 CHAVES_CO 3 115 527501 URTON3 115 1        | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |
| REGION1 | REGION9_I | 340  | 1.0000  | 524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1  | C:524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1     |
| REGION1 | REGION9_I | 340  | -1.0000 | 524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1      | C:524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1 |
| REGION1 | REGION9_I | 368  | -0.0358 | 505418 JONESB05 161 505420 HERGETT5 161 1         | C:505410 KENNETT5 161 505412 PARAGLD5 161 1        |
| REGION1 | REGION9_I | 424  | -1.0000 | 524885 SN_JUAN_TAP6 230 524889 SN_JUAN_WND6 230 1 | Base Case                                          |
| REGION1 | REGION9_I | 518  | -0.0993 | 524669 DS-#20 3 115 524822 CURRY 3 115 1          | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION9_I | 538  | 0.3172  | 525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1    | C:526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1    |
| REGION1 | REGION9_I | 574  | 0.8615  | 524875 OASIS 6 230 524915 SW_4K33 6 230 1         | C:524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1 |
| REGION1 | REGION9_I | 589  | -0.1155 | 526176 DOUD3 115 526475 YUMA_INTG 3 115 1         | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1   |
| REGION1 | REGION9_I | 637  | 0.7992  | 527483 CHAVES_CO 6 230 527800 EDDY_CNTY 6 230 1   | C:524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1     |
| REGION1 | REGION9_I | 638  | 0.0680  | 527546 SAMSON3 115 527564 ROSWLL_INT3 115 1       | C:527482 CHAVES_CO 3 115 527501 URTON3 115 1       |
| REGION1 | REGION9_I | 740  | -0.0993 | 524662 PARMER_CO 3 115 524669 DS-#20 3 115 1      | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION9_I | 746  | -0.0844 | 525480 PLANTX 3 115 525481 PLANTX 6 230 1         | C:525531 TOLK_WEST 6 230 525637 LAMB_CNTY 6 230 1  |
| REGION1 | REGION9_I | 760  | -0.0993 | 524648 CARGILL 3 115 524662 PARMER_CO 3 115 1     | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION9_I | 762  | 0.0678  | 527501 URTON3 115 527522 ROSWELL_CTY3 115 1       | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |
| REGION1 | REGION9_I | 781  | -0.3701 | 525481 PLANTX 6 230 525531 TOLK_WEST 6 230 1      | C:525481 PLANTX 6 230 525524 TOLK_EAST 6 230 2     |
| REGION1 | REGION9_I | 792  | -0.3670 | 525481 PLANTX 6 230 525524 TOLK_EAST 6 230 2      | C:525481 PLANTX 6 230 525531 TOLK_WEST 6 230 1     |
| REGION1 | REGION9_I | 838  | -0.0508 | 524863 FE-CHZPLT 3 115 524874 OASIS 3 115 1       | C:524822 CURRY 3 115 524908 ROOSEVELT 3 115 2      |

|         |            |      |         |                                                   |                                                    |
|---------|------------|------|---------|---------------------------------------------------|----------------------------------------------------|
| REGION1 | REGION9_I  | 859  | 0.0678  | 527534 BRASHER_TP 3 115 527564 ROSWLL_INT3 115 1  | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |
| REGION1 | REGION9_I  | 864  | -0.1212 | 526524 WOLFFORTH 3 115 526736 TERRY 3 115 1       | C:526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1    |
| REGION1 | REGION9_I  | 889  | -0.1417 | 526160 CARLISLE 3 115 526176 DOUD3 115 1          | C:526269 LUBBCK_STH6 230 526525 WOLFFORTH 6 230 1  |
| REGION1 | REGION9_I  | 903  | 0.1984  | 524874 OASIS 3 115 524924 PORTALES 3 115 1        | C:524875 OASIS 6 230 524915 SW_4K33 6 230 1        |
| REGION1 | REGION9_I  | 906  | 0.0993  | 524648 CARGILL 3 115 524655 FRIONA 3 115 1        | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION10_I | -237 | -0.0666 | 524908 ROOSEVELT 3 115 524909 ROSEVELT_N 6 230 1  | C:524874 OASIS 3 115 524875 OASIS 6 230 1          |
| REGION1 | REGION10_I | -129 | -0.0804 | 524874 OASIS 3 115 524875 OASIS 6 230 1           | C:524908 ROOSEVELT 3 115 524909 ROSEVELT_N 6 230 1 |
| REGION1 | REGION10_I | -58  | -0.0546 | 524822 CURRY 3 115 524908 ROOSEVELT 3 115 2       | C:524874 OASIS 3 115 524875 OASIS 6 230 1          |
| REGION1 | REGION10_I | 173  | -0.0660 | 527482 CHAVES_CO 3 115 527483 CHAVES_CO 6 230 2   | C:527482 CHAVES_CO 3 115 527483 CHAVES_CO 6 230 1  |
| REGION1 | REGION10_I | 179  | -0.0471 | 525056 BC-EARTH 3 115 525480 PLANTX 3 115 1       | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION10_I | 295  | -0.1152 | 526475 YUMA_INTG 3 115 526524 WOLFFORTH 3 115 1   | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1   |
| REGION1 | REGION10_I | 314  | 0.0680  | 527482 CHAVES_CO 3 115 527546 SAMSON3 115 1       | C:527482 CHAVES_CO 3 115 527501 URTON3 115 1       |
| REGION1 | REGION10_I | 330  | 0.0678  | 527482 CHAVES_CO 3 115 527501 URTON3 115 1        | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |
| REGION1 | REGION10_I | 340  | -1.0000 | 524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1      | C:524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1 |
| REGION1 | REGION10_I | 340  | 1.0000  | 524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1  | C:524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1     |
| REGION1 | REGION10_I | 424  | -1.0000 | 524885 SN_JUAN_TAP6 230 524889 SN_JUAN_WND6 230 1 | Base Case                                          |
| REGION1 | REGION10_I | 516  | -0.0996 | 524669 DS-#20 3 115 524822 CURRY 3 115 1          | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION10_I | 540  | 0.3160  | 525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1    | C:526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1    |
| REGION1 | REGION10_I | 574  | 0.8614  | 524875 OASIS 6 230 524915 SW_4K33 6 230 1         | C:524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1 |
| REGION1 | REGION10_I | 591  | -0.1152 | 526176 DOUD3 115 526475 YUMA_INTG 3 115 1         | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1   |
| REGION1 | REGION10_I | 637  | 0.7992  | 527483 CHAVES_CO 6 230 527800 EDDY_CNTY 6 230 1   | C:524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1     |
| REGION1 | REGION10_I | 638  | 0.0680  | 527546 SAMSON3 115 527564 ROSWLL_INT3 115 1       | C:527482 CHAVES_CO 3 115 527501 URTON3 115 1       |
| REGION1 | REGION10_I | 738  | -0.0996 | 524662 PARMER_CO 3 115 524669 DS-#20 3 115 1      | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION10_I | 746  | -0.0843 | 525480 PLANTX 3 115 525481 PLANTX 6 230 1         | C:525531 TOLK_WEST 6 230 525637 LAMB_CNTY 6 230 1  |
| REGION1 | REGION10_I | 758  | -0.0996 | 524648 CARGILL 3 115 524662 PARMER_CO 3 115 1     | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION10_I | 763  | 0.0678  | 527501 URTON3 115 527522 ROSWELL_CTY3 115 1       | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |
| REGION1 | REGION10_I | 779  | -0.3712 | 525481 PLANTX 6 230 525531 TOLK_WEST 6 230 1      | C:525481 PLANTX 6 230 525524 TOLK_EAST 6 230 2     |
| REGION1 | REGION10_I | 790  | -0.3681 | 525481 PLANTX 6 230 525524 TOLK_EAST 6 230 2      | C:525481 PLANTX 6 230 525531 TOLK_WEST 6 230 1     |
| REGION1 | REGION10_I | 836  | -0.0509 | 524863 FE-CHZPLT 3 115 524874 OASIS 3 115 1       | C:524822 CURRY 3 115 524908 ROOSEVELT 3 115 2      |
| REGION1 | REGION10_I | 859  | 0.0678  | 527534 BRASHER_TP 3 115 527564 ROSWLL_INT3 115 1  | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |

|         |            |      |         |                                                 |                                                   |
|---------|------------|------|---------|-------------------------------------------------|---------------------------------------------------|
| REGION1 | REGION10_I | 866  | -0.1209 | 526524 WOLFFORTH 3 115 526736 TERRY 3 115 1     | C:526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1   |
| REGION1 | REGION10_I | 892  | -0.1412 | 526160 CARLISLE 3 115 526176 DOUD3 115 1        | C:526269 LUBBCK_STH6 230 526525 WOLFFORTH 6 230 1 |
| REGION1 | REGION10_I | 903  | 0.1984  | 524874 OASIS 3 115 524924 PORTALES 3 115 1      | C:524875 OASIS 6 230 524915 SW_4K33 6 230 1       |
| REGION1 | REGION10_I | 904  | 0.0996  | 524648 CARGILL 3 115 524655 FRIONA 3 115 1      | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1    |
| REGION1 | REGION10_I | 914  | 0.2437  | 526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1   | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1  |
| REGION2 | REGION3_I  | 527  | 0.0592  | 659134 SIDNEY 4 230 659136 SIDNEY*4 230 1       | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1       |
| REGION2 | REGION3_I  | 529  | -0.0592 | 652572 SIDNEY 7 115 659136 SIDNEY*4 230 1       | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1       |
| REGION2 | REGION3_I  | 597  | 0.2320  | 524502 NORTON 3 115 524822 CURRY 3 115 1        | C:524502 NORTON 3 115 524509 FE-TUCMCARI3 115 1   |
| REGION2 | REGION3_I  | 685  | 0.0641  | 659132 OGALALA7 115 659187 ROSCOE 7 115 1       | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1       |
| REGION2 | REGION3_I  | 792  | -0.0649 | 524669 DS-#20 3 115 524822 CURRY 3 115 1        | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1    |
| REGION2 | REGION3_I  | 801  | 0.1469  | 640253 KEYSTON7 115 659132 OGALALA7 115 1       | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1       |
| REGION2 | REGION3_I  | 837  | -0.0641 | 659185 ELSIETP7 115 659187 ROSCOE 7 115 1       | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1       |
| REGION2 | REGION3_I  | 877  | 0.0592  | 652572 SIDNEY 7 115 659238 COLTON 7 115 1       | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1       |
| REGION2 | REGION3_I  | 899  | -0.2609 | 640302 OGALALA4 230 659134 SIDNEY 4 230 1       | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1       |
| REGION2 | REGION3_I  | 913  | 0.1160  | 640302 OGALALA4 230 659132 OGALALA7 115 1       | C:640184 GENTLMN4 230 640302 OGALALA4 230 1       |
| REGION2 | REGION3_I  | 946  | -0.0592 | 652300 CHAPPEL7 115 659238 COLTON 7 115 1       | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1       |
| REGION2 | REGION3_I  | 951  | -0.3326 | 640184 GENTLMN4 230 640302 OGALALA4 230 1       | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1       |
| REGION2 | REGION3_I  | 1026 | 0.2320  | 524486 CAPROCK 3 115 524502 NORTON 3 115 1      | Base Case                                         |
| REGION2 | REGION3_I  | 1069 | 0.1555  | 640252 KEYSTON3 345 B\$0588 KEYST T1 1.00 1     | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1       |
| REGION2 | REGION3_I  | 1070 | -0.1555 | 640253 KEYSTON7 115 B\$0588 KEYST T1 1.00 1     | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1       |
| REGION2 | REGION3_I  | 1132 | -0.0649 | 524662 PARMER_CO 3 115 524669 DS-#20 3 115 1    | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1    |
| REGION2 | REGION3_I  | 1159 | -0.0592 | 640246 JULSTAP7 115 652300 CHAPPEL7 115 1       | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1       |
| REGION2 | REGION3_I  | 1164 | -0.0649 | 524648 CARGILL 3 115 524662 PARMER_CO 3 115 1   | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1    |
| REGION2 | REGION3_I  | 1248 | -0.0442 | 526475 YUMA_INTG 3 115 526524 WOLFFORTH 3 115 1 | C:526269 LUBBCK_STH6 230 526525 WOLFFORTH 6 230 1 |
| REGION2 | REGION3_I  | 1373 | -0.2106 | 525481 PLANTX 6 230 525531 TOLK_WEST 6 230 1    | C:525481 PLANTX 6 230 525524 TOLK_EAST 6 230 2    |
| REGION2 | REGION3_I  | 1387 | 0.0649  | 524648 CARGILL 3 115 524655 FRIONA 3 115 1      | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1    |
| REGION2 | REGION3_I  | 1390 | -0.2091 | 525481 PLANTX 6 230 525524 TOLK_EAST 6 230 2    | C:525481 PLANTX 6 230 525531 TOLK_WEST 6 230 1    |
| REGION2 | REGION3_I  | 1483 | 0.0641  | 659185 ELSIETP7 115 659186 PAXTON 7 115 1       | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1       |
| REGION2 | REGION3_I  | 1626 | -0.0569 | 524597 PANDAHFD 3 115 524606 HEREFORD 3 115 1   | C:524267 BUSHLAND 6 230 524623 DEAFSMITH 6 230 1  |
| REGION2 | REGION3_I  | 1627 | -0.0649 | 524606 HEREFORD 3 115 524655 FRIONA 3 115 1     | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1    |

|         |           |      |         |                                                 |                                                   |
|---------|-----------|------|---------|-------------------------------------------------|---------------------------------------------------|
| REGION2 | REGION3_I | 1695 | -0.0371 | 525480 PLANTX 3 115 525481 PLANTX 6 230 1       | C:525531 TOLK_WEST 6 230 525637 LAMB_CNTY 6 230 1 |
| REGION2 | REGION3_I | 1704 | 0.1002  | 525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1  | C:526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1   |
| REGION2 | REGION3_I | 2576 | -0.0373 | 640068 B.SPRGS7 115 640246 JULSTAP7 115 1       | C:652302 JULESBG7 115 659240 INTERST7 115 1       |
| REGION2 | REGION3_I | 2673 | -0.0809 | 524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1    | C:645458 S3458 3 345 650189 103&ROK3 345 1        |
| REGION2 | REGION3_I | 2710 | -0.3146 | 640183 GENTLMN3 345 640252 KEYSTON3 345 1       | C:659132 OGALALA7 115 659187 ROSCOE 7 115 1       |
| REGION2 | REGION4_I | 242  | 0.0844  | 530553 S HAYS 3 115 530562 HAYS 3 115 1         | C:530558 KNOLL 6 230 530561 KNOLL 3 115 1         |
| REGION2 | REGION4_I | 420  | 0.0844  | 530562 HAYS 3 115 530591 VINE 3 115 1           | C:530558 KNOLL 6 230 530561 KNOLL 3 115 1         |
| REGION2 | REGION4_I | 448  | -0.0316 | 640267 MAXWELS7 115 640287 N.PLATT7 115 1       | C:640093 C.CREEK4 230 640286 N.PLATT4 230 1       |
| REGION2 | REGION4_I | 533  | 0.0585  | 659134 SIDNEY 4 230 659136 SIDNEY*4 230 1       | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1       |
| REGION2 | REGION4_I | 535  | -0.0585 | 652572 SIDNEY 7 115 659136 SIDNEY*4 230 1       | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1       |
| REGION2 | REGION4_I | 597  | 0.2320  | 524502 NORTON 3 115 524822 CURRY 3 115 1        | C:524502 NORTON 3 115 524509 FE-TUCMCARI3 115 1   |
| REGION2 | REGION4_I | 642  | 0.2349  | 514785 WOODWRD4 138 515785 WINDFRM4 138 1       | C:3Wnd: OPEN B\$1035 WOODWRD2 1                   |
| REGION2 | REGION4_I | 655  | 0.0671  | 659132 OGALALA7 115 659187 ROSCOE 7 115 1       | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1       |
| REGION2 | REGION4_I | 659  | -0.0844 | 530561 KNOLL 3 115 530581 N HAYS3 115 1         | C:530558 KNOLL 6 230 530561 KNOLL 3 115 1         |
| REGION2 | REGION4_I | 681  | -0.0500 | 526475 YUMA_INTG 3 115 526524 WOLFFORTH 3 115 1 | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1  |
| REGION2 | REGION4_I | 784  | -0.0603 | 640238 JEFFREY7 115 640287 N.PLATT7 115 1       | C:640093 C.CREEK4 230 640286 N.PLATT4 230 1       |
| REGION2 | REGION4_I | 797  | 0.1476  | 640253 KEYSTON7 115 659132 OGALALA7 115 1       | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1       |
| REGION2 | REGION4_I | 799  | -0.0740 | 514711 WAUKOTPA 138 514714 WOODRNG4 138 1       | C:514709 FRMNTAP4 138 514714 WOODRNG4 138 1       |
| REGION2 | REGION4_I | 800  | -0.0671 | 659185 ELSIETP7 115 659187 ROSCOE 7 115 1       | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1       |
| REGION2 | REGION4_I | 887  | 0.0585  | 652572 SIDNEY 7 115 659238 COLTON 7 115 1       | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1       |
| REGION2 | REGION4_I | 924  | -0.2538 | 640302 OGALALA4 230 659134 SIDNEY 4 230 1       | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1       |
| REGION2 | REGION4_I | 931  | -0.0687 | 514709 FRMNTAP4 138 514714 WOODRNG4 138 1       | C:514711 WAUKOTPA 138 514714 WOODRNG4 138 1       |
| REGION2 | REGION4_I | 932  | 0.1138  | 640302 OGALALA4 230 659132 OGALALA7 115 1       | C:640184 GENTLMN4 230 640302 OGALALA4 230 1       |
| REGION2 | REGION4_I | 946  | -0.0543 | 524669 DS-#20 3 115 524822 CURRY 3 115 1        | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1    |
| REGION2 | REGION4_I | 957  | -0.0585 | 652300 CHAPPEL7 115 659238 COLTON 7 115 1       | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1       |
| REGION2 | REGION4_I | 959  | 0.0902  | 514785 WOODWRD4 138 B\$1035 WOODWRD2 1.00 1     | C:514785 WOODWRD4 138 515785 WINDFRM4 138 1       |
| REGION2 | REGION4_I | 973  | -0.0844 | 530553 S HAYS 3 115 530582 S HAYS6 230 1        | C:530558 KNOLL 6 230 530561 KNOLL 3 115 1         |
| REGION2 | REGION4_I | 984  | -0.3215 | 640184 GENTLMN4 230 640302 OGALALA4 230 1       | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1       |
| REGION2 | REGION4_I | 1026 | 0.2320  | 524486 CAPROCK 3 115 524502 NORTON 3 115 1      | Base Case                                         |
| REGION2 | REGION4_I | 1056 | 0.0992  | 530558 KNOLL 6 230 530561 KNOLL 3 115 1         | C:530553 S HAYS 3 115 530582 S HAYS6 230 1        |



|         |           |      |         |                                                 |                                                   |
|---------|-----------|------|---------|-------------------------------------------------|---------------------------------------------------|
| REGION2 | REGION4_I | 1082 | 0.1578  | 525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1  | C:526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1   |
| REGION2 | REGION4_I | 1127 | 0.1476  | 640252 KEYSTON3 345 B\$0588 KEYST T1 1.00 1     | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1       |
| REGION2 | REGION4_I | 1128 | -0.1476 | 640253 KEYSTON7 115 B\$0588 KEYST T1 1.00 1     | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1       |
| REGION2 | REGION4_I | 1173 | -0.0585 | 640246 JULSTAP7 115 652300 CHAPPEL7 115 1       | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1       |
| REGION2 | REGION4_I | 1271 | 0.2163  | 515785 WINDFRM4 138 520999 MOORLND4 138 1       | C:3Wnd: OPEN B\$1035 WOODWRD2 1                   |
| REGION2 | REGION5_I | 454  | -0.0312 | 640267 MAXWELS7 115 640287 N.PLATT7 115 1       | C:640093 C.CREEK4 230 640286 N.PLATT4 230 1       |
| REGION2 | REGION5_I | 539  | 0.0578  | 659134 SIDNEY 4 230 659136 SIDNEY*4 230 1       | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1       |
| REGION2 | REGION5_I | 541  | -0.0578 | 652572 SIDNEY 7 115 659136 SIDNEY*4 230 1       | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1       |
| REGION2 | REGION5_I | 597  | 0.2320  | 524502 NORTON 3 115 524822 CURRY 3 115 1        | C:524502 NORTON 3 115 524509 FE-TUCMCARI3 115 1   |
| REGION2 | REGION5_I | 657  | -0.0517 | 526475 YUMA_INTG 3 115 526524 WOLFFORTH 3 115 1 | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1  |
| REGION2 | REGION5_I | 687  | 0.0639  | 659132 OGALALA7 115 659187 ROSCOE 7 115 1       | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1       |
| REGION2 | REGION5_I | 821  | 0.1433  | 640253 KEYSTON7 115 659132 OGALALA7 115 1       | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1       |
| REGION2 | REGION5_I | 839  | -0.0639 | 659185 ELSIETP7 115 659187 ROSCOE 7 115 1       | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1       |
| REGION2 | REGION5_I | 898  | 0.0578  | 652572 SIDNEY 7 115 659238 COLTON 7 115 1       | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1       |
| REGION2 | REGION5_I | 938  | -0.2500 | 640302 OGALALA4 230 659134 SIDNEY 4 230 1       | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1       |
| REGION2 | REGION5_I | 947  | 0.1119  | 640302 OGALALA4 230 659132 OGALALA7 115 1       | C:640184 GENTLMN4 230 640302 OGALALA4 230 1       |
| REGION2 | REGION5_I | 968  | -0.0578 | 652300 CHAPPEL7 115 659238 COLTON 7 115 1       | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1       |
| REGION2 | REGION5_I | 969  | -0.0530 | 524669 DS-#20 3 115 524822 CURRY 3 115 1        | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1    |
| REGION2 | REGION5_I | 999  | -0.3167 | 640184 GENTLMN4 230 640302 OGALALA4 230 1       | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1       |
| REGION2 | REGION5_I | 1026 | 0.2320  | 524486 CAPROCK 3 115 524502 NORTON 3 115 1      | Base Case                                         |
| REGION2 | REGION5_I | 1046 | 0.1633  | 525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1  | C:526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1   |
| REGION2 | REGION5_I | 1161 | 0.1433  | 640252 KEYSTON3 345 B\$0588 KEYST T1 1.00 1     | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1       |
| REGION2 | REGION5_I | 1161 | -0.1433 | 640253 KEYSTON7 115 B\$0588 KEYST T1 1.00 1     | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1       |
| REGION2 | REGION5_I | 1186 | -0.0578 | 640246 JULSTAP7 115 652300 CHAPPEL7 115 1       | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1       |
| REGION2 | REGION5_I | 1316 | -0.0517 | 526176 DOUD3 115 526475 YUMA_INTG 3 115 1       | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1  |
| REGION2 | REGION5_I | 1385 | -0.0530 | 524662 PARMER_CO 3 115 524669 DS-#20 3 115 1    | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1    |
| REGION2 | REGION5_I | 1416 | -0.0334 | 640238 JEFFREY7 115 640287 N.PLATT7 115 1       | C:640093 C.CREEK4 230 640286 N.PLATT4 230 1       |
| REGION2 | REGION5_I | 1423 | -0.0530 | 524648 CARGILL 3 115 524662 PARMER_CO 3 115 1   | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1    |
| REGION2 | REGION5_I | 1488 | 0.0639  | 659185 ELSIETP7 115 659186 PAXTON 7 115 1       | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1       |
| REGION2 | REGION5_I | 1530 | -0.0411 | 525480 PLANTX 3 115 525481 PLANTX 6 230 1       | C:525531 TOLK_WEST 6 230 525637 LAMB_CNTY 6 230 1 |

|         |           |      |         |                        |                          |                                                  |
|---------|-----------|------|---------|------------------------|--------------------------|--------------------------------------------------|
| REGION2 | REGION5_I | 2371 | 0.0463  | 524648 CARGILL 3 115   | 524655 FRIONA 3 115 1    | C:659130 GRANTNB7 115 659188 SPCREEK7 115 1      |
| REGION2 | REGION5_I | 2707 | -0.0463 | 524606 HEREFORD 3 115  | 524655 FRIONA 3 115 1    | C:659130 GRANTNB7 115 659188 SPCREEK7 115 1      |
| REGION2 | REGION5_I | 2807 | -0.3038 | 640183 GENTLMN3 345    | 640252 KEYSTON3 345 1    | C:659132 OGALALA7 115 659187 ROSCOE 7 115 1      |
| REGION2 | REGION5_I | 2834 | 0.1093  | 524822 CURRY 3 115     | 524908 ROOSEVELT 3 115 2 | C:659185 ELSIETP7 115 659243 ELSIE 7 115 1       |
| REGION2 | REGION5_I | 3054 | -0.0656 | 640093 C.CREEK4 230    | 640286 N.PLATT4 230 1    | C:659185 ELSIETP7 115 659243 ELSIE 7 115 1       |
| REGION2 | REGION6_I | 430  | -0.0329 | 640267 MAXWELS7 115    | 640287 N.PLATT7 115 1    | C:640093 C.CREEK4 230 640286 N.PLATT4 230 1      |
| REGION2 | REGION6_I | 540  | 0.0577  | 659134 SIDNEY 4 230    | 659136 SIDNEY*4 230 1    | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1      |
| REGION2 | REGION6_I | 542  | -0.0577 | 652572 SIDNEY 7 115    | 659136 SIDNEY*4 230 1    | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1      |
| REGION2 | REGION6_I | 597  | 0.2320  | 524502 NORTON 3 115    | 524822 CURRY 3 115 1     | C:524502 NORTON 3 115 524509 FE-TUCMCARI3 115 1  |
| REGION2 | REGION6_I | 680  | -0.0500 | 526475 YUMA_INTG 3 115 | 526524 WOLFFORTH 3 115 1 | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1 |
| REGION2 | REGION6_I | 686  | 0.0640  | 659132 OGALALA7 115    | 659187 ROSCOE 7 115 1    | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1      |
| REGION2 | REGION6_I | 826  | 0.1424  | 640253 KEYSTON7 115    | 659132 OGALALA7 115 1    | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1      |
| REGION2 | REGION6_I | 839  | -0.0640 | 659185 ELSIETP7 115    | 659187 ROSCOE 7 115 1    | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1      |
| REGION2 | REGION6_I | 899  | 0.0577  | 652572 SIDNEY 7 115    | 659238 COLTON 7 115 1    | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1      |
| REGION2 | REGION6_I | 941  | -0.2493 | 640302 OGALALA4 230    | 659134 SIDNEY 4 230 1    | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1      |
| REGION2 | REGION6_I | 947  | -0.0543 | 524669 DS-#20 3 115    | 524822 CURRY 3 115 1     | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1   |
| REGION2 | REGION6_I | 950  | 0.1115  | 640302 OGALALA4 230    | 659132 OGALALA7 115 1    | C:640184 GENTLMN4 230 640302 OGALALA4 230 1      |
| REGION2 | REGION6_I | 969  | -0.0577 | 652300 CHAPPEL7 115    | 659238 COLTON 7 115 1    | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1      |
| REGION2 | REGION6_I | 1001 | -0.3161 | 640184 GENTLMN4 230    | 640302 OGALALA4 230 1    | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1      |
| REGION2 | REGION6_I | 1026 | 0.2320  | 524486 CAPROCK 3 115   | 524502 NORTON 3 115 1    | Base Case                                        |
| REGION2 | REGION6_I | 1081 | 0.1579  | 525524 TOLK_EAST 6 230 | 525830 TUCO_INT 6 230 1  | C:526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1  |
| REGION2 | REGION6_I | 1168 | 0.1424  | 640252 KEYSTON3 345    | B\$0588 KEYST T1 1.00 1  | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1      |
| REGION2 | REGION6_I | 1168 | -0.1424 | 640253 KEYSTON7 115    | B\$0588 KEYST T1 1.00 1  | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1      |
| REGION2 | REGION6_I | 1188 | -0.0577 | 640246 JULSTAP7 115    | 652300 CHAPPEL7 115 1    | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1      |
| REGION2 | REGION6_I | 1353 | -0.0543 | 524662 PARMER_CO 3 115 | 524669 DS-#20 3 115 1    | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1   |
| REGION2 | REGION6_I | 1361 | -0.0500 | 526176 DOUD3 115       | 526475 YUMA_INTG 3 115 1 | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1 |
| REGION2 | REGION6_I | 1370 | -0.0345 | 640238 JEFFREY7 115    | 640287 N.PLATT7 115 1    | C:640093 C.CREEK4 230 640286 N.PLATT4 230 1      |
| REGION2 | REGION6_I | 1391 | -0.0543 | 524648 CARGILL 3 115   | 524662 PARMER_CO 3 115 1 | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1   |
| REGION2 | REGION6_I | 1487 | 0.0640  | 659185 ELSIETP7 115    | 659186 PAXTON 7 115 1    | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1      |
| REGION2 | REGION6_I | 2338 | 0.0470  | 524648 CARGILL 3 115   | 524655 FRIONA 3 115 1    | C:659130 GRANTNB7 115 659188 SPCREEK7 115 1      |



|         |           |      |         |                    |     |                    |      |   |                      |     |                     |     |   |
|---------|-----------|------|---------|--------------------|-----|--------------------|------|---|----------------------|-----|---------------------|-----|---|
| REGION2 | REGION6_I | 2608 | -0.0368 | 640068 B.SPRGS7    | 115 | 640246 JULSTAP7    | 115  | 1 | C:652302 JULESBG7    | 115 | 659240 INTERST7     | 115 | 1 |
| REGION2 | REGION6_I | 2669 | -0.0470 | 524606 HEREFORD 3  | 115 | 524655 FRIONA 3    | 115  | 1 | C:659130 GRANTNB7    | 115 | 659188 SPCREEK7     | 115 | 1 |
| REGION2 | REGION6_I | 2817 | -0.3027 | 640183 GENTLMN3    | 345 | 640252 KEYSTON3    | 345  | 1 | C:659132 OGALALA7    | 115 | 659187 ROSCOE 7     | 115 | 1 |
| REGION2 | REGION6_I | 2844 | 0.1089  | 524822 CURRY 3     | 115 | 524908 ROOSEVELT 3 | 115  | 2 | C:652302 JULESBG7    | 115 | 659240 INTERST7     | 115 | 1 |
| REGION2 | REGION6_I | 2935 | -0.0683 | 640093 C.CREEK4    | 230 | 640286 N.PLATT4    | 230  | 1 | C:652302 JULESBG7    | 115 | 659240 INTERST7     | 115 | 1 |
| REGION2 | REGION7_I | 436  | -0.0325 | 640267 MAXWELS7    | 115 | 640287 N.PLATT7    | 115  | 1 | C:640093 C.CREEK4    | 230 | 640286 N.PLATT4     | 230 | 1 |
| REGION2 | REGION7_I | 540  | 0.0577  | 659134 SIDNEY 4    | 230 | 659136 SIDNEY*4    | 230  | 1 | C:640302 OGALALA4    | 230 | 659134 SIDNEY 4     | 230 | 1 |
| REGION2 | REGION7_I | 542  | -0.0577 | 652572 SIDNEY 7    | 115 | 659136 SIDNEY*4    | 230  | 1 | C:640302 OGALALA4    | 230 | 659134 SIDNEY 4     | 230 | 1 |
| REGION2 | REGION7_I | 597  | 0.2320  | 524502 NORTON 3    | 115 | 524822 CURRY 3     | 115  | 1 | C:524502 NORTON 3    | 115 | 524509 FE-TUCMCARI3 | 115 | 1 |
| REGION2 | REGION7_I | 668  | -0.0509 | 526475 YUMA_INTG 3 | 115 | 526524 WOLFFORTH 3 | 115  | 1 | C:525524 TOLK_EAST 6 | 230 | 525830 TUCO_INT 6   | 230 | 1 |
| REGION2 | REGION7_I | 689  | 0.0637  | 659132 OGALALA7    | 115 | 659187 ROSCOE 7    | 115  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION7_I | 828  | 0.1421  | 640253 KEYSTON7    | 115 | 659132 OGALALA7    | 115  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION7_I | 842  | -0.0637 | 659185 ELSIETP7    | 115 | 659187 ROSCOE 7    | 115  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION7_I | 900  | 0.0577  | 652572 SIDNEY 7    | 115 | 659238 COLTON 7    | 115  | 1 | C:640302 OGALALA4    | 230 | 659134 SIDNEY 4     | 230 | 1 |
| REGION2 | REGION7_I | 943  | -0.2487 | 640302 OGALALA4    | 230 | 659134 SIDNEY 4    | 230  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION7_I | 951  | 0.1114  | 640302 OGALALA4    | 230 | 659132 OGALALA7    | 115  | 1 | C:640184 GENTLMN4    | 230 | 640302 OGALALA4     | 230 | 1 |
| REGION2 | REGION7_I | 958  | -0.0536 | 524669 DS-#20 3    | 115 | 524822 CURRY 3     | 115  | 1 | C:524623 DEAFSMITH 6 | 230 | 525481 PLANTX 6     | 230 | 1 |
| REGION2 | REGION7_I | 970  | -0.0577 | 652300 CHAPPEL7    | 115 | 659238 COLTON 7    | 115  | 1 | C:640302 OGALALA4    | 230 | 659134 SIDNEY 4     | 230 | 1 |
| REGION2 | REGION7_I | 1004 | -0.3151 | 640184 GENTLMN4    | 230 | 640302 OGALALA4    | 230  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION7_I | 1026 | 0.2320  | 524486 CAPROCK 3   | 115 | 524502 NORTON 3    | 115  | 1 | Base Case            |     |                     |     |   |
| REGION2 | REGION7_I | 1063 | 0.1607  | 525524 TOLK_EAST 6 | 230 | 525830 TUCO_INT 6  | 230  | 1 | C:526435 SUNDOWN 6   | 230 | 526525 WOLFFORTH 6  | 230 | 1 |
| REGION2 | REGION7_I | 1171 | 0.1421  | 640252 KEYSTON3    | 345 | B\$0588 KEYST T1   | 1.00 | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION7_I | 1172 | -0.1421 | 640253 KEYSTON7    | 115 | B\$0588 KEYST T1   | 1.00 | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION7_I | 1189 | -0.0577 | 640246 JULSTAP7    | 115 | 652300 CHAPPEL7    | 115  | 1 | C:640302 OGALALA4    | 230 | 659134 SIDNEY 4     | 230 | 1 |
| REGION2 | REGION7_I | 1338 | -0.0509 | 526176 DOUD3       | 115 | 526475 YUMA_INTG 3 | 115  | 1 | C:525524 TOLK_EAST 6 | 230 | 525830 TUCO_INT 6   | 230 | 1 |
| REGION2 | REGION7_I | 1369 | -0.0536 | 524662 PARMER_CO 3 | 115 | 524669 DS-#20 3    | 115  | 1 | C:524623 DEAFSMITH 6 | 230 | 525481 PLANTX 6     | 230 | 1 |
| REGION2 | REGION7_I | 1396 | -0.0339 | 640238 JEFFREY7    | 115 | 640287 N.PLATT7    | 115  | 1 | C:640093 C.CREEK4    | 230 | 640286 N.PLATT4     | 230 | 1 |
| REGION2 | REGION7_I | 1407 | -0.0536 | 524648 CARGILL 3   | 115 | 524662 PARMER_CO 3 | 115  | 1 | C:524623 DEAFSMITH 6 | 230 | 525481 PLANTX 6     | 230 | 1 |
| REGION2 | REGION7_I | 1494 | 0.0637  | 659185 ELSIETP7    | 115 | 659186 PAXTON 7    | 115  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION7_I | 1538 | -0.0409 | 525480 PLANTX 3    | 115 | 525481 PLANTX 6    | 230  | 1 | C:525531 TOLK_WEST 6 | 230 | 525637 LAMB_CNTY 6  | 230 | 1 |

|         |           |      |         |                        |                          |                                                  |
|---------|-----------|------|---------|------------------------|--------------------------|--------------------------------------------------|
| REGION2 | REGION7_I | 2352 | 0.0467  | 524648 CARGILL 3 115   | 524655 FRIONA 3 115 1    | C:646206 S1206 5 161 648199 SARP4&5T 161 1       |
| REGION2 | REGION7_I | 2608 | -0.0368 | 640068 B.SPRGS7 115    | 640246 JULSTAP7 115 1    | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION2 | REGION7_I | 2686 | -0.0467 | 524606 HEREFORD 3 115  | 524655 FRIONA 3 115 1    | C:646206 S1206 5 161 648199 SARP4&5T 161 1       |
| REGION2 | REGION7_I | 2827 | -0.3017 | 640183 GENTLMN3 345    | 640252 KEYSTON3 345 1    | C:659132 OGALALA7 115 659187 ROSCOE 7 115 1      |
| REGION2 | REGION7_I | 2839 | 0.1091  | 524822 CURRY 3 115     | 524908 ROOSEVELT 3 115 2 | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION2 | REGION8_I | 431  | -0.0328 | 640267 MAXWELS7 115    | 640287 N.PLATT7 115 1    | C:640093 C.CREEK4 230 640286 N.PLATT4 230 1      |
| REGION2 | REGION8_I | 541  | 0.0576  | 659134 SIDNEY 4 230    | 659136 SIDNEY*4 230 1    | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1      |
| REGION2 | REGION8_I | 543  | -0.0576 | 652572 SIDNEY 7 115    | 659136 SIDNEY*4 230 1    | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1      |
| REGION2 | REGION8_I | 597  | 0.2320  | 524502 NORTON 3 115    | 524822 CURRY 3 115 1     | C:524502 NORTON 3 115 524509 FE-TUCMCARI3 115 1  |
| REGION2 | REGION8_I | 663  | -0.0513 | 526475 YUMA_INTG 3 115 | 526524 WOLFFORTH 3 115 1 | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1 |
| REGION2 | REGION8_I | 692  | 0.0635  | 659132 OGALALA7 115    | 659187 ROSCOE 7 115 1    | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1      |
| REGION2 | REGION8_I | 832  | 0.1414  | 640253 KEYSTON7 115    | 659132 OGALALA7 115 1    | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1      |
| REGION2 | REGION8_I | 845  | -0.0635 | 659185 ELSIETP7 115    | 659187 ROSCOE 7 115 1    | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1      |
| REGION2 | REGION8_I | 900  | 0.0576  | 652572 SIDNEY 7 115    | 659238 COLTON 7 115 1    | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1      |
| REGION2 | REGION8_I | 945  | -0.2480 | 640302 OGALALA4 230    | 659134 SIDNEY 4 230 1    | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1      |
| REGION2 | REGION8_I | 953  | 0.1112  | 640302 OGALALA4 230    | 659132 OGALALA7 115 1    | C:640184 GENTLMN4 230 640302 OGALALA4 230 1      |
| REGION2 | REGION8_I | 963  | -0.0534 | 524669 DS-#20 3 115    | 524822 CURRY 3 115 1     | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1   |
| REGION2 | REGION8_I | 971  | -0.0576 | 652300 CHAPPEL7 115    | 659238 COLTON 7 115 1    | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1      |
| REGION2 | REGION8_I | 1008 | -0.3139 | 640184 GENTLMN4 230    | 640302 OGALALA4 230 1    | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1      |
| REGION2 | REGION8_I | 1026 | 0.2320  | 524486 CAPROCK 3 115   | 524502 NORTON 3 115 1    | Base Case                                        |
| REGION2 | REGION8_I | 1055 | 0.1619  | 525524 TOLK_EAST 6 230 | 525830 TUCO_INT 6 230 1  | C:526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1  |
| REGION2 | REGION8_I | 1176 | 0.1414  | 640252 KEYSTON3 345    | B\$0588 KEYST T1 1.00 1  | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1      |
| REGION2 | REGION8_I | 1177 | -0.1414 | 640253 KEYSTON7 115    | B\$0588 KEYST T1 1.00 1  | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1      |
| REGION2 | REGION8_I | 1190 | -0.0576 | 640246 JULSTAP7 115    | 652300 CHAPPEL7 115 1    | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1      |
| REGION2 | REGION8_I | 1327 | -0.0513 | 526176 DOUD3 115       | 526475 YUMA_INTG 3 115 1 | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1 |
| REGION2 | REGION8_I | 1377 | -0.0534 | 524662 PARMER_CO 3 115 | 524669 DS-#20 3 115 1    | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1   |
| REGION2 | REGION8_I | 1402 | -0.0337 | 640238 JEFFREY7 115    | 640287 N.PLATT7 115 1    | C:640093 C.CREEK4 230 640286 N.PLATT4 230 1      |
| REGION2 | REGION8_I | 1415 | -0.0534 | 524648 CARGILL 3 115   | 524662 PARMER_CO 3 115 1 | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1   |
| REGION2 | REGION8_I | 1499 | 0.0635  | 659185 ELSIETP7 115    | 659186 PAXTON 7 115 1    | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1      |
| REGION2 | REGION8_I | 2362 | 0.0465  | 524648 CARGILL 3 115   | 524655 FRIONA 3 115 1    | C:659130 GRANTNB7 115 659188 SPCREEK7 115 1      |

|         |           |      |         |                    |     |                    |      |   |                      |     |                     |     |   |
|---------|-----------|------|---------|--------------------|-----|--------------------|------|---|----------------------|-----|---------------------|-----|---|
| REGION2 | REGION8_I | 2609 | -0.0368 | 640068 B.SPRGS7    | 115 | 640246 JULSTAP7    | 115  | 1 | C:652302 JULESBG7    | 115 | 659240 INTERST7     | 115 | 1 |
| REGION2 | REGION8_I | 2697 | -0.0465 | 524606 HEREFORD 3  | 115 | 524655 FRIONA 3    | 115  | 1 | C:659130 GRANTNB7    | 115 | 659188 SPCREEK7     | 115 | 1 |
| REGION2 | REGION8_I | 2837 | 0.1092  | 524822 CURRY 3     | 115 | 524908 ROOSEVELT 3 | 115  | 2 | C:652302 JULESBG7    | 115 | 659240 INTERST7     | 115 | 1 |
| REGION2 | REGION8_I | 2839 | -0.3004 | 640183 GENTLMN3    | 345 | 640252 KEYSTON3    | 345  | 1 | C:659132 OGALALA7    | 115 | 659187 ROSCOE 7     | 115 | 1 |
| REGION2 | REGION8_I | 3003 | -0.0667 | 640093 C.CREEK4    | 230 | 640286 N.PLATT4    | 230  | 1 | C:652302 JULESBG7    | 115 | 659240 INTERST7     | 115 | 1 |
| REGION2 | REGION9_I | 363  | -0.0363 | 505418 JONESB05    | 161 | 505420 HERGETT5    | 161  | 1 | C:505410 KENNETT5    | 161 | 505412 PARAGLD5     | 161 | 1 |
| REGION2 | REGION9_I | 422  | -0.0335 | 640267 MAXWELS7    | 115 | 640287 N.PLATT7    | 115  | 1 | C:640093 C.CREEK4    | 230 | 640286 N.PLATT4     | 230 | 1 |
| REGION2 | REGION9_I | 541  | 0.0576  | 659134 SIDNEY 4    | 230 | 659136 SIDNEY*4    | 230  | 1 | C:640302 OGALALA4    | 230 | 659134 SIDNEY 4     | 230 | 1 |
| REGION2 | REGION9_I | 544  | -0.0576 | 652572 SIDNEY 7    | 115 | 659136 SIDNEY*4    | 230  | 1 | C:640302 OGALALA4    | 230 | 659134 SIDNEY 4     | 230 | 1 |
| REGION2 | REGION9_I | 597  | 0.2320  | 524502 NORTON 3    | 115 | 524822 CURRY 3     | 115  | 1 | C:524502 NORTON 3    | 115 | 524509 FE-TUCMCARI3 | 115 | 1 |
| REGION2 | REGION9_I | 670  | -0.0508 | 526475 YUMA_INTG 3 | 115 | 526524 WOLFFORTH 3 | 115  | 1 | C:525524 TOLK_EAST 6 | 230 | 525830 TUCO_INT 6   | 230 | 1 |
| REGION2 | REGION9_I | 693  | 0.0633  | 659132 OGALALA7    | 115 | 659187 ROSCOE 7    | 115  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION9_I | 836  | 0.1408  | 640253 KEYSTON7    | 115 | 659132 OGALALA7    | 115  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION9_I | 847  | -0.0633 | 659185 ELSIETP7    | 115 | 659187 ROSCOE 7    | 115  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION9_I | 902  | 0.0576  | 652572 SIDNEY 7    | 115 | 659238 COLTON 7    | 115  | 1 | C:640302 OGALALA4    | 230 | 659134 SIDNEY 4     | 230 | 1 |
| REGION2 | REGION9_I | 948  | -0.2473 | 640302 OGALALA4    | 230 | 659134 SIDNEY 4    | 230  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION9_I | 955  | 0.1110  | 640302 OGALALA4    | 230 | 659132 OGALALA7    | 115  | 1 | C:640184 GENTLMN4    | 230 | 640302 OGALALA4     | 230 | 1 |
| REGION2 | REGION9_I | 957  | -0.0537 | 524669 DS-#20 3    | 115 | 524822 CURRY 3     | 115  | 1 | C:524623 DEAFSMITH 6 | 230 | 525481 PLANTX 6     | 230 | 1 |
| REGION2 | REGION9_I | 972  | -0.0576 | 652300 CHAPPEL7    | 115 | 659238 COLTON 7    | 115  | 1 | C:640302 OGALALA4    | 230 | 659134 SIDNEY 4     | 230 | 1 |
| REGION2 | REGION9_I | 1011 | -0.3130 | 640184 GENTLMN4    | 230 | 640302 OGALALA4    | 230  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION9_I | 1026 | 0.2320  | 524486 CAPROCK 3   | 115 | 524502 NORTON 3    | 115  | 1 | Base Case            |     |                     |     |   |
| REGION2 | REGION9_I | 1066 | 0.1603  | 525524 TOLK_EAST 6 | 230 | 525830 TUCO_INT 6  | 230  | 1 | C:526435 SUNDOWN 6   | 230 | 526525 WOLFFORTH 6  | 230 | 1 |
| REGION2 | REGION9_I | 1182 | 0.1408  | 640252 KEYSTON3    | 345 | B\$0588 KEYST T1   | 1.00 | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION9_I | 1182 | -0.1408 | 640253 KEYSTON7    | 115 | B\$0588 KEYST T1   | 1.00 | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION9_I | 1191 | -0.0576 | 640246 JULSTAP7    | 115 | 652300 CHAPPEL7    | 115  | 1 | C:640302 OGALALA4    | 230 | 659134 SIDNEY 4     | 230 | 1 |
| REGION2 | REGION9_I | 1341 | -0.0508 | 526176 DOUD3       | 115 | 526475 YUMA_INTG 3 | 115  | 1 | C:525524 TOLK_EAST 6 | 230 | 525830 TUCO_INT 6   | 230 | 1 |
| REGION2 | REGION9_I | 1367 | -0.0537 | 524662 PARMER_CO 3 | 115 | 524669 DS-#20 3    | 115  | 1 | C:524623 DEAFSMITH 6 | 230 | 525481 PLANTX 6     | 230 | 1 |
| REGION2 | REGION9_I | 1391 | -0.0340 | 640238 JEFFREY7    | 115 | 640287 N.PLATT7    | 115  | 1 | C:640093 C.CREEK4    | 230 | 640286 N.PLATT4     | 230 | 1 |
| REGION2 | REGION9_I | 1405 | -0.0537 | 524648 CARGILL 3   | 115 | 524662 PARMER_CO 3 | 115  | 1 | C:524623 DEAFSMITH 6 | 230 | 525481 PLANTX 6     | 230 | 1 |
| REGION2 | REGION9_I | 1502 | 0.0633  | 659185 ELSIETP7    | 115 | 659186 PAXTON 7    | 115  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |

|         |            |      |         |                        |                          |                                                  |
|---------|------------|------|---------|------------------------|--------------------------|--------------------------------------------------|
| REGION2 | REGION9_I  | 2352 | 0.0467  | 524648 CARGILL 3 115   | 524655 FRIONA 3 115 1    | C:659130 GRANTNB7 115 659188 SPCREEK7 115 1      |
| REGION2 | REGION9_I  | 2584 | -0.1073 | 500410 HOPKINS4 138    | 500774 SEGURA4 138 1     | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION2 | REGION9_I  | 2610 | -0.0368 | 640068 B.SPRGS7 115    | 640246 JULSTAP7 115 1    | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION2 | REGION9_I  | 2686 | -0.0467 | 524606 HEREFORD 3 115  | 524655 FRIONA 3 115 1    | C:659130 GRANTNB7 115 659188 SPCREEK7 115 1      |
| REGION2 | REGION9_I  | 2777 | -0.0884 | 502401 FLANDER6 230    | 502402 ACADIAN6 230 1    | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION2 | REGION10_I | 417  | -0.0339 | 640267 MAXWELS7 115    | 640287 N.PLATT7 115 1    | C:640093 C.CREEK4 230 640286 N.PLATT4 230 1      |
| REGION2 | REGION10_I | 542  | 0.0575  | 659134 SIDNEY 4 230    | 659136 SIDNEY*4 230 1    | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1      |
| REGION2 | REGION10_I | 544  | -0.0575 | 652572 SIDNEY 7 115    | 659136 SIDNEY*4 230 1    | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1      |
| REGION2 | REGION10_I | 597  | 0.2320  | 524502 NORTON 3 115    | 524822 CURRY 3 115 1     | C:524502 NORTON 3 115 524509 FE-TUCMCARI3 115 1  |
| REGION2 | REGION10_I | 675  | -0.0504 | 526475 YUMA_INTG 3 115 | 526524 WOLFFORTH 3 115 1 | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1 |
| REGION2 | REGION10_I | 694  | 0.0633  | 659132 OGALALA7 115    | 659187 ROSCOE 7 115 1    | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1      |
| REGION2 | REGION10_I | 837  | 0.1405  | 640253 KEYSTON7 115    | 659132 OGALALA7 115 1    | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1      |
| REGION2 | REGION10_I | 848  | -0.0633 | 659185 ELSIETP7 115    | 659187 ROSCOE 7 115 1    | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1      |
| REGION2 | REGION10_I | 902  | 0.0575  | 652572 SIDNEY 7 115    | 659238 COLTON 7 115 1    | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1      |
| REGION2 | REGION10_I | 949  | -0.2471 | 640302 OGALALA4 230    | 659134 SIDNEY 4 230 1    | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1      |
| REGION2 | REGION10_I | 952  | -0.0540 | 524669 DS-#20 3 115    | 524822 CURRY 3 115 1     | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1   |
| REGION2 | REGION10_I | 956  | 0.1109  | 640302 OGALALA4 230    | 659132 OGALALA7 115 1    | C:640184 GENTLMN4 230 640302 OGALALA4 230 1      |
| REGION2 | REGION10_I | 972  | -0.0575 | 652300 CHAPPEL7 115    | 659238 COLTON 7 115 1    | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1      |
| REGION2 | REGION10_I | 1012 | -0.3126 | 640184 GENTLMN4 230    | 640302 OGALALA4 230 1    | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1      |
| REGION2 | REGION10_I | 1026 | 0.2320  | 524486 CAPROCK 3 115   | 524502 NORTON 3 115 1    | Base Case                                        |
| REGION2 | REGION10_I | 1074 | 0.1590  | 525524 TOLK_EAST 6 230 | 525830 TUCO_INT 6 230 1  | C:526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1  |
| REGION2 | REGION10_I | 1184 | 0.1405  | 640252 KEYSTON3 345    | B\$0588 KEYST T1 1.00 1  | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1      |
| REGION2 | REGION10_I | 1185 | -0.1405 | 640253 KEYSTON7 115    | B\$0588 KEYST T1 1.00 1  | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1      |
| REGION2 | REGION10_I | 1192 | -0.0575 | 640246 JULSTAP7 115    | 652300 CHAPPEL7 115 1    | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1      |
| REGION2 | REGION10_I | 1221 | -0.2603 | 505428 SIKESTN5 161    | 505434 IDALIA 5 161 1    | C:505400 N MADRD5 161 505428 SIKESTN5 161 1      |
| REGION2 | REGION10_I | 1351 | -0.0504 | 526176 DOUD3 115       | 526475 YUMA_INTG 3 115 1 | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1 |
| REGION2 | REGION10_I | 1360 | -0.0540 | 524662 PARMER_CO 3 115 | 524669 DS-#20 3 115 1    | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1   |
| REGION2 | REGION10_I | 1384 | -0.0342 | 640238 JEFFREY7 115    | 640287 N.PLATT7 115 1    | C:640093 C.CREEK4 230 640286 N.PLATT4 230 1      |
| REGION2 | REGION10_I | 1398 | -0.0540 | 524648 CARGILL 3 115   | 524662 PARMER_CO 3 115 1 | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1   |
| REGION2 | REGION10_I | 1504 | 0.0633  | 659185 ELSIETP7 115    | 659186 PAXTON 7 115 1    | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1      |

|         |            |      |         |                 |     |                        |      |     |                               |                    |                      |                     |     |     |   |
|---------|------------|------|---------|-----------------|-----|------------------------|------|-----|-------------------------------|--------------------|----------------------|---------------------|-----|-----|---|
| REGION2 | REGION10_I | 2220 | 0.1201  | 505400 N MADRD5 | 161 | 505428 SIKESTN5        | 161  | 1   | C:652570 ALIANCE7             | 115                | 659197 SNAKECK7      | 115                 | 1   |     |   |
| REGION2 | REGION10_I | 2345 | 0.0469  | 524648 CARGILL  | 3   | 115 524655 FRIONA      | 3    | 115 | 1                             | C:659130 GRANTNB7  | 115                  | 659188 SPCREEK7     | 115 | 1   |   |
| REGION2 | REGION10_I | 2611 | -0.0368 | 640068 B.SPRGS7 | 115 | 640246 JULSTAP7        | 115  | 1   | C:652302 JULESBG7             | 115                | 659240 INTERST7      | 115                 | 1   |     |   |
| REGION2 | REGION10_I | 2677 | -0.0469 | 524606 HEREFORD | 3   | 115 524655 FRIONA      | 3    | 115 | 1                             | C:659130 GRANTNB7  | 115                  | 659188 SPCREEK7     | 115 | 1   |   |
| REGION2 | REGION10_I | 2842 | 0.1090  | 524822 CURRY    | 3   | 115 524908 ROOSEVELT   | 3    | 115 | 2                             | C:652302 JULESBG7  | 115                  | 659240 INTERST7     | 115 | 1   |   |
| REGION3 | REGION4_I  | 243  | 0.0838  | 530553 S HAYS   | 3   | 115 530562 HAYS        | 3    | 115 | 1                             | C:530558 KNOLL     | 6                    | 230 530561 KNOLL    | 3   | 115 | 1 |
| REGION3 | REGION4_I  | 350  | 0.1534  | 539667 HAGGARD3 | 115 | 539699 W-DODGE3        | 115  | 1   | C:3Wnd: OPEN B\$0524 HAGGARD3 | 1                  |                      |                     |     |     |   |
| REGION3 | REGION4_I  | 423  | 0.0838  | 530562 HAYS     | 3   | 115 530591 VINE        | 3    | 115 | 1                             | C:530558 KNOLL     | 6                    | 230 530561 KNOLL    | 3   | 115 | 1 |
| REGION3 | REGION4_I  | 635  | -0.1534 | 539667 HAGGARD3 | 115 | B\$0525 HAGGARD3       | 1.00 | 1   | C:510417 VINTAJC4             | 138                | 547486 HOC404        | 4                   | 138 | 1   |   |
| REGION3 | REGION4_I  | 663  | -0.0838 | 530561 KNOLL    | 3   | 115 530581 N HAYS3     | 115  | 1   | C:530558 KNOLL                | 6                  | 230 530561 KNOLL     | 3                   | 115 | 1   |   |
| REGION3 | REGION4_I  | 690  | -0.1534 | 539688 S-DODGE3 | 115 | 539699 W-DODGE3        | 115  | 1   | C:3Wnd: OPEN B\$0524 HAGGARD3 | 1                  |                      |                     |     |     |   |
| REGION3 | REGION4_I  | 724  | 0.0912  | 520920 FTSUPLY4 | 138 | B\$0461 FTSUPPLY       | 1.00 | 1   | C:520920 FTSUPLY4             | 138                | 520957 IODINE        | 4                   | 138 | 1   |   |
| REGION3 | REGION4_I  | 724  | 0.0912  | 520920 FTSUPLY4 | 138 | B\$0462 FTSUPPLY2      | 1.00 | 2   | C:520920 FTSUPLY4             | 138                | 520957 IODINE        | 4                   | 138 | 1   |   |
| REGION3 | REGION4_I  | 762  | -0.1824 | 520920 FTSUPLY4 | 138 | 520922 SLEEPING        | 138  | 1   | Base Case                     |                    |                      |                     |     |     |   |
| REGION3 | REGION4_I  | 771  | -0.0352 | 640253 KEYSTON7 | 115 | 640255 KINGSLY7        | 115  | 1   | C:531414 RANSOM               | 3                  | 115 531456 NESSCTY3  | 115                 | 1   |     |   |
| REGION3 | REGION4_I  | 826  | 0.1534  | 539688 S-DODGE3 | 115 | 539771 NOR-JUD3        | 115  | 1   | C:3Wnd: OPEN B\$0524 HAGGARD3 | 1                  |                      |                     |     |     |   |
| REGION3 | REGION4_I  | 881  | 0.2061  | 514785 WOODWRD4 | 138 | 515785 WINDFRM4        | 138  | 1   | C:520920 FTSUPLY4             | 138                | 520922 SLEEPING      | 138                 | 1   |     |   |
| REGION3 | REGION4_I  | 968  | -0.0489 | 640238 JEFFREY7 | 115 | 640287 N.PLATT7        | 115  | 1   | C:640093 C.CREEK4             | 230                | 640286 N.PLATT4      | 230                 | 1   |     |   |
| REGION3 | REGION4_I  | 980  | -0.0838 | 530553 S HAYS   | 3   | 115 530582 S HAYS6     | 230  | 1   | C:530558 KNOLL                | 6                  | 230 530561 KNOLL     | 3                   | 115 | 1   |   |
| REGION3 | REGION4_I  | 1068 | 0.0981  | 530558 KNOLL    | 6   | 230 530561 KNOLL       | 3    | 115 | 1                             | C:530553 S HAYS    | 3                    | 115 530582 S HAYS6  | 230 | 1   |   |
| REGION3 | REGION4_I  | 1122 | 0.1536  | 520957 IODINE   | 4   | 138 520999 MOORLND4    | 138  | 1   | Base Case                     |                    |                      |                     |     |     |   |
| REGION3 | REGION4_I  | 1145 | 0.0545  | 524266 BUSHLAND | 3   | 115 524306 COULTER3    | 115  | 1   | C:524267 BUSHLAND             | 6                  | 230 524623 DEAFSMITH | 6                   | 230 | 1   |   |
| REGION3 | REGION4_I  | 1203 | -0.0491 | 514711 WAUKOTP4 | 138 | 514714 WOODRNG4        | 138  | 1   | C:514709 FRMNTAP4             | 138                | 514714 WOODRNG4      | 138                 | 1   |     |   |
| REGION3 | REGION4_I  | 1233 | -0.1161 | 524266 BUSHLAND | 3   | 115 524267 BUSHLAND    | 6    | 230 | 1                             | C:523959 POTTER_CO | 6                    | 230 524267 BUSHLAND | 6   | 230 | 1 |
| REGION3 | REGION4_I  | 1622 | 0.1536  | 520920 FTSUPLY4 | 138 | 520957 IODINE          | 4    | 138 | 1                             | C:659130 GRANTNB7  | 115                  | 659188 SPCREEK7     | 115 | 1   |   |
| REGION3 | REGION4_I  | 1759 | -0.2985 | 524267 BUSHLAND | 6   | 230 524276 WILDOR_WND6 | 230  | 1   | C:659130 GRANTNB7             | 115                | 659188 SPCREEK7      | 115                 | 1   |     |   |
| REGION3 | REGION4_I  | 2284 | -0.1051 | 539694 SPEARVL3 | 115 | 539771 NOR-JUD3        | 115  | 1   | C:652311 DUNLAP               | 7                  | 115 659236 BOXBUTE7  | 115                 | 1   |     |   |
| REGION3 | REGION4_I  | 2358 | 0.1307  | 515785 WINDFRM4 | 138 | 520999 MOORLND4        | 138  | 1   | C:652302 JULESBG7             | 115                | 659240 INTERST7      | 115                 | 1   |     |   |
| REGION3 | REGION4_I  | 2595 | 0.1051  | 539694 SPEARVL3 | 115 | B\$0891 SPEARVL6       | 1.00 | 1   | C:652311 DUNLAP               | 7                  | 115 659236 BOXBUTE7  | 115                 | 1   |     |   |
| REGION3 | REGION4_I  | 2596 | -0.1051 | 539695 SPEARVL6 | 230 | B\$0891 SPEARVL6       | 1.00 | 1   | C:652311 DUNLAP               | 7                  | 115 659236 BOXBUTE7  | 115                 | 1   |     |   |

|         |           |      |         |                    |     |                    |      |   |                               |     |                    |     |   |
|---------|-----------|------|---------|--------------------|-----|--------------------|------|---|-------------------------------|-----|--------------------|-----|---|
| REGION3 | REGION4_I | 2775 | -0.0483 | 539671 JUD-LRG3    | 115 | 539771 NOR-JUD3    | 115  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7    | 115 | 1 |
| REGION3 | REGION4_I | 2781 | -0.1735 | 523959 POTTER_CO 6 | 230 | 524267 BUSHLAND 6  | 230  | 1 | C:659130 GRANTNB7             | 115 | 659188 SPCREEK7    | 115 | 1 |
| REGION3 | REGION4_I | 2927 | 0.0602  | 530601 HEIZER 3    | 115 | 539678 MULGREN3    | 115  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7    | 115 | 1 |
| REGION3 | REGION4_I | 3162 | 0.1171  | 90005 KNOLL345     | 345 | 530558 KNOLL 6     | 230  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7    | 115 | 1 |
| REGION3 | REGION4_I | 3203 | -0.0334 | 539664 GRNBURG3    | 115 | 539671 JUD-LRG3    | 115  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7    | 115 | 1 |
| REGION3 | REGION5_I | 350  | 0.1534  | 539667 HAGGARD3    | 115 | 539699 W-DODGE3    | 115  | 1 | C:3Wnd: OPEN B\$0524 HAGGARD3 | 1   |                    |     |   |
| REGION3 | REGION5_I | 635  | -0.1534 | 539667 HAGGARD3    | 115 | B\$0525 HAGGARD3   | 1.00 | 1 | C:514954 INDNHIL4             | 138 | 515380 INDIANH4    | 138 | 1 |
| REGION3 | REGION5_I | 690  | -0.1534 | 539688 S-DODGE3    | 115 | 539699 W-DODGE3    | 115  | 1 | C:3Wnd: OPEN B\$0524 HAGGARD3 | 1   |                    |     |   |
| REGION3 | REGION5_I | 724  | 0.0912  | 520920 FTSUPLY4    | 138 | B\$0462 FTSUPPLY2  | 1.00 | 2 | C:520920 FTSUPLY4             | 138 | 520957 IODINE 4    | 138 | 1 |
| REGION3 | REGION5_I | 724  | 0.0912  | 520920 FTSUPLY4    | 138 | B\$0461 FTSUPPLY   | 1.00 | 1 | C:520920 FTSUPLY4             | 138 | 520957 IODINE 4    | 138 | 1 |
| REGION3 | REGION5_I | 762  | -0.1824 | 520920 FTSUPLY4    | 138 | 520922 SLEEPING    | 138  | 1 | Base Case                     |     |                    |     |   |
| REGION3 | REGION5_I | 771  | -0.0352 | 640253 KEYSTON7    | 115 | 640255 KINGSLY7    | 115  | 1 | C:640103 CANADAY7             | 115 | 640161 ELMCRK_7    | 115 | 1 |
| REGION3 | REGION5_I | 826  | 0.1534  | 539688 S-DODGE3    | 115 | 539771 NOR-JUD3    | 115  | 1 | C:3Wnd: OPEN B\$0524 HAGGARD3 | 1   |                    |     |   |
| REGION3 | REGION5_I | 1128 | 0.0553  | 524266 BUSHLAND 3  | 115 | 524306 COULTER3    | 115  | 1 | C:524267 BUSHLAND 6           | 230 | 524623 DEAFSMITH 6 | 230 | 1 |
| REGION3 | REGION5_I | 1257 | -0.1139 | 524266 BUSHLAND 3  | 115 | 524267 BUSHLAND 6  | 230  | 1 | C:523959 POTTER_CO 6          | 230 | 524267 BUSHLAND 6  | 230 | 1 |
| REGION3 | REGION5_I | 1264 | 0.1363  | 520957 IODINE 4    | 138 | 520999 MOORLND4    | 138  | 1 | Base Case                     |     |                    |     |   |
| REGION3 | REGION5_I | 1284 | -0.1534 | 539671 JUD-LRG3    | 115 | 539771 NOR-JUD3    | 115  | 1 | C:539694 SPEARVL3             | 115 | 539771 NOR-JUD3    | 115 | 1 |
| REGION3 | REGION5_I | 1284 | -0.1534 | 539694 SPEARVL3    | 115 | 539771 NOR-JUD3    | 115  | 1 | C:539671 JUD-LRG3             | 115 | 539771 NOR-JUD3    | 115 | 1 |
| REGION3 | REGION5_I | 1497 | 0.1534  | 539694 SPEARVL3    | 115 | B\$0891 SPEARVL6   | 1.00 | 1 | C:539671 JUD-LRG3             | 115 | 539771 NOR-JUD3    | 115 | 1 |
| REGION3 | REGION5_I | 1497 | -0.1534 | 539695 SPEARVL6    | 230 | B\$0891 SPEARVL6   | 1.00 | 1 | C:539671 JUD-LRG3             | 115 | 539771 NOR-JUD3    | 115 | 1 |
| REGION3 | REGION5_I | 1497 | 0.1363  | 520920 FTSUPLY4    | 138 | 520957 IODINE 4    | 138  | 1 | Base Case                     |     |                    |     |   |
| REGION3 | REGION5_I | 1593 | -0.0547 | 514785 WOODWRD4    | 138 | 515785 WINDFRM4    | 138  | 1 | C:520999 MOORLND4             | 138 | 521001 MORWODS4    | 138 | 1 |
| REGION3 | REGION5_I | 1595 | -0.2985 | 524267 BUSHLAND 6  | 230 | 524276 WILDOR_WND6 | 230  | 1 | Base Case                     |     |                    |     |   |
| REGION3 | REGION5_I | 1759 | -0.0766 | 539664 GRNBURG3    | 115 | 539671 JUD-LRG3    | 115  | 1 | C:539694 SPEARVL3             | 115 | 539771 NOR-JUD3    | 115 | 1 |
| REGION3 | REGION5_I | 2673 | 0.0335  | 539673 MED-LDG3    | 115 | B\$0652 MED-LDG4   | 1.00 | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7    | 115 | 1 |
| REGION3 | REGION5_I | 2674 | -0.0335 | 539674 MED-LDG4    | 138 | B\$0652 MED-LDG4   | 1.00 | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7    | 115 | 1 |
| REGION3 | REGION5_I | 2852 | -0.1689 | 523959 POTTER_CO 6 | 230 | 524267 BUSHLAND 6  | 230  | 1 | C:646206 S1206 5              | 161 | 648199 SARP4&5T    | 161 | 1 |
| REGION3 | REGION5_I | 3122 | 0.0392  | 539664 GRNBURG3    | 115 | 539697 SUNCITY3    | 115  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7    | 115 | 1 |
| REGION3 | REGION5_I | 3165 | 0.0916  | 524267 BUSHLAND 6  | 230 | 524623 DEAFSMITH 6 | 230  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7    | 115 | 1 |
| REGION3 | REGION5_I | 3217 | -0.0392 | 539673 MED-LDG3    | 115 | 539697 SUNCITY3    | 115  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7    | 115 | 1 |



|         |           |      |         |                                                |                                                  |
|---------|-----------|------|---------|------------------------------------------------|--------------------------------------------------|
| REGION3 | REGION5_I | 3404 | 0.0569  | 525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1 | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION5_I | 3535 | -0.0655 | 523771 GRAPEVINE 6 230 524044 NICHOLS 6 230 1  | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION5_I | 3864 | -0.0707 | B\$0420 ELKCTY-6 1.00 511490 ELKCITY6 230 1    | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION5_I | 3864 | -0.0707 | 511458 ELKCTY-4 138 B\$0420 ELKCTY-6 1.00 1    | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION5_I | 4142 | -0.0335 | 539638 FLATRDG3 138 539674 MED-LDG4 138 1      | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION6_I | 350  | 0.1534  | 539667 HAGGARD3 115 539699 W-DODGE3 115 1      | C:3Wnd: OPEN B\$0524 HAGGARD3 1                  |
| REGION3 | REGION6_I | 635  | -0.1534 | 539667 HAGGARD3 115 B\$0525 HAGGARD3 1.00 1    | C:640153 CRETE 7 115 640174 FRIEND 7 115 1       |
| REGION3 | REGION6_I | 690  | -0.1534 | 539688 S-DODGE3 115 539699 W-DODGE3 115 1      | C:3Wnd: OPEN B\$0524 HAGGARD3 1                  |
| REGION3 | REGION6_I | 724  | 0.0912  | 520920 FTSUPLY4 138 B\$0461 FTSUPPLY 1.00 1    | C:520920 FTSUPLY4 138 520957 IODINE 4 138 1      |
| REGION3 | REGION6_I | 724  | 0.0912  | 520920 FTSUPLY4 138 B\$0462 FTSUPPLY2 1.00 2   | C:520920 FTSUPLY4 138 520957 IODINE 4 138 1      |
| REGION3 | REGION6_I | 762  | -0.1824 | 520920 FTSUPLY4 138 520922 SLEEPING 138 1      | Base Case                                        |
| REGION3 | REGION6_I | 771  | -0.0352 | 640253 KEYSTON7 115 640255 KINGSLY7 115 1      | C:3Wnd: OPEN B\$0497 GRTBEND3 1                  |
| REGION3 | REGION6_I | 826  | 0.1534  | 539688 S-DODGE3 115 539771 NOR-JUD3 115 1      | C:3Wnd: OPEN B\$0524 HAGGARD3 1                  |
| REGION3 | REGION6_I | 1146 | 0.1160  | 524266 BUSHLAND 3 115 524306 COULTER3 115 1    | C:523959 POTTER_CO 6 230 524267 BUSHLAND 6 230 1 |
| REGION3 | REGION6_I | 1234 | -0.1160 | 524266 BUSHLAND 3 115 524267 BUSHLAND 6 230 1  | C:523959 POTTER_CO 6 230 524267 BUSHLAND 6 230 1 |
| REGION3 | REGION6_I | 1267 | 0.1360  | 520957 IODINE 4 138 520999 MOORLND4 138 1      | Base Case                                        |
| REGION3 | REGION6_I | 1284 | -0.1534 | 539694 SPEARVL3 115 539771 NOR-JUD3 115 1      | C:539671 JUD-LRG3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION6_I | 1284 | -0.1534 | 539671 JUD-LRG3 115 539771 NOR-JUD3 115 1      | C:539694 SPEARVL3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION6_I | 1497 | 0.1534  | 539694 SPEARVL3 115 B\$0891 SPEARVL6 1.00 1    | C:539671 JUD-LRG3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION6_I | 1497 | -0.1534 | 539695 SPEARVL6 230 B\$0891 SPEARVL6 1.00 1    | C:539671 JUD-LRG3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION6_I | 1500 | 0.1360  | 520920 FTSUPLY4 138 520957 IODINE 4 138 1      | Base Case                                        |
| REGION3 | REGION6_I | 1595 | -0.2985 | 524267 BUSHLAND 6 230 524276 WILDOR_WND6 230 1 | Base Case                                        |
| REGION3 | REGION6_I | 1627 | -0.0828 | 539664 GRNBURG3 115 539671 JUD-LRG3 115 1      | C:539694 SPEARVL3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION6_I | 1680 | -0.0519 | 514785 WOODWRD4 138 515785 WINDFRM4 138 1      | C:520999 MOORLND4 138 521001 MORWODS4 138 1      |
| REGION3 | REGION6_I | 2777 | -0.1734 | 523959 POTTER_CO 6 230 524267 BUSHLAND 6 230 1 | C:645458 S3458 3 345 650189 103&R0K3 345 1       |
| REGION3 | REGION6_I | 2917 | 0.0307  | 539673 MED-LDG3 115 B\$0652 MED-LDG4 1.00 1    | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION6_I | 2918 | -0.0307 | 539674 MED-LDG4 138 B\$0652 MED-LDG4 1.00 1    | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION6_I | 3081 | 0.0397  | 539664 GRNBURG3 115 539697 SUNCITY3 115 1      | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION6_I | 3175 | -0.0397 | 539673 MED-LDG3 115 539697 SUNCITY3 115 1      | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION6_I | 3333 | 0.0870  | 524267 BUSHLAND 6 230 524623 DEAFSMITH 6 230 1 | C:652302 JULESBG7 115 659240 INTERST7 115 1      |

|         |           |      |         |                                                |                                                  |
|---------|-----------|------|---------|------------------------------------------------|--------------------------------------------------|
| REGION3 | REGION6_I | 3705 | 0.0522  | 525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1 | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION6_I | 3996 | -0.0580 | 523771 GRAPEVINE 6 230 524044 NICHOLS 6 230 1  | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION6_I | 4034 | -0.0463 | 531449 HOLCOMB7 345 B\$0548 HOLCOMB 1.00 1     | C:645458 S3458 3 345 650189 103&ROK3 345 1       |
| REGION3 | REGION6_I | 4034 | 0.0463  | 531448 HOLCOMB3 115 B\$0548 HOLCOMB 1.00 1     | C:645458 S3458 3 345 650189 103&ROK3 345 1       |
| REGION3 | REGION6_I | 4190 | -0.0478 | 640093 C.CREEK4 230 640286 N.PLATT4 230 1      | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION7_I | 350  | 0.1534  | 539667 HAGGARD3 115 539699 W-DODGE3 115 1      | C:3Wnd: OPEN B\$0524 HAGGARD3 1                  |
| REGION3 | REGION7_I | 635  | -0.1534 | 539667 HAGGARD3 115 B\$0525 HAGGARD3 1.00 1    | C:533245 KU CAMP3 115 533257 19THSTJ3 115 1      |
| REGION3 | REGION7_I | 690  | -0.1534 | 539688 S-DODGE3 115 539699 W-DODGE3 115 1      | C:3Wnd: OPEN B\$0524 HAGGARD3 1                  |
| REGION3 | REGION7_I | 724  | 0.0912  | 520920 FTSUPLY4 138 B\$0461 FTSUPPLY 1.00 1    | C:520920 FTSUPLY4 138 520957 IODINE 4 138 1      |
| REGION3 | REGION7_I | 724  | 0.0912  | 520920 FTSUPLY4 138 B\$0462 FTSUPPLY2 1.00 2   | C:520920 FTSUPLY4 138 520957 IODINE 4 138 1      |
| REGION3 | REGION7_I | 762  | -0.1824 | 520920 FTSUPLY4 138 520922 SLEEPING 138 1      | Base Case                                        |
| REGION3 | REGION7_I | 771  | -0.0352 | 640253 KEYSTON7 115 640255 KINGSLY7 115 1      | C:640271 MCCOOL 3 345 640277 MOORE 3 345 1       |
| REGION3 | REGION7_I | 826  | 0.1534  | 539688 S-DODGE3 115 539771 NOR-JUD3 115 1      | C:3Wnd: OPEN B\$0524 HAGGARD3 1                  |
| REGION3 | REGION7_I | 1139 | 0.0547  | 524266 BUSHLAND 3 115 524306 COULTER3 115 1    | C:524267 BUSHLAND 6 230 524623 DEAFSMITH 6 230 1 |
| REGION3 | REGION7_I | 1246 | -0.1149 | 524266 BUSHLAND 3 115 524267 BUSHLAND 6 230 1  | C:523959 POTTER_CO 6 230 524267 BUSHLAND 6 230 1 |
| REGION3 | REGION7_I | 1264 | 0.1363  | 520957 IODINE 4 138 520999 MOORLND4 138 1      | Base Case                                        |
| REGION3 | REGION7_I | 1284 | -0.1534 | 539671 JUD-LRG3 115 539771 NOR-JUD3 115 1      | C:539694 SPEARVL3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION7_I | 1284 | -0.1534 | 539694 SPEARVL3 115 539771 NOR-JUD3 115 1      | C:539671 JUD-LRG3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION7_I | 1497 | 0.1534  | 539694 SPEARVL3 115 B\$0891 SPEARVL6 1.00 1    | C:539671 JUD-LRG3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION7_I | 1497 | 0.1363  | 520920 FTSUPLY4 138 520957 IODINE 4 138 1      | Base Case                                        |
| REGION3 | REGION7_I | 1497 | -0.1534 | 539695 SPEARVL6 230 B\$0891 SPEARVL6 1.00 1    | C:539671 JUD-LRG3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION7_I | 1759 | -0.2985 | 524267 BUSHLAND 6 230 524276 WILDOR_WND6 230 1 | C:650233 33&SUP 7 115 650259 59&CO 7 115 1       |
| REGION3 | REGION7_I | 2394 | -0.0509 | 514785 WOODWRD4 138 515785 WINDFRM4 138 1      | C:659130 GRANTNB7 115 659188 SPCREEK7 115 1      |
| REGION3 | REGION7_I | 2644 | -0.0405 | 539664 GRNBURG3 115 539671 JUD-LRG3 115 1      | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION7_I | 2766 | 0.0324  | 539673 MED-LDG3 115 B\$0652 MED-LDG4 1.00 1    | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION7_I | 2768 | -0.0324 | 539674 MED-LDG4 138 B\$0652 MED-LDG4 1.00 1    | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION7_I | 2817 | -0.1713 | 523959 POTTER_CO 6 230 524267 BUSHLAND 6 230 1 | C:659130 GRANTNB7 115 659188 SPCREEK7 115 1      |
| REGION3 | REGION7_I | 3024 | 0.0405  | 539664 GRNBURG3 115 539697 SUNCITY3 115 1      | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION7_I | 3116 | -0.0405 | 539673 MED-LDG3 115 539697 SUNCITY3 115 1      | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION7_I | 3246 | 0.0894  | 524267 BUSHLAND 6 230 524623 DEAFSMITH 6 230 1 | C:652302 JULESBG7 115 659240 INTERST7 115 1      |



|         |           |      |         |                                                |                                                  |
|---------|-----------|------|---------|------------------------------------------------|--------------------------------------------------|
| REGION3 | REGION7_I | 3546 | 0.0546  | 525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1 | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION7_I | 3817 | -0.0607 | 523771 GRAPEVINE 6 230 524044 NICHOLS 6 230 1  | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION7_I | 4038 | -0.0463 | 531449 HOLCOMB7 345 B\$0548 HOLCOMB 1.00 1     | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION7_I | 4038 | 0.0463  | 531448 HOLCOMB3 115 B\$0548 HOLCOMB 1.00 1     | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION7_I | 4170 | -0.0655 | B\$0420 ELKCTY-6 1.00 511490 ELKCITY6 230 1    | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION8_I | 350  | 0.1534  | 539667 HAGGARD3 115 539699 W-DODGE3 115 1      | C:3Wnd: OPEN B\$0524 HAGGARD3 1                  |
| REGION3 | REGION8_I | 635  | -0.1534 | 539667 HAGGARD3 115 B\$0525 HAGGARD3 1.00 1    | C:509064 GEORPAC4 138 509071 LOGANSP4 138 1      |
| REGION3 | REGION8_I | 690  | -0.1534 | 539688 S-DODGE3 115 539699 W-DODGE3 115 1      | C:3Wnd: OPEN B\$0524 HAGGARD3 1                  |
| REGION3 | REGION8_I | 724  | 0.0912  | 520920 FTSUPLY4 138 B\$0461 FTSUPPLY 1.00 1    | C:520920 FTSUPLY4 138 520957 IODINE 4 138 1      |
| REGION3 | REGION8_I | 724  | 0.0912  | 520920 FTSUPLY4 138 B\$0462 FTSUPPLY2 1.00 2   | C:520920 FTSUPLY4 138 520957 IODINE 4 138 1      |
| REGION3 | REGION8_I | 762  | -0.1824 | 520920 FTSUPLY4 138 520922 SLEEPING 138 1      | Base Case                                        |
| REGION3 | REGION8_I | 771  | -0.0352 | 640253 KEYSTON7 115 640255 KINGSLY7 115 1      | C:510399 LSTAR--3 115 510407 PRY-JCT3 115 1      |
| REGION3 | REGION8_I | 826  | 0.1534  | 539688 S-DODGE3 115 539771 NOR-JUD3 115 1      | C:3Wnd: OPEN B\$0524 HAGGARD3 1                  |
| REGION3 | REGION8_I | 1134 | 0.0550  | 524266 BUSHLAND 3 115 524306 COULTER3 115 1    | C:524267 BUSHLAND 6 230 524623 DEAFSMITH 6 230 1 |
| REGION3 | REGION8_I | 1251 | -0.1145 | 524266 BUSHLAND 3 115 524267 BUSHLAND 6 230 1  | C:523959 POTTER_CO 6 230 524267 BUSHLAND 6 230 1 |
| REGION3 | REGION8_I | 1264 | 0.1364  | 520957 IODINE 4 138 520999 MOORLND4 138 1      | Base Case                                        |
| REGION3 | REGION8_I | 1284 | -0.1534 | 539671 JUD-LRG3 115 539771 NOR-JUD3 115 1      | C:539694 SPEARVL3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION8_I | 1284 | -0.1534 | 539694 SPEARVL3 115 539771 NOR-JUD3 115 1      | C:539671 JUD-LRG3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION8_I | 1496 | 0.1364  | 520920 FTSUPLY4 138 520957 IODINE 4 138 1      | Base Case                                        |
| REGION3 | REGION8_I | 1497 | 0.1534  | 539694 SPEARVL3 115 B\$0891 SPEARVL6 1.00 1    | C:539671 JUD-LRG3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION8_I | 1497 | -0.1534 | 539695 SPEARVL6 230 B\$0891 SPEARVL6 1.00 1    | C:539671 JUD-LRG3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION8_I | 1759 | -0.2985 | 524267 BUSHLAND 6 230 524276 WILDOR_WND6 230 1 | C:659162 REDWLCK7 115 659163 BLKWDCK7 115 1      |
| REGION3 | REGION8_I | 2398 | -0.0508 | 514785 WOODWRD4 138 515785 WINDFRM4 138 1      | C:659130 GRANTNB7 115 659188 SPCREEK7 115 1      |
| REGION3 | REGION8_I | 2696 | -0.0397 | 539664 GRNBURG3 115 539671 JUD-LRG3 115 1      | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION8_I | 2818 | 0.0318  | 539673 MED-LDG3 115 B\$0652 MED-LDG4 1.00 1    | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION8_I | 2820 | -0.0318 | 539674 MED-LDG4 138 B\$0652 MED-LDG4 1.00 1    | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION8_I | 2835 | -0.1702 | 523959 POTTER_CO 6 230 524267 BUSHLAND 6 230 1 | C:659130 GRANTNB7 115 659188 SPCREEK7 115 1      |
| REGION3 | REGION8_I | 3084 | 0.0397  | 539664 GRNBURG3 115 539697 SUNCITY3 115 1      | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION8_I | 3178 | -0.0397 | 539673 MED-LDG3 115 539697 SUNCITY3 115 1      | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION8_I | 3208 | 0.0904  | 524267 BUSHLAND 6 230 524623 DEAFSMITH 6 230 1 | C:652302 JULESBG7 115 659240 INTERST7 115 1      |

|         |           |      |         |                                                |                                                  |
|---------|-----------|------|---------|------------------------------------------------|--------------------------------------------------|
| REGION3 | REGION8_I | 3479 | 0.0556  | 525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1 | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION8_I | 3631 | -0.0638 | 523771 GRAPEVINE 6 230 524044 NICHOLS 6 230 1  | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION8_I | 3883 | -0.0354 | 507774 NORAM 4 138 508808 LONGWD 4 138 1       | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION8_I | 3968 | -0.0688 | B\$0420 ELKCTY-6 1.00 511490 ELKCITY6 230 1    | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION8_I | 3968 | -0.0688 | 511458 ELKCTY-4 138 B\$0420 ELKCTY-6 1.00 1    | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION9_I | 350  | 0.1534  | 539667 HAGGARD3 115 539699 W-DODGE3 115 1      | C:3Wnd: OPEN B\$0524 HAGGARD3 1                  |
| REGION3 | REGION9_I | 365  | -0.0360 | 505418 JONESB05 161 505420 HERGETT5 161 1      | C:505410 KENNETT5 161 505412 PARAGLD5 161 1      |
| REGION3 | REGION9_I | 635  | -0.1534 | 539667 HAGGARD3 115 B\$0525 HAGGARD3 1.00 1    | C:514702 BRECKIN4 138 514712 FAIRMON4 138 1      |
| REGION3 | REGION9_I | 690  | -0.1534 | 539688 S-DODGE3 115 539699 W-DODGE3 115 1      | C:3Wnd: OPEN B\$0524 HAGGARD3 1                  |
| REGION3 | REGION9_I | 724  | 0.0912  | 520920 FTSUPLY4 138 B\$0461 FTSUPPLY 1.00 1    | C:520920 FTSUPLY4 138 520957 IODINE 4 138 1      |
| REGION3 | REGION9_I | 724  | 0.0912  | 520920 FTSUPLY4 138 B\$0462 FTSUPPLY2 1.00 2   | C:520920 FTSUPLY4 138 520957 IODINE 4 138 1      |
| REGION3 | REGION9_I | 762  | -0.1824 | 520920 FTSUPLY4 138 520922 SLEEPING 138 1      | Base Case                                        |
| REGION3 | REGION9_I | 771  | -0.0352 | 640253 KEYSTON7 115 640255 KINGSLY7 115 1      | C:514702 BRECKIN4 138 514712 FAIRMON4 138 1      |
| REGION3 | REGION9_I | 826  | 0.1534  | 539688 S-DODGE3 115 539771 NOR-JUD3 115 1      | C:3Wnd: OPEN B\$0524 HAGGARD3 1                  |
| REGION3 | REGION9_I | 1140 | 0.0547  | 524266 BUSHLAND 3 115 524306 COULTER3 115 1    | C:524267 BUSHLAND 6 230 524623 DEAFSMITH 6 230 1 |
| REGION3 | REGION9_I | 1244 | -0.1151 | 524266 BUSHLAND 3 115 524267 BUSHLAND 6 230 1  | C:523959 POTTER_CO 6 230 524267 BUSHLAND 6 230 1 |
| REGION3 | REGION9_I | 1264 | 0.1363  | 520957 IODINE 4 138 520999 MOORLND4 138 1      | Base Case                                        |
| REGION3 | REGION9_I | 1284 | -0.1534 | 539694 SPEARVL3 115 539771 NOR-JUD3 115 1      | C:539671 JUD-LRG3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION9_I | 1284 | -0.1534 | 539671 JUD-LRG3 115 539771 NOR-JUD3 115 1      | C:539694 SPEARVL3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION9_I | 1497 | 0.1534  | 539694 SPEARVL3 115 B\$0891 SPEARVL6 1.00 1    | C:539671 JUD-LRG3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION9_I | 1497 | 0.1363  | 520920 FTSUPLY4 138 520957 IODINE 4 138 1      | Base Case                                        |
| REGION3 | REGION9_I | 1497 | -0.1534 | 539695 SPEARVL6 230 B\$0891 SPEARVL6 1.00 1    | C:539671 JUD-LRG3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION9_I | 1759 | -0.2985 | 524267 BUSHLAND 6 230 524276 WILDOR_WND6 230 1 | C:650267 84&LE 7 115 650272 91&A 7 115 1         |
| REGION3 | REGION9_I | 2376 | -0.0513 | 514785 WOODWRD4 138 515785 WINDFRM4 138 1      | C:646263 S1263 5 161 646280 S1280 5 161 1        |
| REGION3 | REGION9_I | 2583 | -0.1074 | 500410 HOPKINS4 138 500774 SEGURA4 138 1       | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION9_I | 2714 | -0.0394 | 539664 GRNBURG3 115 539671 JUD-LRG3 115 1      | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION9_I | 2777 | -0.0884 | 502401 FLANDER6 230 502402 ACADIAN6 230 1      | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION9_I | 2812 | -0.1716 | 523959 POTTER_CO 6 230 524267 BUSHLAND 6 230 1 | C:659130 GRANTNB7 115 659188 SPCREEK7 115 1      |
| REGION3 | REGION9_I | 2870 | 0.0312  | 539673 MED-LDG3 115 B\$0652 MED-LDG4 1.00 1    | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION9_I | 2871 | -0.0312 | 539674 MED-LDG4 138 B\$0652 MED-LDG4 1.00 1    | C:652302 JULESBG7 115 659240 INTERST7 115 1      |

|         |            |      |         |                    |     |                    |      |   |                               |     |                    |     |   |
|---------|------------|------|---------|--------------------|-----|--------------------|------|---|-------------------------------|-----|--------------------|-----|---|
| REGION3 | REGION9_I  | 2956 | 0.0359  | 500740 RAMOS 4     | 138 | 503301 MRGNCTY4    | 138  | 1 | C:659192 LYNN 7               | 115 | 659239 COVALT 7    | 115 | 1 |
| REGION3 | REGION9_I  | 2960 | 0.0824  | 500410 HOPKINS4    | 138 | 500580 MORBHAN4    | 138  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7    | 115 | 1 |
| REGION3 | REGION9_I  | 2969 | -0.0884 | 502402 ACADIAN6    | 230 | 502403 BONIN 6     | 230  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7    | 115 | 1 |
| REGION3 | REGION9_I  | 3065 | 0.1086  | 500410 HOPKINS4    | 138 | 500660 PATOUT 4    | 138  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7    | 115 | 1 |
| REGION3 | REGION9_I  | 3104 | 0.0394  | 539664 GRNBURG3    | 115 | 539697 SUNCITY3    | 115  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7    | 115 | 1 |
| REGION3 | REGION10_I | 350  | 0.1534  | 539667 HAGGARD3    | 115 | 539699 W-DODGE3    | 115  | 1 | C:3Wnd: OPEN B\$0524 HAGGARD3 | 1   |                    |     |   |
| REGION3 | REGION10_I | 635  | -0.1534 | 539667 HAGGARD3    | 115 | B\$0525 HAGGARD3   | 1.00 | 1 | C:510422 COFFEYT4             | 138 | 533002 DEARING4    | 138 | 1 |
| REGION3 | REGION10_I | 690  | -0.1534 | 539688 S-DODGE3    | 115 | 539699 W-DODGE3    | 115  | 1 | C:3Wnd: OPEN B\$0524 HAGGARD3 | 1   |                    |     |   |
| REGION3 | REGION10_I | 724  | 0.0912  | 520920 FTSUPLY4    | 138 | B\$0461 FTSUPPLY   | 1.00 | 1 | C:520920 FTSUPLY4             | 138 | 520957 IODINE 4    | 138 | 1 |
| REGION3 | REGION10_I | 724  | 0.0912  | 520920 FTSUPLY4    | 138 | B\$0462 FTSUPPLY2  | 1.00 | 2 | C:520920 FTSUPLY4             | 138 | 520957 IODINE 4    | 138 | 1 |
| REGION3 | REGION10_I | 762  | -0.1824 | 520920 FTSUPLY4    | 138 | 520922 SLEEPING    | 138  | 1 | Base Case                     |     |                    |     |   |
| REGION3 | REGION10_I | 771  | -0.0352 | 640253 KEYSTON7    | 115 | 640255 KINGSLY7    | 115  | 1 | C:542969 STILWEL5             | 161 | 543057 BUCYRUS5    | 161 | 1 |
| REGION3 | REGION10_I | 826  | 0.1534  | 539688 S-DODGE3    | 115 | 539771 NOR-JUD3    | 115  | 1 | C:3Wnd: OPEN B\$0524 HAGGARD3 | 1   |                    |     |   |
| REGION3 | REGION10_I | 1144 | 0.0545  | 524266 BUSHLAND 3  | 115 | 524306 COULTER3    | 115  | 1 | C:524267 BUSHLAND 6           | 230 | 524623 DEAFSMITH 6 | 230 | 1 |
| REGION3 | REGION10_I | 1221 | -0.2602 | 505428 SIKESTN5    | 161 | 505434 IDALIA 5    | 161  | 1 | C:505400 N MADRD5             | 161 | 505428 SIKESTN5    | 161 | 1 |
| REGION3 | REGION10_I | 1239 | -0.1156 | 524266 BUSHLAND 3  | 115 | 524267 BUSHLAND 6  | 230  | 1 | C:523959 POTTER_CO 6          | 230 | 524267 BUSHLAND 6  | 230 | 1 |
| REGION3 | REGION10_I | 1264 | 0.1363  | 520957 IODINE 4    | 138 | 520999 MOORLND4    | 138  | 1 | Base Case                     |     |                    |     |   |
| REGION3 | REGION10_I | 1284 | -0.1534 | 539694 SPEARVL3    | 115 | 539771 NOR-JUD3    | 115  | 1 | C:539671 JUD-LRG3             | 115 | 539771 NOR-JUD3    | 115 | 1 |
| REGION3 | REGION10_I | 1284 | -0.1534 | 539671 JUD-LRG3    | 115 | 539771 NOR-JUD3    | 115  | 1 | C:539694 SPEARVL3             | 115 | 539771 NOR-JUD3    | 115 | 1 |
| REGION3 | REGION10_I | 1759 | -0.2985 | 524267 BUSHLAND 6  | 230 | 524276 WILDOR_WND6 | 230  | 1 | C:650275 84&BLUF7             | 115 | 650283 WAVERLY7    | 115 | 1 |
| REGION3 | REGION10_I | 1827 | 0.1363  | 520920 FTSUPLY4    | 138 | 520957 IODINE 4    | 138  | 1 | C:659130 GRANTNB7             | 115 | 659188 SPCREEK7    | 115 | 1 |
| REGION3 | REGION10_I | 2211 | 0.1206  | 505400 N MADRD5    | 161 | 505428 SIKESTN5    | 161  | 1 | C:652570 ALIANCE7             | 115 | 659197 SNAKECK7    | 115 | 1 |
| REGION3 | REGION10_I | 2386 | -0.0511 | 514785 WOODWRD4    | 138 | 515785 WINDFRM4    | 138  | 1 | C:659130 GRANTNB7             | 115 | 659188 SPCREEK7    | 115 | 1 |
| REGION3 | REGION10_I | 2726 | -0.0392 | 539664 GRNBURG3    | 115 | 539671 JUD-LRG3    | 115  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7    | 115 | 1 |
| REGION3 | REGION10_I | 2759 | 0.0988  | 539694 SPEARVL3    | 115 | B\$0891 SPEARVL6   | 1.00 | 1 | C:650261 56&I80 7             | 115 | 650269 70&BLUF7    | 115 | 1 |
| REGION3 | REGION10_I | 2759 | -0.0988 | 539695 SPEARVL6    | 230 | B\$0891 SPEARVL6   | 1.00 | 1 | C:650261 56&I80 7             | 115 | 650269 70&BLUF7    | 115 | 1 |
| REGION3 | REGION10_I | 2795 | -0.1726 | 523959 POTTER_CO 6 | 230 | 524267 BUSHLAND 6  | 230  | 1 | C:659130 GRANTNB7             | 115 | 659188 SPCREEK7    | 115 | 1 |
| REGION3 | REGION10_I | 2908 | 0.0308  | 539673 MED-LDG3    | 115 | B\$0652 MED-LDG4   | 1.00 | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7    | 115 | 1 |
| REGION3 | REGION10_I | 2910 | -0.0308 | 539674 MED-LDG4    | 138 | B\$0652 MED-LDG4   | 1.00 | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7    | 115 | 1 |
| REGION3 | REGION10_I | 3118 | 0.0392  | 539664 GRNBURG3    | 115 | 539697 SUNCITY3    | 115  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7    | 115 | 1 |

|         |            |      |         |                   |      |                    |      |   |                                |     |                 |     |   |
|---------|------------|------|---------|-------------------|------|--------------------|------|---|--------------------------------|-----|-----------------|-----|---|
| REGION3 | REGION10_I | 3213 | -0.0392 | 539673 MED-LDG3   | 115  | 539697 SUNCITY3    | 115  | 1 | C:652302 JULESBG7              | 115 | 659240 INTERST7 | 115 | 1 |
| REGION3 | REGION10_I | 3296 | -0.0779 | B\$0538 HEMP 1    | 1.00 | 507454 HEMPSTD4    | 138  | 1 | C:652302 JULESBG7              | 115 | 659240 INTERST7 | 115 | 1 |
| REGION3 | REGION10_I | 3296 | 0.0779  | B\$0538 HEMP 1    | 1.00 | 507456 HEMPSTD3    | 115  | 1 | C:652302 JULESBG7              | 115 | 659240 INTERST7 | 115 | 1 |
| REGION3 | REGION10_I | 3296 | 0.0880  | 524267 BUSHLAND 6 | 230  | 524623 DEAFSMITH 6 | 230  | 1 | C:652302 JULESBG7              | 115 | 659240 INTERST7 | 115 | 1 |
| REGION3 | REGION10_I | 3360 | -0.0779 | 504122 MCNAB 3    | 115  | 507456 HEMPSTD3    | 115  | 1 | C:652302 JULESBG7              | 115 | 659240 INTERST7 | 115 | 1 |
| REGION4 | REGION5_I  | 915  | -0.1507 | 511485 CLINTJC4   | 138  | 511534 CL-NGTP4    | 138  | 1 | C:511506 WTH WF 4              | 138 | 511536 WEATHTP4 | 138 | 1 |
| REGION4 | REGION5_I  | 950  | -0.1769 | 514785 WOODWRD4   | 138  | 515363 CENT 4      | 138  | 1 | C:533244 JARBAL03              | 115 | 533268 STRANGR3 | 115 | 2 |
| REGION4 | REGION5_I  | 1052 | -0.1362 | 514785 WOODWRD4   | 138  | 515785 WINDFRM4    | 138  | 1 | C:515785 WINDFRM4              | 138 | 520999 MOORLND4 | 138 | 1 |
| REGION4 | REGION5_I  | 1116 | -0.1362 | 515785 WINDFRM4   | 138  | 515786 FPLWIND4    | 138  | 1 | Base Case                      |     |                 |     |   |
| REGION4 | REGION5_I  | 1333 | 0.0454  | 640050 AINSWND7   | 115  | 640051 AINSWRT7    | 115  | 1 | C:640305 ONEILL 7              | 115 | 640349 SPENCER7 | 115 | 1 |
| REGION4 | REGION5_I  | 1439 | 0.1507  | 511506 WTH WF 4   | 138  | 511536 WEATHTP4    | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4 | 138 | 1 |
| REGION4 | REGION5_I  | 1439 | 0.1507  | 511506 WTH WF 4   | 138  | 511534 CL-NGTP4    | 138  | 1 | C:511506 WTH WF 4              | 138 | 511536 WEATHTP4 | 138 | 1 |
| REGION4 | REGION5_I  | 1493 | 0.2415  | 515785 WINDFRM4   | 138  | 520999 MOORLND4    | 138  | 1 | C:514880 NORTWST7              | 345 | 515375 WWRDEHV7 | 345 | 1 |
| REGION4 | REGION5_I  | 1529 | 0.0711  | 640050 AINSWND7   | 115  | 640096 CALAMS 7    | 115  | 1 | C:640050 AINSWND7              | 115 | 640051 AINSWRT7 | 115 | 1 |
| REGION4 | REGION5_I  | 1532 | 0.0711  | 640096 CALAMS 7   | 115  | 640381 THEDFRD7    | 115  | 1 | C:640050 AINSWND7              | 115 | 640051 AINSWRT7 | 115 | 1 |
| REGION4 | REGION5_I  | 1542 | -0.1507 | 511497 WTH_SE 4   | 138  | 511536 WEATHTP4    | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4 | 138 | 1 |
| REGION4 | REGION5_I  | 1547 | -0.0750 | 514788 GLASMTN4   | 138  | 520999 MOORLND4    | 138  | 1 | C:514880 NORTWST7              | 345 | 515375 WWRDEHV7 | 345 | 1 |
| REGION4 | REGION5_I  | 1591 | -0.0303 | B\$1039 WTH_SE    | 1.00 | 511497 WTH_SE 4    | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4 | 138 | 1 |
| REGION4 | REGION5_I  | 1617 | 0.3146  | 514785 WOODWRD4   | 138  | 515376 WWRDEHV4    | 138  | 2 | C:514785 WOODWRD4              | 138 | 515376 WWRDEHV4 | 138 | 1 |
| REGION4 | REGION5_I  | 1621 | 0.3137  | 514785 WOODWRD4   | 138  | 515376 WWRDEHV4    | 138  | 1 | C:514785 WOODWRD4              | 138 | 515376 WWRDEHV4 | 138 | 2 |
| REGION4 | REGION5_I  | 1780 | 0.0472  | 514785 WOODWRD4   | 138  | B\$1035 WOODWRD2   | 1.00 | 1 | C:515785 WINDFRM4              | 138 | 520999 MOORLND4 | 138 | 1 |
| REGION4 | REGION5_I  | 1881 | -0.0763 | 511458 ELKCTY-4   | 138  | 511485 CLINTJC4    | 138  | 1 | C:511489 WTH_JCT4              | 138 | 511497 WTH_SE 4 | 138 | 1 |
| REGION4 | REGION5_I  | 1904 | -0.2801 | B\$1040 WWDEHV-T  | 1.00 | 515376 WWRDEHV4    | 138  | 1 | C:3wnd: OPEN B\$1041 WWDEHV-T2 | 2   |                 |     |   |
| REGION4 | REGION5_I  | 1904 | -0.2801 | B\$1041 WWDEHV-T2 | 1.00 | 515376 WWRDEHV4    | 138  | 2 | C:3wnd: OPEN B\$1040 WWDEHV-T  | 1   |                 |     |   |
| REGION4 | REGION5_I  | 1905 | -0.2801 | 515375 WWRDEHV7   | 345  | B\$1041 WWDEHV-T2  | 1.00 | 2 | C:3wnd: OPEN B\$1040 WWDEHV-T  | 1   |                 |     |   |
| REGION4 | REGION5_I  | 1905 | -0.2801 | 515375 WWRDEHV7   | 345  | B\$1040 WWDEHV-T   | 1.00 | 1 | C:3wnd: OPEN B\$1041 WWDEHV-T2 | 2   |                 |     |   |
| REGION4 | REGION5_I  | 1945 | -0.1204 | 511489 WTH_JCT4   | 138  | 511497 WTH_SE 4    | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4 | 138 | 1 |
| REGION4 | REGION5_I  | 1988 | -0.0750 | 514778 CLEOCOR4   | 138  | 514788 GLASMTN4    | 138  | 1 | C:514880 NORTWST7              | 345 | 515375 WWRDEHV7 | 345 | 1 |
| REGION4 | REGION5_I  | 2034 | 0.1204  | 511540 CAN_GAS4   | 138  | 514821 JENSEN 4    | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4 | 138 | 1 |
| REGION4 | REGION5_I  | 2088 | -0.0722 | 520882 DOVERSW4   | 138  | 521016 OKEENE 4    | 138  | 1 | C:514880 NORTWST7              | 345 | 515375 WWRDEHV7 | 345 | 1 |

|         |           |      |         |                   |      |                   |      |   |                                |     |                    |     |   |
|---------|-----------|------|---------|-------------------|------|-------------------|------|---|--------------------------------|-----|--------------------|-----|---|
| REGION4 | REGION5_I | 2112 | -0.1204 | 511433 HINTON 4   | 138  | 511489 WTH_JCT4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4    | 138 | 1 |
| REGION4 | REGION5_I | 2163 | -0.0711 | 640359 STAPLTN7   | 115  | 640381 THEDFRD7   | 115  | 1 | C:640050 AINSWND7              | 115 | 640051 AINSWRT7    | 115 | 1 |
| REGION4 | REGION5_I | 2229 | 0.0791  | 514822 SOUTHRD4   | 138  | 514823 ROMNOSE4   | 138  | 1 | C:514880 NORTWST7              | 345 | 515375 WWRDEHV7    | 345 | 1 |
| REGION4 | REGION5_I | 2233 | 0.0533  | 520999 MOORLND4   | 138  | 521001 MORWODS4   | 138  | 1 | C:514880 NORTWST7              | 345 | 515375 WWRDEHV7    | 345 | 1 |
| REGION4 | REGION5_I | 2301 | -0.1347 | 530592 SMOKYHLLS6 | 230  | 530593 SMOKY_INT  | 230  | 1 | C:650229 27&PLR 7              | 115 | 650250 40&R0K 7    | 115 | 1 |
| REGION4 | REGION6_I | 915  | -0.1507 | 511485 CLINTJC4   | 138  | 511534 CL-NGTP4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511536 WEATHTP4    | 138 | 1 |
| REGION4 | REGION6_I | 950  | -0.1769 | 514785 WOODWRD4   | 138  | 515363 CENT 4     | 138  | 1 | C:527711 EAGLE_CREEK3          | 115 | 527798 EDDY_CNTY 3 | 115 | 1 |
| REGION4 | REGION6_I | 1052 | -0.1362 | 514785 WOODWRD4   | 138  | 515785 WINDFRM4   | 138  | 1 | C:515785 WINDFRM4              | 138 | 520999 MOORLND4    | 138 | 1 |
| REGION4 | REGION6_I | 1116 | -0.1362 | 515785 WINDFRM4   | 138  | 515786 FPLWIND4   | 138  | 1 | Base Case                      |     |                    |     |   |
| REGION4 | REGION6_I | 1312 | 0.0461  | 640050 AINSWND7   | 115  | 640051 AINSWRT7   | 115  | 1 | C:640305 ONEILL 7              | 115 | 640349 SPENCER7    | 115 | 1 |
| REGION4 | REGION6_I | 1439 | 0.1507  | 511506 WTH WF 4   | 138  | 511534 CL-NGTP4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511536 WEATHTP4    | 138 | 1 |
| REGION4 | REGION6_I | 1439 | 0.1507  | 511506 WTH WF 4   | 138  | 511536 WEATHTP4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4    | 138 | 1 |
| REGION4 | REGION6_I | 1493 | 0.2413  | 515785 WINDFRM4   | 138  | 520999 MOORLND4   | 138  | 1 | C:514880 NORTWST7              | 345 | 515375 WWRDEHV7    | 345 | 1 |
| REGION4 | REGION6_I | 1503 | -0.0772 | 514788 GLASMTN4   | 138  | 520999 MOORLND4   | 138  | 1 | C:514880 NORTWST7              | 345 | 515375 WWRDEHV7    | 345 | 1 |
| REGION4 | REGION6_I | 1529 | 0.0711  | 640050 AINSWND7   | 115  | 640096 CALAMS 7   | 115  | 1 | C:640050 AINSWND7              | 115 | 640051 AINSWRT7    | 115 | 1 |
| REGION4 | REGION6_I | 1532 | 0.0711  | 640096 CALAMS 7   | 115  | 640381 THEDFRD7   | 115  | 1 | C:640050 AINSWND7              | 115 | 640051 AINSWRT7    | 115 | 1 |
| REGION4 | REGION6_I | 1542 | -0.1507 | 511497 WTH_SE 4   | 138  | 511536 WEATHTP4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4    | 138 | 1 |
| REGION4 | REGION6_I | 1560 | -0.0309 | B\$1039 WTH_SE    | 1.00 | 511497 WTH_SE 4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4    | 138 | 1 |
| REGION4 | REGION6_I | 1630 | 0.3121  | 514785 WOODWRD4   | 138  | 515376 WWRDEHV4   | 138  | 2 | C:514785 WOODWRD4              | 138 | 515376 WWRDEHV4    | 138 | 1 |
| REGION4 | REGION6_I | 1634 | 0.3112  | 514785 WOODWRD4   | 138  | 515376 WWRDEHV4   | 138  | 1 | C:514785 WOODWRD4              | 138 | 515376 WWRDEHV4    | 138 | 2 |
| REGION4 | REGION6_I | 1739 | 0.0483  | 514785 WOODWRD4   | 138  | B\$1035 WOODWRD2  | 1.00 | 1 | C:515785 WINDFRM4              | 138 | 520999 MOORLND4    | 138 | 1 |
| REGION4 | REGION6_I | 1803 | -0.0796 | 511458 ELKCTY-4   | 138  | 511485 CLINTJC4   | 138  | 1 | C:511489 WTH_JCT4              | 138 | 511497 WTH_SE 4    | 138 | 1 |
| REGION4 | REGION6_I | 1917 | -0.2782 | B\$1040 WWDEHV-T  | 1.00 | 515376 WWRDEHV4   | 138  | 1 | C:3wnd: OPEN B\$1041 WWDEHV-T2 | 2   |                    |     |   |
| REGION4 | REGION6_I | 1917 | -0.2782 | B\$1041 WWDEHV-T2 | 1.00 | 515376 WWRDEHV4   | 138  | 2 | C:3wnd: OPEN B\$1040 WWDEHV-T  | 1   |                    |     |   |
| REGION4 | REGION6_I | 1918 | -0.2782 | 515375 WWRDEHV7   | 345  | B\$1041 WWDEHV-T2 | 1.00 | 2 | C:3wnd: OPEN B\$1040 WWDEHV-T  | 1   |                    |     |   |
| REGION4 | REGION6_I | 1918 | -0.2782 | 515375 WWRDEHV7   | 345  | B\$1040 WWDEHV-T  | 1.00 | 1 | C:3wnd: OPEN B\$1041 WWDEHV-T2 | 2   |                    |     |   |
| REGION4 | REGION6_I | 1931 | -0.0772 | 514778 CLEOCOR4   | 138  | 514788 GLASMTN4   | 138  | 1 | C:514880 NORTWST7              | 345 | 515375 WWRDEHV7    | 345 | 1 |
| REGION4 | REGION6_I | 1955 | -0.1198 | 511489 WTH_JCT4   | 138  | 511497 WTH_SE 4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4    | 138 | 1 |
| REGION4 | REGION6_I | 2044 | 0.1198  | 511540 CAN_GAS4   | 138  | 514821 JENSEN 4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4    | 138 | 1 |
| REGION4 | REGION6_I | 2067 | -0.0729 | 520882 DOVERSW4   | 138  | 521016 OKEENE 4   | 138  | 1 | C:514880 NORTWST7              | 345 | 515375 WWRDEHV7    | 345 | 1 |

|         |           |      |         |                   |      |                   |      |   |                                |     |                 |     |   |
|---------|-----------|------|---------|-------------------|------|-------------------|------|---|--------------------------------|-----|-----------------|-----|---|
| REGION4 | REGION6_I | 2100 | -0.0304 | 514795 KNOBHIL4   | 138  | 520999 MOORLND4   | 138  | 1 | C:514880 NORTWST7              | 345 | 515375 WWRDEHV7 | 345 | 1 |
| REGION4 | REGION6_I | 2123 | -0.1198 | 511433 HINTON 4   | 138  | 511489 WTH_JCT4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4 | 138 | 1 |
| REGION4 | REGION6_I | 2163 | -0.0711 | 640359 STAPLTN7   | 115  | 640381 THEDFRD7   | 115  | 1 | C:640050 AINSWND7              | 115 | 640051 AINSWRT7 | 115 | 1 |
| REGION4 | REGION6_I | 2301 | -0.1347 | 530592 SMOKYHLLS6 | 230  | 530593 SMOKY_INT  | 230  | 1 | C:500560 MARKSVL4              | 138 | 500960 YBAYOU 4 | 138 | 1 |
| REGION4 | REGION6_I | 2304 | 0.0517  | 520999 MOORLND4   | 138  | 521001 MORWODS4   | 138  | 1 | C:514880 NORTWST7              | 345 | 515375 WWRDEHV7 | 345 | 1 |
| REGION4 | REGION7_I | 915  | -0.1507 | 511485 CLINTJC4   | 138  | 511534 CL-NGTP4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511536 WEATHTP4 | 138 | 1 |
| REGION4 | REGION7_I | 950  | -0.1769 | 514785 WOODWRD4   | 138  | 515363 CENT 4     | 138  | 1 | C:509790 CAT00SA4              | 138 | 509841 PCATSAT4 | 138 | 1 |
| REGION4 | REGION7_I | 1052 | -0.1362 | 514785 WOODWRD4   | 138  | 515785 WINDFRM4   | 138  | 1 | C:515785 WINDFRM4              | 138 | 520999 MOORLND4 | 138 | 1 |
| REGION4 | REGION7_I | 1116 | -0.1362 | 515785 WINDFRM4   | 138  | 515786 FPLWIND4   | 138  | 1 | Base Case                      |     |                 |     |   |
| REGION4 | REGION7_I | 1311 | 0.0462  | 640050 AINSWND7   | 115  | 640051 AINSWRT7   | 115  | 1 | C:640305 ONEILL 7              | 115 | 640349 SPENCER7 | 115 | 1 |
| REGION4 | REGION7_I | 1439 | 0.1507  | 511506 WTH WF 4   | 138  | 511536 WEATHTP4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4 | 138 | 1 |
| REGION4 | REGION7_I | 1439 | 0.1507  | 511506 WTH WF 4   | 138  | 511534 CL-NGTP4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511536 WEATHTP4 | 138 | 1 |
| REGION4 | REGION7_I | 1498 | 0.2405  | 515785 WINDFRM4   | 138  | 520999 MOORLND4   | 138  | 1 | C:514880 NORTWST7              | 345 | 515375 WWRDEHV7 | 345 | 1 |
| REGION4 | REGION7_I | 1526 | -0.0760 | 514788 GLASMTN4   | 138  | 520999 MOORLND4   | 138  | 1 | C:514880 NORTWST7              | 345 | 515375 WWRDEHV7 | 345 | 1 |
| REGION4 | REGION7_I | 1529 | 0.0711  | 640050 AINSWND7   | 115  | 640096 CALAMS 7   | 115  | 1 | C:640050 AINSWND7              | 115 | 640051 AINSWRT7 | 115 | 1 |
| REGION4 | REGION7_I | 1532 | 0.0711  | 640096 CALAMS 7   | 115  | 640381 THEDFRD7   | 115  | 1 | C:640050 AINSWND7              | 115 | 640051 AINSWRT7 | 115 | 1 |
| REGION4 | REGION7_I | 1542 | -0.1507 | 511497 WTH_SE 4   | 138  | 511536 WEATHTP4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4 | 138 | 1 |
| REGION4 | REGION7_I | 1552 | -0.0310 | B\$1039 WTH_SE    | 1.00 | 511497 WTH_SE 4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4 | 138 | 1 |
| REGION4 | REGION7_I | 1621 | 0.3137  | 514785 WOODWRD4   | 138  | 515376 WWRDEHV4   | 138  | 2 | C:514785 WOODWRD4              | 138 | 515376 WWRDEHV4 | 138 | 1 |
| REGION4 | REGION7_I | 1626 | 0.3129  | 514785 WOODWRD4   | 138  | 515376 WWRDEHV4   | 138  | 1 | C:514785 WOODWRD4              | 138 | 515376 WWRDEHV4 | 138 | 2 |
| REGION4 | REGION7_I | 1764 | 0.0476  | 514785 WOODWRD4   | 138  | B\$1035 WOODWRD2  | 1.00 | 1 | C:515785 WINDFRM4              | 138 | 520999 MOORLND4 | 138 | 1 |
| REGION4 | REGION7_I | 1834 | -0.0782 | 511458 ELKCTY-4   | 138  | 511485 CLINTJC4   | 138  | 1 | C:511489 WTH_JCT4              | 138 | 511497 WTH_SE 4 | 138 | 1 |
| REGION4 | REGION7_I | 1906 | -0.2797 | B\$1040 WWDEHV-T  | 1.00 | 515376 WWRDEHV4   | 138  | 1 | C:3wnd: OPEN B\$1041 WWDEHV-T2 | 2   |                 |     |   |
| REGION4 | REGION7_I | 1906 | -0.2797 | B\$1041 WWDEHV-T2 | 1.00 | 515376 WWRDEHV4   | 138  | 2 | C:3wnd: OPEN B\$1040 WWDEHV-T  | 1   |                 |     |   |
| REGION4 | REGION7_I | 1907 | -0.2797 | 515375 WWRDEHV7   | 345  | B\$1040 WWDEHV-T  | 1.00 | 1 | C:3wnd: OPEN B\$1041 WWDEHV-T2 | 2   |                 |     |   |
| REGION4 | REGION7_I | 1907 | -0.2797 | 515375 WWRDEHV7   | 345  | B\$1041 WWDEHV-T2 | 1.00 | 2 | C:3wnd: OPEN B\$1040 WWDEHV-T  | 1   |                 |     |   |
| REGION4 | REGION7_I | 1958 | -0.1196 | 511489 WTH_JCT4   | 138  | 511497 WTH_SE 4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4 | 138 | 1 |
| REGION4 | REGION7_I | 1961 | -0.0760 | 514778 CLEOCOR4   | 138  | 514788 GLASMTN4   | 138  | 1 | C:514880 NORTWST7              | 345 | 515375 WWRDEHV7 | 345 | 1 |
| REGION4 | REGION7_I | 2046 | 0.1196  | 511540 CAN_GAS4   | 138  | 514821 JENSEN 4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4 | 138 | 1 |
| REGION4 | REGION7_I | 2083 | -0.0724 | 520882 DOVERSW4   | 138  | 521016 OKEENE 4   | 138  | 1 | C:514880 NORTWST7              | 345 | 515375 WWRDEHV7 | 345 | 1 |



|         |           |      |         |                   |      |                     |      |   |                                |     |                 |     |   |
|---------|-----------|------|---------|-------------------|------|---------------------|------|---|--------------------------------|-----|-----------------|-----|---|
| REGION4 | REGION7_I | 2125 | -0.1196 | 511433 HINTON 4   | 138  | 511489 WTH_JCT4     | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4 | 138 | 1 |
| REGION4 | REGION7_I | 2163 | -0.0711 | 640359 STAPLTN7   | 115  | 640381 THEDFRD7     | 115  | 1 | C:640050 AINSWND7              | 115 | 640051 AINSWRT7 | 115 | 1 |
| REGION4 | REGION7_I | 2266 | 0.0526  | 520999 MOORLND4   | 138  | 521001 MORWODS4     | 138  | 1 | C:514880 NORTWST7              | 345 | 515375 WWRDEHV7 | 345 | 1 |
| REGION4 | REGION7_I | 2301 | -0.1347 | 530592 SMOKYHLLS6 | 230  | 530593 SMOKY_INT    | 230  | 1 | C:650214 NW68HOL7              | 115 | 650290 ROKEBY 7 | 115 | 1 |
| REGION4 | REGION7_I | 3057 | 0.1162  | 530592 SMOKYHLLS6 | 230  | 532873 SUMMIT 6     | 230  | 1 | C:652302 JULESBG7              | 115 | 659240 INTERST7 | 115 | 1 |
| REGION4 | REGION8_I | 915  | -0.1507 | 511485 CLINTJC4   | 138  | 511534 CL-NGTP4     | 138  | 1 | C:511506 WTH WF 4              | 138 | 511536 WEATHTP4 | 138 | 1 |
| REGION4 | REGION8_I | 950  | -0.1769 | 514785 WOODWRD4   | 138  | 515363 CENT 4       | 138  | 1 | C:3wnd: OPEN B\$0711 NHUNTNT1  | 1   |                 |     |   |
| REGION4 | REGION8_I | 1052 | -0.1362 | 514785 WOODWRD4   | 138  | 515785 WINDFRM4     | 138  | 1 | C:515785 WINDFRM4              | 138 | 520999 MOORLND4 | 138 | 1 |
| REGION4 | REGION8_I | 1116 | -0.1362 | 515785 WINDFRM4   | 138  | 515786 FPLWIND4     | 138  | 1 | Base Case                      |     |                 |     |   |
| REGION4 | REGION8_I | 1302 | 0.0465  | 640050 AINSWND7   | 115  | 640051 AINSWRT7     | 115  | 1 | C:640305 ONEILL 7              | 115 | 640349 SPENCER7 | 115 | 1 |
| REGION4 | REGION8_I | 1439 | 0.1507  | 511506 WTH WF 4   | 138  | 511534 CL-NGTP4     | 138  | 1 | C:511506 WTH WF 4              | 138 | 511536 WEATHTP4 | 138 | 1 |
| REGION4 | REGION8_I | 1439 | 0.1507  | 511506 WTH WF 4   | 138  | 511536 WEATHTP4     | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4 | 138 | 1 |
| REGION4 | REGION8_I | 1500 | -0.0321 | B\$1039 WTH_SE    | 1.00 | 511497 WTH_SE 4     | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4 | 138 | 1 |
| REGION4 | REGION8_I | 1502 | 0.2400  | 515785 WINDFRM4   | 138  | 520999 MOORLND4     | 138  | 1 | C:514880 NORTWST7              | 345 | 515375 WWRDEHV7 | 345 | 1 |
| REGION4 | REGION8_I | 1529 | 0.0711  | 640050 AINSWND7   | 115  | 640096 CALAMS 7     | 115  | 1 | C:640050 AINSWND7              | 115 | 640051 AINSWRT7 | 115 | 1 |
| REGION4 | REGION8_I | 1532 | 0.0711  | 640096 CALAMS 7   | 115  | 640381 THEDFRD7     | 115  | 1 | C:640050 AINSWND7              | 115 | 640051 AINSWRT7 | 115 | 1 |
| REGION4 | REGION8_I | 1542 | -0.1507 | 511497 WTH_SE 4   | 138  | 511536 WEATHTP4     | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4 | 138 | 1 |
| REGION4 | REGION8_I | 1558 | -0.0744 | 514788 GLASMTN4   | 138  | 520999 MOORLND4     | 138  | 1 | C:514880 NORTWST7              | 345 | 515375 WWRDEHV7 | 345 | 1 |
| REGION4 | REGION8_I | 1623 | 0.3134  | 514785 WOODWRD4   | 138  | 515376 WWRDEHV4     | 138  | 2 | C:514785 WOODWRD4              | 138 | 515376 WWRDEHV4 | 138 | 1 |
| REGION4 | REGION8_I | 1627 | 0.3126  | 514785 WOODWRD4   | 138  | 515376 WWRDEHV4     | 138  | 1 | C:514785 WOODWRD4              | 138 | 515376 WWRDEHV4 | 138 | 2 |
| REGION4 | REGION8_I | 1713 | 0.0556  | 549984 BROOKLINE  | 7    | 345 B\$0297 BRKLTX1 | 1.00 | 1 | C:3wnd: OPEN B\$0298 BRKLTX2   | 2   |                 |     |   |
| REGION4 | REGION8_I | 1717 | -0.0556 | 549969 BROOKLINE  | 5    | 161 B\$0297 BRKLTX1 | 1.00 | 1 | C:3wnd: OPEN B\$0298 BRKLTX2   | 2   |                 |     |   |
| REGION4 | REGION8_I | 1739 | 0.0554  | 549984 BROOKLINE  | 7    | 345 B\$0298 BRKLTX2 | 1.00 | 2 | C:3wnd: OPEN B\$0297 BRKLTX1   | 1   |                 |     |   |
| REGION4 | REGION8_I | 1741 | -0.0554 | 549969 BROOKLINE  | 5    | 161 B\$0298 BRKLTX2 | 1.00 | 2 | C:3wnd: OPEN B\$0297 BRKLTX1   | 1   |                 |     |   |
| REGION4 | REGION8_I | 1761 | 0.0477  | 514785 WOODWRD4   | 138  | B\$1035 WOODWRD2    | 1.00 | 1 | C:515785 WINDFRM4              | 138 | 520999 MOORLND4 | 138 | 1 |
| REGION4 | REGION8_I | 1906 | -0.0753 | 511458 ELKCTY-4   | 138  | 511485 CLINTJC4     | 138  | 1 | C:511489 WTH_JCT4              | 138 | 511497 WTH_SE 4 | 138 | 1 |
| REGION4 | REGION8_I | 1909 | -0.2793 | B\$1041 WWDEHV-T2 | 1.00 | 515376 WWRDEHV4     | 138  | 2 | C:3wnd: OPEN B\$1040 WWDEHV-T  | 1   |                 |     |   |
| REGION4 | REGION8_I | 1909 | -0.2793 | B\$1040 WWDEHV-T  | 1.00 | 515376 WWRDEHV4     | 138  | 1 | C:3wnd: OPEN B\$1041 WWDEHV-T2 | 2   |                 |     |   |
| REGION4 | REGION8_I | 1910 | -0.2793 | 515375 WWRDEHV7   | 345  | B\$1041 WWDEHV-T2   | 1.00 | 2 | C:3wnd: OPEN B\$1040 WWDEHV-T  | 1   |                 |     |   |
| REGION4 | REGION8_I | 1910 | -0.2793 | 515375 WWRDEHV7   | 345  | B\$1040 WWDEHV-T    | 1.00 | 1 | C:3wnd: OPEN B\$1041 WWDEHV-T2 | 2   |                 |     |   |

|         |           |      |         |                   |      |                   |      |   |                                |     |                 |     |   |
|---------|-----------|------|---------|-------------------|------|-------------------|------|---|--------------------------------|-----|-----------------|-----|---|
| REGION4 | REGION8_I | 1976 | -0.1185 | 511489 WTH_JCT4   | 138  | 511497 WTH_SE 4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4 | 138 | 1 |
| REGION4 | REGION8_I | 2003 | -0.0744 | 514778 CLEOCOR4   | 138  | 514788 GLASMTN4   | 138  | 1 | C:514880 NORTHST7              | 345 | 515375 WWRDEHV7 | 345 | 1 |
| REGION4 | REGION8_I | 2065 | 0.1185  | 511540 CAN_GAS4   | 138  | 514821 JENSEN 4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4 | 138 | 1 |
| REGION4 | REGION8_I | 2125 | -0.0709 | 520882 DOVERSW4   | 138  | 521016 OKEENE 4   | 138  | 1 | C:514880 NORTHST7              | 345 | 515375 WWRDEHV7 | 345 | 1 |
| REGION4 | REGION8_I | 2145 | -0.1185 | 511433 HINTON 4   | 138  | 511489 WTH_JCT4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4 | 138 | 1 |
| REGION4 | REGION9_I | 369  | -0.0357 | 505418 JONESB05   | 161  | 505420 HERGETT5   | 161  | 1 | C:505410 KENNETT5              | 161 | 505412 PARAGLD5 | 161 | 1 |
| REGION4 | REGION9_I | 915  | -0.1507 | 511485 CLINTJC4   | 138  | 511534 CL-NGTP4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511536 WEATHTP4 | 138 | 1 |
| REGION4 | REGION9_I | 950  | -0.1769 | 514785 WOODWRD4   | 138  | 515363 CENT 4     | 138  | 1 | C:528137 NTH_CANALT 3          | 115 | 528178 PECOS 3  | 115 | 1 |
| REGION4 | REGION9_I | 1052 | -0.1362 | 514785 WOODWRD4   | 138  | 515785 WINDFRM4   | 138  | 1 | C:515785 WINDFRM4              | 138 | 520999 MOORLND4 | 138 | 1 |
| REGION4 | REGION9_I | 1116 | -0.1362 | 515785 WINDFRM4   | 138  | 515786 FPLWIND4   | 138  | 1 | Base Case                      |     |                 |     |   |
| REGION4 | REGION9_I | 1291 | 0.0469  | 640050 AINSWND7   | 115  | 640051 AINSWRT7   | 115  | 1 | C:640305 ONEILL 7              | 115 | 640349 SPENCER7 | 115 | 1 |
| REGION4 | REGION9_I | 1439 | 0.1507  | 511506 WTH WF 4   | 138  | 511534 CL-NGTP4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511536 WEATHTP4 | 138 | 1 |
| REGION4 | REGION9_I | 1439 | 0.1507  | 511506 WTH WF 4   | 138  | 511536 WEATHTP4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4 | 138 | 1 |
| REGION4 | REGION9_I | 1502 | 0.2399  | 515785 WINDFRM4   | 138  | 520999 MOORLND4   | 138  | 1 | C:514880 NORTHST7              | 345 | 515375 WWRDEHV7 | 345 | 1 |
| REGION4 | REGION9_I | 1529 | 0.0711  | 640050 AINSWND7   | 115  | 640096 CALAMS 7   | 115  | 1 | C:640050 AINSWND7              | 115 | 640051 AINSWRT7 | 115 | 1 |
| REGION4 | REGION9_I | 1532 | 0.0711  | 640096 CALAMS 7   | 115  | 640381 THEDFRD7   | 115  | 1 | C:640050 AINSWND7              | 115 | 640051 AINSWRT7 | 115 | 1 |
| REGION4 | REGION9_I | 1538 | -0.0754 | 514788 GLASMTN4   | 138  | 520999 MOORLND4   | 138  | 1 | C:514880 NORTHST7              | 345 | 515375 WWRDEHV7 | 345 | 1 |
| REGION4 | REGION9_I | 1542 | -0.1507 | 511497 WTH_SE 4   | 138  | 511536 WEATHTP4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4 | 138 | 1 |
| REGION4 | REGION9_I | 1546 | -0.0312 | B\$1039 WTH_SE    | 1.00 | 511497 WTH_SE 4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4 | 138 | 1 |
| REGION4 | REGION9_I | 1619 | 0.3142  | 514785 WOODWRD4   | 138  | 515376 WWRDEHV4   | 138  | 2 | C:514785 WOODWRD4              | 138 | 515376 WWRDEHV4 | 138 | 1 |
| REGION4 | REGION9_I | 1623 | 0.3133  | 514785 WOODWRD4   | 138  | 515376 WWRDEHV4   | 138  | 1 | C:514785 WOODWRD4              | 138 | 515376 WWRDEHV4 | 138 | 2 |
| REGION4 | REGION9_I | 1724 | 0.0341  | 505400 N MADRD5   | 161  | 505410 KENNETT5   | 161  | 1 | C:505418 JONESB05              | 161 | 505420 HERGETT5 | 161 | 1 |
| REGION4 | REGION9_I | 1770 | 0.0474  | 514785 WOODWRD4   | 138  | B\$1035 WOODWRD2  | 1.00 | 1 | C:515785 WINDFRM4              | 138 | 520999 MOORLND4 | 138 | 1 |
| REGION4 | REGION9_I | 1810 | -0.0553 | 505418 JONESB05   | 161  | 505442 WATER V5   | 161  | 1 | C:505410 KENNETT5              | 161 | 505412 PARAGLD5 | 161 | 1 |
| REGION4 | REGION9_I | 1826 | -0.1173 | 502401 FLANDER6   | 230  | 502402 ACADIAN6   | 230  | 1 | C:500773 SEGURA 6              | 230 | 500776 SELLRD6  | 230 | 1 |
| REGION4 | REGION9_I | 1834 | -0.0782 | 511458 ELKCTY-4   | 138  | 511485 CLINTJC4   | 138  | 1 | C:511489 WTH_JCT4              | 138 | 511497 WTH_SE 4 | 138 | 1 |
| REGION4 | REGION9_I | 1903 | -0.2802 | B\$1040 WWDEHV-T  | 1.00 | 515376 WWRDEHV4   | 138  | 1 | C:3Wnd: OPEN B\$1041 WWDEHV-T2 | 2   |                 |     |   |
| REGION4 | REGION9_I | 1903 | -0.2802 | B\$1041 WWDEHV-T2 | 1.00 | 515376 WWRDEHV4   | 138  | 2 | C:3Wnd: OPEN B\$1040 WWDEHV-T  | 1   |                 |     |   |
| REGION4 | REGION9_I | 1904 | -0.2802 | 515375 WWRDEHV7   | 345  | B\$1040 WWDEHV-T  | 1.00 | 1 | C:3Wnd: OPEN B\$1041 WWDEHV-T2 | 2   |                 |     |   |
| REGION4 | REGION9_I | 1904 | -0.2802 | 515375 WWRDEHV7   | 345  | B\$1041 WWDEHV-T2 | 1.00 | 2 | C:3Wnd: OPEN B\$1040 WWDEHV-T  | 1   |                 |     |   |



|         |            |      |         |                   |                       |        |                                |                     |       |
|---------|------------|------|---------|-------------------|-----------------------|--------|--------------------------------|---------------------|-------|
| REGION4 | REGION9_I  | 1931 | 0.0934  | 500330 FLANDR 4   | 138 500774 SEGURA4    | 138 1  | C:500773 SEGURA 6              | 230 500776 SELLRD6  | 230 1 |
| REGION4 | REGION9_I  | 1960 | -0.1195 | 511489 WTH_JCT4   | 138 511497 WTH_SE 4   | 138 1  | C:511506 WTH WF 4              | 138 511534 CL-NGTP4 | 138 1 |
| REGION4 | REGION9_I  | 1971 | -0.1173 | 502402 ACADIAN6   | 230 502403 BONIN 6    | 230 1  | C:500773 SEGURA 6              | 230 500776 SELLRD6  | 230 1 |
| REGION4 | REGION9_I  | 1977 | -0.0754 | 514778 CLEOCOR4   | 138 514788 GLASMTN4   | 138 1  | C:514880 NORTWST7              | 345 515375 WWRDEHV7 | 345 1 |
| REGION4 | REGION9_I  | 2015 | 0.1395  | 500410 HOPKINS4   | 138 500580 MORBHAN4   | 138 1  | C:500410 HOPKINS4              | 138 500660 PATOUT 4 | 138 1 |
| REGION4 | REGION10_I | 915  | -0.1507 | 511485 CLINTJC4   | 138 511534 CL-NGTP4   | 138 1  | C:511506 WTH WF 4              | 138 511536 WEATHTP4 | 138 1 |
| REGION4 | REGION10_I | 950  | -0.1769 | 514785 WOODWRD4   | 138 515363 CENT 4     | 138 1  | C:543022 CLAYCM15              | 161 543029 SHOLCRK5 | 161 1 |
| REGION4 | REGION10_I | 1052 | -0.1362 | 514785 WOODWRD4   | 138 515785 WINDFRM4   | 138 1  | C:515785 WINDFRM4              | 138 520999 MOORLND4 | 138 1 |
| REGION4 | REGION10_I | 1116 | -0.1362 | 515785 WINDFRM4   | 138 515786 FPLWIND4   | 138 1  | Base Case                      |                     |       |
| REGION4 | REGION10_I | 1222 | -0.2600 | 505428 SIKESTN5   | 161 505434 IDALIA 5   | 161 1  | C:505400 N MADRD5              | 161 505428 SIKESTN5 | 161 1 |
| REGION4 | REGION10_I | 1286 | 0.0471  | 640050 AINSWND7   | 115 640051 AINSWRT7   | 115 1  | C:640305 ONEILL 7              | 115 640349 SPENCER7 | 115 1 |
| REGION4 | REGION10_I | 1439 | 0.1507  | 511506 WTH WF 4   | 138 511536 WEATHTP4   | 138 1  | C:511506 WTH WF 4              | 138 511534 CL-NGTP4 | 138 1 |
| REGION4 | REGION10_I | 1439 | 0.1507  | 511506 WTH WF 4   | 138 511534 CL-NGTP4   | 138 1  | C:511506 WTH WF 4              | 138 511536 WEATHTP4 | 138 1 |
| REGION4 | REGION10_I | 1504 | 0.2397  | 515785 WINDFRM4   | 138 520999 MOORLND4   | 138 1  | C:514880 NORTWST7              | 345 515375 WWRDEHV7 | 345 1 |
| REGION4 | REGION10_I | 1529 | 0.0711  | 640050 AINSWND7   | 115 640096 CALAMS 7   | 115 1  | C:640050 AINSWND7              | 115 640051 AINSWRT7 | 115 1 |
| REGION4 | REGION10_I | 1532 | 0.0711  | 640096 CALAMS 7   | 115 640381 THEDFRD7   | 115 1  | C:640050 AINSWND7              | 115 640051 AINSWRT7 | 115 1 |
| REGION4 | REGION10_I | 1536 | -0.0755 | 514788 GLASMTN4   | 138 520999 MOORLND4   | 138 1  | C:514880 NORTWST7              | 345 515375 WWRDEHV7 | 345 1 |
| REGION4 | REGION10_I | 1541 | -0.0313 | B\$1039 WTH_SE    | 1.00 511497 WTH_SE 4  | 138 1  | C:511506 WTH WF 4              | 138 511534 CL-NGTP4 | 138 1 |
| REGION4 | REGION10_I | 1542 | -0.1507 | 511497 WTH_SE 4   | 138 511536 WEATHTP4   | 138 1  | C:511506 WTH WF 4              | 138 511534 CL-NGTP4 | 138 1 |
| REGION4 | REGION10_I | 1567 | 0.1862  | 505400 N MADRD5   | 161 505428 SIKESTN5   | 161 1  | C:505428 SIKESTN5              | 161 505434 IDALIA 5 | 161 1 |
| REGION4 | REGION10_I | 1620 | 0.3140  | 514785 WOODWRD4   | 138 515376 WWRDEHV4   | 138 2  | C:514785 WOODWRD4              | 138 515376 WWRDEHV4 | 138 1 |
| REGION4 | REGION10_I | 1624 | 0.3132  | 514785 WOODWRD4   | 138 515376 WWRDEHV4   | 138 1  | C:514785 WOODWRD4              | 138 515376 WWRDEHV4 | 138 2 |
| REGION4 | REGION10_I | 1767 | 0.0475  | 514785 WOODWRD4   | 138 B\$1035 WOODWRD2  | 1.00 1 | C:515785 WINDFRM4              | 138 520999 MOORLND4 | 138 1 |
| REGION4 | REGION10_I | 1822 | -0.0787 | 511458 ELKCTY-4   | 138 511485 CLINTJC4   | 138 1  | C:511489 WTH_JCT4              | 138 511497 WTH_SE 4 | 138 1 |
| REGION4 | REGION10_I | 1904 | -0.2801 | B\$1041 WWDEHV-T2 | 1.00 515376 WWRDEHV4  | 138 2  | C:3wnd: OPEN B\$1040 WWDEHV-T  | 1                   |       |
| REGION4 | REGION10_I | 1904 | -0.2801 | B\$1040 WWDEHV-T  | 1.00 515376 WWRDEHV4  | 138 1  | C:3wnd: OPEN B\$1041 WWDEHV-T2 | 2                   |       |
| REGION4 | REGION10_I | 1905 | -0.2801 | 515375 WWRDEHV7   | 345 B\$1041 WWDEHV-T2 | 1.00 2 | C:3wnd: OPEN B\$1040 WWDEHV-T  | 1                   |       |
| REGION4 | REGION10_I | 1905 | -0.2801 | 515375 WWRDEHV7   | 345 B\$1040 WWDEHV-T  | 1.00 1 | C:3wnd: OPEN B\$1041 WWDEHV-T2 | 2                   |       |
| REGION4 | REGION10_I | 1961 | -0.1194 | 511489 WTH_JCT4   | 138 511497 WTH_SE 4   | 138 1  | C:511506 WTH WF 4              | 138 511534 CL-NGTP4 | 138 1 |
| REGION4 | REGION10_I | 1974 | -0.0755 | 514778 CLEOCOR4   | 138 514788 GLASMTN4   | 138 1  | C:514880 NORTWST7              | 345 515375 WWRDEHV7 | 345 1 |

|         |            |       |         |                     |      |                     |      |   |                               |     |                     |     |   |
|---------|------------|-------|---------|---------------------|------|---------------------|------|---|-------------------------------|-----|---------------------|-----|---|
| REGION4 | REGION10_I | 2050  | 0.1194  | 511540 CAN_GAS4     | 138  | 514821 JENSEN 4     | 138  | 1 | C:511506 WTH WF 4             | 138 | 511534 CL-NGTP4     | 138 | 1 |
| REGION4 | REGION10_I | 2097  | -0.0719 | 520882 DOVERSW4     | 138  | 521016 OKEENE 4     | 138  | 1 | C:514880 NORTHST7             | 345 | 515375 WWRDEHV7     | 345 | 1 |
| REGION4 | REGION10_I | 2129  | -0.1194 | 511433 HINTON 4     | 138  | 511489 WTH_JCT4     | 138  | 1 | C:511506 WTH WF 4             | 138 | 511534 CL-NGTP4     | 138 | 1 |
| REGION4 | REGION10_I | 2301  | -0.1347 | 530592 SMOKYHLLS6   | 230  | 530593 SMOKY_INT    | 230  | 1 | C:650259 59&C0 7              | 115 | 650262 57&GAR 7     | 115 | 1 |
| REGION4 | REGION10_I | 3189  | -0.0805 | B\$0538 HEMP 1      | 1.00 | 507454 HEMPSTD4     | 138  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7     | 115 | 1 |
| REGION5 | REGION6_I  | 1334  | -0.0787 | 539637 MRWYP16      | 230  | B\$0655 MERIDWY1    | 1.00 | 1 | C:3Wnd: OPEN B\$0401 DYESS 2  | 2   |                     |     |   |
| REGION5 | REGION6_I  | 2078  | -0.0812 | 514909 REDBUD 7     | 345  | B\$0820 REDBUD3     | 1.00 | 1 | C:515224 MUSKOG7              | 345 | 515235 PECANCK7     | 345 | 2 |
| REGION5 | REGION6_I  | 2259  | 0.0344  | 539656 CLIFTON3     | 115  | 539665 GRNLEAF3     | 115  | 1 | C:532865 NWMANHT6             | 230 | 539639 ELMCREK6     | 230 | 1 |
| REGION5 | REGION6_I  | 2553  | 0.0787  | 539658 CONCRD6      | 230  | B\$0353 CONCORD6    | 1.00 | 1 | C:532865 NWMANHT6             | 230 | 539639 ELMCREK6     | 230 | 1 |
| REGION5 | REGION6_I  | 2554  | -0.0787 | 539657 CONCORD3     | 115  | B\$0353 CONCORD6    | 1.00 | 1 | C:532865 NWMANHT6             | 230 | 539639 ELMCREK6     | 230 | 1 |
| REGION5 | REGION6_I  | 2713  | -0.0344 | 533332 KNOB HL3     | 115  | 539665 GRNLEAF3     | 115  | 1 | C:532865 NWMANHT6             | 230 | 539639 ELMCREK6     | 230 | 1 |
| REGION5 | REGION6_I  | 2819  | -0.0540 | 523712 KINGSMILL 3  | 115  | 523815 LLANO_WND 3  | 115  | 1 | C:523815 LLANO_WND 3          | 115 | 523817 MIDSTRM_TP 3 | 115 | 1 |
| REGION5 | REGION6_I  | 2819  | 0.0540  | 523815 LLANO_WND 3  | 115  | 523817 MIDSTRM_TP 3 | 115  | 1 | C:523712 KINGSMILL 3          | 115 | 523815 LLANO_WND 3  | 115 | 1 |
| REGION5 | REGION6_I  | 2982  | 0.0540  | 523817 MIDSTRM_TP 3 | 115  | 524043 NICHOLS 3    | 115  | 1 | C:523712 KINGSMILL 3          | 115 | 523815 LLANO_WND 3  | 115 | 1 |
| REGION5 | REGION6_I  | 3283  | -0.0424 | 539656 CLIFTON3     | 115  | 539657 CONCORD3     | 115  | 1 | C:532865 NWMANHT6             | 230 | 539639 ELMCREK6     | 230 | 1 |
| REGION5 | REGION6_I  | 3989  | 0.0787  | 539637 MRWYP16      | 230  | 539639 ELMCREK6     | 230  | 1 | C:531405 WALKMYR3             | 115 | 531481 HUGOTON3     | 115 | 1 |
| REGION5 | REGION6_I  | 4001  | 0.0787  | 539639 ELMCREK6     | 230  | 539658 CONCRD6      | 230  | 1 | C:532865 NWMANHT6             | 230 | 539639 ELMCREK6     | 230 | 1 |
| REGION5 | REGION6_I  | 4001  | -0.0787 | 532865 NWMANHT6     | 230  | 539639 ELMCREK6     | 230  | 1 | C:539639 ELMCREK6             | 230 | 539658 CONCRD6      | 230 | 1 |
| REGION5 | REGION6_I  | 6303  | -0.0669 | 532861 EMANHAT6     | 230  | 532865 NWMANHT6     | 230  | 1 | C:3Wnd: OPEN B\$0353 CONCORD6 | 1   |                     |     |   |
| REGION5 | REGION6_I  | 7385  | 0.0478  | 532865 NWMANHT6     | 230  | B\$0730 NWMANH1X    | 1.00 | 1 | C:532861 EMANHAT6             | 230 | 532865 NWMANHT6     | 230 | 1 |
| REGION5 | REGION6_I  | 7388  | -0.0478 | 533347 NWMANHT3     | 115  | B\$0730 NWMANH1X    | 1.00 | 1 | C:532861 EMANHAT6             | 230 | 532865 NWMANHT6     | 230 | 1 |
| REGION5 | REGION6_I  | 8402  | -0.0309 | 514840 JONESTP4     | 138  | 514941 HSL 4        | 138  | 1 | C:514906 JNSKAM04             | 138 | 514941 HSL 4        | 138 | 1 |
| REGION5 | REGION6_I  | 8575  | -0.1298 | 509807 ONETA--7     | 345  | 509836 OEC 7        | 345  | 1 | C:509807 ONETA--7             | 345 | 509836 OEC 7        | 345 | 2 |
| REGION5 | REGION6_I  | 8575  | -0.1298 | 509807 ONETA--7     | 345  | 509836 OEC 7        | 345  | 2 | C:509807 ONETA--7             | 345 | 509836 OEC 7        | 345 | 1 |
| REGION5 | REGION6_I  | 8757  | -0.0601 | 509852 T.NO.--7     | 345  | 510406 N.E.S.-7     | 345  | 1 | C:510380 DELWARE7             | 345 | 510406 N.E.S.-7     | 345 | 1 |
| REGION5 | REGION6_I  | 11598 | -0.0377 | B\$0888 SOONER5     | 1.00 | 514803 SOONER 7     | 345  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7     | 115 | 1 |
| REGION5 | REGION6_I  | 11603 | 0.0377  | B\$0888 SOONER5     | 1.00 | 514802 SOONER 4     | 138  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7     | 115 | 1 |
| REGION5 | REGION6_I  | 15171 | -0.1151 | 510907 PITTSB-7     | 345  | 510925 KIOWA 7      | 345  | 1 | C:650279 120ALV07             | 115 | 650285 WAGENER7     | 115 | 1 |
| REGION5 | REGION6_I  | 15314 | 0.0520  | 510907 PITTSB-7     | 345  | 515045 SEMINOL7     | 345  | 1 | C:646281 S1281 5              | 161 | 646287 S1287 5      | 161 | 1 |
| REGION5 | REGION6_I  | 16238 | -0.0649 | 514715 WOODRNG7     | 345  | 514901 CIMARON7     | 345  | 1 | C:650114 NW68HOL3             | 345 | 650185 WAGENER3     | 345 | 1 |

|         |           |       |         |                     |     |                     |      |   |                               |     |                     |     |   |
|---------|-----------|-------|---------|---------------------|-----|---------------------|------|---|-------------------------------|-----|---------------------|-----|---|
| REGION5 | REGION6_I | 17294 | 0.0448  | 510380 DELWARE7     | 345 | 532793 NEOSHO 7     | 345  | 1 | C:650114 NW68HOL3             | 345 | 650185 WAGENER3     | 345 | 1 |
| REGION5 | REGION6_I | 17912 | -0.0477 | 510380 DELWARE7     | 345 | 510406 N.E.S. -7    | 345  | 1 | C:650114 NW68HOL3             | 345 | 650185 WAGENER3     | 345 | 1 |
| REGION5 | REGION6_I | 18629 | -0.0745 | 514803 SOONER 7     | 345 | 514881 SPRNGCK7     | 345  | 1 | C:650114 NW68HOL3             | 345 | 650185 WAGENER3     | 345 | 1 |
| REGION5 | REGION6_I | 20172 | -0.0429 | 532852 JEC 6        | 230 | 532861 EMANHAT6     | 230  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7     | 115 | 1 |
| REGION5 | REGION6_I | 22403 | -0.0530 | 532768 EMPEC 7      | 345 | 532796 WICHITA7     | 345  | 1 | C:650114 NW68HOL3             | 345 | 650185 WAGENER3     | 345 | 1 |
| REGION5 | REGION7_I | 1334  | -0.0787 | 539637 MRWYP16      | 230 | B\$0655 MERIDWY1    | 1.00 | 1 | C:3Wnd: OPEN B\$0848 S-GBEND3 | 1   |                     |     |   |
| REGION5 | REGION7_I | 2045  | 0.0381  | 539656 CLIFTON3     | 115 | 539665 GRNLEAF3     | 115  | 1 | C:532865 NWMANHT6             | 230 | 539639 ELMCREK6     | 230 | 1 |
| REGION5 | REGION7_I | 2078  | -0.0812 | 514909 REDBUD 7     | 345 | B\$0820 REDBUD3     | 1.00 | 1 | C:531368 LAWNRID3             | 115 | 531471 STFRANT3     | 115 | 1 |
| REGION5 | REGION7_I | 2456  | -0.0381 | 533332 KNOB HL3     | 115 | 539665 GRNLEAF3     | 115  | 1 | C:532865 NWMANHT6             | 230 | 539639 ELMCREK6     | 230 | 1 |
| REGION5 | REGION7_I | 2553  | 0.0787  | 539658 CONCRD6      | 230 | B\$0353 CONCORD6    | 1.00 | 1 | C:532865 NWMANHT6             | 230 | 539639 ELMCREK6     | 230 | 1 |
| REGION5 | REGION7_I | 2554  | -0.0787 | 539657 CONCORD3     | 115 | B\$0353 CONCORD6    | 1.00 | 1 | C:532865 NWMANHT6             | 230 | 539639 ELMCREK6     | 230 | 1 |
| REGION5 | REGION7_I | 2819  | -0.0540 | 523712 KINGSMILL 3  | 115 | 523815 LLANO_WND 3  | 115  | 1 | C:523815 LLANO_WND 3          | 115 | 523817 MIDSTRM_TP 3 | 115 | 1 |
| REGION5 | REGION7_I | 2819  | 0.0540  | 523815 LLANO_WND 3  | 115 | 523817 MIDSTRM_TP 3 | 115  | 1 | C:523712 KINGSMILL 3          | 115 | 523815 LLANO_WND 3  | 115 | 1 |
| REGION5 | REGION7_I | 2982  | 0.0540  | 523817 MIDSTRM_TP 3 | 115 | 524043 NICHOLS 3    | 115  | 1 | C:523712 KINGSMILL 3          | 115 | 523815 LLANO_WND 3  | 115 | 1 |
| REGION5 | REGION7_I | 3654  | -0.0381 | 539656 CLIFTON3     | 115 | 539657 CONCORD3     | 115  | 1 | C:532865 NWMANHT6             | 230 | 539639 ELMCREK6     | 230 | 1 |
| REGION5 | REGION7_I | 3989  | 0.0787  | 539637 MRWYP16      | 230 | 539639 ELMCREK6     | 230  | 1 | C:523095 HITCHLAND 6          | 230 | 523155 OCHILTREE 6  | 230 | 1 |
| REGION5 | REGION7_I | 4001  | -0.0787 | 532865 NWMANHT6     | 230 | 539639 ELMCREK6     | 230  | 1 | C:539639 ELMCREK6             | 230 | 539658 CONCRD6      | 230 | 1 |
| REGION5 | REGION7_I | 4001  | 0.0787  | 539639 ELMCREK6     | 230 | 539658 CONCRD6      | 230  | 1 | C:532865 NWMANHT6             | 230 | 539639 ELMCREK6     | 230 | 1 |
| REGION5 | REGION7_I | 4070  | 0.0386  | 542965 W.GRDNR7     | 345 | 542968 STILWEL7     | 345  | 1 | C:542968 STILWEL7             | 345 | 542981 LACYGNE7     | 345 | 1 |
| REGION5 | REGION7_I | 5607  | 0.0643  | 532774 SWISVAL7     | 345 | 542965 W.GRDNR7     | 345  | 1 | C:532765 HOYT 7               | 345 | 532766 JEC N 7      | 345 | 1 |
| REGION5 | REGION7_I | 6438  | -0.0655 | 532861 EMANHAT6     | 230 | 532865 NWMANHT6     | 230  | 1 | C:3Wnd: OPEN B\$0353 CONCORD6 | 1   |                     |     |   |
| REGION5 | REGION7_I | 6873  | -0.0501 | 532765 HOYT 7       | 345 | 532766 JEC N 7      | 345  | 1 | C:532851 AUBURN 6             | 230 | 532852 JEC 6        | 230 | 1 |
| REGION5 | REGION7_I | 6956  | 0.0507  | 532865 NWMANHT6     | 230 | B\$0730 NWMANH1X    | 1.00 | 1 | C:532861 EMANHAT6             | 230 | 532865 NWMANHT6     | 230 | 1 |
| REGION5 | REGION7_I | 6960  | -0.0507 | 533347 NWMANHT3     | 115 | B\$0730 NWMANH1X    | 1.00 | 1 | C:532861 EMANHAT6             | 230 | 532865 NWMANHT6     | 230 | 1 |
| REGION5 | REGION7_I | 8575  | -0.1298 | 509807 ONETA--7     | 345 | 509836 OEC 7        | 345  | 1 | C:509807 ONETA--7             | 345 | 509836 OEC 7        | 345 | 2 |
| REGION5 | REGION7_I | 8575  | -0.1298 | 509807 ONETA--7     | 345 | 509836 OEC 7        | 345  | 2 | C:509807 ONETA--7             | 345 | 509836 OEC 7        | 345 | 1 |
| REGION5 | REGION7_I | 9261  | -0.0325 | 510886 IDABEL-4     | 138 | 510918 VALIANT4     | 138  | 1 | C:508298 LYDIA 7              | 345 | 510911 VALIANT7     | 345 | 1 |
| REGION5 | REGION7_I | 9500  | 0.0325  | 510886 IDABEL-4     | 138 | 510888 B.BOWTP4     | 138  | 1 | C:508298 LYDIA 7              | 345 | 510911 VALIANT7     | 345 | 1 |
| REGION5 | REGION7_I | 9857  | 0.0325  | 510888 B.BOWTP4     | 138 | 510890 CRAIGJT4     | 138  | 1 | C:508298 LYDIA 7              | 345 | 510911 VALIANT7     | 345 | 1 |
| REGION5 | REGION7_I | 11481 | 0.1153  | 510907 PITTSB-7     | 345 | 510911 VALIANT7     | 345  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7     | 115 | 1 |

|         |           |       |         |                     |                         |      |   |                               |                         |       |
|---------|-----------|-------|---------|---------------------|-------------------------|------|---|-------------------------------|-------------------------|-------|
| REGION5 | REGION7_I | 13346 | 0.0323  | 532793 NEOSHO 7     | 345 B\$0705 NEOSHO2X    | 1.00 | 1 | C:640374 SWEET W3             | 345 652571 GR ISLD3     | 345 1 |
| REGION5 | REGION7_I | 13353 | -0.0323 | 532937 NEOSHO 5     | 161 B\$0705 NEOSHO2X    | 1.00 | 1 | C:640374 SWEET W3             | 345 652571 GR ISLD3     | 345 1 |
| REGION5 | REGION7_I | 13452 | -0.1332 | 508298 LYDIA 7      | 345 510911 VALIANT7     | 345  | 1 | C:652302 JULESBG7             | 115 659240 INTERST7     | 115 1 |
| REGION5 | REGION7_I | 14821 | 0.0520  | 510380 DELWARE7     | 345 532793 NEOSHO 7     | 345  | 1 | C:646206 S1206 5              | 161 648199 SARP4&5T     | 161 1 |
| REGION5 | REGION7_I | 15171 | -0.1151 | 510907 PITTSB-7     | 345 510925 IOWA 7       | 345  | 1 | C:645100 FC1A 5               | 161 646251 S1251 5      | 161 1 |
| REGION5 | REGION8_I | 1334  | -0.0787 | 539637 MRWYP16      | 230 B\$0655 MERIDWY1    | 1.00 | 1 | C:3Wnd: OPEN B\$0823 RENO 1X  | 1                       |       |
| REGION5 | REGION8_I | 1627  | 0.0586  | 549984 BROOKLINE 7  | 345 B\$0297 BRKLT1X1    | 1.00 | 1 | C:3Wnd: OPEN B\$0298 BRKLT1X2 | 2                       |       |
| REGION5 | REGION8_I | 1631  | -0.0586 | 549969 BROOKLINE 5  | 161 B\$0297 BRKLT1X1    | 1.00 | 1 | C:3Wnd: OPEN B\$0298 BRKLT1X2 | 2                       |       |
| REGION5 | REGION8_I | 1651  | 0.0584  | 549984 BROOKLINE 7  | 345 B\$0298 BRKLT1X2    | 1.00 | 2 | C:3Wnd: OPEN B\$0297 BRKLT1X1 | 1                       |       |
| REGION5 | REGION8_I | 1654  | -0.0584 | 549969 BROOKLINE 5  | 161 B\$0298 BRKLT1X2    | 1.00 | 2 | C:3Wnd: OPEN B\$0297 BRKLT1X1 | 1                       |       |
| REGION5 | REGION8_I | 2064  | 0.0377  | 539656 CLIFTON3     | 115 539665 GRNLEAF3     | 115  | 1 | C:532865 NWMANHT6             | 230 539639 ELMCREK6     | 230 1 |
| REGION5 | REGION8_I | 2078  | -0.0812 | 514909 REDBUD 7     | 345 B\$0820 REDBUD3     | 1.00 | 1 | C:514929 PLVALLY4             | 138 514953 HOLLYWD4     | 138 1 |
| REGION5 | REGION8_I | 2479  | -0.0377 | 533332 KNOB HL3     | 115 539665 GRNLEAF3     | 115  | 1 | C:532865 NWMANHT6             | 230 539639 ELMCREK6     | 230 1 |
| REGION5 | REGION8_I | 2553  | 0.0787  | 539658 CONCRD6      | 230 B\$0353 CONCORD6    | 1.00 | 1 | C:532865 NWMANHT6             | 230 539639 ELMCREK6     | 230 1 |
| REGION5 | REGION8_I | 2554  | -0.0787 | 539657 CONCORD3     | 115 B\$0353 CONCORD6    | 1.00 | 1 | C:532865 NWMANHT6             | 230 539639 ELMCREK6     | 230 1 |
| REGION5 | REGION8_I | 2590  | -0.0481 | 507774 NORAM 4      | 138 508808 LONGWD 4     | 138  | 1 | C:507760 SW SHV 7             | 345 508809 LONGWD 7     | 345 1 |
| REGION5 | REGION8_I | 2659  | -0.0481 | 507749 RAINES 4     | 138 507774 NORAM 4      | 138  | 1 | C:507760 SW SHV 7             | 345 508809 LONGWD 7     | 345 1 |
| REGION5 | REGION8_I | 2692  | -0.0375 | 504000 AVOCA 5      | 161 506931 EROGERS5     | 161  | 1 | Base Case                     |                         |       |
| REGION5 | REGION8_I | 2819  | -0.0540 | 523712 KINGSMILL 3  | 115 523815 LLANO_WND 3  | 115  | 1 | C:523815 LLANO_WND 3          | 115 523817 MIDSTRM_TP 3 | 115 1 |
| REGION5 | REGION8_I | 2819  | 0.0540  | 523815 LLANO_WND 3  | 115 523817 MIDSTRM_TP 3 | 115  | 1 | C:523712 KINGSMILL 3          | 115 523815 LLANO_WND 3  | 115 1 |
| REGION5 | REGION8_I | 2982  | 0.0540  | 523817 MIDSTRM_TP 3 | 115 524043 NICHOLS 3    | 115  | 1 | C:523712 KINGSMILL 3          | 115 523815 LLANO_WND 3  | 115 1 |
| REGION5 | REGION8_I | 3226  | -0.0481 | 507711 ARSHILL4     | 138 507749 RAINES 4     | 138  | 1 | C:507760 SW SHV 7             | 345 508809 LONGWD 7     | 345 1 |
| REGION5 | REGION8_I | 3451  | 0.0308  | 505480 BEAVER 5     | 161 506932 EUREKA 5     | 161  | 1 | C:547481 MON383 7             | 345 549984 BROOKLINE 7  | 345 1 |
| REGION5 | REGION8_I | 3551  | 0.0443  | 542965 W.GRDNR7     | 345 542968 STILWEL7     | 345  | 1 | C:542968 STILWEL7             | 345 542981 LACYGNE7     | 345 1 |
| REGION5 | REGION8_I | 3677  | 0.0521  | 500300 EUNICE 4     | 138 500540 MANUEL 4     | 138  | 1 | C:500920 WSTFORK6             | 230 500940 WELLS 6      | 230 1 |
| REGION5 | REGION8_I | 3688  | -0.0377 | 539656 CLIFTON3     | 115 539657 CONCORD3     | 115  | 1 | C:532865 NWMANHT6             | 230 539639 ELMCREK6     | 230 1 |
| REGION5 | REGION8_I | 3948  | 0.0748  | 508809 LONGWD 7     | 345 B\$0620 LONGWOOD    | 1.00 | 1 | C:507760 SW SHV 7             | 345 508809 LONGWD 7     | 345 1 |
| REGION5 | REGION8_I | 3952  | -0.0748 | 508808 LONGWD 4     | 138 B\$0620 LONGWOOD    | 1.00 | 1 | C:507760 SW SHV 7             | 345 508809 LONGWD 7     | 345 1 |
| REGION5 | REGION8_I | 3989  | 0.0787  | 539637 MRWYP16      | 230 539639 ELMCREK6     | 230  | 1 | C:659154 LAMAR 7              | 115 659195 CRETE 7      | 115 1 |
| REGION5 | REGION8_I | 4001  | 0.0787  | 539639 ELMCREK6     | 230 539658 CONCRD6      | 230  | 1 | C:532865 NWMANHT6             | 230 539639 ELMCREK6     | 230 1 |

|         |           |      |         |                    |     |                    |      |   |                      |     |                     |     |   |
|---------|-----------|------|---------|--------------------|-----|--------------------|------|---|----------------------|-----|---------------------|-----|---|
| REGION5 | REGION8_I | 4001 | -0.0787 | 532865 NWMANHT6    | 230 | 539639 ELMCREK6    | 230  | 1 | C:539639 ELMCREK6    | 230 | 539658 CONCRD6      | 230 | 1 |
| REGION5 | REGION8_I | 4176 | -0.0521 | 500230 COUGH 4     | 138 | 500540 MANUEL 4    | 138  | 1 | C:500920 WSTFORK6    | 230 | 500940 WELLS 6      | 230 | 1 |
| REGION5 | REGION8_I | 4276 | 0.0427  | 504000 AVOCA 5     | 161 | 505480 BEAVER 5    | 161  | 1 | C:547481 MON383 7    | 345 | 549984 BROOKLINE 7  | 345 | 1 |
| REGION5 | REGION8_I | 4808 | -0.0343 | 507755 S SHV 4     | 138 | 507767 WESTELC4    | 138  | 1 | C:507748 POWELL 4    | 138 | 507759 SW SHV 4     | 138 | 1 |
| REGION5 | REGION8_I | 4892 | 0.1087  | 508359 WELSH 7     | 345 | 508832 DIANA 7     | 345  | 1 | C:508359 WELSH 7     | 345 | 508832 DIANA 7      | 345 | 2 |
| REGION5 | REGION9_I | 370  | -0.0356 | 505418 JONESB05    | 161 | 505420 HERGETT5    | 161  | 1 | C:505410 KENNETT5    | 161 | 505412 PARAGLD5     | 161 | 1 |
| REGION5 | REGION9_I | 1334 | -0.0787 | 539637 MRWYP16     | 230 | B\$0655 MERIDWY1   | 1.00 | 1 | C:515151 LTLCITY4    | 138 | 515152 BROWNT4      | 138 | 1 |
| REGION5 | REGION9_I | 1746 | 0.0336  | 505400 N MADRD5    | 161 | 505410 KENNETT5    | 161  | 1 | C:505418 JONESB05    | 161 | 505420 HERGETT5     | 161 | 1 |
| REGION5 | REGION9_I | 1826 | -0.1173 | 502401 FLANDER6    | 230 | 502402 ACADIAN6    | 230  | 1 | C:500773 SEGURA 6    | 230 | 500776 SELLRD6      | 230 | 1 |
| REGION5 | REGION9_I | 1828 | -0.0548 | 505418 JONESB05    | 161 | 505442 WATER V5    | 161  | 1 | C:505410 KENNETT5    | 161 | 505412 PARAGLD5     | 161 | 1 |
| REGION5 | REGION9_I | 1930 | 0.0934  | 500330 FLANDR 4    | 138 | 500774 SEGURA4     | 138  | 1 | C:500773 SEGURA 6    | 230 | 500776 SELLRD6      | 230 | 1 |
| REGION5 | REGION9_I | 1970 | -0.1173 | 502402 ACADIAN6    | 230 | 502403 BONIN 6     | 230  | 1 | C:500773 SEGURA 6    | 230 | 500776 SELLRD6      | 230 | 1 |
| REGION5 | REGION9_I | 2014 | 0.1396  | 500410 HOPKINS4    | 138 | 500580 MORBHAN4    | 138  | 1 | C:500410 HOPKINS4    | 138 | 500660 PATOUT 4     | 138 | 1 |
| REGION5 | REGION9_I | 2033 | 0.0383  | 539656 CLIFTON3    | 115 | 539665 GRNLEAF3    | 115  | 1 | C:532865 NWMANHT6    | 230 | 539639 ELMCREK6     | 230 | 1 |
| REGION5 | REGION9_I | 2055 | -0.1288 | 500410 HOPKINS4    | 138 | 500774 SEGURA4     | 138  | 1 | C:500100 BERWKTP4    | 138 | 500740 RAMOS 4      | 138 | 1 |
| REGION5 | REGION9_I | 2078 | -0.0812 | 514909 REDBUD 7    | 345 | B\$0820 REDBUD3    | 1.00 | 1 | C:542973 HAWTHRN5    | 161 | 543027 RANDLPH5     | 161 | 1 |
| REGION5 | REGION9_I | 2175 | 0.1577  | 500410 HOPKINS4    | 138 | 500660 PATOUT 4    | 138  | 1 | C:500410 HOPKINS4    | 138 | 500580 MORBHAN4     | 138 | 1 |
| REGION5 | REGION9_I | 2213 | 0.0386  | 505480 BEAVER 5    | 161 | 506932 EUREKA 5    | 161  | 1 | Base Case            |     |                     |     |   |
| REGION5 | REGION9_I | 2357 | 0.0444  | 505410 KENNETT5    | 161 | 505412 PARAGLD5    | 161  | 1 | C:505418 JONESB05    | 161 | 505442 WATER V5     | 161 | 1 |
| REGION5 | REGION9_I | 2422 | 0.1577  | 500660 PATOUT 4    | 138 | 500820 TECHE 4     | 138  | 1 | C:500410 HOPKINS4    | 138 | 500580 MORBHAN4     | 138 | 1 |
| REGION5 | REGION9_I | 2442 | -0.0383 | 533332 KNOB HL3    | 115 | 539665 GRNLEAF3    | 115  | 1 | C:532865 NWMANHT6    | 230 | 539639 ELMCREK6     | 230 | 1 |
| REGION5 | REGION9_I | 2465 | 0.1709  | 500940 WELLS 6     | 230 | 502420 LABBETAP    | 230  | 1 | C:500940 WELLS 6     | 230 | 502410 PMOUTON6     | 230 | 1 |
| REGION5 | REGION9_I | 2541 | -0.1458 | 502403 BONIN 6     | 230 | 502421 LABBE       | 230  | 2 | C:502403 BONIN 6     | 230 | 502421 LABBE        | 230 | 1 |
| REGION5 | REGION9_I | 2541 | -0.1458 | 502403 BONIN 6     | 230 | 502421 LABBE       | 230  | 1 | C:502403 BONIN 6     | 230 | 502421 LABBE        | 230 | 2 |
| REGION5 | REGION9_I | 2553 | 0.0787  | 539658 CONCRD6     | 230 | B\$0353 CONCORD6   | 1.00 | 1 | C:532865 NWMANHT6    | 230 | 539639 ELMCREK6     | 230 | 1 |
| REGION5 | REGION9_I | 2554 | -0.0787 | 539657 CONCORD3    | 115 | B\$0353 CONCORD6   | 1.00 | 1 | C:532865 NWMANHT6    | 230 | 539639 ELMCREK6     | 230 | 1 |
| REGION5 | REGION9_I | 2635 | 0.1586  | 500940 WELLS 6     | 230 | 502410 PMOUTON6    | 230  | 1 | C:500940 WELLS 6     | 230 | 502420 LABBETAP     | 230 | 1 |
| REGION5 | REGION9_I | 2703 | 0.1314  | 500773 SEGURA 6    | 230 | 500774 SEGURA4     | 138  | 1 | C:500330 FLANDR 4    | 138 | 500774 SEGURA4      | 138 | 1 |
| REGION5 | REGION9_I | 2723 | 0.1586  | 502410 PMOUTON6    | 230 | 502421 LABBE       | 230  | 1 | C:500940 WELLS 6     | 230 | 502420 LABBETAP     | 230 | 1 |
| REGION5 | REGION9_I | 2819 | -0.0540 | 523712 KINGSMILL 3 | 115 | 523815 LLANO_WND 3 | 115  | 1 | C:523815 LLANO_WND 3 | 115 | 523817 MIDSTRM_TP 3 | 115 | 1 |

|         |            |      |         |                                                  |                                                    |
|---------|------------|------|---------|--------------------------------------------------|----------------------------------------------------|
| REGION5 | REGION9_I  | 2819 | 0.0540  | 523815 LLANO_WND 3 115 523817 MIDSTRM_TP 3 115 1 | C:523712 KINGSMILL 3 115 523815 LLANO_WND 3 115 1  |
| REGION5 | REGION9_I  | 2853 | 0.1396  | 500580 MORBHAN4 138 500820 TECHE 4 138 1         | C:500410 HOPKINS4 138 500660 PATOUT 4 138 1        |
| REGION5 | REGION9_I  | 2876 | 0.0331  | 549984 BROOKLINE 7 345 B\$0297 BRKLTXT1 1.00 1   | C:3Wnd: OPEN B\$0298 BRKLTXT2 2                    |
| REGION5 | REGION9_I  | 2883 | -0.0331 | 549969 BROOKLINE 5 161 B\$0297 BRKLTXT1 1.00 1   | C:3Wnd: OPEN B\$0298 BRKLTXT2 2                    |
| REGION5 | REGION9_I  | 2919 | 0.0330  | 549984 BROOKLINE 7 345 B\$0298 BRKLTXT2 1.00 2   | C:3Wnd: OPEN B\$0297 BRKLTXT1 1                    |
| REGION5 | REGION10_I | 1223 | -0.2599 | 505428 SIKESTN5 161 505434 IDALIA 5 161 1        | C:505400 N MADRD5 161 505428 SIKESTN5 161 1        |
| REGION5 | REGION10_I | 1334 | -0.0787 | 539637 MRWYP16 230 B\$0655 MERIDWY1 1.00 1       | C:3Wnd: OPEN B\$0249 ANDRK345 2                    |
| REGION5 | REGION10_I | 1563 | 0.1867  | 505400 N MADRD5 161 505428 SIKESTN5 161 1        | C:505428 SIKESTN5 161 505434 IDALIA 5 161 1        |
| REGION5 | REGION10_I | 2014 | 0.0386  | 539656 CLIFTON3 115 539665 GRNLEAF3 115 1        | C:532865 NWMANHT6 230 539639 ELMCREK6 230 1        |
| REGION5 | REGION10_I | 2078 | -0.0812 | 514909 REDBUD 7 345 B\$0820 REDBUD3 1.00 1       | C:528325 LE-WAIT3 115 528334 LE-LOVINTN3 115 1     |
| REGION5 | REGION10_I | 2418 | -0.0386 | 533332 KNOB HL3 115 539665 GRNLEAF3 115 1        | C:532865 NWMANHT6 230 539639 ELMCREK6 230 1        |
| REGION5 | REGION10_I | 2425 | -0.0818 | B\$0538 HEMP 1 1.00 507454 HEMPSTD4 138 1        | Base Case                                          |
| REGION5 | REGION10_I | 2425 | 0.0818  | B\$0538 HEMP 1 1.00 507456 HEMPSTD3 115 1        | Base Case                                          |
| REGION5 | REGION10_I | 2553 | 0.0787  | 539658 CONCRD6 230 B\$0353 CONCORD6 1.00 1       | C:532865 NWMANHT6 230 539639 ELMCREK6 230 1        |
| REGION5 | REGION10_I | 2554 | -0.0787 | 539657 CONCORD3 115 B\$0353 CONCORD6 1.00 1      | C:532865 NWMANHT6 230 539639 ELMCREK6 230 1        |
| REGION5 | REGION10_I | 2599 | 0.0328  | 505480 BEAVER 5 161 506932 EUREKA 5 161 1        | Base Case                                          |
| REGION5 | REGION10_I | 2619 | 0.0600  | 542965 W.GRDNR7 345 542968 STILWEL7 345 1        | C:542968 STILWEL7 345 542981 LACYGNE7 345 1        |
| REGION5 | REGION10_I | 2819 | -0.0540 | 523712 KINGSMILL 3 115 523815 LLANO_WND 3 115 1  | C:523815 LLANO_WND 3 115 523817 MIDSTRM_TP 3 115 1 |
| REGION5 | REGION10_I | 2819 | 0.0540  | 523815 LLANO_WND 3 115 523817 MIDSTRM_TP 3 115 1 | C:523712 KINGSMILL 3 115 523815 LLANO_WND 3 115 1  |
| REGION5 | REGION10_I | 2982 | 0.0540  | 523817 MIDSTRM_TP 3 115 524043 NICHOLS 3 115 1   | C:523712 KINGSMILL 3 115 523815 LLANO_WND 3 115 1  |
| REGION5 | REGION10_I | 3009 | -0.0831 | 504122 MCNAB 3 115 507456 HEMPSTD3 115 1         | C:508572 LEBROCK7 345 508585 TENRUSK7 345 1        |
| REGION5 | REGION10_I | 3069 | 0.0831  | 504122 MCNAB 3 115 507453 HOPE 3 115 1           | C:508572 LEBROCK7 345 508585 TENRUSK7 345 1        |
| REGION5 | REGION10_I | 3989 | 0.0787  | 539637 MRWYP16 230 539639 ELMCREK6 230 1         | C:659154 LAMAR 7 115 659195 CRETE 7 115 1          |
| REGION5 | REGION10_I | 4686 | -0.0818 | 503912 FULTON 3 115 507453 HOPE 3 115 1          | C:652302 JULESBG7 115 659240 INTERST7 115 1        |
| REGION5 | REGION10_I | 7050 | -0.0551 | 532865 NWMANHT6 230 539639 ELMCREK6 230 1        | C:652302 JULESBG7 115 659240 INTERST7 115 1        |
| REGION5 | REGION10_I | 7373 | -0.0324 | 505416 CENTR H5 161 505418 JONESB05 161 1        | C:652302 JULESBG7 115 659240 INTERST7 115 1        |
| REGION5 | REGION10_I | 7465 | 0.1356  | 515224 MUSKOGEE7 345 515302 FTSMITH7 345 1       | C:652302 JULESBG7 115 659240 INTERST7 115 1        |
| REGION5 | REGION10_I | 7769 | 0.1225  | 515302 FTSMITH7 345 B\$0457 FTSMITH1 1.00 1      | C:652302 JULESBG7 115 659240 INTERST7 115 1        |
| REGION5 | REGION10_I | 7772 | -0.1225 | 515305 FTSMITH8 500 B\$0457 FTSMITH1 1.00 1      | C:652302 JULESBG7 115 659240 INTERST7 115 1        |
| REGION5 | REGION10_I | 7997 | 0.0303  | 500050 BSALES 4 138 500890 WAXLAKE4 138 1        | C:652302 JULESBG7 115 659240 INTERST7 115 1        |



|            |              |      |         |                    |     |                    |      |   |                               |     |                     |     |   |
|------------|--------------|------|---------|--------------------|-----|--------------------|------|---|-------------------------------|-----|---------------------|-----|---|
| REGION5    | REGION10_I   | 8332 | -0.0303 | 500050 BSALES 4    | 138 | 500820 TECHE 4     | 138  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7     | 115 | 1 |
| REGION5    | REGION10_I   | 8517 | -0.0324 | 505412 PARAGLD5    | 161 | 505416 CENTR H5    | 161  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7     | 115 | 1 |
| REGION5    | REGION10_I   | 8567 | -0.0303 | 500290 ELPTAP 4    | 138 | 500890 WAXLAKE4    | 138  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7     | 115 | 1 |
| REGION5    | REGION10_I   | 9064 | -0.0303 | 500060 BVISTA 4    | 138 | 500290 ELPTAP 4    | 138  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7     | 115 | 1 |
| REGION5    | REGION10_I   | 9866 | -0.1816 | 508298 LYDIA 7     | 345 | 510911 VALIANT7    | 345  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7     | 115 | 1 |
| REGION1234 | REGION5678_I | 985  | 0.0545  | 539667 HAGGARD3    | 115 | 539699 W-DODGE3    | 115  | 1 | C:3Wnd: OPEN B\$0524 HAGGARD3 | 1   |                     |     |   |
| REGION1234 | REGION5678_I | 1582 | -0.0349 | 526475 YUMA_INTG 3 | 115 | 526524 WOLFFORTH 3 | 115  | 1 | C:526269 LUBBCK_STH6          | 230 | 526525 WOLFFORTH 6  | 230 | 1 |
| REGION1234 | REGION5678_I | 1787 | -0.0545 | 539667 HAGGARD3    | 115 | B\$0525 HAGGARD3   | 1.00 | 1 | C:509755 WEKIWA-7             | 345 | 509870 SAPLPRD7     | 345 | 1 |
| REGION1234 | REGION5678_I | 1841 | -0.0749 | 511485 CLINTJC4    | 138 | 511534 CL-NGTP4    | 138  | 1 | C:511506 WTH WF 4             | 138 | 511536 WEATHTP4     | 138 | 1 |
| REGION1234 | REGION5678_I | 1910 | -0.0880 | 514785 WOODWRD4    | 138 | 515363 CENT 4      | 138  | 1 | C:542965 W.GRDNR7             | 345 | 542968 STILWEL7     | 345 | 1 |
| REGION1234 | REGION5678_I | 1943 | -0.0545 | 539688 S-DODGE3    | 115 | 539699 W-DODGE3    | 115  | 1 | C:3Wnd: OPEN B\$0524 HAGGARD3 | 1   |                     |     |   |
| REGION1234 | REGION5678_I | 1947 | 0.0877  | 525524 TOLK_EAST 6 | 230 | 525830 TUCO_INT 6  | 230  | 1 | C:526435 SUNDOWN 6            | 230 | 526525 WOLFFORTH 6  | 230 | 1 |
| REGION1234 | REGION5678_I | 2115 | -0.0677 | 514785 WOODWRD4    | 138 | 515785 WINDFRM4    | 138  | 1 | C:515785 WINDFRM4             | 138 | 520999 MOORLND4     | 138 | 1 |
| REGION1234 | REGION5678_I | 2217 | 0.0310  | 640050 AINSWND7    | 115 | 640051 AINSWRT7    | 115  | 1 | C:640098 CALAWAY7             | 115 | 640267 MAXWELS7     | 115 | 1 |
| REGION1234 | REGION5678_I | 2245 | -0.0677 | 515785 WINDFRM4    | 138 | 515786 FPLWIND4    | 138  | 1 | Base Case                     |     |                     |     |   |
| REGION1234 | REGION5678_I | 2325 | 0.0545  | 539688 S-DODGE3    | 115 | 539771 NOR-JUD3    | 115  | 1 | C:3Wnd: OPEN B\$0524 HAGGARD3 | 1   |                     |     |   |
| REGION1234 | REGION5678_I | 2342 | 0.0568  | 524266 BUSHLAND 3  | 115 | 524306 COULTER3    | 115  | 1 | C:523959 POTTER_CO 6          | 230 | 524267 BUSHLAND 6   | 230 | 1 |
| REGION1234 | REGION5678_I | 2523 | -0.0568 | 524266 BUSHLAND 3  | 115 | 524267 BUSHLAND 6  | 230  | 1 | C:523959 POTTER_CO 6          | 230 | 524267 BUSHLAND 6   | 230 | 1 |
| REGION1234 | REGION5678_I | 2558 | -0.0349 | 526176 DOUD3       | 115 | 526475 YUMA_INTG 3 | 115  | 1 | C:526269 LUBBCK_STH6          | 230 | 526525 WOLFFORTH 6  | 230 | 1 |
| REGION1234 | REGION5678_I | 2614 | 0.0530  | 524502 NORTON 3    | 115 | 524822 CURRY 3     | 115  | 1 | C:524502 NORTON 3             | 115 | 524509 FE-TUCMCARI3 | 115 | 1 |
| REGION1234 | REGION5678_I | 2826 | -0.0410 | 514788 GLASMTN4    | 138 | 520999 MOORLND4    | 138  | 1 | C:514880 NORTWST7             | 345 | 515375 WWRDEHV7     | 345 | 1 |
| REGION1234 | REGION5678_I | 2895 | 0.0749  | 511506 WTH WF 4    | 138 | 511536 WEATHTP4    | 138  | 1 | C:511506 WTH WF 4             | 138 | 511534 CL-NGTP4     | 138 | 1 |
| REGION1234 | REGION5678_I | 2895 | 0.0749  | 511506 WTH WF 4    | 138 | 511534 CL-NGTP4    | 138  | 1 | C:511506 WTH WF 4             | 138 | 511536 WEATHTP4     | 138 | 1 |
| REGION1234 | REGION5678_I | 3751 | 0.0947  | 530592 SMOKYHLLS6  | 230 | 532873 SUMMIT 6    | 230  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7     | 115 | 1 |
| REGION1234 | REGION5678_I | 4628 | -0.0670 | 530592 SMOKYHLLS6  | 230 | 530593 SMOKY_INT   | 230  | 1 | C:650267 84&LE 7              | 115 | 650285 WAGENER7     | 115 | 1 |
| REGION1234 | REGION5678_I | 4750 | 0.0649  | 515785 WINDFRM4    | 138 | 520999 MOORLND4    | 138  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7     | 115 | 1 |
| REGION1234 | REGION5678_I | 4954 | -0.1060 | 524267 BUSHLAND 6  | 230 | 524276 WILDOR_WND6 | 230  | 1 | C:659192 LYNN 7               | 115 | 659239 COVALT 7     | 115 | 1 |
| REGION1234 | REGION5678_I | 4963 | 0.0530  | 524486 CAPROCK 3   | 115 | 524502 NORTON 3    | 115  | 1 | C:659154 LAMAR 7              | 115 | 659195 CRETE 7      | 115 | 1 |
| REGION1234 | REGION5678_I | 5328 | -0.0468 | 511489 WTH_JCT4    | 138 | 511497 WTH_SE 4    | 138  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7     | 115 | 1 |
| REGION1234 | REGION5678_I | 5417 | -0.0473 | 511497 WTH_SE 4    | 138 | 511536 WEATHTP4    | 138  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7     | 115 | 1 |

|            |              |      |         |                    |     |                   |      |    |                               |     |                 |     |   |
|------------|--------------|------|---------|--------------------|-----|-------------------|------|----|-------------------------------|-----|-----------------|-----|---|
| REGION1234 | REGION5678_I | 5465 | -0.0367 | 640093 C.CREEK4    | 230 | 640286 N.PLATT4   | 230  | 1  | C:652302 JULESBG7             | 115 | 659240 INTERST7 | 115 | 1 |
| REGION1234 | REGION5678_I | 5479 | -0.0582 | 539679 MULGREN6    | 230 | 539695 SPEARVL6   | 230  | 1  | C:652302 JULESBG7             | 115 | 659240 INTERST7 | 115 | 1 |
| REGION1234 | REGION5678_I | 5546 | -0.0417 | 523771 GRAPEVINE 6 | 230 | 524044 NICHOLS 6  | 230  | 1  | C:652302 JULESBG7             | 115 | 659240 INTERST7 | 115 | 1 |
| REGION1234 | REGION5678_I | 5555 | 0.0468  | 511540 CAN_GAS4    | 138 | 514821 JENSEN 4   | 138  | 1  | C:652302 JULESBG7             | 115 | 659240 INTERST7 | 115 | 1 |
| REGION1234 | REGION5678_I | 5658 | -0.0853 | 523959 POTTER_CO 6 | 230 | 524267 BUSHLAND 6 | 230  | 1  | C:659130 GRANTNB7             | 115 | 659188 SPCREEK7 | 115 | 1 |
| REGION6    | REGION7_I    | 2070 | -0.0477 | 532851 AUBURN 6    | 230 | 532852 JEC 6      | 230  | 1  | C:532765 HOYT 7               | 345 | 532766 JEC N 7  | 345 | 1 |
| REGION6    | REGION7_I    | 2466 | -0.0461 | 509834 COGENT 7    | 345 | B\$0339 COGEN G1  | 1.00 | 1  | Base Case                     |     |                 |     |   |
| REGION6    | REGION7_I    | 2665 | 0.1353  | 532774 SWISVAL7    | 345 | 542965 W.GRDNR7   | 345  | 1  | C:532765 HOYT 7               | 345 | 532766 JEC N 7  | 345 | 1 |
| REGION6    | REGION7_I    | 2897 | 0.0464  | 646211 S1211 5     | 161 | 646250 S1250 5    | 161  | 2  | C:646211 S1211 5              | 161 | 646250 S1250 5  | 161 | 1 |
| REGION6    | REGION7_I    | 3424 | 0.0459  | 542965 W.GRDNR7    | 345 | 542968 STILWEL7   | 345  | 1  | C:542968 STILWEL7             | 345 | 542981 LACYGNE7 | 345 | 1 |
| REGION6    | REGION7_I    | 3522 | -0.0921 | 532765 HOYT 7      | 345 | 532766 JEC N 7    | 345  | 1  | C:532766 JEC N 7              | 345 | 532773 SUMMIT 7 | 345 | 1 |
| REGION6    | REGION7_I    | 3675 | 0.0461  | 646211 S1211 5     | 161 | 646250 S1250 5    | 161  | 1  | C:646211 S1211 5              | 161 | 646250 S1250 5  | 161 | 2 |
| REGION6    | REGION7_I    | 3904 | -0.0420 | 512734 FARML 4     | 138 | B\$0338 COFAUT02  | 1.00 | 2  | C:3wnd: OPEN B\$0337 COFAUT01 | 1   |                 |     |   |
| REGION6    | REGION7_I    | 3904 | -0.0420 | 512734 FARML 4     | 138 | B\$0337 COFAUT01  | 1.00 | 1  | C:3wnd: OPEN B\$0338 COFAUT02 | 2   |                 |     |   |
| REGION6    | REGION7_I    | 5129 | -0.0786 | 532800 LATHAMS7    | 345 | 547501 ELKRVR17   | 345  | 1  | C:3wnd: OPEN B\$0636 MARIETTA | 1   |                 |     |   |
| REGION6    | REGION7_I    | 5283 | 0.1116  | 532768 EMPEC 7     | 345 | 532774 SWISVAL7   | 345  | 1  | C:532768 EMPEC 7              | 345 | 532796 WICHITA7 | 345 | 1 |
| REGION6    | REGION7_I    | 5319 | -0.0305 | 541221 PLTCTY 5    | 161 | 541350 IATAN5     | 161  | 1  | C:532772 STRANGR7             | 345 | 542977 CRAIG 7  | 345 | 1 |
| REGION6    | REGION7_I    | 5590 | 0.1251  | 532765 HOYT 7      | 345 | 532772 STRANGR7   | 345  | 1  | C:532774 SWISVAL7             | 345 | 542965 W.GRDNR7 | 345 | 1 |
| REGION6    | REGION7_I    | 5749 | 0.1117  | 532772 STRANGR7    | 345 | 542977 CRAIG 7    | 345  | 1  | C:532774 SWISVAL7             | 345 | 542965 W.GRDNR7 | 345 | 1 |
| REGION6    | REGION7_I    | 6393 | 0.0363  | 532937 NEOSHO 5    | 161 | 547465 COL 94 5   | 161  | 1  | C:532932 LITCH 5              | 161 | 547476 ASB349 5 | 161 | 1 |
| REGION6    | REGION7_I    | 6673 | 0.0368  | 532851 AUBURN 6    | 230 | 532856 SWISVAL6   | 230  | 1  | C:532765 HOYT 7               | 345 | 532766 JEC N 7  | 345 | 1 |
| REGION6    | REGION7_I    | 6725 | 0.0363  | 547465 COL 94 5    | 161 | 547469 RIV4525    | 161  | 1  | C:532932 LITCH 5              | 161 | 547476 ASB349 5 | 161 | 1 |
| REGION6    | REGION7_I    | 7210 | 0.0317  | 542972 HAWTH 7     | 345 | B\$0532 HAWT 20   | 1.00 | 20 | C:3wnd: OPEN B\$0533 HAWT 22  | 22  |                 |     |   |
| REGION6    | REGION7_I    | 7210 | -0.0317 | 542973 HAWTHRN5    | 161 | B\$0532 HAWT 20   | 1.00 | 20 | C:3wnd: OPEN B\$0533 HAWT 22  | 22  |                 |     |   |
| REGION6    | REGION7_I    | 7290 | 0.0420  | 510378 SCOFCTY4    | 138 | 510422 COFFEYT4   | 138  | 1  | C:510379 DELWARE4             | 138 | 512734 FARML 4  | 138 | 1 |
| REGION6    | REGION7_I    | 7517 | 0.0860  | 532768 EMPEC 7     | 345 | 532796 WICHITA7   | 345  | 1  | C:532768 EMPEC 7              | 345 | 532774 SWISVAL7 | 345 | 1 |
| REGION6    | REGION7_I    | 8028 | -0.0405 | 532853 LAWHILL6    | 230 | 532856 SWISVAL6   | 230  | 1  | C:532774 SWISVAL7             | 345 | 542965 W.GRDNR7 | 345 | 1 |
| REGION6    | REGION7_I    | 8267 | 0.0361  | 532932 LITCH 5     | 161 | 547476 ASB349 5   | 161  | 1  | C:532937 NEOSHO 5             | 161 | 547465 COL 94 5 | 161 | 1 |
| REGION6    | REGION7_I    | 8316 | -0.0420 | 510378 SCOFCTY4    | 138 | 512734 FARML 4    | 138  | 1  | C:510379 DELWARE4             | 138 | 512734 FARML 4  | 138 | 1 |
| REGION6    | REGION7_I    | 8500 | 0.0358  | 532770 MORRIS 7    | 345 | B\$0679 MORRIS1X  | 1.00 | 1  | C:532768 EMPEC 7              | 345 | 532774 SWISVAL7 | 345 | 1 |



|         |           |      |         |                    |                      |      |   |                               |                     |       |
|---------|-----------|------|---------|--------------------|----------------------|------|---|-------------------------------|---------------------|-------|
| REGION6 | REGION7_I | 8508 | -0.0358 | 532863 MORRIS 6    | 230 B\$0679 MORRIS1X | 1.00 | 1 | C:532768 EMPEC 7              | 345 532774 SWISVAL7 | 345 1 |
| REGION6 | REGION7_I | 9333 | 0.0847  | 541199 ST JOE 3    | 345 542972 HAWTH 7   | 345  | 1 | C:532772 STRANGR7             | 345 542977 CRAIG 7  | 345 1 |
| REGION6 | REGION7_I | 9375 | -0.0938 | 640139 COOPER 3    | 345 645458 S3458 3   | 345  | 1 | C:645458 S3458 3              | 345 650189 103&R0K3 | 345 1 |
| REGION6 | REGION7_I | 9555 | -0.0420 | 510379 DELWARE4    | 138 512734 FARML 4   | 138  | 1 | C:510378 SCOFCTY4             | 138 512734 FARML 4  | 138 1 |
| REGION6 | REGION7_I | 9803 | 0.0402  | 640278 SHELDON7    | 115 B\$0675 MOORE T1 | 1.00 | 1 | C:640278 SHELDON7             | 115 650242 SW7&PH 7 | 115 1 |
| REGION6 | REGION8_I | 1934 | 0.0493  | 549984 BROOKLINE 7 | 345 B\$0297 BRKLT1X1 | 1.00 | 1 | C:3Wnd: OPEN B\$0298 BRKLT1X2 | 2                   |       |
| REGION6 | REGION8_I | 1939 | -0.0493 | 549969 BROOKLINE 5 | 161 B\$0297 BRKLT1X1 | 1.00 | 1 | C:3Wnd: OPEN B\$0298 BRKLT1X2 | 2                   |       |
| REGION6 | REGION8_I | 1963 | 0.0491  | 549984 BROOKLINE 7 | 345 B\$0298 BRKLT1X2 | 1.00 | 2 | C:3Wnd: OPEN B\$0297 BRKLT1X1 | 1                   |       |
| REGION6 | REGION8_I | 1965 | -0.0491 | 549969 BROOKLINE 5 | 161 B\$0298 BRKLT1X2 | 1.00 | 2 | C:3Wnd: OPEN B\$0297 BRKLT1X1 | 1                   |       |
| REGION6 | REGION8_I | 2376 | -0.0415 | 532851 AUBURN 6    | 230 532852 JEC 6     | 230  | 1 | C:532765 HOYT 7               | 345 532766 JEC N 7  | 345 1 |
| REGION6 | REGION8_I | 2466 | -0.0461 | 509834 COGENT 7    | 345 B\$0339 COGEN G1 | 1.00 | 1 | Base Case                     |                     |       |
| REGION6 | REGION8_I | 2591 | -0.0481 | 507774 NORAM 4     | 138 508808 LONGWD 4  | 138  | 1 | C:507760 SW SHV 7             | 345 508809 LONGWD 7 | 345 1 |
| REGION6 | REGION8_I | 2660 | -0.0481 | 507749 RAINES 4    | 138 507774 NORAM 4   | 138  | 1 | C:507760 SW SHV 7             | 345 508809 LONGWD 7 | 345 1 |
| REGION6 | REGION8_I | 2864 | 0.0469  | 646211 S1211 5     | 161 646250 S1250 5   | 161  | 2 | C:646211 S1211 5              | 161 646250 S1250 5  | 161 1 |
| REGION6 | REGION8_I | 2944 | 0.1224  | 532774 SWISVAL7    | 345 542965 W.GRDNR7  | 345  | 1 | C:532765 HOYT 7               | 345 532766 JEC N 7  | 345 1 |
| REGION6 | REGION8_I | 3049 | 0.0515  | 542965 W.GRDNR7    | 345 542968 STILWEL7  | 345  | 1 | C:542968 STILWEL7             | 345 542981 LACYGNE7 | 345 1 |
| REGION6 | REGION8_I | 3227 | -0.0481 | 507711 ARSHILL4    | 138 507749 RAINES 4  | 138  | 1 | C:507760 SW SHV 7             | 345 508809 LONGWD 7 | 345 1 |
| REGION6 | REGION8_I | 3520 | 0.0544  | 500300 EUNICE 4    | 138 500540 MANUEL 4  | 138  | 1 | C:500920 WSTFORK6             | 230 500940 WELLS 6  | 230 1 |
| REGION6 | REGION8_I | 3633 | 0.0466  | 646211 S1211 5     | 161 646250 S1250 5   | 161  | 1 | C:646211 S1211 5              | 161 646250 S1250 5  | 161 2 |
| REGION6 | REGION8_I | 3748 | 0.0789  | 508809 LONGWD 7    | 345 B\$0620 LONGWOOD | 1.00 | 1 | C:507760 SW SHV 7             | 345 508809 LONGWD 7 | 345 1 |
| REGION6 | REGION8_I | 3751 | -0.0789 | 508808 LONGWD 4    | 138 B\$0620 LONGWOOD | 1.00 | 1 | C:507760 SW SHV 7             | 345 508809 LONGWD 7 | 345 1 |
| REGION6 | REGION8_I | 3798 | -0.0854 | 532765 HOYT 7      | 345 532766 JEC N 7   | 345  | 1 | C:532766 JEC N 7              | 345 532773 SUMMIT 7 | 345 1 |
| REGION6 | REGION8_I | 3904 | -0.0420 | 512734 FARML 4     | 138 B\$0338 COFAUTO2 | 1.00 | 2 | C:3Wnd: OPEN B\$0337 COFAUTO1 | 1                   |       |
| REGION6 | REGION8_I | 3904 | -0.0420 | 512734 FARML 4     | 138 B\$0337 COFAUTO1 | 1.00 | 1 | C:3Wnd: OPEN B\$0338 COFAUTO2 | 2                   |       |
| REGION6 | REGION8_I | 3998 | -0.0544 | 500230 COUGH 4     | 138 500540 MANUEL 4  | 138  | 1 | C:500920 WSTFORK6             | 230 500940 WELLS 6  | 230 1 |
| REGION6 | REGION8_I | 4884 | -0.0307 | 504000 AVOCA 5     | 161 506931 EROGERS5  | 161  | 1 | C:508298 LYDIA 7              | 345 510911 VALIANT7 | 345 1 |
| REGION6 | REGION8_I | 4915 | -0.0335 | 507755 S SHV 4     | 138 507767 WESTELC4  | 138  | 1 | C:507748 POWELL 4             | 138 507759 SW SHV 4 | 138 1 |
| REGION6 | REGION8_I | 4976 | -0.1092 | 500920 WSTFORK6    | 230 500940 WELLS 6   | 230  | 1 | C:500300 EUNICE 4             | 138 500540 MANUEL 4 | 138 1 |
| REGION6 | REGION8_I | 5124 | 0.0302  | 500230 COUGH 4     | 138 500780 SHOAKS 4  | 138  | 1 | C:500190 COCODR 6             | 230 500340 FHILL 6  | 230 1 |
| REGION6 | REGION8_I | 5129 | -0.0786 | 532800 LATHAMS7    | 345 547501 ELKRVR17  | 345  | 1 | C:3Wnd: OPEN B\$0940 TECH194X | 1                   |       |

|         |           |      |         |                 |     |                  |      |   |                   |     |                 |     |   |
|---------|-----------|------|---------|-----------------|-----|------------------|------|---|-------------------|-----|-----------------|-----|---|
| REGION6 | REGION8_I | 5215 | -0.0317 | 507738 LINWOOD4 | 138 | 507748 POWELL 4  | 138  | 1 | C:507767 WESTELC4 | 138 | 507768 WESTELT4 | 138 | 1 |
| REGION6 | REGION8_I | 5440 | -0.1092 | 500880 VILPLT 6 | 230 | 500920 WSTFORK6  | 230  | 1 | C:500300 EUNICE 4 | 138 | 500540 MANUEL 4 | 138 | 1 |
| REGION6 | REGION8_I | 5633 | 0.1047  | 532768 EMPEC 7  | 345 | 532774 SWISVAL7  | 345  | 1 | C:532768 EMPEC 7  | 345 | 532796 WICHITA7 | 345 | 1 |
| REGION6 | REGION8_I | 5709 | -0.0359 | 505516 OZARK H5 | 161 | 505522 VAN BUR5  | 161  | 1 | C:515339 VBI 5    | 161 | 515360 TWNBRD5  | 161 | 1 |
| REGION6 | REGION8_I | 5822 | -0.0317 | 507748 POWELL 4 | 138 | 507759 SW SHV 4  | 138  | 1 | C:507767 WESTELC4 | 138 | 507768 WESTELT4 | 138 | 1 |
| REGION6 | REGION9_I | 367  | -0.0358 | 505418 JONESB05 | 161 | 505420 HERGETT5  | 161  | 1 | C:505410 KENNETT5 | 161 | 505412 PARAGLD5 | 161 | 1 |
| REGION6 | REGION9_I | 1671 | 0.0351  | 505400 N MADRD5 | 161 | 505410 KENNETT5  | 161  | 1 | C:505418 JONESB05 | 161 | 505420 HERGETT5 | 161 | 1 |
| REGION6 | REGION9_I | 1758 | -0.0570 | 505418 JONESB05 | 161 | 505442 WATER V5  | 161  | 1 | C:505410 KENNETT5 | 161 | 505412 PARAGLD5 | 161 | 1 |
| REGION6 | REGION9_I | 1827 | -0.1172 | 502401 FLANDER6 | 230 | 502402 ACADIAN6  | 230  | 1 | C:500773 SEGURA 6 | 230 | 500776 SELLRD6  | 230 | 1 |
| REGION6 | REGION9_I | 1936 | 0.0931  | 500330 FLANDR 4 | 138 | 500774 SEGURA4   | 138  | 1 | C:500773 SEGURA 6 | 230 | 500776 SELLRD6  | 230 | 1 |
| REGION6 | REGION9_I | 1972 | -0.1172 | 502402 ACADIAN6 | 230 | 502403 BONIN 6   | 230  | 1 | C:500773 SEGURA 6 | 230 | 500776 SELLRD6  | 230 | 1 |
| REGION6 | REGION9_I | 2020 | 0.1392  | 500410 HOPKINS4 | 138 | 500580 MORBHAN4  | 138  | 1 | C:500410 HOPKINS4 | 138 | 500660 PATOUT 4 | 138 | 1 |
| REGION6 | REGION9_I | 2055 | -0.1288 | 500410 HOPKINS4 | 138 | 500774 SEGURA4   | 138  | 1 | C:500100 BERWKTP4 | 138 | 500740 RAMOS 4  | 138 | 1 |
| REGION6 | REGION9_I | 2182 | 0.1572  | 500410 HOPKINS4 | 138 | 500660 PATOUT 4  | 138  | 1 | C:500410 HOPKINS4 | 138 | 500580 MORBHAN4 | 138 | 1 |
| REGION6 | REGION9_I | 2242 | 0.0467  | 505410 KENNETT5 | 161 | 505412 PARAGLD5  | 161  | 1 | C:505418 JONESB05 | 161 | 505442 WATER V5 | 161 | 1 |
| REGION6 | REGION9_I | 2285 | -0.0432 | 532851 AUBURN 6 | 230 | 532852 JEC 6     | 230  | 1 | C:532765 HOYT 7   | 345 | 532766 JEC N 7  | 345 | 1 |
| REGION6 | REGION9_I | 2429 | 0.1572  | 500660 PATOUT 4 | 138 | 500820 TECHE 4   | 138  | 1 | C:500410 HOPKINS4 | 138 | 500580 MORBHAN4 | 138 | 1 |
| REGION6 | REGION9_I | 2466 | -0.0461 | 509834 COGENT 7 | 345 | B\$0339 COGEN G1 | 1.00 | 1 | Base Case         |     |                 |     |   |
| REGION6 | REGION9_I | 2466 | 0.1708  | 500940 WELLS 6  | 230 | 502420 LABBETAP  | 230  | 1 | C:500940 WELLS 6  | 230 | 502410 PMOUTON6 | 230 | 1 |
| REGION6 | REGION9_I | 2540 | -0.1459 | 502403 BONIN 6  | 230 | 502421 LABBE     | 230  | 2 | C:502403 BONIN 6  | 230 | 502421 LABBE    | 230 | 1 |
| REGION6 | REGION9_I | 2540 | -0.1459 | 502403 BONIN 6  | 230 | 502421 LABBE     | 230  | 1 | C:502403 BONIN 6  | 230 | 502421 LABBE    | 230 | 2 |
| REGION6 | REGION9_I | 2597 | 0.0319  | 505440 DONIPHN5 | 161 | 505442 WATER V5  | 161  | 1 | C:505410 KENNETT5 | 161 | 505412 PARAGLD5 | 161 | 1 |
| REGION6 | REGION9_I | 2636 | 0.1585  | 500940 WELLS 6  | 230 | 502410 PMOUTON6  | 230  | 1 | C:500940 WELLS 6  | 230 | 502420 LABBETAP | 230 | 1 |
| REGION6 | REGION9_I | 2711 | 0.1310  | 500773 SEGURA 6 | 230 | 500774 SEGURA4   | 138  | 1 | C:500330 FLANDR 4 | 138 | 500774 SEGURA4  | 138 | 1 |
| REGION6 | REGION9_I | 2724 | 0.1585  | 502410 PMOUTON6 | 230 | 502421 LABBE     | 230  | 1 | C:500940 WELLS 6  | 230 | 502420 LABBETAP | 230 | 1 |
| REGION6 | REGION9_I | 2743 | 0.0573  | 542965 W.GRDNR7 | 345 | 542968 STILWEL7  | 345  | 1 | C:542968 STILWEL7 | 345 | 542981 LACYGNE7 | 345 | 1 |
| REGION6 | REGION9_I | 2819 | 0.0303  | 505480 BEAVER 5 | 161 | 506932 EUREKA 5  | 161  | 1 | Base Case         |     |                 |     |   |
| REGION6 | REGION9_I | 2855 | 0.0471  | 646211 S1211 5  | 161 | 646250 S1250 5   | 161  | 2 | C:646211 S1211 5  | 161 | 646250 S1250 5  | 161 | 1 |
| REGION6 | REGION9_I | 2863 | 0.1392  | 500580 MORBHAN4 | 138 | 500820 TECHE 4   | 138  | 1 | C:500410 HOPKINS4 | 138 | 500660 PATOUT 4 | 138 | 1 |
| REGION6 | REGION9_I | 2869 | 0.1256  | 532774 SWISVAL7 | 345 | 542965 W.GRDNR7  | 345  | 1 | C:532765 HOYT 7   | 345 | 532766 JEC N 7  | 345 | 1 |

|         |            |      |         |                 |      |                  |      |   |                               |                           |
|---------|------------|------|---------|-----------------|------|------------------|------|---|-------------------------------|---------------------------|
| REGION6 | REGION9_I  | 2956 | 0.0359  | 500740 RAMOS 4  | 138  | 503301 MRGNCTY4  | 138  | 1 | C:3Wnd: OPEN B\$0648 MC00L T2 | 1                         |
| REGION6 | REGION9_I  | 3219 | -0.0444 | 500760 RAPIDES6 | 230  | 500770 RODEMR 6  | 230  | 1 | C:500770 RODEMR 6             | 230 500790 SHERWD 6 230 1 |
| REGION6 | REGION9_I  | 5094 | -0.0506 | 500100 BERWKTP4 | 138  | 500740 RAMOS 4   | 138  | 1 | C:659192 LYNN 7               | 115 659197 SNAKECK7 115 1 |
| REGION6 | REGION9_I  | 5128 | -0.0506 | 500060 BVISTA 4 | 138  | 500100 BERWKTP4  | 138  | 1 | C:659192 LYNN 7               | 115 659197 SNAKECK7 115 1 |
| REGION6 | REGION9_I  | 5129 | -0.0786 | 532800 LATHAMS7 | 345  | 547501 ELKRVR17  | 345  | 1 | C:659195 CRETE 7              | 115 659245 CRETEHE7 115 1 |
| REGION6 | REGION10_I | 1220 | -0.2606 | 505428 SIKESTN5 | 161  | 505434 IDALIA 5  | 161  | 1 | C:505400 N MADRD5             | 161 505428 SIKESTN5 161 1 |
| REGION6 | REGION10_I | 1576 | 0.1851  | 505400 N MADRD5 | 161  | 505428 SIKESTN5  | 161  | 1 | C:505428 SIKESTN5             | 161 505434 IDALIA 5 161 1 |
| REGION6 | REGION10_I | 2196 | -0.0449 | 532851 AUBURN 6 | 230  | 532852 JEC 6     | 230  | 1 | C:532765 HOYT 7               | 345 532766 JEC N 7 345 1  |
| REGION6 | REGION10_I | 2336 | 0.0673  | 542965 W.GRDNR7 | 345  | 542968 STILWEL7  | 345  | 1 | C:542968 STILWEL7             | 345 542981 LACYGNE7 345 1 |
| REGION6 | REGION10_I | 2466 | -0.0461 | 509834 COGENT 7 | 345  | B\$0339 COGEN G1 | 1.00 | 1 | Base Case                     |                           |
| REGION6 | REGION10_I | 2643 | -0.0751 | B\$0538 HEMP 1  | 1.00 | 507454 HEMPSTD4  | 138  | 1 | Base Case                     |                           |
| REGION6 | REGION10_I | 2643 | 0.0751  | B\$0538 HEMP 1  | 1.00 | 507456 HEMPSTD3  | 115  | 1 | Base Case                     |                           |
| REGION6 | REGION10_I | 2756 | 0.1308  | 532774 SWISVAL7 | 345  | 542965 W.GRDNR7  | 345  | 1 | C:532765 HOYT 7               | 345 532766 JEC N 7 345 1  |
| REGION6 | REGION10_I | 2857 | 0.0471  | 646211 S1211 5  | 161  | 646250 S1250 5   | 161  | 2 | C:646211 S1211 5              | 161 646250 S1250 5 161 1  |
| REGION6 | REGION10_I | 3290 | -0.0760 | 504122 MCNAB 3  | 115  | 507456 HEMPSTD3  | 115  | 1 | C:508572 LEBROCK7             | 345 508585 TENRUSK7 345 1 |
| REGION6 | REGION10_I | 3356 | 0.0760  | 504122 MCNAB 3  | 115  | 507453 HOPE 3    | 115  | 1 | C:508572 LEBROCK7             | 345 508585 TENRUSK7 345 1 |
| REGION6 | REGION10_I | 3473 | -0.0934 | 532765 HOYT 7   | 345  | 532766 JEC N 7   | 345  | 1 | C:532766 JEC N 7              | 345 532773 SUMMIT 7 345 1 |
| REGION6 | REGION10_I | 3623 | 0.0468  | 646211 S1211 5  | 161  | 646250 S1250 5   | 161  | 1 | C:646211 S1211 5              | 161 646250 S1250 5 161 2  |
| REGION6 | REGION10_I | 3904 | -0.0420 | 512734 FARML 4  | 138  | B\$0337 COFAUT01 | 1.00 | 1 | C:3Wnd: OPEN B\$0338 COFAUT02 | 2                         |
| REGION6 | REGION10_I | 3904 | -0.0420 | 512734 FARML 4  | 138  | B\$0338 COFAUT02 | 1.00 | 2 | C:3Wnd: OPEN B\$0337 COFAUT01 | 1                         |
| REGION6 | REGION10_I | 4369 | -0.0751 | 503912 FULTON 3 | 115  | 507453 HOPE 3    | 115  | 1 | Base Case                     |                           |
| REGION6 | REGION10_I | 5129 | -0.0786 | 532800 LATHAMS7 | 345  | 547501 ELKRVR17  | 345  | 1 | C:640342 SHELCKR3             | 345 640343 SHELCKR4 230 1 |
| REGION6 | REGION10_I | 7801 | -0.0306 | 505416 CENTR H5 | 161  | 505418 JONESB05  | 161  | 1 | C:645456 S3456 3              | 345 645458 S3458 3 345 1  |
| REGION6 | REGION10_I | 8109 | -0.0313 | 650238 20&PIO 7 | 115  | 650242 SW7&PH 7  | 115  | 1 | C:3Wnd: OPEN B\$0675 MOORE T1 | 1                         |
| REGION6 | REGION10_I | 8788 | 0.0879  | 532765 HOYT 7   | 345  | 532772 STRANGR7  | 345  | 1 | C:640234 HUMBOLT5             | 161 646280 S1280 5 161 1  |
| REGION6 | REGION10_I | 9012 | -0.0306 | 505412 PARAGLD5 | 161  | 505416 CENTR H5  | 161  | 1 | C:645456 S3456 3              | 345 645458 S3458 3 345 1  |
| REGION6 | REGION10_I | 9226 | 0.0758  | 532768 EMPEC 7  | 345  | 532774 SWISVAL7  | 345  | 1 | C:640374 SWEET W3             | 345 652571 GR ISLD3 345 1 |
| REGION6 | REGION10_I | 9327 | 0.0423  | 640278 SHELDON7 | 115  | B\$0675 MOORE T1 | 1.00 | 1 | C:640278 SHELDON7             | 115 650242 SW7&PH 7 115 1 |
| REGION6 | REGION10_I | 9329 | -0.0423 | 640277 MOORE 3  | 345  | B\$0675 MOORE T1 | 1.00 | 1 | C:640278 SHELDON7             | 115 650242 SW7&PH 7 115 1 |
| REGION6 | REGION10_I | 9937 | 0.1019  | 515224 MUSKOG7  | 345  | 515302 FTSMITH7  | 345  | 1 | C:640246 JULSTAP7             | 115 652302 JULESBG7 115 1 |

|         |            |       |         |                    |     |                  |      |   |                              |     |                 |     |   |
|---------|------------|-------|---------|--------------------|-----|------------------|------|---|------------------------------|-----|-----------------|-----|---|
| REGION6 | REGION10_I | 10173 | 0.0935  | 515302 FTSMITH7    | 345 | B\$0457 FTSMITH1 | 1.00 | 1 | C:640246 JULSTAP7            | 115 | 652302 JULESBG7 | 115 | 1 |
| REGION6 | REGION10_I | 10177 | -0.0935 | 515305 FTSMITH8    | 500 | B\$0457 FTSMITH1 | 1.00 | 1 | C:640246 JULSTAP7            | 115 | 652302 JULESBG7 | 115 | 1 |
| REGION6 | REGION10_I | 11336 | 0.0470  | 541198 PECULR 7    | 345 | 541200 PHILL 7   | 345  | 1 | C:640234 HUMBOLT5            | 161 | 646280 S1280 5  | 161 | 1 |
| REGION6 | REGION10_I | 11550 | 0.0629  | 532768 EMPEC 7     | 345 | 532796 WICHITA7  | 345  | 1 | C:640234 HUMBOLT5            | 161 | 646280 S1280 5  | 161 | 1 |
| REGION6 | REGION10_I | 11834 | -0.0306 | 505410 KENNETT5    | 161 | 505412 PARAGLD5  | 161  | 1 | C:645456 S3456 3             | 345 | 645458 S3458 3  | 345 | 1 |
| REGION7 | REGION8_I  | 2389  | 0.0399  | 549984 BROOKLINE 7 | 345 | B\$0297 BRKLTx1  | 1.00 | 1 | C:3Wnd: OPEN B\$0298 BRKLTx2 | 2   |                 |     |   |
| REGION7 | REGION8_I  | 2394  | -0.0399 | 549969 BROOKLINE 5 | 161 | B\$0297 BRKLTx1  | 1.00 | 1 | C:3Wnd: OPEN B\$0298 BRKLTx2 | 2   |                 |     |   |
| REGION7 | REGION8_I  | 2424  | 0.0398  | 549984 BROOKLINE 7 | 345 | B\$0298 BRKLTx2  | 1.00 | 2 | C:3Wnd: OPEN B\$0297 BRKLTx1 | 1   |                 |     |   |
| REGION7 | REGION8_I  | 2427  | -0.0398 | 549969 BROOKLINE 5 | 161 | B\$0298 BRKLTx2  | 1.00 | 2 | C:3Wnd: OPEN B\$0297 BRKLTx1 | 1   |                 |     |   |
| REGION7 | REGION8_I  | 2613  | -0.0477 | 507774 NORAM 4     | 138 | 508808 LONGWD 4  | 138  | 1 | C:507760 SW SHV 7            | 345 | 508809 LONGWD 7 | 345 | 1 |
| REGION7 | REGION8_I  | 2683  | -0.0477 | 507749 RAINES 4    | 138 | 507774 NORAM 4   | 138  | 1 | C:507760 SW SHV 7            | 345 | 508809 LONGWD 7 | 345 | 1 |
| REGION7 | REGION8_I  | 2897  | 0.0345  | 541225 PHILL 5     | 161 | 541243 LKWINGB5  | 161  | 1 | C:541218 GRNWD 5             | 161 | 541233 LEESUM 5 | 161 | 1 |
| REGION7 | REGION8_I  | 3255  | -0.0477 | 507711 ARSHILL4    | 138 | 507749 RAINES 4  | 138  | 1 | C:507760 SW SHV 7            | 345 | 508809 LONGWD 7 | 345 | 1 |
| REGION7 | REGION8_I  | 3316  | 0.0345  | 541243 LKWINGB5    | 161 | 541249 HOOKRD 5  | 161  | 1 | C:541218 GRNWD 5             | 161 | 541233 LEESUM 5 | 161 | 1 |
| REGION7 | REGION8_I  | 3502  | 0.0612  | 546652 QUIND 5     | 161 | 546684 EFAIRFX5  | 161  | 1 | C:546652 QUIND 5             | 161 | 546653 NEARMAN5 | 161 | 1 |
| REGION7 | REGION8_I  | 3633  | 0.0669  | 546652 QUIND 5     | 161 | 546653 NEARMAN5  | 161  | 1 | C:546652 QUIND 5             | 161 | 546684 EFAIRFX5 | 161 | 1 |
| REGION7 | REGION8_I  | 3803  | 0.0503  | 500300 EUNICE 4    | 138 | 500540 MANUEL 4  | 138  | 1 | C:500920 WSTFORK6            | 230 | 500940 WELLS 6  | 230 | 1 |
| REGION7 | REGION8_I  | 3977  | 0.0370  | 546653 NEARMAN5    | 161 | 546654 SUNSET 5  | 161  | 1 | C:546653 NEARMAN5            | 161 | 546656 MAYWOOD5 | 161 | 1 |
| REGION7 | REGION8_I  | 4116  | -0.0302 | 508806 LIEBERM4    | 138 | 508833 IPCJEFF4  | 138  | 1 | C:508809 LONGWD 7            | 345 | 508841 WILKES 7 | 345 | 1 |
| REGION7 | REGION8_I  | 4319  | -0.0503 | 500230 COUGH 4     | 138 | 500540 MANUEL 4  | 138  | 1 | C:500920 WSTFORK6            | 230 | 500940 WELLS 6  | 230 | 1 |
| REGION7 | REGION8_I  | 4354  | -0.0310 | 507711 ARSHILL4    | 138 | 508806 LIEBERM4  | 138  | 1 | C:507774 NORAM 4             | 138 | 508808 LONGWD 4 | 138 | 1 |
| REGION7 | REGION8_I  | 4415  | -0.0612 | 546663 GM PLT 5    | 161 | 546684 EFAIRFX5  | 161  | 1 | C:546652 QUIND 5             | 161 | 546653 NEARMAN5 | 161 | 1 |
| REGION7 | REGION8_I  | 4420  | -0.0345 | 541224 LNGVW 5     | 161 | 541249 HOOKRD 5  | 161  | 1 | C:541218 GRNWD 5             | 161 | 541233 LEESUM 5 | 161 | 1 |
| REGION7 | REGION8_I  | 4552  | 0.0382  | 508566 SABMINT4    | 138 | 508569 SEMRSHL4  | 138  | 1 | C:508809 LONGWD 7            | 345 | 508841 WILKES 7 | 345 | 1 |
| REGION7 | REGION8_I  | 4822  | 0.0370  | 546654 SUNSET 5    | 161 | 546655 KAW W 5   | 161  | 1 | C:546653 NEARMAN5            | 161 | 546656 MAYWOOD5 | 161 | 1 |
| REGION7 | REGION8_I  | 4874  | 0.0612  | 546663 GM PLT 5    | 161 | 546667 FAIRFX-5  | 161  | 1 | C:546652 QUIND 5             | 161 | 546653 NEARMAN5 | 161 | 1 |
| REGION7 | REGION8_I  | 4906  | -0.0305 | 508835 JEFFRSN4    | 138 | 508840 WILKES 4  | 138  | 1 | C:508809 LONGWD 7            | 345 | 508841 WILKES 7 | 345 | 1 |
| REGION7 | REGION8_I  | 4921  | -0.0335 | 507755 S SHV 4     | 138 | 507767 WESTELC4  | 138  | 1 | C:507748 POWELL 4            | 138 | 507759 SW SHV 4 | 138 | 1 |
| REGION7 | REGION8_I  | 5073  | -0.0305 | 532772 STRANGR7    | 345 | 542982 IATAN 7   | 345  | 1 | C:541199 ST JOE 3            | 345 | 542982 IATAN 7  | 345 | 1 |
| REGION7 | REGION8_I  | 5109  | 0.0327  | 541225 PHILL 5     | 161 | 541239 HSNVL 5   | 161  | 1 | C:541225 PHILL 5             | 161 | 541243 LKWINGB5 | 161 | 1 |

|         |           |      |         |                 |                      |      |   |                             |                     |       |
|---------|-----------|------|---------|-----------------|----------------------|------|---|-----------------------------|---------------------|-------|
| REGION7 | REGION8_I | 5135 | 0.0575  | 508809 LONGWD 7 | 345 B\$0620 LONGWOOD | 1.00 | 1 | C:507760 SW SHV 7           | 345 508809 LONGWD 7 | 345 1 |
| REGION7 | REGION8_I | 5140 | -0.0575 | 508808 LONGWD 4 | 138 B\$0620 LONGWOOD | 1.00 | 1 | C:507760 SW SHV 7           | 345 508809 LONGWD 7 | 345 1 |
| REGION7 | REGION8_I | 5264 | -0.0612 | 546659 CTR CTY5 | 161 546667 FAIRFX-5  | 161  | 1 | C:546652 QUIND 5            | 161 546653 NEARMAN5 | 161 1 |
| REGION7 | REGION8_I | 5302 | 0.0382  | 508562 PIRKEY 4 | 138 508566 SABMINT4  | 138  | 1 | C:508809 LONGWD 7           | 345 508841 WILKES 7 | 345 1 |
| REGION7 | REGION8_I | 5361 | -0.1014 | 500920 WSTFORK6 | 230 500940 WELLS 6   | 230  | 1 | C:500300 EUNICE 4           | 138 500540 MANUEL 4 | 138 1 |
| REGION7 | REGION9_I | 362  | -0.0363 | 505418 JONESB05 | 161 505420 HERGETT5  | 161  | 1 | C:505410 KENNETT5           | 161 505412 PARAGLD5 | 161 1 |
| REGION7 | REGION9_I | 1714 | 0.0343  | 505400 N MADRD5 | 161 505410 KENNETT5  | 161  | 1 | C:505418 JONESB05           | 161 505420 HERGETT5 | 161 1 |
| REGION7 | REGION9_I | 1806 | -0.1186 | 502401 FLANDER6 | 230 502402 ACADIAN6  | 230  | 1 | C:500773 SEGURA 6           | 230 500776 SELLRD6  | 230 1 |
| REGION7 | REGION9_I | 1831 | -0.0547 | 505418 JONESB05 | 161 505442 WATER V5  | 161  | 1 | C:505410 KENNETT5           | 161 505412 PARAGLD5 | 161 1 |
| REGION7 | REGION9_I | 1917 | 0.0941  | 500330 FLANDR 4 | 138 500774 SEGURA4   | 138  | 1 | C:500773 SEGURA 6           | 230 500776 SELLRD6  | 230 1 |
| REGION7 | REGION9_I | 1949 | -0.1186 | 502402 ACADIAN6 | 230 502403 BONIN 6   | 230  | 1 | C:500773 SEGURA 6           | 230 500776 SELLRD6  | 230 1 |
| REGION7 | REGION9_I | 2003 | 0.1404  | 500410 HOPKINS4 | 138 500580 MORBHAN4  | 138  | 1 | C:500410 HOPKINS4           | 138 500660 PATOUT 4 | 138 1 |
| REGION7 | REGION9_I | 2055 | -0.1289 | 500410 HOPKINS4 | 138 500774 SEGURA4   | 138  | 1 | C:500100 BERWKTP4           | 138 500740 RAMOS 4  | 138 1 |
| REGION7 | REGION9_I | 2164 | 0.1586  | 500410 HOPKINS4 | 138 500660 PATOUT 4  | 138  | 1 | C:500410 HOPKINS4           | 138 500580 MORBHAN4 | 138 1 |
| REGION7 | REGION9_I | 2337 | 0.0448  | 505410 KENNETT5 | 161 505412 PARAGLD5  | 161  | 1 | C:505418 JONESB05           | 161 505442 WATER V5 | 161 1 |
| REGION7 | REGION9_I | 2409 | 0.1586  | 500660 PATOUT 4 | 138 500820 TECHE 4   | 138  | 1 | C:500410 HOPKINS4           | 138 500580 MORBHAN4 | 138 1 |
| REGION7 | REGION9_I | 2492 | -0.1487 | 502403 BONIN 6  | 230 502421 LABBE     | 230  | 1 | C:502403 BONIN 6            | 230 502421 LABBE    | 230 2 |
| REGION7 | REGION9_I | 2492 | -0.1487 | 502403 BONIN 6  | 230 502421 LABBE     | 230  | 2 | C:502403 BONIN 6            | 230 502421 LABBE    | 230 1 |
| REGION7 | REGION9_I | 2563 | 0.1643  | 500940 WELLS 6  | 230 502420 LABBETAP  | 230  | 1 | C:500940 WELLS 6            | 230 502410 PMOUTON6 | 230 1 |
| REGION7 | REGION9_I | 2688 | 0.1321  | 500773 SEGURA 6 | 230 500774 SEGURA4   | 138  | 1 | C:500330 FLANDR 4           | 138 500774 SEGURA4  | 138 1 |
| REGION7 | REGION9_I | 2740 | 0.1525  | 500940 WELLS 6  | 230 502410 PMOUTON6  | 230  | 1 | C:500940 WELLS 6            | 230 502420 LABBETAP | 230 1 |
| REGION7 | REGION9_I | 2798 | -0.0511 | 500760 RAPIDES6 | 230 500770 RODEMR 6  | 230  | 1 | C:500770 RODEMR 6           | 230 500790 SHERWD 6 | 230 1 |
| REGION7 | REGION9_I | 2808 | 0.0356  | 541225 PHILL 5  | 161 541243 LKWINGB5  | 161  | 1 | C:541218 GRNWD 5            | 161 541233 LEESUM 5 | 161 1 |
| REGION7 | REGION9_I | 2831 | 0.1525  | 502410 PMOUTON6 | 230 502421 LABBE     | 230  | 1 | C:500940 WELLS 6            | 230 502420 LABBETAP | 230 1 |
| REGION7 | REGION9_I | 2839 | 0.1404  | 500580 MORBHAN4 | 138 500820 TECHE 4   | 138  | 1 | C:500410 HOPKINS4           | 138 500660 PATOUT 4 | 138 1 |
| REGION7 | REGION9_I | 2956 | 0.0359  | 500740 RAMOS 4  | 138 503301 MRGNCTY4  | 138  | 1 | C:640068 B.SPRGS7           | 115 640086 BLUECK 7 | 115 1 |
| REGION7 | REGION9_I | 3104 | 0.0351  | 507755 S SHV 4  | 138 507765 WALLAKE4  | 138  | 1 | C:500250 DOLHILL7           | 345 500260 DOLHILL6 | 230 1 |
| REGION7 | REGION9_I | 3213 | 0.0356  | 541243 LKWINGB5 | 161 541249 HOOKRD 5  | 161  | 1 | C:541218 GRNWD 5            | 161 541233 LEESUM 5 | 161 1 |
| REGION7 | REGION9_I | 3382 | 0.0309  | 541206 PRALEE 5 | 161 541211 BLSPS 5   | 161  | 1 | C:3wnd: OPEN B\$0765 P HILL | 1                   |       |
| REGION7 | REGION9_I | 5166 | 0.0536  | 502401 FLANDER6 | 230 502425 BEADLE 6  | 230  | 1 | C:659130 GRANTNB7           | 115 659188 SPCREEK7 | 115 1 |

|         |            |      |         |         |          |     |        |        |          |     |     |           |                             |          |        |          |          |          |     |     |   |
|---------|------------|------|---------|---------|----------|-----|--------|--------|----------|-----|-----|-----------|-----------------------------|----------|--------|----------|----------|----------|-----|-----|---|
| REGION7 | REGION9_I  | 5314 | -0.0485 | 500100  | BERWKTP4 | 138 | 500740 | RAMOS  | 4        | 138 | 1   | C:659130  | GRANTNB7                    | 115      | 659188 | SPCREEK7 | 115      | 1        |     |     |   |
| REGION7 | REGION9_I  | 5349 | -0.0485 | 500060  | BVISTA   | 4   | 138    | 500100 | BERWKTP4 | 138 | 1   | C:659130  | GRANTNB7                    | 115      | 659188 | SPCREEK7 | 115      | 1        |     |     |   |
| REGION7 | REGION9_I  | 5436 | -0.0334 | 504440  | BUFORD   | 5   | 161    | 505460 | BULL SH5 | 161 | 1   | C:652302  | JULESBG7                    | 115      | 659240 | INTERST7 | 115      | 1        |     |     |   |
| REGION7 | REGION9_I  | 5620 | 0.0605  | 500440  | IVANHOE4 |     | 138    | 500460 | JULTAP   | 4   | 138 | 1         | C:652302                    | JULESBG7 | 115    | 659240   | INTERST7 | 115      | 1   |     |   |
| REGION7 | REGION9_I  | 5633 | 0.0605  | 500460  | JULTAP   | 4   | 138    | 500820 | TECHE    | 4   | 138 | 1         | C:652302                    | JULESBG7 | 115    | 659240   | INTERST7 | 115      | 1   |     |   |
| REGION7 | REGION10_I | 1224 | -0.2598 | 505428  | SIKESTN5 |     | 161    | 505434 | IDALIA   | 5   | 161 | 1         | C:505400                    | N MADRD5 | 161    | 505428   | SIKESTN5 | 161      | 1   |     |   |
| REGION7 | REGION10_I | 1564 | 0.1866  | 505400  | N MADRD5 |     | 161    | 505428 | SIKESTN5 | 161 | 1   | C:505428  | SIKESTN5                    | 161      | 505434 | IDALIA   | 5        | 161      | 1   |     |   |
| REGION7 | REGION10_I | 2202 | -0.0901 | B\$0538 | HEMP     | 1   | 1.00   | 507454 | HEMPSTD4 | 138 | 1   | Base Case |                             |          |        |          |          |          |     |     |   |
| REGION7 | REGION10_I | 2202 | 0.0901  | B\$0538 | HEMP     | 1   | 1.00   | 507456 | HEMPSTD3 | 115 | 1   | Base Case |                             |          |        |          |          |          |     |     |   |
| REGION7 | REGION10_I | 2544 | -0.0846 | 504122  | MCNAB    | 3   | 115    | 507456 | HEMPSTD3 | 115 | 1   | C:508298  | LYDIA                       | 7        | 345    | 510911   | VALIANT7 | 345      | 1   |     |   |
| REGION7 | REGION10_I | 2603 | 0.0846  | 504122  | MCNAB    | 3   | 115    | 507453 | HOPE     | 3   | 115 | 1         | C:508298                    | LYDIA    | 7      | 345      | 510911   | VALIANT7 | 345 | 1   |   |
| REGION7 | REGION10_I | 2740 | 0.0365  | 541225  | PHILL    | 5   | 161    | 541243 | LKWINGB5 | 161 | 1   | C:541218  | GRNWD                       | 5        | 161    | 541233   | LEESUM   | 5        | 161 | 1   |   |
| REGION7 | REGION10_I | 3136 | 0.0365  | 541243  | LKWINGB5 |     | 161    | 541249 | HOOKRD   | 5   | 161 | 1         | C:541218                    | GRNWD    | 5      | 161      | 541233   | LEESUM   | 5   | 161 | 1 |
| REGION7 | REGION10_I | 3212 | 0.0326  | 541206  | PRALEE   | 5   | 161    | 541211 | BLSPS    | 5   | 161 | 1         | C:3wnd: OPEN B\$0765 P HILL |          |        |          |          |          | 1   |     |   |
| REGION7 | REGION10_I | 3500 | 0.0613  | 546652  | QUIND    | 5   | 161    | 546684 | EFAIRFX5 | 161 | 1   | C:546652  | QUIND                       | 5        | 161    | 546653   | NEARMAN5 | 161      | 1   |     |   |
| REGION7 | REGION10_I | 3635 | 0.0669  | 546652  | QUIND    | 5   | 161    | 546653 | NEARMAN5 | 161 | 1   | C:546652  | QUIND                       | 5        | 161    | 546684   | EFAIRFX5 | 161      | 1   |     |   |
| REGION7 | REGION10_I | 3640 | -0.0901 | 503912  | FULTON   | 3   | 115    | 507453 | HOPE     | 3   | 115 | 1         | Base Case                   |          |        |          |          |          |     |     |   |
| REGION7 | REGION10_I | 3932 | -0.0326 | 541205  | BLSPE    | 5   | 161    | 541211 | BLSPS    | 5   | 161 | 1         | C:3wnd: OPEN B\$0765 P HILL |          |        |          |          |          | 1   |     |   |
| REGION7 | REGION10_I | 4008 | 0.0367  | 546653  | NEARMAN5 |     | 161    | 546654 | SUNSET   | 5   | 161 | 1         | C:546653                    | NEARMAN5 | 161    | 546656   | MAYWOOD5 | 161      | 1   |     |   |
| REGION7 | REGION10_I | 4128 | 0.0306  | 541218  | GRNWD    | 5   | 161    | 541233 | LEESUM   | 5   | 161 | 1         | C:541225                    | PHILL    | 5      | 161      | 541243   | LKWINGB5 | 161 | 1   |   |
| REGION7 | REGION10_I | 4180 | -0.0365 | 541224  | LNGVW    | 5   | 161    | 541249 | HOOKRD   | 5   | 161 | 1         | C:541218                    | GRNWD    | 5      | 161      | 541233   | LEESUM   | 5   | 161 | 1 |
| REGION7 | REGION10_I | 4412 | -0.0613 | 546663  | GM PLT   | 5   | 161    | 546684 | EFAIRFX5 | 161 | 1   | C:546652  | QUIND                       | 5        | 161    | 546653   | NEARMAN5 | 161      | 1   |     |   |
| REGION7 | REGION10_I | 4859 | 0.0367  | 546654  | SUNSET   | 5   | 161    | 546655 | KAW W    | 5   | 161 | 1         | C:546653                    | NEARMAN5 | 161    | 546656   | MAYWOOD5 | 161      | 1   |     |   |
| REGION7 | REGION10_I | 4871 | 0.0613  | 546663  | GM PLT   | 5   | 161    | 546667 | FAIRFX-5 | 161 | 1   | C:546652  | QUIND                       | 5        | 161    | 546653   | NEARMAN5 | 161      | 1   |     |   |
| REGION7 | REGION10_I | 4959 | -0.0464 | 541199  | ST JOE   | 3   | 345    | 542982 | IATAN    | 7   | 345 | 1         | C:532772                    | STRANGR7 | 345    | 542982   | IATAN    | 7        | 345 | 1   |   |
| REGION7 | REGION10_I | 5260 | -0.0613 | 546659  | CTR CTY5 |     | 161    | 546667 | FAIRFX-5 | 161 | 1   | C:546652  | QUIND                       | 5        | 161    | 546653   | NEARMAN5 | 161      | 1   |     |   |
| REGION7 | REGION10_I | 5755 | 0.0613  | 546659  | CTR CTY5 |     | 161    | 546661 | ARMDALE5 | 161 | 1   | C:546652  | QUIND                       | 5        | 161    | 546653   | NEARMAN5 | 161      | 1   |     |   |
| REGION7 | REGION10_I | 6154 | -0.0306 | 541206  | PRALEE   | 5   | 161    | 541233 | LEESUM   | 5   | 161 | 1         | C:541225                    | PHILL    | 5      | 161      | 541243   | LKWINGB5 | 161 | 1   |   |
| REGION7 | REGION10_I | 6186 | -0.0613 | 546651  | BARBER   | 5   | 161    | 546661 | ARMDALE5 | 161 | 1   | C:546652  | QUIND                       | 5        | 161    | 546653   | NEARMAN5 | 161      | 1   |     |   |
| REGION7 | REGION10_I | 6243 | -0.0309 | 543031  | GRNWOOD5 |     | 161    | 546742 | METRO    | 5   | 161 | 1         | C:546652                    | QUIND    | 5      | 161      | 546684   | EFAIRFX5 | 161 | 1   |   |



|         |            |      |         |                 |                     |      |   |                             |                     |       |
|---------|------------|------|---------|-----------------|---------------------|------|---|-----------------------------|---------------------|-------|
| REGION7 | REGION10_I | 6289 | 0.0583  | 541225 PHILL 5  | 161 B\$0765 P HILL  | 1.00 | 1 | C:541225 PHILL 5            | 161 541243 LKWINGB5 | 161 1 |
| REGION7 | REGION10_I | 6289 | -0.0583 | 541200 PHILL 7  | 345 B\$0765 P HILL  | 1.00 | 1 | C:541225 PHILL 5            | 161 541243 LKWINGB5 | 161 1 |
| REGION7 | REGION10_I | 6308 | -0.0383 | 505416 CENTR H5 | 161 505418 JONESB05 | 161  | 1 | C:505428 SIKESTN5           | 161 505434 IDALIA 5 | 161 1 |
| REGION7 | REGION10_I | 6314 | 0.0316  | 500050 BSALES 4 | 138 500890 WAXLAKE4 | 138  | 1 | Base Case                   |                     |       |
| REGION7 | REGION10_I | 6377 | 0.0361  | 541225 PHILL 5  | 161 541239 HSNVL 5  | 161  | 1 | C:3Wnd: OPEN B\$0765 P HILL | 1                   |       |
| REGION8 | REGION9_I  | 359  | -0.0366 | 505418 JONESB05 | 161 505420 HERGETT5 | 161  | 1 | C:505410 KENNETT5           | 161 505412 PARAGLD5 | 161 1 |
| REGION8 | REGION9_I  | 767  | -0.0575 | 500680 PINEV 6  | 230 500790 SHERWD 6 | 230  | 1 | C:500760 RAPIDES6           | 230 500840 TWINBR6  | 230 1 |
| REGION8 | REGION9_I  | 771  | 0.0575  | 500680 PINEV 6  | 230 500690 PINEV 4  | 138  | 1 | C:500760 RAPIDES6           | 230 500840 TWINBR6  | 230 1 |
| REGION8 | REGION9_I  | 908  | -0.1575 | 500760 RAPIDES6 | 230 500770 RODEMR 6 | 230  | 1 | C:500770 RODEMR 6           | 230 500790 SHERWD 6 | 230 1 |
| REGION8 | REGION9_I  | 1063 | -0.2487 | 507711 ARSHILL4 | 138 507789 ARSGENS4 | 138  | 1 | C:526934 YOAKUM 3           | 115 526935 YOAKUM 6 | 230 2 |
| REGION8 | REGION9_I  | 1085 | 0.1090  | 507711 ARSHILL4 | 138 507742 MCWILLI4 | 138  | 1 | C:507711 ARSHILL4           | 138 507731 FTHUMBG4 | 138 1 |
| REGION8 | REGION9_I  | 1336 | 0.0611  | 507738 LINWOOD4 | 138 507771 CEDARGR4 | 138  | 1 | C:507711 ARSHILL4           | 138 507731 FTHUMBG4 | 138 1 |
| REGION8 | REGION9_I  | 1336 | -0.0611 | 507755 S SHV 4  | 138 507771 CEDARGR4 | 138  | 1 | C:507711 ARSHILL4           | 138 507731 FTHUMBG4 | 138 1 |
| REGION8 | REGION9_I  | 1459 | 0.0475  | 500840 TWINBR6  | 230 500850 TWINBR4  | 138  | 1 | C:500680 PINEV 6            | 230 500790 SHERWD 6 | 230 1 |
| REGION8 | REGION9_I  | 1471 | 0.1384  | 500770 RODEMR 6 | 230 500790 SHERWD 6 | 230  | 1 | C:500760 RAPIDES6           | 230 500770 RODEMR 6 | 230 1 |
| REGION8 | REGION9_I  | 1486 | -0.0482 | 500280 ELEESV 6 | 230 500770 RODEMR 6 | 230  | 1 | C:500200 COLFAX 6           | 230 500770 RODEMR 6 | 230 1 |
| REGION8 | REGION9_I  | 1487 | 0.0549  | 500690 PINEV 4  | 138 500780 SHOAKS 4 | 138  | 1 | C:500690 PINEV 4            | 138 500700 PVKFTAP4 | 138 1 |
| REGION8 | REGION9_I  | 1530 | 0.1428  | 500190 COCODR 6 | 230 500230 COUGH 4  | 138  | 1 | C:500190 COCODR 6           | 230 500880 VILPLT 6 | 230 1 |
| REGION8 | REGION9_I  | 1791 | -0.1196 | 502401 FLANDER6 | 230 502402 ACADIAN6 | 230  | 1 | C:500773 SEGURA 6           | 230 500776 SELLRD6  | 230 1 |
| REGION8 | REGION9_I  | 1795 | -0.1591 | 500340 FHILL 6  | 230 500760 RAPIDES6 | 230  | 1 | C:500190 COCODR 6           | 230 500770 RODEMR 6 | 230 1 |
| REGION8 | REGION9_I  | 1818 | 0.0323  | 505400 N MADRD5 | 161 505410 KENNETT5 | 161  | 1 | C:505418 JONESB05           | 161 505420 HERGETT5 | 161 1 |
| REGION8 | REGION9_I  | 1863 | 0.0967  | 500330 FLANDR 4 | 138 500774 SEGURA4  | 138  | 1 | C:500773 SEGURA 6           | 230 500776 SELLRD6  | 230 1 |
| REGION8 | REGION9_I  | 1888 | -0.0531 | 505418 JONESB05 | 161 505442 WATER V5 | 161  | 1 | C:505410 KENNETT5           | 161 505412 PARAGLD5 | 161 1 |
| REGION8 | REGION9_I  | 1888 | 0.0575  | 500690 PINEV 4  | 138 500700 PVKFTAP4 | 138  | 1 | C:500690 PINEV 4            | 138 500780 SHOAKS 4 | 138 1 |
| REGION8 | REGION9_I  | 1933 | -0.1196 | 502402 ACADIAN6 | 230 502403 BONIN 6  | 230  | 1 | C:500773 SEGURA 6           | 230 500776 SELLRD6  | 230 1 |
| REGION8 | REGION9_I  | 1948 | 0.1443  | 500410 HOPKINS4 | 138 500580 MORBHAN4 | 138  | 1 | C:500410 HOPKINS4           | 138 500660 PATOUT 4 | 138 1 |
| REGION8 | REGION9_I  | 2056 | -0.1288 | 500410 HOPKINS4 | 138 500774 SEGURA4  | 138  | 1 | C:500100 BERWKTP4           | 138 500740 RAMOS 4  | 138 1 |
| REGION8 | REGION9_I  | 2097 | -0.1591 | 500190 COCODR 6 | 230 500340 FHILL 6  | 230  | 1 | C:500190 COCODR 6           | 230 500770 RODEMR 6 | 230 1 |
| REGION8 | REGION9_I  | 2104 | 0.1631  | 500410 HOPKINS4 | 138 500660 PATOUT 4 | 138  | 1 | C:500410 HOPKINS4           | 138 500580 MORBHAN4 | 138 1 |
| REGION8 | REGION9_I  | 2197 | -0.1090 | 507738 LINWOOD4 | 138 507742 MCWILLI4 | 138  | 1 | C:507711 ARSHILL4           | 138 507731 FTHUMBG4 | 138 1 |



|         |            |      |         |                 |      |                 |     |   |                   |     |                    |     |       |
|---------|------------|------|---------|-----------------|------|-----------------|-----|---|-------------------|-----|--------------------|-----|-------|
| REGION8 | REGION9_I  | 2198 | -0.0468 | 500230 COUGH 4  | 138  | 500780 SHOAKS 4 | 138 | 1 | C:500190 COCODR 6 | 230 | 500230 COUGH 4     | 138 | 1     |
| REGION8 | REGION9_I  | 2228 | 0.0963  | 507711 ARSHILL4 | 138  | 507731 FTHUMB4  | 138 | 1 | C:507711 ARSHILL4 | 138 | 507742 MCWILLI4    | 138 | 1     |
| REGION8 | REGION9_I  | 2290 | 0.0482  | 500280 ELEESV 6 | 230  | 500470 LEESV 6  | 230 | 1 | C:500200 COLFAX 6 | 230 | 500770 RODEMR 6    | 230 | 1     |
| REGION8 | REGION9_I  | 2298 | 0.0482  | 500470 LEESV 6  | 230  | 500480 LEESV 4  | 138 | 1 | C:500200 COLFAX 6 | 230 | 500770 RODEMR 6    | 230 | 1     |
| REGION8 | REGION9_I  | 2331 | 0.1806  | 500940 WELLS 6  | 230  | 502420 LABBETAP | 230 | 1 | C:500940 WELLS 6  | 230 | 502410 PMOUTON6    | 230 | 1     |
| REGION8 | REGION10_I | 869  | -0.0508 | 500680 PINEV 6  | 230  | 500790 SHERWD 6 | 230 | 1 | C:500760 RAPIDES6 | 230 | 500840 TWINBR6     | 230 | 1     |
| REGION8 | REGION10_I | 874  | 0.0508  | 500680 PINEV 6  | 230  | 500690 PINEV 4  | 138 | 1 | C:500760 RAPIDES6 | 230 | 500840 TWINBR6     | 230 | 1     |
| REGION8 | REGION10_I | 1062 | -0.0674 | 500280 ELEESV 6 | 230  | 500770 RODEMR 6 | 230 | 1 | C:500200 COLFAX 6 | 230 | 500770 RODEMR 6    | 230 | 1     |
| REGION8 | REGION10_I | 1063 | -0.2487 | 507711 ARSHILL4 | 138  | 507789 ARSGENS4 | 138 | 1 | C:523410 CRMWA#4  | 3   | 115 524043 NICHOLS | 3   | 115 1 |
| REGION8 | REGION10_I | 1117 | 0.1059  | 507711 ARSHILL4 | 138  | 507742 MCWILLI4 | 138 | 1 | C:507711 ARSHILL4 | 138 | 507731 FTHUMB4     | 138 | 1     |
| REGION8 | REGION10_I | 1132 | -0.1264 | 500760 RAPIDES6 | 230  | 500770 RODEMR 6 | 230 | 1 | C:500770 RODEMR 6 | 230 | 500790 SHERWD 6    | 230 | 1     |
| REGION8 | REGION10_I | 1231 | -0.2582 | 505428 SIKESTN5 | 161  | 505434 IDALIA 5 | 161 | 1 | C:505400 N MADRD5 | 161 | 505428 SIKESTN5    | 161 | 1     |
| REGION8 | REGION10_I | 1429 | 0.0571  | 507738 LINWOOD4 | 138  | 507771 CEDARGR4 | 138 | 1 | C:507711 ARSHILL4 | 138 | 507731 FTHUMB4     | 138 | 1     |
| REGION8 | REGION10_I | 1429 | -0.0571 | 507755 S SHV 4  | 138  | 507771 CEDARGR4 | 138 | 1 | C:507711 ARSHILL4 | 138 | 507731 FTHUMB4     | 138 | 1     |
| REGION8 | REGION10_I | 1543 | 0.1891  | 505400 N MADRD5 | 161  | 505428 SIKESTN5 | 161 | 1 | C:505428 SIKESTN5 | 161 | 505434 IDALIA 5    | 161 | 1     |
| REGION8 | REGION10_I | 1637 | 0.0674  | 500280 ELEESV 6 | 230  | 500470 LEESV 6  | 230 | 1 | C:500200 COLFAX 6 | 230 | 500770 RODEMR 6    | 230 | 1     |
| REGION8 | REGION10_I | 1642 | 0.0674  | 500470 LEESV 6  | 230  | 500480 LEESV 4  | 138 | 1 | C:500200 COLFAX 6 | 230 | 500770 RODEMR 6    | 230 | 1     |
| REGION8 | REGION10_I | 1643 | 0.0422  | 500840 TWINBR6  | 230  | 500850 TWINBR4  | 138 | 1 | C:500680 PINEV 6  | 230 | 500790 SHERWD 6    | 230 | 1     |
| REGION8 | REGION10_I | 1682 | 0.0486  | 500690 PINEV 4  | 138  | 500780 SHOAKS 4 | 138 | 1 | C:500690 PINEV 4  | 138 | 500700 PVKFTAP4    | 138 | 1     |
| REGION8 | REGION10_I | 1826 | 0.1114  | 500770 RODEMR 6 | 230  | 500790 SHERWD 6 | 230 | 1 | C:500760 RAPIDES6 | 230 | 500770 RODEMR 6    | 230 | 1     |
| REGION8 | REGION10_I | 2003 | 0.1090  | 500190 COCODR 6 | 230  | 500230 COUGH 4  | 138 | 1 | C:500190 COCODR 6 | 230 | 500880 VILPLT 6    | 230 | 1     |
| REGION8 | REGION10_I | 2136 | 0.0509  | 500690 PINEV 4  | 138  | 500700 PVKFTAP4 | 138 | 1 | C:500690 PINEV 4  | 138 | 500780 SHOAKS 4    | 138 | 1     |
| REGION8 | REGION10_I | 2264 | -0.1059 | 507738 LINWOOD4 | 138  | 507742 MCWILLI4 | 138 | 1 | C:507711 ARSHILL4 | 138 | 507731 FTHUMB4     | 138 | 1     |
| REGION8 | REGION10_I | 2302 | 0.0932  | 507711 ARSHILL4 | 138  | 507731 FTHUMB4  | 138 | 1 | C:507711 ARSHILL4 | 138 | 507742 MCWILLI4    | 138 | 1     |
| REGION8 | REGION10_I | 2363 | -0.1208 | 500340 FHILL 6  | 230  | 500760 RAPIDES6 | 230 | 1 | C:500190 COCODR 6 | 230 | 500770 RODEMR 6    | 230 | 1     |
| REGION8 | REGION10_I | 2583 | -0.0768 | B\$0538 HEMP 1  | 1.00 | 507454 HEMPSTD4 | 138 | 1 | Base Case         |     |                    |     |       |
| REGION8 | REGION10_I | 2583 | 0.0768  | B\$0538 HEMP 1  | 1.00 | 507456 HEMPSTD3 | 115 | 1 | Base Case         |     |                    |     |       |
| REGION8 | REGION10_I | 2661 | -0.0809 | 504122 MCNAB 3  | 115  | 507456 HEMPSTD3 | 115 | 1 | C:508298 LYDIA 7  | 345 | 510911 VALIANT7    | 345 | 1     |
| REGION8 | REGION10_I | 2723 | 0.0809  | 504122 MCNAB 3  | 115  | 507453 HOPE 3   | 115 | 1 | C:508298 LYDIA 7  | 345 | 510911 VALIANT7    | 345 | 1     |
| REGION8 | REGION10_I | 2760 | -0.1208 | 500190 COCODR 6 | 230  | 500340 FHILL 6  | 230 | 1 | C:500190 COCODR 6 | 230 | 500770 RODEMR 6    | 230 | 1     |

|         |            |      |         |                     |     |                 |                 |     |     |                   |                   |                 |                     |                     |     |     |   |   |
|---------|------------|------|---------|---------------------|-----|-----------------|-----------------|-----|-----|-------------------|-------------------|-----------------|---------------------|---------------------|-----|-----|---|---|
| REGION8 | REGION10_I | 2871 | 0.0509  | 500700 PVKFTAP4     | 138 | 500780 SHOAKS   | 4               | 138 | 1   | C:500690 PINEV    | 4                 | 138             | 500780 SHOAKS       | 4                   | 138 | 1   |   |   |
| REGION8 | REGION10_I | 2916 | 0.1023  | 549961 JAMES RIVER5 | 161 | 549963 MENTOR   | 5               | 161 | 1   | C:549954 SWPS     | 5                 | 161             | 549961 JAMES RIVER5 | 161                 | 1   | 1   |   |   |
| REGION8 | REGION10_I | 2962 | -0.0904 | 500200 COLFAX       | 6   | 230             | 500770 RODEMR   | 6   | 230 | 1                 | C:500280 ELEESV   | 6               | 230                 | 500770 RODEMR       | 6   | 230 | 1 |   |
| REGION8 | REGION10_I | 3005 | 0.1023  | 549963 MENTOR       | 5   | 161             | 549970 CLAY     | 5   | 161 | 1                 | C:549954 SWPS     | 5               | 161                 | 549961 JAMES RIVER5 | 161 | 1   | 1 |   |
| REGION8 | REGION10_I | 3009 | -0.0342 | 500230 COUGH        | 4   | 138             | 500780 SHOAKS   | 4   | 138 | 1                 | C:500190 COCODR   | 6               | 230                 | 500230 COUGH        | 4   | 138 | 1 |   |
| REGION9 | REGION10_I | 1238 | -0.2567 | 505428 SIKESTN5     | 161 | 505434 IDALIA   | 5               | 161 | 1   | C:505400 N MADRD5 | 161               | 505428 SIKESTN5 | 161                 | 1                   | 1   | 1   |   |   |
| REGION9 | REGION10_I | 1356 | -0.1093 | 500410 HOPKINS4     | 138 | 500660 PATOUT   | 4               | 138 | 1   | C:500580 MORBHAN4 | 138               | 500820 TECHE    | 4                   | 138                 | 1   | 1   |   |   |
| REGION9 | REGION10_I | 1491 | 0.1957  | 505400 N MADRD5     | 161 | 505428 SIKESTN5 | 161             | 1   | 1   | C:505428 SIKESTN5 | 161               | 505434 IDALIA   | 5                   | 161                 | 1   | 1   |   |   |
| REGION9 | REGION10_I | 1494 | -0.1093 | 500660 PATOUT       | 4   | 138             | 500820 TECHE    | 4   | 138 | 1                 | C:500580 MORBHAN4 | 138             | 500820 TECHE        | 4                   | 138 | 1   | 1 |   |
| REGION9 | REGION10_I | 1721 | -0.0968 | 500410 HOPKINS4     | 138 | 500580 MORBHAN4 | 138             | 1   | 1   | C:500660 PATOUT   | 4                 | 138             | 500820 TECHE        | 4                   | 138 | 1   | 1 |   |
| REGION9 | REGION10_I | 1791 | -0.0968 | 500580 MORBHAN4     | 138 | 500820 TECHE    | 4               | 138 | 1   | C:500660 PATOUT   | 4                 | 138             | 500820 TECHE        | 4                   | 138 | 1   | 1 |   |
| REGION9 | REGION10_I | 1914 | -0.0543 | 500740 RAMOS        | 4   | 138             | 503301 MRGNCTY4 | 138 | 1   | C:515009 MCELROY4 | 138               | 515011 STILWTR4 | 138                 | 1                   | 1   | 1   |   |   |
| REGION9 | REGION10_I | 2403 | 0.0776  | 505418 JONESB05     | 161 | 505442 WATER V5 | 161             | 1   | 1   | C:505416 CENTR H5 | 161               | 505418 JONESB05 | 161                 | 1                   | 1   | 1   |   |   |
| REGION9 | REGION10_I | 2815 | 0.0983  | 500410 HOPKINS4     | 138 | 500774 SEGURA4  | 138             | 1   | 1   | C:500050 BSALES   | 4                 | 138             | 500890 WAXLAKE4     | 138                 | 1   | 1   | 1 |   |
| REGION9 | REGION10_I | 2827 | -0.0394 | 505416 CENTR H5     | 161 | 505418 JONESB05 | 161             | 1   | 1   | C:505400 N MADRD5 | 161               | 505410 KENNETT5 | 161                 | 1                   | 1   | 1   |   |   |
| REGION9 | REGION10_I | 2886 | 0.0837  | 500050 BSALES       | 4   | 138             | 500890 WAXLAKE4 | 138 | 1   | C:500740 RAMOS    | 4                 | 138             | 503301 MRGNCTY4     | 138                 | 1   | 1   | 1 |   |
| REGION9 | REGION10_I | 3008 | -0.0837 | 500050 BSALES       | 4   | 138             | 500820 TECHE    | 4   | 138 | 1                 | C:500740 RAMOS    | 4               | 138                 | 503301 MRGNCTY4     | 138 | 1   | 1 |   |
| REGION9 | REGION10_I | 3093 | -0.0837 | 500290 ELPTAP       | 4   | 138             | 500890 WAXLAKE4 | 138 | 1   | C:500740 RAMOS    | 4                 | 138             | 503301 MRGNCTY4     | 138                 | 1   | 1   | 1 |   |
| REGION9 | REGION10_I | 3151 | -0.0666 | 500460 JULTAP       | 4   | 138             | 500820 TECHE    | 4   | 138 | 1                 | C:500660 PATOUT   | 4               | 138                 | 500820 TECHE        | 4   | 138 | 1 | 1 |
| REGION9 | REGION10_I | 3163 | -0.0666 | 500440 IVANHOE4     | 138 | 500460 JULTAP   | 4               | 138 | 1   | C:500660 PATOUT   | 4                 | 138             | 500820 TECHE        | 4                   | 138 | 1   | 1 |   |
| REGION9 | REGION10_I | 3251 | -0.0610 | B\$0538 HEMP        | 1   | 1.00            | 507454 HEMPSTD4 | 138 | 1   | Base Case         |                   |                 |                     |                     |     |     |   |   |
| REGION9 | REGION10_I | 3251 | 0.0610  | B\$0538 HEMP        | 1   | 1.00            | 507456 HEMPSTD3 | 115 | 1   | Base Case         |                   |                 |                     |                     |     |     |   |   |
| REGION9 | REGION10_I | 3272 | -0.0837 | 500060 BVISTA       | 4   | 138             | 500290 ELPTAP   | 4   | 138 | 1                 | C:500740 RAMOS    | 4               | 138                 | 503301 MRGNCTY4     | 138 | 1   | 1 |   |
| REGION9 | REGION10_I | 3282 | -0.0856 | 505412 PARAGLD5     | 161 | 505416 CENTR H5 | 161             | 1   | 1   | C:505418 JONESB05 | 161               | 505442 WATER V5 | 161                 | 1                   | 1   | 1   |   |   |
| REGION9 | REGION10_I | 3398 | -0.0634 | 504122 MCNAB        | 3   | 115             | 507456 HEMPSTD3 | 115 | 1   | C:508298 LYDIA    | 7                 | 345             | 510911 VALIANT7     | 345                 | 1   | 1   |   |   |
| REGION9 | REGION10_I | 3452 | -0.0342 | 500320 FISHER       | 4   | 138             | 500860 VP TAP   | 4   | 138 | 1                 | C:500200 COLFAX   | 6               | 230                 | 500770 RODEMR       | 6   | 230 | 1 |   |
| REGION9 | REGION10_I | 3477 | 0.0634  | 504122 MCNAB        | 3   | 115             | 507453 HOPE     | 3   | 115 | 1                 | C:508298 LYDIA    | 7               | 345                 | 510911 VALIANT7     | 345 | 1   | 1 |   |
| REGION9 | REGION10_I | 3633 | 0.0492  | 505418 JONESB05     | 161 | 505420 HERGETT5 | 161             | 1   | 1   | C:505416 CENTR H5 | 161               | 505418 JONESB05 | 161                 | 1                   | 1   | 1   |   |   |
| REGION9 | REGION10_I | 3753 | 0.0837  | 500060 BVISTA       | 4   | 138             | 500100 BERWKTP4 | 138 | 1   | C:500740 RAMOS    | 4                 | 138             | 503301 MRGNCTY4     | 138                 | 1   | 1   | 1 |   |
| REGION9 | REGION10_I | 3774 | 0.0837  | 500100 BERWKTP4     | 138 | 500740 RAMOS    | 4               | 138 | 1   | C:500740 RAMOS    | 4                 | 138             | 503301 MRGNCTY4     | 138                 | 1   | 1   | 1 |   |

|         |            |      |         |                 |     |                     |     |     |                   |                   |                     |                     |     |   |
|---------|------------|------|---------|-----------------|-----|---------------------|-----|-----|-------------------|-------------------|---------------------|---------------------|-----|---|
| REGION9 | REGION10_I | 5265 | -0.0688 | 505410 KENNETT5 | 161 | 505412 PARAGLD5     | 161 | 1   | C:640374 SWEET W3 | 345               | 652571 GR ISLD3     | 345                 | 1   |   |
| REGION9 | REGION10_I | 6281 | -0.0610 | 503912 FULTON   | 3   | 115 507453 HOPE     | 3   | 115 | 1                 | C:652302 JULESBG7 | 115                 | 659240 INTERST7     | 115 | 1 |
| REGION9 | REGION10_I | 6415 | -0.0361 | 505440 DONIPHN5 | 161 | 505442 WATER V5     | 161 | 1   | C:640374 SWEET W3 | 345               | 652571 GR ISLD3     | 345                 | 1   |   |
| REGION9 | REGION10_I | 6437 | -0.0541 | 500200 COLFAX   | 6   | 230 500770 RODEMR   | 6   | 230 | 1                 | C:646206 S1206    | 5                   | 161 648199 SARP4&5T | 161 | 1 |
| REGION9 | REGION10_I | 8093 | 0.0365  | 500170 CLARN    | 6   | 230 500570 MESSICK6 | 230 | 1   | C:646206 S1206    | 5                 | 161 648199 SARP4&5T | 161                 | 1   |   |

Table 1: Basecase FCITC Results (Without Priority Projects)

| From    | To        | FCITC | TDF     | Limiting Constraint |              |     |        |              |              | Contingency |     |           |              |              |        |           |              |              |     |     |   |
|---------|-----------|-------|---------|---------------------|--------------|-----|--------|--------------|--------------|-------------|-----|-----------|--------------|--------------|--------|-----------|--------------|--------------|-----|-----|---|
| REGION1 | REGION2_I | -339  | -0.0435 | 524908              | ROOSEVELT    | 3   | 115    | 524909       | ROSEVELT_N   | 6           | 230 | 1         | C:524874     | OASIS        | 3      | 115       | 524875       | OASIS        | 6   | 230 | 1 |
| REGION1 | REGION2_I | -161  | -0.0576 | 524874              | OASIS        | 3   | 115    | 524875       | OASIS        | 6           | 230 | 1         | C:524908     | ROOSEVELT    | 3      | 115       | 524909       | ROSEVELT_N   | 6   | 230 | 1 |
| REGION1 | REGION2_I | -66   | -0.0357 | 524822              | CURRY        | 3   | 115    | 524908       | ROOSEVELT    | 3           | 115 | 2         | C:524874     | OASIS        | 3      | 115       | 524875       | OASIS        | 6   | 230 | 1 |
| REGION1 | REGION2_I | 156   | -0.0724 | 527482              | CHAVES_CO    | 3   | 115    | 527483       | CHAVES_CO    | 6           | 230 | 2         | C:527482     | CHAVES_CO    | 3      | 115       | 527483       | CHAVES_CO    | 6   | 230 | 1 |
| REGION1 | REGION2_I | 285   | 0.0746  | 527482              | CHAVES_CO    | 3   | 115    | 527546       | SAMSON3      | 115         | 1   | C:527482  | CHAVES_CO    | 3            | 115    | 527501    | URTON3       | 115          | 1   |     |   |
| REGION1 | REGION2_I | 299   | 0.0744  | 527482              | CHAVES_CO    | 3   | 115    | 527501       | URTON3       | 115         | 1   | C:527482  | CHAVES_CO    | 3            | 115    | 527546    | SAMSON3      | 115          | 1   |     |   |
| REGION1 | REGION2_I | 340   | -1.0000 | 524875              | OASIS        | 6   | 230    | 524885       | SN_JUAN_TAP6 | 230         | 1   | C:524885  | SN_JUAN_TAP6 | 230          | 527483 | CHAVES_CO | 6            | 230          | 1   |     |   |
| REGION1 | REGION2_I | 340   | 1.0000  | 524885              | SN_JUAN_TAP6 | 230 | 527483 | CHAVES_CO    | 6            | 230         | 1   | C:524875  | OASIS        | 6            | 230    | 524885    | SN_JUAN_TAP6 | 230          | 1   |     |   |
| REGION1 | REGION2_I | 424   | -1.0000 | 524885              | SN_JUAN_TAP6 | 230 | 524889 | SN_JUAN_WND6 | 230          | 1           |     | Base Case |              |              |        |           |              |              |     |     |   |
| REGION1 | REGION2_I | 567   | 0.8707  | 524875              | OASIS        | 6   | 230    | 524915       | SW_4K33      | 6           | 230 | 1         | C:524885     | SN_JUAN_TAP6 | 230    | 527483    | CHAVES_CO    | 6            | 230 | 1   |   |
| REGION1 | REGION2_I | 581   | 0.0746  | 527546              | SAMSON3      | 115 | 527564 | ROSWLL_INT3  | 115          | 1           |     | C:527482  | CHAVES_CO    | 3            | 115    | 527501    | URTON3       | 115          | 1   |     |   |
| REGION1 | REGION2_I | 638   | 0.7977  | 527483              | CHAVES_CO    | 6   | 230    | 527800       | EDDY_CNTY    | 6           | 230 | 1         | C:524875     | OASIS        | 6      | 230       | 524885       | SN_JUAN_TAP6 | 230 | 1   |   |
| REGION1 | REGION2_I | 694   | 0.0744  | 527501              | URTON3       | 115 | 527522 | ROSWELL_CTY3 | 115          | 1           |     | C:527482  | CHAVES_CO    | 3            | 115    | 527546    | SAMSON3      | 115          | 1   |     |   |
| REGION1 | REGION2_I | 782   | 0.0744  | 527534              | BRASHER_TP   | 3   | 115    | 527564       | ROSWLL_INT3  | 115         | 1   | C:527482  | CHAVES_CO    | 3            | 115    | 527546    | SAMSON3      | 115          | 1   |     |   |
| REGION1 | REGION2_I | 836   | -0.0808 | 524669              | DS-#20       | 3   | 115    | 524822       | CURRY        | 3           | 115 | 1         | C:524885     | SN_JUAN_TAP6 | 230    | 527483    | CHAVES_CO    | 6            | 230 | 1   |   |
| REGION1 | REGION2_I | 905   | -0.0692 | 525480              | PLANTX       | 3   | 115    | 525481       | PLANTX       | 6           | 230 | 1         | C:525531     | TOLK_WEST    | 6      | 230       | 525637       | LAMB_CNTY    | 6   | 230 | 1 |
| REGION1 | REGION2_I | 925   | -0.0763 | 527482              | CHAVES_CO    | 3   | 115    | 527483       | CHAVES_CO    | 6           | 230 | 1         | C:527482     | CHAVES_CO    | 3      | 115       | 527483       | CHAVES_CO    | 6   | 230 | 2 |
| REGION1 | REGION2_I | 932   | 0.1921  | 524874              | OASIS        | 3   | 115    | 524924       | PORTALES     | 3           | 115 | 1         | C:524875     | OASIS        | 6      | 230       | 524915       | SW_4K33      | 6   | 230 | 1 |
| REGION1 | REGION2_I | 955   | -0.1727 | 524863              | FE-CHZPLT    | 3   | 115    | 524874       | OASIS        | 3           | 115 | 1         | C:524875     | OASIS        | 6      | 230       | 524915       | SW_4K33      | 6   | 230 | 1 |
| REGION1 | REGION2_I | 967   | 0.2024  | 527564              | ROSWLL_INT3  | 115 | 527597 | TWEEDY3      | 115          | 1           |     | C:524875  | OASIS        | 6            | 230    | 524885    | SN_JUAN_TAP6 | 230          | 1   |     |   |
| REGION1 | REGION2_I | 1036  | 0.2024  | 527597              | TWEEDY3      | 115 | 527798 | EDDY_CNTY    | 3            | 115         | 1   | C:524875  | OASIS        | 6            | 230    | 524885    | SN_JUAN_TAP6 | 230          | 1   |     |   |
| REGION1 | REGION2_I | 1069  | -0.1727 | 524764              | NORRIS_TP    | 3   | 115    | 524863       | FE-CHZPLT    | 3           | 115 | 1         | C:524875     | OASIS        | 6      | 230       | 524915       | SW_4K33      | 6   | 230 | 1 |

|         |           |      |         |        |              |     |        |              |              |     |           |           |              |              |        |              |              |              |     |     |   |
|---------|-----------|------|---------|--------|--------------|-----|--------|--------------|--------------|-----|-----------|-----------|--------------|--------------|--------|--------------|--------------|--------------|-----|-----|---|
| REGION1 | REGION2_I | 1108 | -0.0808 | 524662 | PARMER_CO    | 3   | 115    | 524669       | DS-#20       | 3   | 115       | 1         | C:524885     | SN_JUAN_TAP6 | 230    | 527483       | CHAVES_CO    | 6            | 230 | 1   |   |
| REGION1 | REGION2_I | 1134 | -0.0808 | 524648 | CARGILL      | 3   | 115    | 524662       | PARMER_CO    | 3   | 115       | 1         | C:524885     | SN_JUAN_TAP6 | 230    | 527483       | CHAVES_CO    | 6            | 230 | 1   |   |
| REGION1 | REGION2_I | 1143 | 0.1727  | 524764 | NORRIS_TP    | 3   | 115    | 524822       | CURRY        | 3   | 115       | 1         | C:524875     | OASIS        | 6      | 230          | 524915       | SW_4K33      | 6   | 230 | 1 |
| REGION1 | REGION2_I | 1216 | -0.3416 | 527849 | LEA_CNTY     | 6   | 230    | 527865       | CUNNINHAM    | 6   | 230       | 1         | C:524875     | OASIS        | 6      | 230          | 524885       | SN_JUAN_TAP6 | 230 | 1   |   |
| REGION1 | REGION2_I | 1267 | -0.1047 | 528160 | CARLSBAD     | 3   | 115    | 528178       | PECOS        | 3   | 115       | 1         | C:524875     | OASIS        | 6      | 230          | 524885       | SN_JUAN_TAP6 | 230 | 1   |   |
| REGION1 | REGION2_I | 1281 | 0.0409  | 524345 | OSAGE_       | 3   | 115    | 524523       | CANYON_EAST3 | 115 | 1         | C:524885  | SN_JUAN_TAP6 | 230          | 524889 | SN_JUAN_WND6 | 230          | 1            |     |     |   |
| REGION1 | REGION2_I | 1313 | 0.0808  | 524648 | CARGILL      | 3   | 115    | 524655       | FRIONA       | 3   | 115       | 1         | C:524885     | SN_JUAN_TAP6 | 230    | 527483       | CHAVES_CO    | 6            | 230 | 1   |   |
| REGION1 | REGION2_I | 1332 | 0.0744  | 527522 | ROSWELL_CTY3 | 115 | 527534 | BRASHER_TP   | 3            | 115 | 1         | C:527482  | CHAVES_CO    | 3            | 115    | 527546       | SAMSON3      | 115          | 1   |     |   |
| REGION1 | REGION3_I | -207 | -0.0712 | 524908 | ROOSEVELT    | 3   | 115    | 524909       | ROSEVELT_N   | 6   | 230       | 1         | C:524874     | OASIS        | 3      | 115          | 524875       | OASIS        | 6   | 230 | 1 |
| REGION1 | REGION3_I | -109 | -0.0848 | 524874 | OASIS        | 3   | 115    | 524875       | OASIS        | 6   | 230       | 1         | C:524908     | ROOSEVELT    | 3      | 115          | 524909       | ROSEVELT_N   | 6   | 230 | 1 |
| REGION1 | REGION3_I | -40  | -0.0584 | 524822 | CURRY        | 3   | 115    | 524908       | ROOSEVELT    | 3   | 115       | 2         | C:524874     | OASIS        | 3      | 115          | 524875       | OASIS        | 6   | 230 | 1 |
| REGION1 | REGION3_I | 172  | -0.0659 | 527482 | CHAVES_CO    | 3   | 115    | 527483       | CHAVES_CO    | 6   | 230       | 2         | C:527482     | CHAVES_CO    | 3      | 115          | 527483       | CHAVES_CO    | 6   | 230 | 1 |
| REGION1 | REGION3_I | 191  | -0.0585 | 525056 | BC-EARTH     | 3   | 115    | 525480       | PLANTX       | 3   | 115       | 1         | C:524623     | DEAFSMITH    | 6      | 230          | 525481       | PLANTX       | 6   | 230 | 1 |
| REGION1 | REGION3_I | 313  | 0.0679  | 527482 | CHAVES_CO    | 3   | 115    | 527546       | SAMSON3      | 115 | 1         | C:527482  | CHAVES_CO    | 3            | 115    | 527501       | URTON3       | 115          | 1   |     |   |
| REGION1 | REGION3_I | 329  | 0.0677  | 527482 | CHAVES_CO    | 3   | 115    | 527501       | URTON3       | 115 | 1         | C:527482  | CHAVES_CO    | 3            | 115    | 527546       | SAMSON3      | 115          | 1   |     |   |
| REGION1 | REGION3_I | 334  | -0.0511 | 526475 | YUMA_INTG    | 3   | 115    | 526524       | WOLFFORTH    | 3   | 115       | 1         | C:525830     | TUCO_INT     | 6      | 230          | 526161       | CARLISLE     | 6   | 230 | 1 |
| REGION1 | REGION3_I | 340  | 1.0000  | 524885 | SN_JUAN_TAP6 | 230 | 527483 | CHAVES_CO    | 6            | 230 | 1         | C:524875  | OASIS        | 6            | 230    | 524885       | SN_JUAN_TAP6 | 230          | 1   |     |   |
| REGION1 | REGION3_I | 340  | -1.0000 | 524875 | OASIS        | 6   | 230    | 524885       | SN_JUAN_TAP6 | 230 | 1         | C:524885  | SN_JUAN_TAP6 | 230          | 527483 | CHAVES_CO    | 6            | 230          | 1   |     |   |
| REGION1 | REGION3_I | 424  | -1.0000 | 524885 | SN_JUAN_TAP6 | 230 | 524889 | SN_JUAN_WND6 | 230          | 1   | Base Case |           |              |              |        |              |              |              |     |     |   |
| REGION1 | REGION3_I | 497  | -0.1078 | 524669 | DS-#20       | 3   | 115    | 524822       | CURRY        | 3   | 115       | 1         | C:524623     | DEAFSMITH    | 6      | 230          | 525481       | PLANTX       | 6   | 230 | 1 |
| REGION1 | REGION3_I | 574  | 0.8593  | 524875 | OASIS        | 6   | 230    | 524915       | SW_4K33      | 6   | 230       | 1         | C:524885     | SN_JUAN_TAP6 | 230    | 527483       | CHAVES_CO    | 6            | 230 | 1   |   |
| REGION1 | REGION3_I | 620  | 0.2643  | 525524 | TOLK_EAST    | 6   | 230    | 525830       | TUCO_INT     | 6   | 230       | 1         | C:526435     | SUNDOWN      | 6      | 230          | 526525       | WOLFFORTH    | 6   | 230 | 1 |
| REGION1 | REGION3_I | 637  | 0.7992  | 527483 | CHAVES_CO    | 6   | 230    | 527800       | EDDY_CNTY    | 6   | 230       | 1         | C:524875     | OASIS        | 6      | 230          | 524885       | SN_JUAN_TAP6 | 230 | 1   |   |
| REGION1 | REGION3_I | 638  | 0.0679  | 527546 | SAMSON3      | 115 | 527564 | ROSWLL_INT3  | 115          | 1   | C:527482  | CHAVES_CO | 3            | 115          | 527501 | URTON3       | 115          | 1            |     |     |   |
| REGION1 | REGION3_I | 673  | -0.1293 | 526176 | DOUD3        | 115 | 526475 | YUMA_INTG    | 3            | 115 | 1         | C:526269  | LUBBCK_STH6  | 230          | 526525 | WOLFFORTH    | 6            | 230          | 1   |     |   |
| REGION1 | REGION3_I | 702  | -0.1078 | 524662 | PARMER_CO    | 3   | 115    | 524669       | DS-#20       | 3   | 115       | 1         | C:524623     | DEAFSMITH    | 6      | 230          | 525481       | PLANTX       | 6   | 230 | 1 |
| REGION1 | REGION3_I | 717  | -0.4120 | 525481 | PLANTX       | 6   | 230    | 525531       | TOLK_WEST    | 6   | 230       | 1         | C:525481     | PLANTX       | 6      | 230          | 525524       | TOLK_EAST    | 6   | 230 | 2 |
| REGION1 | REGION3_I | 720  | -0.1078 | 524648 | CARGILL      | 3   | 115    | 524662       | PARMER_CO    | 3   | 115       | 1         | C:524623     | DEAFSMITH    | 6      | 230          | 525481       | PLANTX       | 6   | 230 | 1 |
| REGION1 | REGION3_I | 727  | -0.4087 | 525481 | PLANTX       | 6   | 230    | 525524       | TOLK_EAST    | 6   | 230       | 2         | C:525481     | PLANTX       | 6      | 230          | 525531       | TOLK_WEST    | 6   | 230 | 1 |
| REGION1 | REGION3_I | 762  | 0.0677  | 527501 | URTON3       | 115 | 527522 | ROSWELL_CTY3 | 115          | 1   | C:527482  | CHAVES_CO | 3            | 115          | 527546 | SAMSON3      | 115          | 1            |     |     |   |

|         |           |      |         |                         |                           |                                 |                           |
|---------|-----------|------|---------|-------------------------|---------------------------|---------------------------------|---------------------------|
| REGION1 | REGION3_I | 770  | -0.0813 | 525480 PLANTX 3 115     | 525481 PLANTX 6 230 1     | C:525531 TOLK_WEST 6 230        | 525637 LAMB_CNTY 6 230 1  |
| REGION1 | REGION3_I | 803  | -0.0539 | 524863 FE-CHZPLT 3 115  | 524874 OASIS 3 115 1      | C:524822 CURRY 3 115            | 524908 ROOSEVELT 3 115 2  |
| REGION1 | REGION3_I | 855  | 0.1078  | 524648 CARGILL 3 115    | 524655 FRIONA 3 115 1     | C:524623 DEAFSMITH 6 230        | 525481 PLANTX 6 230 1     |
| REGION1 | REGION3_I | 859  | 0.0677  | 527534 BRASHER_TP 3 115 | 527564 ROSWLL_INT3 115 1  | C:527482 CHAVES_CO 3 115        | 527546 SAMSON3 115 1      |
| REGION1 | REGION3_I | 890  | -0.1157 | 526524 WOLFFORTH 3 115  | 526736 TERRY 3 115 1      | C:526435 SUNDOWN 6 230          | 526525 WOLFFORTH 6 230 1  |
| REGION1 | REGION3_I | 891  | -0.1056 | 524597 PANDAHFD 3 115   | 524606 HEREFORD 3 115 1   | C:524267 BUSHLAND 6 230         | 524623 DEAFSMITH 6 230 1  |
| REGION1 | REGION3_I | 893  | -0.1832 | 524623 DEAFSMITH 6 230  | 525481 PLANTX 6 230 1     | C:525056 BC-EARTH 3 115         | 525480 PLANTX 3 115 1     |
| REGION1 | REGION3_I | 905  | 0.1980  | 524874 OASIS 3 115      | 524924 PORTALES 3 115 1   | C:524875 OASIS 6 230            | 524915 SW_4K33 6 230 1    |
| REGION1 | REGION4_I | -212 | -0.0698 | 524908 ROOSEVELT 3 115  | 524909 ROSEVELT_N 6 230 1 | C:524874 OASIS 3 115            | 524875 OASIS 6 230 1      |
| REGION1 | REGION4_I | -111 | -0.0835 | 524874 OASIS 3 115      | 524875 OASIS 6 230 1      | C:524908 ROOSEVELT 3 115        | 524909 ROSEVELT_N 6 230 1 |
| REGION1 | REGION4_I | -41  | -0.0572 | 524822 CURRY 3 115      | 524908 ROOSEVELT 3 115 2  | C:524874 OASIS 3 115            | 524875 OASIS 6 230 1      |
| REGION1 | REGION4_I | 172  | -0.0657 | 527482 CHAVES_CO 3 115  | 527483 CHAVES_CO 6 230 2  | C:527482 CHAVES_CO 3 115        | 527483 CHAVES_CO 6 230 1  |
| REGION1 | REGION4_I | 203  | -0.0550 | 525056 BC-EARTH 3 115   | 525480 PLANTX 3 115 1     | C:524623 DEAFSMITH 6 230        | 525481 PLANTX 6 230 1     |
| REGION1 | REGION4_I | 225  | 0.0892  | 530553 S HAYS 3 115     | 530562 HAYS 3 115 1       | C:530558 KNOLL 6 230            | 530561 KNOLL 3 115 1      |
| REGION1 | REGION4_I | 309  | -0.0553 | 526475 YUMA_INTG 3 115  | 526524 WOLFFORTH 3 115 1  | C:525830 TUCO_INT 6 230         | 526161 CARLISLE 6 230 1   |
| REGION1 | REGION4_I | 314  | 0.0677  | 527482 CHAVES_CO 3 115  | 527546 SAMSON3 115 1      | C:527482 CHAVES_CO 3 115        | 527501 URTON3 115 1       |
| REGION1 | REGION4_I | 330  | 0.0675  | 527482 CHAVES_CO 3 115  | 527501 URTON3 115 1       | C:527482 CHAVES_CO 3 115        | 527546 SAMSON3 115 1      |
| REGION1 | REGION4_I | 340  | 1.0000  | 524885 SN_JUAN_TAP6 230 | 527483 CHAVES_CO 6 230 1  | C:524875 OASIS 6 230            | 524885 SN_JUAN_TAP6 230 1 |
| REGION1 | REGION4_I | 340  | -1.0000 | 524875 OASIS 6 230      | 524885 SN_JUAN_TAP6 230 1 | C:524885 SN_JUAN_TAP6 230       | 527483 CHAVES_CO 6 230 1  |
| REGION1 | REGION4_I | 394  | 0.0892  | 530562 HAYS 3 115       | 530591 VINE 3 115 1       | C:530558 KNOLL 6 230            | 530561 KNOLL 3 115 1      |
| REGION1 | REGION4_I | 424  | -1.0000 | 524885 SN_JUAN_TAP6 230 | 524889 SN_JUAN_WND6 230 1 | Base Case                       |                           |
| REGION1 | REGION4_I | 507  | 0.2753  | 514785 WOODWRD4 138     | 515785 WINDFRM4 138 1     | C:3Wnd: OPEN B\$1035 WOODWRD2 1 |                           |
| REGION1 | REGION4_I | 509  | -0.1053 | 524669 DS-#20 3 115     | 524822 CURRY 3 115 1      | C:524623 DEAFSMITH 6 230        | 525481 PLANTX 6 230 1     |
| REGION1 | REGION4_I | 571  | 0.2871  | 525524 TOLK_EAST 6 230  | 525830 TUCO_INT 6 230 1   | C:526435 SUNDOWN 6 230          | 526525 WOLFFORTH 6 230 1  |
| REGION1 | REGION4_I | 574  | 0.8600  | 524875 OASIS 6 230      | 524915 SW_4K33 6 230 1    | C:524885 SN_JUAN_TAP6 230       | 527483 CHAVES_CO 6 230 1  |
| REGION1 | REGION4_I | 619  | -0.0892 | 530561 KNOLL 3 115      | 530581 N HAYS3 115 1      | C:530558 KNOLL 6 230            | 530561 KNOLL 3 115 1      |
| REGION1 | REGION4_I | 636  | -0.1051 | 526176 DOUD3 115        | 526475 YUMA_INTG 3 115 1  | C:525524 TOLK_EAST 6 230        | 525830 TUCO_INT 6 230 1   |
| REGION1 | REGION4_I | 637  | 0.7992  | 527483 CHAVES_CO 6 230  | 527800 EDDY_CNTY 6 230 1  | C:524875 OASIS 6 230            | 524885 SN_JUAN_TAP6 230 1 |
| REGION1 | REGION4_I | 640  | 0.0677  | 527546 SAMSON3 115      | 527564 ROSWLL_INT3 115 1  | C:527482 CHAVES_CO 3 115        | 527501 URTON3 115 1       |
| REGION1 | REGION4_I | 719  | -0.1053 | 524662 PARMER_CO 3 115  | 524669 DS-#20 3 115 1     | C:524623 DEAFSMITH 6 230        | 525481 PLANTX 6 230 1     |

|         |           |      |         |                         |                           |                           |                           |
|---------|-----------|------|---------|-------------------------|---------------------------|---------------------------|---------------------------|
| REGION1 | REGION4_I | 738  | -0.1053 | 524648 CARGILL 3 115    | 524662 PARMER_CO 3 115 1  | C:524623 DEAFSMITH 6 230  | 525481 PLANTX 6 230 1     |
| REGION1 | REGION4_I | 747  | -0.3957 | 525481 PLANTX 6 230     | 525531 TOLK_WEST 6 230 1  | C:525481 PLANTX 6 230     | 525524 TOLK_EAST 6 230 2  |
| REGION1 | REGION4_I | 757  | -0.3924 | 525481 PLANTX 6 230     | 525524 TOLK_EAST 6 230 2  | C:525481 PLANTX 6 230     | 525531 TOLK_WEST 6 230 1  |
| REGION1 | REGION4_I | 762  | -0.0822 | 525480 PLANTX 3 115     | 525481 PLANTX 6 230 1     | C:525531 TOLK_WEST 6 230  | 525637 LAMB_CNTY 6 230 1  |
| REGION1 | REGION4_I | 765  | 0.0675  | 527501 URTON3 115       | 527522 ROSWELL_CTY3 115 1 | C:527482 CHAVES_CO 3 115  | 527546 SAMSON3 115 1      |
| REGION1 | REGION4_I | 798  | 0.1021  | 514785 WOODWRD4 138     | B\$1035 WOODWRD2 1.00 1   | C:514785 WOODWRD4 138     | 515785 WINDFRM4 138 1     |
| REGION1 | REGION4_I | 817  | -0.0530 | 524863 FE-CHZPLT 3 115  | 524874 OASIS 3 115 1      | C:524822 CURRY 3 115      | 524908 ROOSEVELT 3 115 2  |
| REGION1 | REGION4_I | 862  | 0.0675  | 527534 BRASHER_TP 3 115 | 527564 ROSWLL_INT3 115 1  | C:527482 CHAVES_CO 3 115  | 527546 SAMSON3 115 1      |
| REGION1 | REGION5_I | -214 | -0.0689 | 524908 ROOSEVELT 3 115  | 524909 ROSEVELT_N 6 230 1 | C:524874 OASIS 3 115      | 524875 OASIS 6 230 1      |
| REGION1 | REGION5_I | -112 | -0.0826 | 524874 OASIS 3 115      | 524875 OASIS 6 230 1      | C:524908 ROOSEVELT 3 115  | 524909 ROSEVELT_N 6 230 1 |
| REGION1 | REGION5_I | -41  | -0.0565 | 524822 CURRY 3 115      | 524908 ROOSEVELT 3 115 2  | C:524874 OASIS 3 115      | 524875 OASIS 6 230 1      |
| REGION1 | REGION5_I | 172  | -0.0658 | 527482 CHAVES_CO 3 115  | 527483 CHAVES_CO 6 230 2  | C:527482 CHAVES_CO 3 115  | 527483 CHAVES_CO 6 230 1  |
| REGION1 | REGION5_I | 213  | -0.0525 | 525056 BC-EARTH 3 115   | 525480 PLANTX 3 115 1     | C:524623 DEAFSMITH 6 230  | 525481 PLANTX 6 230 1     |
| REGION1 | REGION5_I | 303  | -0.0564 | 526475 YUMA_INTG 3 115  | 526524 WOLFFORTH 3 115 1  | C:525830 TUCO_INT 6 230   | 526161 CARLISLE 6 230 1   |
| REGION1 | REGION5_I | 313  | 0.0678  | 527482 CHAVES_CO 3 115  | 527546 SAMSON3 115 1      | C:527482 CHAVES_CO 3 115  | 527501 URTON3 115 1       |
| REGION1 | REGION5_I | 330  | 0.0676  | 527482 CHAVES_CO 3 115  | 527501 URTON3 115 1       | C:527482 CHAVES_CO 3 115  | 527546 SAMSON3 115 1      |
| REGION1 | REGION5_I | 340  | 1.0000  | 524885 SN_JUAN_TAP6 230 | 527483 CHAVES_CO 6 230 1  | C:524875 OASIS 6 230      | 524885 SN_JUAN_TAP6 230 1 |
| REGION1 | REGION5_I | 340  | -1.0000 | 524875 OASIS 6 230      | 524885 SN_JUAN_TAP6 230 1 | C:524885 SN_JUAN_TAP6 230 | 527483 CHAVES_CO 6 230 1  |
| REGION1 | REGION5_I | 424  | -1.0000 | 524885 SN_JUAN_TAP6 230 | 524889 SN_JUAN_WND6 230 1 | Base Case                 |                           |
| REGION1 | REGION5_I | 518  | -0.1035 | 524669 DS-#20 3 115     | 524822 CURRY 3 115 1      | C:524623 DEAFSMITH 6 230  | 525481 PLANTX 6 230 1     |
| REGION1 | REGION5_I | 556  | 0.2949  | 525524 TOLK_EAST 6 230  | 525830 TUCO_INT 6 230 1   | C:526435 SUNDOWN 6 230    | 526525 WOLFFORTH 6 230 1  |
| REGION1 | REGION5_I | 574  | 0.8604  | 524875 OASIS 6 230      | 524915 SW_4K33 6 230 1    | C:524885 SN_JUAN_TAP6 230 | 527483 CHAVES_CO 6 230 1  |
| REGION1 | REGION5_I | 622  | -0.1076 | 526176 DOUD3 115        | 526475 YUMA_INTG 3 115 1  | C:525524 TOLK_EAST 6 230  | 525830 TUCO_INT 6 230 1   |
| REGION1 | REGION5_I | 637  | 0.7992  | 527483 CHAVES_CO 6 230  | 527800 EDDY_CNTY 6 230 1  | C:524875 OASIS 6 230      | 524885 SN_JUAN_TAP6 230 1 |
| REGION1 | REGION5_I | 639  | 0.0678  | 527546 SAMSON3 115      | 527564 ROSWLL_INT3 115 1  | C:527482 CHAVES_CO 3 115  | 527501 URTON3 115 1       |
| REGION1 | REGION5_I | 731  | -0.1035 | 524662 PARMER_CO 3 115  | 524669 DS-#20 3 115 1     | C:524623 DEAFSMITH 6 230  | 525481 PLANTX 6 230 1     |
| REGION1 | REGION5_I | 751  | -0.1035 | 524648 CARGILL 3 115    | 524662 PARMER_CO 3 115 1  | C:524623 DEAFSMITH 6 230  | 525481 PLANTX 6 230 1     |
| REGION1 | REGION5_I | 757  | -0.0828 | 525480 PLANTX 3 115     | 525481 PLANTX 6 230 1     | C:525531 TOLK_WEST 6 230  | 525637 LAMB_CNTY 6 230 1  |
| REGION1 | REGION5_I | 760  | -0.3886 | 525481 PLANTX 6 230     | 525531 TOLK_WEST 6 230 1  | C:525481 PLANTX 6 230     | 525524 TOLK_EAST 6 230 2  |
| REGION1 | REGION5_I | 764  | 0.0676  | 527501 URTON3 115       | 527522 ROSWELL_CTY3 115 1 | C:527482 CHAVES_CO 3 115  | 527546 SAMSON3 115 1      |



|         |           |      |         |                                                   |                                                    |
|---------|-----------|------|---------|---------------------------------------------------|----------------------------------------------------|
| REGION1 | REGION5_I | 771  | -0.3854 | 525481 PLANTX 6 230 525524 TOLK_EAST 6 230 2      | C:525481 PLANTX 6 230 525531 TOLK_WEST 6 230 1     |
| REGION1 | REGION5_I | 826  | -0.0524 | 524863 FE-CHZPLT 3 115 524874 OASIS 3 115 1       | C:524822 CURRY 3 115 524908 ROOSEVELT 3 115 2      |
| REGION1 | REGION5_I | 861  | 0.0676  | 527534 BRASHER_TP 3 115 527564 ROSWLL_INT3 115 1  | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |
| REGION1 | REGION5_I | 891  | 0.1035  | 524648 CARGILL 3 115 524655 FRIONA 3 115 1        | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION5_I | 901  | -0.1143 | 526524 WOLFFORTH 3 115 526736 TERRY 3 115 1       | C:526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1    |
| REGION1 | REGION5_I | 903  | 0.1984  | 524874 OASIS 3 115 524924 PORTALES 3 115 1        | C:524875 OASIS 6 230 524915 SW_4K33 6 230 1        |
| REGION1 | REGION5_I | 929  | -0.1332 | 526160 CARLISLE 3 115 526176 DOUD3 115 1          | C:526269 LUBBCK_STH6 230 526525 WOLFFORTH 6 230 1  |
| REGION1 | REGION5_I | 967  | -0.0974 | 524597 PANDAHFD 3 115 524606 HEREFORD 3 115 1     | C:524267 BUSHLAND 6 230 524623 DEAFSMITH 6 230 1   |
| REGION1 | REGION6_I | -214 | -0.0691 | 524908 ROOSEVELT 3 115 524909 ROSEVELT_N 6 230 1  | C:524874 OASIS 3 115 524875 OASIS 6 230 1          |
| REGION1 | REGION6_I | -112 | -0.0828 | 524874 OASIS 3 115 524875 OASIS 6 230 1           | C:524908 ROOSEVELT 3 115 524909 ROSEVELT_N 6 230 1 |
| REGION1 | REGION6_I | -41  | -0.0567 | 524822 CURRY 3 115 524908 ROOSEVELT 3 115 2       | C:524874 OASIS 3 115 524875 OASIS 6 230 1          |
| REGION1 | REGION6_I | 172  | -0.0658 | 527482 CHAVES_CO 3 115 527483 CHAVES_CO 6 230 2   | C:527482 CHAVES_CO 3 115 527483 CHAVES_CO 6 230 1  |
| REGION1 | REGION6_I | 210  | -0.0531 | 525056 BC-EARTH 3 115 525480 PLANTX 3 115 1       | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION6_I | 304  | -0.0561 | 526475 YUMA_INTG 3 115 526524 WOLFFORTH 3 115 1   | C:525830 TUCO_INT 6 230 526161 CARLISLE 6 230 1    |
| REGION1 | REGION6_I | 313  | 0.0677  | 527482 CHAVES_CO 3 115 527546 SAMSON3 115 1       | C:527482 CHAVES_CO 3 115 527501 URTON3 115 1       |
| REGION1 | REGION6_I | 330  | 0.0676  | 527482 CHAVES_CO 3 115 527501 URTON3 115 1        | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |
| REGION1 | REGION6_I | 340  | 1.0000  | 524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1  | C:524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1     |
| REGION1 | REGION6_I | 340  | -1.0000 | 524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1      | C:524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1 |
| REGION1 | REGION6_I | 424  | -1.0000 | 524885 SN_JUAN_TAP6 230 524889 SN_JUAN_WND6 230 1 | Base Case                                          |
| REGION1 | REGION6_I | 516  | -0.1040 | 524669 DS-#20 3 115 524822 CURRY 3 115 1          | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION6_I | 560  | 0.2929  | 525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1    | C:526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1    |
| REGION1 | REGION6_I | 574  | 0.8603  | 524875 OASIS 6 230 524915 SW_4K33 6 230 1         | C:524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1 |
| REGION1 | REGION6_I | 626  | -0.1070 | 526176 DOUD3 115 526475 YUMA_INTG 3 115 1         | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1   |
| REGION1 | REGION6_I | 637  | 0.7992  | 527483 CHAVES_CO 6 230 527800 EDDY_CNTY 6 230 1   | C:524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1     |
| REGION1 | REGION6_I | 639  | 0.0677  | 527546 SAMSON3 115 527564 ROSWLL_INT3 115 1       | C:527482 CHAVES_CO 3 115 527501 URTON3 115 1       |
| REGION1 | REGION6_I | 728  | -0.1040 | 524662 PARMER_CO 3 115 524669 DS-#20 3 115 1      | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION6_I | 747  | -0.1040 | 524648 CARGILL 3 115 524662 PARMER_CO 3 115 1     | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION6_I | 757  | -0.3905 | 525481 PLANTX 6 230 525531 TOLK_WEST 6 230 1      | C:525481 PLANTX 6 230 525524 TOLK_EAST 6 230 2     |
| REGION1 | REGION6_I | 758  | -0.0826 | 525480 PLANTX 3 115 525481 PLANTX 6 230 1         | C:525531 TOLK_WEST 6 230 525637 LAMB_CNTY 6 230 1  |
| REGION1 | REGION6_I | 764  | 0.0676  | 527501 URTON3 115 527522 ROSWELL_CTY3 115 1       | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |



|         |           |      |         |                                                   |                                                    |
|---------|-----------|------|---------|---------------------------------------------------|----------------------------------------------------|
| REGION1 | REGION6_I | 767  | -0.3872 | 525481 PLANTX 6 230 525524 TOLK_EAST 6 230 2      | C:525481 PLANTX 6 230 525531 TOLK_WEST 6 230 1     |
| REGION1 | REGION6_I | 824  | -0.0525 | 524863 FE-CHZPLT 3 115 524874 OASIS 3 115 1       | C:524822 CURRY 3 115 524908 ROOSEVELT 3 115 2      |
| REGION1 | REGION6_I | 861  | 0.0676  | 527534 BRASHER_TP 3 115 527564 ROSWLL_INT3 115 1  | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |
| REGION1 | REGION6_I | 887  | 0.1040  | 524648 CARGILL 3 115 524655 FRIONA 3 115 1        | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION6_I | 903  | 0.1984  | 524874 OASIS 3 115 524924 PORTALES 3 115 1        | C:524875 OASIS 6 230 524915 SW_4K33 6 230 1        |
| REGION1 | REGION6_I | 906  | -0.1137 | 526524 WOLFFORTH 3 115 526736 TERRY 3 115 1       | C:526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1    |
| REGION1 | REGION6_I | 935  | -0.1324 | 526160 CARLISLE 3 115 526176 DOUD3 115 1          | C:526269 LUBBCK_STH6 230 526525 WOLFFORTH 6 230 1  |
| REGION1 | REGION6_I | 960  | -0.1704 | 524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1      | C:525056 BC-EARTH 3 115 525480 PLANTX 3 115 1      |
| REGION1 | REGION7_I | -214 | -0.0689 | 524908 ROOSEVELT 3 115 524909 ROSEVELT_N 6 230 1  | C:524874 OASIS 3 115 524875 OASIS 6 230 1          |
| REGION1 | REGION7_I | -112 | -0.0827 | 524874 OASIS 3 115 524875 OASIS 6 230 1           | C:524908 ROOSEVELT 3 115 524909 ROSEVELT_N 6 230 1 |
| REGION1 | REGION7_I | -41  | -0.0565 | 524822 CURRY 3 115 524908 ROOSEVELT 3 115 2       | C:524874 OASIS 3 115 524875 OASIS 6 230 1          |
| REGION1 | REGION7_I | 172  | -0.0658 | 527482 CHAVES_CO 3 115 527483 CHAVES_CO 6 230 2   | C:527482 CHAVES_CO 3 115 527483 CHAVES_CO 6 230 1  |
| REGION1 | REGION7_I | 212  | -0.0527 | 525056 BC-EARTH 3 115 525480 PLANTX 3 115 1       | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION7_I | 303  | -0.0564 | 526475 YUMA_INTG 3 115 526524 WOLFFORTH 3 115 1   | C:525830 TUCO_INT 6 230 526161 CARLISLE 6 230 1    |
| REGION1 | REGION7_I | 313  | 0.0677  | 527482 CHAVES_CO 3 115 527546 SAMSON3 115 1       | C:527482 CHAVES_CO 3 115 527501 URTON3 115 1       |
| REGION1 | REGION7_I | 330  | 0.0676  | 527482 CHAVES_CO 3 115 527501 URTON3 115 1        | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |
| REGION1 | REGION7_I | 340  | 1.0000  | 524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1  | C:524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1     |
| REGION1 | REGION7_I | 340  | -1.0000 | 524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1      | C:524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1 |
| REGION1 | REGION7_I | 424  | -1.0000 | 524885 SN_JUAN_TAP6 230 524889 SN_JUAN_WND6 230 1 | Base Case                                          |
| REGION1 | REGION7_I | 518  | -0.1036 | 524669 DS-#20 3 115 524822 CURRY 3 115 1          | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION7_I | 557  | 0.2944  | 525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1    | C:526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1    |
| REGION1 | REGION7_I | 574  | 0.8604  | 524875 OASIS 6 230 524915 SW_4K33 6 230 1         | C:524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1 |
| REGION1 | REGION7_I | 623  | -0.1074 | 526176 DOUD3 115 526475 YUMA_INTG 3 115 1         | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1   |
| REGION1 | REGION7_I | 637  | 0.7992  | 527483 CHAVES_CO 6 230 527800 EDDY_CNTY 6 230 1   | C:524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1     |
| REGION1 | REGION7_I | 639  | 0.0677  | 527546 SAMSON3 115 527564 ROSWLL_INT3 115 1       | C:527482 CHAVES_CO 3 115 527501 URTON3 115 1       |
| REGION1 | REGION7_I | 730  | -0.1036 | 524662 PARMER_CO 3 115 524669 DS-#20 3 115 1      | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION7_I | 750  | -0.1036 | 524648 CARGILL 3 115 524662 PARMER_CO 3 115 1     | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION7_I | 757  | -0.0827 | 525480 PLANTX 3 115 525481 PLANTX 6 230 1         | C:525531 TOLK_WEST 6 230 525637 LAMB_CNTY 6 230 1  |
| REGION1 | REGION7_I | 759  | -0.3891 | 525481 PLANTX 6 230 525531 TOLK_WEST 6 230 1      | C:525481 PLANTX 6 230 525524 TOLK_EAST 6 230 2     |
| REGION1 | REGION7_I | 764  | 0.0676  | 527501 URTON3 115 527522 ROSWELL_CTY3 115 1       | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |

|         |           |      |         |                                                   |                                                    |
|---------|-----------|------|---------|---------------------------------------------------|----------------------------------------------------|
| REGION1 | REGION7_I | 770  | -0.3859 | 525481 PLANTX 6 230 525524 TOLK_EAST 6 230 2      | C:525481 PLANTX 6 230 525531 TOLK_WEST 6 230 1     |
| REGION1 | REGION7_I | 826  | -0.0524 | 524863 FE-CHZPLT 3 115 524874 OASIS 3 115 1       | C:524822 CURRY 3 115 524908 ROOSEVELT 3 115 2      |
| REGION1 | REGION7_I | 861  | 0.0676  | 527534 BRASHER_TP 3 115 527564 ROSWLL_INT3 115 1  | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |
| REGION1 | REGION7_I | 890  | 0.1036  | 524648 CARGILL 3 115 524655 FRIONA 3 115 1        | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION7_I | 903  | -0.1141 | 526524 WOLFFORTH 3 115 526736 TERRY 3 115 1       | C:526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1    |
| REGION1 | REGION7_I | 903  | 0.1984  | 524874 OASIS 3 115 524924 PORTALES 3 115 1        | C:524875 OASIS 6 230 524915 SW_4K33 6 230 1        |
| REGION1 | REGION7_I | 931  | -0.1330 | 526160 CARLISLE 3 115 526176 DOUD3 115 1          | C:526269 LUBBCK_STH6 230 526525 WOLFFORTH 6 230 1  |
| REGION1 | REGION7_I | 965  | -0.0975 | 524597 PANDAHFD 3 115 524606 HEREFORD 3 115 1     | C:524267 BUSHLAND 6 230 524623 DEAFSMITH 6 230 1   |
| REGION1 | REGION8_I | -214 | -0.0688 | 524908 ROOSEVELT 3 115 524909 ROSEVELT_N 6 230 1  | C:524874 OASIS 3 115 524875 OASIS 6 230 1          |
| REGION1 | REGION8_I | -112 | -0.0826 | 524874 OASIS 3 115 524875 OASIS 6 230 1           | C:524908 ROOSEVELT 3 115 524909 ROSEVELT_N 6 230 1 |
| REGION1 | REGION8_I | -41  | -0.0564 | 524822 CURRY 3 115 524908 ROOSEVELT 3 115 2       | C:524874 OASIS 3 115 524875 OASIS 6 230 1          |
| REGION1 | REGION8_I | 172  | -0.0658 | 527482 CHAVES_CO 3 115 527483 CHAVES_CO 6 230 2   | C:527482 CHAVES_CO 3 115 527483 CHAVES_CO 6 230 1  |
| REGION1 | REGION8_I | 213  | -0.0524 | 525056 BC-EARTH 3 115 525480 PLANTX 3 115 1       | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION8_I | 302  | -0.0565 | 526475 YUMA_INTG 3 115 526524 WOLFFORTH 3 115 1   | C:525830 TUCO_INT 6 230 526161 CARLISLE 6 230 1    |
| REGION1 | REGION8_I | 313  | 0.0678  | 527482 CHAVES_CO 3 115 527546 SAMSON3 115 1       | C:527482 CHAVES_CO 3 115 527501 URTON3 115 1       |
| REGION1 | REGION8_I | 330  | 0.0676  | 527482 CHAVES_CO 3 115 527501 URTON3 115 1        | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |
| REGION1 | REGION8_I | 340  | 1.0000  | 524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1  | C:524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1     |
| REGION1 | REGION8_I | 340  | -1.0000 | 524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1      | C:524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1 |
| REGION1 | REGION8_I | 424  | -1.0000 | 524885 SN_JUAN_TAP6 230 524889 SN_JUAN_WND6 230 1 | Base Case                                          |
| REGION1 | REGION8_I | 519  | -0.1034 | 524669 DS-#20 3 115 524822 CURRY 3 115 1          | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION8_I | 555  | 0.2953  | 525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1    | C:526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1    |
| REGION1 | REGION8_I | 574  | 0.8604  | 524875 OASIS 6 230 524915 SW_4K33 6 230 1         | C:524885 SN_JUAN_TAP6 230 527483 CHAVES_CO 6 230 1 |
| REGION1 | REGION8_I | 621  | -0.1077 | 526176 DOUD3 115 526475 YUMA_INTG 3 115 1         | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1   |
| REGION1 | REGION8_I | 637  | 0.7992  | 527483 CHAVES_CO 6 230 527800 EDDY_CNTY 6 230 1   | C:524875 OASIS 6 230 524885 SN_JUAN_TAP6 230 1     |
| REGION1 | REGION8_I | 639  | 0.0678  | 527546 SAMSON3 115 527564 ROSWLL_INT3 115 1       | C:527482 CHAVES_CO 3 115 527501 URTON3 115 1       |
| REGION1 | REGION8_I | 732  | -0.1034 | 524662 PARMER_CO 3 115 524669 DS-#20 3 115 1      | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION8_I | 751  | -0.1034 | 524648 CARGILL 3 115 524662 PARMER_CO 3 115 1     | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1     |
| REGION1 | REGION8_I | 756  | -0.0828 | 525480 PLANTX 3 115 525481 PLANTX 6 230 1         | C:525531 TOLK_WEST 6 230 525637 LAMB_CNTY 6 230 1  |
| REGION1 | REGION8_I | 761  | -0.3882 | 525481 PLANTX 6 230 525531 TOLK_WEST 6 230 1      | C:525481 PLANTX 6 230 525524 TOLK_EAST 6 230 2     |
| REGION1 | REGION8_I | 764  | 0.0676  | 527501 URTON3 115 527522 ROSWELL_CTY3 115 1       | C:527482 CHAVES_CO 3 115 527546 SAMSON3 115 1      |

|         |           |      |         |                         |                           |                           |                           |
|---------|-----------|------|---------|-------------------------|---------------------------|---------------------------|---------------------------|
| REGION1 | REGION8_I | 771  | -0.3850 | 525481 PLANTX 6 230     | 525524 TOLK_EAST 6 230 2  | C:525481 PLANTX 6 230     | 525531 TOLK_WEST 6 230 1  |
| REGION1 | REGION8_I | 827  | -0.0523 | 524863 FE-CHZPLT 3 115  | 524874 OASIS 3 115 1      | C:524822 CURRY 3 115      | 524908 ROOSEVELT 3 115 2  |
| REGION1 | REGION8_I | 861  | 0.0676  | 527534 BRASHER_TP 3 115 | 527564 ROSWLL_INT3 115 1  | C:527482 CHAVES_CO 3 115  | 527546 SAMSON3 115 1      |
| REGION1 | REGION8_I | 892  | 0.1034  | 524648 CARGILL 3 115    | 524655 FRIONA 3 115 1     | C:524623 DEAFSMITH 6 230  | 525481 PLANTX 6 230 1     |
| REGION1 | REGION8_I | 900  | -0.1144 | 526524 WOLFFORTH 3 115  | 526736 TERRY 3 115 1      | C:526435 SUNDOWN 6 230    | 526525 WOLFFORTH 6 230 1  |
| REGION1 | REGION8_I | 903  | 0.1984  | 524874 OASIS 3 115      | 524924 PORTALES 3 115 1   | C:524875 OASIS 6 230      | 524915 SW_4K33 6 230 1    |
| REGION1 | REGION8_I | 928  | -0.1333 | 526160 CARLISLE 3 115   | 526176 DOUD3 115 1        | C:526269 LUBBCK_STH6 230  | 526525 WOLFFORTH 6 230 1  |
| REGION1 | REGION8_I | 968  | -0.0972 | 524597 PANDAHFD 3 115   | 524606 HEREFORD 3 115 1   | C:524267 BUSHLAND 6 230   | 524623 DEAFSMITH 6 230 1  |
| REGION1 | REGION9_I | -214 | -0.0689 | 524908 ROOSEVELT 3 115  | 524909 ROSEVELT_N 6 230 1 | C:524874 OASIS 3 115      | 524875 OASIS 6 230 1      |
| REGION1 | REGION9_I | -112 | -0.0826 | 524874 OASIS 3 115      | 524875 OASIS 6 230 1      | C:524908 ROOSEVELT 3 115  | 524909 ROSEVELT_N 6 230 1 |
| REGION1 | REGION9_I | -41  | -0.0565 | 524822 CURRY 3 115      | 524908 ROOSEVELT 3 115 2  | C:524874 OASIS 3 115      | 524875 OASIS 6 230 1      |
| REGION1 | REGION9_I | 172  | -0.0658 | 527482 CHAVES_CO 3 115  | 527483 CHAVES_CO 6 230 2  | C:527482 CHAVES_CO 3 115  | 527483 CHAVES_CO 6 230 1  |
| REGION1 | REGION9_I | 212  | -0.0526 | 525056 BC-EARTH 3 115   | 525480 PLANTX 3 115 1     | C:524623 DEAFSMITH 6 230  | 525481 PLANTX 6 230 1     |
| REGION1 | REGION9_I | 303  | -0.0564 | 526475 YUMA_INTG 3 115  | 526524 WOLFFORTH 3 115 1  | C:525830 TUCO_INT 6 230   | 526161 CARLISLE 6 230 1   |
| REGION1 | REGION9_I | 313  | 0.0677  | 527482 CHAVES_CO 3 115  | 527546 SAMSON3 115 1      | C:527482 CHAVES_CO 3 115  | 527501 URTON3 115 1       |
| REGION1 | REGION9_I | 330  | 0.0676  | 527482 CHAVES_CO 3 115  | 527501 URTON3 115 1       | C:527482 CHAVES_CO 3 115  | 527546 SAMSON3 115 1      |
| REGION1 | REGION9_I | 340  | -1.0000 | 524875 OASIS 6 230      | 524885 SN_JUAN_TAP6 230 1 | C:524885 SN_JUAN_TAP6 230 | 527483 CHAVES_CO 6 230 1  |
| REGION1 | REGION9_I | 340  | 1.0000  | 524885 SN_JUAN_TAP6 230 | 527483 CHAVES_CO 6 230 1  | C:524875 OASIS 6 230      | 524885 SN_JUAN_TAP6 230 1 |
| REGION1 | REGION9_I | 378  | -0.0358 | 505418 JONESB05 161     | 505420 HERGETT5 161 1     | C:505410 KENNETT5 161     | 505412 PARAGLD5 161 1     |
| REGION1 | REGION9_I | 424  | -1.0000 | 524885 SN_JUAN_TAP6 230 | 524889 SN_JUAN_WND6 230 1 | Base Case                 |                           |
| REGION1 | REGION9_I | 518  | -0.1036 | 524669 DS-#20 3 115     | 524822 CURRY 3 115 1      | C:524623 DEAFSMITH 6 230  | 525481 PLANTX 6 230 1     |
| REGION1 | REGION9_I | 556  | 0.2945  | 525524 TOLK_EAST 6 230  | 525830 TUCO_INT 6 230 1   | C:526435 SUNDOWN 6 230    | 526525 WOLFFORTH 6 230 1  |
| REGION1 | REGION9_I | 574  | 0.8604  | 524875 OASIS 6 230      | 524915 SW_4K33 6 230 1    | C:524885 SN_JUAN_TAP6 230 | 527483 CHAVES_CO 6 230 1  |
| REGION1 | REGION9_I | 623  | -0.1075 | 526176 DOUD3 115        | 526475 YUMA_INTG 3 115 1  | C:525524 TOLK_EAST 6 230  | 525830 TUCO_INT 6 230 1   |
| REGION1 | REGION9_I | 637  | 0.7992  | 527483 CHAVES_CO 6 230  | 527800 EDDY_CNTY 6 230 1  | C:524875 OASIS 6 230      | 524885 SN_JUAN_TAP6 230 1 |
| REGION1 | REGION9_I | 639  | 0.0677  | 527546 SAMSON3 115      | 527564 ROSWLL_INT3 115 1  | C:527482 CHAVES_CO 3 115  | 527501 URTON3 115 1       |
| REGION1 | REGION9_I | 731  | -0.1036 | 524662 PARMER_CO 3 115  | 524669 DS-#20 3 115 1     | C:524623 DEAFSMITH 6 230  | 525481 PLANTX 6 230 1     |
| REGION1 | REGION9_I | 750  | -0.1036 | 524648 CARGILL 3 115    | 524662 PARMER_CO 3 115 1  | C:524623 DEAFSMITH 6 230  | 525481 PLANTX 6 230 1     |
| REGION1 | REGION9_I | 757  | -0.0827 | 525480 PLANTX 3 115     | 525481 PLANTX 6 230 1     | C:525531 TOLK_WEST 6 230  | 525637 LAMB_CNTY 6 230 1  |
| REGION1 | REGION9_I | 759  | -0.3889 | 525481 PLANTX 6 230     | 525531 TOLK_WEST 6 230 1  | C:525481 PLANTX 6 230     | 525524 TOLK_EAST 6 230 2  |

|         |            |      |         |        |              |     |        |              |              |     |           |           |              |              |        |           |              |              |     |     |   |
|---------|------------|------|---------|--------|--------------|-----|--------|--------------|--------------|-----|-----------|-----------|--------------|--------------|--------|-----------|--------------|--------------|-----|-----|---|
| REGION1 | REGION9_I  | 764  | 0.0676  | 527501 | URTON3       | 115 | 527522 | ROSWELL_CTY3 | 115          | 1   | C:527482  | CHAVES_CO | 3            | 115          | 527546 | SAMSON3   | 115          | 1            |     |     |   |
| REGION1 | REGION9_I  | 770  | -0.3857 | 525481 | PLANTX       | 6   | 230    | 525524       | TOLK_EAST    | 6   | 230       | 2         | C:525481     | PLANTX       | 6      | 230       | 525531       | TOLK_WEST    | 6   | 230 | 1 |
| REGION1 | REGION9_I  | 826  | -0.0524 | 524863 | FE-CHZPLT    | 3   | 115    | 524874       | OASIS        | 3   | 115       | 1         | C:524822     | CURRY        | 3      | 115       | 524908       | ROOSEVELT    | 3   | 115 | 2 |
| REGION1 | REGION9_I  | 861  | 0.0676  | 527534 | BRASHER_TP   | 3   | 115    | 527564       | ROSWLL_INT3  | 115 | 1         | C:527482  | CHAVES_CO    | 3            | 115    | 527546    | SAMSON3      | 115          | 1   |     |   |
| REGION1 | REGION9_I  | 890  | 0.1036  | 524648 | CARGILL      | 3   | 115    | 524655       | FRIONA       | 3   | 115       | 1         | C:524623     | DEAFSMITH    | 6      | 230       | 525481       | PLANTX       | 6   | 230 | 1 |
| REGION1 | REGION9_I  | 902  | -0.1142 | 526524 | WOLFFORTH    | 3   | 115    | 526736       | TERRY        | 3   | 115       | 1         | C:526435     | SUNDOWN      | 6      | 230       | 526525       | WOLFFORTH    | 6   | 230 | 1 |
| REGION1 | REGION9_I  | 903  | 0.1984  | 524874 | OASIS        | 3   | 115    | 524924       | PORTALES     | 3   | 115       | 1         | C:524875     | OASIS        | 6      | 230       | 524915       | SW_4K33      | 6   | 230 | 1 |
| REGION1 | REGION9_I  | 930  | -0.1330 | 526160 | CARLISLE     | 3   | 115    | 526176       | DOUD3        | 115 | 1         | C:526269  | LUBBCK_STH6  | 230          | 526525 | WOLFFORTH | 6            | 230          | 1   |     |   |
| REGION1 | REGION10_I | -214 | -0.0689 | 524908 | ROOSEVELT    | 3   | 115    | 524909       | ROSEVELT_N   | 6   | 230       | 1         | C:524874     | OASIS        | 3      | 115       | 524875       | OASIS        | 6   | 230 | 1 |
| REGION1 | REGION10_I | -112 | -0.0827 | 524874 | OASIS        | 3   | 115    | 524875       | OASIS        | 6   | 230       | 1         | C:524908     | ROOSEVELT    | 3      | 115       | 524909       | ROSEVELT_N   | 6   | 230 | 1 |
| REGION1 | REGION10_I | -41  | -0.0565 | 524822 | CURRY        | 3   | 115    | 524908       | ROOSEVELT    | 3   | 115       | 2         | C:524874     | OASIS        | 3      | 115       | 524875       | OASIS        | 6   | 230 | 1 |
| REGION1 | REGION10_I | 172  | -0.0658 | 527482 | CHAVES_CO    | 3   | 115    | 527483       | CHAVES_CO    | 6   | 230       | 2         | C:527482     | CHAVES_CO    | 3      | 115       | 527483       | CHAVES_CO    | 6   | 230 | 1 |
| REGION1 | REGION10_I | 211  | -0.0528 | 525056 | BC-EARTH     | 3   | 115    | 525480       | PLANTX       | 3   | 115       | 1         | C:524623     | DEAFSMITH    | 6      | 230       | 525481       | PLANTX       | 6   | 230 | 1 |
| REGION1 | REGION10_I | 303  | -0.0563 | 526475 | YUMA_INTG    | 3   | 115    | 526524       | WOLFFORTH    | 3   | 115       | 1         | C:525830     | TUCO_INT     | 6      | 230       | 526161       | CARLISLE     | 6   | 230 | 1 |
| REGION1 | REGION10_I | 313  | 0.0677  | 527482 | CHAVES_CO    | 3   | 115    | 527546       | SAMSON3      | 115 | 1         | C:527482  | CHAVES_CO    | 3            | 115    | 527501    | URTON3       | 115          | 1   |     |   |
| REGION1 | REGION10_I | 330  | 0.0676  | 527482 | CHAVES_CO    | 3   | 115    | 527501       | URTON3       | 115 | 1         | C:527482  | CHAVES_CO    | 3            | 115    | 527546    | SAMSON3      | 115          | 1   |     |   |
| REGION1 | REGION10_I | 340  | -1.0000 | 524875 | OASIS        | 6   | 230    | 524885       | SN_JUAN_TAP6 | 230 | 1         | C:524885  | SN_JUAN_TAP6 | 230          | 527483 | CHAVES_CO | 6            | 230          | 1   |     |   |
| REGION1 | REGION10_I | 340  | 1.0000  | 524885 | SN_JUAN_TAP6 | 230 | 527483 | CHAVES_CO    | 6            | 230 | 1         | C:524875  | OASIS        | 6            | 230    | 524885    | SN_JUAN_TAP6 | 230          | 1   |     |   |
| REGION1 | REGION10_I | 424  | -1.0000 | 524885 | SN_JUAN_TAP6 | 230 | 524889 | SN_JUAN_WND6 | 230          | 1   | Base Case |           |              |              |        |           |              |              |     |     |   |
| REGION1 | REGION10_I | 517  | -0.1037 | 524669 | DS-#20       | 3   | 115    | 524822       | CURRY        | 3   | 115       | 1         | C:524623     | DEAFSMITH    | 6      | 230       | 525481       | PLANTX       | 6   | 230 | 1 |
| REGION1 | REGION10_I | 557  | 0.2940  | 525524 | TOLK_EAST    | 6   | 230    | 525830       | TUCO_INT     | 6   | 230       | 1         | C:526435     | SUNDOWN      | 6      | 230       | 526525       | WOLFFORTH    | 6   | 230 | 1 |
| REGION1 | REGION10_I | 574  | 0.8604  | 524875 | OASIS        | 6   | 230    | 524915       | SW_4K33      | 6   | 230       | 1         | C:524885     | SN_JUAN_TAP6 | 230    | 527483    | CHAVES_CO    | 6            | 230 | 1   |   |
| REGION1 | REGION10_I | 624  | -0.1073 | 526176 | DOUD3        | 115 | 526475 | YUMA_INTG    | 3            | 115 | 1         | C:525524  | TOLK_EAST    | 6            | 230    | 525830    | TUCO_INT     | 6            | 230 | 1   |   |
| REGION1 | REGION10_I | 637  | 0.7992  | 527483 | CHAVES_CO    | 6   | 230    | 527800       | EDDY_CNTY    | 6   | 230       | 1         | C:524875     | OASIS        | 6      | 230       | 524885       | SN_JUAN_TAP6 | 230 | 1   |   |
| REGION1 | REGION10_I | 639  | 0.0677  | 527546 | SAMSON3      | 115 | 527564 | ROSWLL_INT3  | 115          | 1   | C:527482  | CHAVES_CO | 3            | 115          | 527501 | URTON3    | 115          | 1            |     |     |   |
| REGION1 | REGION10_I | 730  | -0.1037 | 524662 | PARMER_CO    | 3   | 115    | 524669       | DS-#20       | 3   | 115       | 1         | C:524623     | DEAFSMITH    | 6      | 230       | 525481       | PLANTX       | 6   | 230 | 1 |
| REGION1 | REGION10_I | 749  | -0.1037 | 524648 | CARGILL      | 3   | 115    | 524662       | PARMER_CO    | 3   | 115       | 1         | C:524623     | DEAFSMITH    | 6      | 230       | 525481       | PLANTX       | 6   | 230 | 1 |
| REGION1 | REGION10_I | 757  | -0.0827 | 525480 | PLANTX       | 3   | 115    | 525481       | PLANTX       | 6   | 230       | 1         | C:525531     | TOLK_WEST    | 6      | 230       | 525637       | LAMB_CNTY    | 6   | 230 | 1 |
| REGION1 | REGION10_I | 759  | -0.3894 | 525481 | PLANTX       | 6   | 230    | 525531       | TOLK_WEST    | 6   | 230       | 1         | C:525481     | PLANTX       | 6      | 230       | 525524       | TOLK_EAST    | 6   | 230 | 2 |
| REGION1 | REGION10_I | 764  | 0.0676  | 527501 | URTON3       | 115 | 527522 | ROSWELL_CTY3 | 115          | 1   | C:527482  | CHAVES_CO | 3            | 115          | 527546 | SAMSON3   | 115          | 1            |     |     |   |

|         |            |      |         |                         |                          |                          |                           |
|---------|------------|------|---------|-------------------------|--------------------------|--------------------------|---------------------------|
| REGION1 | REGION10_I | 769  | -0.3862 | 525481 PLANTX 6 230     | 525524 TOLK_EAST 6 230 2 | C:525481 PLANTX 6 230    | 525531 TOLK_WEST 6 230 1  |
| REGION1 | REGION10_I | 825  | -0.0524 | 524863 FE-CHZPLT 3 115  | 524874 OASIS 3 115 1     | C:524822 CURRY 3 115     | 524908 ROOSEVELT 3 115 2  |
| REGION1 | REGION10_I | 861  | 0.0676  | 527534 BRASHER_TP 3 115 | 527564 ROSWLL_INT3 115 1 | C:527482 CHAVES_CO 3 115 | 527546 SAMSON3 115 1      |
| REGION1 | REGION10_I | 889  | 0.1037  | 524648 CARGILL 3 115    | 524655 FRIONA 3 115 1    | C:524623 DEAFSMITH 6 230 | 525481 PLANTX 6 230 1     |
| REGION1 | REGION10_I | 903  | 0.1984  | 524874 OASIS 3 115      | 524924 PORTALES 3 115 1  | C:524875 OASIS 6 230     | 524915 SW_4K33 6 230 1    |
| REGION1 | REGION10_I | 904  | -0.1140 | 526524 WOLFFORTH 3 115  | 526736 TERRY 3 115 1     | C:526435 SUNDOWN 6 230   | 526525 WOLFFORTH 6 230 1  |
| REGION1 | REGION10_I | 932  | -0.1328 | 526160 CARLISLE 3 115   | 526176 DOUD3 115 1       | C:526269 LUBBCK_STH6 230 | 526525 WOLFFORTH 6 230 1  |
| REGION1 | REGION10_I | 964  | -0.0976 | 524597 PANDAHFD 3 115   | 524606 HEREFORD 3 115 1  | C:524267 BUSHLAND 6 230  | 524623 DEAFSMITH 6 230 1  |
| REGION2 | REGION3_I  | 527  | 0.0592  | 659134 SIDNEY 4 230     | 659136 SIDNEY*4 230 1    | C:640302 OGALALA4 230    | 659134 SIDNEY 4 230 1     |
| REGION2 | REGION3_I  | 529  | -0.0592 | 652572 SIDNEY 7 115     | 659136 SIDNEY*4 230 1    | C:640302 OGALALA4 230    | 659134 SIDNEY 4 230 1     |
| REGION2 | REGION3_I  | 596  | 0.2326  | 524502 NORTON 3 115     | 524822 CURRY 3 115 1     | C:524502 NORTON 3 115    | 524509 FE-TUCMCARI3 115 1 |
| REGION2 | REGION3_I  | 683  | 0.0643  | 659132 OGALALA7 115     | 659187 ROSCOE 7 115 1    | C:640183 GENTLMN3 345    | 640252 KEYSTON3 345 1     |
| REGION2 | REGION3_I  | 809  | 0.1466  | 640253 KEYSTON7 115     | 659132 OGALALA7 115 1    | C:640183 GENTLMN3 345    | 640252 KEYSTON3 345 1     |
| REGION2 | REGION3_I  | 835  | -0.0643 | 659185 ELSIETP7 115     | 659187 ROSCOE 7 115 1    | C:640183 GENTLMN3 345    | 640252 KEYSTON3 345 1     |
| REGION2 | REGION3_I  | 861  | -0.0623 | 524669 DS-#20 3 115     | 524822 CURRY 3 115 1     | C:524623 DEAFSMITH 6 230 | 525481 PLANTX 6 230 1     |
| REGION2 | REGION3_I  | 877  | 0.0592  | 652572 SIDNEY 7 115     | 659238 COLTON 7 115 1    | C:640302 OGALALA4 230    | 659134 SIDNEY 4 230 1     |
| REGION2 | REGION3_I  | 902  | -0.2609 | 640302 OGALALA4 230     | 659134 SIDNEY 4 230 1    | C:640183 GENTLMN3 345    | 640252 KEYSTON3 345 1     |
| REGION2 | REGION3_I  | 916  | 0.1161  | 640302 OGALALA4 230     | 659132 OGALALA7 115 1    | C:640184 GENTLMN4 230    | 640302 OGALALA4 230 1     |
| REGION2 | REGION3_I  | 946  | -0.0592 | 652300 CHAPPEL7 115     | 659238 COLTON 7 115 1    | C:640302 OGALALA4 230    | 659134 SIDNEY 4 230 1     |
| REGION2 | REGION3_I  | 954  | -0.3327 | 640184 GENTLMN4 230     | 640302 OGALALA4 230 1    | C:640183 GENTLMN3 345    | 640252 KEYSTON3 345 1     |
| REGION2 | REGION3_I  | 1024 | 0.2326  | 524486 CAPROCK 3 115    | 524502 NORTON 3 115 1    | Base Case                |                           |
| REGION2 | REGION3_I  | 1078 | 0.1552  | 640252 KEYSTON3 345     | B\$0588 KEYST T1 1.00 1  | C:640183 GENTLMN3 345    | 640252 KEYSTON3 345 1     |
| REGION2 | REGION3_I  | 1079 | -0.1552 | 640253 KEYSTON7 115     | B\$0588 KEYST T1 1.00 1  | C:640183 GENTLMN3 345    | 640252 KEYSTON3 345 1     |
| REGION2 | REGION3_I  | 1108 | -0.0478 | 526475 YUMA_INTG 3 115  | 526524 WOLFFORTH 3 115 1 | C:526269 LUBBCK_STH6 230 | 526525 WOLFFORTH 6 230 1  |
| REGION2 | REGION3_I  | 1158 | -0.0592 | 640246 JULSTAP7 115     | 652300 CHAPPEL7 115 1    | C:640302 OGALALA4 230    | 659134 SIDNEY 4 230 1     |
| REGION2 | REGION3_I  | 1215 | -0.0623 | 524662 PARMER_CO 3 115  | 524669 DS-#20 3 115 1    | C:524623 DEAFSMITH 6 230 | 525481 PLANTX 6 230 1     |
| REGION2 | REGION3_I  | 1248 | -0.0623 | 524648 CARGILL 3 115    | 524662 PARMER_CO 3 115 1 | C:524623 DEAFSMITH 6 230 | 525481 PLANTX 6 230 1     |
| REGION2 | REGION3_I  | 1473 | -0.2005 | 525481 PLANTX 6 230     | 525531 TOLK_WEST 6 230 1 | C:525481 PLANTX 6 230    | 525524 TOLK_EAST 6 230 2  |
| REGION2 | REGION3_I  | 1480 | 0.0643  | 659185 ELSIETP7 115     | 659186 PAXTON 7 115 1    | C:640183 GENTLMN3 345    | 640252 KEYSTON3 345 1     |
| REGION2 | REGION3_I  | 1480 | 0.0623  | 524648 CARGILL 3 115    | 524655 FRIONA 3 115 1    | C:524623 DEAFSMITH 6 230 | 525481 PLANTX 6 230 1     |

|         |           |      |         |                                                 |                                                   |
|---------|-----------|------|---------|-------------------------------------------------|---------------------------------------------------|
| REGION2 | REGION3_I | 1491 | -0.1991 | 525481 PLANTX 6 230 525524 TOLK_EAST 6 230 2    | C:525481 PLANTX 6 230 525531 TOLK_WEST 6 230 1    |
| REGION2 | REGION3_I | 1501 | 0.1092  | 525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1  | C:526435 SUNDOWN 6 230 526525 WOLFFORTH 6 230 1   |
| REGION2 | REGION3_I | 1659 | -0.0378 | 525480 PLANTX 3 115 525481 PLANTX 6 230 1       | C:525531 TOLK_WEST 6 230 525637 LAMB_CNTY 6 230 1 |
| REGION2 | REGION3_I | 2450 | -0.0516 | 524606 HEREFORD 3 115 524655 FRIONA 3 115 1     | C:646206 S1206 5 161 648199 SARP4&5T 161 1        |
| REGION2 | REGION3_I | 2573 | -0.0373 | 640068 B.SPRGS7 115 640246 JULSTAP7 115 1       | C:652302 JULESBG7 115 659240 INTERST7 115 1       |
| REGION2 | REGION3_I | 2631 | -0.0304 | 524597 PANDAHFD 3 115 524606 HEREFORD 3 115 1   | C:646206 S1206 5 161 648199 SARP4&5T 161 1        |
| REGION2 | REGION3_I | 2717 | -0.3144 | 640183 GENTLMN3 345 640252 KEYSTON3 345 1       | C:659132 OGALALA7 115 659187 ROSCOE 7 115 1       |
| REGION2 | REGION3_I | 2904 | 0.1065  | 524822 CURRY 3 115 524908 ROOSEVELT 3 115 2     | C:652302 JULESBG7 115 659240 INTERST7 115 1       |
| REGION2 | REGION4_I | 239  | 0.0842  | 530553 S HAYS 3 115 530562 HAYS 3 115 1         | C:530558 KNOLL 6 230 530561 KNOLL 3 115 1         |
| REGION2 | REGION4_I | 417  | 0.0842  | 530562 HAYS 3 115 530591 VINE 3 115 1           | C:530558 KNOLL 6 230 530561 KNOLL 3 115 1         |
| REGION2 | REGION4_I | 514  | 0.2715  | 514785 WOODWRD4 138 515785 WINDFRM4 138 1       | C:3wnd: OPEN B\$1035 WOODWRD2 1                   |
| REGION2 | REGION4_I | 531  | 0.0588  | 659134 SIDNEY 4 230 659136 SIDNEY*4 230 1       | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1       |
| REGION2 | REGION4_I | 534  | -0.0588 | 652572 SIDNEY 7 115 659136 SIDNEY*4 230 1       | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1       |
| REGION2 | REGION4_I | 596  | 0.2326  | 524502 NORTON 3 115 524822 CURRY 3 115 1        | C:524502 NORTON 3 115 524509 FE-TUCMCARI3 115 1   |
| REGION2 | REGION4_I | 652  | 0.0674  | 659132 OGALALA7 115 659187 ROSCOE 7 115 1       | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1       |
| REGION2 | REGION4_I | 656  | -0.0842 | 530561 KNOLL 3 115 530581 N HAYS3 115 1         | C:530558 KNOLL 6 230 530561 KNOLL 3 115 1         |
| REGION2 | REGION4_I | 785  | -0.0590 | 640238 JEFFREY7 115 640287 N.PLATT7 115 1       | C:640093 C.CREEK4 230 640286 N.PLATT4 230 1       |
| REGION2 | REGION4_I | 794  | -0.0414 | 526475 YUMA_INTG 3 115 526524 WOLFFORTH 3 115 1 | C:525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1  |
| REGION2 | REGION4_I | 794  | 0.1494  | 640253 KEYSTON7 115 659132 OGALALA7 115 1       | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1       |
| REGION2 | REGION4_I | 797  | -0.0674 | 659185 ELSIETP7 115 659187 ROSCOE 7 115 1       | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1       |
| REGION2 | REGION4_I | 811  | 0.1004  | 514785 WOODWRD4 138 B\$1035 WOODWRD2 1.00 1     | C:514785 WOODWRD4 138 515785 WINDFRM4 138 1       |
| REGION2 | REGION4_I | 884  | 0.0588  | 652572 SIDNEY 7 115 659238 COLTON 7 115 1       | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1       |
| REGION2 | REGION4_I | 898  | -0.0597 | 524669 DS-#20 3 115 524822 CURRY 3 115 1        | C:524623 DEAFSMITH 6 230 525481 PLANTX 6 230 1    |
| REGION2 | REGION4_I | 920  | -0.2558 | 640302 OGALALA4 230 659134 SIDNEY 4 230 1       | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1       |
| REGION2 | REGION4_I | 928  | 0.1146  | 640302 OGALALA4 230 659132 OGALALA7 115 1       | C:640184 GENTLMN4 230 640302 OGALALA4 230 1       |
| REGION2 | REGION4_I | 953  | -0.0588 | 652300 CHAPPEL7 115 659238 COLTON 7 115 1       | C:640302 OGALALA4 230 659134 SIDNEY 4 230 1       |
| REGION2 | REGION4_I | 971  | -0.0842 | 530553 S HAYS 3 115 530582 S HAYS6 230 1        | C:530558 KNOLL 6 230 530561 KNOLL 3 115 1         |
| REGION2 | REGION4_I | 980  | -0.3239 | 640184 GENTLMN4 230 640302 OGALALA4 230 1       | C:640183 GENTLMN3 345 640252 KEYSTON3 345 1       |
| REGION2 | REGION4_I | 1024 | 0.2326  | 524486 CAPROCK 3 115 524502 NORTON 3 115 1      | Base Case                                         |
| REGION2 | REGION4_I | 1044 | 0.2530  | 515785 WINDFRM4 138 520999 MOORLND4 138 1       | C:3wnd: OPEN B\$1035 WOODWRD2 1                   |



|         |           |      |         |                    |     |                    |      |   |                      |     |                     |     |   |
|---------|-----------|------|---------|--------------------|-----|--------------------|------|---|----------------------|-----|---------------------|-----|---|
| REGION2 | REGION4_I | 1057 | 0.0991  | 530558 KNOLL 6     | 230 | 530561 KNOLL 3     | 115  | 1 | C:530553 S HAYS 3    | 115 | 530582 S HAYS6      | 230 | 1 |
| REGION2 | REGION4_I | 1115 | -0.0603 | 514711 WAUKOTP4    | 138 | 514714 WOODRNG4    | 138  | 1 | C:514709 FRMNTAP4    | 138 | 514714 WOODRNG4     | 138 | 1 |
| REGION2 | REGION4_I | 1120 | 0.1494  | 640252 KEYSTON3    | 345 | B\$0588 KEYST T1   | 1.00 | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION4_I | 1121 | -0.1494 | 640253 KEYSTON7    | 115 | B\$0588 KEYST T1   | 1.00 | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION4_I | 1168 | -0.0588 | 640246 JULSTAP7    | 115 | 652300 CHAPPEL7    | 115  | 1 | C:640302 OGALALA4    | 230 | 659134 SIDNEY 4     | 230 | 1 |
| REGION2 | REGION4_I | 1234 | 0.1263  | 514787 DEWEY 4     | 138 | 521065 TALOGA 4    | 138  | 1 | C:514785 WOODWRD4    | 138 | 515785 WINDFRM4     | 138 | 1 |
| REGION2 | REGION4_I | 1242 | 0.1320  | 525524 TOLK_EAST 6 | 230 | 525830 TUCO_INT 6  | 230  | 1 | C:526435 SUNDOWN 6   | 230 | 526525 WOLFFORTH 6  | 230 | 1 |
| REGION2 | REGION4_I | 1267 | -0.0597 | 524662 PARMER_CO 3 | 115 | 524669 DS-#20 3    | 115  | 1 | C:524623 DEAFSMITH 6 | 230 | 525481 PLANTX 6     | 230 | 1 |
| REGION2 | REGION5_I | 537  | 0.0582  | 659134 SIDNEY 4    | 230 | 659136 SIDNEY*4    | 230  | 1 | C:640302 OGALALA4    | 230 | 659134 SIDNEY 4     | 230 | 1 |
| REGION2 | REGION5_I | 539  | -0.0582 | 652572 SIDNEY 7    | 115 | 659136 SIDNEY*4    | 230  | 1 | C:640302 OGALALA4    | 230 | 659134 SIDNEY 4     | 230 | 1 |
| REGION2 | REGION5_I | 596  | 0.2326  | 524502 NORTON 3    | 115 | 524822 CURRY 3     | 115  | 1 | C:524502 NORTON 3    | 115 | 524509 FE-TUCMCARI3 | 115 | 1 |
| REGION2 | REGION5_I | 683  | 0.0643  | 659132 OGALALA7    | 115 | 659187 ROSCOE 7    | 115  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION5_I | 749  | -0.0438 | 526475 YUMA_INTG 3 | 115 | 526524 WOLFFORTH 3 | 115  | 1 | C:525524 TOLK_EAST 6 | 230 | 525830 TUCO_INT 6   | 230 | 1 |
| REGION2 | REGION5_I | 814  | 0.1457  | 640253 KEYSTON7    | 115 | 659132 OGALALA7    | 115  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION5_I | 835  | -0.0643 | 659185 ELSIETP7    | 115 | 659187 ROSCOE 7    | 115  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION5_I | 893  | 0.0582  | 652572 SIDNEY 7    | 115 | 659238 COLTON 7    | 115  | 1 | C:640302 OGALALA4    | 230 | 659134 SIDNEY 4     | 230 | 1 |
| REGION2 | REGION5_I | 926  | -0.0579 | 524669 DS-#20 3    | 115 | 524822 CURRY 3     | 115  | 1 | C:524623 DEAFSMITH 6 | 230 | 525481 PLANTX 6     | 230 | 1 |
| REGION2 | REGION5_I | 932  | -0.2525 | 640302 OGALALA4    | 230 | 659134 SIDNEY 4    | 230  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION5_I | 941  | 0.1130  | 640302 OGALALA4    | 230 | 659132 OGALALA7    | 115  | 1 | C:640184 GENTLMN4    | 230 | 640302 OGALALA4     | 230 | 1 |
| REGION2 | REGION5_I | 963  | -0.0582 | 652300 CHAPPEL7    | 115 | 659238 COLTON 7    | 115  | 1 | C:640302 OGALALA4    | 230 | 659134 SIDNEY 4     | 230 | 1 |
| REGION2 | REGION5_I | 992  | -0.3199 | 640184 GENTLMN4    | 230 | 640302 OGALALA4    | 230  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION5_I | 1024 | 0.2326  | 524486 CAPROCK 3   | 115 | 524502 NORTON 3    | 115  | 1 | Base Case            |     |                     |     |   |
| REGION2 | REGION5_I | 1149 | 0.1457  | 640252 KEYSTON3    | 345 | B\$0588 KEYST T1   | 1.00 | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION5_I | 1149 | -0.1457 | 640253 KEYSTON7    | 115 | B\$0588 KEYST T1   | 1.00 | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION5_I | 1172 | 0.1398  | 525524 TOLK_EAST 6 | 230 | 525830 TUCO_INT 6  | 230  | 1 | C:526435 SUNDOWN 6   | 230 | 526525 WOLFFORTH 6  | 230 | 1 |
| REGION2 | REGION5_I | 1180 | -0.0582 | 640246 JULSTAP7    | 115 | 652300 CHAPPEL7    | 115  | 1 | C:640302 OGALALA4    | 230 | 659134 SIDNEY 4     | 230 | 1 |
| REGION2 | REGION5_I | 1306 | -0.0579 | 524662 PARMER_CO 3 | 115 | 524669 DS-#20 3    | 115  | 1 | C:524623 DEAFSMITH 6 | 230 | 525481 PLANTX 6     | 230 | 1 |
| REGION2 | REGION5_I | 1341 | -0.0579 | 524648 CARGILL 3   | 115 | 524662 PARMER_CO 3 | 115  | 1 | C:524623 DEAFSMITH 6 | 230 | 525481 PLANTX 6     | 230 | 1 |
| REGION2 | REGION5_I | 1466 | -0.0316 | 640238 JEFFREY7    | 115 | 640287 N.PLATT7    | 115  | 1 | C:640093 C.CREEK4    | 230 | 640286 N.PLATT4     | 230 | 1 |
| REGION2 | REGION5_I | 1480 | 0.0643  | 659185 ELSIETP7    | 115 | 659186 PAXTON 7    | 115  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |



|         |           |      |         |                  |     |                  |                  |      |     |                    |                    |                 |                 |                     |     |     |   |
|---------|-----------|------|---------|------------------|-----|------------------|------------------|------|-----|--------------------|--------------------|-----------------|-----------------|---------------------|-----|-----|---|
| REGION2 | REGION5_I | 1526 | -0.0438 | 526176 DOUD3     | 115 | 526475 YUMA_INTG | 3                | 115  | 1   | C:525524 TOLK_EAST | 6                  | 230             | 525830 TUCO_INT | 6                   | 230 | 1   |   |
| REGION2 | REGION5_I | 2258 | 0.0491  | 524648 CARGILL   | 3   | 115              | 524655 FRIONA    | 3    | 115 | 1                  | C:659130 GRANTNB7  | 115             | 659188 SPCREEK7 | 115                 | 1   |     |   |
| REGION2 | REGION5_I | 2575 | -0.0491 | 524606 HEREFORD  | 3   | 115              | 524655 FRIONA    | 3    | 115 | 1                  | C:659130 GRANTNB7  | 115             | 659188 SPCREEK7 | 115                 | 1   |     |   |
| REGION2 | REGION5_I | 2592 | -0.0371 | 640068 B.SPRGS7  | 115 | 640246 JULSTAP7  | 115              | 1    |     | C:652302 JULESBG7  | 115                | 659240 INTERST7 | 115             | 1                   |     |     |   |
| REGION2 | REGION5_I | 2775 | -0.3079 | 640183 GENTLMN3  | 345 | 640252 KEYSTON3  | 345              | 1    |     | C:659132 OGALALA7  | 115                | 659187 ROSCOE   | 7               | 115                 | 1   |     |   |
| REGION2 | REGION5_I | 2864 | 0.1080  | 524822 CURRY     | 3   | 115              | 524908 ROOSEVELT | 3    | 115 | 2                  | C:652302 JULESBG7  | 115             | 659240 INTERST7 | 115                 | 1   |     |   |
| REGION2 | REGION5_I | 3230 | -0.0613 | 640093 C.CREEK4  | 230 | 640286 N.PLATT4  | 230              | 1    |     | C:659185 ELSIETP7  | 115                | 659243 ELSIE    | 7               | 115                 | 1   |     |   |
| REGION2 | REGION5_I | 3438 | -0.0506 | 524764 NORRIS_TP | 3   | 115              | 524822 CURRY     | 3    | 115 | 1                  | C:765341 COMANCH5  | 345             | 765342 MED-LDG5 | 345                 | 2   |     |   |
| REGION2 | REGION6_I | 419  | -0.0301 | 640267 MAXWELS7  | 115 | 640287 N.PLATT7  | 115              | 1    |     | C:640093 C.CREEK4  | 230                | 640286 N.PLATT4 | 230             | 1                   |     |     |   |
| REGION2 | REGION6_I | 538  | 0.0580  | 659134 SIDNEY    | 4   | 230              | 659136 SIDNEY*4  | 230  | 1   | C:640302 OGALALA4  | 230                | 659134 SIDNEY   | 4               | 230                 | 1   |     |   |
| REGION2 | REGION6_I | 540  | -0.0580 | 652572 SIDNEY    | 7   | 115              | 659136 SIDNEY*4  | 230  | 1   | C:640302 OGALALA4  | 230                | 659134 SIDNEY   | 4               | 230                 | 1   |     |   |
| REGION2 | REGION6_I | 596  | 0.2326  | 524502 NORTON    | 3   | 115              | 524822 CURRY     | 3    | 115 | 1                  | C:524502 NORTON    | 3               | 115             | 524509 FE-TUCMCARI3 | 115 | 1   |   |
| REGION2 | REGION6_I | 683  | 0.0643  | 659132 OGALALA7  | 115 | 659187 ROSCOE    | 7                | 115  | 1   | C:640183 GENTLMN3  | 345                | 640252 KEYSTON3 | 345             | 1                   |     |     |   |
| REGION2 | REGION6_I | 760  | -0.0432 | 526475 YUMA_INTG | 3   | 115              | 526524 WOLFFORTH | 3    | 115 | 1                  | C:525524 TOLK_EAST | 6               | 230             | 525830 TUCO_INT     | 6   | 230 | 1 |
| REGION2 | REGION6_I | 821  | 0.1446  | 640253 KEYSTON7  | 115 | 659132 OGALALA7  | 115              | 1    |     | C:640183 GENTLMN3  | 345                | 640252 KEYSTON3 | 345             | 1                   |     |     |   |
| REGION2 | REGION6_I | 835  | -0.0643 | 659185 ELSIETP7  | 115 | 659187 ROSCOE    | 7                | 115  | 1   | C:640183 GENTLMN3  | 345                | 640252 KEYSTON3 | 345             | 1                   |     |     |   |
| REGION2 | REGION6_I | 895  | 0.0580  | 652572 SIDNEY    | 7   | 115              | 659238 COLTON    | 7    | 115 | 1                  | C:640302 OGALALA4  | 230             | 659134 SIDNEY   | 4                   | 230 | 1   |   |
| REGION2 | REGION6_I | 918  | -0.0584 | 524669 DS-#20    | 3   | 115              | 524822 CURRY     | 3    | 115 | 1                  | C:524623 DEAFSMITH | 6               | 230             | 525481 PLANTX       | 6   | 230 | 1 |
| REGION2 | REGION6_I | 936  | -0.2515 | 640302 OGALALA4  | 230 | 659134 SIDNEY    | 4                | 230  | 1   | C:640183 GENTLMN3  | 345                | 640252 KEYSTON3 | 345             | 1                   |     |     |   |
| REGION2 | REGION6_I | 945  | 0.1125  | 640302 OGALALA4  | 230 | 659132 OGALALA7  | 115              | 1    |     | C:640184 GENTLMN4  | 230                | 640302 OGALALA4 | 230             | 1                   |     |     |   |
| REGION2 | REGION6_I | 965  | -0.0580 | 652300 CHAPPEL7  | 115 | 659238 COLTON    | 7                | 115  | 1   | C:640302 OGALALA4  | 230                | 659134 SIDNEY   | 4               | 230                 | 1   |     |   |
| REGION2 | REGION6_I | 996  | -0.3188 | 640184 GENTLMN4  | 230 | 640302 OGALALA4  | 230              | 1    |     | C:640183 GENTLMN3  | 345                | 640252 KEYSTON3 | 345             | 1                   |     |     |   |
| REGION2 | REGION6_I | 1024 | 0.2326  | 524486 CAPROCK   | 3   | 115              | 524502 NORTON    | 3    | 115 | 1                  | Base Case          |                 |                 |                     |     |     |   |
| REGION2 | REGION6_I | 1157 | 0.1446  | 640252 KEYSTON3  | 345 | B\$0588 KEYST    | T1               | 1.00 | 1   | C:640183 GENTLMN3  | 345                | 640252 KEYSTON3 | 345             | 1                   |     |     |   |
| REGION2 | REGION6_I | 1158 | -0.1446 | 640253 KEYSTON7  | 115 | B\$0588 KEYST    | T1               | 1.00 | 1   | C:640183 GENTLMN3  | 345                | 640252 KEYSTON3 | 345             | 1                   |     |     |   |
| REGION2 | REGION6_I | 1182 | -0.0580 | 640246 JULSTAP7  | 115 | 652300 CHAPPEL7  | 115              | 1    |     | C:640302 OGALALA4  | 230                | 659134 SIDNEY   | 4               | 230                 | 1   |     |   |
| REGION2 | REGION6_I | 1189 | 0.1378  | 525524 TOLK_EAST | 6   | 230              | 525830 TUCO_INT  | 6    | 230 | 1                  | C:526435 SUNDOWN   | 6               | 230             | 526525 WOLFFORTH    | 6   | 230 | 1 |
| REGION2 | REGION6_I | 1296 | -0.0584 | 524662 PARMER_CO | 3   | 115              | 524669 DS-#20    | 3    | 115 | 1                  | C:524623 DEAFSMITH | 6               | 230             | 525481 PLANTX       | 6   | 230 | 1 |
| REGION2 | REGION6_I | 1330 | -0.0584 | 524648 CARGILL   | 3   | 115              | 524662 PARMER_CO | 3    | 115 | 1                  | C:524623 DEAFSMITH | 6               | 230             | 525481 PLANTX       | 6   | 230 | 1 |
| REGION2 | REGION6_I | 1409 | -0.0328 | 640238 JEFFREY7  | 115 | 640287 N.PLATT7  | 115              | 1    |     | C:640093 C.CREEK4  | 230                | 640286 N.PLATT4 | 230             | 1                   |     |     |   |

|         |           |      |         |                    |     |                    |      |   |                      |     |                     |     |   |
|---------|-----------|------|---------|--------------------|-----|--------------------|------|---|----------------------|-----|---------------------|-----|---|
| REGION2 | REGION6_I | 1480 | 0.0643  | 659185 ELSIETP7    | 115 | 659186 PAXTON 7    | 115  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION6_I | 1549 | -0.0432 | 526176 DOUD3       | 115 | 526475 YUMA_INTG 3 | 115  | 1 | C:525524 TOLK_EAST 6 | 230 | 525830 TUCO_INT 6   | 230 | 1 |
| REGION2 | REGION6_I | 1579 | 0.0584  | 524648 CARGILL 3   | 115 | 524655 FRIONA 3    | 115  | 1 | C:524623 DEAFSMITH 6 | 230 | 525481 PLANTX 6     | 230 | 1 |
| REGION2 | REGION6_I | 2561 | -0.0494 | 524606 HEREFORD 3  | 115 | 524655 FRIONA 3    | 115  | 1 | C:646206 S1206 5     | 161 | 648199 SARP4&5T     | 161 | 1 |
| REGION2 | REGION6_I | 2596 | -0.0370 | 640068 B.SPRGS7    | 115 | 640246 JULSTAP7    | 115  | 1 | C:652302 JULESBG7    | 115 | 659240 INTERST7     | 115 | 1 |
| REGION2 | REGION6_I | 2789 | -0.3063 | 640183 GENTLMN3    | 345 | 640252 KEYSTON3    | 345  | 1 | C:659132 OGALALA7    | 115 | 659187 ROSCOE 7     | 115 | 1 |
| REGION2 | REGION6_I | 2867 | 0.1079  | 524822 CURRY 3     | 115 | 524908 ROOSEVELT 3 | 115  | 2 | C:765341 COMANCH5    | 345 | 765342 MED-LDG5     | 345 | 2 |
| REGION2 | REGION6_I | 3078 | -0.0643 | 640093 C.CREEK4    | 230 | 640286 N.PLATT4    | 230  | 1 | C:659185 ELSIETP7    | 115 | 659243 ELSIE 7      | 115 | 1 |
| REGION2 | REGION7_I | 538  | 0.0580  | 659134 SIDNEY 4    | 230 | 659136 SIDNEY*4    | 230  | 1 | C:640302 OGALALA4    | 230 | 659134 SIDNEY 4     | 230 | 1 |
| REGION2 | REGION7_I | 540  | -0.0580 | 652572 SIDNEY 7    | 115 | 659136 SIDNEY*4    | 230  | 1 | C:640302 OGALALA4    | 230 | 659134 SIDNEY 4     | 230 | 1 |
| REGION2 | REGION7_I | 596  | 0.2326  | 524502 NORTON 3    | 115 | 524822 CURRY 3     | 115  | 1 | C:524502 NORTON 3    | 115 | 524509 FE-TUCMCARI3 | 115 | 1 |
| REGION2 | REGION7_I | 686  | 0.0640  | 659132 OGALALA7    | 115 | 659187 ROSCOE 7    | 115  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION7_I | 752  | -0.0437 | 526475 YUMA_INTG 3 | 115 | 526524 WOLFFORTH 3 | 115  | 1 | C:525524 TOLK_EAST 6 | 230 | 525830 TUCO_INT 6   | 230 | 1 |
| REGION2 | REGION7_I | 822  | 0.1443  | 640253 KEYSTON7    | 115 | 659132 OGALALA7    | 115  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION7_I | 838  | -0.0640 | 659185 ELSIETP7    | 115 | 659187 ROSCOE 7    | 115  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION7_I | 895  | 0.0580  | 652572 SIDNEY 7    | 115 | 659238 COLTON 7    | 115  | 1 | C:640302 OGALALA4    | 230 | 659134 SIDNEY 4     | 230 | 1 |
| REGION2 | REGION7_I | 924  | -0.0581 | 524669 DS-#20 3    | 115 | 524822 CURRY 3     | 115  | 1 | C:524623 DEAFSMITH 6 | 230 | 525481 PLANTX 6     | 230 | 1 |
| REGION2 | REGION7_I | 937  | -0.2511 | 640302 OGALALA4    | 230 | 659134 SIDNEY 4    | 230  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION7_I | 946  | 0.1125  | 640302 OGALALA4    | 230 | 659132 OGALALA7    | 115  | 1 | C:640184 GENTLMN4    | 230 | 640302 OGALALA4     | 230 | 1 |
| REGION2 | REGION7_I | 965  | -0.0580 | 652300 CHAPPEL7    | 115 | 659238 COLTON 7    | 115  | 1 | C:640302 OGALALA4    | 230 | 659134 SIDNEY 4     | 230 | 1 |
| REGION2 | REGION7_I | 998  | -0.3180 | 640184 GENTLMN4    | 230 | 640302 OGALALA4    | 230  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION7_I | 1024 | 0.2326  | 524486 CAPROCK 3   | 115 | 524502 NORTON 3    | 115  | 1 | Base Case            |     |                     |     |   |
| REGION2 | REGION7_I | 1160 | 0.1443  | 640252 KEYSTON3    | 345 | B\$0588 KEYST T1   | 1.00 | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION7_I | 1160 | -0.1443 | 640253 KEYSTON7    | 115 | B\$0588 KEYST T1   | 1.00 | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION7_I | 1177 | 0.1393  | 525524 TOLK_EAST 6 | 230 | 525830 TUCO_INT 6  | 230  | 1 | C:526435 SUNDOWN 6   | 230 | 526525 WOLFFORTH 6  | 230 | 1 |
| REGION2 | REGION7_I | 1183 | -0.0580 | 640246 JULSTAP7    | 115 | 652300 CHAPPEL7    | 115  | 1 | C:640302 OGALALA4    | 230 | 659134 SIDNEY 4     | 230 | 1 |
| REGION2 | REGION7_I | 1303 | -0.0581 | 524662 PARMER_CO 3 | 115 | 524669 DS-#20 3    | 115  | 1 | C:524623 DEAFSMITH 6 | 230 | 525481 PLANTX 6     | 230 | 1 |
| REGION2 | REGION7_I | 1338 | -0.0581 | 524648 CARGILL 3   | 115 | 524662 PARMER_CO 3 | 115  | 1 | C:524623 DEAFSMITH 6 | 230 | 525481 PLANTX 6     | 230 | 1 |
| REGION2 | REGION7_I | 1439 | -0.0322 | 640238 JEFFREY7    | 115 | 640287 N.PLATT7    | 115  | 1 | C:640093 C.CREEK4    | 230 | 640286 N.PLATT4     | 230 | 1 |
| REGION2 | REGION7_I | 1486 | 0.0640  | 659185 ELSIETP7    | 115 | 659186 PAXTON 7    | 115  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |

|         |           |      |         |                  |     |                  |                  |      |     |                    |                    |                 |                 |                     |     |     |   |
|---------|-----------|------|---------|------------------|-----|------------------|------------------|------|-----|--------------------|--------------------|-----------------|-----------------|---------------------|-----|-----|---|
| REGION2 | REGION7_I | 1532 | -0.0437 | 526176 DOUD3     | 115 | 526475 YUMA_INTG | 3                | 115  | 1   | C:525524 TOLK_EAST | 6                  | 230             | 525830 TUCO_INT | 6                   | 230 | 1   |   |
| REGION2 | REGION7_I | 2255 | 0.0492  | 524648 CARGILL   | 3   | 115              | 524655 FRIONA    | 3    | 115 | 1                  | C:659130 GRANTNB7  | 115             | 659188 SPCREEK7 | 115                 | 1   |     |   |
| REGION2 | REGION7_I | 2572 | -0.0492 | 524606 HEREFORD  | 3   | 115              | 524655 FRIONA    | 3    | 115 | 1                  | C:659130 GRANTNB7  | 115             | 659188 SPCREEK7 | 115                 | 1   |     |   |
| REGION2 | REGION7_I | 2595 | -0.0370 | 640068 B.SPRGS7  | 115 | 640246 JULSTAP7  | 115              | 1    |     | C:652302 JULESBG7  | 115                | 659240 INTERST7 | 115             | 1                   |     |     |   |
| REGION2 | REGION7_I | 2796 | -0.3056 | 640183 GENTLMN3  | 345 | 640252 KEYSTON3  | 345              | 1    |     | C:659132 OGALALA7  | 115                | 659187 ROSCOE   | 7               | 115                 | 1   |     |   |
| REGION2 | REGION7_I | 2864 | 0.1080  | 524822 CURRY     | 3   | 115              | 524908 ROOSEVELT | 3    | 115 | 2                  | C:765341 COMANCH5  | 345             | 765342 MED-LDG5 | 345                 | 1   |     |   |
| REGION2 | REGION7_I | 3148 | -0.0629 | 640093 C.CREEK4  | 230 | 640286 N.PLATT4  | 230              | 1    |     | C:659185 ELSIETP7  | 115                | 659243 ELSIE    | 7               | 115                 | 1   |     |   |
| REGION2 | REGION7_I | 3439 | -0.0506 | 524764 NORRIS_TP | 3   | 115              | 524822 CURRY     | 3    | 115 | 1                  | C:765341 COMANCH5  | 345             | 765342 MED-LDG5 | 345                 | 2   |     |   |
| REGION2 | REGION8_I | 539  | 0.0580  | 659134 SIDNEY    | 4   | 230              | 659136 SIDNEY*4  | 230  | 1   | C:640302 OGALALA4  | 230                | 659134 SIDNEY   | 4               | 230                 | 1   |     |   |
| REGION2 | REGION8_I | 541  | -0.0580 | 652572 SIDNEY    | 7   | 115              | 659136 SIDNEY*4  | 230  | 1   | C:640302 OGALALA4  | 230                | 659134 SIDNEY   | 4               | 230                 | 1   |     |   |
| REGION2 | REGION8_I | 596  | 0.2326  | 524502 NORTON    | 3   | 115              | 524822 CURRY     | 3    | 115 | 1                  | C:524502 NORTON    | 3               | 115             | 524509 FE-TUCMCARI3 | 115 | 1   |   |
| REGION2 | REGION8_I | 688  | 0.0638  | 659132 OGALALA7  | 115 | 659187 ROSCOE    | 7                | 115  | 1   | C:640183 GENTLMN3  | 345                | 640252 KEYSTON3 | 345             | 1                   |     |     |   |
| REGION2 | REGION8_I | 747  | -0.0440 | 526475 YUMA_INTG | 3   | 115              | 526524 WOLFFORTH | 3    | 115 | 1                  | C:525524 TOLK_EAST | 6               | 230             | 525830 TUCO_INT     | 6   | 230 | 1 |
| REGION2 | REGION8_I | 826  | 0.1437  | 640253 KEYSTON7  | 115 | 659132 OGALALA7  | 115              | 1    |     | C:640183 GENTLMN3  | 345                | 640252 KEYSTON3 | 345             | 1                   |     |     |   |
| REGION2 | REGION8_I | 841  | -0.0638 | 659185 ELSIETP7  | 115 | 659187 ROSCOE    | 7                | 115  | 1   | C:640183 GENTLMN3  | 345                | 640252 KEYSTON3 | 345             | 1                   |     |     |   |
| REGION2 | REGION8_I | 896  | 0.0580  | 652572 SIDNEY    | 7   | 115              | 659238 COLTON    | 7    | 115 | 1                  | C:640302 OGALALA4  | 230             | 659134 SIDNEY   | 4                   | 230 | 1   |   |
| REGION2 | REGION8_I | 927  | -0.0578 | 524669 DS-#20    | 3   | 115              | 524822 CURRY     | 3    | 115 | 1                  | C:524623 DEAFSMITH | 6               | 230             | 525481 PLANTX       | 6   | 230 | 1 |
| REGION2 | REGION8_I | 940  | -0.2504 | 640302 OGALALA4  | 230 | 659134 SIDNEY    | 4                | 230  | 1   | C:640183 GENTLMN3  | 345                | 640252 KEYSTON3 | 345             | 1                   |     |     |   |
| REGION2 | REGION8_I | 947  | 0.1123  | 640302 OGALALA4  | 230 | 659132 OGALALA7  | 115              | 1    |     | C:640184 GENTLMN4  | 230                | 640302 OGALALA4 | 230             | 1                   |     |     |   |
| REGION2 | REGION8_I | 966  | -0.0580 | 652300 CHAPPEL7  | 115 | 659238 COLTON    | 7                | 115  | 1   | C:640302 OGALALA4  | 230                | 659134 SIDNEY   | 4               | 230                 | 1   |     |   |
| REGION2 | REGION8_I | 1002 | -0.3169 | 640184 GENTLMN4  | 230 | 640302 OGALALA4  | 230              | 1    |     | C:640183 GENTLMN3  | 345                | 640252 KEYSTON3 | 345             | 1                   |     |     |   |
| REGION2 | REGION8_I | 1024 | 0.2326  | 524486 CAPROCK   | 3   | 115              | 524502 NORTON    | 3    | 115 | 1                  | Base Case          |                 |                 |                     |     |     |   |
| REGION2 | REGION8_I | 1164 | 0.1437  | 640252 KEYSTON3  | 345 | B\$0588 KEYST    | T1               | 1.00 | 1   | C:640183 GENTLMN3  | 345                | 640252 KEYSTON3 | 345             | 1                   |     |     |   |
| REGION2 | REGION8_I | 1165 | -0.1437 | 640253 KEYSTON7  | 115 | B\$0588 KEYST    | T1               | 1.00 | 1   | C:640183 GENTLMN3  | 345                | 640252 KEYSTON3 | 345             | 1                   |     |     |   |
| REGION2 | REGION8_I | 1169 | 0.1402  | 525524 TOLK_EAST | 6   | 230              | 525830 TUCO_INT  | 6    | 230 | 1                  | C:526435 SUNDOWN   | 6               | 230             | 526525 WOLFFORTH    | 6   | 230 | 1 |
| REGION2 | REGION8_I | 1184 | -0.0580 | 640246 JULSTAP7  | 115 | 652300 CHAPPEL7  | 115              | 1    |     | C:640302 OGALALA4  | 230                | 659134 SIDNEY   | 4               | 230                 | 1   |     |   |
| REGION2 | REGION8_I | 1308 | -0.0578 | 524662 PARMER_CO | 3   | 115              | 524669 DS-#20    | 3    | 115 | 1                  | C:524623 DEAFSMITH | 6               | 230             | 525481 PLANTX       | 6   | 230 | 1 |
| REGION2 | REGION8_I | 1343 | -0.0578 | 524648 CARGILL   | 3   | 115              | 524662 PARMER_CO | 3    | 115 | 1                  | C:524623 DEAFSMITH | 6               | 230             | 525481 PLANTX       | 6   | 230 | 1 |
| REGION2 | REGION8_I | 1446 | -0.0320 | 640238 JEFFREY7  | 115 | 640287 N.PLATT7  | 115              | 1    |     | C:640093 C.CREEK4  | 230                | 640286 N.PLATT4 | 230             | 1                   |     |     |   |
| REGION2 | REGION8_I | 1491 | 0.0638  | 659185 ELSIETP7  | 115 | 659186 PAXTON    | 7                | 115  | 1   | C:640183 GENTLMN3  | 345                | 640252 KEYSTON3 | 345             | 1                   |     |     |   |

|         |           |      |         |                  |     |                  |                  |      |     |                    |                    |                 |                 |                     |     |     |   |
|---------|-----------|------|---------|------------------|-----|------------------|------------------|------|-----|--------------------|--------------------|-----------------|-----------------|---------------------|-----|-----|---|
| REGION2 | REGION8_I | 1522 | -0.0440 | 526176 DOUD3     | 115 | 526475 YUMA_INTG | 3                | 115  | 1   | C:525524 TOLK_EAST | 6                  | 230             | 525830 TUCO_INT | 6                   | 230 | 1   |   |
| REGION2 | REGION8_I | 2260 | 0.0491  | 524648 CARGILL   | 3   | 115              | 524655 FRIONA    | 3    | 115 | 1                  | C:659130 GRANTNB7  | 115             | 659188 SPCREEK7 | 115                 | 1   |     |   |
| REGION2 | REGION8_I | 2578 | -0.0491 | 524606 HEREFORD  | 3   | 115              | 524655 FRIONA    | 3    | 115 | 1                  | C:659130 GRANTNB7  | 115             | 659188 SPCREEK7 | 115                 | 1   |     |   |
| REGION2 | REGION8_I | 2596 | -0.0370 | 640068 B.SPRGS7  | 115 | 640246 JULSTAP7  | 115              | 1    |     | C:652302 JULESBG7  | 115                | 659240 INTERST7 | 115             | 1                   |     |     |   |
| REGION2 | REGION8_I | 2807 | -0.3043 | 640183 GENTLMN3  | 345 | 640252 KEYSTON3  | 345              | 1    |     | C:659132 OGALALA7  | 115                | 659187 ROSCOE   | 7               | 115                 | 1   |     |   |
| REGION2 | REGION8_I | 2863 | 0.1080  | 524822 CURRY     | 3   | 115              | 524908 ROOSEVELT | 3    | 115 | 2                  | C:652302 JULESBG7  | 115             | 659240 INTERST7 | 115                 | 1   |     |   |
| REGION2 | REGION8_I | 3158 | -0.0627 | 640093 C.CREEK4  | 230 | 640286 N.PLATT4  | 230              | 1    |     | C:659185 ELSIETP7  | 115                | 659243 ELSIE    | 7               | 115                 | 1   |     |   |
| REGION2 | REGION8_I | 3437 | -0.0506 | 524764 NORRIS_TP | 3   | 115              | 524822 CURRY     | 3    | 115 | 1                  | C:765341 COMANCH5  | 345             | 765342 MED-LDG5 | 345                 | 1   |     |   |
| REGION2 | REGION9_I | 374  | -0.0362 | 505418 JONESB05  | 161 | 505420 HERGETT5  | 161              | 1    |     | C:505410 KENNETT5  | 161                | 505412 PARAGLD5 | 161             | 1                   |     |     |   |
| REGION2 | REGION9_I | 411  | -0.0307 | 640267 MAXWELS7  | 115 | 640287 N.PLATT7  | 115              | 1    |     | C:640093 C.CREEK4  | 230                | 640286 N.PLATT4 | 230             | 1                   |     |     |   |
| REGION2 | REGION9_I | 540  | 0.0579  | 659134 SIDNEY    | 4   | 230              | 659136 SIDNEY*4  | 230  | 1   | C:640302 OGALALA4  | 230                | 659134 SIDNEY   | 4               | 230                 | 1   |     |   |
| REGION2 | REGION9_I | 542  | -0.0579 | 652572 SIDNEY    | 7   | 115              | 659136 SIDNEY*4  | 230  | 1   | C:640302 OGALALA4  | 230                | 659134 SIDNEY   | 4               | 230                 | 1   |     |   |
| REGION2 | REGION9_I | 596  | 0.2326  | 524502 NORTON    | 3   | 115              | 524822 CURRY     | 3    | 115 | 1                  | C:524502 NORTON    | 3               | 115             | 524509 FE-TUCMCARI3 | 115 | 1   |   |
| REGION2 | REGION9_I | 690  | 0.0636  | 659132 OGALALA7  | 115 | 659187 ROSCOE    | 7                | 115  | 1   | C:640183 GENTLMN3  | 345                | 640252 KEYSTON3 | 345             | 1                   |     |     |   |
| REGION2 | REGION9_I | 751  | -0.0437 | 526475 YUMA_INTG | 3   | 115              | 526524 WOLFFORTH | 3    | 115 | 1                  | C:525524 TOLK_EAST | 6               | 230             | 525830 TUCO_INT     | 6   | 230 | 1 |
| REGION2 | REGION9_I | 830  | 0.1429  | 640253 KEYSTON7  | 115 | 659132 OGALALA7  | 115              | 1    |     | C:640183 GENTLMN3  | 345                | 640252 KEYSTON3 | 345             | 1                   |     |     |   |
| REGION2 | REGION9_I | 843  | -0.0636 | 659185 ELSIETP7  | 115 | 659187 ROSCOE    | 7                | 115  | 1   | C:640183 GENTLMN3  | 345                | 640252 KEYSTON3 | 345             | 1                   |     |     |   |
| REGION2 | REGION9_I | 898  | 0.0579  | 652572 SIDNEY    | 7   | 115              | 659238 COLTON    | 7    | 115 | 1                  | C:640302 OGALALA4  | 230             | 659134 SIDNEY   | 4                   | 230 | 1   |   |
| REGION2 | REGION9_I | 924  | -0.0580 | 524669 DS-#20    | 3   | 115              | 524822 CURRY     | 3    | 115 | 1                  | C:524623 DEAFSMITH | 6               | 230             | 525481 PLANTX       | 6   | 230 | 1 |
| REGION2 | REGION9_I | 943  | -0.2496 | 640302 OGALALA4  | 230 | 659134 SIDNEY    | 4                | 230  | 1   | C:640183 GENTLMN3  | 345                | 640252 KEYSTON3 | 345             | 1                   |     |     |   |
| REGION2 | REGION9_I | 950  | 0.1120  | 640302 OGALALA4  | 230 | 659132 OGALALA7  | 115              | 1    |     | C:640184 GENTLMN4  | 230                | 640302 OGALALA4 | 230             | 1                   |     |     |   |
| REGION2 | REGION9_I | 968  | -0.0579 | 652300 CHAPPEL7  | 115 | 659238 COLTON    | 7                | 115  | 1   | C:640302 OGALALA4  | 230                | 659134 SIDNEY   | 4               | 230                 | 1   |     |   |
| REGION2 | REGION9_I | 1005 | -0.3158 | 640184 GENTLMN4  | 230 | 640302 OGALALA4  | 230              | 1    |     | C:640183 GENTLMN3  | 345                | 640252 KEYSTON3 | 345             | 1                   |     |     |   |
| REGION2 | REGION9_I | 1024 | 0.2326  | 524486 CAPROCK   | 3   | 115              | 524502 NORTON    | 3    | 115 | 1                  | Base Case          |                 |                 |                     |     |     |   |
| REGION2 | REGION9_I | 1170 | 0.1429  | 640252 KEYSTON3  | 345 | B\$0588 KEYST    | T1               | 1.00 | 1   | C:640183 GENTLMN3  | 345                | 640252 KEYSTON3 | 345             | 1                   |     |     |   |
| REGION2 | REGION9_I | 1171 | -0.1429 | 640253 KEYSTON7  | 115 | B\$0588 KEYST    | T1               | 1.00 | 1   | C:640183 GENTLMN3  | 345                | 640252 KEYSTON3 | 345             | 1                   |     |     |   |
| REGION2 | REGION9_I | 1175 | 0.1395  | 525524 TOLK_EAST | 6   | 230              | 525830 TUCO_INT  | 6    | 230 | 1                  | C:526435 SUNDOWN   | 6               | 230             | 526525 WOLFFORTH    | 6   | 230 | 1 |
| REGION2 | REGION9_I | 1185 | -0.0579 | 640246 JULSTAP7  | 115 | 652300 CHAPPEL7  | 115              | 1    |     | C:640302 OGALALA4  | 230                | 659134 SIDNEY   | 4               | 230                 | 1   |     |   |
| REGION2 | REGION9_I | 1304 | -0.0580 | 524662 PARMER_CO | 3   | 115              | 524669 DS-#20    | 3    | 115 | 1                  | C:524623 DEAFSMITH | 6               | 230             | 525481 PLANTX       | 6   | 230 | 1 |
| REGION2 | REGION9_I | 1339 | -0.0580 | 524648 CARGILL   | 3   | 115              | 524662 PARMER_CO | 3    | 115 | 1                  | C:524623 DEAFSMITH | 6               | 230             | 525481 PLANTX       | 6   | 230 | 1 |

|         |            |      |         |                    |     |                    |      |   |                      |     |                     |     |   |
|---------|------------|------|---------|--------------------|-----|--------------------|------|---|----------------------|-----|---------------------|-----|---|
| REGION2 | REGION9_I  | 1431 | -0.0323 | 640238 JEFFREY7    | 115 | 640287 N.PLATT7    | 115  | 1 | C:640093 C.CREEK4    | 230 | 640286 N.PLATT4     | 230 | 1 |
| REGION2 | REGION9_I  | 1495 | 0.0636  | 659185 ELSIETP7    | 115 | 659186 PAXTON 7    | 115  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION9_I  | 1530 | -0.0437 | 526176 DOUD3       | 115 | 526475 YUMA_INTG 3 | 115  | 1 | C:525524 TOLK_EAST 6 | 230 | 525830 TUCO_INT 6   | 230 | 1 |
| REGION2 | REGION9_I  | 2256 | 0.0492  | 524648 CARGILL 3   | 115 | 524655 FRIONA 3    | 115  | 1 | C:659130 GRANTNB7    | 115 | 659188 SPCREEK7     | 115 | 1 |
| REGION2 | REGION9_I  | 2573 | -0.0492 | 524606 HEREFORD 3  | 115 | 524655 FRIONA 3    | 115  | 1 | C:659130 GRANTNB7    | 115 | 659188 SPCREEK7     | 115 | 1 |
| REGION2 | REGION9_I  | 2583 | -0.1074 | 500410 HOPKINS4    | 138 | 500774 SEGURA4     | 138  | 1 | C:652302 JULESBG7    | 115 | 659240 INTERST7     | 115 | 1 |
| REGION2 | REGION9_I  | 2598 | -0.0370 | 640068 B.SPRGS7    | 115 | 640246 JULSTAP7    | 115  | 1 | C:652302 JULESBG7    | 115 | 659240 INTERST7     | 115 | 1 |
| REGION2 | REGION9_I  | 2777 | -0.0884 | 502401 FLANDER6    | 230 | 502402 ACADIAN6    | 230  | 1 | C:652302 JULESBG7    | 115 | 659240 INTERST7     | 115 | 1 |
| REGION2 | REGION10_I | 405  | -0.0312 | 640267 MAXWELS7    | 115 | 640287 N.PLATT7    | 115  | 1 | C:640093 C.CREEK4    | 230 | 640286 N.PLATT4     | 230 | 1 |
| REGION2 | REGION10_I | 540  | 0.0579  | 659134 SIDNEY 4    | 230 | 659136 SIDNEY*4    | 230  | 1 | C:640302 OGALALA4    | 230 | 659134 SIDNEY 4     | 230 | 1 |
| REGION2 | REGION10_I | 542  | -0.0579 | 652572 SIDNEY 7    | 115 | 659136 SIDNEY*4    | 230  | 1 | C:640302 OGALALA4    | 230 | 659134 SIDNEY 4     | 230 | 1 |
| REGION2 | REGION10_I | 596  | 0.2326  | 524502 NORTON 3    | 115 | 524822 CURRY 3     | 115  | 1 | C:524502 NORTON 3    | 115 | 524509 FE-TUCMCARI3 | 115 | 1 |
| REGION2 | REGION10_I | 691  | 0.0636  | 659132 OGALALA7    | 115 | 659187 ROSCOE 7    | 115  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION10_I | 754  | -0.0436 | 526475 YUMA_INTG 3 | 115 | 526524 WOLFFORTH 3 | 115  | 1 | C:525524 TOLK_EAST 6 | 230 | 525830 TUCO_INT 6   | 230 | 1 |
| REGION2 | REGION10_I | 832  | 0.1426  | 640253 KEYSTON7    | 115 | 659132 OGALALA7    | 115  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION10_I | 844  | -0.0636 | 659185 ELSIETP7    | 115 | 659187 ROSCOE 7    | 115  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION10_I | 898  | 0.0579  | 652572 SIDNEY 7    | 115 | 659238 COLTON 7    | 115  | 1 | C:640302 OGALALA4    | 230 | 659134 SIDNEY 4     | 230 | 1 |
| REGION2 | REGION10_I | 923  | -0.0581 | 524669 DS-#20 3    | 115 | 524822 CURRY 3     | 115  | 1 | C:524623 DEAFSMITH 6 | 230 | 525481 PLANTX 6     | 230 | 1 |
| REGION2 | REGION10_I | 944  | -0.2493 | 640302 OGALALA4    | 230 | 659134 SIDNEY 4    | 230  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION10_I | 951  | 0.1119  | 640302 OGALALA4    | 230 | 659132 OGALALA7    | 115  | 1 | C:640184 GENTLMN4    | 230 | 640302 OGALALA4     | 230 | 1 |
| REGION2 | REGION10_I | 968  | -0.0579 | 652300 CHAPPEL7    | 115 | 659238 COLTON 7    | 115  | 1 | C:640302 OGALALA4    | 230 | 659134 SIDNEY 4     | 230 | 1 |
| REGION2 | REGION10_I | 1007 | -0.3154 | 640184 GENTLMN4    | 230 | 640302 OGALALA4    | 230  | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION10_I | 1024 | 0.2326  | 524486 CAPROCK 3   | 115 | 524502 NORTON 3    | 115  | 1 | Base Case            |     |                     |     |   |
| REGION2 | REGION10_I | 1173 | 0.1426  | 640252 KEYSTON3    | 345 | B\$0588 KEYST T1   | 1.00 | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION10_I | 1174 | -0.1426 | 640253 KEYSTON7    | 115 | B\$0588 KEYST T1   | 1.00 | 1 | C:640183 GENTLMN3    | 345 | 640252 KEYSTON3     | 345 | 1 |
| REGION2 | REGION10_I | 1180 | 0.1389  | 525524 TOLK_EAST 6 | 230 | 525830 TUCO_INT 6  | 230  | 1 | C:526435 SUNDOWN 6   | 230 | 526525 WOLFFORTH 6  | 230 | 1 |
| REGION2 | REGION10_I | 1186 | -0.0579 | 640246 JULSTAP7    | 115 | 652300 CHAPPEL7    | 115  | 1 | C:640302 OGALALA4    | 230 | 659134 SIDNEY 4     | 230 | 1 |
| REGION2 | REGION10_I | 1221 | -0.2603 | 505428 SIKESTN5    | 161 | 505434 IDALIA 5    | 161  | 1 | C:505400 N MADRD5    | 161 | 505428 SIKESTN5     | 161 | 1 |
| REGION2 | REGION10_I | 1301 | -0.0581 | 524662 PARMER_CO 3 | 115 | 524669 DS-#20 3    | 115  | 1 | C:524623 DEAFSMITH 6 | 230 | 525481 PLANTX 6     | 230 | 1 |
| REGION2 | REGION10_I | 1336 | -0.0581 | 524648 CARGILL 3   | 115 | 524662 PARMER_CO 3 | 115  | 1 | C:524623 DEAFSMITH 6 | 230 | 525481 PLANTX 6     | 230 | 1 |

|         |            |      |         |                   |     |                    |      |   |                               |     |                   |     |   |
|---------|------------|------|---------|-------------------|-----|--------------------|------|---|-------------------------------|-----|-------------------|-----|---|
| REGION2 | REGION10_I | 1422 | -0.0325 | 640238 JEFFREY7   | 115 | 640287 N.PLATT7    | 115  | 1 | C:640093 C.CREEK4             | 230 | 640286 N.PLATT4   | 230 | 1 |
| REGION2 | REGION10_I | 1497 | 0.0636  | 659185 ELSIETP7   | 115 | 659186 PAXTON 7    | 115  | 1 | C:640183 GENTLMN3             | 345 | 640252 KEYSTON3   | 345 | 1 |
| REGION2 | REGION10_I | 2216 | 0.1204  | 505400 N MADRD5   | 161 | 505428 SIKESTN5    | 161  | 1 | C:765341 COMANCH5             | 345 | 765342 MED-LDG5   | 345 | 1 |
| REGION2 | REGION10_I | 2253 | 0.0493  | 524648 CARGILL 3  | 115 | 524655 FRIONA 3    | 115  | 1 | C:659130 GRANTNB7             | 115 | 659188 SPCREEK7   | 115 | 1 |
| REGION2 | REGION10_I | 2569 | -0.0493 | 524606 HEREFORD 3 | 115 | 524655 FRIONA 3    | 115  | 1 | C:659130 GRANTNB7             | 115 | 659188 SPCREEK7   | 115 | 1 |
| REGION2 | REGION10_I | 2826 | -0.3023 | 640183 GENTLMN3   | 345 | 640252 KEYSTON3    | 345  | 1 | C:659132 OGALALA7             | 115 | 659187 ROSCOE 7   | 115 | 1 |
| REGION2 | REGION10_I | 2865 | 0.1079  | 524822 CURRY 3    | 115 | 524908 ROOSEVELT 3 | 115  | 2 | C:765341 COMANCH5             | 345 | 765342 MED-LDG5   | 345 | 1 |
| REGION2 | REGION10_I | 3090 | -0.0641 | 640093 C.CREEK4   | 230 | 640286 N.PLATT4    | 230  | 1 | C:659185 ELSIETP7             | 115 | 659243 ELSIE 7    | 115 | 1 |
| REGION3 | REGION4_I  | 242  | 0.0829  | 530553 S HAYS 3   | 115 | 530562 HAYS 3      | 115  | 1 | C:530558 KNOLL 6              | 230 | 530561 KNOLL 3    | 115 | 1 |
| REGION3 | REGION4_I  | 351  | 0.1530  | 539667 HAGGARD3   | 115 | 539699 W-DODGE3    | 115  | 1 | C:3Wnd: OPEN B\$0524 HAGGARD3 | 1   |                   |     |   |
| REGION3 | REGION4_I  | 424  | 0.0829  | 530562 HAYS 3     | 115 | 530591 VINE 3      | 115  | 1 | C:530558 KNOLL 6              | 230 | 530561 KNOLL 3    | 115 | 1 |
| REGION3 | REGION4_I  | 637  | -0.1530 | 539667 HAGGARD3   | 115 | B\$0525 HAGGARD3   | 1.00 | 1 | C:531476 SWNDTAP3             | 115 | 531478 IRSKDOL3   | 115 | 1 |
| REGION3 | REGION4_I  | 666  | -0.0829 | 530561 KNOLL 3    | 115 | 530581 N HAYS3     | 115  | 1 | C:530558 KNOLL 6              | 230 | 530561 KNOLL 3    | 115 | 1 |
| REGION3 | REGION4_I  | 683  | 0.2478  | 514785 WOODWRD4   | 138 | 515785 WINDFRM4    | 138  | 1 | C:520920 FTSUPLY4             | 138 | 520922 SLEEPING   | 138 | 1 |
| REGION3 | REGION4_I  | 692  | -0.1530 | 539688 S-DODGE3   | 115 | 539699 W-DODGE3    | 115  | 1 | C:3Wnd: OPEN B\$0524 HAGGARD3 | 1   |                   |     |   |
| REGION3 | REGION4_I  | 726  | 0.0909  | 520920 FTSUPLY4   | 138 | B\$0462 FTSUPPLY2  | 1.00 | 2 | C:520920 FTSUPLY4             | 138 | 520957 IODINE 4   | 138 | 1 |
| REGION3 | REGION4_I  | 726  | 0.0909  | 520920 FTSUPLY4   | 138 | B\$0461 FTSUPPLY   | 1.00 | 1 | C:520920 FTSUPLY4             | 138 | 520957 IODINE 4   | 138 | 1 |
| REGION3 | REGION4_I  | 764  | -0.1819 | 520920 FTSUPLY4   | 138 | 520922 SLEEPING    | 138  | 1 | Base Case                     |     |                   |     |   |
| REGION3 | REGION4_I  | 774  | -0.0351 | 640253 KEYSTON7   | 115 | 640255 KINGSLY7    | 115  | 1 | C:640103 CANADAY7             | 115 | 640242 JOHN.2 7   | 115 | 1 |
| REGION3 | REGION4_I  | 828  | 0.1530  | 539688 S-DODGE3   | 115 | 539771 NOR-JUD3    | 115  | 1 | C:3Wnd: OPEN B\$0524 HAGGARD3 | 1   |                   |     |   |
| REGION3 | REGION4_I  | 979  | -0.0473 | 640238 JEFFREY7   | 115 | 640287 N.PLATT7    | 115  | 1 | C:640093 C.CREEK4             | 230 | 640286 N.PLATT4   | 230 | 1 |
| REGION3 | REGION4_I  | 987  | -0.0829 | 530553 S HAYS 3   | 115 | 530582 S HAYS6     | 230  | 1 | C:530558 KNOLL 6              | 230 | 530561 KNOLL 3    | 115 | 1 |
| REGION3 | REGION4_I  | 1078 | 0.0971  | 530558 KNOLL 6    | 230 | 530561 KNOLL 3     | 115  | 1 | C:530553 S HAYS 3             | 115 | 530582 S HAYS6    | 230 | 1 |
| REGION3 | REGION4_I  | 1087 | 0.1241  | 524266 BUSHLAND 3 | 115 | 524306 COULTER3    | 115  | 1 | C:523959 POTTER_CO 6          | 230 | 524267 BUSHLAND 6 | 230 | 1 |
| REGION3 | REGION4_I  | 1114 | 0.1543  | 520957 IODINE 4   | 138 | 520999 MOORLND4    | 138  | 1 | Base Case                     |     |                   |     |   |
| REGION3 | REGION4_I  | 1170 | -0.1241 | 524266 BUSHLAND 3 | 115 | 524267 BUSHLAND 6  | 230  | 1 | C:523959 POTTER_CO 6          | 230 | 524267 BUSHLAND 6 | 230 | 1 |
| REGION3 | REGION4_I  | 1282 | 0.2292  | 515785 WINDFRM4   | 138 | 520999 MOORLND4    | 138  | 1 | C:520920 FTSUPLY4             | 138 | 520922 SLEEPING   | 138 | 1 |
| REGION3 | REGION4_I  | 1287 | -0.1530 | 539694 SPEARVL3   | 115 | 539771 NOR-JUD3    | 115  | 1 | C:539671 JUD-LRG3             | 115 | 539771 NOR-JUD3   | 115 | 1 |
| REGION3 | REGION4_I  | 1287 | -0.1530 | 539671 JUD-LRG3   | 115 | 539771 NOR-JUD3    | 115  | 1 | C:539694 SPEARVL3             | 115 | 539771 NOR-JUD3   | 115 | 1 |
| REGION3 | REGION4_I  | 1320 | 0.1543  | 520920 FTSUPLY4   | 138 | 520957 IODINE 4    | 138  | 1 | Base Case                     |     |                   |     |   |



|         |           |      |         |                    |                                |                                                  |
|---------|-----------|------|---------|--------------------|--------------------------------|--------------------------------------------------|
| REGION3 | REGION4_I | 1467 | 0.0431  | 640286 N.PLATT4    | 230 B\$0692 N.PLATTE T8 1.00 1 | C:3Wnd: OPEN B\$0693 N.PLATTE T9 2               |
| REGION3 | REGION4_I | 1467 | 0.0431  | 640286 N.PLATT4    | 230 B\$0693 N.PLATTE T9 1.00 2 | C:3Wnd: OPEN B\$0692 N.PLATTE T8 1               |
| REGION3 | REGION4_I | 1468 | -0.0431 | 640287 N.PLATT7    | 115 B\$0693 N.PLATTE T9 1.00 2 | C:3Wnd: OPEN B\$0692 N.PLATTE T8 1               |
| REGION3 | REGION4_I | 1468 | -0.0431 | 640287 N.PLATT7    | 115 B\$0692 N.PLATTE T8 1.00 1 | C:3Wnd: OPEN B\$0693 N.PLATTE T9 2               |
| REGION3 | REGION4_I | 1764 | -0.2976 | 524267 BUSHLAND 6  | 230 524276 WILDOR_WND6 230 1   | C:650238 20&PIO 7 115 650251 30&A S07 115 1      |
| REGION3 | REGION4_I | 2454 | 0.1060  | 539694 SPEARVL3    | 115 B\$0891 SPEARVL6 1.00 1    | C:765341 COMANCH5 345 765342 MED-LDG5 345 1      |
| REGION3 | REGION4_I | 2455 | -0.1060 | 539695 SPEARVL6    | 230 B\$0891 SPEARVL6 1.00 1    | C:765341 COMANCH5 345 765342 MED-LDG5 345 1      |
| REGION3 | REGION4_I | 2529 | -0.1930 | 523959 POTTER_CO 6 | 230 524267 BUSHLAND 6 230 1    | C:646206 S1206 5 161 648199 SARP4&5T 161 1       |
| REGION3 | REGION5_I | 351  | 0.1530  | 539667 HAGGARD3    | 115 539699 W-DODGE3 115 1      | C:3Wnd: OPEN B\$0524 HAGGARD3 1                  |
| REGION3 | REGION5_I | 637  | -0.1530 | 539667 HAGGARD3    | 115 B\$0525 HAGGARD3 1.00 1    | C:533302 EEUREKA3 115 533308 VAUGHN 3 115 1      |
| REGION3 | REGION5_I | 692  | -0.1530 | 539688 S-DODGE3    | 115 539699 W-DODGE3 115 1      | C:3Wnd: OPEN B\$0524 HAGGARD3 1                  |
| REGION3 | REGION5_I | 726  | 0.0909  | 520920 FTSUPPLY4   | 138 B\$0461 FTSUPPLY 1.00 1    | C:520920 FTSUPPLY4 138 520957 IODINE 4 138 1     |
| REGION3 | REGION5_I | 726  | 0.0909  | 520920 FTSUPPLY4   | 138 B\$0462 FTSUPPLY2 1.00 2   | C:520920 FTSUPPLY4 138 520957 IODINE 4 138 1     |
| REGION3 | REGION5_I | 764  | -0.1819 | 520920 FTSUPPLY4   | 138 520922 SLEEPING 138 1      | Base Case                                        |
| REGION3 | REGION5_I | 774  | -0.0351 | 640253 KEYSTON7    | 115 640255 KINGSLY7 115 1      | C:3Wnd: OPEN B\$0536 HEC 122X 1                  |
| REGION3 | REGION5_I | 828  | 0.1530  | 539688 S-DODGE3    | 115 539771 NOR-JUD3 115 1      | C:3Wnd: OPEN B\$0524 HAGGARD3 1                  |
| REGION3 | REGION5_I | 1115 | 0.1210  | 524266 BUSHLAND 3  | 115 524306 COULTER3 115 1      | C:523959 POTTER_CO 6 230 524267 BUSHLAND 6 230 1 |
| REGION3 | REGION5_I | 1200 | -0.1210 | 524266 BUSHLAND 3  | 115 524267 BUSHLAND 6 230 1    | C:523959 POTTER_CO 6 230 524267 BUSHLAND 6 230 1 |
| REGION3 | REGION5_I | 1259 | 0.1365  | 520957 IODINE 4    | 138 520999 MOORLND4 138 1      | Base Case                                        |
| REGION3 | REGION5_I | 1287 | -0.1530 | 539671 JUD-LRG3    | 115 539771 NOR-JUD3 115 1      | C:539694 SPEARVL3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION5_I | 1287 | -0.1530 | 539694 SPEARVL3    | 115 539771 NOR-JUD3 115 1      | C:539671 JUD-LRG3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION5_I | 1492 | 0.1365  | 520920 FTSUPPLY4   | 138 520957 IODINE 4 138 1      | Base Case                                        |
| REGION3 | REGION5_I | 1500 | 0.1530  | 539694 SPEARVL3    | 115 B\$0891 SPEARVL6 1.00 1    | C:539671 JUD-LRG3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION5_I | 1501 | -0.1530 | 539695 SPEARVL6    | 230 B\$0891 SPEARVL6 1.00 1    | C:539671 JUD-LRG3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION5_I | 1764 | -0.2976 | 524267 BUSHLAND 6  | 230 524276 WILDOR_WND6 230 1   | C:646298 S1298 5 161 646305 S1305 5 161 1        |
| REGION3 | REGION5_I | 2618 | -0.1866 | 523959 POTTER_CO 6 | 230 524267 BUSHLAND 6 230 1    | C:659130 GRANTNB7 115 659188 SPCREEK7 115 1      |
| REGION3 | REGION5_I | 3367 | -0.0397 | 514785 WOODWRD4    | 138 515785 WINDFRM4 138 1      | C:646281 S1281 5 161 646287 S1287 5 161 1        |
| REGION3 | REGION5_I | 3775 | -0.0496 | 531449 HOLCOMB7    | 345 B\$0548 HOLCOMB 1.00 1     | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION5_I | 3775 | 0.0496  | 531448 HOLCOMB3    | 115 B\$0548 HOLCOMB 1.00 1     | C:652302 JULESBG7 115 659240 INTERST7 115 1      |
| REGION3 | REGION5_I | 3845 | -0.0325 | 539664 GRNBURG3    | 115 539671 JUD-LRG3 115 1      | C:765341 COMANCH5 345 765342 MED-LDG5 345 1      |



|         |           |      |         |                                                |                                                  |
|---------|-----------|------|---------|------------------------------------------------|--------------------------------------------------|
| REGION3 | REGION5_I | 3897 | 0.0732  | 524267 BUSHLAND 6 230 524623 DEAFSMITH 6 230 1 | C:765341 COMANCH5 345 765342 MED-LDG5 345 1      |
| REGION3 | REGION5_I | 4317 | 0.0325  | 539664 GRNBURG3 115 539697 SUNCITY3 115 1      | C:765341 COMANCH5 345 765342 MED-LDG5 345 1      |
| REGION3 | REGION5_I | 4435 | -0.0325 | 539673 MED-LDG3 115 539697 SUNCITY3 115 1      | C:765341 COMANCH5 345 765342 MED-LDG5 345 2      |
| REGION3 | REGION5_I | 4887 | 0.0385  | 525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1 | C:765341 COMANCH5 345 765342 MED-LDG5 345 2      |
| REGION3 | REGION5_I | 4914 | -0.0403 | 640093 C.CREEK4 230 640286 N.PLATT4 230 1      | C:659185 ELSIETP7 115 659243 ELSIE 7 115 1       |
| REGION3 | REGION5_I | 5150 | 0.0314  | 511458 ELKCTY-4 138 511485 CLINTJC4 138 1      | C:765341 COMANCH5 345 765342 MED-LDG5 345 1      |
| REGION3 | REGION5_I | 5214 | -0.0430 | 523771 GRAPEVINE 6 230 524044 NICHOLS 6 230 1  | C:765341 COMANCH5 345 765342 MED-LDG5 345 1      |
| REGION3 | REGION5_I | 5834 | 0.0455  | 511490 ELKCITY6 230 B\$0420 ELKCTY-6 1.00 1    | C:765341 COMANCH5 345 765342 MED-LDG5 345 1      |
| REGION3 | REGION6_I | 351  | 0.1530  | 539667 HAGGARD3 115 539699 W-DODGE3 115 1      | C:3Wnd: OPEN B\$0524 HAGGARD3 1                  |
| REGION3 | REGION6_I | 637  | -0.1530 | 539667 HAGGARD3 115 B\$0525 HAGGARD3 1.00 1    | C:3Wnd: OPEN B\$0488 GR.IS T2 1                  |
| REGION3 | REGION6_I | 692  | -0.1530 | 539688 S-DODGE3 115 539699 W-DODGE3 115 1      | C:3Wnd: OPEN B\$0524 HAGGARD3 1                  |
| REGION3 | REGION6_I | 726  | 0.0909  | 520920 FTSUPPLY4 138 B\$0462 FTSUPPLY2 1.00 2  | C:520920 FTSUPPLY4 138 520957 IODINE 4 138 1     |
| REGION3 | REGION6_I | 726  | 0.0909  | 520920 FTSUPPLY4 138 B\$0461 FTSUPPLY 1.00 1   | C:520920 FTSUPPLY4 138 520957 IODINE 4 138 1     |
| REGION3 | REGION6_I | 764  | -0.1819 | 520920 FTSUPPLY4 138 520922 SLEEPING 138 1     | Base Case                                        |
| REGION3 | REGION6_I | 774  | -0.0351 | 640253 KEYSTON7 115 640255 KINGSLY7 115 1      | C:520814 ANADARK4 138 520923 GEORGIA4 138 1      |
| REGION3 | REGION6_I | 828  | 0.1530  | 539688 S-DODGE3 115 539771 NOR-JUD3 115 1      | C:3Wnd: OPEN B\$0524 HAGGARD3 1                  |
| REGION3 | REGION6_I | 1108 | 0.1217  | 524266 BUSHLAND 3 115 524306 COULTER3 115 1    | C:523959 POTTER_CO 6 230 524267 BUSHLAND 6 230 1 |
| REGION3 | REGION6_I | 1193 | -0.1217 | 524266 BUSHLAND 3 115 524267 BUSHLAND 6 230 1  | C:523959 POTTER_CO 6 230 524267 BUSHLAND 6 230 1 |
| REGION3 | REGION6_I | 1264 | 0.1360  | 520957 IODINE 4 138 520999 MOORLND4 138 1      | Base Case                                        |
| REGION3 | REGION6_I | 1287 | -0.1530 | 539694 SPEARVL3 115 539771 NOR-JUD3 115 1      | C:539671 JUD-LRG3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION6_I | 1287 | -0.1530 | 539671 JUD-LRG3 115 539771 NOR-JUD3 115 1      | C:539694 SPEARVL3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION6_I | 1498 | 0.1360  | 520920 FTSUPPLY4 138 520957 IODINE 4 138 1     | Base Case                                        |
| REGION3 | REGION6_I | 1500 | 0.1530  | 539694 SPEARVL3 115 B\$0891 SPEARVL6 1.00 1    | C:539671 JUD-LRG3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION6_I | 1501 | -0.1530 | 539695 SPEARVL6 230 B\$0891 SPEARVL6 1.00 1    | C:539671 JUD-LRG3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION6_I | 1600 | -0.2976 | 524267 BUSHLAND 6 230 524276 WILDOR_WND6 230 1 | Base Case                                        |
| REGION3 | REGION6_I | 1632 | -0.0698 | 539659 CUDAHY 3 115 539671 JUD-LRG3 115 1      | C:539694 SPEARVL3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION6_I | 1752 | -0.0698 | 539646 KISMET 3 115 539659 CUDAHY 3 115 1      | C:539694 SPEARVL3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION6_I | 2591 | -0.1884 | 523959 POTTER_CO 6 230 524267 BUSHLAND 6 230 1 | C:646206 S1206 5 161 648199 SARP4&5T 161 1       |
| REGION3 | REGION6_I | 2973 | -0.0446 | 514785 WOODWRD4 138 515785 WINDFRM4 138 1      | C:646206 S1206 5 161 648199 SARP4&5T 161 1       |
| REGION3 | REGION6_I | 3600 | -0.0347 | 539664 GRNBURG3 115 539671 JUD-LRG3 115 1      | C:765341 COMANCH5 345 765342 MED-LDG5 345 1      |

|         |           |      |         |                    |                        |      |   |                               |                       |       |
|---------|-----------|------|---------|--------------------|------------------------|------|---|-------------------------------|-----------------------|-------|
| REGION3 | REGION6_I | 3735 | -0.0501 | 531449 HOLCOMB7    | 345 B\$0548 HOLCOMB    | 1.00 | 1 | C:652302 JULESBG7             | 115 659240 INTERST7   | 115 1 |
| REGION3 | REGION6_I | 3735 | 0.0501  | 531448 HOLCOMB3    | 115 B\$0548 HOLCOMB    | 1.00 | 1 | C:652302 JULESBG7             | 115 659240 INTERST7   | 115 1 |
| REGION3 | REGION6_I | 3993 | 0.0715  | 524267 BUSHLAND 6  | 230 524623 DEAFSMITH 6 | 230  | 1 | C:765341 COMANCH5             | 345 765342 MED-LDG5   | 345 2 |
| REGION3 | REGION6_I | 4042 | 0.0347  | 539664 GRNBURG3    | 115 539697 SUNCITY3    | 115  | 1 | C:765341 COMANCH5             | 345 765342 MED-LDG5   | 345 2 |
| REGION3 | REGION6_I | 4152 | -0.0347 | 539673 MED-LDG3    | 115 539697 SUNCITY3    | 115  | 1 | C:765341 COMANCH5             | 345 765342 MED-LDG5   | 345 1 |
| REGION3 | REGION6_I | 4571 | -0.0433 | 640093 C.CREEK4    | 230 640286 N.PLATT4    | 230  | 1 | C:659185 ELSIETP7             | 115 659243 ELSIE 7    | 115 1 |
| REGION3 | REGION6_I | 5115 | 0.0368  | 525524 TOLK_EAST 6 | 230 525830 TUCO_INT 6  | 230  | 1 | C:765341 COMANCH5             | 345 765342 MED-LDG5   | 345 1 |
| REGION3 | REGION6_I | 5888 | -0.0381 | 523771 GRAPEVINE 6 | 230 524044 NICHOLS 6   | 230  | 1 | C:765341 COMANCH5             | 345 765342 MED-LDG5   | 345 2 |
| REGION3 | REGION7_I | 351  | 0.1530  | 539667 HAGGARD3    | 115 539699 W-DODGE3    | 115  | 1 | C:3wnd: OPEN B\$0524 HAGGARD3 | 1                     |       |
| REGION3 | REGION7_I | 637  | -0.1530 | 539667 HAGGARD3    | 115 B\$0525 HAGGARD3   | 1.00 | 1 | C:541232 LEX161 5             | 161 541236 RICHMND5   | 161 1 |
| REGION3 | REGION7_I | 692  | -0.1530 | 539688 S-DODGE3    | 115 539699 W-DODGE3    | 115  | 1 | C:3wnd: OPEN B\$0524 HAGGARD3 | 1                     |       |
| REGION3 | REGION7_I | 726  | 0.0909  | 520920 FTSUPPLY4   | 138 B\$0462 FTSUPPLY2  | 1.00 | 2 | C:520920 FTSUPPLY4            | 138 520957 IODINE 4   | 138 1 |
| REGION3 | REGION7_I | 726  | 0.0909  | 520920 FTSUPPLY4   | 138 B\$0461 FTSUPPLY   | 1.00 | 1 | C:520920 FTSUPPLY4            | 138 520957 IODINE 4   | 138 1 |
| REGION3 | REGION7_I | 764  | -0.1819 | 520920 FTSUPPLY4   | 138 520922 SLEEPING    | 138  | 1 | Base Case                     |                       |       |
| REGION3 | REGION7_I | 774  | -0.0351 | 640253 KEYSTON7    | 115 640255 KINGSLY7    | 115  | 1 | C:514778 CLEOCOR4             | 138 514789 MENOTAP4   | 138 1 |
| REGION3 | REGION7_I | 828  | 0.1530  | 539688 S-DODGE3    | 115 539771 NOR-JUD3    | 115  | 1 | C:3wnd: OPEN B\$0524 HAGGARD3 | 1                     |       |
| REGION3 | REGION7_I | 1113 | 0.1211  | 524266 BUSHLAND 3  | 115 524306 COULTER3    | 115  | 1 | C:523959 POTTER_CO 6          | 230 524267 BUSHLAND 6 | 230 1 |
| REGION3 | REGION7_I | 1198 | -0.1211 | 524266 BUSHLAND 3  | 115 524267 BUSHLAND 6  | 230  | 1 | C:523959 POTTER_CO 6          | 230 524267 BUSHLAND 6 | 230 1 |
| REGION3 | REGION7_I | 1261 | 0.1363  | 520957 IODINE 4    | 138 520999 MOORLND4    | 138  | 1 | Base Case                     |                       |       |
| REGION3 | REGION7_I | 1287 | -0.1530 | 539671 JUD-LRG3    | 115 539771 NOR-JUD3    | 115  | 1 | C:539694 SPEARVL3             | 115 539771 NOR-JUD3   | 115 1 |
| REGION3 | REGION7_I | 1287 | -0.1530 | 539694 SPEARVL3    | 115 539771 NOR-JUD3    | 115  | 1 | C:539671 JUD-LRG3             | 115 539771 NOR-JUD3   | 115 1 |
| REGION3 | REGION7_I | 1494 | 0.1363  | 520920 FTSUPPLY4   | 138 520957 IODINE 4    | 138  | 1 | Base Case                     |                       |       |
| REGION3 | REGION7_I | 1500 | 0.1530  | 539694 SPEARVL3    | 115 B\$0891 SPEARVL6   | 1.00 | 1 | C:539671 JUD-LRG3             | 115 539771 NOR-JUD3   | 115 1 |
| REGION3 | REGION7_I | 1501 | -0.1530 | 539695 SPEARVL6    | 230 B\$0891 SPEARVL6   | 1.00 | 1 | C:539671 JUD-LRG3             | 115 539771 NOR-JUD3   | 115 1 |
| REGION3 | REGION7_I | 1764 | -0.2976 | 524267 BUSHLAND 6  | 230 524276 WILDOR_WND6 | 230  | 1 | C:765341 COMANCH5             | 345 765342 MED-LDG5   | 345 1 |
| REGION3 | REGION7_I | 2612 | -0.1870 | 523959 POTTER_CO 6 | 230 524267 BUSHLAND 6  | 230  | 1 | C:765341 COMANCH5             | 345 765342 MED-LDG5   | 345 1 |
| REGION3 | REGION7_I | 3180 | -0.0417 | 514785 WOODWRD4    | 138 515785 WINDFRM4    | 138  | 1 | C:765341 COMANCH5             | 345 765342 MED-LDG5   | 345 1 |
| REGION3 | REGION7_I | 3578 | -0.0349 | 539664 GRNBURG3    | 115 539671 JUD-LRG3    | 115  | 1 | C:765341 COMANCH5             | 345 765342 MED-LDG5   | 345 1 |
| REGION3 | REGION7_I | 3745 | -0.0500 | 531449 HOLCOMB7    | 345 B\$0548 HOLCOMB    | 1.00 | 1 | C:765341 COMANCH5             | 345 765342 MED-LDG5   | 345 1 |
| REGION3 | REGION7_I | 3745 | 0.0500  | 531448 HOLCOMB3    | 115 B\$0548 HOLCOMB    | 1.00 | 1 | C:765341 COMANCH5             | 345 765342 MED-LDG5   | 345 1 |

|         |           |      |         |                                                |                                                  |
|---------|-----------|------|---------|------------------------------------------------|--------------------------------------------------|
| REGION3 | REGION7_I | 3923 | 0.0727  | 524267 BUSHLAND 6 230 524623 DEAFSMITH 6 230 1 | C:765341 COMANCH5 345 765342 MED-LDG5 345 2      |
| REGION3 | REGION7_I | 4018 | 0.0349  | 539664 GRNBURG3 115 539697 SUNCITY3 115 1      | C:765341 COMANCH5 345 765342 MED-LDG5 345 1      |
| REGION3 | REGION7_I | 4127 | -0.0349 | 539673 MED-LDG3 115 539697 SUNCITY3 115 1      | C:765341 COMANCH5 345 765342 MED-LDG5 345 2      |
| REGION3 | REGION7_I | 4354 | 0.0306  | 539673 MED-LDG3 115 B\$0652 MED-LDG4 1.00 1    | C:765341 COMANCH5 345 765342 MED-LDG5 345 2      |
| REGION3 | REGION7_I | 4361 | -0.0306 | 539674 MED-LDG4 138 B\$0652 MED-LDG4 1.00 1    | C:765341 COMANCH5 345 765342 MED-LDG5 345 1      |
| REGION3 | REGION7_I | 4821 | -0.0422 | 640093 C.CREEK4 230 640286 N.PLATT4 230 1      | C:765341 COMANCH5 345 765342 MED-LDG5 345 2      |
| REGION3 | REGION7_I | 4945 | 0.0380  | 525524 TOLK_EAST 6 230 525830 TUCO_INT 6 230 1 | C:765341 COMANCH5 345 765342 MED-LDG5 345 2      |
| REGION3 | REGION7_I | 5643 | -0.0397 | 523771 GRAPEVINE 6 230 524044 NICHOLS 6 230 1  | C:765341 COMANCH5 345 765342 MED-LDG5 345 2      |
| REGION3 | REGION8_I | 351  | 0.1530  | 539667 HAGGARD3 115 539699 W-DODGE3 115 1      | C:3Wnd: OPEN B\$0524 HAGGARD3 1                  |
| REGION3 | REGION8_I | 637  | -0.1530 | 539667 HAGGARD3 115 B\$0525 HAGGARD3 1.00 1    | C:532791 BENTON 7 345 532796 WICHITA7 345 1      |
| REGION3 | REGION8_I | 692  | -0.1530 | 539688 S-DODGE3 115 539699 W-DODGE3 115 1      | C:3Wnd: OPEN B\$0524 HAGGARD3 1                  |
| REGION3 | REGION8_I | 726  | 0.0909  | 520920 FTSUPPLY4 138 B\$0461 FTSUPPLY 1.00 1   | C:520920 FTSUPPLY4 138 520957 IODINE 4 138 1     |
| REGION3 | REGION8_I | 726  | 0.0909  | 520920 FTSUPPLY4 138 B\$0462 FTSUPPLY2 1.00 2  | C:520920 FTSUPPLY4 138 520957 IODINE 4 138 1     |
| REGION3 | REGION8_I | 764  | -0.1819 | 520920 FTSUPPLY4 138 520922 SLEEPING 138 1     | Base Case                                        |
| REGION3 | REGION8_I | 774  | -0.0351 | 640253 KEYSTON7 115 640255 KINGSLY7 115 1      | C:527848 LEA_CNTY 3 115 528334 LE-LOVINTN3 115 1 |
| REGION3 | REGION8_I | 828  | 0.1530  | 539688 S-DODGE3 115 539771 NOR-JUD3 115 1      | C:3Wnd: OPEN B\$0524 HAGGARD3 1                  |
| REGION3 | REGION8_I | 1116 | 0.1208  | 524266 BUSHLAND 3 115 524306 COULTER3 115 1    | C:523959 POTTER_CO 6 230 524267 BUSHLAND 6 230 1 |
| REGION3 | REGION8_I | 1201 | -0.1208 | 524266 BUSHLAND 3 115 524267 BUSHLAND 6 230 1  | C:523959 POTTER_CO 6 230 524267 BUSHLAND 6 230 1 |
| REGION3 | REGION8_I | 1260 | 0.1365  | 520957 IODINE 4 138 520999 MOORLND4 138 1      | Base Case                                        |
| REGION3 | REGION8_I | 1287 | -0.1530 | 539694 SPEARVL3 115 539771 NOR-JUD3 115 1      | C:539671 JUD-LRG3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION8_I | 1287 | -0.1530 | 539671 JUD-LRG3 115 539771 NOR-JUD3 115 1      | C:539694 SPEARVL3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION8_I | 1492 | 0.1365  | 520920 FTSUPPLY4 138 520957 IODINE 4 138 1     | Base Case                                        |
| REGION3 | REGION8_I | 1500 | 0.1530  | 539694 SPEARVL3 115 B\$0891 SPEARVL6 1.00 1    | C:539671 JUD-LRG3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION8_I | 1501 | -0.1530 | 539695 SPEARVL6 230 B\$0891 SPEARVL6 1.00 1    | C:539671 JUD-LRG3 115 539771 NOR-JUD3 115 1      |
| REGION3 | REGION8_I | 1764 | -0.2976 | 524267 BUSHLAND 6 230 524276 WILDOR_WND6 230 1 | C:659192 LYNN 7 115 659197 SNAKECK7 115 1        |
| REGION3 | REGION8_I | 2622 | -0.1863 | 523959 POTTER_CO 6 230 524267 BUSHLAND 6 230 1 | C:659130 GRANTNB7 115 659188 SPCREEK7 115 1      |
| REGION3 | REGION8_I | 3270 | -0.0409 | 514785 WOODWRD4 138 515785 WINDFRM4 138 1      | C:659130 GRANTNB7 115 659188 SPCREEK7 115 1      |
| REGION3 | REGION8_I | 3628 | -0.0344 | 539664 GRNBURG3 115 539671 JUD-LRG3 115 1      | C:765341 COMANCH5 345 765342 MED-LDG5 345 1      |
| REGION3 | REGION8_I | 3708 | -0.0505 | 531449 HOLCOMB7 345 B\$0548 HOLCOMB 1.00 1     | C:659185 ELSIETP7 115 659243 ELSIE 7 115 1       |
| REGION3 | REGION8_I | 3708 | 0.0505  | 531448 HOLCOMB3 115 B\$0548 HOLCOMB 1.00 1     | C:659185 ELSIETP7 115 659243 ELSIE 7 115 1       |

|         |           |      |         |                    |                        |        |                               |                       |       |
|---------|-----------|------|---------|--------------------|------------------------|--------|-------------------------------|-----------------------|-------|
| REGION3 | REGION8_I | 3877 | -0.0355 | 507774 NORAM 4     | 138 508808 LONGWD 4    | 138 1  | C:659185 ELSIETP7             | 115 659243 ELSIE 7    | 115 1 |
| REGION3 | REGION8_I | 3880 | 0.0735  | 524267 BUSHLAND 6  | 230 524623 DEAFSMITH 6 | 230 1  | C:765341 COMANCH5             | 345 765342 MED-LDG5   | 345 1 |
| REGION3 | REGION8_I | 3970 | -0.0355 | 507749 RAINES 4    | 138 507774 NORAM 4     | 138 1  | C:659185 ELSIETP7             | 115 659243 ELSIE 7    | 115 1 |
| REGION3 | REGION8_I | 4075 | 0.0344  | 539664 GRNBURG3    | 115 539697 SUNCITY3    | 115 1  | C:765341 COMANCH5             | 345 765342 MED-LDG5   | 345 2 |
| REGION3 | REGION8_I | 4186 | -0.0344 | 539673 MED-LDG3    | 115 539697 SUNCITY3    | 115 1  | C:765341 COMANCH5             | 345 765342 MED-LDG5   | 345 1 |
| REGION3 | REGION8_I | 4362 | 0.0306  | 539673 MED-LDG3    | 115 B\$0652 MED-LDG4   | 1.00 1 | C:765341 COMANCH5             | 345 765342 MED-LDG5   | 345 1 |
| REGION3 | REGION8_I | 4369 | -0.0306 | 539674 MED-LDG4    | 138 B\$0652 MED-LDG4   | 1.00 1 | C:765341 COMANCH5             | 345 765342 MED-LDG5   | 345 1 |
| REGION3 | REGION8_I | 4739 | -0.0355 | 507711 ARSHILL4    | 138 507749 RAINES 4    | 138 1  | C:659185 ELSIETP7             | 115 659243 ELSIE 7    | 115 1 |
| REGION3 | REGION9_I | 351  | 0.1530  | 539667 HAGGARD3    | 115 539699 W-DODGE3    | 115 1  | C:3Wnd: OPEN B\$0524 HAGGARD3 | 1                     |       |
| REGION3 | REGION9_I | 377  | -0.0359 | 505418 JONESB05    | 161 505420 HERGETT5    | 161 1  | C:505410 KENNETT5             | 161 505412 PARAGLD5   | 161 1 |
| REGION3 | REGION9_I | 637  | -0.1530 | 539667 HAGGARD3    | 115 B\$0525 HAGGARD3   | 1.00 1 | C:640124 COL.SE 7             | 115 640328 RISNGCY7   | 115 1 |
| REGION3 | REGION9_I | 692  | -0.1530 | 539688 S-DODGE3    | 115 539699 W-DODGE3    | 115 1  | C:3Wnd: OPEN B\$0524 HAGGARD3 | 1                     |       |
| REGION3 | REGION9_I | 726  | 0.0909  | 520920 FTSUPLY4    | 138 B\$0462 FTSUPPLY2  | 1.00 2 | C:520920 FTSUPLY4             | 138 520957 IODINE 4   | 138 1 |
| REGION3 | REGION9_I | 726  | 0.0909  | 520920 FTSUPLY4    | 138 B\$0461 FTSUPPLY   | 1.00 1 | C:520920 FTSUPLY4             | 138 520957 IODINE 4   | 138 1 |
| REGION3 | REGION9_I | 764  | -0.1819 | 520920 FTSUPLY4    | 138 520922 SLEEPING    | 138 1  | Base Case                     |                       |       |
| REGION3 | REGION9_I | 774  | -0.0351 | 640253 KEYSTON7    | 115 640255 KINGSLY7    | 115 1  | C:3Wnd: OPEN B\$0319 CHIKASI2 | 1                     |       |
| REGION3 | REGION9_I | 828  | 0.1530  | 539688 S-DODGE3    | 115 539771 NOR-JUD3    | 115 1  | C:3Wnd: OPEN B\$0524 HAGGARD3 | 1                     |       |
| REGION3 | REGION9_I | 1114 | 0.1211  | 524266 BUSHLAND 3  | 115 524306 COULTER3    | 115 1  | C:523959 POTTER_CO 6          | 230 524267 BUSHLAND 6 | 230 1 |
| REGION3 | REGION9_I | 1199 | -0.1211 | 524266 BUSHLAND 3  | 115 524267 BUSHLAND 6  | 230 1  | C:523959 POTTER_CO 6          | 230 524267 BUSHLAND 6 | 230 1 |
| REGION3 | REGION9_I | 1261 | 0.1364  | 520957 IODINE 4    | 138 520999 MOORLND4    | 138 1  | Base Case                     |                       |       |
| REGION3 | REGION9_I | 1287 | -0.1530 | 539694 SPEARVL3    | 115 539771 NOR-JUD3    | 115 1  | C:539671 JUD-LRG3             | 115 539771 NOR-JUD3   | 115 1 |
| REGION3 | REGION9_I | 1287 | -0.1530 | 539671 JUD-LRG3    | 115 539771 NOR-JUD3    | 115 1  | C:539694 SPEARVL3             | 115 539771 NOR-JUD3   | 115 1 |
| REGION3 | REGION9_I | 1494 | 0.1364  | 520920 FTSUPLY4    | 138 520957 IODINE 4    | 138 1  | Base Case                     |                       |       |
| REGION3 | REGION9_I | 1500 | 0.1530  | 539694 SPEARVL3    | 115 B\$0891 SPEARVL6   | 1.00 1 | C:539671 JUD-LRG3             | 115 539771 NOR-JUD3   | 115 1 |
| REGION3 | REGION9_I | 1501 | -0.1530 | 539695 SPEARVL6    | 230 B\$0891 SPEARVL6   | 1.00 1 | C:539671 JUD-LRG3             | 115 539771 NOR-JUD3   | 115 1 |
| REGION3 | REGION9_I | 1764 | -0.2976 | 524267 BUSHLAND 6  | 230 524276 WILDOR_WND6 | 230 1  | C:652302 JULESBG7             | 115 659240 INTERST7   | 115 1 |
| REGION3 | REGION9_I | 2581 | -0.1075 | 500410 HOPKINS4    | 138 500774 SEGURA4     | 138 1  | C:652302 JULESBG7             | 115 659240 INTERST7   | 115 1 |
| REGION3 | REGION9_I | 2611 | -0.1871 | 523959 POTTER_CO 6 | 230 524267 BUSHLAND 6  | 230 1  | C:659130 GRANTNB7             | 115 659188 SPCREEK7   | 115 1 |
| REGION3 | REGION9_I | 2777 | -0.0884 | 502401 FLANDER6    | 230 502402 ACADIAN6    | 230 1  | C:652302 JULESBG7             | 115 659240 INTERST7   | 115 1 |
| REGION3 | REGION9_I | 2957 | 0.0359  | 500740 RAMOS 4     | 138 503301 MRGNCTY4    | 138 1  | C:659236 BOXBUTE7             | 115 659237 HEMINGF7   | 115 1 |

|         |            |      |         |                    |     |                    |      |   |                               |     |                   |     |   |
|---------|------------|------|---------|--------------------|-----|--------------------|------|---|-------------------------------|-----|-------------------|-----|---|
| REGION3 | REGION9_I  | 2958 | 0.0825  | 500410 HOPKINS4    | 138 | 500580 MORBHAN4    | 138  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7   | 115 | 1 |
| REGION3 | REGION9_I  | 2969 | -0.0884 | 502402 ACADIAN6    | 230 | 502403 BONIN 6     | 230  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7   | 115 | 1 |
| REGION3 | REGION9_I  | 3063 | 0.1088  | 500410 HOPKINS4    | 138 | 500660 PATOUT 4    | 138  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7   | 115 | 1 |
| REGION3 | REGION9_I  | 3076 | -0.0434 | 514785 WOODWRD4    | 138 | 515785 WINDFRM4    | 138  | 1 | C:659130 GRANTNB7             | 115 | 659188 SPCREEK7   | 115 | 1 |
| REGION3 | REGION9_I  | 3421 | 0.1088  | 500660 PATOUT 4    | 138 | 500820 TECHE 4     | 138  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7   | 115 | 1 |
| REGION3 | REGION9_I  | 3596 | 0.0306  | 505410 KENNETT5    | 161 | 505412 PARAGLD5    | 161  | 1 | C:659130 GRANTNB7             | 115 | 659188 SPCREEK7   | 115 | 1 |
| REGION3 | REGION9_I  | 3633 | -0.0344 | 539664 GRNBURG3    | 115 | 539671 JUD-LRG3    | 115  | 1 | C:765341 COMANCH5             | 345 | 765342 MED-LDG5   | 345 | 2 |
| REGION3 | REGION9_I  | 3704 | -0.0422 | 505418 JONESBO5    | 161 | 505442 WATER V5    | 161  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7   | 115 | 1 |
| REGION3 | REGION10_I | 351  | 0.1530  | 539667 HAGGARD3    | 115 | 539699 W-DODGE3    | 115  | 1 | C:3Wnd: OPEN B\$0524 HAGGARD3 |     |                   |     | 1 |
| REGION3 | REGION10_I | 637  | -0.1530 | 539667 HAGGARD3    | 115 | B\$0525 HAGGARD3   | 1.00 | 1 | C:533236 COOP 3               | 115 | 533277 WAKARUS3   | 115 | 1 |
| REGION3 | REGION10_I | 692  | -0.1530 | 539688 S-DODGE3    | 115 | 539699 W-DODGE3    | 115  | 1 | C:3Wnd: OPEN B\$0524 HAGGARD3 |     |                   |     | 1 |
| REGION3 | REGION10_I | 726  | 0.0909  | 520920 FTSUPPLY4   | 138 | B\$0462 FTSUPPLY2  | 1.00 | 2 | C:520920 FTSUPPLY4            | 138 | 520957 IODINE 4   | 138 | 1 |
| REGION3 | REGION10_I | 726  | 0.0909  | 520920 FTSUPPLY4   | 138 | B\$0461 FTSUPPLY   | 1.00 | 1 | C:520920 FTSUPPLY4            | 138 | 520957 IODINE 4   | 138 | 1 |
| REGION3 | REGION10_I | 764  | -0.1819 | 520920 FTSUPPLY4   | 138 | 520922 SLEEPING    | 138  | 1 | Base Case                     |     |                   |     |   |
| REGION3 | REGION10_I | 774  | -0.0351 | 640253 KEYSTON7    | 115 | 640255 KINGSLY7    | 115  | 1 | C:541214 TWA 5                | 161 | 541230 RNRIDGE5   | 161 | 1 |
| REGION3 | REGION10_I | 828  | 0.1530  | 539688 S-DODGE3    | 115 | 539771 NOR-JUD3    | 115  | 1 | C:3Wnd: OPEN B\$0524 HAGGARD3 |     |                   |     | 1 |
| REGION3 | REGION10_I | 1112 | 0.1213  | 524266 BUSHLAND 3  | 115 | 524306 COULTER3    | 115  | 1 | C:523959 POTTER_CO 6          | 230 | 524267 BUSHLAND 6 | 230 | 1 |
| REGION3 | REGION10_I | 1197 | -0.1213 | 524266 BUSHLAND 3  | 115 | 524267 BUSHLAND 6  | 230  | 1 | C:523959 POTTER_CO 6          | 230 | 524267 BUSHLAND 6 | 230 | 1 |
| REGION3 | REGION10_I | 1221 | -0.2602 | 505428 SIKESTN5    | 161 | 505434 IDALIA 5    | 161  | 1 | C:505400 N MADRD5             | 161 | 505428 SIKESTN5   | 161 | 1 |
| REGION3 | REGION10_I | 1261 | 0.1363  | 520957 IODINE 4    | 138 | 520999 MOORLND4    | 138  | 1 | Base Case                     |     |                   |     |   |
| REGION3 | REGION10_I | 1287 | -0.1530 | 539671 JUD-LRG3    | 115 | 539771 NOR-JUD3    | 115  | 1 | C:539694 SPEARVL3             | 115 | 539771 NOR-JUD3   | 115 | 1 |
| REGION3 | REGION10_I | 1287 | -0.1530 | 539694 SPEARVL3    | 115 | 539771 NOR-JUD3    | 115  | 1 | C:539671 JUD-LRG3             | 115 | 539771 NOR-JUD3   | 115 | 1 |
| REGION3 | REGION10_I | 1764 | -0.2976 | 524267 BUSHLAND 6  | 230 | 524276 WILDOR_WND6 | 230  | 1 | C:650256 56&EV 7              | 115 | 650260 56&Q 7     | 115 | 1 |
| REGION3 | REGION10_I | 1824 | 0.1364  | 520920 FTSUPPLY4   | 138 | 520957 IODINE 4    | 138  | 1 | C:765341 COMANCH5             | 345 | 765342 MED-LDG5   | 345 | 1 |
| REGION3 | REGION10_I | 2207 | 0.1209  | 505400 N MADRD5    | 161 | 505428 SIKESTN5    | 161  | 1 | C:652570 ALIANCE7             | 115 | 659197 SNAKECK7   | 115 | 1 |
| REGION3 | REGION10_I | 2552 | 0.1022  | 539694 SPEARVL3    | 115 | B\$0891 SPEARVL6   | 1.00 | 1 | C:659132 OGALALA7             | 115 | 659187 ROSCOE 7   | 115 | 1 |
| REGION3 | REGION10_I | 2553 | -0.1022 | 539695 SPEARVL6    | 230 | B\$0891 SPEARVL6   | 1.00 | 1 | C:659132 OGALALA7             | 115 | 659187 ROSCOE 7   | 115 | 1 |
| REGION3 | REGION10_I | 2605 | -0.1875 | 523959 POTTER_CO 6 | 230 | 524267 BUSHLAND 6  | 230  | 1 | C:659130 GRANTNB7             | 115 | 659188 SPCREEK7   | 115 | 1 |
| REGION3 | REGION10_I | 2980 | -0.0448 | 514785 WOODWRD4    | 138 | 515785 WINDFRM4    | 138  | 1 | C:659130 GRANTNB7             | 115 | 659188 SPCREEK7   | 115 | 1 |
| REGION3 | REGION10_I | 3272 | 0.0811  | 507454 HEMPSTD4    | 138 | B\$0538 HEMP 1     | 1.00 | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7   | 115 | 1 |

|         |            |      |         |         |           |      |         |           |           |      |                                  |          |                                 |          |        |          |          |     |   |
|---------|------------|------|---------|---------|-----------|------|---------|-----------|-----------|------|----------------------------------|----------|---------------------------------|----------|--------|----------|----------|-----|---|
| REGION3 | REGION10_I | 3272 | -0.0811 | 507456  | HEMPSTD3  | 115  | B\$0538 | HEMP      | 1         | 1.00 | 1                                | C:652302 | JULESBG7                        | 115      | 659240 | INTERST7 | 115      | 1   |   |
| REGION3 | REGION10_I | 3333 | -0.0811 | 504122  | MCNAB     | 3    | 115     | 507456    | HEMPSTD3  |      | 115                              | 1        | C:652302                        | JULESBG7 | 115    | 659240   | INTERST7 | 115 | 1 |
| REGION3 | REGION10_I | 3395 | 0.0811  | 504122  | MCNAB     | 3    | 115     | 507453    | HOPE      | 3    | 115                              | 1        | C:652302                        | JULESBG7 | 115    | 659240   | INTERST7 | 115 | 1 |
| REGION3 | REGION10_I | 3636 | -0.0344 | 539664  | GRNBURG3  | 115  | 539671  | JUD-LRG3  |           |      | 115                              | 1        | C:765341                        | COMANCH5 | 345    | 765342   | MED-LDG5 | 345 | 2 |
| REGION3 | REGION10_I | 3731 | -0.0502 | 531449  | HOLCOMB7  | 345  | B\$0548 | HOLCOMB   |           | 1.00 | 1                                | C:652302 | JULESBG7                        | 115      | 659240 | INTERST7 | 115      | 1   |   |
| REGION3 | REGION10_I | 3731 | 0.0502  | 531448  | HOLCOMB3  | 115  | B\$0548 | HOLCOMB   |           | 1.00 | 1                                | C:652302 | JULESBG7                        | 115      | 659240 | INTERST7 | 115      | 1   |   |
| REGION3 | REGION10_I | 3940 | 0.0724  | 524267  | BUSHLAND  | 6    | 230     | 524623    | DEAFSMITH | 6    | 230                              | 1        | C:765341                        | COMANCH5 | 345    | 765342   | MED-LDG5 | 345 | 1 |
| REGION3 | REGION10_I | 4084 | 0.0344  | 539664  | GRNBURG3  | 115  | 539697  | SUNCITY3  |           |      | 115                              | 1        | C:765341                        | COMANCH5 | 345    | 765342   | MED-LDG5 | 345 | 1 |
| REGION4 | REGION5_I  | 915  | -0.1507 | 511485  | CLINTJC4  | 138  | 511534  | CL-NGTP4  |           |      | 138                              | 1        | C:511506                        | WTH WF 4 | 138    | 511536   | WEATHTP4 | 138 | 1 |
| REGION4 | REGION5_I  | 950  | -0.1769 | 514785  | WOODWRD4  | 138  | 515363  | CENT      | 4         |      | 138                              | 1        | C:511435                        | SNYDER-4 | 138    | 511440   | ALTUSJT4 | 138 | 1 |
| REGION4 | REGION5_I  | 1053 | -0.1362 | 514785  | WOODWRD4  | 138  | 515785  | WINDFRM4  |           |      | 138                              | 1        | C:515785                        | WINDFRM4 | 138    | 520999   | MOORLND4 | 138 | 1 |
| REGION4 | REGION5_I  | 1116 | -0.1362 | 515785  | WINDFRM4  | 138  | 515786  | FPLWIND4  |           |      | 138                              | 1        | Base Case                       |          |        |          |          |     |   |
| REGION4 | REGION5_I  | 1327 | 0.0452  | 640050  | AINSWND7  | 115  | 640051  | AINSWRT7  |           |      | 115                              | 1        | C:640305                        | ONEILL 7 | 115    | 640349   | SPENCER7 | 115 | 1 |
| REGION4 | REGION5_I  | 1439 | 0.1507  | 511506  | WTH WF 4  | 138  | 511536  | WEATHTP4  |           |      | 138                              | 1        | C:511506                        | WTH WF 4 | 138    | 511534   | CL-NGTP4 | 138 | 1 |
| REGION4 | REGION5_I  | 1439 | 0.1507  | 511506  | WTH WF 4  | 138  | 511534  | CL-NGTP4  |           |      | 138                              | 1        | C:511506                        | WTH WF 4 | 138    | 511536   | WEATHTP4 | 138 | 1 |
| REGION4 | REGION5_I  | 1499 | 0.3495  | 514785  | WOODWRD4  | 138  | 515376  | WWRDEHV4  |           |      | 138                              | 2        | C:514785                        | WOODWRD4 | 138    | 515376   | WWRDEHV4 | 138 | 1 |
| REGION4 | REGION5_I  | 1503 | 0.3485  | 514785  | WOODWRD4  | 138  | 515376  | WWRDEHV4  |           |      | 138                              | 1        | C:514785                        | WOODWRD4 | 138    | 515376   | WWRDEHV4 | 138 | 2 |
| REGION4 | REGION5_I  | 1530 | 0.0711  | 640050  | AINSWND7  | 115  | 640096  | CALAMS    | 7         |      | 115                              | 1        | C:640050                        | AINSWND7 | 115    | 640051   | AINSWRT7 | 115 | 1 |
| REGION4 | REGION5_I  | 1532 | 0.0711  | 640096  | CALAMS    | 7    | 115     | 640381    | THEDFRD7  |      | 115                              | 1        | C:640050                        | AINSWND7 | 115    | 640051   | AINSWRT7 | 115 | 1 |
| REGION4 | REGION5_I  | 1542 | -0.1507 | 511497  | WTH_SE 4  | 138  | 511536  | WEATHTP4  |           |      | 138                              | 1        | C:511506                        | WTH WF 4 | 138    | 511534   | CL-NGTP4 | 138 | 1 |
| REGION4 | REGION5_I  | 1616 | -0.0307 | B\$1039 | WTH_SE    | 1.00 | 511497  | WTH_SE 4  |           |      | 138                              | 1        | C:511506                        | WTH WF 4 | 138    | 511534   | CL-NGTP4 | 138 | 1 |
| REGION4 | REGION5_I  | 1746 | -0.3143 | B\$1041 | WWDEHV-T2 | 1.00 | 515376  | WWRDEHV4  |           |      | 138                              | 2        | C:3wnd: OPEN B\$1040 WWDEHV-T 1 |          |        |          |          |     |   |
| REGION4 | REGION5_I  | 1746 | 0.3143  | 515376  | WWRDEHV4  | 138  | B\$1040 | WWDEHV-T  | 1.00      | 1    | C:3wnd: OPEN B\$1041 WWDEHV-T2 2 |          |                                 |          |        |          |          |     |   |
| REGION4 | REGION5_I  | 1747 | -0.3143 | 515375  | WWRDEHV7  | 345  | B\$1040 | WWDEHV-T  | 1.00      | 1    | C:3wnd: OPEN B\$1041 WWDEHV-T2 2 |          |                                 |          |        |          |          |     |   |
| REGION4 | REGION5_I  | 1747 | -0.3143 | 515375  | WWRDEHV7  | 345  | B\$1041 | WWDEHV-T2 | 1.00      | 2    | C:3wnd: OPEN B\$1040 WWDEHV-T 1  |          |                                 |          |        |          |          |     |   |
| REGION4 | REGION5_I  | 1877 | -0.0782 | 511458  | ELKCTY-4  | 138  | 511485  | CLINTJC4  |           |      | 138                              | 1        | C:511489                        | WTH_JCT4 | 138    | 511497   | WTH_SE 4 | 138 | 1 |
| REGION4 | REGION5_I  | 1940 | -0.1200 | 511489  | WTH_JCT4  | 138  | 511497  | WTH_SE 4  |           |      | 138                              | 1        | C:511506                        | WTH WF 4 | 138    | 511534   | CL-NGTP4 | 138 | 1 |
| REGION4 | REGION5_I  | 2028 | 0.1200  | 511540  | CAN_GAS4  | 138  | 514821  | JENSEN    | 4         |      | 138                              | 1        | C:511506                        | WTH WF 4 | 138    | 511534   | CL-NGTP4 | 138 | 1 |
| REGION4 | REGION5_I  | 2037 | 0.1362  | 515785  | WINDFRM4  | 138  | 520999  | MOORLND4  |           |      | 138                              | 1        | C:514785                        | WOODWRD4 | 138    | 515785   | WINDFRM4 | 138 | 1 |
| REGION4 | REGION5_I  | 2107 | -0.1200 | 511433  | HINTON    | 4    | 138     | 511489    | WTH_JCT4  |      | 138                              | 1        | C:511506                        | WTH WF 4 | 138    | 511534   | CL-NGTP4 | 138 | 1 |



|         |           |      |         |                   |                       |        |                                |                       |       |
|---------|-----------|------|---------|-------------------|-----------------------|--------|--------------------------------|-----------------------|-------|
| REGION4 | REGION5_I | 2156 | -0.0386 | 514788 GLASMTN4   | 138 520999 MOORLND4   | 138 1  | C:514795 KNOBHIL4              | 138 520999 MOORLND4   | 138 1 |
| REGION4 | REGION5_I | 2164 | -0.0711 | 640359 STAPLTN7   | 115 640381 THEDFRD7   | 115 1  | C:640050 AINSWND7              | 115 640051 AINSWRT7   | 115 1 |
| REGION4 | REGION5_I | 2302 | -0.1347 | 530592 SMOKYHLLS6 | 230 530593 SMOKY_INT  | 230 1  | C:3wnd: OPEN B\$0365 CRAIG 33  | 33                    |       |
| REGION4 | REGION5_I | 2304 | -0.1347 | 530558 KNOLL 6    | 230 530592 SMOKYHLLS6 | 230 1  | C:530592 SMOKYHLLS6            | 230 532873 SUMMIT 6   | 230 1 |
| REGION4 | REGION5_I | 2304 | 0.1347  | 530592 SMOKYHLLS6 | 230 532873 SUMMIT 6   | 230 1  | C:530558 KNOLL 6               | 230 530592 SMOKYHLLS6 | 230 1 |
| REGION4 | REGION5_I | 2313 | -0.1122 | 514820 JENSENT4   | 138 514821 JENSEN 4   | 138 1  | C:511506 WTH WF 4              | 138 511534 CL-NGTP4   | 138 1 |
| REGION4 | REGION5_I | 2348 | -0.0711 | 640267 MAXWELS7   | 115 640359 STAPLTN7   | 115 1  | C:640050 AINSWND7              | 115 640051 AINSWRT7   | 115 1 |
| REGION4 | REGION5_I | 2359 | 0.1200  | 511433 HINTON 4   | 138 511540 CAN_GAS4   | 138 1  | C:511506 WTH WF 4              | 138 511534 CL-NGTP4   | 138 1 |
| REGION4 | REGION6_I | 915  | -0.1507 | 511485 CLINTJC4   | 138 511534 CL-NGTP4   | 138 1  | C:511506 WTH WF 4              | 138 511536 WEATHTP4   | 138 1 |
| REGION4 | REGION6_I | 950  | -0.1769 | 514785 WOODWRD4   | 138 515363 CENT 4     | 138 1  | C:514708 OTTER 4               | 138 514713 WRVALLY4   | 138 1 |
| REGION4 | REGION6_I | 1053 | -0.1362 | 514785 WOODWRD4   | 138 515785 WINDFRM4   | 138 1  | C:515785 WINDFRM4              | 138 520999 MOORLND4   | 138 1 |
| REGION4 | REGION6_I | 1116 | -0.1362 | 515785 WINDFRM4   | 138 515786 FPLWIND4   | 138 1  | Base Case                      |                       |       |
| REGION4 | REGION6_I | 1301 | 0.0461  | 640050 AINSWND7   | 115 640051 AINSWRT7   | 115 1  | C:640305 ONEILL 7              | 115 640349 SPENCER7   | 115 1 |
| REGION4 | REGION6_I | 1439 | 0.1507  | 511506 WTH WF 4   | 138 511534 CL-NGTP4   | 138 1  | C:511506 WTH WF 4              | 138 511536 WEATHTP4   | 138 1 |
| REGION4 | REGION6_I | 1439 | 0.1507  | 511506 WTH WF 4   | 138 511536 WEATHTP4   | 138 1  | C:511506 WTH WF 4              | 138 511534 CL-NGTP4   | 138 1 |
| REGION4 | REGION6_I | 1465 | 0.3575  | 514785 WOODWRD4   | 138 515376 WWRDEHV4   | 138 2  | C:514785 WOODWRD4              | 138 515376 WWRDEHV4   | 138 1 |
| REGION4 | REGION6_I | 1469 | 0.3565  | 514785 WOODWRD4   | 138 515376 WWRDEHV4   | 138 1  | C:514785 WOODWRD4              | 138 515376 WWRDEHV4   | 138 2 |
| REGION4 | REGION6_I | 1530 | 0.0711  | 640050 AINSWND7   | 115 640096 CALAMS 7   | 115 1  | C:640050 AINSWND7              | 115 640051 AINSWRT7   | 115 1 |
| REGION4 | REGION6_I | 1532 | 0.0711  | 640096 CALAMS 7   | 115 640381 THEDFRD7   | 115 1  | C:640050 AINSWND7              | 115 640051 AINSWRT7   | 115 1 |
| REGION4 | REGION6_I | 1542 | -0.1507 | 511497 WTH_SE 4   | 138 511536 WEATHTP4   | 138 1  | C:511506 WTH WF 4              | 138 511534 CL-NGTP4   | 138 1 |
| REGION4 | REGION6_I | 1589 | -0.0312 | B\$1039 WTH_SE    | 1.00 511497 WTH_SE 4  | 138 1  | C:511506 WTH WF 4              | 138 511534 CL-NGTP4   | 138 1 |
| REGION4 | REGION6_I | 1695 | -0.3237 | B\$1041 WWDEHV-T2 | 1.00 515376 WWRDEHV4  | 138 2  | C:3wnd: OPEN B\$1040 WWDEHV-T  | 1                     |       |
| REGION4 | REGION6_I | 1695 | 0.3237  | 515376 WWRDEHV4   | 138 B\$1040 WWDEHV-T  | 1.00 1 | C:3wnd: OPEN B\$1041 WWDEHV-T2 | 2                     |       |
| REGION4 | REGION6_I | 1696 | -0.3237 | 515375 WWRDEHV7   | 345 B\$1041 WWDEHV-T2 | 1.00 2 | C:3wnd: OPEN B\$1040 WWDEHV-T  | 1                     |       |
| REGION4 | REGION6_I | 1696 | -0.3237 | 515375 WWRDEHV7   | 345 B\$1040 WWDEHV-T  | 1.00 1 | C:3wnd: OPEN B\$1041 WWDEHV-T2 | 2                     |       |
| REGION4 | REGION6_I | 1800 | -0.0816 | 511458 ELKCTY-4   | 138 511485 CLINTJC4   | 138 1  | C:511489 WTH_JCT4              | 138 511497 WTH_SE 4   | 138 1 |
| REGION4 | REGION6_I | 1949 | -0.1194 | 511489 WTH_JCT4   | 138 511497 WTH_SE 4   | 138 1  | C:511506 WTH WF 4              | 138 511534 CL-NGTP4   | 138 1 |
| REGION4 | REGION6_I | 2036 | 0.1194  | 511540 CAN_GAS4   | 138 514821 JENSEN 4   | 138 1  | C:511506 WTH WF 4              | 138 511534 CL-NGTP4   | 138 1 |
| REGION4 | REGION6_I | 2037 | 0.1362  | 515785 WINDFRM4   | 138 520999 MOORLND4   | 138 1  | C:514785 WOODWRD4              | 138 515785 WINDFRM4   | 138 1 |
| REGION4 | REGION6_I | 2117 | -0.1194 | 511433 HINTON 4   | 138 511489 WTH_JCT4   | 138 1  | C:511506 WTH WF 4              | 138 511534 CL-NGTP4   | 138 1 |



|         |           |      |         |                   |      |                   |      |   |                                  |     |                   |     |   |
|---------|-----------|------|---------|-------------------|------|-------------------|------|---|----------------------------------|-----|-------------------|-----|---|
| REGION4 | REGION6_I | 2120 | -0.0393 | 514788 GLASMTN4   | 138  | 520999 MOORLND4   | 138  | 1 | C:514795 KNOBHIL4                | 138 | 520999 MOORLND4   | 138 | 1 |
| REGION4 | REGION6_I | 2164 | -0.0711 | 640359 STAPLTN7   | 115  | 640381 THEDFRD7   | 115  | 1 | C:640050 AINSWND7                | 115 | 640051 AINSWRT7   | 115 | 1 |
| REGION4 | REGION6_I | 2302 | -0.1347 | 530592 SMOKYHLLS6 | 230  | 530593 SMOKY_INT  | 230  | 1 | C:532772 STRANGR7                | 345 | 542977 CRAIG 7    | 345 | 1 |
| REGION4 | REGION6_I | 2304 | -0.1347 | 530558 KNOLL 6    | 230  | 530592 SMOKYHLLS6 | 230  | 1 | C:530592 SMOKYHLLS6              | 230 | 532873 SUMMIT 6   | 230 | 1 |
| REGION4 | REGION6_I | 2304 | 0.1347  | 530592 SMOKYHLLS6 | 230  | 532873 SUMMIT 6   | 230  | 1 | C:530558 KNOLL 6                 | 230 | 530592 SMOKYHLLS6 | 230 | 1 |
| REGION4 | REGION6_I | 2331 | -0.1113 | 514820 JENSENT4   | 138  | 514821 JENSEN 4   | 138  | 1 | C:511506 WTH WF 4                | 138 | 511534 CL-NGTP4   | 138 | 1 |
| REGION4 | REGION6_I | 2348 | -0.0711 | 640267 MAXWELS7   | 115  | 640359 STAPLTN7   | 115  | 1 | C:640050 AINSWND7                | 115 | 640051 AINSWRT7   | 115 | 1 |
| REGION4 | REGION6_I | 2369 | 0.1194  | 511433 HINTON 4   | 138  | 511540 CAN_GAS4   | 138  | 1 | C:511506 WTH WF 4                | 138 | 511534 CL-NGTP4   | 138 | 1 |
| REGION4 | REGION7_I | 915  | -0.1507 | 511485 CLINTJC4   | 138  | 511534 CL-NGTP4   | 138  | 1 | C:511506 WTH WF 4                | 138 | 511536 WEATHTP4   | 138 | 1 |
| REGION4 | REGION7_I | 950  | -0.1769 | 514785 WOODWRD4   | 138  | 515363 CENT 4     | 138  | 1 | C:511509 53CACHE4                | 138 | 511537 ARTVLTP4   | 138 | 1 |
| REGION4 | REGION7_I | 1053 | -0.1362 | 514785 WOODWRD4   | 138  | 515785 WINDFRM4   | 138  | 1 | C:515785 WINDFRM4                | 138 | 520999 MOORLND4   | 138 | 1 |
| REGION4 | REGION7_I | 1116 | -0.1362 | 515785 WINDFRM4   | 138  | 515786 FPLWIND4   | 138  | 1 | Base Case                        |     |                   |     |   |
| REGION4 | REGION7_I | 1303 | 0.0460  | 640050 AINSWND7   | 115  | 640051 AINSWRT7   | 115  | 1 | C:640305 ONEILL 7                | 115 | 640349 SPENCER7   | 115 | 1 |
| REGION4 | REGION7_I | 1439 | 0.1507  | 511506 WTH WF 4   | 138  | 511536 WEATHTP4   | 138  | 1 | C:511506 WTH WF 4                | 138 | 511534 CL-NGTP4   | 138 | 1 |
| REGION4 | REGION7_I | 1439 | 0.1507  | 511506 WTH WF 4   | 138  | 511534 CL-NGTP4   | 138  | 1 | C:511506 WTH WF 4                | 138 | 511536 WEATHTP4   | 138 | 1 |
| REGION4 | REGION7_I | 1472 | 0.3559  | 514785 WOODWRD4   | 138  | 515376 WWRDEHV4   | 138  | 2 | C:514785 WOODWRD4                | 138 | 515376 WWRDEHV4   | 138 | 1 |
| REGION4 | REGION7_I | 1476 | 0.3549  | 514785 WOODWRD4   | 138  | 515376 WWRDEHV4   | 138  | 1 | C:514785 WOODWRD4                | 138 | 515376 WWRDEHV4   | 138 | 2 |
| REGION4 | REGION7_I | 1530 | 0.0711  | 640050 AINSWND7   | 115  | 640096 CALAMS 7   | 115  | 1 | C:640050 AINSWND7                | 115 | 640051 AINSWRT7   | 115 | 1 |
| REGION4 | REGION7_I | 1532 | 0.0711  | 640096 CALAMS 7   | 115  | 640381 THEDFRD7   | 115  | 1 | C:640050 AINSWND7                | 115 | 640051 AINSWRT7   | 115 | 1 |
| REGION4 | REGION7_I | 1542 | -0.1507 | 511497 WTH_SE 4   | 138  | 511536 WEATHTP4   | 138  | 1 | C:511506 WTH WF 4                | 138 | 511534 CL-NGTP4   | 138 | 1 |
| REGION4 | REGION7_I | 1578 | -0.0315 | B\$1039 WTH_SE    | 1.00 | 511497 WTH_SE 4   | 138  | 1 | C:511506 WTH WF 4                | 138 | 511534 CL-NGTP4   | 138 | 1 |
| REGION4 | REGION7_I | 1706 | 0.3218  | 515376 WWRDEHV4   | 138  | B\$1040 WWDEHV-T  | 1.00 | 1 | C:3wnd: OPEN B\$1041 WWDEHV-T2 2 |     |                   |     |   |
| REGION4 | REGION7_I | 1706 | -0.3218 | B\$1041 WWDEHV-T2 | 1.00 | 515376 WWRDEHV4   | 138  | 2 | C:3wnd: OPEN B\$1040 WWDEHV-T 1  |     |                   |     |   |
| REGION4 | REGION7_I | 1706 | -0.3218 | 515375 WWRDEHV7   | 345  | B\$1041 WWDEHV-T2 | 1.00 | 2 | C:3wnd: OPEN B\$1040 WWDEHV-T 1  |     |                   |     |   |
| REGION4 | REGION7_I | 1706 | -0.3218 | 515375 WWRDEHV7   | 345  | B\$1040 WWDEHV-T  | 1.00 | 1 | C:3wnd: OPEN B\$1041 WWDEHV-T2 2 |     |                   |     |   |
| REGION4 | REGION7_I | 1831 | -0.0802 | 511458 ELKCTY-4   | 138  | 511485 CLINTJC4   | 138  | 1 | C:511489 WTH_JCT4                | 138 | 511497 WTH_SE 4   | 138 | 1 |
| REGION4 | REGION7_I | 1952 | -0.1192 | 511489 WTH_JCT4   | 138  | 511497 WTH_SE 4   | 138  | 1 | C:511506 WTH WF 4                | 138 | 511534 CL-NGTP4   | 138 | 1 |
| REGION4 | REGION7_I | 2037 | 0.1362  | 515785 WINDFRM4   | 138  | 520999 MOORLND4   | 138  | 1 | C:514785 WOODWRD4                | 138 | 515785 WINDFRM4   | 138 | 1 |
| REGION4 | REGION7_I | 2040 | 0.1192  | 511540 CAN_GAS4   | 138  | 514821 JENSEN 4   | 138  | 1 | C:511506 WTH WF 4                | 138 | 511534 CL-NGTP4   | 138 | 1 |
| REGION4 | REGION7_I | 2121 | -0.1192 | 511433 HINTON 4   | 138  | 511489 WTH_JCT4   | 138  | 1 | C:511506 WTH WF 4                | 138 | 511534 CL-NGTP4   | 138 | 1 |

|         |           |      |         |                    |      |                   |      |   |                                |     |                   |     |   |
|---------|-----------|------|---------|--------------------|------|-------------------|------|---|--------------------------------|-----|-------------------|-----|---|
| REGION4 | REGION7_I | 2162 | -0.0385 | 514788 GLASMTN4    | 138  | 520999 MOORLND4   | 138  | 1 | C:514795 KNOBHIL4              | 138 | 520999 MOORLND4   | 138 | 1 |
| REGION4 | REGION7_I | 2164 | -0.0711 | 640359 STAPLTN7    | 115  | 640381 THEDFRD7   | 115  | 1 | C:640050 AINSWND7              | 115 | 640051 AINSWRT7   | 115 | 1 |
| REGION4 | REGION7_I | 2302 | -0.1347 | 530592 SMOKYHLLS6  | 230  | 530593 SMOKY_INT  | 230  | 1 | C:512656 GRDA1 5               | 161 | 512742 GOOGLE5    | 161 | 1 |
| REGION4 | REGION7_I | 2304 | 0.1347  | 530592 SMOKYHLLS6  | 230  | 532873 SUMMIT 6   | 230  | 1 | C:530558 KNOLL 6               | 230 | 530592 SMOKYHLLS6 | 230 | 1 |
| REGION4 | REGION7_I | 2304 | -0.1347 | 530558 KNOLL 6     | 230  | 530592 SMOKYHLLS6 | 230  | 1 | C:530592 SMOKYHLLS6            | 230 | 532873 SUMMIT 6   | 230 | 1 |
| REGION4 | REGION7_I | 2343 | -0.1107 | 514820 JENSENT4    | 138  | 514821 JENSEN 4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4   | 138 | 1 |
| REGION4 | REGION7_I | 2348 | -0.0711 | 640267 MAXWELS7    | 115  | 640359 STAPLTN7   | 115  | 1 | C:640050 AINSWND7              | 115 | 640051 AINSWRT7   | 115 | 1 |
| REGION4 | REGION7_I | 2374 | 0.1192  | 511433 HINTON 4    | 138  | 511540 CAN_GAS4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4   | 138 | 1 |
| REGION4 | REGION8_I | 915  | -0.1507 | 511485 CLINTJC4    | 138  | 511534 CL-NGTP4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511536 WEATHTP4   | 138 | 1 |
| REGION4 | REGION8_I | 950  | -0.1769 | 514785 WOODWRD4    | 138  | 515363 CENT 4     | 138  | 1 | C:641085 E7THST 7              | 115 | 641088 HASTCTY7   | 115 | 1 |
| REGION4 | REGION8_I | 1053 | -0.1362 | 514785 WOODWRD4    | 138  | 515785 WINDFRM4   | 138  | 1 | C:515785 WINDFRM4              | 138 | 520999 MOORLND4   | 138 | 1 |
| REGION4 | REGION8_I | 1116 | -0.1362 | 515785 WINDFRM4    | 138  | 515786 FPLWIND4   | 138  | 1 | Base Case                      |     |                   |     |   |
| REGION4 | REGION8_I | 1294 | 0.0463  | 640050 AINSWND7    | 115  | 640051 AINSWRT7   | 115  | 1 | C:640305 ONEILL 7              | 115 | 640349 SPENCER7   | 115 | 1 |
| REGION4 | REGION8_I | 1439 | 0.1507  | 511506 WTH WF 4    | 138  | 511536 WEATHTP4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4   | 138 | 1 |
| REGION4 | REGION8_I | 1439 | 0.1507  | 511506 WTH WF 4    | 138  | 511534 CL-NGTP4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511536 WEATHTP4   | 138 | 1 |
| REGION4 | REGION8_I | 1490 | 0.3517  | 514785 WOODWRD4    | 138  | 515376 WWRDEHV4   | 138  | 2 | C:514785 WOODWRD4              | 138 | 515376 WWRDEHV4   | 138 | 1 |
| REGION4 | REGION8_I | 1494 | 0.3506  | 514785 WOODWRD4    | 138  | 515376 WWRDEHV4   | 138  | 1 | C:514785 WOODWRD4              | 138 | 515376 WWRDEHV4   | 138 | 2 |
| REGION4 | REGION8_I | 1529 | -0.0325 | B\$1039 WTH_SE     | 1.00 | 511497 WTH_SE 4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4   | 138 | 1 |
| REGION4 | REGION8_I | 1530 | 0.0711  | 640050 AINSWND7    | 115  | 640096 CALAMS 7   | 115  | 1 | C:640050 AINSWND7              | 115 | 640051 AINSWRT7   | 115 | 1 |
| REGION4 | REGION8_I | 1532 | 0.0711  | 640096 CALAMS 7    | 115  | 640381 THEDFRD7   | 115  | 1 | C:640050 AINSWND7              | 115 | 640051 AINSWRT7   | 115 | 1 |
| REGION4 | REGION8_I | 1542 | -0.1507 | 511497 WTH_SE 4    | 138  | 511536 WEATHTP4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4   | 138 | 1 |
| REGION4 | REGION8_I | 1731 | -0.3171 | B\$1041 WWDEHV-T2  | 1.00 | 515376 WWRDEHV4   | 138  | 2 | C:3wnd: OPEN B\$1040 WWDEHV-T  | 1   |                   |     |   |
| REGION4 | REGION8_I | 1731 | 0.3171  | 515376 WWRDEHV4    | 138  | B\$1040 WWDEHV-T  | 1.00 | 1 | C:3wnd: OPEN B\$1041 WWDEHV-T2 | 2   |                   |     |   |
| REGION4 | REGION8_I | 1732 | -0.3171 | 515375 WWRDEHV7    | 345  | B\$1040 WWDEHV-T  | 1.00 | 1 | C:3wnd: OPEN B\$1041 WWDEHV-T2 | 2   |                   |     |   |
| REGION4 | REGION8_I | 1732 | -0.3171 | 515375 WWRDEHV7    | 345  | B\$1041 WWDEHV-T2 | 1.00 | 2 | C:3wnd: OPEN B\$1040 WWDEHV-T  | 1   |                   |     |   |
| REGION4 | REGION8_I | 1737 | 0.0542  | 549984 BROOKLINE 7 | 345  | B\$0297 BRKLTX1   | 1.00 | 1 | C:3wnd: OPEN B\$0298 BRKLTX2   | 2   |                   |     |   |
| REGION4 | REGION8_I | 1741 | -0.0542 | 549969 BROOKLINE 5 | 161  | B\$0297 BRKLTX1   | 1.00 | 1 | C:3wnd: OPEN B\$0298 BRKLTX2   | 2   |                   |     |   |
| REGION4 | REGION8_I | 1763 | 0.0541  | 549984 BROOKLINE 7 | 345  | B\$0298 BRKLTX2   | 1.00 | 2 | C:3wnd: OPEN B\$0297 BRKLTX1   | 1   |                   |     |   |
| REGION4 | REGION8_I | 1765 | -0.0541 | 549969 BROOKLINE 5 | 161  | B\$0298 BRKLTX2   | 1.00 | 2 | C:3wnd: OPEN B\$0297 BRKLTX1   | 1   |                   |     |   |
| REGION4 | REGION8_I | 1909 | -0.0770 | 511458 ELKCTY-4    | 138  | 511485 CLINTJC4   | 138  | 1 | C:511489 WTH_JCT4              | 138 | 511497 WTH_SE 4   | 138 | 1 |

|         |           |      |         |                   |      |                   |      |   |                                |     |                 |     |   |
|---------|-----------|------|---------|-------------------|------|-------------------|------|---|--------------------------------|-----|-----------------|-----|---|
| REGION4 | REGION8_I | 1969 | -0.1182 | 511489 WTH_JCT4   | 138  | 511497 WTH_SE 4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4 | 138 | 1 |
| REGION4 | REGION8_I | 2037 | 0.1362  | 515785 WINDFRM4   | 138  | 520999 MOORLND4   | 138  | 1 | C:514785 WOODWRD4              | 138 | 515785 WINDFRM4 | 138 | 1 |
| REGION4 | REGION8_I | 2058 | 0.1182  | 511540 CAN_GAS4   | 138  | 514821 JENSEN 4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4 | 138 | 1 |
| REGION4 | REGION8_I | 2139 | -0.1182 | 511433 HINTON 4   | 138  | 511489 WTH_JCT4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4 | 138 | 1 |
| REGION4 | REGION8_I | 2164 | -0.0711 | 640359 STAPLTN7   | 115  | 640381 THEDFRD7   | 115  | 1 | C:640050 AINSWND7              | 115 | 640051 AINSWRT7 | 115 | 1 |
| REGION4 | REGION8_I | 2181 | -0.0382 | 514788 GLASMTN4   | 138  | 520999 MOORLND4   | 138  | 1 | C:514795 KNOBHIL4              | 138 | 520999 MOORLND4 | 138 | 1 |
| REGION4 | REGION8_I | 2302 | -0.1347 | 530592 SMOKYHLLS6 | 230  | 530593 SMOKY_INT  | 230  | 1 | C:532794 ROSEHIL7              | 345 | 532800 LATHAMS7 | 345 | 1 |
| REGION4 | REGION8_I | 2304 | -0.1347 | 530558 KNOLL 6    | 230  | 530592 SMOKYHLLS6 | 230  | 1 | C:530592 SMOKYHLLS6            | 230 | 532873 SUMMIT 6 | 230 | 1 |
| REGION4 | REGION9_I | 378  | -0.0358 | 505418 JONESB05   | 161  | 505420 HERGETT5   | 161  | 1 | C:505410 KENNETT5              | 161 | 505412 PARAGLD5 | 161 | 1 |
| REGION4 | REGION9_I | 915  | -0.1507 | 511485 CLINTJC4   | 138  | 511534 CL-NGTP4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511536 WEATHTP4 | 138 | 1 |
| REGION4 | REGION9_I | 950  | -0.1769 | 514785 WOODWRD4   | 138  | 515363 CENT 4     | 138  | 1 | C:510379 DELWARE4              | 138 | 512734 FARML 4  | 138 | 1 |
| REGION4 | REGION9_I | 1053 | -0.1362 | 514785 WOODWRD4   | 138  | 515785 WINDFRM4   | 138  | 1 | C:515785 WINDFRM4              | 138 | 520999 MOORLND4 | 138 | 1 |
| REGION4 | REGION9_I | 1116 | -0.1362 | 515785 WINDFRM4   | 138  | 515786 FPLWIND4   | 138  | 1 | Base Case                      |     |                 |     |   |
| REGION4 | REGION9_I | 1282 | 0.0468  | 640050 AINSWND7   | 115  | 640051 AINSWRT7   | 115  | 1 | C:640305 ONEILL 7              | 115 | 640349 SPENCER7 | 115 | 1 |
| REGION4 | REGION9_I | 1439 | 0.1507  | 511506 WTH WF 4   | 138  | 511536 WEATHTP4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4 | 138 | 1 |
| REGION4 | REGION9_I | 1439 | 0.1507  | 511506 WTH WF 4   | 138  | 511534 CL-NGTP4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511536 WEATHTP4 | 138 | 1 |
| REGION4 | REGION9_I | 1474 | 0.3554  | 514785 WOODWRD4   | 138  | 515376 WWRDEHV4   | 138  | 2 | C:514785 WOODWRD4              | 138 | 515376 WWRDEHV4 | 138 | 1 |
| REGION4 | REGION9_I | 1478 | 0.3544  | 514785 WOODWRD4   | 138  | 515376 WWRDEHV4   | 138  | 1 | C:514785 WOODWRD4              | 138 | 515376 WWRDEHV4 | 138 | 2 |
| REGION4 | REGION9_I | 1530 | 0.0711  | 640050 AINSWND7   | 115  | 640096 CALAMS 7   | 115  | 1 | C:640050 AINSWND7              | 115 | 640051 AINSWRT7 | 115 | 1 |
| REGION4 | REGION9_I | 1532 | 0.0711  | 640096 CALAMS 7   | 115  | 640381 THEDFRD7   | 115  | 1 | C:640050 AINSWND7              | 115 | 640051 AINSWRT7 | 115 | 1 |
| REGION4 | REGION9_I | 1542 | -0.1507 | 511497 WTH_SE 4   | 138  | 511536 WEATHTP4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4 | 138 | 1 |
| REGION4 | REGION9_I | 1575 | -0.0315 | B\$1039 WTH_SE    | 1.00 | 511497 WTH_SE 4   | 138  | 1 | C:511506 WTH WF 4              | 138 | 511534 CL-NGTP4 | 138 | 1 |
| REGION4 | REGION9_I | 1709 | 0.3211  | 515376 WWRDEHV4   | 138  | B\$1040 WWDEHV-T  | 1.00 | 1 | C:3wnd: OPEN B\$1041 WWDEHV-T2 | 2   |                 |     |   |
| REGION4 | REGION9_I | 1709 | -0.3211 | B\$1041 WWDEHV-T2 | 1.00 | 515376 WWRDEHV4   | 138  | 2 | C:3wnd: OPEN B\$1040 WWDEHV-T  | 1   |                 |     |   |
| REGION4 | REGION9_I | 1710 | -0.3211 | 515375 WWRDEHV7   | 345  | B\$1041 WWDEHV-T2 | 1.00 | 2 | C:3wnd: OPEN B\$1040 WWDEHV-T  | 1   |                 |     |   |
| REGION4 | REGION9_I | 1710 | -0.3211 | 515375 WWRDEHV7   | 345  | B\$1040 WWDEHV-T  | 1.00 | 1 | C:3wnd: OPEN B\$1041 WWDEHV-T2 | 2   |                 |     |   |
| REGION4 | REGION9_I | 1720 | 0.0342  | 505400 N MADRD5   | 161  | 505410 KENNETT5   | 161  | 1 | C:505418 JONESB05              | 161 | 505420 HERGETT5 | 161 | 1 |
| REGION4 | REGION9_I | 1797 | -0.0555 | 505418 JONESB05   | 161  | 505442 WATER V5   | 161  | 1 | C:505410 KENNETT5              | 161 | 505412 PARAGLD5 | 161 | 1 |
| REGION4 | REGION9_I | 1826 | -0.1173 | 502401 FLANDER6   | 230  | 502402 ACADIAN6   | 230  | 1 | C:500773 SEGURA 6              | 230 | 500776 SELLRD6  | 230 | 1 |
| REGION4 | REGION9_I | 1836 | -0.0800 | 511458 ELKCTY-4   | 138  | 511485 CLINTJC4   | 138  | 1 | C:511489 WTH_JCT4              | 138 | 511497 WTH_SE 4 | 138 | 1 |

|         |            |      |         |                   |                       |        |                                  |                     |       |
|---------|------------|------|---------|-------------------|-----------------------|--------|----------------------------------|---------------------|-------|
| REGION4 | REGION9_I  | 1932 | 0.0934  | 500330 FLANDR 4   | 138 500774 SEGURA4    | 138 1  | C:500773 SEGURA 6                | 230 500776 SELLRD6  | 230 1 |
| REGION4 | REGION9_I  | 1953 | -0.1192 | 511489 WTH_JCT4   | 138 511497 WTH_SE 4   | 138 1  | C:511506 WTH WF 4                | 138 511534 CL-NGTP4 | 138 1 |
| REGION4 | REGION9_I  | 1971 | -0.1173 | 502402 ACADIAN6   | 230 502403 BONIN 6    | 230 1  | C:500773 SEGURA 6                | 230 500776 SELLRD6  | 230 1 |
| REGION4 | REGION9_I  | 2016 | 0.1396  | 500410 HOPKINS4   | 138 500580 MORBHAN4   | 138 1  | C:500410 HOPKINS4                | 138 500660 PATOUT 4 | 138 1 |
| REGION4 | REGION9_I  | 2037 | 0.1362  | 515785 WINDFRM4   | 138 520999 MOORLND4   | 138 1  | C:514785 WOODWRD4                | 138 515785 WINDFRM4 | 138 1 |
| REGION4 | REGION9_I  | 2041 | 0.1192  | 511540 CAN_GAS4   | 138 514821 JENSEN 4   | 138 1  | C:511506 WTH WF 4                | 138 511534 CL-NGTP4 | 138 1 |
| REGION4 | REGION9_I  | 2055 | -0.1289 | 500410 HOPKINS4   | 138 500774 SEGURA4    | 138 1  | C:500100 BERWKTP4                | 138 500740 RAMOS 4  | 138 1 |
| REGION4 | REGION9_I  | 2121 | -0.1192 | 511433 HINTON 4   | 138 511489 WTH_JCT4   | 138 1  | C:511506 WTH WF 4                | 138 511534 CL-NGTP4 | 138 1 |
| REGION4 | REGION10_I | 915  | -0.1507 | 511485 CLINTJC4   | 138 511534 CL-NGTP4   | 138 1  | C:511506 WTH WF 4                | 138 511536 WEATHTP4 | 138 1 |
| REGION4 | REGION10_I | 950  | -0.1769 | 514785 WOODWRD4   | 138 515363 CENT 4     | 138 1  | C:509756 CARSN-S4                | 138 509777 KENSH-W4 | 138 1 |
| REGION4 | REGION10_I | 1053 | -0.1362 | 514785 WOODWRD4   | 138 515785 WINDFRM4   | 138 1  | C:515785 WINDFRM4                | 138 520999 MOORLND4 | 138 1 |
| REGION4 | REGION10_I | 1116 | -0.1362 | 515785 WINDFRM4   | 138 515786 FPLWIND4   | 138 1  | Base Case                        |                     |       |
| REGION4 | REGION10_I | 1221 | -0.2601 | 505428 SIKESTN5   | 161 505434 IDALIA 5   | 161 1  | C:505400 N MADRD5                | 161 505428 SIKESTN5 | 161 1 |
| REGION4 | REGION10_I | 1276 | 0.0470  | 640050 AINSWND7   | 115 640051 AINSWRT7   | 115 1  | C:640305 ONEILL 7                | 115 640349 SPENCER7 | 115 1 |
| REGION4 | REGION10_I | 1439 | 0.1507  | 511506 WTH WF 4   | 138 511536 WEATHTP4   | 138 1  | C:511506 WTH WF 4                | 138 511534 CL-NGTP4 | 138 1 |
| REGION4 | REGION10_I | 1439 | 0.1507  | 511506 WTH WF 4   | 138 511534 CL-NGTP4   | 138 1  | C:511506 WTH WF 4                | 138 511536 WEATHTP4 | 138 1 |
| REGION4 | REGION10_I | 1466 | 0.3575  | 514785 WOODWRD4   | 138 515376 WWRDEHV4   | 138 2  | C:514785 WOODWRD4                | 138 515376 WWRDEHV4 | 138 1 |
| REGION4 | REGION10_I | 1469 | 0.3564  | 514785 WOODWRD4   | 138 515376 WWRDEHV4   | 138 1  | C:514785 WOODWRD4                | 138 515376 WWRDEHV4 | 138 2 |
| REGION4 | REGION10_I | 1530 | 0.0711  | 640050 AINSWND7   | 115 640096 CALAMS 7   | 115 1  | C:640050 AINSWND7                | 115 640051 AINSWRT7 | 115 1 |
| REGION4 | REGION10_I | 1532 | 0.0711  | 640096 CALAMS 7   | 115 640381 THEDFRD7   | 115 1  | C:640050 AINSWND7                | 115 640051 AINSWRT7 | 115 1 |
| REGION4 | REGION10_I | 1542 | -0.1507 | 511497 WTH_SE 4   | 138 511536 WEATHTP4   | 138 1  | C:511506 WTH WF 4                | 138 511534 CL-NGTP4 | 138 1 |
| REGION4 | REGION10_I | 1568 | 0.1861  | 505400 N MADRD5   | 161 505428 SIKESTN5   | 161 1  | C:505428 SIKESTN5                | 161 505434 IDALIA 5 | 161 1 |
| REGION4 | REGION10_I | 1572 | -0.0316 | B\$1039 WTH_SE    | 1.00 511497 WTH_SE 4  | 138 1  | C:511506 WTH WF 4                | 138 511534 CL-NGTP4 | 138 1 |
| REGION4 | REGION10_I | 1697 | 0.3234  | 515376 WWRDEHV4   | 138 B\$1040 WWDEHV-T  | 1.00 1 | C:3wnd: OPEN B\$1041 WWDEHV-T2 2 |                     |       |
| REGION4 | REGION10_I | 1697 | -0.3234 | B\$1041 WWDEHV-T2 | 1.00 515376 WWRDEHV4  | 138 2  | C:3wnd: OPEN B\$1040 WWDEHV-T 1  |                     |       |
| REGION4 | REGION10_I | 1698 | -0.3234 | 515375 WWRDEHV7   | 345 B\$1041 WWDEHV-T2 | 1.00 2 | C:3wnd: OPEN B\$1040 WWDEHV-T 1  |                     |       |
| REGION4 | REGION10_I | 1698 | -0.3234 | 515375 WWRDEHV7   | 345 B\$1040 WWDEHV-T  | 1.00 1 | C:3wnd: OPEN B\$1041 WWDEHV-T2 2 |                     |       |
| REGION4 | REGION10_I | 1824 | -0.0805 | 511458 ELKCTY-4   | 138 511485 CLINTJC4   | 138 1  | C:511489 WTH_JCT4                | 138 511497 WTH_SE 4 | 138 1 |
| REGION4 | REGION10_I | 1954 | -0.1191 | 511489 WTH_JCT4   | 138 511497 WTH_SE 4   | 138 1  | C:511506 WTH WF 4                | 138 511534 CL-NGTP4 | 138 1 |
| REGION4 | REGION10_I | 2037 | 0.1362  | 515785 WINDFRM4   | 138 520999 MOORLND4   | 138 1  | C:514785 WOODWRD4                | 138 515785 WINDFRM4 | 138 1 |

|         |            |      |         |                     |      |                     |      |   |                               |     |                     |     |   |
|---------|------------|------|---------|---------------------|------|---------------------|------|---|-------------------------------|-----|---------------------|-----|---|
| REGION4 | REGION10_I | 2042 | 0.1191  | 511540 CAN_GAS4     | 138  | 514821 JENSEN 4     | 138  | 1 | C:511506 WTH WF 4             | 138 | 511534 CL-NGTP4     | 138 | 1 |
| REGION4 | REGION10_I | 2123 | -0.1191 | 511433 HINTON 4     | 138  | 511489 WTH_JCT4     | 138  | 1 | C:511506 WTH WF 4             | 138 | 511534 CL-NGTP4     | 138 | 1 |
| REGION4 | REGION10_I | 2164 | -0.0711 | 640359 STAPLTN7     | 115  | 640381 THEDFRD7     | 115  | 1 | C:640050 AINSWND7             | 115 | 640051 AINSWRT7     | 115 | 1 |
| REGION4 | REGION10_I | 2191 | -0.0380 | 514788 GLASMTN4     | 138  | 520999 MOORLND4     | 138  | 1 | C:514795 KNOBHIL4             | 138 | 520999 MOORLND4     | 138 | 1 |
| REGION4 | REGION10_I | 2302 | -0.1347 | 530592 SMOKYHLLS6   | 230  | 530593 SMOKY_INT    | 230  | 1 | C:650238 20&PIO 7             | 115 | 650258 40&GER 7     | 115 | 1 |
| REGION4 | REGION10_I | 3219 | 0.0824  | 507454 HEMPSTD4     | 138  | B\$0538 HEMP 1      | 1.00 | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7     | 115 | 1 |
| REGION4 | REGION10_I | 3219 | -0.0824 | 507456 HEMPSTD3     | 115  | B\$0538 HEMP 1      | 1.00 | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7     | 115 | 1 |
| REGION4 | REGION10_I | 3280 | -0.0824 | 504122 MCNAB 3      | 115  | 507456 HEMPSTD3     | 115  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7     | 115 | 1 |
| REGION5 | REGION6_I  | 1337 | -0.0786 | 539637 MRWYP16      | 230  | B\$0655 MERIDWY1    | 1.00 | 1 | C:650238 20&PIO 7             | 115 | 650251 30&A S07     | 115 | 1 |
| REGION5 | REGION6_I  | 2082 | -0.0810 | 514909 REDBUD 7     | 345  | B\$0820 REDBUD3     | 1.00 | 1 | C:514873 LNEOAK 4             | 138 | 514879 NORTHST4     | 138 | 1 |
| REGION5 | REGION6_I  | 2209 | 0.0342  | 539656 CLIFTON3     | 115  | 539665 GRNLEAF3     | 115  | 1 | C:532865 NWMANHT6             | 230 | 539639 ELMCREK6     | 230 | 1 |
| REGION5 | REGION6_I  | 2558 | 0.0786  | 539658 CONCRD6      | 230  | B\$0353 CONCORD6    | 1.00 | 1 | C:532865 NWMANHT6             | 230 | 539639 ELMCREK6     | 230 | 1 |
| REGION5 | REGION6_I  | 2559 | -0.0786 | 539657 CONCORD3     | 115  | B\$0353 CONCORD6    | 1.00 | 1 | C:532865 NWMANHT6             | 230 | 539639 ELMCREK6     | 230 | 1 |
| REGION5 | REGION6_I  | 2668 | -0.0342 | 533332 KNOB HL3     | 115  | 539665 GRNLEAF3     | 115  | 1 | C:532865 NWMANHT6             | 230 | 539639 ELMCREK6     | 230 | 1 |
| REGION5 | REGION6_I  | 2825 | -0.0539 | 523712 KINGSMILL 3  | 115  | 523815 LLANO_WND 3  | 115  | 1 | C:523815 LLANO_WND 3          | 115 | 523817 MIDSTRM_TP 3 | 115 | 1 |
| REGION5 | REGION6_I  | 2825 | 0.0539  | 523815 LLANO_WND 3  | 115  | 523817 MIDSTRM_TP 3 | 115  | 1 | C:523712 KINGSMILL 3          | 115 | 523815 LLANO_WND 3  | 115 | 1 |
| REGION5 | REGION6_I  | 2989 | 0.0539  | 523817 MIDSTRM_TP 3 | 115  | 524043 NICHOLS 3    | 115  | 1 | C:523712 KINGSMILL 3          | 115 | 523815 LLANO_WND 3  | 115 | 1 |
| REGION5 | REGION6_I  | 3248 | -0.0421 | 539656 CLIFTON3     | 115  | 539657 CONCORD3     | 115  | 1 | C:532865 NWMANHT6             | 230 | 539639 ELMCREK6     | 230 | 1 |
| REGION5 | REGION6_I  | 3998 | 0.0786  | 539637 MRWYP16      | 230  | 539639 ELMCREK6     | 230  | 1 | C:640208 HARBINE7             | 115 | 640426 STEELEC7     | 115 | 1 |
| REGION5 | REGION6_I  | 4010 | -0.0786 | 532865 NWMANHT6     | 230  | 539639 ELMCREK6     | 230  | 1 | C:539639 ELMCREK6             | 230 | 539658 CONCRD6      | 230 | 1 |
| REGION5 | REGION6_I  | 4010 | 0.0786  | 539639 ELMCREK6     | 230  | 539658 CONCRD6      | 230  | 1 | C:532865 NWMANHT6             | 230 | 539639 ELMCREK6     | 230 | 1 |
| REGION5 | REGION6_I  | 6310 | -0.0668 | 532861 EMANHAT6     | 230  | 532865 NWMANHT6     | 230  | 1 | C:539639 ELMCREK6             | 230 | 539658 CONCRD6      | 230 | 1 |
| REGION5 | REGION6_I  | 7355 | -0.0477 | B\$0730 NWMANH1X    | 1.00 | 532865 NWMANHT6     | 230  | 1 | C:532861 EMANHAT6             | 230 | 532865 NWMANHT6     | 230 | 1 |
| REGION5 | REGION6_I  | 7358 | -0.0477 | 533347 NWMANHT3     | 115  | B\$0730 NWMANH1X    | 1.00 | 1 | C:532861 EMANHAT6             | 230 | 532865 NWMANHT6     | 230 | 1 |
| REGION5 | REGION6_I  | 8265 | -0.0313 | 514840 JONESTP4     | 138  | 514941 HSL 4        | 138  | 1 | C:514906 JNSKAM04             | 138 | 514941 HSL 4        | 138 | 1 |
| REGION5 | REGION6_I  | 8594 | -0.1296 | 509807 ONETA--7     | 345  | 509836 OEC 7        | 345  | 1 | C:509807 ONETA--7             | 345 | 509836 OEC 7        | 345 | 2 |
| REGION5 | REGION6_I  | 8594 | -0.1296 | 509807 ONETA--7     | 345  | 509836 OEC 7        | 345  | 2 | C:509807 ONETA--7             | 345 | 509836 OEC 7        | 345 | 1 |
| REGION5 | REGION6_I  | 8869 | -0.0590 | 509852 T.NO.--7     | 345  | 510406 N.E.S.-7     | 345  | 1 | C:510380 DELWARE7             | 345 | 510406 N.E.S.-7     | 345 | 1 |
| REGION5 | REGION6_I  | 9890 | 0.0380  | 514803 SOONER 7     | 345  | B\$0888 SOONER5     | 1.00 | 1 | C:3Wnd: OPEN B\$1031 WOODRNG2 |     |                     |     | 1 |
| REGION5 | REGION6_I  | 9895 | -0.0380 | 514802 SOONER 4     | 138  | B\$0888 SOONER5     | 1.00 | 1 | C:3Wnd: OPEN B\$1031 WOODRNG2 |     |                     |     | 1 |

|         |           |       |         |                     |                         |        |                               |                         |       |
|---------|-----------|-------|---------|---------------------|-------------------------|--------|-------------------------------|-------------------------|-------|
| REGION5 | REGION6_I | 10204 | -0.0301 | 533333 KSU 3        | 115 533347 NWMANHT3     | 115 1  | C:532861 EMANHAT6             | 230 532865 NWMANHT6     | 230 1 |
| REGION5 | REGION6_I | 10941 | 0.0572  | 510907 PITTSB-7     | 345 515045 SEMINOL7     | 345 1  | C:510907 PITTSB-7             | 345 514809 JOHNCO 7     | 345 1 |
| REGION5 | REGION6_I | 11021 | -0.0376 | 542965 W.GRDNR7     | 345 542968 STILWEL7     | 345 1  | C:542965 W.GRDNR7             | 345 542981 LACYGNE7     | 345 1 |
| REGION5 | REGION6_I | 11406 | -0.0491 | 514908 ARCADIA7     | 345 514909 REDBUD 7     | 345 2  | C:514908 ARCADIA7             | 345 514909 REDBUD 7     | 345 1 |
| REGION5 | REGION6_I | 11432 | 0.0301  | 533333 KSU 3        | 115 533334 MATTERS3     | 115 1  | C:532861 EMANHAT6             | 230 532865 NWMANHT6     | 230 1 |
| REGION5 | REGION6_I | 11479 | -0.0490 | 514908 ARCADIA7     | 345 514909 REDBUD 7     | 345 1  | C:514908 ARCADIA7             | 345 514909 REDBUD 7     | 345 2 |
| REGION5 | REGION6_I | 15205 | -0.1149 | 510907 PITTSB-7     | 345 510925 KIOWA 7      | 345 1  | C:646255 S1255 5              | 161 648055 S3455T1T     | 345 1 |
| REGION5 | REGION6_I | 18192 | -0.0566 | 514715 WOODRNG7     | 345 514901 CIMARON7     | 345 1  | C:765341 COMANCH5             | 345 765342 MED-LDG5     | 345 1 |
| REGION5 | REGION7_I | 1337  | -0.0786 | 539637 MRWYP16      | 230 B\$0655 MERIDWY1    | 1.00 1 | C:3Wnd: OPEN B\$0334 CLRAUTO2 | 2                       |       |
| REGION5 | REGION7_I | 2008  | 0.0376  | 539656 CLIFTON3     | 115 539665 GRNLEAF3     | 115 1  | C:532865 NWMANHT6             | 230 539639 ELMCREK6     | 230 1 |
| REGION5 | REGION7_I | 2082  | -0.0810 | 514909 REDBUD 7     | 345 B\$0820 REDBUD3     | 1.00 1 | C:3Wnd: OPEN B\$0335 CLRAUTO4 | 1                       |       |
| REGION5 | REGION7_I | 2425  | -0.0376 | 533332 KNOB HL3     | 115 539665 GRNLEAF3     | 115 1  | C:532865 NWMANHT6             | 230 539639 ELMCREK6     | 230 1 |
| REGION5 | REGION7_I | 2558  | 0.0786  | 539658 CONCRD6      | 230 B\$0353 CONCORD6    | 1.00 1 | C:532865 NWMANHT6             | 230 539639 ELMCREK6     | 230 1 |
| REGION5 | REGION7_I | 2559  | -0.0786 | 539657 CONCORD3     | 115 B\$0353 CONCORD6    | 1.00 1 | C:532865 NWMANHT6             | 230 539639 ELMCREK6     | 230 1 |
| REGION5 | REGION7_I | 2825  | -0.0539 | 523712 KINGSMILL 3  | 115 523815 LLANO_WND 3  | 115 1  | C:523815 LLANO_WND 3          | 115 523817 MIDSTRM_TP 3 | 115 1 |
| REGION5 | REGION7_I | 2825  | 0.0539  | 523815 LLANO_WND 3  | 115 523817 MIDSTRM_TP 3 | 115 1  | C:523712 KINGSMILL 3          | 115 523815 LLANO_WND 3  | 115 1 |
| REGION5 | REGION7_I | 2989  | 0.0539  | 523817 MIDSTRM_TP 3 | 115 524043 NICHOLS 3    | 115 1  | C:523712 KINGSMILL 3          | 115 523815 LLANO_WND 3  | 115 1 |
| REGION5 | REGION7_I | 3634  | -0.0376 | 539656 CLIFTON3     | 115 539657 CONCORD3     | 115 1  | C:532865 NWMANHT6             | 230 539639 ELMCREK6     | 230 1 |
| REGION5 | REGION7_I | 3998  | 0.0786  | 539637 MRWYP16      | 230 539639 ELMCREK6     | 230 1  | C:3Wnd: OPEN B\$0600 LANG 1X  | 1                       |       |
| REGION5 | REGION7_I | 4010  | -0.0786 | 532865 NWMANHT6     | 230 539639 ELMCREK6     | 230 1  | C:539639 ELMCREK6             | 230 539658 CONCRD6      | 230 1 |
| REGION5 | REGION7_I | 4010  | 0.0786  | 539639 ELMCREK6     | 230 539658 CONCRD6      | 230 1  | C:532865 NWMANHT6             | 230 539639 ELMCREK6     | 230 1 |
| REGION5 | REGION7_I | 4944  | 0.0362  | 542965 W.GRDNR7     | 345 542968 STILWEL7     | 345 1  | C:542968 STILWEL7             | 345 542981 LACYGNE7     | 345 1 |
| REGION5 | REGION7_I | 5757  | 0.0654  | 532774 SWISVAL7     | 345 542965 W.GRDNR7     | 345 1  | C:532765 HOYT 7               | 345 532766 JEC N 7      | 345 1 |
| REGION5 | REGION7_I | 6449  | -0.0653 | 532861 EMANHAT6     | 230 532865 NWMANHT6     | 230 1  | C:539639 ELMCREK6             | 230 539658 CONCRD6      | 230 1 |
| REGION5 | REGION7_I | 6737  | -0.0519 | 532765 HOYT 7       | 345 532766 JEC N 7      | 345 1  | C:532851 AUBURN 6             | 230 532852 JEC 6        | 230 1 |
| REGION5 | REGION7_I | 7044  | -0.0498 | B\$0730 NWMANH1X    | 1.00 532865 NWMANHT6    | 230 1  | C:532861 EMANHAT6             | 230 532865 NWMANHT6     | 230 1 |
| REGION5 | REGION7_I | 7047  | -0.0498 | 533347 NWMANHT3     | 115 B\$0730 NWMANH1X    | 1.00 1 | C:532861 EMANHAT6             | 230 532865 NWMANHT6     | 230 1 |
| REGION5 | REGION7_I | 8594  | -0.1296 | 509807 ONETA--7     | 345 509836 OEC 7        | 345 2  | C:509807 ONETA--7             | 345 509836 OEC 7        | 345 1 |
| REGION5 | REGION7_I | 8594  | -0.1296 | 509807 ONETA--7     | 345 509836 OEC 7        | 345 1  | C:509807 ONETA--7             | 345 509836 OEC 7        | 345 2 |
| REGION5 | REGION7_I | 9966  | 0.1237  | 510907 PITTSB-7     | 345 510911 VALIANT7     | 345 1  | C:510907 PITTSB-7             | 345 514809 JOHNCO 7     | 345 1 |



|         |           |       |         |                     |                         |      |   |                               |                         |       |
|---------|-----------|-------|---------|---------------------|-------------------------|------|---|-------------------------------|-------------------------|-------|
| REGION5 | REGION7_I | 13245 | 0.0327  | 532793 NEOSHO 7     | 345 B\$0705 NEOSHO2X    | 1.00 | 1 | C:659185 ELSIETP7             | 115 659243 ELSIE 7      | 115 1 |
| REGION5 | REGION7_I | 13251 | -0.0327 | 532937 NEOSHO 5     | 161 B\$0705 NEOSHO2X    | 1.00 | 1 | C:659185 ELSIETP7             | 115 659243 ELSIE 7      | 115 1 |
| REGION5 | REGION7_I | 15205 | -0.1149 | 510907 PITTSB-7     | 345 510925 KIOWA 7      | 345  | 1 | C:652311 DUNLAP 7             | 115 659236 BOXBUTE7     | 115 1 |
| REGION5 | REGION7_I | 15763 | 0.0488  | 532765 HOYT 7       | 345 532772 STRANGR7     | 345  | 1 | C:659185 ELSIETP7             | 115 659243 ELSIE 7      | 115 1 |
| REGION5 | REGION7_I | 15919 | 0.0480  | 510380 DELWARE7     | 345 532793 NEOSHO 7     | 345  | 1 | C:765341 COMANCH5             | 345 765342 MED-LDG5     | 345 2 |
| REGION5 | REGION7_I | 16964 | -0.0498 | 510380 DELWARE7     | 345 510406 N.E.S. -7    | 345  | 1 | C:765341 COMANCH5             | 345 765342 MED-LDG5     | 345 1 |
| REGION5 | REGION7_I | 17048 | 0.0420  | 532768 EMPEC 7      | 345 532774 SWISVAL7     | 345  | 1 | C:659185 ELSIETP7             | 115 659243 ELSIE 7      | 115 1 |
| REGION5 | REGION7_I | 17499 | -0.0737 | 509745 CLARKSV7     | 345 509807 ONETA- -7    | 345  | 1 | C:659185 ELSIETP7             | 115 659243 ELSIE 7      | 115 1 |
| REGION5 | REGION8_I | 1337  | -0.0786 | 539637 MRWYP16      | 230 B\$0655 MERIDWY1    | 1.00 | 1 | C:543028 NASHUA-5             | 161 543029 SHOLCRK5     | 161 1 |
| REGION5 | REGION8_I | 1627  | 0.0579  | 549984 BROOKLINE 7  | 345 B\$0297 BRKLTXT1    | 1.00 | 1 | C:3wnd: OPEN B\$0298 BRKLTXT2 | 2                       |       |
| REGION5 | REGION8_I | 1631  | -0.0579 | 549969 BROOKLINE 5  | 161 B\$0297 BRKLTXT1    | 1.00 | 1 | C:3wnd: OPEN B\$0298 BRKLTXT2 | 2                       |       |
| REGION5 | REGION8_I | 1651  | 0.0577  | 549984 BROOKLINE 7  | 345 B\$0298 BRKLTXT2    | 1.00 | 2 | C:3wnd: OPEN B\$0297 BRKLTXT1 | 1                       |       |
| REGION5 | REGION8_I | 1654  | -0.0577 | 549969 BROOKLINE 5  | 161 B\$0298 BRKLTXT2    | 1.00 | 2 | C:3wnd: OPEN B\$0297 BRKLTXT1 | 1                       |       |
| REGION5 | REGION8_I | 2030  | 0.0372  | 539656 CLIFTON3     | 115 539665 GRNLEAF3     | 115  | 1 | C:532865 NWMANHT6             | 230 539639 ELMCREK6     | 230 1 |
| REGION5 | REGION8_I | 2082  | -0.0810 | 514909 REDBUD 7     | 345 B\$0820 REDBUD3     | 1.00 | 1 | C:515008 KINZE 4              | 138 515009 MCELROY4     | 138 1 |
| REGION5 | REGION8_I | 2452  | -0.0372 | 533332 KNOB HL3     | 115 539665 GRNLEAF3     | 115  | 1 | C:532865 NWMANHT6             | 230 539639 ELMCREK6     | 230 1 |
| REGION5 | REGION8_I | 2558  | 0.0786  | 539658 CONCRD6      | 230 B\$0353 CONCORD6    | 1.00 | 1 | C:532865 NWMANHT6             | 230 539639 ELMCREK6     | 230 1 |
| REGION5 | REGION8_I | 2559  | -0.0786 | 539657 CONCORD3     | 115 B\$0353 CONCORD6    | 1.00 | 1 | C:532865 NWMANHT6             | 230 539639 ELMCREK6     | 230 1 |
| REGION5 | REGION8_I | 2589  | -0.0481 | 507774 NORAM 4      | 138 508808 LONGWD 4     | 138  | 1 | C:507760 SW SHV 7             | 345 508809 LONGWD 7     | 345 1 |
| REGION5 | REGION8_I | 2658  | -0.0481 | 507749 RAINES 4     | 138 507774 NORAM 4      | 138  | 1 | C:507760 SW SHV 7             | 345 508809 LONGWD 7     | 345 1 |
| REGION5 | REGION8_I | 2692  | -0.0367 | 504000 AVOCA 5      | 161 506931 EROGERS5     | 161  | 1 | Base Case                     |                         |       |
| REGION5 | REGION8_I | 2825  | -0.0539 | 523712 KINGSMILL 3  | 115 523815 LLANO_WND 3  | 115  | 1 | C:523815 LLANO_WND 3          | 115 523817 MIDSTRM_TP 3 | 115 1 |
| REGION5 | REGION8_I | 2825  | 0.0539  | 523815 LLANO_WND 3  | 115 523817 MIDSTRM_TP 3 | 115  | 1 | C:523712 KINGSMILL 3          | 115 523815 LLANO_WND 3  | 115 1 |
| REGION5 | REGION8_I | 2989  | 0.0539  | 523817 MIDSTRM_TP 3 | 115 524043 NICHOLS 3    | 115  | 1 | C:523712 KINGSMILL 3          | 115 523815 LLANO_WND 3  | 115 1 |
| REGION5 | REGION8_I | 3225  | -0.0481 | 507711 ARSHILL4     | 138 507749 RAINES 4     | 138  | 1 | C:507760 SW SHV 7             | 345 508809 LONGWD 7     | 345 1 |
| REGION5 | REGION8_I | 3675  | -0.0372 | 539656 CLIFTON3     | 115 539657 CONCORD3     | 115  | 1 | C:532865 NWMANHT6             | 230 539639 ELMCREK6     | 230 1 |
| REGION5 | REGION8_I | 3688  | 0.0516  | 500300 EUNICE 4     | 138 500540 MANUEL 4     | 138  | 1 | C:500920 WSTFORK6             | 230 500940 WELLS 6      | 230 1 |
| REGION5 | REGION8_I | 3970  | 0.0736  | 508809 LONGWD 7     | 345 B\$0620 LONGWOOD    | 1.00 | 1 | C:507760 SW SHV 7             | 345 508809 LONGWD 7     | 345 1 |
| REGION5 | REGION8_I | 3974  | -0.0736 | 508808 LONGWD 4     | 138 B\$0620 LONGWOOD    | 1.00 | 1 | C:507760 SW SHV 7             | 345 508809 LONGWD 7     | 345 1 |
| REGION5 | REGION8_I | 3998  | 0.0786  | 539637 MRWYP16      | 230 539639 ELMCREK6     | 230  | 1 | C:3wnd: OPEN B\$0550 HOOVER3X | 1                       |       |



|         |           |      |         |                 |     |                  |      |   |                   |     |                 |     |   |
|---------|-----------|------|---------|-----------------|-----|------------------|------|---|-------------------|-----|-----------------|-----|---|
| REGION5 | REGION8_I | 4010 | 0.0786  | 539639 ELMCREK6 | 230 | 539658 CONCRD6   | 230  | 1 | C:532865 NWMANHT6 | 230 | 539639 ELMCREK6 | 230 | 1 |
| REGION5 | REGION8_I | 4010 | -0.0786 | 532865 NWMANHT6 | 230 | 539639 ELMCREK6  | 230  | 1 | C:539639 ELMCREK6 | 230 | 539658 CONCRD6  | 230 | 1 |
| REGION5 | REGION8_I | 4083 | 0.0303  | 505480 BEAVER 5 | 161 | 506932 EUREKA 5  | 161  | 1 | C:515224 MUSKOG7  | 345 | 515302 FTSMITH7 | 345 | 1 |
| REGION5 | REGION8_I | 4192 | -0.0516 | 500230 COUGH 4  | 138 | 500540 MANUEL 4  | 138  | 1 | C:500920 WSTFORK6 | 230 | 500940 WELLS 6  | 230 | 1 |
| REGION5 | REGION8_I | 4205 | 0.0425  | 542965 W.GRDNR7 | 345 | 542968 STILWEL7  | 345  | 1 | C:542968 STILWEL7 | 345 | 542981 LACYGNE7 | 345 | 1 |
| REGION5 | REGION8_I | 4316 | 0.0418  | 504000 AVOCA 5  | 161 | 505480 BEAVER 5  | 161  | 1 | C:506935 FLINTCR7 | 345 | 547481 MON383 7 | 345 | 1 |
| REGION5 | REGION8_I | 6306 | -0.0917 | 500920 WSTFORK6 | 230 | 500940 WELLS 6   | 230  | 1 | C:646281 S1281 5  | 161 | 646287 S1287 5  | 161 | 1 |
| REGION5 | REGION8_I | 6859 | -0.0917 | 500880 VILPLT 6 | 230 | 500920 WSTFORK6  | 230  | 1 | C:646281 S1281 5  | 161 | 646287 S1287 5  | 161 | 1 |
| REGION5 | REGION9_I | 379  | -0.0357 | 505418 JONESB05 | 161 | 505420 HERGETT5  | 161  | 1 | C:505410 KENNETT5 | 161 | 505412 PARAGLD5 | 161 | 1 |
| REGION5 | REGION9_I | 1337 | -0.0786 | 539637 MRWYP16  | 230 | B\$0655 MERIDWY1 | 1.00 | 1 | C:533039 ELPASO 4 | 138 | 533066 64TH 4   | 138 | 1 |
| REGION5 | REGION9_I | 1749 | 0.0337  | 505400 N MADRD5 | 161 | 505410 KENNETT5  | 161  | 1 | C:505418 JONESB05 | 161 | 505420 HERGETT5 | 161 | 1 |
| REGION5 | REGION9_I | 1826 | -0.0547 | 505418 JONESB05 | 161 | 505442 WATER V5  | 161  | 1 | C:505410 KENNETT5 | 161 | 505412 PARAGLD5 | 161 | 1 |
| REGION5 | REGION9_I | 1826 | -0.1173 | 502401 FLANDER6 | 230 | 502402 ACADIAN6  | 230  | 1 | C:500773 SEGURA 6 | 230 | 500776 SELLRD6  | 230 | 1 |
| REGION5 | REGION9_I | 1930 | 0.0935  | 500330 FLANDR 4 | 138 | 500774 SEGURA4   | 138  | 1 | C:500773 SEGURA 6 | 230 | 500776 SELLRD6  | 230 | 1 |
| REGION5 | REGION9_I | 1971 | -0.1173 | 502402 ACADIAN6 | 230 | 502403 BONIN 6   | 230  | 1 | C:500773 SEGURA 6 | 230 | 500776 SELLRD6  | 230 | 1 |
| REGION5 | REGION9_I | 1991 | 0.0380  | 539656 CLIFTON3 | 115 | 539665 GRNLEAF3  | 115  | 1 | C:532865 NWMANHT6 | 230 | 539639 ELMCREK6 | 230 | 1 |
| REGION5 | REGION9_I | 2014 | 0.1398  | 500410 HOPKINS4 | 138 | 500580 MORBHAN4  | 138  | 1 | C:500410 HOPKINS4 | 138 | 500660 PATOUT 4 | 138 | 1 |
| REGION5 | REGION9_I | 2055 | -0.1289 | 500410 HOPKINS4 | 138 | 500774 SEGURA4   | 138  | 1 | C:500100 BERWKTP4 | 138 | 500740 RAMOS 4  | 138 | 1 |
| REGION5 | REGION9_I | 2082 | -0.0810 | 514909 REDBUD 7 | 345 | B\$0820 REDBUD3  | 1.00 | 1 | C:539661 E-GBEND3 | 115 | 539689 S-GBEND3 | 115 | 1 |
| REGION5 | REGION9_I | 2174 | 0.1579  | 500410 HOPKINS4 | 138 | 500660 PATOUT 4  | 138  | 1 | C:500410 HOPKINS4 | 138 | 500580 MORBHAN4 | 138 | 1 |
| REGION5 | REGION9_I | 2219 | 0.0376  | 505480 BEAVER 5 | 161 | 506932 EUREKA 5  | 161  | 1 | Base Case         |     |                 |     |   |
| REGION5 | REGION9_I | 2358 | 0.0444  | 505410 KENNETT5 | 161 | 505412 PARAGLD5  | 161  | 1 | C:505418 JONESB05 | 161 | 505442 WATER V5 | 161 | 1 |
| REGION5 | REGION9_I | 2405 | -0.0380 | 533332 KNOB HL3 | 115 | 539665 GRNLEAF3  | 115  | 1 | C:532865 NWMANHT6 | 230 | 539639 ELMCREK6 | 230 | 1 |
| REGION5 | REGION9_I | 2421 | 0.1579  | 500660 PATOUT 4 | 138 | 500820 TECHE 4   | 138  | 1 | C:500410 HOPKINS4 | 138 | 500580 MORBHAN4 | 138 | 1 |
| REGION5 | REGION9_I | 2465 | 0.1709  | 500940 WELLS 6  | 230 | 502420 LABBETAP  | 230  | 1 | C:500940 WELLS 6  | 230 | 502410 PMOUTON6 | 230 | 1 |
| REGION5 | REGION9_I | 2542 | -0.1458 | 502403 BONIN 6  | 230 | 502421 LABBE     | 230  | 1 | C:502403 BONIN 6  | 230 | 502421 LABBE    | 230 | 2 |
| REGION5 | REGION9_I | 2542 | -0.1458 | 502403 BONIN 6  | 230 | 502421 LABBE     | 230  | 2 | C:502403 BONIN 6  | 230 | 502421 LABBE    | 230 | 1 |
| REGION5 | REGION9_I | 2558 | 0.0786  | 539658 CONCRD6  | 230 | B\$0353 CONCORD6 | 1.00 | 1 | C:532865 NWMANHT6 | 230 | 539639 ELMCREK6 | 230 | 1 |
| REGION5 | REGION9_I | 2559 | -0.0786 | 539657 CONCORD3 | 115 | B\$0353 CONCORD6 | 1.00 | 1 | C:532865 NWMANHT6 | 230 | 539639 ELMCREK6 | 230 | 1 |
| REGION5 | REGION9_I | 2635 | 0.1586  | 500940 WELLS 6  | 230 | 502410 PMOUTON6  | 230  | 1 | C:500940 WELLS 6  | 230 | 502420 LABBETAP | 230 | 1 |

|         |            |      |         |                     |     |                     |      |   |                               |     |                     |     |   |
|---------|------------|------|---------|---------------------|-----|---------------------|------|---|-------------------------------|-----|---------------------|-----|---|
| REGION5 | REGION9_I  | 2703 | 0.1315  | 500773 SEGURA 6     | 230 | 500774 SEGURA4      | 138  | 1 | C:500330 FLANDR 4             | 138 | 500774 SEGURA4      | 138 | 1 |
| REGION5 | REGION9_I  | 2723 | 0.1586  | 502410 PMOUTON6     | 230 | 502421 LABBE        | 230  | 1 | C:500940 WELLS 6              | 230 | 502420 LABBETAP     | 230 | 1 |
| REGION5 | REGION9_I  | 2825 | -0.0539 | 523712 KINGSMILL 3  | 115 | 523815 LLANO_WND 3  | 115  | 1 | C:523815 LLANO_WND 3          | 115 | 523817 MIDSTRM_TP 3 | 115 | 1 |
| REGION5 | REGION9_I  | 2825 | 0.0539  | 523815 LLANO_WND 3  | 115 | 523817 MIDSTRM_TP 3 | 115  | 1 | C:523712 KINGSMILL 3          | 115 | 523815 LLANO_WND 3  | 115 | 1 |
| REGION5 | REGION9_I  | 2853 | 0.1398  | 500580 MORBHAN4     | 138 | 500820 TECHE 4      | 138  | 1 | C:500410 HOPKINS4             | 138 | 500660 PATOUT 4     | 138 | 1 |
| REGION5 | REGION9_I  | 2915 | 0.0323  | 549984 BROOKLINE 7  | 345 | B\$0297 BRKLTXT1    | 1.00 | 1 | C:3Wnd: OPEN B\$0298 BRKLTXT2 | 2   |                     |     |   |
| REGION5 | REGION9_I  | 2922 | -0.0323 | 549969 BROOKLINE 5  | 161 | B\$0297 BRKLTXT1    | 1.00 | 1 | C:3Wnd: OPEN B\$0298 BRKLTXT2 | 2   |                     |     |   |
| REGION5 | REGION9_I  | 2957 | 0.0359  | 500740 RAMOS 4      | 138 | 503301 MRGNCTY4     | 138  | 1 | C:509738 ORU E4               | 138 | 509849 ORU ETP4     | 138 | 1 |
| REGION5 | REGION10_I | 1222 | -0.2598 | 505428 SIKESTN5     | 161 | 505434 IDALIA 5     | 161  | 1 | C:505400 N MADRD5             | 161 | 505428 SIKESTN5     | 161 | 1 |
| REGION5 | REGION10_I | 1337 | -0.0786 | 539637 MRWYP16      | 230 | B\$0655 MERIDWY1    | 1.00 | 1 | C:533371 NORTHVW3             | 115 | 533381 SUMMIT 3     | 115 | 1 |
| REGION5 | REGION10_I | 1563 | 0.1867  | 505400 N MADRD5     | 161 | 505428 SIKESTN5     | 161  | 1 | C:505428 SIKESTN5             | 161 | 505434 IDALIA 5     | 161 | 1 |
| REGION5 | REGION10_I | 1965 | 0.0385  | 539656 CLIFTON3     | 115 | 539665 GRNLEAF3     | 115  | 1 | C:532865 NWMANHT6             | 230 | 539639 ELMCREK6     | 230 | 1 |
| REGION5 | REGION10_I | 2082 | -0.0810 | 514909 REDBUD 7     | 345 | B\$0820 REDBUD3     | 1.00 | 1 | C:3Wnd: OPEN B\$0367 CRESWL2X | 1   |                     |     |   |
| REGION5 | REGION10_I | 2374 | -0.0385 | 533332 KNOB HL3     | 115 | 539665 GRNLEAF3     | 115  | 1 | C:532865 NWMANHT6             | 230 | 539639 ELMCREK6     | 230 | 1 |
| REGION5 | REGION10_I | 2439 | 0.0849  | 507454 HEMPSTD4     | 138 | B\$0538 HEMP 1      | 1.00 | 1 | Base Case                     |     |                     |     |   |
| REGION5 | REGION10_I | 2439 | -0.0849 | 507456 HEMPSTD3     | 115 | B\$0538 HEMP 1      | 1.00 | 1 | Base Case                     |     |                     |     |   |
| REGION5 | REGION10_I | 2558 | 0.0786  | 539658 CONCRD6      | 230 | B\$0353 CONCORD6    | 1.00 | 1 | C:532865 NWMANHT6             | 230 | 539639 ELMCREK6     | 230 | 1 |
| REGION5 | REGION10_I | 2559 | -0.0786 | 539657 CONCORD3     | 115 | B\$0353 CONCORD6    | 1.00 | 1 | C:532865 NWMANHT6             | 230 | 539639 ELMCREK6     | 230 | 1 |
| REGION5 | REGION10_I | 2620 | 0.0319  | 505480 BEAVER 5     | 161 | 506932 EUREKA 5     | 161  | 1 | Base Case                     |     |                     |     |   |
| REGION5 | REGION10_I | 2825 | -0.0539 | 523712 KINGSMILL 3  | 115 | 523815 LLANO_WND 3  | 115  | 1 | C:523815 LLANO_WND 3          | 115 | 523817 MIDSTRM_TP 3 | 115 | 1 |
| REGION5 | REGION10_I | 2825 | 0.0539  | 523815 LLANO_WND 3  | 115 | 523817 MIDSTRM_TP 3 | 115  | 1 | C:523712 KINGSMILL 3          | 115 | 523815 LLANO_WND 3  | 115 | 1 |
| REGION5 | REGION10_I | 2989 | 0.0539  | 523817 MIDSTRM_TP 3 | 115 | 524043 NICHOLS 3    | 115  | 1 | C:523712 KINGSMILL 3          | 115 | 523815 LLANO_WND 3  | 115 | 1 |
| REGION5 | REGION10_I | 3013 | -0.0861 | 504122 MCNAB 3      | 115 | 507456 HEMPSTD3     | 115  | 1 | C:508572 LEBROCK7             | 345 | 508585 TENRUSK7     | 345 | 1 |
| REGION5 | REGION10_I | 3021 | 0.0592  | 542965 W.GRDNR7     | 345 | 542968 STILWEL7     | 345  | 1 | C:542968 STILWEL7             | 345 | 542981 LACYGNE7     | 345 | 1 |
| REGION5 | REGION10_I | 3072 | 0.0861  | 504122 MCNAB 3      | 115 | 507453 HOPE 3       | 115  | 1 | C:508572 LEBROCK7             | 345 | 508585 TENRUSK7     | 345 | 1 |
| REGION5 | REGION10_I | 3998 | 0.0786  | 539637 MRWYP16      | 230 | 539639 ELMCREK6     | 230  | 1 | C:659192 LYNN 7               | 115 | 659197 SNAKECK7     | 115 | 1 |
| REGION5 | REGION10_I | 4618 | -0.0849 | 503912 FULTON 3     | 115 | 507453 HOPE 3       | 115  | 1 | C:659185 ELSIETP7             | 115 | 659243 ELSIE 7      | 115 | 1 |
| REGION5 | REGION10_I | 7049 | -0.0549 | 532865 NWMANHT6     | 230 | 539639 ELMCREK6     | 230  | 1 | C:659185 ELSIETP7             | 115 | 659243 ELSIE 7      | 115 | 1 |
| REGION5 | REGION10_I | 7381 | -0.0323 | 505416 CENTR H5     | 161 | 505418 JONESB05     | 161  | 1 | C:659185 ELSIETP7             | 115 | 659243 ELSIE 7      | 115 | 1 |
| REGION5 | REGION10_I | 7680 | 0.1300  | 515224 MUSKOGEE7    | 345 | 515302 FTSMITH7     | 345  | 1 | C:659185 ELSIETP7             | 115 | 659243 ELSIE 7      | 115 | 1 |

|            |              |       |         |                    |                       |        |                               |                         |       |
|------------|--------------|-------|---------|--------------------|-----------------------|--------|-------------------------------|-------------------------|-------|
| REGION5    | REGION10_I   | 7978  | 0.0304  | 500050 BSALES 4    | 138 500890 WAXLAKE4   | 138 1  | C:659185 ELSIETP7             | 115 659243 ELSIE 7      | 115 1 |
| REGION5    | REGION10_I   | 7993  | 0.1175  | 515302 FTSMITH7    | 345 B\$0457 FTSMITH1  | 1.00 1 | C:659185 ELSIETP7             | 115 659243 ELSIE 7      | 115 1 |
| REGION5    | REGION10_I   | 7996  | -0.1175 | 515305 FTSMITH8    | 500 B\$0457 FTSMITH1  | 1.00 1 | C:659185 ELSIETP7             | 115 659243 ELSIE 7      | 115 1 |
| REGION5    | REGION10_I   | 8312  | -0.0304 | 500050 BSALES 4    | 138 500820 TECHE 4    | 138 1  | C:659185 ELSIETP7             | 115 659243 ELSIE 7      | 115 1 |
| REGION5    | REGION10_I   | 8527  | -0.0323 | 505412 PARAGLD5    | 161 505416 CENTR H5   | 161 1  | C:659185 ELSIETP7             | 115 659243 ELSIE 7      | 115 1 |
| REGION5    | REGION10_I   | 8546  | -0.0304 | 500290 ELPTAP 4    | 138 500890 WAXLAKE4   | 138 1  | C:659185 ELSIETP7             | 115 659243 ELSIE 7      | 115 1 |
| REGION5    | REGION10_I   | 9041  | -0.0304 | 500060 BVISTA 4    | 138 500290 ELPTAP 4   | 138 1  | C:659185 ELSIETP7             | 115 659243 ELSIE 7      | 115 1 |
| REGION5    | REGION10_I   | 10134 | 0.1334  | 510907 PITTSB-7    | 345 510911 VALIANT7   | 345 1  | C:659185 ELSIETP7             | 115 659243 ELSIE 7      | 115 1 |
| REGION1234 | REGION5678_I | 985   | 0.0545  | 539667 HAGGARD3    | 115 539699 W-DODGE3   | 115 1  | C:3Wnd: OPEN B\$0524 HAGGARD3 | 1                       |       |
| REGION1234 | REGION5678_I | 1788  | -0.0545 | 539667 HAGGARD3    | 115 B\$0525 HAGGARD3  | 1.00 1 | C:509060 CARTHGT4             | 138 509099 HULLTAP4     | 138 1 |
| REGION1234 | REGION5678_I | 1842  | -0.0749 | 511485 CLINTJC4    | 138 511534 CL-NGTP4   | 138 1  | C:511506 WTH WF 4             | 138 511536 WEATHTP4     | 138 1 |
| REGION1234 | REGION5678_I | 1911  | -0.0879 | 514785 WOODWRD4    | 138 515363 CENT 4     | 138 1  | C:542997 LEEDS 5              | 161 543009 WINJT N5     | 161 1 |
| REGION1234 | REGION5678_I | 1945  | -0.0545 | 539688 S-DODGE3    | 115 539699 W-DODGE3   | 115 1  | C:3Wnd: OPEN B\$0524 HAGGARD3 | 1                       |       |
| REGION1234 | REGION5678_I | 2119  | -0.0677 | 514785 WOODWRD4    | 138 515785 WINDFRM4   | 138 1  | C:515785 WINDFRM4             | 138 520999 MOORLND4     | 138 1 |
| REGION1234 | REGION5678_I | 2193  | 0.0615  | 524266 BUSHLAND 3  | 115 524306 COULTER3   | 115 1  | C:523959 POTTER_CO 6          | 230 524267 BUSHLAND 6   | 230 1 |
| REGION1234 | REGION5678_I | 2237  | 0.0733  | 525524 TOLK_EAST 6 | 230 525830 TUCO_INT 6 | 230 1  | C:526435 SUNDOWN 6            | 230 526525 WOLFFORTH 6  | 230 1 |
| REGION1234 | REGION5678_I | 2246  | -0.0677 | 515785 WINDFRM4    | 138 515786 FPLWIND4   | 138 1  | Base Case                     |                         |       |
| REGION1234 | REGION5678_I | 2326  | 0.0545  | 539688 S-DODGE3    | 115 539771 NOR-JUD3   | 115 1  | C:3Wnd: OPEN B\$0524 HAGGARD3 | 1                       |       |
| REGION1234 | REGION5678_I | 2360  | -0.0615 | 524266 BUSHLAND 3  | 115 524267 BUSHLAND 6 | 230 1  | C:523959 POTTER_CO 6          | 230 524267 BUSHLAND 6   | 230 1 |
| REGION1234 | REGION5678_I | 2616  | 0.0530  | 524502 NORTON 3    | 115 524822 CURRY 3    | 115 1  | C:524502 NORTON 3             | 115 524509 FE-TUCMCARI3 | 115 1 |
| REGION1234 | REGION5678_I | 2896  | 0.0749  | 511506 WTH WF 4    | 138 511534 CL-NGTP4   | 138 1  | C:511506 WTH WF 4             | 138 511536 WEATHTP4     | 138 1 |
| REGION1234 | REGION5678_I | 2896  | 0.0749  | 511506 WTH WF 4    | 138 511536 WEATHTP4   | 138 1  | C:511506 WTH WF 4             | 138 511534 CL-NGTP4     | 138 1 |
| REGION1234 | REGION5678_I | 3078  | 0.0353  | 640050 AINSWND7    | 115 640096 CALAMS 7   | 115 1  | C:640050 AINSWND7             | 115 640051 AINSWRT7     | 115 1 |
| REGION1234 | REGION5678_I | 3078  | 0.0353  | 640050 AINSWND7    | 115 640051 AINSWRT7   | 115 1  | C:640050 AINSWND7             | 115 640096 CALAMS 7     | 115 1 |
| REGION1234 | REGION5678_I | 3084  | 0.0353  | 640096 CALAMS 7    | 115 640381 THEDFRD7   | 115 1  | C:640050 AINSWND7             | 115 640051 AINSWRT7     | 115 1 |
| REGION1234 | REGION5678_I | 3103  | -0.0749 | 511497 WTH_SE 4    | 138 511536 WEATHTP4   | 138 1  | C:511506 WTH WF 4             | 138 511534 CL-NGTP4     | 138 1 |
| REGION1234 | REGION5678_I | 3130  | 0.0379  | 640253 KEYSTON7    | 115 659132 OGALALA7   | 115 1  | C:640183 GENTLMN3             | 345 640252 KEYSTON3     | 345 1 |
| REGION1234 | REGION5678_I | 4385  | 0.0680  | 515785 WINDFRM4    | 138 520999 MOORLND4   | 138 1  | C:765341 COMANCH5             | 345 765342 MED-LDG5     | 345 2 |
| REGION1234 | REGION5678_I | 4631  | -0.0670 | 530592 SMOKYHLLS6  | 230 530593 SMOKY_INT  | 230 1  | C:650275 84&BLUF7             | 115 650283 WAVERLY7     | 115 1 |
| REGION1234 | REGION5678_I | 4780  | 0.0733  | 530592 SMOKYHLLS6  | 230 532873 SUMMIT 6   | 230 1  | C:765341 COMANCH5             | 345 765342 MED-LDG5     | 345 1 |

|            |              |      |         |                                                   |                                             |
|------------|--------------|------|---------|---------------------------------------------------|---------------------------------------------|
| REGION1234 | REGION5678_I | 4956 | -0.1060 | 524267 BUSHLAND 6 230 524276 WILDOR_WND6 230 1    | C:650271 81&OC 7 115 650274 91&HWY27 115 1  |
| REGION1234 | REGION5678_I | 4965 | 0.0530  | 524486 CAPROCK 3 115 524502 NORTON 3 115 1        | C:650217 8&N 7 115 650219 17&HOL 7 115 1    |
| REGION1234 | REGION5678_I | 5041 | -0.0969 | 523959 POTTER_CO 6 230 524267 BUSHLAND 6 230 1    | C:646206 S1206 5 161 648199 SARP4&5T 161 1  |
| REGION1234 | REGION5678_I | 5737 | -0.0430 | 511489 WTH_JCT4 138 511497 WTH_SE 4 138 1         | C:765341 COMANCH5 345 765342 MED-LDG5 345 1 |
| REGION1234 | REGION5678_I | 5981 | 0.0430  | 511540 CAN_GAS4 138 514821 JENSEN 4 138 1         | C:765341 COMANCH5 345 765342 MED-LDG5 345 1 |
| REGION1234 | REGION5678_I | 5982 | -0.0331 | 640093 C.CREEK4 230 640286 N.PLATT4 230 1         | C:659185 ELSIETP7 115 659243 ELSIE 7 115 1  |
| REGION1234 | REGION5678_I | 6044 | -0.0383 | 640302 OGALALA4 230 659134 SIDNEY 4 230 1         | C:659134 SIDNEY 4 230 659136 SIDNEY*4 230 1 |
| REGION1234 | REGION5678_I | 6103 | -0.0795 | 524885 SN_JUAN_TAP6 230 524889 SN_JUAN_WND6 230 1 | C:646209 S1209 5 161 648009 S1209T1T 161 1  |
| REGION6    | REGION7_I    | 2196 | -0.0461 | 532851 AUBURN 6 230 532852 JEC 6 230 1            | C:532765 HOYT 7 345 532766 JEC N 7 345 1    |
| REGION6    | REGION7_I    | 2468 | -0.0460 | 509834 COGENT 7 345 B\$0339 COGEN G1 1.00 1       | Base Case                                   |
| REGION6    | REGION7_I    | 2885 | 0.0467  | 646211 S1211 5 161 646250 S1250 5 161 2           | C:646211 S1211 5 161 646250 S1250 5 161 1   |
| REGION6    | REGION7_I    | 2948 | 0.1278  | 532774 SWISVAL7 345 542965 W.GRDNR7 345 1         | C:532765 HOYT 7 345 532766 JEC N 7 345 1    |
| REGION6    | REGION7_I    | 3590 | -0.0912 | 532765 HOYT 7 345 532766 JEC N 7 345 1            | C:532766 JEC N 7 345 532773 SUMMIT 7 345 1  |
| REGION6    | REGION7_I    | 3657 | 0.0464  | 646211 S1211 5 161 646250 S1250 5 161 1           | C:646211 S1211 5 161 646250 S1250 5 161 2   |
| REGION6    | REGION7_I    | 3908 | 0.0419  | B\$0337 COFAUTO1 1.00 512734 FARML 4 138 1        | C:3wnd: OPEN B\$0338 COFAUTO2 2             |
| REGION6    | REGION7_I    | 3908 | -0.0419 | 512734 FARML 4 138 B\$0338 COFAUTO2 1.00 2        | C:3wnd: OPEN B\$0337 COFAUTO1 1             |
| REGION6    | REGION7_I    | 4806 | 0.0372  | 542965 W.GRDNR7 345 542968 STILWEL7 345 1         | C:542968 STILWEL7 345 542981 LACYGNE7 345 1 |
| REGION6    | REGION7_I    | 5135 | -0.0785 | 532800 LATHAMS7 345 547501 ELKRV7 345 1           | C:640215 HASTING7 115 640313 PAULINE7 115 2 |
| REGION6    | REGION7_I    | 5445 | 0.1087  | 532768 EMPEC 7 345 532774 SWISVAL7 345 1          | C:532768 EMPEC 7 345 532796 WICHITA7 345 1  |
| REGION6    | REGION7_I    | 5925 | 0.1198  | 532765 HOYT 7 345 532772 STRANGR7 345 1           | C:532774 SWISVAL7 345 542965 W.GRDNR7 345 1 |
| REGION6    | REGION7_I    | 6041 | -0.0361 | 542973 HAWTHRN5 161 B\$0532 HAWT 20 1.00 20       | C:3wnd: OPEN B\$0533 HAWT 22 22             |
| REGION6    | REGION7_I    | 6041 | 0.0361  | 542972 HAWTH 7 345 B\$0532 HAWT 20 1.00 20        | C:3wnd: OPEN B\$0533 HAWT 22 22             |
| REGION6    | REGION7_I    | 6547 | 0.0357  | 532937 NEOSHO 5 161 547465 COL 94 5 161 1         | C:532932 LITCH 5 161 547476 ASB349 5 161 1  |
| REGION6    | REGION7_I    | 6581 | 0.0999  | 532772 STRANGR7 345 542977 CRAIG 7 345 1          | C:532774 SWISVAL7 345 542965 W.GRDNR7 345 1 |
| REGION6    | REGION7_I    | 6885 | 0.0357  | 547465 COL 94 5 161 547469 RIV4525 161 1          | C:532932 LITCH 5 161 547476 ASB349 5 161 1  |
| REGION6    | REGION7_I    | 7054 | 0.0350  | 532851 AUBURN 6 230 532856 SWISVAL6 230 1         | C:532765 HOYT 7 345 532766 JEC N 7 345 1    |
| REGION6    | REGION7_I    | 7297 | 0.0419  | 510378 SCOFCTY4 138 510422 COFFEYT4 138 1         | C:510379 DELWARE4 138 512734 FARML 4 138 1  |
| REGION6    | REGION7_I    | 7306 | 0.0858  | 532768 EMPEC 7 345 532796 WICHITA7 345 1          | C:532768 EMPEC 7 345 532774 SWISVAL7 345 1  |
| REGION6    | REGION7_I    | 8325 | -0.0419 | 510378 SCOFCTY4 138 512734 FARML 4 138 1          | C:510379 DELWARE4 138 512734 FARML 4 138 1  |
| REGION6    | REGION7_I    | 8442 | 0.0355  | 532932 LITCH 5 161 547476 ASB349 5 161 1          | C:532937 NEOSHO 5 161 547465 COL 94 5 161 1 |

|         |           |      |         |                    |      |                  |      |    |                               |     |                 |     |   |
|---------|-----------|------|---------|--------------------|------|------------------|------|----|-------------------------------|-----|-----------------|-----|---|
| REGION6 | REGION7_I | 8443 | -0.0390 | 532853 LAWHILL6    | 230  | 532856 SWISVAL6  | 230  | 1  | C:532774 SWISVAL7             | 345 | 542965 W.GRDNR7 | 345 | 1 |
| REGION6 | REGION7_I | 8599 | -0.1001 | 640139 COOPER 3    | 345  | 645458 S3458 3   | 345  | 1  | C:645458 S3458 3              | 345 | 650189 103&R0K3 | 345 | 1 |
| REGION6 | REGION7_I | 8608 | 0.0362  | 532770 MORRIS 7    | 345  | B\$0679 MORRIS1X | 1.00 | 1  | C:532768 EMPEC 7              | 345 | 532774 SWISVAL7 | 345 | 1 |
| REGION6 | REGION7_I | 8616 | -0.0362 | 532863 MORRIS 6    | 230  | B\$0679 MORRIS1X | 1.00 | 1  | C:532768 EMPEC 7              | 345 | 532774 SWISVAL7 | 345 | 1 |
| REGION6 | REGION7_I | 9398 | -0.0325 | 542973 HAWTHRN5    | 161  | B\$0533 HAWT 22  | 1.00 | 22 | C:3wnd: OPEN B\$0532 HAWT 20  | 20  |                 |     |   |
| REGION6 | REGION7_I | 9398 | 0.0325  | 542972 HAWTH 7     | 345  | B\$0533 HAWT 22  | 1.00 | 22 | C:3wnd: OPEN B\$0532 HAWT 20  | 20  |                 |     |   |
| REGION6 | REGION7_I | 9565 | -0.0419 | 510379 DELWARE4    | 138  | 512734 FARML 4   | 138  | 1  | C:510378 SCOFCTY4             | 138 | 512734 FARML 4  | 138 | 1 |
| REGION6 | REGION7_I | 9636 | 0.0409  | 640278 SHELDON7    | 115  | B\$0675 MOORE T1 | 1.00 | 1  | C:640278 SHELDON7             | 115 | 650242 SW7&PH 7 | 115 | 1 |
| REGION6 | REGION8_I | 1911 | 0.0493  | 549984 BROOKLINE 7 | 345  | B\$0297 BRKLTX1  | 1.00 | 1  | C:3wnd: OPEN B\$0298 BRKLTX2  | 2   |                 |     |   |
| REGION6 | REGION8_I | 1915 | -0.0493 | 549969 BROOKLINE 5 | 161  | B\$0297 BRKLTX1  | 1.00 | 1  | C:3wnd: OPEN B\$0298 BRKLTX2  | 2   |                 |     |   |
| REGION6 | REGION8_I | 1939 | 0.0491  | 549984 BROOKLINE 7 | 345  | B\$0298 BRKLTX2  | 1.00 | 2  | C:3wnd: OPEN B\$0297 BRKLTX1  | 1   |                 |     |   |
| REGION6 | REGION8_I | 1942 | -0.0491 | 549969 BROOKLINE 5 | 161  | B\$0298 BRKLTX2  | 1.00 | 2  | C:3wnd: OPEN B\$0297 BRKLTX1  | 1   |                 |     |   |
| REGION6 | REGION8_I | 2468 | -0.0460 | 509834 COGENT 7    | 345  | B\$0339 COGEN G1 | 1.00 | 1  | Base Case                     |     |                 |     |   |
| REGION6 | REGION8_I | 2558 | -0.0396 | 532851 AUBURN 6    | 230  | 532852 JEC 6     | 230  | 1  | C:532765 HOYT 7               | 345 | 532766 JEC N 7  | 345 | 1 |
| REGION6 | REGION8_I | 2590 | -0.0481 | 507774 NORAM 4     | 138  | 508808 LONGWD 4  | 138  | 1  | C:507760 SW SHV 7             | 345 | 508809 LONGWD 7 | 345 | 1 |
| REGION6 | REGION8_I | 2659 | -0.0481 | 507749 RAINES 4    | 138  | 507774 NORAM 4   | 138  | 1  | C:507760 SW SHV 7             | 345 | 508809 LONGWD 7 | 345 | 1 |
| REGION6 | REGION8_I | 2855 | 0.0472  | 646211 S1211 5     | 161  | 646250 S1250 5   | 161  | 2  | C:646211 S1211 5              | 161 | 646250 S1250 5  | 161 | 1 |
| REGION6 | REGION8_I | 3226 | -0.0481 | 507711 ARSHILL4    | 138  | 507749 RAINES 4  | 138  | 1  | C:507760 SW SHV 7             | 345 | 508809 LONGWD 7 | 345 | 1 |
| REGION6 | REGION8_I | 3306 | 0.1139  | 532774 SWISVAL7    | 345  | 542965 W.GRDNR7  | 345  | 1  | C:532765 HOYT 7               | 345 | 532766 JEC N 7  | 345 | 1 |
| REGION6 | REGION8_I | 3536 | 0.0538  | 500300 EUNICE 4    | 138  | 500540 MANUEL 4  | 138  | 1  | C:500920 WSTFORK6             | 230 | 500940 WELLS 6  | 230 | 1 |
| REGION6 | REGION8_I | 3619 | 0.0469  | 646211 S1211 5     | 161  | 646250 S1250 5   | 161  | 1  | C:646211 S1211 5              | 161 | 646250 S1250 5  | 161 | 2 |
| REGION6 | REGION8_I | 3771 | 0.0775  | 508809 LONGWD 7    | 345  | B\$0620 LONGWOOD | 1.00 | 1  | C:507760 SW SHV 7             | 345 | 508809 LONGWD 7 | 345 | 1 |
| REGION6 | REGION8_I | 3774 | -0.0775 | 508808 LONGWD 4    | 138  | B\$0620 LONGWOOD | 1.00 | 1  | C:507760 SW SHV 7             | 345 | 508809 LONGWD 7 | 345 | 1 |
| REGION6 | REGION8_I | 3908 | -0.0419 | 512734 FARML 4     | 138  | B\$0338 COFAUTO2 | 1.00 | 2  | C:3wnd: OPEN B\$0337 COFAUTO1 | 1   |                 |     |   |
| REGION6 | REGION8_I | 3908 | 0.0419  | B\$0337 COFAUTO1   | 1.00 | 512734 FARML 4   | 138  | 1  | C:3wnd: OPEN B\$0338 COFAUTO2 | 2   |                 |     |   |
| REGION6 | REGION8_I | 3920 | -0.0836 | 532765 HOYT 7      | 345  | 532766 JEC N 7   | 345  | 1  | C:532766 JEC N 7              | 345 | 532773 SUMMIT 7 | 345 | 1 |
| REGION6 | REGION8_I | 4020 | -0.0538 | 500230 COUGH 4     | 138  | 500540 MANUEL 4  | 138  | 1  | C:500920 WSTFORK6             | 230 | 500940 WELLS 6  | 230 | 1 |
| REGION6 | REGION8_I | 4105 | 0.0436  | 542965 W.GRDNR7    | 345  | 542968 STILWEL7  | 345  | 1  | C:542968 STILWEL7             | 345 | 542981 LACYGNE7 | 345 | 1 |
| REGION6 | REGION8_I | 4901 | -0.0336 | 507755 S SHV 4     | 138  | 507767 WESTELC4  | 138  | 1  | C:507748 POWELL 4             | 138 | 507759 SW SHV 4 | 138 | 1 |
| REGION6 | REGION8_I | 5008 | -0.1080 | 500920 WSTFORK6    | 230  | 500940 WELLS 6   | 230  | 1  | C:500300 EUNICE 4             | 138 | 500540 MANUEL 4 | 138 | 1 |

|         |           |      |         |                 |                      |        |                   |                     |       |
|---------|-----------|------|---------|-----------------|----------------------|--------|-------------------|---------------------|-------|
| REGION6 | REGION8_I | 5135 | -0.0785 | 532800 LATHAMS7 | 345 547501 ELKVR17   | 345 1  | C:543055 SEOTTWA5 | 161 543077 PLSTVAL5 | 161 1 |
| REGION6 | REGION8_I | 5208 | -0.0317 | 507738 LINWOOD4 | 138 507748 POWELL 4  | 138 1  | C:507767 WESTELC4 | 138 507768 WESTELT4 | 138 1 |
| REGION6 | REGION8_I | 5477 | -0.1080 | 500880 VILPLT 6 | 230 500920 WSTFORK6  | 230 1  | C:500300 EUNICE 4 | 138 500540 MANUEL 4 | 138 1 |
| REGION6 | REGION8_I | 5684 | -0.0358 | 505516 OZARK H5 | 161 505522 VAN BUR5  | 161 1  | C:515339 VBI 5    | 161 515360 TWNBDRG5 | 161 1 |
| REGION6 | REGION8_I | 5739 | 0.0939  | 508359 WELSH 7  | 345 508832 DIANA 7   | 345 1  | C:508359 WELSH 7  | 345 508832 DIANA 7  | 345 2 |
| REGION6 | REGION8_I | 5791 | 0.0935  | 508359 WELSH 7  | 345 508832 DIANA 7   | 345 2  | C:508359 WELSH 7  | 345 508832 DIANA 7  | 345 1 |
| REGION6 | REGION8_I | 5814 | -0.0317 | 507748 POWELL 4 | 138 507759 SW SHV 4  | 138 1  | C:507767 WESTELC4 | 138 507768 WESTELT4 | 138 1 |
| REGION6 | REGION8_I | 5825 | 0.1016  | 532768 EMPEC 7  | 345 532774 SWISVAL7  | 345 1  | C:532768 EMPEC 7  | 345 532796 WICHITA7 | 345 1 |
| REGION6 | REGION9_I | 377  | -0.0359 | 505418 JONESB05 | 161 505420 HERGETT5  | 161 1  | C:505410 KENNETT5 | 161 505412 PARAGLD5 | 161 1 |
| REGION6 | REGION9_I | 1681 | 0.0350  | 505400 N MADRD5 | 161 505410 KENNETT5  | 161 1  | C:505418 JONESB05 | 161 505420 HERGETT5 | 161 1 |
| REGION6 | REGION9_I | 1761 | -0.0567 | 505418 JONESB05 | 161 505442 WATER V5  | 161 1  | C:505410 KENNETT5 | 161 505412 PARAGLD5 | 161 1 |
| REGION6 | REGION9_I | 1827 | -0.1172 | 502401 FLANDER6 | 230 502402 ACADIAN6  | 230 1  | C:500773 SEGURA 6 | 230 500776 SELLRD6  | 230 1 |
| REGION6 | REGION9_I | 1936 | 0.0932  | 500330 FLANDR 4 | 138 500774 SEGURA4   | 138 1  | C:500773 SEGURA 6 | 230 500776 SELLRD6  | 230 1 |
| REGION6 | REGION9_I | 1972 | -0.1172 | 502402 ACADIAN6 | 230 502403 BONIN 6   | 230 1  | C:500773 SEGURA 6 | 230 500776 SELLRD6  | 230 1 |
| REGION6 | REGION9_I | 2020 | 0.1394  | 500410 HOPKINS4 | 138 500580 MORBHAN4  | 138 1  | C:500410 HOPKINS4 | 138 500660 PATOUT 4 | 138 1 |
| REGION6 | REGION9_I | 2055 | -0.1289 | 500410 HOPKINS4 | 138 500774 SEGURA4   | 138 1  | C:500100 BERWKTP4 | 138 500740 RAMOS 4  | 138 1 |
| REGION6 | REGION9_I | 2181 | 0.1574  | 500410 HOPKINS4 | 138 500660 PATOUT 4  | 138 1  | C:500410 HOPKINS4 | 138 500580 MORBHAN4 | 138 1 |
| REGION6 | REGION9_I | 2252 | 0.0465  | 505410 KENNETT5 | 161 505412 PARAGLD5  | 161 1  | C:505418 JONESB05 | 161 505442 WATER V5 | 161 1 |
| REGION6 | REGION9_I | 2428 | 0.1574  | 500660 PATOUT 4 | 138 500820 TECHE 4   | 138 1  | C:500410 HOPKINS4 | 138 500580 MORBHAN4 | 138 1 |
| REGION6 | REGION9_I | 2439 | -0.0415 | 532851 AUBURN 6 | 230 532852 JEC 6     | 230 1  | C:532765 HOYT 7   | 345 532766 JEC N 7  | 345 1 |
| REGION6 | REGION9_I | 2466 | 0.1708  | 500940 WELLS 6  | 230 502420 LABBETAP  | 230 1  | C:500940 WELLS 6  | 230 502410 PMOUTON6 | 230 1 |
| REGION6 | REGION9_I | 2468 | -0.0460 | 509834 COGENT 7 | 345 B\$0339 COGEN G1 | 1.00 1 | Base Case         |                     |       |
| REGION6 | REGION9_I | 2540 | -0.1459 | 502403 BONIN 6  | 230 502421 LABBE     | 230 2  | C:502403 BONIN 6  | 230 502421 LABBE    | 230 1 |
| REGION6 | REGION9_I | 2540 | -0.1459 | 502403 BONIN 6  | 230 502421 LABBE     | 230 1  | C:502403 BONIN 6  | 230 502421 LABBE    | 230 2 |
| REGION6 | REGION9_I | 2615 | 0.0317  | 505440 DONIPHN5 | 161 505442 WATER V5  | 161 1  | C:505410 KENNETT5 | 161 505412 PARAGLD5 | 161 1 |
| REGION6 | REGION9_I | 2636 | 0.1585  | 500940 WELLS 6  | 230 502410 PMOUTON6  | 230 1  | C:500940 WELLS 6  | 230 502420 LABBETAP | 230 1 |
| REGION6 | REGION9_I | 2710 | 0.1311  | 500773 SEGURA 6 | 230 500774 SEGURA4   | 138 1  | C:500330 FLANDR 4 | 138 500774 SEGURA4  | 138 1 |
| REGION6 | REGION9_I | 2724 | 0.1585  | 502410 PMOUTON6 | 230 502421 LABBE     | 230 1  | C:500940 WELLS 6  | 230 502420 LABBETAP | 230 1 |
| REGION6 | REGION9_I | 2771 | 0.0302  | 505480 BEAVER 5 | 161 506932 EUREKA 5  | 161 1  | Base Case         |                     |       |
| REGION6 | REGION9_I | 2848 | 0.0473  | 646211 S1211 5  | 161 646250 S1250 5   | 161 2  | C:646211 S1211 5  | 161 646250 S1250 5  | 161 1 |



|         |            |      |         |                  |      |              |                  |      |      |                               |                   |                 |                 |                 |     |     |   |
|---------|------------|------|---------|------------------|------|--------------|------------------|------|------|-------------------------------|-------------------|-----------------|-----------------|-----------------|-----|-----|---|
| REGION6 | REGION9_I  | 2861 | 0.1394  | 500580 MORBHAN4  | 138  | 500820 TECHE | 4                | 138  | 1    | C:500410 HOPKINS4             | 138               | 500660 PATOUT   | 4               | 138             | 1   |     |   |
| REGION6 | REGION9_I  | 2957 | 0.0359  | 500740 RAMOS     | 4    | 138          | 503301 MRGNCTY4  | 138  | 1    | C:521028 PINK SW4             | 138               | 521048 SHAWNEE4 |                 | 138             | 1   |     |   |
| REGION6 | REGION9_I  | 3184 | 0.1183  | 532774 SWISVAL7  |      | 345          | 542965 W.GRDNR7  | 345  | 1    | C:532765 HOYT                 | 7                 | 345             | 532766 JEC N    | 7               | 345 | 1   |   |
| REGION6 | REGION9_I  | 3198 | -0.0454 | 500760 RAPIDES6  |      | 230          | 500770 RODEMR    | 6    | 230  | 1                             | C:500770 RODEMR   | 6               | 230             | 500790 SHERWD   | 6   | 230 | 1 |
| REGION6 | REGION9_I  | 3610 | 0.0470  | 646211 S1211     | 5    | 161          | 646250 S1250     | 5    | 161  | 1                             | C:646211 S1211    | 5               | 161             | 646250 S1250    | 5   | 161 | 2 |
| REGION6 | REGION9_I  | 5098 | -0.0504 | 500100 BERWKTP4  |      | 138          | 500740 RAMOS     | 4    | 138  | 1                             | C:646206 S1206    | 5               | 161             | 648199 SARP4&5T |     | 161 | 1 |
| REGION6 | REGION9_I  | 5132 | -0.0504 | 500060 BVISTA    | 4    | 138          | 500100 BERWKTP4  | 138  | 1    | C:646206 S1206                | 5                 | 161             | 648199 SARP4&5T |                 | 161 | 1   |   |
| REGION6 | REGION9_I  | 5135 | -0.0785 | 532800 LATHAMS7  |      | 345          | 547501 ELKRVR17  | 345  | 1    | C:650215 19&ALV07             |                   | 115             | 650261 56&I80   | 7               | 115 | 1   |   |
| REGION6 | REGION10_I | 1220 | -0.2605 | 505428 SIKESTN5  |      | 161          | 505434 IDALIA    | 5    | 161  | 1                             | C:505400 N MADRD5 |                 | 161             | 505428 SIKESTN5 |     | 161 | 1 |
| REGION6 | REGION10_I | 1576 | 0.1852  | 505400 N MADRD5  |      | 161          | 505428 SIKESTN5  | 161  | 1    | C:505428 SIKESTN5             |                   | 161             | 505434 IDALIA   | 5               | 161 | 1   |   |
| REGION6 | REGION10_I | 2330 | -0.0435 | 532851 AUBURN    | 6    | 230          | 532852 JEC       | 6    | 230  | 1                             | C:532765 HOYT     | 7               | 345             | 532766 JEC N    | 7   | 345 | 1 |
| REGION6 | REGION10_I | 2468 | -0.0460 | 509834 COGENT    | 7    | 345          | B\$0339 COGEN    | G1   | 1.00 | 1                             | Base Case         |                 |                 |                 |     |     |   |
| REGION6 | REGION10_I | 2651 | 0.0781  | 507454 HEMPSTD4  |      | 138          | B\$0538 HEMP     | 1    | 1.00 | 1                             | Base Case         |                 |                 |                 |     |     |   |
| REGION6 | REGION10_I | 2652 | -0.0781 | 507456 HEMPSTD3  |      | 115          | B\$0538 HEMP     | 1    | 1.00 | 1                             | Base Case         |                 |                 |                 |     |     |   |
| REGION6 | REGION10_I | 2851 | 0.0473  | 646211 S1211     | 5    | 161          | 646250 S1250     | 5    | 161  | 2                             | C:646211 S1211    | 5               | 161             | 646250 S1250    | 5   | 161 | 1 |
| REGION6 | REGION10_I | 2969 | 0.0602  | 542965 W.GRDNR7  |      | 345          | 542968 STILWEL7  | 345  | 1    | C:542968 STILWEL7             |                   | 345             | 542981 LACYGNE7 |                 | 345 | 1   |   |
| REGION6 | REGION10_I | 3035 | 0.1241  | 532774 SWISVAL7  |      | 345          | 542965 W.GRDNR7  | 345  | 1    | C:532765 HOYT                 | 7                 | 345             | 532766 JEC N    | 7               | 345 | 1   |   |
| REGION6 | REGION10_I | 3285 | -0.0790 | 504122 MCNAB     | 3    | 115          | 507456 HEMPSTD3  | 115  | 1    | C:508572 LEBROCK7             |                   | 345             | 508585 TENRUSK7 |                 | 345 | 1   |   |
| REGION6 | REGION10_I | 3348 | 0.0790  | 504122 MCNAB     | 3    | 115          | 507453 HOPE      | 3    | 115  | 1                             | C:508572 LEBROCK7 |                 | 345             | 508585 TENRUSK7 |     | 345 | 1 |
| REGION6 | REGION10_I | 3561 | -0.0920 | 532765 HOYT      | 7    | 345          | 532766 JEC N     | 7    | 345  | 1                             | C:532766 JEC N    | 7               | 345             | 532773 SUMMIT   | 7   | 345 | 1 |
| REGION6 | REGION10_I | 3614 | 0.0470  | 646211 S1211     | 5    | 161          | 646250 S1250     | 5    | 161  | 1                             | C:646211 S1211    | 5               | 161             | 646250 S1250    | 5   | 161 | 2 |
| REGION6 | REGION10_I | 3908 | -0.0419 | 512734 FARML     | 4    | 138          | B\$0338 COFAUT02 | 1.00 | 2    | C:3Wnd: OPEN B\$0337 COFAUT01 |                   | 1               |                 |                 |     |     |   |
| REGION6 | REGION10_I | 3908 | 0.0419  | B\$0337 COFAUT01 | 1.00 | 512734 FARML | 4                | 138  | 1    | C:3Wnd: OPEN B\$0338 COFAUT02 |                   | 2               |                 |                 |     |     |   |
| REGION6 | REGION10_I | 4311 | -0.0781 | 503912 FULTON    | 3    | 115          | 507453 HOPE      | 3    | 115  | 1                             | Base Case         |                 |                 |                 |     |     |   |
| REGION6 | REGION10_I | 5135 | -0.0785 | 532800 LATHAMS7  |      | 345          | 547501 ELKRVR17  | 345  | 1    | C:650262 57&GAR               | 7                 | 115             | 650267 84&LE    | 7               | 115 | 1   |   |
| REGION6 | REGION10_I | 7771 | -0.0307 | 505416 CENTR     | H5   | 161          | 505418 JONESB05  | 161  | 1    | C:652302 JULESBG7             |                   | 115             | 659240 INTERST7 |                 | 115 | 1   |   |
| REGION6 | REGION10_I | 8978 | -0.0307 | 505412 PARAGLD5  |      | 161          | 505416 CENTR     | H5   | 161  | 1                             | C:652302 JULESBG7 |                 | 115             | 659240 INTERST7 |     | 115 | 1 |
| REGION6 | REGION10_I | 9215 | 0.0834  | 532765 HOYT      | 7    | 345          | 532772 STRANGR7  | 345  | 1    | C:646258 S1258                | 5                 | 161             | 646263 S1263    | 5               | 161 | 1   |   |
| REGION6 | REGION10_I | 9379 | 0.0422  | 640278 SHELDON7  |      | 115          | B\$0675 MOORE    | T1   | 1.00 | 1                             | C:650238 20&PIO   | 7               | 115             | 650242 SW7&PH   | 7   | 115 | 1 |
| REGION6 | REGION10_I | 9381 | -0.0422 | 640277 MOORE     | 3    | 345          | B\$0675 MOORE    | T1   | 1.00 | 1                             | C:650238 20&PIO   | 7               | 115             | 650242 SW7&PH   | 7   | 115 | 1 |



|         |            |       |         |                    |     |                  |      |   |                               |     |                 |     |   |
|---------|------------|-------|---------|--------------------|-----|------------------|------|---|-------------------------------|-----|-----------------|-----|---|
| REGION6 | REGION10_I | 9861  | 0.0726  | 532768 EMPEC 7     | 345 | 532774 SWISVAL7  | 345  | 1 | C:765341 COMANCH5             | 345 | 765342 MED-LDG5 | 345 | 2 |
| REGION6 | REGION10_I | 9958  | 0.1002  | 515224 MUSKOG7     | 345 | 515302 FTSMITH7  | 345  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7 | 115 | 1 |
| REGION6 | REGION10_I | 10204 | 0.0920  | 515302 FTSMITH7    | 345 | B\$0457 FTSMITH1 | 1.00 | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7 | 115 | 1 |
| REGION6 | REGION10_I | 10208 | -0.0920 | 515305 FTSMITH8    | 500 | B\$0457 FTSMITH1 | 1.00 | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7 | 115 | 1 |
| REGION6 | REGION10_I | 10817 | 0.0649  | 532768 EMPEC 7     | 345 | 532796 WICHITA7  | 345  | 1 | C:646258 S1258 5              | 161 | 646263 S1263 5  | 161 | 1 |
| REGION6 | REGION10_I | 11791 | -0.0307 | 505410 KENNETT5    | 161 | 505412 PARAGLD5  | 161  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7 | 115 | 1 |
| REGION6 | REGION10_I | 13923 | 0.0971  | 510907 PITTSB-7    | 345 | 510911 VALIANT7  | 345  | 1 | C:652302 JULESBG7             | 115 | 659240 INTERST7 | 115 | 1 |
| REGION6 | REGION10_I | 14313 | 0.0383  | 541198 PECULR 7    | 345 | 541200 PHILL 7   | 345  | 1 | C:646206 S1206 5              | 161 | 648199 SARP4&5T | 161 | 1 |
| REGION7 | REGION8_I  | 2359  | 0.0399  | 549984 BROOKLINE 7 | 345 | B\$0297 BRKLTXT1 | 1.00 | 1 | C:3Wnd: OPEN B\$0298 BRKLTXT2 |     | 2               |     |   |
| REGION7 | REGION8_I  | 2364  | -0.0399 | 549969 BROOKLINE 5 | 161 | B\$0297 BRKLTXT1 | 1.00 | 1 | C:3Wnd: OPEN B\$0298 BRKLTXT2 |     | 2               |     |   |
| REGION7 | REGION8_I  | 2394  | 0.0398  | 549984 BROOKLINE 7 | 345 | B\$0298 BRKLTXT2 | 1.00 | 2 | C:3Wnd: OPEN B\$0297 BRKLTXT1 |     | 1               |     |   |
| REGION7 | REGION8_I  | 2397  | -0.0398 | 549969 BROOKLINE 5 | 161 | B\$0298 BRKLTXT2 | 1.00 | 2 | C:3Wnd: OPEN B\$0297 BRKLTXT1 |     | 1               |     |   |
| REGION7 | REGION8_I  | 2610  | -0.0477 | 507774 NORAM 4     | 138 | 508808 LONGWD 4  | 138  | 1 | C:507760 SW SHV 7             | 345 | 508809 LONGWD 7 | 345 | 1 |
| REGION7 | REGION8_I  | 2680  | -0.0477 | 507749 RAINES 4    | 138 | 507774 NORAM 4   | 138  | 1 | C:507760 SW SHV 7             | 345 | 508809 LONGWD 7 | 345 | 1 |
| REGION7 | REGION8_I  | 2909  | 0.0341  | 541225 PHILL 5     | 161 | 541243 LKWINGB5  | 161  | 1 | C:541218 GRNWD 5              | 161 | 541233 LEESUM 5 | 161 | 1 |
| REGION7 | REGION8_I  | 3252  | -0.0477 | 507711 ARSHILL4    | 138 | 507749 RAINES 4  | 138  | 1 | C:507760 SW SHV 7             | 345 | 508809 LONGWD 7 | 345 | 1 |
| REGION7 | REGION8_I  | 3332  | 0.0341  | 541243 LKWINGB5    | 161 | 541249 HOOKRD 5  | 161  | 1 | C:541218 GRNWD 5              | 161 | 541233 LEESUM 5 | 161 | 1 |
| REGION7 | REGION8_I  | 3514  | 0.0610  | 546652 QUIND 5     | 161 | 546684 EFAIRFX5  | 161  | 1 | C:546652 QUIND 5              | 161 | 546653 NEARMAN5 | 161 | 1 |
| REGION7 | REGION8_I  | 3644  | 0.0666  | 546652 QUIND 5     | 161 | 546653 NEARMAN5  | 161  | 1 | C:546652 QUIND 5              | 161 | 546684 EFAIRFX5 | 161 | 1 |
| REGION7 | REGION8_I  | 3804  | 0.0500  | 500300 EUNICE 4    | 138 | 500540 MANUEL 4  | 138  | 1 | C:500920 WSTFORK6             | 230 | 500940 WELLS 6  | 230 | 1 |
| REGION7 | REGION8_I  | 3984  | 0.0368  | 546653 NEARMAN5    | 161 | 546654 SUNSET 5  | 161  | 1 | C:546653 NEARMAN5             | 161 | 546656 MAYWOOD5 | 161 | 1 |
| REGION7 | REGION8_I  | 4112  | -0.0311 | 508806 LIEBERM4    | 138 | 508833 IPCJEFF4  | 138  | 1 | C:508809 LONGWD 7             | 345 | 508841 WILKES 7 | 345 | 1 |
| REGION7 | REGION8_I  | 4324  | -0.0500 | 500230 COUGH 4     | 138 | 500540 MANUEL 4  | 138  | 1 | C:500920 WSTFORK6             | 230 | 500940 WELLS 6  | 230 | 1 |
| REGION7 | REGION8_I  | 4350  | -0.0312 | 507711 ARSHILL4    | 138 | 508806 LIEBERM4  | 138  | 1 | C:507774 NORAM 4              | 138 | 508808 LONGWD 4 | 138 | 1 |
| REGION7 | REGION8_I  | 4430  | -0.0610 | 546663 GM PLT 5    | 161 | 546684 EFAIRFX5  | 161  | 1 | C:546652 QUIND 5              | 161 | 546653 NEARMAN5 | 161 | 1 |
| REGION7 | REGION8_I  | 4450  | -0.0341 | 541224 LNGVW 5     | 161 | 541249 HOOKRD 5  | 161  | 1 | C:541218 GRNWD 5              | 161 | 541233 LEESUM 5 | 161 | 1 |
| REGION7 | REGION8_I  | 4553  | 0.0389  | 508566 SABMINT4    | 138 | 508569 SEMRSHL4  | 138  | 1 | C:508809 LONGWD 7             | 345 | 508841 WILKES 7 | 345 | 1 |
| REGION7 | REGION8_I  | 4832  | 0.0368  | 546654 SUNSET 5    | 161 | 546655 KAW W 5   | 161  | 1 | C:546653 NEARMAN5             | 161 | 546656 MAYWOOD5 | 161 | 1 |
| REGION7 | REGION8_I  | 4858  | -0.0319 | 508835 JEFFRSN4    | 138 | 508840 WILKES 4  | 138  | 1 | C:508809 LONGWD 7             | 345 | 508841 WILKES 7 | 345 | 1 |
| REGION7 | REGION8_I  | 4891  | 0.0610  | 546663 GM PLT 5    | 161 | 546667 FAIRFX-5  | 161  | 1 | C:546652 QUIND 5              | 161 | 546653 NEARMAN5 | 161 | 1 |

|         |           |      |         |                 |                      |        |                   |                     |       |
|---------|-----------|------|---------|-----------------|----------------------|--------|-------------------|---------------------|-------|
| REGION7 | REGION8_I | 4916 | -0.0335 | 507755 S SHV 4  | 138 507767 WESTELC4  | 138 1  | C:507748 POWELL 4 | 138 507759 SW SHV 4 | 138 1 |
| REGION7 | REGION8_I | 4985 | -0.0307 | 532772 STRANGR7 | 345 542982 IATAN 7   | 345 1  | C:541199 ST JOE 3 | 345 542982 IATAN 7  | 345 1 |
| REGION7 | REGION8_I | 5142 | 0.0569  | 508809 LONGWD 7 | 345 B\$0620 LONGWOOD | 1.00 1 | C:507760 SW SHV 7 | 345 508809 LONGWD 7 | 345 1 |
| REGION7 | REGION8_I | 5147 | -0.0569 | 508808 LONGWD 4 | 138 B\$0620 LONGWOOD | 1.00 1 | C:507760 SW SHV 7 | 345 508809 LONGWD 7 | 345 1 |
| REGION7 | REGION8_I | 5170 | 0.0320  | 541225 PHILL 5  | 161 541239 HSNVL 5   | 161 1  | C:541225 PHILL 5  | 161 541243 LKWINGB5 | 161 1 |
| REGION7 | REGION8_I | 5282 | -0.0610 | 546659 CTR CTY5 | 161 546667 FAIRFX-5  | 161 1  | C:546652 QUIND 5  | 161 546653 NEARMAN5 | 161 1 |
| REGION7 | REGION8_I | 5291 | 0.0389  | 508562 PIRKEY 4 | 138 508566 SABMINT4  | 138 1  | C:508809 LONGWD 7 | 345 508841 WILKES 7 | 345 1 |
| REGION7 | REGION8_I | 5361 | -0.0308 | 507738 LINWOOD4 | 138 507748 POWELL 4  | 138 1  | C:507767 WESTELC4 | 138 507768 WESTELT4 | 138 1 |
| REGION7 | REGION9_I | 372  | -0.0364 | 505418 JONESB05 | 161 505420 HERGETT5  | 161 1  | C:505410 KENNETT5 | 161 505412 PARAGLD5 | 161 1 |
| REGION7 | REGION9_I | 1719 | 0.0343  | 505400 N MADRD5 | 161 505410 KENNETT5  | 161 1  | C:505418 JONESB05 | 161 505420 HERGETT5 | 161 1 |
| REGION7 | REGION9_I | 1806 | -0.1186 | 502401 FLANDER6 | 230 502402 ACADIAN6  | 230 1  | C:500773 SEGURA 6 | 230 500776 SELLRD6  | 230 1 |
| REGION7 | REGION9_I | 1830 | -0.0545 | 505418 JONESB05 | 161 505442 WATER V5  | 161 1  | C:505410 KENNETT5 | 161 505412 PARAGLD5 | 161 1 |
| REGION7 | REGION9_I | 1917 | 0.0941  | 500330 FLANDR 4 | 138 500774 SEGURA4   | 138 1  | C:500773 SEGURA 6 | 230 500776 SELLRD6  | 230 1 |
| REGION7 | REGION9_I | 1949 | -0.1186 | 502402 ACADIAN6 | 230 502403 BONIN 6   | 230 1  | C:500773 SEGURA 6 | 230 500776 SELLRD6  | 230 1 |
| REGION7 | REGION9_I | 2004 | 0.1405  | 500410 HOPKINS4 | 138 500580 MORBHAN4  | 138 1  | C:500410 HOPKINS4 | 138 500660 PATOUT 4 | 138 1 |
| REGION7 | REGION9_I | 2055 | -0.1289 | 500410 HOPKINS4 | 138 500774 SEGURA4   | 138 1  | C:500100 BERWKTP4 | 138 500740 RAMOS 4  | 138 1 |
| REGION7 | REGION9_I | 2164 | 0.1587  | 500410 HOPKINS4 | 138 500660 PATOUT 4  | 138 1  | C:500410 HOPKINS4 | 138 500580 MORBHAN4 | 138 1 |
| REGION7 | REGION9_I | 2340 | 0.0447  | 505410 KENNETT5 | 161 505412 PARAGLD5  | 161 1  | C:505418 JONESB05 | 161 505442 WATER V5 | 161 1 |
| REGION7 | REGION9_I | 2409 | 0.1587  | 500660 PATOUT 4 | 138 500820 TECHE 4   | 138 1  | C:500410 HOPKINS4 | 138 500580 MORBHAN4 | 138 1 |
| REGION7 | REGION9_I | 2492 | -0.1487 | 502403 BONIN 6  | 230 502421 LABBE     | 230 1  | C:502403 BONIN 6  | 230 502421 LABBE    | 230 2 |
| REGION7 | REGION9_I | 2492 | -0.1487 | 502403 BONIN 6  | 230 502421 LABBE     | 230 2  | C:502403 BONIN 6  | 230 502421 LABBE    | 230 1 |
| REGION7 | REGION9_I | 2562 | 0.1644  | 500940 WELLS 6  | 230 502420 LABBETAP  | 230 1  | C:500940 WELLS 6  | 230 502410 PMOUTON6 | 230 1 |
| REGION7 | REGION9_I | 2688 | 0.1322  | 500773 SEGURA 6 | 230 500774 SEGURA4   | 138 1  | C:500330 FLANDR 4 | 138 500774 SEGURA4  | 138 1 |
| REGION7 | REGION9_I | 2739 | 0.1525  | 500940 WELLS 6  | 230 502410 PMOUTON6  | 230 1  | C:500940 WELLS 6  | 230 502420 LABBETAP | 230 1 |
| REGION7 | REGION9_I | 2809 | -0.0516 | 500760 RAPIDES6 | 230 500770 RODEMR 6  | 230 1  | C:500770 RODEMR 6 | 230 500790 SHERWD 6 | 230 1 |
| REGION7 | REGION9_I | 2829 | 0.0351  | 541225 PHILL 5  | 161 541243 LKWINGB5  | 161 1  | C:541218 GRNWD 5  | 161 541233 LEESUM 5 | 161 1 |
| REGION7 | REGION9_I | 2831 | 0.1525  | 502410 PMOUTON6 | 230 502421 LABBE     | 230 1  | C:500940 WELLS 6  | 230 502420 LABBETAP | 230 1 |
| REGION7 | REGION9_I | 2839 | 0.1405  | 500580 MORBHAN4 | 138 500820 TECHE 4   | 138 1  | C:500410 HOPKINS4 | 138 500660 PATOUT 4 | 138 1 |
| REGION7 | REGION9_I | 2957 | 0.0359  | 500740 RAMOS 4  | 138 503301 MRGNCTY4  | 138 1  | C:645458 S3458 3  | 345 645740 S3740 3  | 345 1 |
| REGION7 | REGION9_I | 3125 | 0.0357  | 507755 S SHV 4  | 138 507765 WALLAKE4  | 138 1  | C:500250 DOLHILL7 | 345 500260 DOLHILL6 | 230 1 |

|         |            |      |         |                 |     |                 |                 |      |     |                   |                             |                 |                 |                 |     |     |   |
|---------|------------|------|---------|-----------------|-----|-----------------|-----------------|------|-----|-------------------|-----------------------------|-----------------|-----------------|-----------------|-----|-----|---|
| REGION7 | REGION9_I  | 3241 | 0.0351  | 541243 LKWINGB5 | 161 | 541249 HOOKRD   | 5               | 161  | 1   | C:541218 GRNWD    | 5                           | 161             | 541233 LEESUM   | 5               | 161 | 1   |   |
| REGION7 | REGION9_I  | 5167 | 0.0536  | 502401 FLANDER6 | 230 | 502425 BEADLE   | 6               | 230  | 1   | C:765341 COMANCH5 | 345                         | 765342 MED-LDG5 | 345             | 2               |     |     |   |
| REGION7 | REGION9_I  | 5313 | -0.0484 | 500100 BERWKTP4 | 138 | 500740 RAMOS    | 4               | 138  | 1   | C:765341 COMANCH5 | 345                         | 765342 MED-LDG5 | 345             | 2               |     |     |   |
| REGION7 | REGION9_I  | 5348 | -0.0484 | 500060 BVISTA   | 4   | 138             | 500100 BERWKTP4 | 138  | 1   | C:765341 COMANCH5 | 345                         | 765342 MED-LDG5 | 345             | 1               |     |     |   |
| REGION7 | REGION9_I  | 5450 | -0.0331 | 504440 BUFORD   | 5   | 161             | 505460 BULL SH5 | 161  | 1   | C:652302 JULESBG7 | 115                         | 659240 INTERST7 | 115             | 1               |     |     |   |
| REGION7 | REGION9_I  | 5618 | 0.0606  | 500440 IVANHOE4 | 138 | 500460 JULTAP   | 4               | 138  | 1   | C:652302 JULESBG7 | 115                         | 659240 INTERST7 | 115             | 1               |     |     |   |
| REGION7 | REGION9_I  | 5631 | 0.0606  | 500460 JULTAP   | 4   | 138             | 500820 TECHE    | 4    | 138 | 1                 | C:652302 JULESBG7           | 115             | 659240 INTERST7 | 115             | 1   |     |   |
| REGION7 | REGION9_I  | 5747 | -0.0536 | 502417 ELKS     | 6   | 230             | 502425 BEADLE   | 6    | 230 | 1                 | C:765341 COMANCH5           | 345             | 765342 MED-LDG5 | 345             | 1   |     |   |
| REGION7 | REGION10_I | 1223 | -0.2597 | 505428 SIKESTN5 | 161 | 505434 IDALIA   | 5               | 161  | 1   | C:505400 N MADRD5 | 161                         | 505428 SIKESTN5 | 161             | 1               |     |     |   |
| REGION7 | REGION10_I | 1564 | 0.1866  | 505400 N MADRD5 | 161 | 505428 SIKESTN5 | 161             | 1    | 1   | C:505428 SIKESTN5 | 161                         | 505434 IDALIA   | 5               | 161             | 1   |     |   |
| REGION7 | REGION10_I | 2261 | 0.0916  | 507454 HEMPSTD4 | 138 | B\$0538 HEMP    | 1               | 1.00 | 1   | Base Case         |                             |                 |                 |                 |     |     |   |
| REGION7 | REGION10_I | 2261 | -0.0916 | 507456 HEMPSTD3 | 115 | B\$0538 HEMP    | 1               | 1.00 | 1   | Base Case         |                             |                 |                 |                 |     |     |   |
| REGION7 | REGION10_I | 2739 | -0.0919 | 504122 MCNAB    | 3   | 115             | 507456 HEMPSTD3 | 115  | 1   | C:510907 PITTSB-7 | 345                         | 510911 VALIANT7 | 345             | 1               |     |     |   |
| REGION7 | REGION10_I | 2763 | 0.0359  | 541225 PHILL    | 5   | 161             | 541243 LKWINGB5 | 161  | 1   | C:541218 GRNWD    | 5                           | 161             | 541233 LEESUM   | 5               | 161 | 1   |   |
| REGION7 | REGION10_I | 2794 | 0.0919  | 504122 MCNAB    | 3   | 115             | 507453 HOPE     | 3    | 115 | 1                 | C:510907 PITTSB-7           | 345             | 510911 VALIANT7 | 345             | 1   |     |   |
| REGION7 | REGION10_I | 3165 | 0.0359  | 541243 LKWINGB5 | 161 | 541249 HOOKRD   | 5               | 161  | 1   | C:541218 GRNWD    | 5                           | 161             | 541233 LEESUM   | 5               | 161 | 1   |   |
| REGION7 | REGION10_I | 3245 | 0.0328  | 541206 PRALEE   | 5   | 161             | 541211 BLSPS    | 5    | 161 | 1                 | C:3Wnd: OPEN B\$0765 P HILL | 1               |                 |                 |     |     |   |
| REGION7 | REGION10_I | 3512 | 0.0610  | 546652 QUIND    | 5   | 161             | 546684 EFAIRFX5 | 161  | 1   | C:546652 QUIND    | 5                           | 161             | 546653 NEARMAN5 | 161             | 1   |     |   |
| REGION7 | REGION10_I | 3646 | 0.0666  | 546652 QUIND    | 5   | 161             | 546653 NEARMAN5 | 161  | 1   | C:546652 QUIND    | 5                           | 161             | 546684 EFAIRFX5 | 161             | 1   |     |   |
| REGION7 | REGION10_I | 3676 | -0.0916 | 503912 FULTON   | 3   | 115             | 507453 HOPE     | 3    | 115 | 1                 | Base Case                   |                 |                 |                 |     |     |   |
| REGION7 | REGION10_I | 3960 | -0.0328 | 541205 BLSPE    | 5   | 161             | 541211 BLSPS    | 5    | 161 | 1                 | C:3Wnd: OPEN B\$0765 P HILL | 1               |                 |                 |     |     |   |
| REGION7 | REGION10_I | 4017 | 0.0365  | 546653 NEARMAN5 | 161 | 546654 SUNSET   | 5               | 161  | 1   | C:546653 NEARMAN5 | 161                         | 546656 MAYWOOD5 | 161             | 1               |     |     |   |
| REGION7 | REGION10_I | 4178 | 0.0303  | 541218 GRNWD    | 5   | 161             | 541233 LEESUM   | 5    | 161 | 1                 | C:541225 PHILL              | 5               | 161             | 541243 LKWINGB5 | 161 | 1   |   |
| REGION7 | REGION10_I | 4227 | -0.0359 | 541224 LNGVW    | 5   | 161             | 541249 HOOKRD   | 5    | 161 | 1                 | C:541218 GRNWD              | 5               | 161             | 541233 LEESUM   | 5   | 161 | 1 |
| REGION7 | REGION10_I | 4427 | -0.0610 | 546663 GM PLT   | 5   | 161             | 546684 EFAIRFX5 | 161  | 1   | C:546652 QUIND    | 5                           | 161             | 546653 NEARMAN5 | 161             | 1   |     |   |
| REGION7 | REGION10_I | 4873 | 0.0365  | 546654 SUNSET   | 5   | 161             | 546655 KAW W    | 5    | 161 | 1                 | C:546653 NEARMAN5           | 161             | 546656 MAYWOOD5 | 161             | 1   |     |   |
| REGION7 | REGION10_I | 4888 | 0.0610  | 546663 GM PLT   | 5   | 161             | 546667 FAIRFX-5 | 161  | 1   | C:546652 QUIND    | 5                           | 161             | 546653 NEARMAN5 | 161             | 1   |     |   |
| REGION7 | REGION10_I | 5118 | -0.0432 | 541199 ST JOE   | 3   | 345             | 542982 IATAN    | 7    | 345 | 1                 | C:532772 STRANGR7           | 345             | 542982 IATAN    | 7               | 345 | 1   |   |
| REGION7 | REGION10_I | 5278 | -0.0610 | 546659 CTR CTY5 | 161 | 546667 FAIRFX-5 | 161             | 1    | 1   | C:546652 QUIND    | 5                           | 161             | 546653 NEARMAN5 | 161             | 1   |     |   |
| REGION7 | REGION10_I | 5775 | 0.0610  | 546659 CTR CTY5 | 161 | 546661 ARMDALE5 | 161             | 1    | 1   | C:546652 QUIND    | 5                           | 161             | 546653 NEARMAN5 | 161             | 1   |     |   |

|         |            |      |         |                 |     |                 |      |   |                     |     |                     |     |   |
|---------|------------|------|---------|-----------------|-----|-----------------|------|---|---------------------|-----|---------------------|-----|---|
| REGION7 | REGION10_I | 6188 | 0.0303  | 542973 HAWTHRN5 | 161 | 543020 BRMGHAM5 | 161  | 1 | C:541201 SIBLEY 7   | 345 | 542972 HAWTH 7      | 345 | 1 |
| REGION7 | REGION10_I | 6207 | -0.0610 | 546651 BARBER 5 | 161 | 546661 ARMDALE5 | 161  | 1 | C:546652 QUIND 5    | 161 | 546653 NEARMAN5     | 161 | 1 |
| REGION7 | REGION10_I | 6226 | -0.0303 | 541206 PRALEE 5 | 161 | 541233 LEESUM 5 | 161  | 1 | C:541225 PHILL 5    | 161 | 541243 LKWINGB5     | 161 | 1 |
| REGION7 | REGION10_I | 6237 | -0.0310 | 543031 GRNWOOD5 | 161 | 546742 METRO 5  | 161  | 1 | C:546652 QUIND 5    | 161 | 546684 EFAIRFX5     | 161 | 1 |
| REGION7 | REGION10_I | 6243 | 0.0590  | 541225 PHILL 5  | 161 | B\$0765 P HILL  | 1.00 | 1 | C:541225 PHILL 5    | 161 | 541243 LKWINGB5     | 161 | 1 |
| REGION7 | REGION10_I | 6244 | -0.0590 | 541200 PHILL 7  | 345 | B\$0765 P HILL  | 1.00 | 1 | C:541225 PHILL 5    | 161 | 541243 LKWINGB5     | 161 | 1 |
| REGION7 | REGION10_I | 6307 | -0.0383 | 505416 CENTR H5 | 161 | 505418 JONESB05 | 161  | 1 | C:505428 SIKESTN5   | 161 | 505434 IDALIA 5     | 161 | 1 |
| REGION7 | REGION10_I | 6310 | 0.0316  | 500050 BSALES 4 | 138 | 500890 WAXLAKE4 | 138  | 1 | Base Case           |     |                     |     |   |
| REGION8 | REGION9_I  | 370  | -0.0366 | 505418 JONESB05 | 161 | 505420 HERGETT5 | 161  | 1 | C:505410 KENNETT5   | 161 | 505412 PARAGLD5     | 161 | 1 |
| REGION8 | REGION9_I  | 780  | -0.0575 | 500680 PINEV 6  | 230 | 500790 SHERWD 6 | 230  | 1 | C:500760 RAPIDES6   | 230 | 500840 TWINBR6      | 230 | 1 |
| REGION8 | REGION9_I  | 785  | 0.0575  | 500680 PINEV 6  | 230 | 500690 PINEV 4  | 138  | 1 | C:500760 RAPIDES6   | 230 | 500840 TWINBR6      | 230 | 1 |
| REGION8 | REGION9_I  | 922  | -0.1573 | 500760 RAPIDES6 | 230 | 500770 RODEMR 6 | 230  | 1 | C:500770 RODEMR 6   | 230 | 500790 SHERWD 6     | 230 | 1 |
| REGION8 | REGION9_I  | 1064 | -0.2486 | 507711 ARSHILL4 | 138 | 507789 ARSGENS4 | 138  | 1 | C:528094 7-RIVERS 3 | 115 | 528109 CV-LAKEWOOD3 | 115 | 1 |
| REGION8 | REGION9_I  | 1092 | 0.1089  | 507711 ARSHILL4 | 138 | 507742 MCWILLI4 | 138  | 1 | C:507711 ARSHILL4   | 138 | 507731 FTHUMBG4     | 138 | 1 |
| REGION8 | REGION9_I  | 1348 | 0.0610  | 507738 LINWOOD4 | 138 | 507771 CEDARGR4 | 138  | 1 | C:507711 ARSHILL4   | 138 | 507731 FTHUMBG4     | 138 | 1 |
| REGION8 | REGION9_I  | 1348 | -0.0610 | 507755 S SHV 4  | 138 | 507771 CEDARGR4 | 138  | 1 | C:507711 ARSHILL4   | 138 | 507731 FTHUMBG4     | 138 | 1 |
| REGION8 | REGION9_I  | 1462 | -0.0482 | 500280 ELEESV 6 | 230 | 500770 RODEMR 6 | 230  | 1 | C:500200 COLFAX 6   | 230 | 500770 RODEMR 6     | 230 | 1 |
| REGION8 | REGION9_I  | 1473 | 0.0475  | 500840 TWINBR6  | 230 | 500850 TWINBR4  | 138  | 1 | C:500680 PINEV 6    | 230 | 500790 SHERWD 6     | 230 | 1 |
| REGION8 | REGION9_I  | 1485 | 0.1382  | 500770 RODEMR 6 | 230 | 500790 SHERWD 6 | 230  | 1 | C:500760 RAPIDES6   | 230 | 500770 RODEMR 6     | 230 | 1 |
| REGION8 | REGION9_I  | 1501 | 0.0549  | 500690 PINEV 4  | 138 | 500780 SHOAKS 4 | 138  | 1 | C:500690 PINEV 4    | 138 | 500700 PVKFTAP4     | 138 | 1 |
| REGION8 | REGION9_I  | 1544 | 0.1426  | 500190 COCODR 6 | 230 | 500230 COUGH 4  | 138  | 1 | C:500190 COCODR 6   | 230 | 500880 VILPLT 6     | 230 | 1 |
| REGION8 | REGION9_I  | 1792 | -0.1196 | 502401 FLANDER6 | 230 | 502402 ACADIAN6 | 230  | 1 | C:500773 SEGURA 6   | 230 | 500776 SELLRD6      | 230 | 1 |
| REGION8 | REGION9_I  | 1809 | -0.1589 | 500340 FHILL 6  | 230 | 500760 RAPIDES6 | 230  | 1 | C:500190 COCODR 6   | 230 | 500770 RODEMR 6     | 230 | 1 |
| REGION8 | REGION9_I  | 1823 | 0.0323  | 505400 N MADRD5 | 161 | 505410 KENNETT5 | 161  | 1 | C:505418 JONESB05   | 161 | 505420 HERGETT5     | 161 | 1 |
| REGION8 | REGION9_I  | 1865 | 0.0968  | 500330 FLANDR 4 | 138 | 500774 SEGURA4  | 138  | 1 | C:500773 SEGURA 6   | 230 | 500776 SELLRD6      | 230 | 1 |
| REGION8 | REGION9_I  | 1879 | -0.0531 | 505418 JONESB05 | 161 | 505442 WATER V5 | 161  | 1 | C:505410 KENNETT5   | 161 | 505412 PARAGLD5     | 161 | 1 |
| REGION8 | REGION9_I  | 1903 | 0.0575  | 500690 PINEV 4  | 138 | 500700 PVKFTAP4 | 138  | 1 | C:500690 PINEV 4    | 138 | 500780 SHOAKS 4     | 138 | 1 |
| REGION8 | REGION9_I  | 1934 | -0.1196 | 502402 ACADIAN6 | 230 | 502403 BONIN 6  | 230  | 1 | C:500773 SEGURA 6   | 230 | 500776 SELLRD6      | 230 | 1 |
| REGION8 | REGION9_I  | 1949 | 0.1444  | 500410 HOPKINS4 | 138 | 500580 MORBHAN4 | 138  | 1 | C:500410 HOPKINS4   | 138 | 500660 PATOUT 4     | 138 | 1 |
| REGION8 | REGION9_I  | 2056 | -0.1288 | 500410 HOPKINS4 | 138 | 500774 SEGURA4  | 138  | 1 | C:500100 BERWKTP4   | 138 | 500740 RAMOS 4      | 138 | 1 |

|         |            |      |         |                 |     |                 |      |   |                             |     |                 |     |   |
|---------|------------|------|---------|-----------------|-----|-----------------|------|---|-----------------------------|-----|-----------------|-----|---|
| REGION8 | REGION9_I  | 2105 | 0.1631  | 500410 HOPKINS4 | 138 | 500660 PATOUT 4 | 138  | 1 | C:500410 HOPKINS4           | 138 | 500580 MORBHAN4 | 138 | 1 |
| REGION8 | REGION9_I  | 2111 | -0.1589 | 500190 COCODR 6 | 230 | 500340 FHILL 6  | 230  | 1 | C:500190 COCODR 6           | 230 | 500770 RODEMR 6 | 230 | 1 |
| REGION8 | REGION9_I  | 2206 | -0.1089 | 507738 LINWOOD4 | 138 | 507742 MCWILLI4 | 138  | 1 | C:507711 ARSHILL4           | 138 | 507731 FTHUMB4  | 138 | 1 |
| REGION8 | REGION9_I  | 2210 | -0.0467 | 500230 COUGH 4  | 138 | 500780 SHOAKS 4 | 138  | 1 | C:500190 COCODR 6           | 230 | 500230 COUGH 4  | 138 | 1 |
| REGION8 | REGION9_I  | 2235 | 0.0963  | 507711 ARSHILL4 | 138 | 507731 FTHUMB4  | 138  | 1 | C:507711 ARSHILL4           | 138 | 507742 MCWILLI4 | 138 | 1 |
| REGION8 | REGION9_I  | 2266 | 0.0482  | 500280 ELEESV 6 | 230 | 500470 LEESV 6  | 230  | 1 | C:500200 COLFAX 6           | 230 | 500770 RODEMR 6 | 230 | 1 |
| REGION8 | REGION9_I  | 2273 | 0.0482  | 500470 LEESV 6  | 230 | 500480 LEESV 4  | 138  | 1 | C:500200 COLFAX 6           | 230 | 500770 RODEMR 6 | 230 | 1 |
| REGION8 | REGION9_I  | 2332 | 0.1806  | 500940 WELLS 6  | 230 | 502420 LABBETAP | 230  | 1 | C:500940 WELLS 6            | 230 | 502410 PMOUTON6 | 230 | 1 |
| REGION8 | REGION10_I | 886  | -0.0506 | 500680 PINEV 6  | 230 | 500790 SHERWD 6 | 230  | 1 | C:500760 RAPIDES6           | 230 | 500840 TWINBR6  | 230 | 1 |
| REGION8 | REGION10_I | 891  | 0.0506  | 500680 PINEV 6  | 230 | 500690 PINEV 4  | 138  | 1 | C:500760 RAPIDES6           | 230 | 500840 TWINBR6  | 230 | 1 |
| REGION8 | REGION10_I | 1045 | -0.0674 | 500280 ELEESV 6 | 230 | 500770 RODEMR 6 | 230  | 1 | C:500200 COLFAX 6           | 230 | 500770 RODEMR 6 | 230 | 1 |
| REGION8 | REGION10_I | 1064 | -0.2486 | 507711 ARSHILL4 | 138 | 507789 ARSGENS4 | 138  | 1 | C:3Wnd: OPEN B\$0919 SW5TH3 | 1   |                 |     |   |
| REGION8 | REGION10_I | 1125 | 0.1057  | 507711 ARSHILL4 | 138 | 507742 MCWILLI4 | 138  | 1 | C:507711 ARSHILL4           | 138 | 507731 FTHUMB4  | 138 | 1 |
| REGION8 | REGION10_I | 1150 | -0.1261 | 500760 RAPIDES6 | 230 | 500770 RODEMR 6 | 230  | 1 | C:500770 RODEMR 6           | 230 | 500790 SHERWD 6 | 230 | 1 |
| REGION8 | REGION10_I | 1230 | -0.2582 | 505428 SIKESTN5 | 161 | 505434 IDALIA 5 | 161  | 1 | C:505400 N MADRD5           | 161 | 505428 SIKESTN5 | 161 | 1 |
| REGION8 | REGION10_I | 1441 | 0.0570  | 507738 LINWOOD4 | 138 | 507771 CEDARGR4 | 138  | 1 | C:507711 ARSHILL4           | 138 | 507731 FTHUMB4  | 138 | 1 |
| REGION8 | REGION10_I | 1442 | -0.0570 | 507755 S SHV 4  | 138 | 507771 CEDARGR4 | 138  | 1 | C:507711 ARSHILL4           | 138 | 507731 FTHUMB4  | 138 | 1 |
| REGION8 | REGION10_I | 1544 | 0.1891  | 505400 N MADRD5 | 161 | 505428 SIKESTN5 | 161  | 1 | C:505428 SIKESTN5           | 161 | 505434 IDALIA 5 | 161 | 1 |
| REGION8 | REGION10_I | 1619 | 0.0674  | 500280 ELEESV 6 | 230 | 500470 LEESV 6  | 230  | 1 | C:500200 COLFAX 6           | 230 | 500770 RODEMR 6 | 230 | 1 |
| REGION8 | REGION10_I | 1624 | 0.0674  | 500470 LEESV 6  | 230 | 500480 LEESV 4  | 138  | 1 | C:500200 COLFAX 6           | 230 | 500770 RODEMR 6 | 230 | 1 |
| REGION8 | REGION10_I | 1661 | 0.0421  | 500840 TWINBR6  | 230 | 500850 TWINBR4  | 138  | 1 | C:500680 PINEV 6            | 230 | 500790 SHERWD 6 | 230 | 1 |
| REGION8 | REGION10_I | 1700 | 0.0485  | 500690 PINEV 4  | 138 | 500780 SHOAKS 4 | 138  | 1 | C:500690 PINEV 4            | 138 | 500700 PVKFTAP4 | 138 | 1 |
| REGION8 | REGION10_I | 1846 | 0.1112  | 500770 RODEMR 6 | 230 | 500790 SHERWD 6 | 230  | 1 | C:500760 RAPIDES6           | 230 | 500770 RODEMR 6 | 230 | 1 |
| REGION8 | REGION10_I | 2023 | 0.1088  | 500190 COCODR 6 | 230 | 500230 COUGH 4  | 138  | 1 | C:500190 COCODR 6           | 230 | 500880 VILPLT 6 | 230 | 1 |
| REGION8 | REGION10_I | 2155 | 0.0508  | 500690 PINEV 4  | 138 | 500700 PVKFTAP4 | 138  | 1 | C:500690 PINEV 4            | 138 | 500780 SHOAKS 4 | 138 | 1 |
| REGION8 | REGION10_I | 2273 | -0.1057 | 507738 LINWOOD4 | 138 | 507742 MCWILLI4 | 138  | 1 | C:507711 ARSHILL4           | 138 | 507731 FTHUMB4  | 138 | 1 |
| REGION8 | REGION10_I | 2311 | 0.0931  | 507711 ARSHILL4 | 138 | 507731 FTHUMB4  | 138  | 1 | C:507711 ARSHILL4           | 138 | 507742 MCWILLI4 | 138 | 1 |
| REGION8 | REGION10_I | 2385 | -0.1206 | 500340 FHILL 6  | 230 | 500760 RAPIDES6 | 230  | 1 | C:500190 COCODR 6           | 230 | 500770 RODEMR 6 | 230 | 1 |
| REGION8 | REGION10_I | 2720 | 0.0761  | 507454 HEMPSTD4 | 138 | B\$0538 HEMP 1  | 1.00 | 1 | Base Case                   |     |                 |     |   |
| REGION8 | REGION10_I | 2720 | -0.0761 | 507456 HEMPSTD3 | 115 | B\$0538 HEMP 1  | 1.00 | 1 | Base Case                   |     |                 |     |   |

|         |            |      |         |                     |     |                     |      |   |                       |     |                     |     |   |
|---------|------------|------|---------|---------------------|-----|---------------------|------|---|-----------------------|-----|---------------------|-----|---|
| REGION8 | REGION10_I | 2783 | -0.1206 | 500190 COCODR 6     | 230 | 500340 FHILL 6      | 230  | 1 | C:500190 COCODR 6     | 230 | 500770 RODEMR 6     | 230 | 1 |
| REGION8 | REGION10_I | 2892 | 0.0508  | 500700 PVKFTAP4     | 138 | 500780 SHOAKS 4     | 138  | 1 | C:500690 PINEV 4      | 138 | 500780 SHOAKS 4     | 138 | 1 |
| REGION8 | REGION10_I | 2917 | 0.1022  | 549961 JAMES RIVER5 | 161 | 549963 MENTOR 5     | 161  | 1 | C:549954 SWPS 5       | 161 | 549961 JAMES RIVER5 | 161 | 1 |
| REGION8 | REGION10_I | 2918 | -0.0907 | 500200 COLFAX 6     | 230 | 500770 RODEMR 6     | 230  | 1 | C:500280 ELEESV 6     | 230 | 500770 RODEMR 6     | 230 | 1 |
| REGION8 | REGION10_I | 3006 | 0.1022  | 549963 MENTOR 5     | 161 | 549970 CLAY 5       | 161  | 1 | C:549954 SWPS 5       | 161 | 549961 JAMES RIVER5 | 161 | 1 |
| REGION8 | REGION10_I | 3029 | -0.0341 | 500230 COUGH 4      | 138 | 500780 SHOAKS 4     | 138  | 1 | C:500190 COCODR 6     | 230 | 500230 COUGH 4      | 138 | 1 |
| REGION8 | REGION10_I | 3059 | -0.1043 | 549954 SWPS 5       | 161 | 549961 JAMES RIVER5 | 161  | 1 | C:549961 JAMES RIVER5 | 161 | 549963 MENTOR 5     | 161 | 1 |
| REGION8 | REGION10_I | 3136 | 0.1536  | 500880 VILPLT 6     | 230 | 500920 WSTFORK6     | 230  | 1 | C:500200 COLFAX 6     | 230 | 500770 RODEMR 6     | 230 | 1 |
| REGION9 | REGION10_I | 1238 | -0.2567 | 505428 SIKESTN5     | 161 | 505434 IDALIA 5     | 161  | 1 | C:505400 N MADRD5     | 161 | 505428 SIKESTN5     | 161 | 1 |
| REGION9 | REGION10_I | 1358 | -0.1090 | 500410 HOPKINS4     | 138 | 500660 PATOUT 4     | 138  | 1 | C:500580 MORBHAN4     | 138 | 500820 TECHE 4      | 138 | 1 |
| REGION9 | REGION10_I | 1492 | 0.1956  | 505400 N MADRD5     | 161 | 505428 SIKESTN5     | 161  | 1 | C:505428 SIKESTN5     | 161 | 505434 IDALIA 5     | 161 | 1 |
| REGION9 | REGION10_I | 1496 | -0.1090 | 500660 PATOUT 4     | 138 | 500820 TECHE 4      | 138  | 1 | C:500580 MORBHAN4     | 138 | 500820 TECHE 4      | 138 | 1 |
| REGION9 | REGION10_I | 1724 | -0.0965 | 500410 HOPKINS4     | 138 | 500580 MORBHAN4     | 138  | 1 | C:500660 PATOUT 4     | 138 | 500820 TECHE 4      | 138 | 1 |
| REGION9 | REGION10_I | 1794 | -0.0965 | 500580 MORBHAN4     | 138 | 500820 TECHE 4      | 138  | 1 | C:500660 PATOUT 4     | 138 | 500820 TECHE 4      | 138 | 1 |
| REGION9 | REGION10_I | 1912 | -0.0544 | 500740 RAMOS 4      | 138 | 503301 MRGNCTY4     | 138  | 1 | C:533172 QUINTON3     | 115 | 533186 29 GAGE3     | 115 | 1 |
| REGION9 | REGION10_I | 2408 | 0.0776  | 505418 JONESB05     | 161 | 505442 WATER V5     | 161  | 1 | C:505416 CENTR H5     | 161 | 505418 JONESB05     | 161 | 1 |
| REGION9 | REGION10_I | 2823 | 0.0980  | 500410 HOPKINS4     | 138 | 500774 SEGURA4      | 138  | 1 | C:500050 BSALES 4     | 138 | 500890 WAXLAKE4     | 138 | 1 |
| REGION9 | REGION10_I | 2826 | -0.0394 | 505416 CENTR H5     | 161 | 505418 JONESB05     | 161  | 1 | C:505400 N MADRD5     | 161 | 505410 KENNETT5     | 161 | 1 |
| REGION9 | REGION10_I | 2895 | 0.0836  | 500050 BSALES 4     | 138 | 500890 WAXLAKE4     | 138  | 1 | C:500740 RAMOS 4      | 138 | 503301 MRGNCTY4     | 138 | 1 |
| REGION9 | REGION10_I | 3017 | -0.0836 | 500050 BSALES 4     | 138 | 500820 TECHE 4      | 138  | 1 | C:500740 RAMOS 4      | 138 | 503301 MRGNCTY4     | 138 | 1 |
| REGION9 | REGION10_I | 3102 | -0.0836 | 500290 ELPTAP 4     | 138 | 500890 WAXLAKE4     | 138  | 1 | C:500740 RAMOS 4      | 138 | 503301 MRGNCTY4     | 138 | 1 |
| REGION9 | REGION10_I | 3158 | -0.0664 | 500460 JULTAP 4     | 138 | 500820 TECHE 4      | 138  | 1 | C:500660 PATOUT 4     | 138 | 500820 TECHE 4      | 138 | 1 |
| REGION9 | REGION10_I | 3170 | -0.0664 | 500440 IVANHOE4     | 138 | 500460 JULTAP 4     | 138  | 1 | C:500660 PATOUT 4     | 138 | 500820 TECHE 4      | 138 | 1 |
| REGION9 | REGION10_I | 3282 | -0.0836 | 500060 BVISTA 4     | 138 | 500290 ELPTAP 4     | 138  | 1 | C:500740 RAMOS 4      | 138 | 503301 MRGNCTY4     | 138 | 1 |
| REGION9 | REGION10_I | 3282 | -0.0856 | 505412 PARAGLD5     | 161 | 505416 CENTR H5     | 161  | 1 | C:505418 JONESB05     | 161 | 505442 WATER V5     | 161 | 1 |
| REGION9 | REGION10_I | 3373 | -0.0343 | 500320 FISHER 4     | 138 | 500860 VP TAP 4     | 138  | 1 | C:500200 COLFAX 6     | 230 | 500770 RODEMR 6     | 230 | 1 |
| REGION9 | REGION10_I | 3411 | 0.0607  | 507454 HEMPSTD4     | 138 | B\$0538 HEMP 1      | 1.00 | 1 | Base Case             |     |                     |     |   |
| REGION9 | REGION10_I | 3411 | -0.0607 | 507456 HEMPSTD3     | 115 | B\$0538 HEMP 1      | 1.00 | 1 | Base Case             |     |                     |     |   |
| REGION9 | REGION10_I | 3622 | 0.0493  | 505418 JONESB05     | 161 | 505420 HERGETT5     | 161  | 1 | C:505416 CENTR H5     | 161 | 505418 JONESB05     | 161 | 1 |
| REGION9 | REGION10_I | 3763 | 0.0836  | 500060 BVISTA 4     | 138 | 500100 BERWKTP4     | 138  | 1 | C:500740 RAMOS 4      | 138 | 503301 MRGNCTY4     | 138 | 1 |

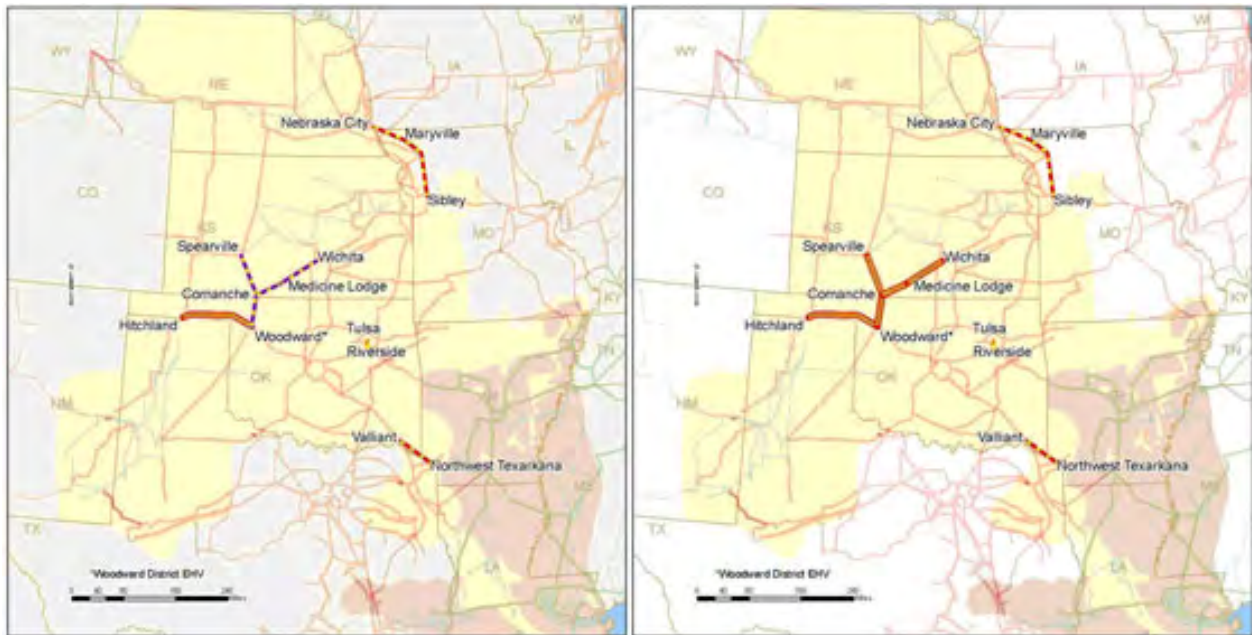


|         |            |      |         |                 |     |                 |                 |     |     |                   |                   |                 |                 |                 |     |   |
|---------|------------|------|---------|-----------------|-----|-----------------|-----------------|-----|-----|-------------------|-------------------|-----------------|-----------------|-----------------|-----|---|
| REGION9 | REGION10_I | 3784 | 0.0836  | 500100 BERWKTP4 | 138 | 500740 RAMOS    | 4               | 138 | 1   | C:500740 RAMOS    | 4                 | 138             | 503301 MRGNCTY4 | 138             | 1   |   |
| REGION9 | REGION10_I | 4453 | -0.0607 | 504122 MCNAB    | 3   | 115             | 507456 HEMPSTD3 | 115 | 1   | C:652302 JULESBG7 | 115               | 659240 INTERST7 | 115             | 1               |     |   |
| REGION9 | REGION10_I | 4535 | 0.0607  | 504122 MCNAB    | 3   | 115             | 507453 HOPE     | 3   | 115 | 1                 | C:652302 JULESBG7 | 115             | 659240 INTERST7 | 115             | 1   |   |
| REGION9 | REGION10_I | 5262 | -0.0688 | 505410 KENNETT5 | 161 | 505412 PARAGLD5 | 161             | 1   |     | C:640374 SWEET W3 | 345               | 652571 GR ISLD3 | 345             | 1               |     |   |
| REGION9 | REGION10_I | 6364 | -0.0542 | 500200 COLFAX   | 6   | 230             | 500770 RODEMR   | 6   | 230 | 1                 | C:646206 S1206    | 5               | 161             | 648199 SARP4&5T | 161 | 1 |
| REGION9 | REGION10_I | 6412 | -0.0361 | 505440 DONIPHN5 | 161 | 505442 WATER    | V5              | 161 | 1   | C:640374 SWEET W3 | 345               | 652571 GR ISLD3 | 345             | 1               |     |   |
| REGION9 | REGION10_I | 6455 | -0.0607 | 503912 FULTON   | 3   | 115             | 507453 HOPE     | 3   | 115 | 1                 | C:652302 JULESBG7 | 115             | 659240 INTERST7 | 115             | 1   |   |
| REGION9 | REGION10_I | 7934 | 0.0367  | 500170 CLARN    | 6   | 230             | 500570 MESSICK6 | 230 | 1   | C:646206 S1206    | 5                 | 161             | 648199 SARP4&5T | 161             | 1   |   |

Table 2: Change Case FCITC Results (With Priority Projects)



# SPP Priority Projects— Natural Gas Price Reduction



Southwest Power Pool

Benefits of EHV transmission

P. Jeffrey Palermo  
26 March 2010

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# 1 Background

The Southwest Power Pool (SPP) staff engaged KEMA, Inc. in December 2009 to assist the evaluation of the proposed Priority Projects that were intended to capture near-term opportunities associated with the heightened focus on electric transmission expansion. KEMA was asked to develop a white paper describing the strategic benefits of the Priority Projects. These benefits were to include:

1. Flexibility for future resource planning decisions affecting generation resource decisions and associated supply contracts;
2. Reliability that improves service reliability and restoration times in response to normal and extraordinary events;
3. Fuel diversity and price elasticity in supply and demand of marginal fuels;
4. Right-of-way utilization of the corridors for transmission facilities to avoid “corridor fatigue” and land use/habitat fragmentation issues; and
5. Strategic regional and national benefits including the market response to major topology/congestion changes, or EHV network headroom that enables more efficient and economic management of grid operations and maintenance schedules.

During the course of the work SPP asked KEMA to focus on the third of these—fuel diversity benefits. This report addresses KEMA’s work regarding the fuel diversity benefits of the Priority Projects.

## 2 Transmission functions and benefits

The modern electric power system is one of mankind’s greatest engineering achievements. The National Science Foundation declared it the greatest engineering achievement of the 20<sup>th</sup> century stating “it keeps our factories running—as well as the telecommunications industry, the appliances in our homes, and the lifesaving equipment in our hospitals.”<sup>1</sup> The interconnection power system is remarkably complex as it integrates thousands of individual devices each of which has dozens to thousands of components—from large power plants to circuit breakers and circuit disconnects.

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1. See [www.greatachievements.org](http://www.greatachievements.org).

The electric power system is a “unitary” system—the load, generation and delivery systems must all be in balance at all times. The load and generation must obviously be in balance otherwise the generation would speed up or slow down from the 60 Hz standard frequency. There must also be enough transmission and distribution capacity available for the generation to be delivered to the load.

In this context it is interesting to compare the costs of these different parts of the utility system. On a national basis, generation typically is about 67% of the total cost of electricity, distribution is about 26%, and transmission is about 7%.<sup>2</sup> As will be discussed below, the transmission system is what establishes the market size and can often limit operation of the most economic generating units. In this way the transmission system—representing 7% of the cost—can have a significant impact on the cost of generation—representing 67% of the cost. This means that transmission system has a highly leveraged impact on the total cost of electricity.

In today’s utility environment there are a number of generation supply markets. Regardless of the political boundaries of these markets, it is the electric system that defines the technical electrical boundaries. The lack of transmission at a market’s boundaries is what limits the free exchange of power between market areas.<sup>3</sup> Some obvious examples include the limited interconnections between ERCOT and SPP, or between ISO-NE and NYISO. There are other famous boundaries that limit power flow into southern California from Arizona and into the Washington–New York City corridor. These were highlighted in the *National Electric Transmission Congestion Study*.<sup>4</sup>

Within a market area it is the transmission system that allows the free exchange of energy, limits market power by including more suppliers within the geographic area, reduces the installed generating capacity required, increases load and generation diversity, and makes possible considerable flexibility in system operation.

### 3 The relationship of natural gas use and supply price

Economic theory predicts that a decrease in the use of natural gas will lead to an inward shift in the natural gas demand curve, leading to a reduction in natural gas

- 
2. US Energy Information Administration, *Annual Energy Outlook 2009*, updated reference case, Table A8—data for 2007 ([tinyurl.com/2007-Electric-Price-components](http://tinyurl.com/2007-Electric-Price-components)).
  3. It is also common to find transmission limitations within a market that will result in transmission congestion.
  4. U.S. Department of Energy, *National Electric Transmission Congestion Study*, August 2006.

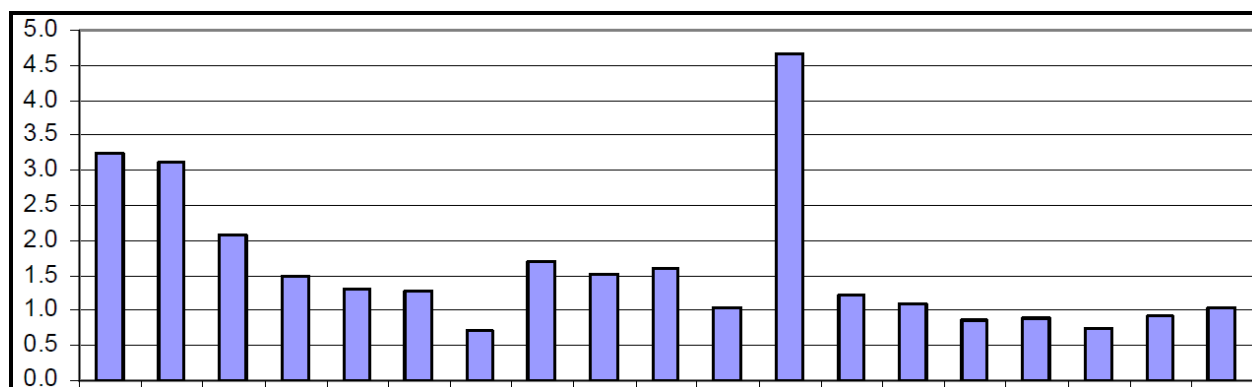
prices. Such reductions benefit consumers by reducing fuel costs to electric generators and by reducing the price of natural gas for direct use in the residential, commercial, industrial, and transportation sectors. The magnitude of the price reduction will vary based on the amount of reduced use of natural gas and the shape of the natural gas supply curve (measured by the inverse price elasticity of natural gas supply).

While there have been many studies of the price elasticity of natural gas—the response of users to changes in gas prices, there have been a smaller number of studies of the supplier’s inverse price elasticity of natural gas—the response of supplier prices to changes in demand. Perhaps the most significant of these is a 2005 study by Lawrence Berkeley National Labs.<sup>5</sup> This report focused on the results of 19 studies:

- Seven studies by the Energy Information Administration focused on national renewable portfolio standards (RPS) policies, two of which model multiple RPS scenarios;
- Nine by the Union of Concerned Scientists that studied national RPS policies, three were multiple RPS scenarios, and one also included aggressive energy efficiency investments; and
- Three by the Tellus Institute that evaluated three different standards of a state-level RPS in Rhode Island (combined with RPS policies in Massachusetts and Connecticut).

The inverse elasticity results for these 19 studies are shown in Figure 1.

Figure 1: Range of long-term inverse elasticity results from 19 studies



5. Ryan Wiser, Mark Bolinger, Matt St. Clair, *Easing the Natural Gas Crisis: Reducing Natural Gas Prices through Increased Deployment of Renewable Energy and Energy Efficiency*, January 2005.

The Lawrence Berkeley National Labs study found that there was reasonable consistency in the average long-term inverse elasticities. While the overall range is between 0.7 and 4.7, the study deemphasized some of the ‘outliers’ and focused on the elasticities from 13 of 19 analyses falling between 0.8 and 2.0.<sup>6</sup> The highest and lowest study results would mean price reductions from 0.7% to 4.7% for each 1% drop in demand.

We chose to exclude the highest 4 and the lowest 4 cases shown in Figure 1—so the inverse elasticity range is between 0.9 and 1.7. The average inverse elasticity for these 11 studies is 1.2.

While the 2005 Lawrence Berkeley National Labs study is focused on the impact of renewable energy and energy efficiency, the authors made it clear that “these effects are not strictly limited to renewable energy and energy efficiency investments: any non-natural-gas resource that displaces gas use is expected to provide similar consumer benefits.”<sup>7</sup>

For this analysis we have assumed an average inverse elasticity for natural gas supply of 1.2.

## 4 The impact of Priority Projects on SPP gas use

### 4.1 The two groups of Priority Projects

Staff presented the results of the initial Priority Projects in 2009. They were directed to perform additional analysis on a group of six projects. These projects were referred to as Group 1 and are listed here and shown in Figure 2:

1. Spearville – Comanche – Medicine Lodge – Wichita (765 kV construction and 345 kV operation);
2. Comanche – Woodward District EHV (765 kV construction and 345 kV operation);
3. Hitchland – Woodward District EHV (345 kV DCT1);
4. Valiant – NW Texarkana (345 kV);

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6. This would mean that each 1% reduction in national, natural gas demand is expected to lead to a 0.8% to 2% reduction in wellhead gas prices.

7. Testimony Prepared for a Hearing on Power Generation Resource Incentives & Diversity Standards California Senate Committee on Energy and Natural Resources Tuesday, March 8, 2005, 2:30 PM, Dr. Ryan Wiser, Scientist, Lawrence Berkeley National Laboratory, page 5.

- 
5. Nebraska City – Maryville – Sibley (345kV); and
  6. Riverside – Tulsa Reactor (138 kV).

The staff was also requested to study an alternative where 345 kV double-circuits are substituted for the 765 kV lines in Group 1. This is referred to as Group 2 listed here and shown in Figure 3:

1. Spearville – Comanche – Medicine Lodge – Wichita (2 x 345 kV);
2. Comanche – Woodward District EHV (2 x 345 kV);
3. Hitchland – Woodward District EHV (2 x 345 kV);
4. Valiant – NW Texarkana (345 kV);
5. Nebraska City– Maryville – Sibley (345 kV); and
6. Riverside – Tulsa Reactor (138 kV).



Figure 2: Group 1 Priority Projects

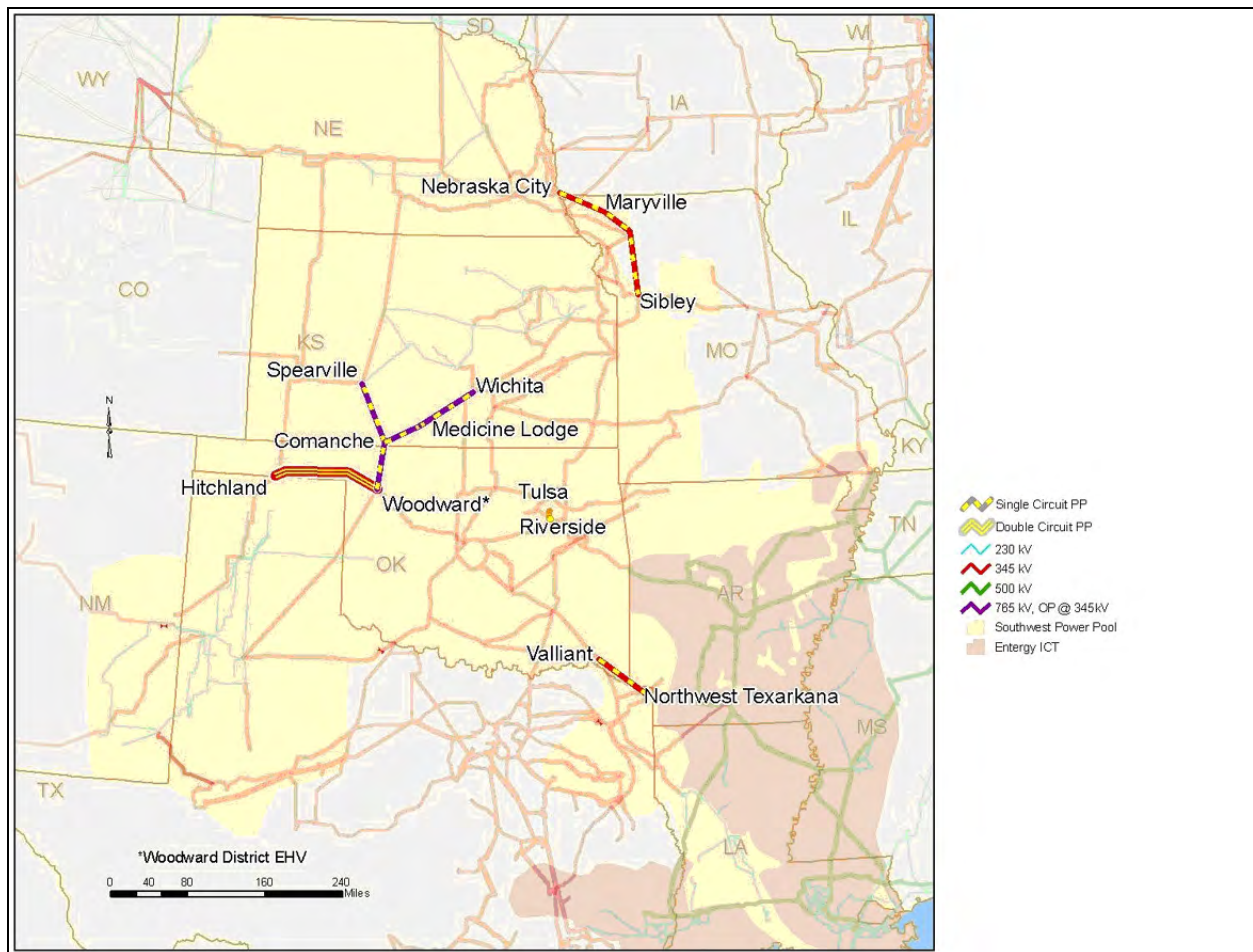
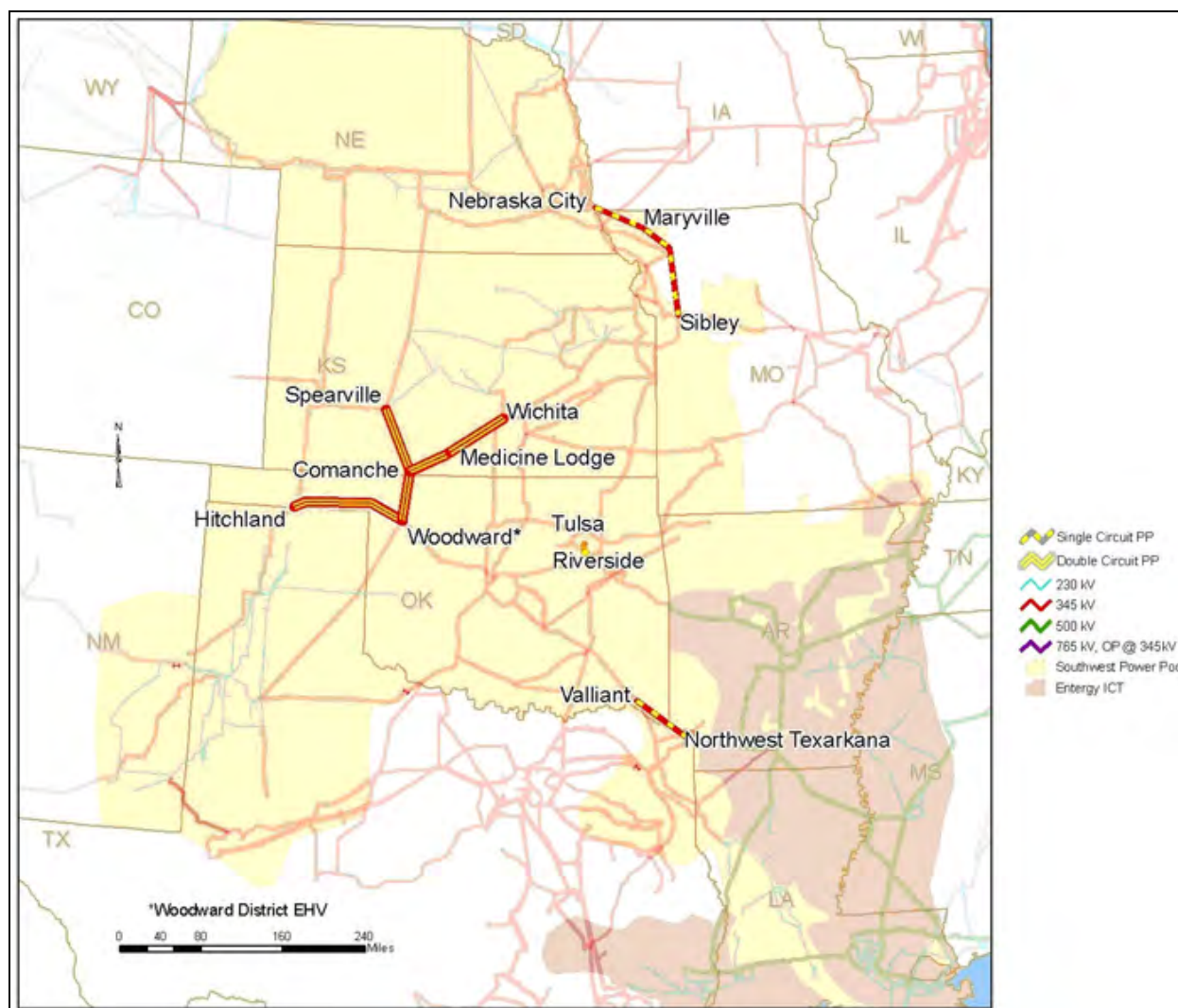


Figure 3: Group 2 Priority Projects



## 4.2 SPP production-cost analyses

SPP staff has made a series of computer simulations of the SPP system. These simulations estimated the operation and productions costs of the generation located within the SPP footprint. The simulation reports the performance of each generating unit in the system including the electrical output (MWh) and thermal input (MMbtu). In total 18 simulations were made—for three years (2009, 2014 and 2019), two levels of wind penetration (7 GW and 11 GW), and for three transmission topologies (existing system, adding Group 1 Priority Projects, and adding Group 2 Priority Projects).

The results for gas-fueled generators from the production-cost simulations are shown in Table 1. With 7 GW of wind generation the savings in natural gas consumption are slightly more than 5%. With 11 GW of wind the savings are nearly 8%.

**Table 1: Production-cost simulation changes for Group 1 and 2 Priority Projects**

|                                                                                                 | 2009    |         | 2014    |         | 2019    |         |
|-------------------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|
|                                                                                                 | Group 1 | Group 2 | Group 1 | Group 2 | Group 1 | Group 2 |
| <b>7 GW wind</b>                                                                                |         |         |         |         |         |         |
| Gas MWh                                                                                         | -5.03%  | -5.09%  | -5.63%  | -5.74%  | -4.64%  | -4.66%  |
| Gas MMBtu                                                                                       | -4.98%  | -5.04%  | -5.58%  | -5.71%  | -4.68%  | -4.72%  |
| 2009-2019 average                                                                               |         |         |         |         | -5.08%  | -5.15%  |
| <b>11 GW wind</b>                                                                               |         |         |         |         |         |         |
| Gas MWh                                                                                         | -7.77%  | -7.97%  | -8.01%  | -8.41%  | -7.12%  | -7.45%  |
| Gas MMBtu                                                                                       | -7.73%  | -7.90%  | -8.00%  | -8.42%  | -7.24%  | -7.58%  |
| 2009-2019 average                                                                               |         |         |         |         | -7.66%  | -7.97%  |
| Note: The production cost changes are with respect to the base transmission plan for each year. |         |         |         |         |         |         |

Additional detail of the production-cost simulation results are shown in Table 5 at the end of this document. This table shows the electricity production (MWh) and the fuel use (MMBtu) for each type of generation. Of particular interest to this report are the top five sections reporting the results for natural gas generation. The results from these five sections are the source for the data in Table 1, above.

## 5 Changes in natural gas costs due to Priority Projects

The change in natural gas prices due to the Priority Projects is calculated from three variables:

1. The inverse supply price elasticity (§3, above),
2. The change in use by SPP (see Table 1, above), and
3. The use of natural gas by SPP compared to the nation (discussed here).

The natural gas consumption by end use for 2004-2008 is shown in Table 2. The table lists the total gas use for the nation, total electric use for the nation, and the gas use for electricity by the states in the SPP area plus that of SWPS. The table shows that

27.64% of the natural gas consumed in the US is used to produce electricity and that 1.81% of the nation's use is to produce electricity in the SPP.

Table 2: Natural gas consumption by end use (Mcf)

|                                      | 2004       | 2005       | 2006       | 2007       | 2008       | Average    |
|--------------------------------------|------------|------------|------------|------------|------------|------------|
| U.S. total <sup>8</sup>              | 22,388,975 | 22,010,596 | 21,684,641 | 23,097,140 | 23,226,612 | 22,481,593 |
| U.S. Electricity                     | 5,463,763  | 5,869,145  | 6,222,100  | 6,841,408  | 6,668,379  | 6,212,959  |
| % electric                           | 24.40%     | 26.67%     | 28.69%     | 29.62%     | 28.71%     | 27.64%     |
| SPP use for electricity <sup>9</sup> |            |            |            |            |            |            |
| Arkansas                             | 40,138     | 48,987     | 71,056     | 63,594     | 64,188     |            |
| Kansas                               | 10,474     | 14,105     | 22,477     | 25,560     | 26,640     |            |
| Louisiana                            | 245,361    | 285,022    | 195,927    | 224,419    | 236,543    |            |
| Missouri                             | 24,574     | 31,831     | 32,480     | 41,067     | 43,009     |            |
| 10%                                  | 2,457      | 3,183      | 3,248      | 4,107      | 4,301      |            |
| Nebraska                             | 3,340      | 8,066      | 7,787      | 10,908     | 7,230      |            |
| Oklahoma                             | 199,907    | 242,178    | 278,602    | 286,686    | 282,942    |            |
| SWPS TX-NM                           | 89,172     | 110,355    | 128,745    | 134,993    | 132,457    |            |
| SPP total                            | 305,350    | 377,887    | 440,859    | 462,253    | 453,570    | 407,984    |
| % electric of USA                    | 1.36%      | 1.72%      | 2.03%      | 2.00%      | 1.95%      | 1.81%      |

Most of the data in Table 2 is directly from the US DOE database. Since only a small portion of the Missouri generation is in the SPP footprint, we assumed that less than 10% of the state's use would be included. While the amounts for Arkansas and Louisiana are shown they were not included in the totals since electric generation from gas units in both states is less than 1% of the SPP total. It was also necessary to estimate the use by SWPS-TX-NM. The production-cost simulations showed that SWPS used just under 30% of the SPP's total gas as shown in Table 3. This was used to estimate the SWPS gas use in Table 2.<sup>10</sup>

8. Source for national data: [http://tonto.eia.doe.gov/dnav/ng/ng\\_cons\\_sum\\_a\\_EPG0\\_VCO\\_mmc\\_f\\_a.htm](http://tonto.eia.doe.gov/dnav/ng/ng_cons_sum_a_EPG0_VCO_mmc_f_a.htm)

9. Source for SPP state data: [http://tonto.eia.doe.gov/dnav/ng/ng\\_sum\\_lsum\\_a\\_EPG0\\_veu\\_mmc\\_f\\_a.htm](http://tonto.eia.doe.gov/dnav/ng/ng_sum_lsum_a_EPG0_veu_mmc_f_a.htm)

10. The calculation is (the sum of the other states {KS, MO, NE, OK}) x 0.2920 ÷ (1 - 0.2920)

**Table 3: SWPS share of total natural gas from computer simulation**

|             | MMbtu       |
|-------------|-------------|
| SWPS CC     | 28,339,825  |
| SWPS CT-gas | 12,563,041  |
| SWPS St-gas | 21,130,504  |
| SWPS gas    | 62,033,370  |
| Total gas   | 212,420,030 |
| SWPS share  | 29.20%      |

The impact on natural gas prices due to changes in natural gas use is shown in Table 4. The calculations shown in Table 4 mean that:

With 7 GW of wind generation

- Group 1 Priority Projects will reduce gas use by 5.08%
- Group 2 Priority Projects will reduce gas use by 5.15%

With 11 GW of wind generation

- Group 1 Priority Projects will reduce gas use by 7.66%
- Group 2 Priority Projects will reduce gas use by 7.97%

**Table 4: Impact of the Priority Projects on SPP natural gas prices**

|            |                                       | Δ by Group |         | Notes                                            |
|------------|---------------------------------------|------------|---------|--------------------------------------------------|
|            |                                       | 1          | 2       |                                                  |
| 7 GW wind  |                                       |            |         |                                                  |
| 1          | Δ gas MMBtu                           | -5.08%     | -5.15%  | See Table 4                                      |
| 2          | Inverse price elasticity of supply    | 1.2        | 1.2     | See Figure 1 and the discussion at the end of §3 |
| 3          | SPP share of nation gas use           | 1.81%      | 1.81%   | See Table 2                                      |
| 4          | SPP-only price impact                 | -0.111%    | -0.112% | Product of lines 1, 2 and 3                      |
| 5          | Inverse price elasticity of supply    | 1.2        | 1.2     | Same as line 2                                   |
| 6          | US electric share of national gas use | 27.64%     | 27.64%  | See Table 2                                      |
| 7          | US price impact                       | -1.69%     | -1.71%  | Product of lines 1, 5 and 6                      |
| 11 GW wind |                                       |            |         |                                                  |
| 8          | Δ gas MMBtu                           | -7.66%     | -7.97%  | See Table 4                                      |
| 9          | Inverse price elasticity of supply    | 1.2        | 1.2     | See Figure 1 and the discussion at the end of §3 |
| 10         | SPP share of nation gas use           | 1.81%      | 1.81%   | See Table 2                                      |
| 11         | SPP-only price impact                 | -0.167%    | -0.173% | Product of lines 8, 9 and 10                     |
| 12         | Inverse price elasticity of supply    | 1.2        | 1.2     | Same as line 9                                   |
| 13         | US electric share of national gas use | 27.64%     | 27.64%  | See Table 2                                      |
| 14         | US price                              | -2.54%     | -2.64%  | Product of lines 8, 12 and 13                    |

The price impact is the product of: 1) The inverse supply price elasticity, 2) The change in use by SPP, and 3) The SPP natural gas share of the nation. These calculations are shown in Table 4. To demonstrate the calculations consider the case with 7 GW of wind and the Group 1 transmission additions and the US price impact:

- The inverse supply price elasticity from Figure 1 and the discussion at the end of §3 1.2
- The change in gas MMBtu from Table 4 -5.08%
- The electricity from supply natural gas share of the nation Table 2 27.64%
- The resulting price impact is the product 1.69%

If other regions of the nation make similar improvements to their transmission systems as the SPP the price reduction of natural gas will be about 1.7% for the 7 GW cases and 2.6% for the 11 GW cases.<sup>11</sup> There are a number of states that have adopted mandates for renewable energy penetration. Most have adopted a goal of 20% renewable generation by 2020. It is, thus, almost certain that most other areas of the nation will make transmission system improvements to accommodate the increased amounts of wind and other renewable generation.

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11. If the SPP were the only system to make these types of transmission changes the impact on natural gas prices would be much smaller—about 0.11% for the 7 GW cases and 0.17% for the 11 GW cases. In either case, the reduced price of natural gas will affect all users of natural gas in all areas of the country.



Table 5: Annual computer simulation results summary

|               | 7GW wind    |             |             |             |             |             | 11 GW wind  |             |             |             |             |             |
|---------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
|               | 2009        |             |             | 2014        |             |             | 2009        |             |             | 2014        |             |             |
|               | Base        | Group 1     | Group 2     | Base        | Group 1     | Group 2     | Base        | Group 1     | Group 2     | Base        | Group 1     | Group 2     |
| CC (gas)      |             |             |             |             |             |             |             |             |             |             |             |             |
|               | 20,248,338  | 19,242,451  | 19,264,221  | 25,686,605  | 24,165,043  | 24,187,352  | 34,064,155  | 32,488,204  | 32,514,295  | 19,876,947  | 18,319,570  | 18,288,124  |
|               | MMbtu       | 148,464,262 | 141,089,379 | 188,975,639 | 177,593,565 | 177,806,844 | 251,512,708 | 239,677,463 | 239,898,966 | 145,803,872 | 134,350,961 | 134,152,141 |
| CT-gas        |             |             |             |             |             |             |             |             |             |             |             |             |
|               | 2,314,055   | 2,290,825   | 2,303,428   | 2,851,806   | 2,720,201   | 2,713,613   | 3,983,788   | 3,825,506   | 3,815,815   | 2,252,294   | 2,262,941   | 2,280,835   |
|               | MMbtu       | 21,172,422  | 21,019,828  | 27,375,479  | 26,165,134  | 26,137,083  | 40,230,759  | 38,600,440  | 38,531,576  | 20,610,024  | 20,797,133  | 21,015,499  |
| ST-gas        |             |             |             |             |             |             |             |             |             |             |             |             |
|               | 4,206,807   | 3,889,243   | 3,839,180   | 6,283,108   | 5,976,559   | 5,920,701   | 9,286,415   | 8,826,353   | 8,797,607   | 4,018,700   | 3,532,629   | 3,495,864   |
|               | MMbtu       | 42,783,346  | 39,728,322  | 39,245,604  | 61,073,905  | 60,534,118  | 95,032,806  | 90,386,951  | 90,106,636  | 40,905,118  | 36,141,725  | 35,778,477  |
| Subtotal gas  |             |             |             |             |             |             |             |             |             |             |             |             |
|               | MWh         | 26,769,200  | 25,422,520  | 25,406,829  | 34,821,519  | 32,861,803  | 47,334,358  | 45,140,063  | 45,127,717  | 26,147,941  | 24,115,140  | 24,064,823  |
|               | MMbtu       | 212,420,030 | 201,837,529 | 201,711,731 | 280,488,670 | 264,832,604 | 386,776,274 | 368,664,853 | 368,537,178 | 207,319,014 | 191,289,819 | 190,946,117 |
| Δ Gas         |             |             |             |             |             |             |             |             |             |             |             |             |
|               | MWh         | 0           | -1,346,680  | -1,362,370  | 0           | -1,959,716  | 0           | -2,194,295  | -2,206,641  | 0           | -2,032,801  | -2,083,118  |
|               |             |             | -5.03%      | -5.09%      |             | -5.63%      |             | -4.64%      | -4.66%      |             | -7.77%      | -7.97%      |
|               | MMbtu       | 0           | -10,582,501 | -10,708,299 | 0           | -15,656,065 | 0           | -18,111,421 | -18,239,096 | 0           | -16,029,195 | -16,372,897 |
|               |             |             | -4.98%      | -5.04%      |             | -5.58%      |             | -4.68%      | -4.72%      |             | -7.73%      | -7.90%      |
| 11-yr average |             |             |             |             |             |             |             |             |             |             |             |             |
| CT gen        |             |             |             |             |             |             |             |             |             |             |             |             |
|               | MWh         | 42,900      | 42,783      | 42,389      | 143,628     | 136,668     | 340,339     | 320,937     | 321,448     | 42,554      | 43,277      | 42,696      |
|               | MMbtu       | 443,289     | 441,697     | 437,154     | 1,482,550   | 1,409,938   | 3,510,271   | 3,306,484   | 3,312,715   | 439,409     | 446,525     | 440,494     |
| CT-oil        |             |             |             |             |             |             |             |             |             |             |             |             |
|               | MWh         | 8,661       | 8,676       | 8,860       | 177,048     | 160,359     | 396,083     | 355,940     | 353,853     | 8,349       | 8,421       | 8,422       |
|               | MMbtu       | 96,911      | 96,978      | 99,510      | 2,384,000   | 2,153,129   | 5,255,002   | 4,712,844   | 4,665,651   | 92,678      | 93,569      | 93,599      |
| ST-coal       |             |             |             |             |             |             |             |             |             |             |             |             |
|               | MWh         | 165,398,689 | 167,185,470 | 167,305,133 | 163,999,019 | 165,569,391 | 167,721,729 | 169,013,079 | 169,044,217 | 161,096,123 | 161,493,976 | 161,504,722 |
|               | MMbtu       | 1749912657  | 1638824125  | 1638567196  | 1734648113  | 1751868495  | 1774916478  | 1788872631  | 1789177487  | 1704395406  | 1709286927  | 1709286927  |
| ST-nuclear    |             |             |             |             |             |             |             |             |             |             |             |             |
|               | MWh         | 18,837,055  | 18,837,055  | 18,837,055  | 18,963,127  | 18,963,127  | 21,300,351  | 21,300,351  | 21,300,351  | 18,837,055  | 18,837,055  | 18,837,055  |
|               | MMbtu       | 197,974,883 | 197,974,883 | 197,974,883 | 199,192,409 | 199,192,409 | 223,743,648 | 223,743,648 | 223,743,648 | 197,974,883 | 197,974,883 | 197,974,883 |
| Total         |             |             |             |             |             |             |             |             |             |             |             |             |
| MWh           | 211,056,505 | 211,496,505 | 211,600,267 | 218,104,341 | 217,691,349 | 217,730,890 | 237,092,859 | 236,130,369 | 236,147,585 | 206,132,022 | 204,497,869 | 204,457,718 |
| MMbtu         | 410,935,113 | 400,351,086 | 400,223,277 | 483,547,628 | 467,588,080 | 467,198,165 | 619,285,194 | 600,427,828 | 600,279,191 | 405,825,984 | 389,804,795 | 389,455,092 |
| Δ Total       |             |             |             |             |             |             |             |             |             |             |             |             |
| MWh           | 0           | 440,000     | 543,762     | 0           | -412,992    | -373,451    | 0           | -962,490    | -945,274    | 0           | -1,634,153  | -1,674,305  |
|               |             | 0.21%       | 0.26%       |             | -0.19%      | -0.17%      |             | -0.41%      | -0.40%      |             | -0.79%      | -0.81%      |
| MMbtu         | 0           | -10,584,027 | -10,711,836 | 0           | -15,959,548 | -16,349,464 | 0           | -18,857,366 | -19,006,003 | 0           | -16,021,188 | -16,370,891 |
|               |             | -2.58%      | -2.61%      |             | -3.30%      | -3.38%      |             | -3.05%      | -3.07%      |             | -3.95%      | -4.03%      |
|               |             |             |             |             |             |             |             |             |             |             |             |             |





# ITP20

## 2013 Integrated Transmission Plan 20-Year Assessment Report

July 30, 2013

Engineering

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## Revision History

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| Date       | Author    | Change Description                                |
|------------|-----------|---------------------------------------------------|
| 05/29/2013 | SPP staff | Draft for ESWG and TWG review                     |
| 06/20/2013 | SPP staff | Revised draft presented for ESWG and TWG approval |
| 06/26/2013 | SPP staff | Endorsed by TWG                                   |
| 06/27/2013 | SPP staff | Endorsed by ESWG                                  |
| 07/05/2013 | SPP staff | Draft presented for MOPC approval                 |
| 07/17/2013 | SPP staff | Endorsed by MOPC                                  |
| 07/30/2013 | SPP staff | Approved by BOD                                   |

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## Executive Summary

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The Integrated Transmission Planning (ITP) process is Southwest Power Pool's iterative three-year study process that includes 20-Year, 10-Year and Near Term Assessments. The 20-Year Assessment identifies transmission projects, generally above 300 kV, needed to provide a grid flexible enough to provide benefits to the region across multiple scenarios. The 10-Year Assessment focuses on facilities 100 kV and above to meet system needs over a ten-year horizon. The Near Term Assessment is performed annually and assesses system upgrades, at all applicable voltage levels, required in the near term planning horizon to address reliability needs. Along with the Highway/Byway cost allocation methodology, the ITP process promotes transmission investment that will meet reliability, economic, and public policy needs<sup>1</sup> to create a cost-effective, flexible, and robust transmission network that will improve access to the region's diverse generating resources. This report documents the 20-year Assessment that concludes in July 2013.

Five distinct futures were considered to account for possible variations in system conditions over the assessment's 20-year horizon. The futures were developed by the Strategic Planning Committee (SPC) and the Economic Studies Working Group (ESWG). The futures are presented briefly below and further discussed in Section 3:

1. **Business-As-Usual:** This future includes renewable resources (approximately 10 GW of nameplate wind capacity) necessary to meet state renewable mandates and targets as identified in the 2012 Policy Survey<sup>2</sup>, load growth projected by load serving entities, and the impacts of Environmental Protection Agency (EPA) regulations that are outlined in the Policy Drivers.
2. **Additional Wind:** This future assumes a 20% federal Renewable Electricity Standard (RES). It includes renewable resources (approximately 16.5 GW of nameplate wind capacity) necessary to meet that standard.
3. **Additional Wind plus Exports:** This future includes the 20% RES of Future 2, plus approximately 10 GW of additional wind generation to be exported outside of SPP.
4. **Combined Policy:** This future approximates the effects of additional investment in Demand Side Management and Smart Grid technology. This future include an annual 1 percentage point reduction to the load growth assumed in the other futures, the 20% RES of Future 2, and a carbon constraint, as described in the Policy Drivers section.
5. **Joint SPP/MISO Future:** This future includes coordinated input assumptions and models from SPP's ESGW and MISO's Planning Advisory Committee (PAC). This future is based on the same guidelines as the business as usual future: normal load growth, state mandates and targets for renewable generation, etc. However, some of the actual assumption values vary from Future 1 due to collaboration with MISO.

The recommended 2013 ITP20 portfolio shown in Figure 0.1 is estimated at **\$560 million** in engineering and construction cost and includes projects needed to meet potential reliability, economic, and policy

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<sup>1</sup> The Highway/Byway cost allocation approving order is *Sw. Power Pool, Inc.*, 131 FERC ¶ 61,252 (2010). The approving order for ITP is *Sw. Power Pool, Inc.*, 132 FERC ¶ 61,042 (2010).

<sup>2</sup> [2012 Policy Survey](#)

requirements. These projects, with a total estimated net present value revenue requirement of **\$845 million**, are expected to provide net benefits of approximately **\$1.5 billion** over the life of the projects under a Future 1 scenario containing 9 GW of wind capacity.

12 projects make up the portfolio:

| Name                             | Type                             | Size                  | Focus         |
|----------------------------------|----------------------------------|-----------------------|---------------|
| Keystone – Red Willow            | New Branch                       | 345 kV                | Reliability   |
| Tolk – Tuco                      | New Branch                       | 345 kV                | Reliability   |
| S3459                            | 2nd Transformer                  | 345/161 kV            | Economic      |
| Holcomb                          | 2nd Transformer                  | 345/115 kV            | Reliability   |
| Maryville                        | New Transformer                  | 345/161 kV            | Reliability   |
| Pecan Creek – Muskogee           | Upgrade 2 circuits               | 345 kV                | Reliability   |
| Nashua                           | Upgrade Transformer              | 345/161 kV            | Reliability   |
| JEC – Auburn – Swissvale         | Rebuild (New Auburn transformer) | 345 kV,<br>345/115 kV | Reliability   |
| Clinton – Truman – N Warsaw      | Upgrade Branch                   | 161 kV                | Seams Project |
| S3740 - S3454                    | New Branch                       | 345 kV                | Reliability   |
| Chamber Springs - S Fayetteville | New Branch & Transformer         | 345 KV,<br>345/161 kV | Economic      |
| Wolf Creek - Neosho              | New Branch                       | 345 kV                | Economic      |

*Table 0.1: 2013 ITP20 Transmission Plan*

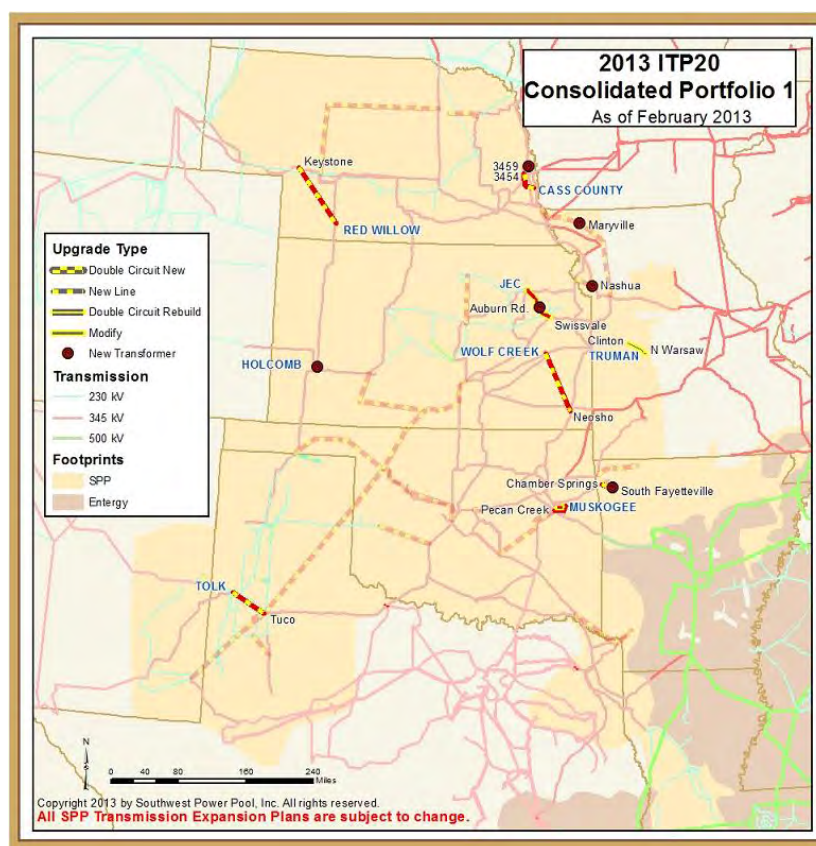


Figure 0.1: 2013 ITP20 Transmission Plan<sup>3</sup>

<sup>3</sup> The S3740 station is labeled in the report maps as Cass County.

# PART I: STUDY PROCESS



## **Section 1: Introduction**

---

### **1.1: The 20-Year ITP**

The 20-Year Integrated Transmission Planning Assessment (ITP20) is designed to identify a transmission expansion portfolio containing primarily Extra High Voltage (EHV) projects needed to address reliability needs, support policy initiatives, and enable economic opportunities in the SPP transmission system within the studied twenty-year horizon.

The portfolio will be used as a roadmap for the development of appropriate EHV projects in the coming years that would provide increased flexibility and value to SPP's members as those needs become better known through the performance of other planning assessments. The ITP20 is not intended to address lower voltage solutions that will be needed to integrate new EHV projects.

The goals of the ITP20 are to:

- Focus on regional needs.
- Utilize a value-based approach to analyze 20-year out transmission system needs.
- Identify 345 kV and above solutions stemming from such needs as:
  - Resolving potential reliability criteria violations
  - Mitigating known or expected congestion
  - Improving access to markets
  - Improving interconnections with SPP's neighbors
  - Meeting expected load growth demands
  - Facilitating or responding to expected facility retirements
- Meet public policy initiatives
- Synergize the Generation Interconnection and Transmission Service Studies with other planning processes

### **1.2: How to Read This Report**

This report focuses on the year 2033 (20 years from 2013) and is divided into multiple sections.

- Part I addresses the concepts behind this study's approach, key procedural steps in development of the analysis, and overarching assumptions used in the study.
- Part II demonstrates the findings of the study, empirical results, and conclusions.
- Part III addresses the portfolio specific results, describes the projects that merit consideration, and contains recommendations, expected benefits, and costs. Please note that negative numbers here are shown in red and in parentheses.
- Part IV contains detailed data and holds the report's appendix material.

**SPP Footprint**

Within this study, any reference to the SPP footprint refers to the set of Balancing Authorities and Transmission Owners<sup>4</sup> (TO) whose transmission facilities are under the functional control of the SPP Regional Transmission Organization (RTO) unless otherwise noted.

Energy markets were also modeled for other regions in the Eastern Interconnection. Notably, Associated Electric Cooperatives Inc. (AECI) and Mid-Continent Area Power Pool (MAPP) were modeled as stand-alone entities, while Entergy and CLECO were modeled within the Midcontinent ISO (MISO) energy market to reflect their commitments to be a part of MISO's planning region and market.

**Supporting Documents**

The development of this study was guided by the supporting documents noted below. These documents provide structure for this assessment:

- SPP 2013 ITP20 Scope
- SPP ITP Manual
- SPP Robustness Metrics Procedural Manual
- SPP Metrics Task Force Report

All referenced reports and documents contained in this report are available on SPP.org.

**Confidentiality and Open Access**

Proprietary information is frequently exchanged between SPP and its stakeholders in the course of any study and is extensively used during the ITP development process. This report does not contain confidential marketing data, pricing information, marketing strategies, or other data considered not acceptable for release into the public domain. This report does disclose planning and operational matters, including the outcome of certain contingencies, operating transfer capabilities, and plans for new facilities that are considered non-sensitive data.

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<sup>4</sup> SPP.org > About > Fast Facts > Footprints



## Section 2: Stakeholder Collaboration

Assumptions and procedures for the 2013 ITP20 analysis were developed through SPP stakeholder meetings that took place in 2012 and 2013. The assumptions were presented and discussed through a series of meetings with members, liaison-members, industry specialists, and consultants to facilitate a thorough evaluation. Groups involved in this development included the following:

- Economic Studies Working Group (ESWG)
- Transmission Working Group (TWG)
- Metrics Task Force (MTF)
- Regional Tariff Working Group (RTWG)
- Cost Allocation Working Group (CAWG)
- Markets and Operations Policy Committee (MOPC)
- Strategic Planning Committee (SPC)
- SPP Regional State Committee (RSC)
- SPP Board of Directors



SPP Staff served as facilitators for these groups and worked closely with the chairs to ensure all views were heard and that SPP's member-driven value proposition was followed.

The ESWG and TWG provided technical guidance and review for inputs, assumptions, and findings. Policy level considerations were tendered to appropriate organizational groups including the MOPC, SPC, RSC, and Board of Directors. Stakeholder feedback was key to the selection of the 2013 ITP20 projects.

- The TWG was responsible for technical oversight of the load forecasts, transmission topology inputs, constraint selection criteria, reliability assessments, transmission project designs, voltage studies, and the report.
- The ESWG was responsible for technical oversight of the economic modeling assumptions, futures, resource plans and siting, metric development and usage, congestion analysis, economic model review, calculation of benefits, and the report.
- The strategic and policy guidance for the study was provided by the SPC, MOPC, RSC, and Board of Directors.

### Planning Workshops

In addition to the standard working group meetings, three transmission planning workshops (or summits) were conducted to elicit further input and provide stakeholders with a chance to interact with staff on all related planning topics.

- Key drivers developed by the stakeholders were presented at the planning summit on August 22, 2012<sup>5</sup>.
- Potential upgrades were presented at the planning summit on December 4, 2012<sup>6</sup>.

<sup>5</sup> SPP.org > Engineering > Transmission Planning > 2012 August Planning Summit

- Recommended solutions with completed reliability, stability and economic analysis results were presented at the planning summit on May 15, 2013<sup>7</sup>.

### **Policy Survey**

The 2012 Policy Survey asked stakeholders to identify:

- existing wind farms
- other existing renewable resources
- wind farms coming online by end of year 2013
- state renewable mandates for wind generation through the year 2033
- state renewable targets for wind generation through the year 2033
- projected impacts of EPA regulation on existing generation, including retrofits, retirements, fuel switching, and derates

The results of the 2012 Policy Survey were used in the modeling of EPA regulation impacts on existing generation, as detailed in Section 4.3: . The results were also used in resource planning for both conventional and renewable resources, as detailed in Section 5: . After modeling existing renewables as reported in the survey, each zone was analyzed to see if it met the renewable targets and mandates reported in the survey. If a zone was short on renewables, additional wind was added in order to meet the targets and mandates for each zone.

### **Project Cost Overview**

Project costs utilized in the 2013 ITP20 were developed in accordance with the guidelines of the Project Cost Working Group (PCWG). Conceptual Estimates were prepared by SPP staff based on historical cost information in an SPP database and updated information provided by the TO.

### **New Benefit Metrics**

New benefit metrics were developed by the ESWG and MTF in 2012. The report published by the MTF catalogued eight additional metrics that could be used to assess the value of transmission projects for the Regional Cost Allocation Review (RCAR). ESWG provided direction to use three of these new metrics as part of the 2013 ITP20 for informational purposes, and concluded that using all of the new metrics would add unneeded complexity to the study. Below is a list of metrics used in the 2013 ITP20:

#### Historical ITP metrics:

- Adjusted Production Cost (APC)
- Reduced capacity expansion costs due to reduced transmission losses on peak
- Reduction of emission rates and values
- Savings due to lower ancillary service needs and ancillary service production costs

#### Newly developed metrics:

- Mitigation of transmission outage costs
- Assumed benefit of mandated reliability projects
- Benefit from meeting public policy goals

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<sup>6</sup> SPP.org > Engineering > Transmission Planning > 2012 December Planning Summit

<sup>7</sup> SPP.org > Engineering > Transmission Planning > 2013 May Planning Summit

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## Section 3: Future Selection

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### **3.1: Uncertainty and Important Issues**

Designing a transmission expansion plan to meet future needs is challenging because of the inability to accurately predict the policy environment, future load growth, fuel prices, and technological development over an extended time period. To address these challenges, five distinct sets of assumptions were developed and studied as individual “futures” for the 2013 ITP20.

### **3.2: Futures Descriptions**

The 2013 ITP20 study was conducted on a set of five futures. These futures consider evolving changes in technology and public policy that may influence the transmission system and energy industry as a whole. By accounting for multiple future scenarios, SPP staff can assess what transmission needs arise for various uncertainties. In all futures, EPA environmental regulations, as known or anticipated at the time of the study, are incorporated and Entergy and CLECO are assumed to be members of MISO.



#### **Future 1: Business as Usual**

This future includes state renewable mandates and targets as identified in the 2012 Policy Survey resulting in 9.2 GW of renewable resources modeled in SPP, load growth projected by load serving entities, and SPP member-identified generator retirement projections of approximately 4 GW. This future assumes no major changes to policies that are currently in place.

#### **Future 2: Additional Wind**

This future’s assumptions build upon the Business as Usual future assumptions. Instead of implementing current state renewable mandates and targets, a 20% Renewable Energy Standard (RES) was implemented for each region in the Eastern Interconnect, resulting in 16.4 GW of renewable resources modeled in SPP. This provides an assessment of the transmission outlook if a similar federal renewable standard were implemented.

#### **Future 3: Additional Wind Plus Exports**

Future 3 assumes that SPP will produce and export 10 GW of wind resources above the 20% RES of Future 2 to assist other regions in meeting their RES. This 10 GW was exported to Entergy, PJM, Southern Company, and TVA.

#### **Future 4: Combined Policy**

This future examines various policy changes and their impacts that would encourage more “green” generation. A 20% RES for each region is implemented in this future, as well as a carbon constraint of \$36/ton. A potential result of these policy changes is a more aggressive demand response/energy efficiency approach than the Business as Usual future. This was implemented through reductions in peak demand and energy usage, as well as a flatter load curve and higher load factor (see *Figure 3.1*).

An annual 1% reduction to the growth of load was applied from 2021 through 2033 for the SPP region such that the load growth during these years was 0.3% instead of 1.3%. This was done to account for efficiencies gained in demand response/energy efficiency technology that might be expected if the carbon constraint is implemented. The decrease in annual energy percentage is approximately half of the decrease in peak demand percentage resulting in a higher load factor than the Business as Usual future. The impact of these two technologies is shown in *Figure 3.1*:

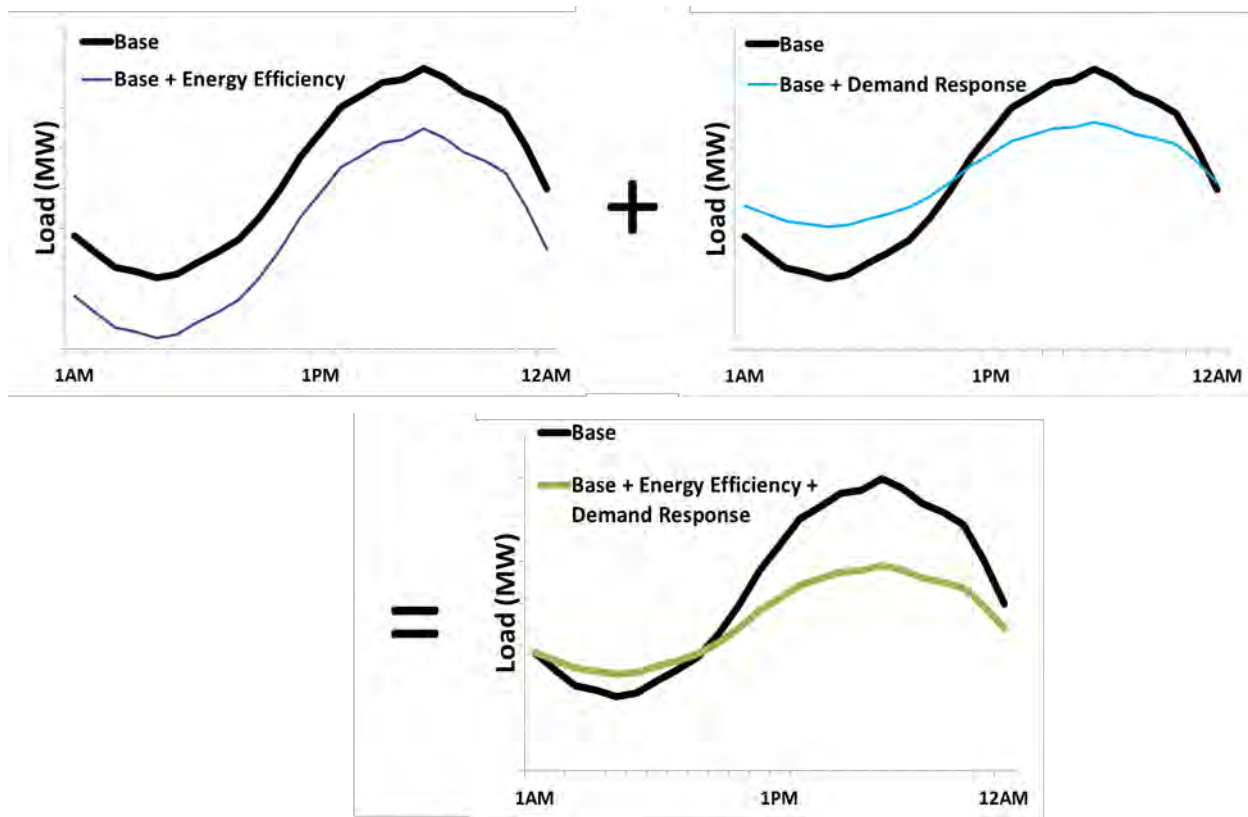


*Figure 3.1: Impact of Demand Response & Energy Efficiency Over One Day*

#### **Future 5: Joint SPP/MISO Future**

The joint future parameters were developed by the SPP ESWG and the MISO Planning Advisory Committee (PAC). The ESWG and PAC determined that the joint model should reflect “business as usual” conditions. This future is based on the same guidelines as Future 1 (normal load growth, state targets for renewable generation, etc.). While the joint future is similar to Future 1, it is not absolutely the same. Some of the assumption values vary from Future 1 due to collaboration with MISO for the joint future. These Future 5 differences include additional transmission constraints outside of SPP, natural gas prices approximately 4 cents less than Future 1 gas prices, and more generation in the MISO region of the resource plan than Future 1.

Data provided by MISO regarding the modeling of the MISO region was also leveraged in the other futures to improve the representation of the MISO region in the SPP model.



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## Section 4: Study Drivers

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### **4.1: Introduction**

Drivers for the 2013 ITP20 were discussed and developed through the stakeholder process in accordance with the 2013 ITP20 Scope and involved stakeholders from several diverse groups. Stakeholder load, energy, generation, transmission, financial, and market design inputs were carefully considered in determining the need for, and design of, transmission.

### **4.2: Load & Energy Outlook**

#### **Peak and Off-Peak Load**

Future electricity usage was forecasted by utilities in the SPP footprint and collected and reviewed through the efforts of the Model Development Working Group (MDWG). The highest usage, referred to as the system peak, usually occurs in the summer for SPP. The non-coincident peak load for SPP was forecasted to be 59.4 GW for 2023 and 67.7 GW for 2033. Note that all demand figures shown in this section include the loads of the Transmission Owners within the SPP OATT footprint as well as all other Load Serving Entities within the SPP region.

Once inputs such as the peak load values, annual energy values, hourly load curves, and hourly wind generation profiles were incorporated into the model, the economic modeling tool calculated the security-constrained unit commitment and security-constrained economic dispatch (SCUC/SCED) for each of the 8,760 hours in the year 2033.

Four seasonal peak hours were focused upon that uniquely stress the grid:

- 1) **Summer peak** – The summer hour with the highest load
- 2) **Winter peak** – The winter hour with the highest load
- 3) **High wind hour** – The hour with highest ratio of wind output to load, in order to evaluate grid exposure to significant output from these resources.
- 4) **Low hydro hour** – The hour with the lowest ratio of hydro output to load, in order to evaluate transmission needs arising from hydro power being unavailable to serve load.

These four hours were analyzed for reliability overloads. Hourly load shapes were developed consistent with the peak demand and energy values. The results indicated that the summer peak hour for 2033 would occur on August 3 at 5 p.m., the winter peak hour would occur on December 13 at 7 p.m., the high wind hour would occur on May 9 at 3 a.m., and the low hydro hour would occur on August 30 at 4 a.m.

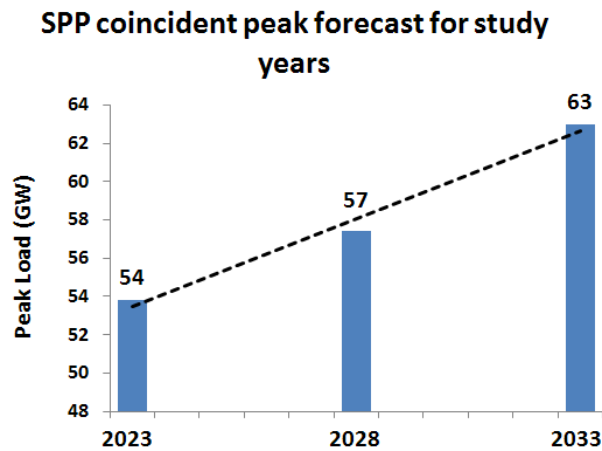


Figure 4.1: SPP coincident peak forecast for 2033 and intervening years

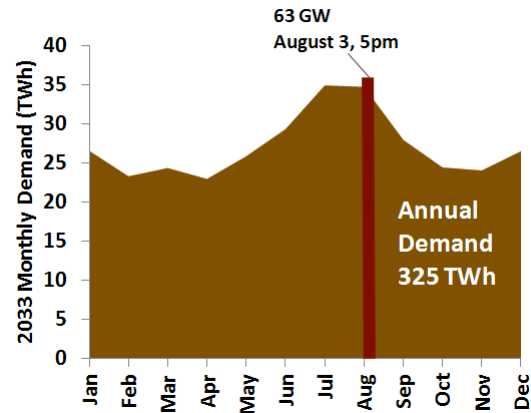


Figure 4.2: SPP Annual Energy Demand Forecast

### Peak Load and Energy

The sum of energy used throughout a year, referred to as the net energy for load forecasts, was forecast by SPP using the load factor data provided by SPP members (via EIA-411 forms) and reviewed by the MDWG and ESWG contacts. Annual net energy for load (including losses) was forecasted at 292 TWh for 2023 and 334 TWh for 2033. Coincident peak load was forecasted at 54 GW for 2023 and 63 GW for 2033. Figure 4.1 and Figure 4.2 show the forecasted peak and energy values for 2033 and the expected growth in peak load for the intervening years.

### Major Load Centers in SPP

Table 4.2 shows the percentage of the peak load that is located in each load center. The largest cities in SPP: Omaha, Kansas City, Wichita, Tulsa, and Oklahoma City all lie along the eastern border of SPP and account for 28% of the region's load at peak. Load in the western portion of SPP is concentrated primarily in Amarillo and near Lubbock.

### Diverse Peak Demand Growth Rates

The MDWG models included diverse peak load growth rates for each area. Table 4.3 lists the peak load growth rates for the key areas in the model. These forecasted values result in an average annual growth rate of 1.32% for SPP.

| City          | State | % of Peak |
|---------------|-------|-----------|
| Amarillo      | TX    | 0.98%     |
| Fayetteville  | AR    | 1.35%     |
| Kansas City   | MO    | 9.73%     |
| Lincoln       | NE    | 1.40%     |
| Lubbock       | TX    | 1.88%     |
| Oklahoma City | OK    | 6.29%     |
| Omaha         | NE    | 4.49%     |
| Shreveport    | LA    | 2.06%     |
| Springfield   | MO    | 1.72%     |
| Tulsa         | OK    | 4.54%     |
| Wichita       | KS    | 3.22%     |

Table 4.2: Load Centers in SPP



| Area     | SUNC | MKEC | OKGE | WERE | AEPW | LES  | NPPD | GRDA |
|----------|------|------|------|------|------|------|------|------|
| Rate (%) | 0.66 | 0.69 | 1.34 | 0.82 | 1.29 | 1.11 | 0.61 | 2.08 |

| Area     | KCPL | MIDW | WFEC | EMDE | GMO  | OPPD | CUS  | SPS  |
|----------|------|------|------|------|------|------|------|------|
| Rate (%) | 0.69 | 1.54 | 1.19 | 1.25 | 1.72 | 1.78 | 1.34 | 2.02 |

Table 4.3: Annual Peak Load Growth Rates for SPP OATT Transmission Owners 2012 - 2033 (%)

### 4.3: Policy Drivers

The potential impacts of the proposed Cross-State Air Pollution Rule (CSAPR)<sup>8</sup>, Mercury and Air Toxics Standards (MATS)<sup>9</sup>, Section 316(b) of the Clean Water Act<sup>10</sup>, and EPA's Regional Haze<sup>11</sup> Program were accounted for in the resource planning, production cost modeling, and benefit metric calculations for all futures using the best information available at the time of the study. Four techniques were employed to capture these potential impacts:

- unit retirements
- unit derates
- unit retrofits
- unit fuel switching
- emission price forecasts for SO<sub>2</sub>, NO<sub>x</sub>, and CO<sub>2</sub>

The unit retirements, derates, and fuel switching decisions were guided by the 2012 Policy Survey. Emission price forecasts for SO<sub>2</sub> and NO<sub>x</sub> for the 2033 study year were based upon Ventyx simulation ready data (specifically, the 2012 Spring Reference Case released in May 2012). A CO<sub>2</sub> price was only utilized in Future 4, as this is the only future with the carbon constraint. The CO<sub>2</sub> price in this future was \$36/ton, as determined by the ESWG.

### 4.4: Utilization of 345 kV AC, 765 kV AC, or HVDC

#### Voltage Levels and Technology Choice (AC vs. DC)

The ITP20 focuses on developing a long-term EHV transmission backbone for the SPP system. When developing the plans, much consideration was given to the voltage level that would be selected for the projects. Options included the use of AC voltages of 345 kV or 765 kV as well as DC voltages of  $\pm 600$  kV.

<sup>8</sup> <http://epa.gov/airtransport/>

<sup>9</sup> <http://www.epa.gov/mats/>

<sup>10</sup> <http://water.epa.gov/lawsregs/lawsguidance/cwa/316b/>

<sup>11</sup> <http://www.epa.gov/visibility/program.html>

### **EHV Design Considerations**

When considering the design of an EHV grid, many factors must be considered, such as contingency planning, typical line lengths, line loadability, capacity requirements, voltage, reliability, cost, asset life, and operational issues.

### **NERC N-1 Reliability Standards**

SPP designs and operates its transmission system to be capable of withstanding the next transmission outage that may occur – this is called “N-1” planning and is in accordance with NERC planning standards. Due to N-1 planning, any EHV network must be looped so that if one element of the EHV grid is lost, a parallel path will exist to move that power across the grid and avoid overloading the underlying transmission lines. It should be noted that HVDC lines provide the benefit of an inherent N-1 design since, per common practice and NERC reliability standards, the loss of a single “pole” (similar to an AC phase) is considered an N-1 contingency event. In contrast, loss of an entire AC circuit is considered an N-1 event.

### **Distances within the SPP System and to External Paths**

Line lengths are another factor when considering EHV transmission systems. The length of an AC transmission line affects its performance in terms of voltage, loadability, and stability. HVDC transmission lines do not have performance impacts due to line lengths. The longest distance within the SPP system is approximately 500 miles, while distances of over 700 miles are seen between western SPP resource regions and some external paths. When considering line length, it is necessary to consider the proximity of generation to load on the system. In the current SPP system, generation is generally located close to load centers. As wind capacity has increased, some generation is concentrated in areas of high wind potential towards the western part of the system. It has become necessary to connect this generation with a network that is capable of moving power to the eastern portion of the SPP system or the eastern United States where the major load centers are located.

### **Line Length and Loadability**

The length of an AC transmission line has an impact on its performance characteristics. A transmission line’s loadability can be estimated based on its length, voltage level, and the type of conductors utilized. As line length increases, loadability decreases. The decrease in loadability can be countered by using higher voltage transmission for longer distances, or using HVDC alternatives that are not impacted by line length.

### **Capacity Needs**

In addition to loadability, capacity needs should be considered when designing EHV transmission. Generally, higher capacity lines are desired for their ability to move power across long distances. The typical capacity of a 345 kV line in the SPP system is 1,200 – 1,800 MVA. Using double circuit 345 kV or a higher voltage such as 765 kV will increase the capacity of those lines. In consideration of longer lines, HVDC transmission lines may be a good option for higher power transfers. When considering EHV designs, system voltage and technology (AC vs. DC) can be a factor in selecting the design.

### **Voltage Support**

A transmission line can either support voltage (produce VARs) or require voltage support from other reactive devices (consume VARs), depending on its loading level. In either case, transmission system design should account for these factors. Under light-load conditions, system voltages may rise due to VARs being produced from long EHV lines.

Shunt reactors would be necessary to help mitigate the rise in voltage. Some lines may need additional support to allow more power to flow through them. Series capacitors may be added to increase the

loadability of a transmission line. However, the addition of series compensation can complicate operations and may lead to stability concerns.

Note that HVDC lines do not produce or consume VARs; however, the substations (converter stations) at either end of a HVDC line do require VARs which is typically accommodated by the filters and other reactive power equipment within the design of an HVDC link.

**Construction Cost**

Cost plays a factor in EHV grid design. Lower-voltage designs cost less to construct initially. Higher voltage lines have a larger initial investment but provide significantly higher capacity and more flexibility in bulk power transport. Lower voltage lines offer more flexibility to act as a collector system for wind generation. A 345 kV substation connection is considerably less costly than a 765 kV connection for a generator due to the costs of the step-up transformers. Along with the initial cost, the lifetime of the asset needs to be considered. Transmission lines are generally assumed to have a 40-year life.

Table 4.4 summarizes some of the key characteristics of line costs for different technologies. Table 4.5 summarizes the additional costs of HVDC converter stations.

| Voltage     | Approximate Costs/Mile |
|-------------|------------------------|
| 600 kV HVDC | \$2,000,000            |
| 765 kV AC   | \$2,300,000            |
| 345 kV AC   | \$1,200,000            |

*Table 4.4: Approximate Costs of Different Transmission Line Technologies\**

\*These costs are for transmission line construction and Right-of-Way only and do not include HVDC converter station costs or costs for AC lines that require reactive compensation or additional station work to accommodate longer lengths.

| HVDC Station Type          | Approximate Costs for Station |
|----------------------------|-------------------------------|
| Converter End Station      | \$300,000,000                 |
| Converter Midpoint Station | \$100,000,000                 |

*Table 4.5: Approximate Costs of HVDC Converter Stations*

Due to the cost of converter stations, HVDC solutions can be more expensive than AC alternatives when considering line lengths shorter than about 300 – 350 miles; however, for longer distances, the cost is more competitive with AC alternatives due to lower losses on DC transmission and the need associated with long AC projects to require additional equipment for voltage support when traversing distances greater than 300 – 350 miles.

**Facts about Alternative Voltage and Technology Choices**

There are several key advantages to higher voltage transmission line alternatives as opposed to lower voltage alternatives. Among the advantages of higher voltage AC lines are higher capacity and loadability, reduced losses, and smaller right-of-way (ROW) needs for an equivalent amount of capacity.

There are also some drawbacks to higher voltage lines, including higher costs, and additional voltage management due to higher voltage AC lines acting as capacitors in light-load situations. HVDC alternatives offer the capability to meet specific, long distance transfer needs without the loadability limitations, higher ROW requirements of multiple low voltage or high voltage AC lines, and lower losses than any other alternative. Drawbacks of HVDC links include higher costs (when considering transmission solutions for distances of less than 300 miles and/or for lower bulk power transfer levels), due to the costs of conversion equipment for the HVDC link.

**Voltage Level Selection in the 2013 ITP20**

The EHV solutions utilized in the 2013 ITP20 were primarily 345 kV, as this technology provided the increased transfer capacity and robustness for a lower cost than other EHV technologies. The extensive needs of Future 3 resulted in portfolios for that future that included 765 kV AC as well as HVDC technologies.

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## Section 5: Resource Expansion Plan

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### **5.1: Resource Plan Development**

Identifying the resource outlook for each future is a key component of evaluating the transmission system for a 20-year horizon. Resources are added and retired frequently, and the SPP generation portfolio will not look the same in 20 years as it looks today. Resource expansion plans were developed for the SPP region and neighboring regions for use in the study. They include both conventional and renewable generation plans and are unique to each future.

### **5.2: Conventional Resource Plan**

A conventional resource plan was developed for each future for the years 2023, 2028, and 2033 to analyze the 40 year benefit of the recommended transmission portfolio.

#### **Generator Review**

An ITP20 generator review was conducted with stakeholders providing information as inputs to the analysis including maximum capacities, ownership, retirements, and other operating characteristics of all generators in SPP. Between the generator review and 2012 Policy Survey, approximately 4 GW of conventional generation in the SPP region was identified as retired by 2033. The existing generation in the SPP region was updated with this information before development of the resource plan.

#### **Conventional Resource Plan Approach**

SPP Criteria 2.1.9<sup>12</sup> states that each load serving entity must meet a 12% capacity margin, and this is not expected to change with the implementation of the Integrated Marketplace. The resource plan was developed with this same requirement. Projected capacity margins were calculated for each zone using existing generation and 2033 load projections. Each zone's capacity was assessed to ensure that it met the 12% capacity margin requirement. Only 5% of wind nameplate capacity was counted towards the capacity margin requirement, due to the unpredictability of wind levels. ESWG vetted a resource list of generic prototype generators that comprise representative parameters of specific generation technologies. Prototype generators were utilized in resource planning simulations to determine the optimum generation mix to add to each zone. All new generation identified in the conventional resource plan was natural gas-fired, comprising a combination of combined cycle and fast-start combustion turbine units.

#### **Generation Siting**

After new generation was added for each zone, it was sited within these zones based on location of existing gas generation and stakeholder feedback. ESWG and other stakeholders provided input on the locations in their areas that are best suited for additional gas generation and the appropriate buses to place these generators based on space requirements, proximity to gas pipelines, and existing electric transmission.

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<sup>12</sup> SPP.org > Org Groups > Governing Documents > Criteria & Appendices January 30, 2012

### Conventional Resource Plan – External Regions

Resource plans were also developed for external regions for Futures 1-4. Each region was assessed to determine the capacity shortfall, and natural gas combined cycle and combustion turbine units were added so that each region met a capacity margin of 12%. New units were sited at lines with high transfer capacity. Units were added in Entergy, AECI, TVA, PJM, MISO, MAPP Non-MISO, and SERC. SPP Staff provided the resource plan to WAPA, AECI, and Entergy for their review. No additional changes were provided during the development of these resource plans.

In Future 5, SPP Staff leveraged the resource plan from Future 1 for WAPA, AECI, and Entergy. Otherwise, Future 5 incorporates the resource plan provided by MISO for the MISO region and all other regions. MISO performed the resource plan analysis using a similar tool to the tool used for the SPP region. The MISO results of this analysis were merged into the SPP model.

### SPP Capacity Additions by Unit Type by 2033 – Summary

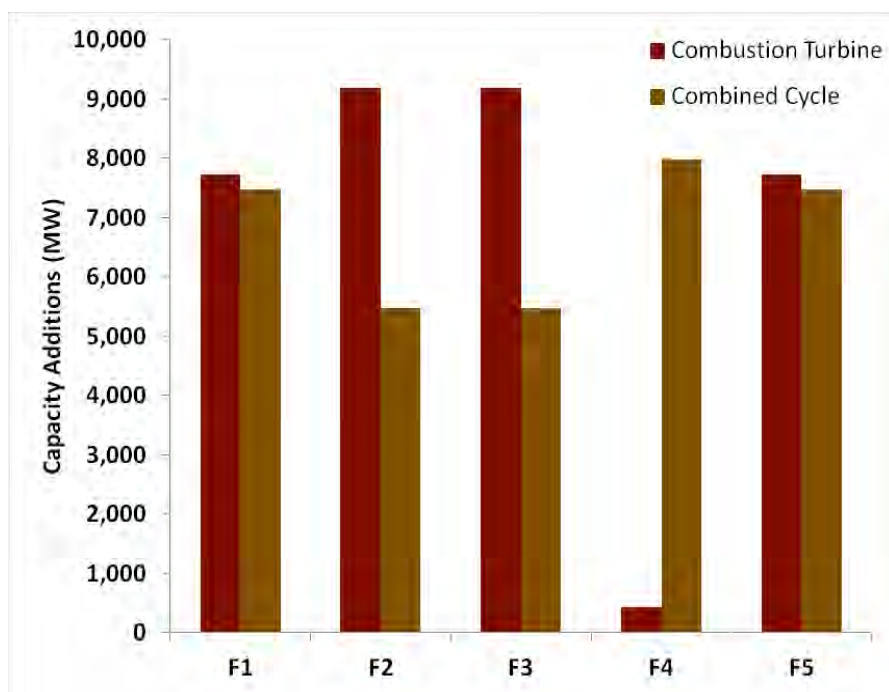


Figure 5.1: Conventional Capacity Additions by Unit Type

Figure 5.1 new generation additions by future for the SPP region. Futures 1 and 5 have 15.2 GW of additional generation, Futures 2 and 3 have 14.7 GW of additional generation, and Future 4 has 8.4 GW of additional generation. The CT units have lower capital costs, while the CC units have lower operating costs. While CC and CT capacities are roughly equal in Future 1, Futures 2 and 3 include more CT generation as a result of having more wind than Future 1. The quick-start CT units are able to ramp up quickly when wind speeds decrease.

Because of the decreased peak and energy levels in Future 4, there is less need for new generation to meet capacity margins. The \$36/ton carbon tax in Future 4 contributed to most new generators in this Future being CC's, because of the lower heat rate compared to CT's. This leads to CC's producing more generation output per ton of carbon emissions than CT's, making them the most feasible generation option in this Future.

### Futures 1 and 5 Conventional Resource Plan for 2033 – SPP

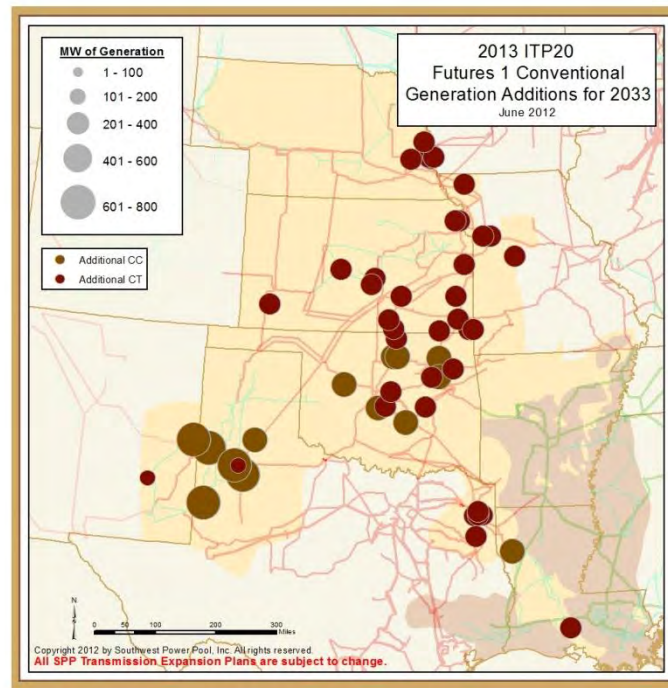


*Figure 5.2: Conventional Generation Additions for Futures 1 and 5*

Figure 5.2 shows locations and technology type of all new conventional generation added to Futures 1 and 5 for 2033.

- Additional Sites
  - 15 Combined Cycle
  - 37 Combustion Turbine
- Additional Capacity
  - 7.5 GW Combined Cycle
  - 7.7 GW Combustion Turbine



## Futures 2 and 3 Conventional Resource Plan for 2033 – SPP

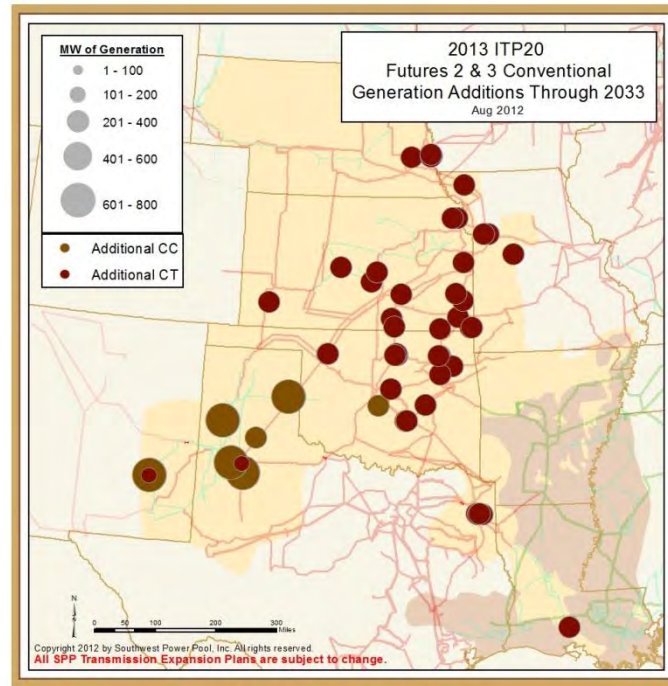


*Figure 5.3: Conventional Generation Additions for Futures 2 and 3*

Figure 5.3 shows locations and technology type of all new conventional generation added to Futures 2 and 3 for 2033.

- Additional Sites
  - 10 Combined Cycle
  - 44 Combustion Turbine
- Additional Capacity
  - 5.5 GW Combined Cycle
  - 9.2 GW Combustion Turbine

### Future 4 Conventional Resource Plan for 2033 – SPP

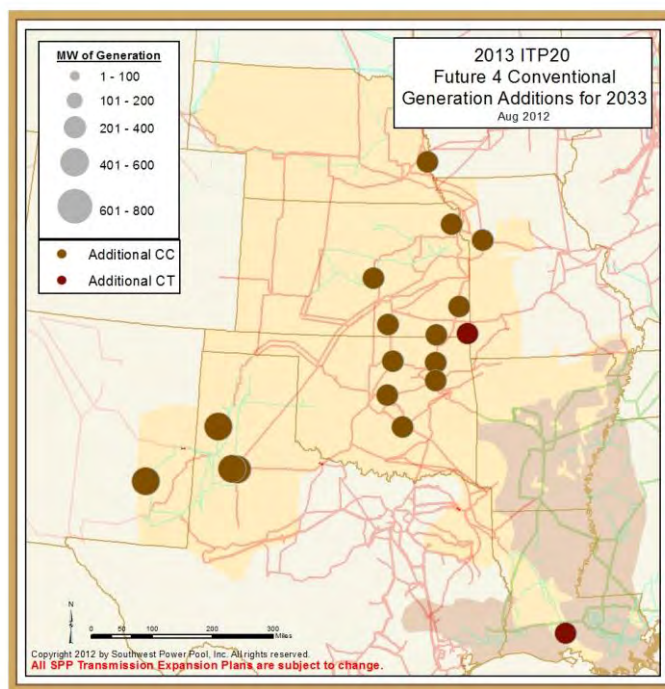


Figure 5.4: Conventional Generation Additions for Future 4

Figure 5.4 shows locations and technology type of all new conventional generation added to Future 4 for 2033.

- Additional Sites
  - 17 Combined Cycle
  - 2 Combustion Turbine
- Additional Capacity
  - 8.0 GW Combined Cycle
  - 0.4 GW Combustion Turbine

Additional information and results of the conventional resource plan are shown in Appendix Z, including generation added by year, generation added by zone, and external region generation addition details.

### **5.3: Renewable Resource Plan**

A renewable resource plan was developed for each future for the years 2023, 2028, and 2033.

#### **Existing Wind**

The 2012 Policy Survey was used to gather information on existing wind in the SPP system to include in the models. Existing wind is defined as wind generation that is in-service or currently in development

and expected to be in-service by the end of 2013. Members reported 6.3 GW of existing wind in the SPP region. Another 0.8 GW of existing wind generation is currently contracted for export with firm service and was modeled accordingly. The total existing wind reported by members within the SPP region is 7.1GW and was included in the models for all futures<sup>13</sup>.

### Additional Wind

The 2012 Policy Survey was used to gather information on members' state renewable targets and mandates with which to comply with by 2033. Additional wind generation was added to the system in Futures 1 and 5 when the existing wind was not sufficient to meet state targets and mandates. The total additional wind added in the SPP footprint for Futures 1 and 5 is 2.1 GW. The additional wind energy was allocated to the zones within SPP as needed to meet state renewable targets and mandates.

In Futures 2 – 4, new wind generation was added in order to meet a regional renewable standard of 20%. The additional wind energy was allocated to the zones within SPP as needed to serve 20% of their energy requirements. In Future 3, an additional 9.2 GW of export wind energy was added to wind-rich areas within SPP, bringing the total amount of export wind energy to 10.0 GW. The table below shows wind generation by future:

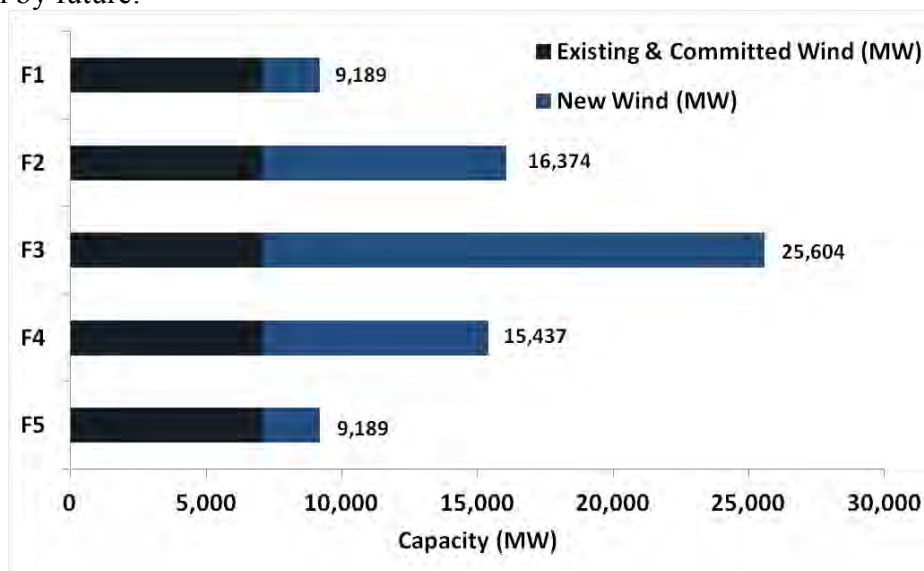


Table 5.1: SPP Wind by Future

### Siting of Additional Wind

Generic wind sites were selected by the ESWG based upon the locations selected in previous ITP studies because of their potential for high wind output. The generic sites were added as follows:

- 2.1 GW of additional wind in Futures 1 and 5 was apportioned to 25 additional wind sites in NM, TX, OK, KS, MO, and NE.
- 9.3 GW of additional wind in Future 2 was apportioned to 30 additional wind sites in NM, TX, OK, KS, and NE.

<sup>13</sup> As of April 2013, the total wind capacity in the SPP region has increased to approximately 7.4 GW.

- 18.5 GW of additional wind in Future 3 was apportioned to 30 additional wind sites in NM, TX, OK, KS, and NE. 10 GW of wind is exported in this future.
- 8.3 GW of additional wind in Future 4 was apportioned to 30 additional wind sites in NM, TX, OK, KS, and NE.
- Capacities of these new wind farms were adjusted in each future to meet renewable requirements.

It was anticipated that few new wind farms would be located in Missouri if the state's renewable incentives, available only under Futures 1 and 5 state renewable targets, were to be eliminated. If there is a federal RES, as considered in Futures 2-4, it is anticipated that Missouri would import wind from neighboring states, from which wind is more cost-effective to implement.

### Renewable Resource Plan – External Regions

Renewable resource plans were also developed for external regions for all futures. PJM provides Business as Usual renewable data to MISO, and MISO provided SPP with Business as Usual renewable data for MISO and PJM, which includes 31.6 GW of renewables for MISO and 4.8 GW of renewables for PJM. No additional renewable generation was added in Futures 1 and 5. In Futures 2 – 4, wind was added throughout the Eastern Interconnect, in addition to the MISO data, to reach the 20% renewable standard in all regions. Most of the additional renewable energy was assumed to be generated from wind, though biomass was also added in SERC, TVA, and Entergy, due to the lower wind potential in the southeast. These renewable units were sited at high voltage buses with high transfer capacities.

### Futures 1 and 5 Renewable Resource Plan for 2033 – SPP

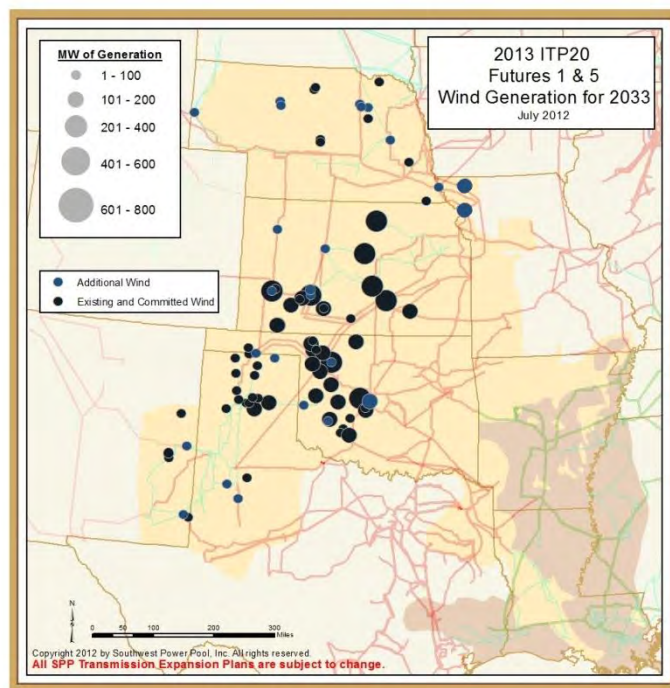


Figure 5.5: Renewable Resource Plan for Futures 1 and 5

Figure 5.5 shows the location of all wind generation for the SPP region for Futures 1 and 5.

- Wind Sites
  - 71 Existing

- 25 New
- Wind Capacity
  - 7.1 GW Existing
  - 2.1 GW New
  - 9.2 GW Total

### Future 2 Renewable Resource Plan for 2033 – SPP

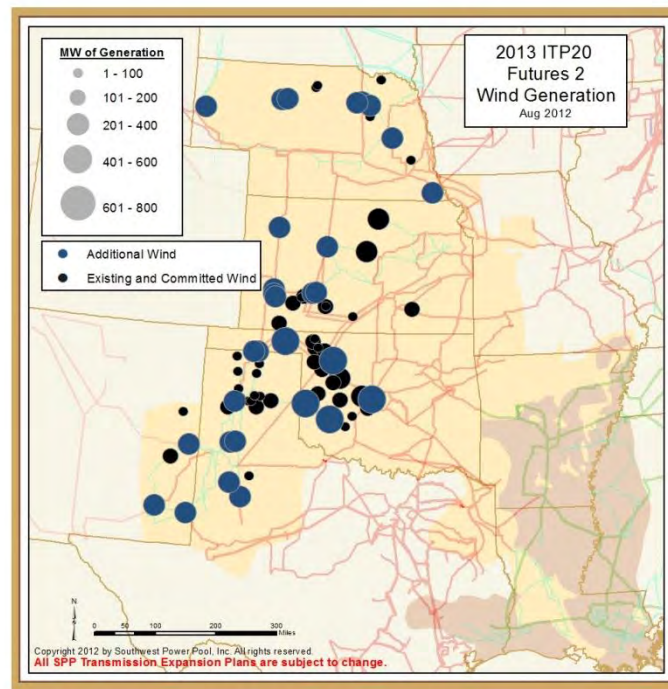


*Figure 5.6: Renewable Resource Plan for Future 2*

Figure 5.6 shows the location of all wind generation for the SPP region for Future 2.

- Wind Sites
  - 71 Existing
  - 30 New
- Wind Capacity
  - 7.1 GW Existing
  - 9.0 GW New
  - 16.1 GW Total



### Future 3 Renewable Resource Plan for 2033 – SPP

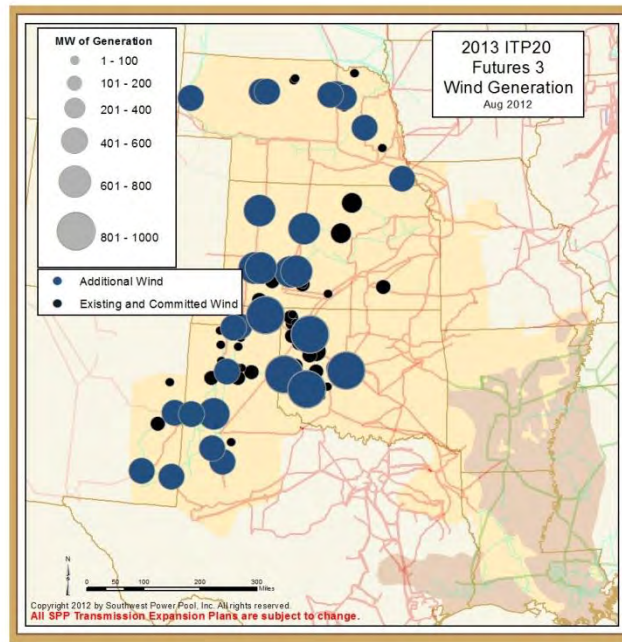


*Figure 5.7: Renewable Resource Plan for Future 3*

Figure 5.7 shows the location of all wind generation for the SPP region for Future 3.

- Wind Sites
  - 71 Existing
  - 30 New
- Wind Capacity
  - 7.1 GW Existing
  - 18.5 GW New
  - 25.1 GW Total

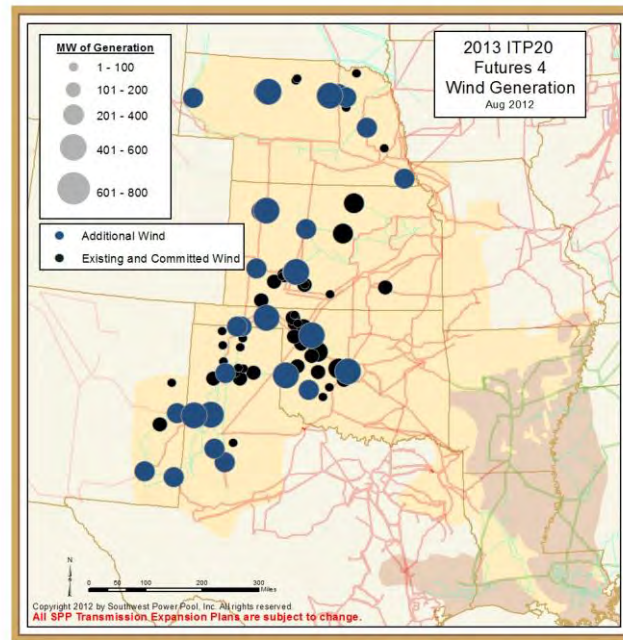
**Future 4 Renewable Resource Plan for 2033 – SPP**

*Figure 5.8: Renewable Resource Plan for Future 4*

Figure 5.8 shows the location of all wind generation for the SPP region for Future 4.

- Wind Sites
  - 71 Existing
  - 30 New
- Wind Capacity
  - 7.1 GW Existing
  - 8.3 GW New
  - 15.4 GW Total

Additional information and results of the renewable resource plan are shown in Appendix Z, including zonal breakdown of wind, bus locations, and external region details.



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## Section 6: Analysis Methodology

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### **6.1: Analytical Approaches**

SPP transmission system performance was assessed from different perspectives designed to identify transmission expansion projects necessary to accomplish the reliability, policy, and economic objectives of the SPP Regional Transmission Organization (RTO). Among other considerations, the six perspectives ensured that the transmission expansion portfolio would:

- Avoid exposure to Category A and B NERC Transmission Planning (TPL) standard criteria violations during the operation of the system under high stresses;
- Facilitate the use of renewable energy sources as required by policy targets and mandates;
- Contribute to the voltage stability of the system; and
- Reduce congestion and increase opportunities for competition within the SPP Integrated Marketplace.

Priority was given to the relief of all of the potential reliability violations seen during the four seasonal peak hours (summer peak, winter peak, low hydro, and peak wind) and to the facilitation of all state renewable policy goals and requirements. The relief of annual congestion and reduction in market prices were pursued where cost-justified; a transmission expansion project was considered cost-justified when it yielded a benefit-to-cost ratio of at least 1.0. In some cases, there was overlap among these priorities; for example, a project may relieve potential reliability violations AND reduce annual congestion in a cost-justified manner.

#### **SCUC & SCED Analysis for multiple futures**

An assessment was conducted to develop a list of constraints for use in the Security Constrained Unit Commitment and Economic Dispatch (SCUC & SCED) analysis. Elements that, under contingency, limit the incremental transfer of power throughout the system were identified, reviewed, and approved by the Transmission Working Group (TWG). Revisions to the constraint definition studies included modification of the contingency definition based upon terminal equipment, normal and emergency rating changes, and removal of invalid contingencies from the constraint definition.

The constraint list included normal and emergency ratings and was limited to the following types of issues:

- System Intact and N-1 situations<sup>14</sup>
- Existing common right-of way and tower contingencies for 300+ kV facilities<sup>15</sup>
- Thermal loading and voltage stability interfaces
- Contingencies of 300+ kV voltages transmission lines
- Contingencies of transformers with a 300+ kV voltage winding

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<sup>14</sup> N-1 criterion describes the impact to the system if one element in the system fails or goes out of service

<sup>15</sup> The current NERC Standard TPL-001-0.1 includes outages of any two circuits of a multiple circuit tower line within Category C, and the loss of all transmission lines on a common right-of-way within category D. NERC Standard TPL-001-2 will replace this standard (pending FERC approval) and includes such outages in Category P7 and Table 1 – Steady State & Stability Performance Extreme Events.

- Monitored facilities of 100+kV voltages only

Neighboring areas supplied their respective list of constraints.

All system needs were identified through the use of a SCUC & SCED simulation that accounted for 8,760 hours representing each hour of the year 2033. Line loading was determined using direct current (DC) models<sup>16</sup>.

### **Utilization of Past Studies & Stakeholder Expertise for Solutions**

SPP shared potential violations with the stakeholders and posted on the SPP password protected TrueShare site<sup>17</sup> for review. SPP Staff collected potential solutions from stakeholders throughout the footprint, as well as entities outside of the footprint. Additionally, solutions previously identified in the 2012 ITP10, ITP Near-Term, 2010 ITP20, Aggregate Studies, and Generation Interconnection Studies were also considered in this analysis.

### **Treatment of Individual Projects & Groupings**

After assessment of the needs, SPP investigated mitigation of the overloads and congestion through individual projects by performing the following actions:

- Each project was tested to ensure the project provided the expected result.
- Projects were grouped to measure the impact of the projects upon similar constraints and overloads.
- Efficiencies were sought by identifying projects with synergy and projects that duplicated the value captured by another project.
- Combined reliability, policy, and economic analysis to produce a transmission expansion portfolio of projects.

## **6.2: Projecting Potential Criteria Violations**

### **Reliability Needs**

Thermal overloads were identified in four hours that represent situations that uniquely stress the grid<sup>18</sup>. Any constraint that was binding with a shadow price in any of the 4 hours was defined as a reliability need.

- Summer peak – highest coincident load during summer months
- Winter peak – highest coincident load during winter months
- Low hydro – highest ratio of coincident load to hydro output during summer months<sup>19</sup>
- Peak wind – highest ratio of wind output to coincident load

<sup>16</sup> The use of an alternating current (AC) model would provide greater precision in these calculations and yields not only thermal loading, but voltage levels as well. The complexity of such a model development is not justified given the strategic rather than detailed nature of this assessment. An AC model will be utilized for the stability assessment (see below). Apart from the stability assessment to verify line loadability and general system stability, the correction of voltage limitations will be addressed in the ITP10 and ITPNT.

<sup>17</sup> Send an email to [questions@spp.org](mailto:questions@spp.org) for access to the TrueShare site.

<sup>18</sup> Summer peak, winter peak, low hydro, and high wind situations have been studied in various SPP studies since 2006.

<sup>19</sup> Hydro generation in SWPA and WAPA was included in the calculations to select the low hydro hour.

In addition, any constraints that breached for any hour (indicating that the SCED was unable to honor the facility rating) were identified as reliability needs, as these violations indicate a severe potential for overloading of the facility.

### **Reliability & Economic Efficiencies**

All potential reliability upgrades were evaluated in the economic model to determine potential economic benefit. Potential upgrades were developed into portfolios to determine which group of upgrades provided the best overall solution. Potential upgrades were reviewed to determine if an upgrade with a greater economic benefit could defer or replace an identified reliability solution while still providing mitigation of the reliability issue. Costs associated with deferred projects can be subtracted from the total cost of transmission expansion portfolios.

The methodology by which reliability projects were replaced with economic projects followed these steps:

1. Identified reliability need.
2. Provided and tested reliability mitigation.
3. Identified congestion in the system.
4. Paired congestion nearby and related to reliability needs to compare alternative projects.
5. Measured and compared the value of resolving the congestion with an economic project that also mitigated the reliability need.

$$\text{Value of reliability project} = \text{Value}_{rp} = \text{APC Benefit}_{rp} - \text{Cost}_{rp}$$

$$\text{Value of economic project} = \text{Value}_{ep} = \text{APC Benefit}_{ep} - \text{Cost}_{ep} - \text{Value}_{rp}$$

6. Selected the economic project to mitigate the reliability need and relieve the congestion, where cost-effective.

### **6.3: Meeting Policy Requirements**

For policy requirements, staff focused on satisfying renewable targets and mandates within a future through use of renewable generation as defined by the SPP Members through the 2012 Policy Survey. The primary generation technology used to meet these renewable standards, as provided by the stakeholders, was wind generation.

Wind farms may experience the effects of congestion and be curtailed by the SCED. Shortfalls in the achievement of the renewable requirements of each future due to this curtailment were identified. Renewable resources that experience an annual energy output of less than 97% of the targeted energy were identified as policy needs. The targeted energy is based on maximum capacity, capacity factor, and generation profile.

### **6.4: Projecting Congestion & Market Prices**

#### **Annual Conditions Reviewed by the Economic Studies Working Group (ESWG)**

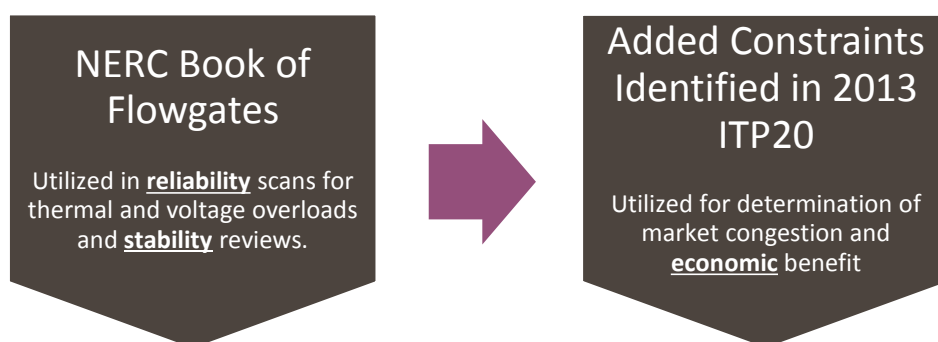
Congestion was assessed on an annual basis for each future including many variables. Some of these variables change on an hourly basis, such as load demand, wind generation, forced outages of generating plants, and maintenance outages of generating plants. A total of 8,760 hours were evaluated for the year 2033.

Relevant congestion of each constraint was identified through two methods:

- The number of hours congested, and the average shadow price<sup>20</sup> associated with the congestion for all binding hours.
- These two numbers were multiplied together to compute an average congestion cost across all hours of the year.
- This average congestion cost was used to rank the severity of the congestion for each constraint.

### Identification of Additional Constraints

Staff defined the initial list of constraints from the NERC Book of Flowgates for the SPP region. This list of constraints was used to create the economic dispatch utilized in the reliability scans for potential thermal and voltage violations. Additional constraints were incorporated that would protect the facilities from overloads under many system conditions. These additional constraints facilitated the capture of both market congestion and economic benefit and adjusted the flowgate list in expectation of transmission that is not anticipated by the NERC Book of Flowgates.



### Congestion Prioritization & Screening

The impact of the top 15 constraints upon the region's APC was measured to identify the depth of the congestion at each constraint and prioritize which constraints provided opportunity for APC savings. This was accomplished by calculating the change in APC with and without the constraint. By targeting the top 15 constraints, the areas of greatest opportunity for economic projects were identified to be considered for improvement.

## 6.5: Determining Recommended Portfolio

Individual projects within the recommended portfolio provided reliability, economic, and policy benefits within the business as usual future (F1) and at least one other future. Based on the weighting shown in Figure 6.1, a project had to score at least 60% out of 100% to be included in the recommended portfolio.



<sup>20</sup> The "Shadow Price" refers to the savings in congestion costs if the constraint limit in question were increased by 1 MW.

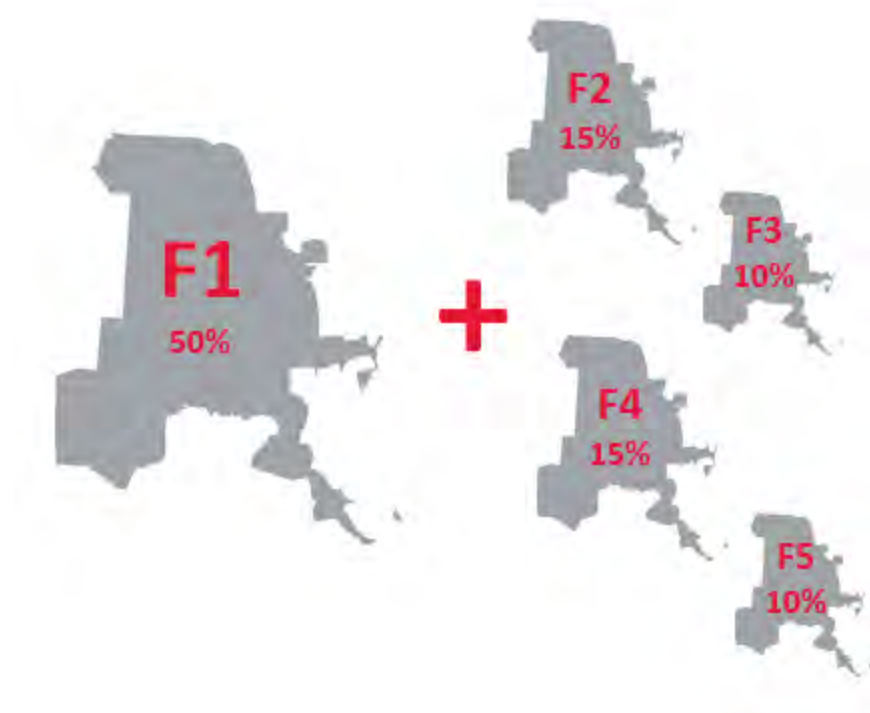


Figure 6.1: Project weighting by future

### Project Staging

Project staging is the process by which appropriate in-service dates for new projects are established. Project staging was not performed as part of the 2013 ITP20. The ITP20 study is a broader look at transmission expansion 20 years into the future, while the ITP10 and ITPNT are more refined studies that will help to establish the staging of projects from the ITP20.

## **6.6: Measuring Economic Value**

For the 2013 ITP20, the Metrics Task Force developed several monetized metrics to facilitate better understanding of the financial impacts of proposed projects. The ESGWG chose three of the new metrics for inclusion in the 2013 ITP20, to be calculated for informational purposes only.

The metrics suggested by MTF are the following:

| <b>Benefit</b>                                         | <b>MTF Metric Name</b>                                                        | <b>Current or New?</b> |
|--------------------------------------------------------|-------------------------------------------------------------------------------|------------------------|
| <b>APC benefits</b>                                    | Adjusted Production Cost (APC)                                                | ●                      |
|                                                        | Marginal energy losses benefits                                               | ✓                      |
|                                                        | Mitigation of transmission outage costs                                       | ✓*                     |
| <b>Positive impact on capacity required for losses</b> | Reduced capacity expansion costs due to reduced transmission losses on peak   | ●                      |
| <b>Improvements in reliability</b>                     | Avoided or delayed reliability projects                                       | ●                      |
|                                                        | Capital savings due to reduction of members' Minimum Required Capacity Margin | ✓                      |
|                                                        | Reduced loss of load probability                                              | ✓                      |
|                                                        | Reducing the cost of extreme events                                           | ✓                      |
|                                                        | Assumed benefit of mandated reliability projects                              | ✓*                     |
| <b>Reduction of Emission Rates and Values</b>          | Reduction of emission rates and values                                        | ●                      |
| <b>Improvements to Import/Export Limits</b>            | Increased wheeling through and out revenues                                   | ✓                      |
| <b>Public Policy Benefits</b>                          | Benefit from meeting public policy goals                                      | ✓*                     |

● Previously used ITP Metric   ✓ New Metric   ✓\* New Metric calculated solely for informational purposes in 2013 ITP20

While APC benefits were calculated for numerous projects and the final portfolio, the other metrics were calculated only for the final portfolio in each future.

#### **Calculation of Adjusted Production Cost (APC)**

APC is a measure of the impact on production cost savings by Locational Marginal Price (LMP), accounting for purchases and sales of energy between each area of the transmission grid. APC is

determined using a production cost modeling tool that accounts for hourly commitment and dispatch. The calculation, performed on an hourly basis, is as follows:

$$APC = \text{Production Cost} - \text{Revenue from Sales} + \text{Cost of Purchases}$$

$$\text{Revenue from Sales} = MW \text{ Exported} \times \text{Zonal } LMP_{Gen \text{ Weighted}}$$

$$\text{Cost of Purchases} = MW \text{ Imported} \times \text{Zonal } LMP_{Load \text{ Weighted}}$$

APC captures the monetary cost associated with fuel prices, run times, grid congestion, ramp rates, energy purchases, energy sales, and other factors that directly relate to energy production by generating resources in the SPP footprint.

### Mitigation of transmission outage costs

Metric calculates the benefit of reducing additional congestion based on new transmission projects. Standard production cost simulations assume that transmission lines and facilities are available during all hours of the year and that no planned or unexpected outages of transmission facilities will occur. In practice, however, planned and unexpected transmission outages impose non-trivial additional congestion costs on the system. The benefit of reducing this additional congestion is thus not captured in the standard APC metric. The availability of new transmission projects decreases congestion and increases the operational flexibility of the system to mitigate the impacts of transmission outages. The ESWG provided direction to calculate the results of this metric for informational purposes only, and it is included in the Appendix Section 21:.

### Assumed benefit of mandated reliability projects

Metric assumes that benefits are equal to costs for mandated reliability projects. This benefit was only considered for projects under the category of “regional reliability” that were mutually exclusive from any other reliability benefit applied to those same projects. Treating benefits for mandated reliability projects equal to their costs avoids potential undervaluing of the portfolio value of reliability projects which are mandated and thus not justified solely by other economic benefits. The ESWG provided direction to calculate the results of this metric for informational purposes only, and it is included in the Appendix Section 21:.

### Benefit from meeting public policy goals

Metric measures benefit of meeting public policy targets and mandates in the SPP region related to renewable energy supplies. Public policy can be met through state law, settlement agreement, or a regulatory determination made by a state regulatory authority. It does not include economic decisions made by individual utilities to acquire renewable energy supplies absent some form of legal requirement. ESWG provided direction to calculate the results of this metric for informational purposes only, and it is included in the Appendix Section 21:.

### Reduced Losses

Metric captures the change in total system losses due to the finalized portfolio. Losses were calculated for each hour of the DC simulation. The difference in production costs due to the change in losses was reflected in the APC calculation. The reduction in capacity capital costs associated with these losses was not captured by this metric or in the APC calculations, but was captured through the use of the Reduced Capacity Costs Metric.



**Reduced Capacity Costs**

Metric captures a value for the generation capacity that may no longer be required due to a reduction in losses and capacity margin. The reduced capacity could be reflected in reduced losses and the potential reduction in capacity margins. This value was monetized using the savings in capital attributed to the corresponding reduction in installed capacity requirements. The Benefits Analysis Techniques Task Force (BATTF) established a \$750/kW figure to use as the approximate capital cost of a CT for this calculation.

**Reduction of Emissions Rates and Values**

Metric captures the cost savings associated with reduced SO<sub>2</sub>, NO<sub>x</sub>, and CO<sub>2</sub> emissions because the allowance prices for these pollutants are inputs to the production cost model simulations. The quantified changes in SO<sub>2</sub>, NO<sub>x</sub>, and CO<sub>2</sub> emissions were measured and reported in addition to the APC results in order to provide further insight into system expectations.

**Methodology for Calculating Economic Benefit Incremental to Reliability**

The value of economic projects in the 2013 ITP20 is computed as the incremental cost and benefit of the economic project above and beyond reliability and policy projects. The calculation assumes that all of the reliability and policy projects are in-service (the base case) and measures the benefit of adding the economic project to the system (the change case).

# PART II: STUDY FINDINGS



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## Section 7: Benchmarking

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Numerous benchmarks were conducted to ensure the accuracy of the data produced in the planning simulations. A model was developed that reflected transmission and generation in-service as of 2011 and simulation results from that model were compared with historical statistics and measurements from SPP Operations, the North American Electric Reliability Corporation (NERC) and the Energy Information Administration. The goal was to provide a reasonableness review of the study data.

### **7.1: Benchmarking Setup**

For the results of the benchmarking process to provide value it was important to mimic the assumptions that were realized operationally in 2011. This includes using actual data from 2011 such as fuel prices.

SPP used data provided by SPP Operations and SPP Market Monitoring (MMU) to benchmark against. This data reflects the actual values from 2011 for load, generation, and LMP prices. It is unreasonable to expect that the simulation runs for benchmarking would exactly match 2011 actual data for several reasons. Even though SPP used 2011 input data there are still some differences. The PROMOD IV<sup>®</sup> simulation models did not capture operational data exactly. Sharp load adjustments such as those that are experienced during and after outages and storms would be captured differently.

One of the major differences between SPP's operations in 2011 and the PROMOD IV<sup>®</sup> simulation is the type of market. PROMOD IV<sup>®</sup> models a day-ahead market using a consolidated balancing authority. Since this market structure operates differently than SPP's current market, one would expect different results. Another challenge when benchmarking PROMOD IV<sup>®</sup> data to SPP's 2011 data is the difference in area definitions. PROMOD IV<sup>®</sup> will report prices, load, generation, etc. for the whole of the SPP footprint. However the price data provided by MMU only reflects market participants. Therefore the PROMOD IV<sup>®</sup> results include additional data not included in the Market Monitoring data.

Due to the hurdles and applicability in comparing PROMOD IV<sup>®</sup> data with 2011 actual data SPP focused more on benchmarking the shape of the data rather than the magnitude of the values. As an example, the load for a particular zone in PROMOD IV<sup>®</sup> would not match the load of that same zone in the MMU since MMU defines that zone differently. What would be important though is for the shape of that load throughout the year to be consistent. The same application applies to prices and generation. Instead of focusing on the magnitude of generation over the course of the year, this benchmarking effort focuses on capacity factors.

### **7.2: Generator Operation**

#### **Capacity Factor by Unit Type**

Comparison of annual capacity factor is a method for measuring the similarity in planning simulations and operational situations. Capacity factor checks provide a quality control check of differences in modeled unit outages for nuclear units and assumptions regarding renewable, intermittent resources.

When compared with capacity factors as tracked by the EIA for 2011 and previous years, the capacity factor by unit category fell within or near expected ranges. Part of the difference is due to the variation between the unit categories reported to the EIA and those available within the 2013 ITP20 models.

Capacity factors for the 2013 ITP20 were derived from the PROMOD IV<sup>®</sup> report agent software. The average capacity factors from the EIA are from the EIA Electric Power Annual for 2005 – 2011 and can be found on the EIA website<sup>21</sup>. The capacity factor from the EIA includes other renewables such as biomass and solar and reflect data submitted by utilities across the Eastern Interconnect.

| Unit Category  | 2013 ITP20 Capacity Factor | EIA Capacity Factor Range |
|----------------|----------------------------|---------------------------|
| Nuclear        | 68%                        | 67 – 97%                  |
| ST Coal        | 72%                        | 64 – 74%                  |
| Wind           | 45%                        | 40 – 47%                  |
| Combined Cycle | 40%                        | 33 – 42%                  |
| Hydro          | 28%                        | 23 – 46%                  |
| ST Gas         | 10%                        | 10 – 15%                  |
| CT Gas         | 5%                         | 10 – 15%                  |

*Table 7.1: Benchmarking the Capacity Factor by Unit*

### Generation by Unit Category

The share of generation by category throughout the footprint is a basic foundation for measuring the benefits of additional transmission. This generation mix will change as fuel price and congestion vary in the economic dispatches and will drive changes to the APC for each area in SPP.

The generation mix presented in the simulations was in-line with expectations. When compared with the generation mix from 2011, the share of generation apportioned to each unit category was within an acceptable range. Coal and combined cycle gas generation sources provided 82% of the total generation in the simulation. Historically, according to the EIA, these sources provided 77%. It should be noted that in 2011, the Fort Calhoun Nuclear plant suffered flooding and has not been brought online. EIA data for 2011 also shows a 67% capacity factor for nuclear in SPP.

Total generated energy by unit category for the 2013 ITP20 was derived from the PROMOD IV<sup>®</sup> report agent software for the year 2011. Historical generation output was approximated from EIA-923 data and can be found on the EIA website. Figure 7.1 illustrates the percentage of generation share (by energy) for each unit type.

<sup>21</sup> EIA.gov

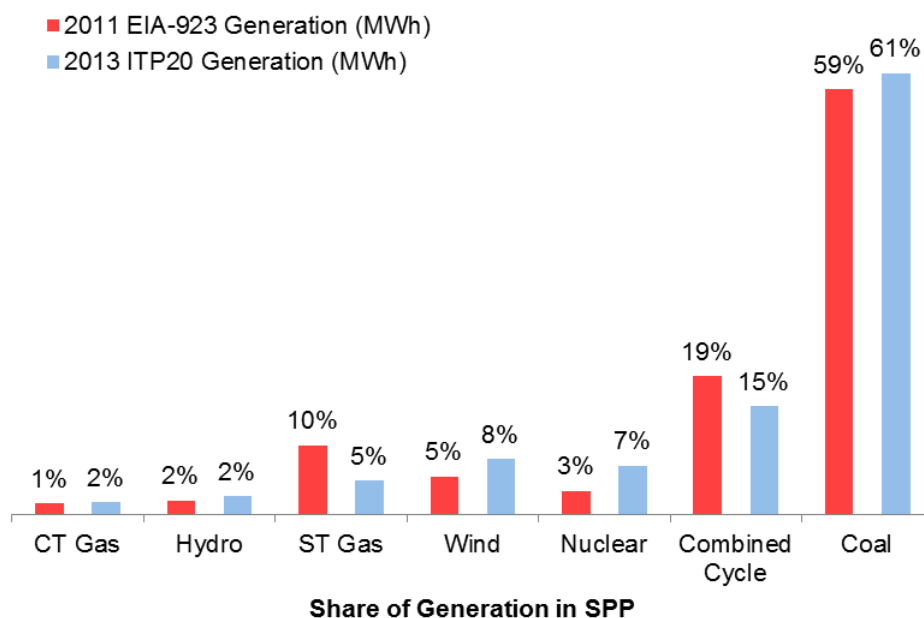


Figure 7.1: Benchmarked Unit Generation by Category

### Maintenance Outages

Generator maintenance outages in the simulations were compared with statistics available through the NERC Generating Availability Data System. The proper reflection of generator outages is important to the study because of the direct impact these outages have on flowgate congestion, system flows and the economics of following load levels. The method of forecasting maintenance outages correlated strongly with these statistics. Significant generator outages from 2011 were incorporated in the benchmark model based upon data from SPP Operations. This increased the precision of the benchmarking and accounted for significant weather related and maintenance outages.

### Operating & Spinning Reserve Adequacy

Operational Reserve is an important reliability requirement that is modeled to account for capacity that might be needed in the event of unit failure. Simulation data matches the requirements set forth by SPP criteria of capacity equal to the largest unit in SPP + 50% of the next largest unit as operating reserve. Additionally, 50% of this operating reserve must be in the form of spinning reserve. PROMOD IV<sup>®</sup> reports any unit not on maintenance as available for reserve if it meets the criteria for spinning or quick start. **Error! Reference source not found.** shows the quick start and spinning reserve that was available in the benchmarking runs, as well as the operating reserve requirement of 1,740 MW and the spinning reserve requirement of 870 MW. The spinning reserve available in the PROMOD IV<sup>®</sup> runs exceeded not only the spinning reserve requirement, but also the operating reserve requirement.

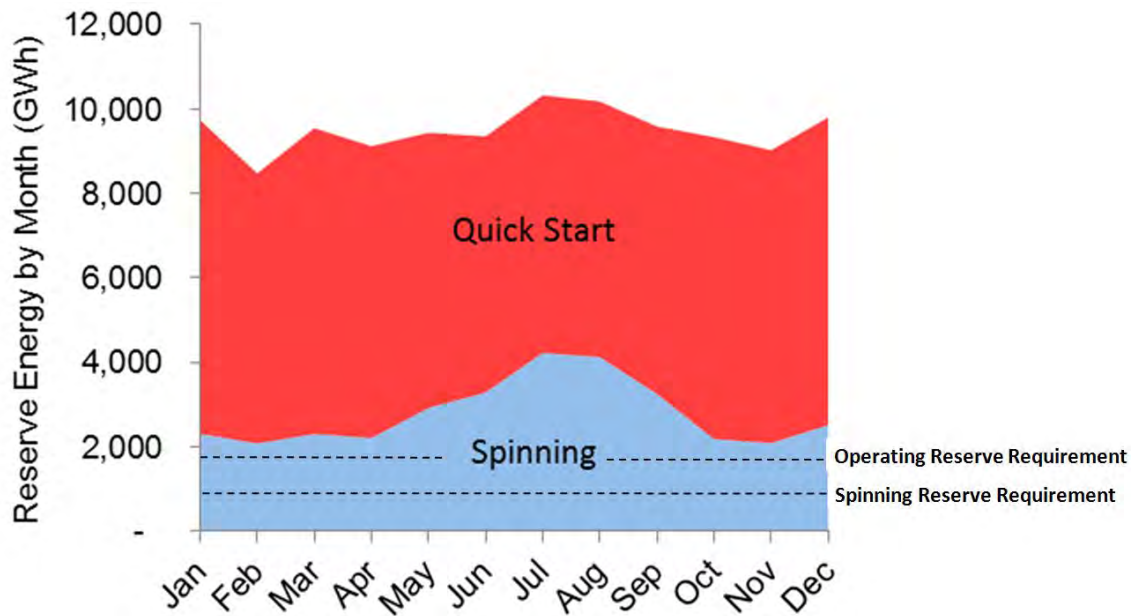


Figure 7.2: Spinning Reserve Adequacy

### Coal Transportation Costs

The comparison of transportation costs within the model was necessary to ensure that reasonable fuel prices are reflected at the coal plants within the model. A standard linear relationship between the distance of a plant from its coal source was used to simulate reasonableness in fuel prices between coal plants. The outlying data points (four were identified) within the model set were corrected to coincide with an average cost per mile of 0.16¢. Costs for other plants were brought in line with this average for consistency. This information was gathered directly from the Powerbase<sup>®</sup> tool that was used to model the system. GIS information from SPP's modeling department was utilized to determine the straight line distance from each plant to the plant's sourcing mine (Powder River Basin in all cases).

### 7.3: Reasonable System LMPs

Benchmarking was done on average Locational Marginal Prices (LMPs) by Area. Figure 7.3 compares the average monthly price of energy in the EIS market from 2009-2011 to the average monthly bus LMPs of the 2013 ITP20 benchmarking runs. This check is important because close correlation between actual LIPs and simulated LMPs for the year benchmarked should exist if the simulations portray SPP accurately.

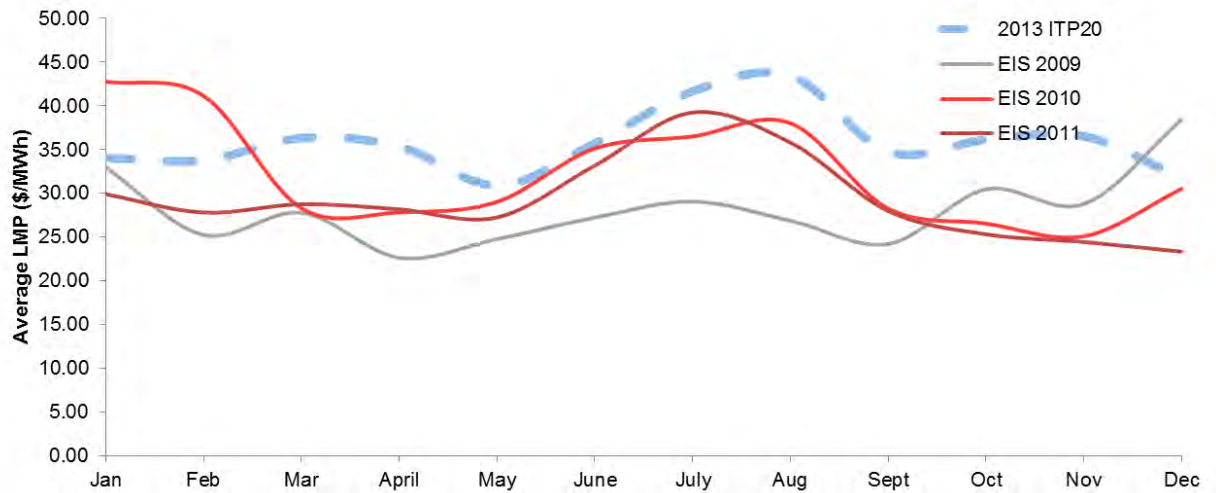


Figure 7.3: Benchmarking LMPs

Historical prices were provided by SPP's Market Monitoring group, simulated LMPs were derived from the PROMOD IV<sup>®</sup> report agent software. The average LMP for each area in the 2013 ITP20 benchmarking simulations was within a reasonable bandwidth of the historical trends, with two exceptions:

1. Empire District Electric had a difference in PROMOD IV<sup>®</sup> LMP and MMU LIP for May, 2011. The PROMOD IV<sup>®</sup> LMP average was \$37, while the MMU LIP average was \$26. This may be due to loss of load caused by the tornado that went through Joplin during that month. One item to point out is that Empire receives a significant amount of generation from jointly owned units such as Plum Point (a coal plant in Arkansas). Also when compared to the output data from the latest PROMOD IV<sup>®</sup> runs for the year 2033, the shape is more consistent with the MMU data.
2. Southwestern Public Service (SPS) had LMP shapes consistent with the MMU LIP shapes from 2011. However, the PROMOD IV<sup>®</sup> LMP value was higher than the MMU LIP value. Multiple possibilities were investigated. One item to note is that the MMU defines the SPS zone differently than it is defined in PROMOD IV<sup>®</sup>. The PROMOD IV<sup>®</sup> SPS LMP values do not represent Lubbock and other municipals. The MMU data only represents load in the market. If MMU LIP values are low in Lubbock and other municipals, this could potentially drag down the average LIP values for SPS that are represented in the MMU data.

### Forecasted LMPs for 2033 Simulations

A simulation of 2033 was conducted and the shadow prices for binding constraints during that time-frame were compared with a current SPP Monthly State of the Market Report. The results indicated that prices seen in the 2033 simulation were higher than in the operations horizon. This was consistent with an expectation that increases in energy usage and fuel price will drive market prices upward. Figure 7.4 shows that the shadow prices (y-axis) and hours binding (x-axis) for TWG approved constraints were greater and more frequent than experienced in the EIS market in 2011.



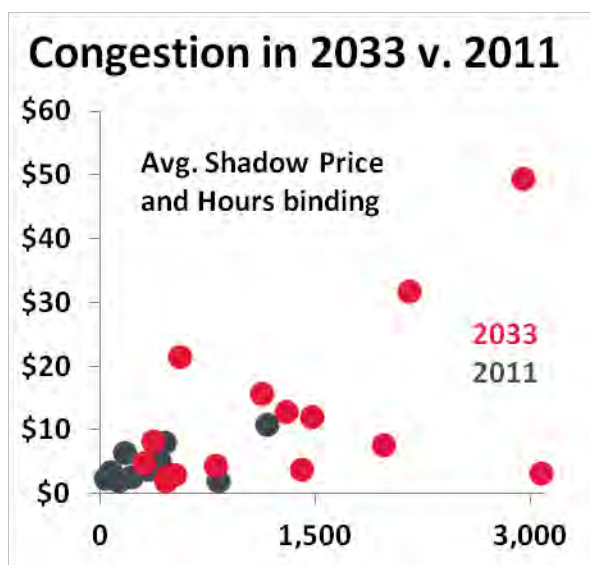


Figure 7.4 Congestion in 2033 was greater than in 2011

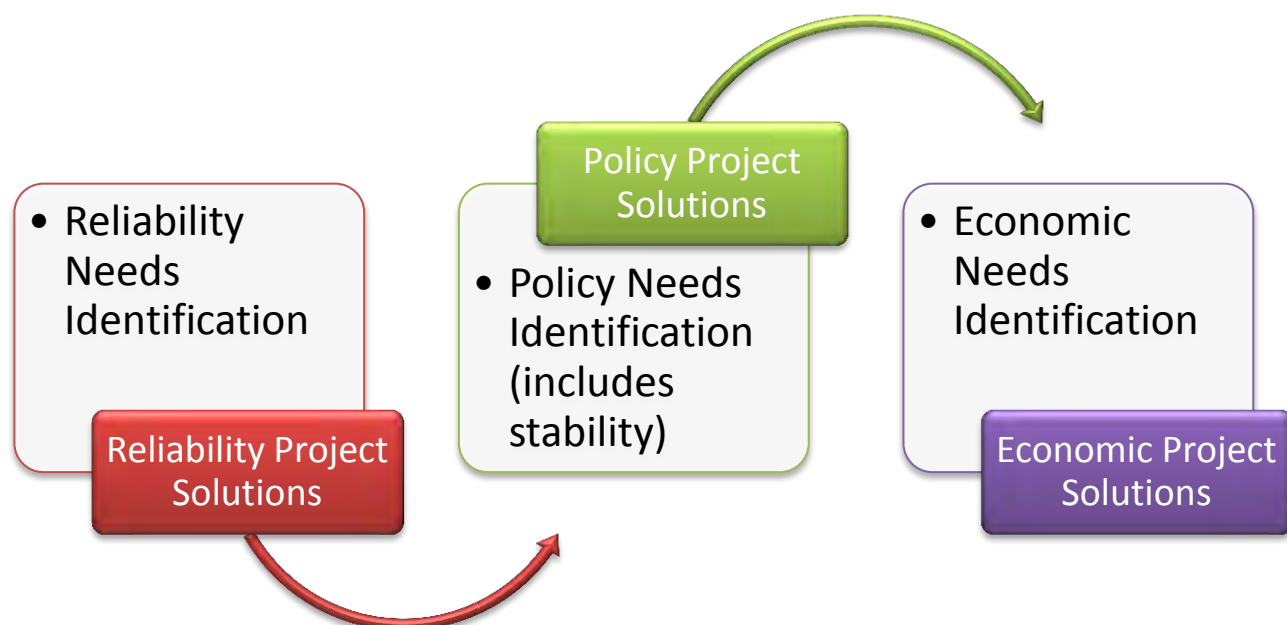
# PART III: NEEDS & PROJECT SOLUTIONS



## Section 8: Overview

### **8.1: Transmission Needs and Solution Development**

The 2013 ITP20 transmission planning analysis considers three separate types of needs and upgrades: reliability, policy, and economic. Reliability needs were identified first, followed by reliability project solutions, which were included in the base case model for policy analysis. Policy needs were then identified, followed by policy project solutions. (An analysis of stability needs and stability project solutions was included as part of the policy analysis.) Reliability and policy solutions were included in the base case model for economic analysis. Economic solutions were then identified to meet economic needs.



### **8.2: Consideration of Lower Voltage Solutions**

While facilities above 100 kV were monitored for overloads and congestion, project solutions in the final portfolio are primarily Extra High Voltage (EHV) solutions in accordance with the SPP tariff.

In the development of project solutions to meet needs, lower voltage solutions (100 kV – 300 kV) were considered and tested in addition to EHV solutions. In several cases, a lower voltage solution and an EHV solution were both tested for the same need, and a preferred solution was selected. While lower voltage solutions were sometimes identified as the preferred solutions for some needs, these lower voltage solutions were generally excluded from the final portfolios. Lower voltage needs are not being mitigated with projects in the final 2013 ITP20 transmission plan, and will be addressed if they are identified in the ITP10 and ITPNT processes.

## Section 9: Reliability Needs and Solutions

### 9.1: Methodology

Reliability needs were identified based on analysis of four hours representing situations where the transmission system is uniquely stressed. An N-1 contingency scan outaged 345 kV branches and transformers in the SPP footprint and monitored 100 kV and above elements to identify binding or breaching constraints. Binding constraints identified in each of these hours during the N-1 contingency scans were identified as reliability needs.

Any reliability need of a radial facility was ignored. If generation connected to a transformer caused the transformer to bind, then the need was ignored since the placement of the generator at a different bus of the transformer could mitigate the need.

Hours used to determine Reliability Needs were:

- **Summer and winter peak hours** represent the highest coincident load during summer and winter months
- **Low hydro hour** represents the highest ratio of coincident load to hydro output during summer months (This included hydro generation in SWPA and WAPA)
- **Peak wind hour** represents the highest ratio of wind output to coincident load

The Table 9.1 summarizes the coincident load, wind and hydro generation in each hour.

| SIMULATED   |                |      |      |       |
|-------------|----------------|------|------|-------|
| HOURL       | HOURL          | LOAD | WIND | HYDRO |
| Summer Peak | Aug. 3, 17:00  | 66.3 | 1.7  | 2.8   |
| Winter Peak | Dec. 13, 19:00 | 46.4 | 4.1  | 2.4   |
| Low Hydro   | Aug. 30, 4:00  | 33.5 | 3.7  | 0.0   |
| Peak Wind   | May 9, 3:00    | 27.9 | 8.1  | 0.3   |

[Values in GW for 2033]

*Table 9.1: Four reliability peak hours*

Additionally, any constraints that breach at any hour (indicating that the Security Constrained Economic Dispatch (SCED) was unable to honor the facility rating) were identified as reliability needs.

### 9.2: Reliability Needs

The number of reliability needs identified for each future is shown in Figure 9.1. It includes all binding elements in the four peak hours and all breaching elements in any hour. This includes facilities within SPP as well as SPP tie lines.

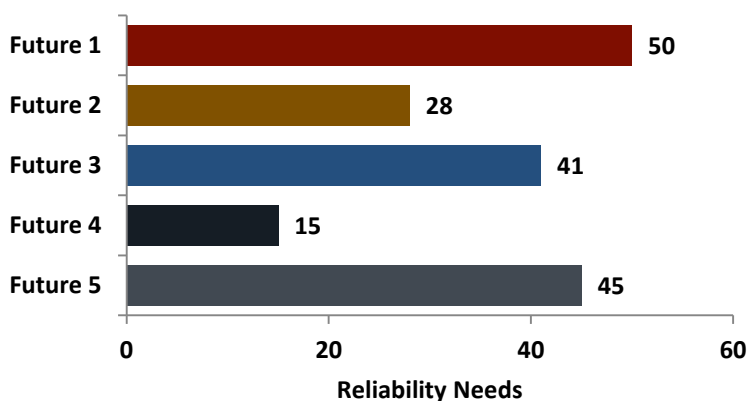


*Figure 9.1: Reliability Needs Summary by Future*

Table 9.2 to 9.6 summarize the reliability needs identified for each future. Included in each table is a listing of: the peak hour(s) in which the binding occurs, the constrained and contingent elements and their area locations, and the direction of flow across the constrained element. A positive (+) flow means power is flowing from the first listed element to the second, and negative (-) indicates power flow from the second listed element to the first. For transformers, (+) flow indicates power is flowing from the high side to low side, and (-) flow indicates power is flowing from the low side to the high side.

| Hour(s)    | Constraint                               | Constraint Area(s) | Direction of Flow | Event (Contingency)                | Contingency Area(s) |
|------------|------------------------------------------|--------------------|-------------------|------------------------------------|---------------------|
| SP         | Farmington - Chamber Springs 161 kV      | AEPW               | (-)               | Chamber Springs - Tontitown 345 kV | AEPW                |
| SP         | Avoca - East Rogers 161 kV               | AEPW               | (-)               | Shipe Road - Kings River 345 kV    | AEPW                |
| SP         | Hackett - Bonanza 161 kV                 | AEPW               | (-)               | Base Case                          | -                   |
| WP         | Fitzhugh - Ozark Dam 161 kV              | AEPW-SWPA          | (-)               | Base Case                          | -                   |
| HW         | Elk City - Red Hills Wind 138 kV         | AEPW-WFEC          | (-)               | Base Case                          | -                   |
| WP         | St. Joe - Midway 161 kV                  | GMO                | (+)               | Fairport - St. Joe 345 kV          | AECI-GMO            |
| WP, SP     | Truman - N Warsaw 161 kV                 | SWPA-GMO           | (+)               | Overton - Sibley 345 kV            | AMMO-GMO            |
| LH         | Shawnee - Metropolitan 161 kV            | KCPL-KACY          | (-)               | 87th Street - Craig 345 kV         | WERE-KCPL           |
| SP, HW     | Nashua 345/161 kV transformer            | KCPL               | (+)               | Hawthorne - Nashua 345 kV          | KCPL                |
| SP         | Huntsville - HEC 115 kV                  | MIDW-WERE          | (-)               | Reno - Wichita 345 kV              | WERE                |
| SP         | Beatrice - Harbine 115 kV                | NPPD               | (+)               | McCool 345/115 kV transformer      | NPPD                |
| SP         | Spencer - Ft. Randle 115 kV              | NPPD-WAPA          | (-)               | Base Case                          | -                   |
| SP         | Keystone - Ogallala 115 kV               | NPPD               | (+)               | Gentleman - Keystone 345 kV        | NPPD                |
| WP, SP     | Muskogee - Pecan Creek 345 kV            | OKGE               | (+)               | Clarksville - Muskogee 345 kV      | AEPW-OKGE           |
| SP         | S1221 - S1255 161 kV                     | OPPD               | (-)               | S3459 345/161 transformer          | OPPD                |
| SP         | Sundown 230/115 kV transformer           | SPS                | (+)               | Amoco - Hobbs 345 kV               | SPS                 |
| SP         | Plant X 230/115 kV transformer           | SPS                | (+)               | Base Case                          | -                   |
| HW, LH     | Sundown - Amoco 230 kV                   | SPS                | (+)               | Tuco - Amoco 345 kV                | SPS                 |
| SP         | Chaves - Samson 115 kV                   | SPS                | (+)               | Base case                          | -                   |
| SP         | Chaves - Urton 115 kV                    | SPS                | (+)               | Base case                          | -                   |
| SP         | Eagle Creek - Eddy 115 kV                | SPS                | (-)               | Base case                          | -                   |
| SP, LH, HW | Cimarron River Tap - East Liberal 115 kV | SUNC               | (+)               | Conestoga - Finney 345 kV          | SPS                 |
| SP, LH     | Holcomb 345/115 kV transformer           | SUNC               | (-)               | Holcomb - Setab 345 kV             | SUNC                |
| LH, HW     | Harper - Milan Tap 138 kV                | SUNC               | (+)               | Wichita - Flat Ridge 345 kV        | WERE-SUNC           |
| HW, LH     | North Dodge - East Dodge 115 kV          | SUNC               | (+)               | Base Case                          | -                   |
| SP         | Goodyear Jct. - Northland 115 kV         | WERE               | (-)               | Hoyt - Stranger Creek 345 kV       | WERE                |
| LH         | Centennial - Paola 161 kV                | KCPL               | (+)               | Neosho - LaCygne 345 kV            | WERE-KCPL           |
| HW         | Swisher - Tuco 230 kV                    | SPS                | (+)               | Woodward EHV - Border 345 kV       | OKGE                |
| SP         | Litchfield - Franklin 161 kV             | WERE               | (-)               | Neosho - LaCygne 345 kV            | WERE-KCPL           |
| SP, HW, LH | Morgan - Stockton 161 kV                 | AECI-SWPA          | (-)               | Neosho - LaCygne 345 kV            | WERE-KCPL           |
| SP         | S3455 - S3740 345 kV                     | OPPD               | (-)               | S3456 - S3458 345 kV               | OPPD                |
| SP         | Maryville - Maryville 161 kV             | AECI-GMO           | (+)               | Overton - Sibley 345 kV            | AMMO-GMO            |
| SP         | Bull Shoals - Midway 161 kV              | SWPA-EES           | (+)               | ANO - Pleasant Hill 500 kV         | EES                 |
| SP         | Overton - Jacksonville 138 kV            | AEPW               | (+)               | Tenaska Switch - Crockett 345 kV   | AEPW                |
| SP         | Bushland - Deaf Smith 230 kV             | SPS                | (+)               | Woodward EHV - Border 345 kV       | OKGE                |
| SP         | Prairie Lee - Blue Springs South 161 kV  | GMO                | (+)               | Sibley 345/161 kV transformer      | GMO                 |
| HW         | Fulton - Patmos West 115 kV              | AEPW-EES           | (+)               | Sarepta - Longwood 345 kV          | AEPW-EES            |
| HW         | Neosho - Riverton 161 kV                 | WERE-EMDE          | (+)               | Blackberry - Neosho 345 kV         | AECI-WERE           |
| HW         | Ft. Calhoun Interface                    | OPPD               | (+)               | Base Case                          | -                   |

Table 9.2: Future 1 Reliability Needs

| Hour(s)    | Constraint                          | Constraint Area(s) | Direction of Flow | Event (Contingency)                  | Contingency Area(s) |
|------------|-------------------------------------|--------------------|-------------------|--------------------------------------|---------------------|
| SP         | Farmington - Chamber Springs 161 kV | AEPW               | (-)               | Chamber Springs - Tontitown 345 kV   | AEPW                |
| LH, HW     | Carnegie - Hobart Junction 138 kV   | AEPW               | (-)               | Elk City - Gracemont 345 kV          | AEPW-OKGE           |
| SP         | Oologah - Northeastern 138 kV       | AECI-AEPW          | (-)               | Chamber Springs - Clarksville 345 kV | AEPW                |
| HW         | Neosho - Riverton 161 kV            | WERE-EMDE          | (+)               | Blackberry - Neosho 345 kV           | AECI-WERE           |
| SP         | Neosho - Tipton Ford 161 kV         | SWPA-EMDE          | (-)               | Chamber Springs - Clarksville 345 kV | AEPW                |
| WP         | St. Joe - Midway 161 kV             | GMO                | (+)               | Fairport - St. Joe 345 kV            | AECI-GMO            |
| SP, LH, HW | Clinton - Truman 161 kV             | AECI-SWPA          | (+)               | Overton - Sibley 345 kV              | AMMO-GMO            |
| SP         | Truman - N Warsaw 161 kV            | SWPA-GMO           | (+)               | Overton - Sibley 345 kV              | AMMO-GMO            |
| SP         | Nashua 345/161 kV transformer       | KCPL               | (+)               | Hawthorne - Nashua 345 kV            | KCPL                |
| HW         | Smoky Hills - Summit 230 kV         | MIDW-WERE          | (+)               | Post Rock - Spearville 345 kV        | MIDW-SUNC           |
| SP         | Keystone - Ogallala 115 kV          | NPPD               | (+)               | Base Case                            | -                   |
| HW         | Kenzie - McElroy 138 kV             | OKGE               | (-)               | Cleveland - Sooner 345 kV            | GRDA-OKGE           |
| HW         | Cimarron - Draper 345 kV            | OKGE               | (+)               | Northwest - Arcadia 345 kV           | OKGE                |
| SP, WP     | Muskogee - Pecan Creek 345 kV       | OKGE               | (+)               | Clarksville - Muskogee 345 kV        | AEPW-OKGE           |
| SP         | S1221 - S1255 161 kV                | OPPD               | (-)               | S3459 345/161 transformer            | OPPD                |
| LH         | Sundown 230/115 kV transformer      | SPS                | (-)               | Amoco - Hobbs 345 kV                 | SPS                 |
| HW, LH     | Potter 345/230 kV transformer       | SPS                | (+)               | Border - Tuco 345 kV                 | OKGE-SPS            |
| WP         | Sundown - Amoco 230 kV              | SPS                | (+)               | Tuco - Amoco 345 kV                  | SPS                 |
| WP, SP     | Pioneer Tap - SATMKEC3 115 kV       | SUNC               | (+)               | Base case                            | -                   |
| SP         | Essex - Idalia 161 kV               | AECI-SWPA          | (+)               | Base Case                            | -                   |
| LH         | Morgan - Stockton 161 kV            | AECI-SWPA          | (-)               | Neosho - LaCygne 345 kV              | WERE-KCPL           |
| SP         | S3455 - S3740 345 kV                | OPPD               | (-)               | S3456 - S3458 345 kV                 | OPPD                |

Table 9.3: Future 2 Reliability Needs



| Hour(s) | Constraint                                  | Constraint Area(s) | Direction of Flow | Event (Contingency)                  | Contingency Area(s) |
|---------|---------------------------------------------|--------------------|-------------------|--------------------------------------|---------------------|
| HW      | Welsh - Diana 345 kV                        | AEPW               | (+)               | Welsh - Diana 345 kV                 | AEPW                |
| SP      | Farmington - Chamber Springs 161 kV         | AEPW               | (-)               | Chamber Springs - Tontitown 345 kV   | AEPW                |
| SP      | Owasso 109th - Northeastern 138 kV          | AEPW               | (-)               | Cleveland - Sooner 345 kV            | GRDA-OKGE           |
| HW      | Lone Oak - Enogex Wilburton Tap 138 kV      | AEPW               | (+)               | Pittsburg - Valiant 345 kV           | AEPW                |
| SP      | Weleetka - Weleetka 138 kV                  | SWPA-AEPW          | (-)               | Chamber Springs - Clarksville 345 kV | AEPW                |
| HW      | Webber Tap - Osage 138 kV                   | AEPW-OKGE          | (-)               | Cleveland - Sooner 345 kV            | GRDA-OKGE           |
| HW      | Snyder 138/69 kV transformer                | AEPW               | (+)               | Elk City - Gracemont 345 kV          | AEPW-OKGE           |
| HW      | Altus Jct. - Parklane 138 kV                | AEPW-OMPA          | (+)               | Elk City - Gracemont 345 kV          | AEPW-OKGE           |
| HW      | Lawton Eastside - Sunnyside 345 kV          | AEPW-OKGE          | (+)               | Base Case                            | -                   |
| HW      | Lawton 112 & W Gore - Lawton Air Tap 138 kV | AEPW               | (+)               | Lawton Eastside - Gracemont 345 kV   | AEPW-OKGE           |
| HW      | Cornville Tap - Paoli 138 kV                | WFEC               | (+)               | Lawton Eastside - Sunnyside          | AEPW-OKGE           |
| SP      | Catoosa - Terra Nitrogen Tap 138 kV         | AEPW               | (-)               | Base Case                            | -                   |
| SP      | Terra Nitrogen Tap - Verdigris 138 kV       | AEPW               | (-)               | Base Case                            | -                   |
| SP      | Claremore Transok - Northeastern 138 kV     | AEPW               | (-)               | Base Case                            | -                   |
| SP      | Owasso 86th - Northeastern 138 kV           | AEPW               | (-)               | Base Case                            | -                   |
| LH      | Conestoga - Hitchland 345 kV                | SPS                | (+)               | Spearville - Buckner 345 kV          | SUNC                |
| HW      | Neosho - Riverton 161 kV                    | WERE-EMDE          | (+)               | Blackberry - Neosho 345 kV           | AECI-WERE           |
| WP      | St. Joe - Midway 161 kV                     | GMO                | (+)               | Fairport - St. Joe 345 kV            | AECI-GMO            |
| WP, SP  | Truman - N Warsaw 161 kV                    | SWPA-GMO           | (+)               | Neosho - LaCygne 345 kV              | WERE-KCPL           |
| LH, SP  | Nashua 345/161 kV transformer               | KCPL               | (+)               | Hawthorne - Nashua 345 kV            | KCPL                |
| HW      | Smoky Hills - Summit 230 kV                 | MIDW-WERE          | (+)               | Wichita - Flat Ridge 345 kV          | WERE-SUNC           |
| LH      | Woodward - Windfarm Switching 138 kV        | OKGE               | (-)               | Tatonga - Mathewson 345 kV           | OKGE                |
| SP      | Woodward - Windfarm Switching 138 kV        | OKGE               | (-)               | Woodward EHV - Flat Ridge 345 kV     | OKGE-SUNC           |
| SP, WP  | Muskogee - Pecan Creek 345 kV               | OKGE               | (+)               | Clarksville - Muskogee 345 kV        | AEPW-OKGE           |
| SP      | S1221 - S1255 161 kV                        | OPPD               | (-)               | S3459 345/161 transformer            | OPPD                |
| LH      | Potter 345/230 kV transformer               | SPS                | (+)               | Woodward EHV - Border 345 kV         | OKGE                |
| LH      | Sundown - Amoco 230 kV                      | SPS                | (+)               | Tuco - Amoco 345 kV                  | SPS                 |
| SP      | Pioneer Tap - SATMKEC3 115 kV               | SUNC               | (+)               | Base case                            | -                   |
| LH      | North Dodge - East Dodge 115 kV             | SUNC               | (+)               | Base case                            | -                   |
| SP      | Springfield - Clay 161 kV                   | SWPA-SPRM          | (+)               | Huben - Morgan 345 kV                | AECI                |
| WP      | Russellville - Dardanelle 161 kV            | EES-SWPA           | (+)               | ANO - Fort Smith 500 kV              | EES-OKGE            |
| SP      | Goodyear Jct. - Northland 115 kV            | WERE               | (-)               | Hoyt - Stranger Creek 345 kV         | WERE                |
| LH      | Centennial - Paola 161 kV                   | KCPL               | (+)               | Neosho - LaCygne 345 kV              | WERE-KCPL           |
| SP      | Butler - Midian 138 kV                      | WERE               | (-)               | Benton - Rose Hill 345 kV            | WERE                |
| LH      | El Paso - Farber 138 kV                     | WERE               | (+)               | Rose Hill - Sooner Tap 345 kV        | WERE-OKGE           |
| HW      | Kelly - King Hill 115 kV                    | WERE               | (+)               | St. Joe - Cooper 345 kV              | GMO-NPPD            |
| LH      | Morgan - Stockton 161 kV                    | AECI-SWPA          | (-)               | Neosho - LaCygne 345 kV              | WERE-KCPL           |
| SP      | S3455 - S3740 345 kV                        | OPPD               | (-)               | S3456 - S3458 345 kV                 | OPPD                |

Table 9.4: Future 3 Reliability Needs

| Hour(s) | Constraint                              | Constraint Area(s) | Direction of Flow | Event (Contingency)            | Contingency Area(s) |
|---------|-----------------------------------------|--------------------|-------------------|--------------------------------|---------------------|
| HW      | Carnegie - Hobart Junction 138 kV       | AEPW               | (-)               | Elk City - Gracemont 345 kV    | AEPW-OKGE           |
| SP      | Prairie Lee - Blue Springs South 161 kV | GMO                | (+)               | Pleasant Hill - Sibley 345 kV  | GMO                 |
| SP      | Clinton - Truman 161 kV                 | AECI-SWPA          | (+)               | Overton - Sibley 345 kV        | AMMO-GMO            |
| SP      | Truman - N Warsaw 161 kV                | SWPA-GMO           | (+)               | Neosho - LaCygne 345 kV        | WERE-KCPL           |
| SP      | Missouri City - Eckles Road 161 kV      | AECI-INDN          | (-)               | St. Joe - Fairport 345 kV      | GMO-AECI            |
| SP      | Nashua 345/161 kV transformer           | KCPL               | (+)               | Hawthorne - Nashua 345 kV      | KCPL                |
| HW      | Smoky Hills - Summit 230 kV             | MIDW-WERE          | (+)               | Wichita - Flat Ridge 345 kV    | WERE-SUNC           |
| HW      | Cimarron - Draper 345 kV                | OKGE               | (+)               | Northwest - Arcadia 345 kV     | OKGE                |
| HW      | Jensen Tap - Jensen 138 kV              | OKGE               | (-)               | Elk City - Gracemont 345 kV    | AEPW-OKGE           |
| HW      | Potter 345/230 kV transformer           | SPS                | (+)               | Woodward EHV - Border 345 kV   | OKGE                |
| HW, LH  | Essex - Idalia 161 kV                   | AECI-SWPA          | (+)               | New Madrid 345/161 transformer | AECI                |
| SP      | Bull Shoals - Midway 161 kV             | SWPA-EES           | (+)               | ANO - Pleasant Hill 500 kV     | EES                 |
| SP      | Springfield - Clay 161 kV               | SWPA-SPRM          | (+)               | Huben - Morgan 345 kV          | AECI                |
| HW      | Middleton Tap - Creswell 138 kV         | OKGE-WERE          | (-)               | Rose Hill - Sooner Tap 345 kV  | WERE-OKGE           |

Table 9.5: Future 4 Reliability Needs

| Hour(s)    | Constraint                               | Constraint Area(s) | Direction of Flow | Event (Contingency)                  | Contingency Area(s) |
|------------|------------------------------------------|--------------------|-------------------|--------------------------------------|---------------------|
| SP         | Farmington - Chamber Springs 161 kV      | AEPW               | (-)               | Chamber Springs - Tontitown 345 kV   | AEPW                |
| WP         | Avoca - Beaver 161 kV                    | AEPW               | (-)               | Chamber Springs - Clarksville 345 kV | AEPW                |
| SP         | Hackett - Bonanza 161 kV                 | AEPW               | (-)               | Base Case                            | -                   |
| SP         | Truman - N Warsaw 161 kV                 | AECI-SWPA-GMO      | (+)               | Overton - Sibley 345 kV              | AMMO-GMO            |
| SP         | Beatrice - Harbine 115 kV                | NPPD               | (+)               | McCool 345/115 kV transformer        | NPPD                |
| HW         | Harper - Milan Tap 138 kV                | SUNC               | (+)               | Wichita - Thistle 345 kV             | WERE-SUNC           |
| HW, LH     | North Dodge - East Dodge 115 kV          | SUNC               | (+)               | Base Case                            | -                   |
| SP         | S3455 - S3740 345 kV                     | OPPD               | (-)               | S3456 - S3458 345 kV                 | OPPD                |
| SP         | Muskogee - Pecan Creek 345 kV            | OKGE               | (+)               | Clarksville - Muskogee 345 kV        | AEPW-OKGE           |
| SP         | S1221 - S1255 161 kV                     | OPPD               | (-)               | S3459 345/161 kV transformer         | OPPD                |
| SP         | Sundown 230/115 kV transformer           | SPS                | (+)               | Amoco - Hobbs 345 kV                 | SPS                 |
| HW, LH, SP | Cimarron River Tap - East Liberal 115 kV | SUNC-SPS           | (+)               | Conestoga - Finney 345 kV            | SPS                 |
| LH         | Holcomb 345/115 kV transformer           | SUNC               | (-)               | Holcomb - Finney 345 kV              | SUNC                |
| SP, WP     | Essex - Idalia 161 kV                    | AECI-SWPA          | (+)               | New Madrid 345/161 kV transformer    | AMMO-AECI           |
| SP         | Missouri City - Eckles Road 161 kV       | AECI-INDN          | (-)               | Fairport - St. Joe 345 kV            | AECI-GMO            |
| SP         | Oologah - Northeastern 138 kV            | AECI-AEPW          | (-)               | Chamber Springs - Clarksville 345 kV | AEPW                |
| SP         | Reves Road - Hackett 161 kV              | AEPW               | (+)               | Base Case                            | -                   |
| SP         | Weleetka - Weleetka 138 kV               | SWPA-AEPW          | (-)               | Base Case                            | -                   |
| SP         | Woodward - Windfarm Switching 138 kV     | OKGE               | (-)               | Base Case                            | -                   |
| HW         | Jensen Tap - Jensen 138 kV               | OKGE               | (-)               | Elk City - Gracemont 345 kV          | AEPW-OKGE           |
| WP         | Midwest - Franklin 138 kV                | OKGE-WFEC          | (+)               | Minco - Gracemont 345 kV             | OKGE                |
| SP         | Hitchland 230/115 kV transformer         | SPS                | (+)               | Hitchland - Potter 345 kV            | SPS                 |
| HW         | South Dodge - West Dodge 115 kV          | SUNC               | (-)               | Spearville - Buckner 345 kV          | SUNC                |
| SP         | Victory Hill 230/115 kV transformer      | NPPD               | (+)               | Wayside - Stegall 230 kV             | NPPD-MAPP           |
| SP         | Allen - Lubbock South 115 kV             | SPS                | (-)               | Tuco - New Deal 345 kV               | SPS                 |
| LH, WP     | Blue Springs East - Duncan Road 161 kV   | GMO                | (-)               | Pleasant Hill - Sibley 345 kV        | GMO                 |
| LH         | Mingo - Red Willow 345 kV                | SUNC-NPPD          | (-)               | Post Rock - Axtell 345 kV            | NPPD-MIDW           |
| SP         | Great Bend Tap - Seward 115 kV           | SUNC               | (+)               | Conestoga - Finney 345 kV            | SPS                 |
| LH         | East Manhattan - JEC 230 kV              | WERE               | (+)               | JEC - Summit 345 kV                  | WERE                |
| SP         | Tuco - Carlisle 230 kV                   | SPS                | (+)               | Tuco - Amoco 345 kV                  | SPS                 |
| SP, LH     | Stanton - Indiana 115 kV                 | SPS                | (+)               | Amoco - Hobbs 345 kV                 | SPS                 |
| LH         | Morgan - Stockton 161 kV                 | AECI-SWPA          | (-)               | Neosho - LaCygne 345 kV              | WERE-KCPL           |
| SP         | Litchfield - Franklin 161 kV             | WERE               | (-)               | Neosho - LaCygne 345 kV              | WERE-KCPL           |
| LH         | Marmaton - Centerville 161 kV            | WERE-KCPL          | (-)               | Neosho - LaCygne 345 kV              | WERE-KCPL           |
| LH         | Nashua 345/161 kV transformer            | KCPL               | (+)               | Nashua - Hawthorne 345 kV            | KCPL                |
| HW         | Neosho - Riverton 161 kV                 | WERE-EMDE          | (+)               | Blackberry - Neosho 345 kV           | AECI-WERE           |
| SP         | Hereford - Deaf Smith 115 kV             | SPS                | (+)               | Tuco - Border 345 kV                 | SPS                 |
| LH         | Clinton - Truman 161 kV                  | AECI-SWPA          | (+)               | Neosho - LaCygne 345 kV              | WERE-KCPL           |
| SP         | Maryville - Maryville 161 kV             | AECI-GMO           | (+)               | Fairport - St. Joe 345 kV            | AECI-GMO            |

Table 9.6: Future 5 Reliability Needs

### 9.3: Reliability Solutions

Project solutions were developed by stakeholders and staff. 100 kV and above projects were considered as solutions for reliability needs. To test the reliability solutions, a project was added to the model for the hour in which the overload occurred. Loading on the constrained element was assessed. The solution was considered valid if the element was no longer binding or breaching the limit. Multiple solutions were considered for many needs, and engineering judgment was used to determine the solution that provided the best fit for the region.

The following Table 9.7 through 9.11 summarize the reliability project solutions for each future, including the constrained element that is being relieved by each project.

| Reliability Project                                                                       | Project Area(s) | Constrained Element                                                               | Miles Added/Modified |
|-------------------------------------------------------------------------------------------|-----------------|-----------------------------------------------------------------------------------|----------------------|
| New Chamber Springs - S Fayetteville 345 kV, new 345/161 kV transformer at S Fayetteville | AEPW            | Farmington - Chamber Springs 161 kV                                               | 18                   |
| Reconductor Avoca - East Rogers 161 kV                                                    | AEPW            | Avoca - East Rogers 161 kV                                                        | 6                    |
| Reconductor Bonanza - Hackett 161 kV                                                      | AEPW            | Hackett - Bonanza 161 kV                                                          | 2                    |
| Reconductor Fitzhugh - Ozark Dam 161 kV                                                   | AEPW-SWPA       | Fitzhugh - Ozark Dam 161 kV                                                       | 2                    |
| Reconductor Red Hills Wind - Elk City 138 kV                                              | AEPW-WFEC       | Elk City - Red Hills Wind 138 kV                                                  | 35                   |
| New Maryville 345/161 kV transformer                                                      | GMO-AECI        | St. Joe - Midway 161 kV                                                           | 0                    |
| Reconductor Clinton - Truman - N Warsaw 161 kV                                            | AECI-SWPA-GMO   | Truman - N Warsaw 161 kV                                                          | 31                   |
| New Wolf Creek - Neosho 345 kV line                                                       | WERE            | Morgan - Stockton 161 kV, Litchfield - Franklin 161 kV, Centennial - Paola 161 kV | 99                   |
| Reconductor Shawnee - Metropolitan 161 kV                                                 | KCPL-KACY       | Shawnee - Metropolitan 161 kV                                                     | 5                    |
| Increase Nashua 345/161 kV transformer size to 650/715 MVA                                | KCPL            | Nashua 345/161 kV transformer                                                     | 0                    |
| Reconductor HEC - Huntsville 115 kV                                                       | MIDW-WERE       | Huntsville - HEC 115 kV                                                           | 29                   |
| Reconductor Beatrice - Harbine 115 kV                                                     | NPPD            | Beatrice - Harbine 115 kV                                                         | 14                   |
| Reconductor Ft. Randall - Spencer 115 kV                                                  | WAPA-NPPD       | Spencer - Ft. Randle 115 kV                                                       | 20                   |
| New Keystone - Red Willow 345 kV                                                          | NPPD            | Keystone - Ogallala 115 kV                                                        | 110                  |
| Rebuild JEC - Auburn - Swissvale 230 kV to 345 kV, new Auburn 345/115 kV transformer      | WERE            | Goodyear Jct. - Northland 115 kV                                                  | 47                   |
| Reconductor Pecan Creek - Muskogee 345 kV circuit 1                                       | OKGE            | Muskogee - Pecan Creek 345 kV                                                     | 23                   |
| Reconductor Pecan Creek - Muskogee 345 kV circuit 2                                       | OKGE            | Muskogee - Pecan Creek 345 kV                                                     | 16                   |
| New 2nd S3459 345/161 kV transformer                                                      | OPPD            | S1221 - S1255 161 kV                                                              | 0                    |
| New 2nd Sundown 230/115 kV transformer                                                    | SPS             | Sundown 230/115 kV transformer                                                    | 0                    |
| New 2nd Plant X 230/115 kV transformer                                                    | SPS             | Plant X 230/115 kV transformer                                                    | 0                    |
| New Tolk - Tuco 345 kV                                                                    | SPS             | Swisher - Tuco 230 kV                                                             | 64                   |
| Reconductor Chaves - Samson 115 kV                                                        | SPS             | Chaves - Samson 115 kV                                                            | 8                    |
| Reconductor Chaves - Urton 115 kV                                                         | SPS             | Chaves - Urton 115 kV                                                             | 4                    |
| Reconductor Eagle Creek - Eddy 115 kV                                                     | SPS             | Eagle Creek - Eddy 115 kV                                                         | 10                   |
| Reconductor Cimarron River Tap - East Liberal - Texas Co 115 kV                           | SUNC-SPS        | Cimarron River Tap - East Liberal 115 kV                                          | 12                   |
| New 2nd Holcomb 345/115 kV transformer                                                    | SUNC            | Holcomb 345/115 kV transformer                                                    | 0                    |
| Reconductor Harper - Milan Tap 138 kV                                                     | SUNC            | Harper - Milan Tap 138 kV                                                         | 22                   |
| Reconductor North Dodge - East Dodge 115 kV                                               | SUNC            | North Dodge - East Dodge 115 kV                                                   | 5                    |
| New S3740 - S3454 345 kV                                                                  | OPPD            | S3455 - S3740 345 kV                                                              | 28                   |
| Reconductor Maryville - Maryville 161 kV                                                  | AECI-GMO        | Fairport - St. Joe 345 kV                                                         | 1                    |
| Reconductor Bull Shoals - Midway 161kV                                                    | SWPA-EES        | Bull Shoals - Midway 161 kV                                                       | 7                    |
| Reconductor Overton - Jacksonville 138 kV                                                 | AEPW            | Overton - Jacksonville 138 kV                                                     | 30                   |
| Reconductor Bushland - Deaf Smith 230 kV                                                  | SPS             | Bushland - Deaf Smith 230 kV                                                      | 33                   |
| Replace wavetrap for Prairie Lee - Blue Springs South 161 kV                              | GMO             | Prairie Lee - Blue Springs South 161 kV                                           | 3                    |
| Reconductor Sundown - Amoco 230 kV                                                        | SPS             | Sundown - Amoco 230 kV                                                            | 5                    |

|                                      |              |                           |    |
|--------------------------------------|--------------|---------------------------|----|
| Reconductor Fulton - Patmos 115 kV   | AEPW-EES-EAI | Sarepta - Longwood 345 kV | 15 |
| Reconductor Neosho - Riverton 161 kV | WERE-EMDE    | Neosho - Riverton 161 kV  | 28 |
| New S1251 - S1252 161 kV             | OPPD         | Ft. Calhoun Interface     | 19 |

*Table 9.7: Future 1 Reliability Solutions*

| Reliability Project                                                                       | Project Area(s) | Constrained Element                               | Miles Added/Modified |
|-------------------------------------------------------------------------------------------|-----------------|---------------------------------------------------|----------------------|
| New Chamber Springs - S Fayetteville 345 kV, new 345/161 kV transformer at S Fayetteville | AEPW            | Farmington - Chamber Springs 161 kV               | 18                   |
| Reconductor Carnegie - Hobart Junction 138 kV                                             | AEPW            | Carnegie - Hobart Junction 138 kV                 | 26                   |
| Reconductor Oologah - Northeastern 138 kV                                                 | AECI-AEPW       | Oologah - Northeastern 138 kV                     | 3                    |
| Reconductor Neosho - Riverton 161 kV                                                      | WERE-EMDE       | Neosho - Riverton 161 kV                          | 28                   |
| Reconductor Neosho - Tipton Ford 161 kV                                                   | SWPA-EMDE       | Neosho - Tipton Ford 161 kV                       | 11                   |
| New Maryville 345/161 kV transformer                                                      | GMO-AECI        | St. Joe - Midway 161 kV                           | 0                    |
| Reconductor Clinton - Truman - N Warsaw 161 kV                                            | AECI-SWPA-GMO   | Clinton - Truman 161 kV, Truman - N Warsaw 161 kV | 31                   |
| New Wolf Creek - Neosho 345 kV line                                                       | WERE            | Morgan - Stockton 161 kV                          | 99                   |
| Increase Nashua 345/161 kV transformer size to 650/715 MVA                                | KCPL            | Nashua 345/161 kV transformer                     | 0                    |
| New Summit - Post Rock 345 kV                                                             | MIDW-WERE       | Smoky Hills - Summit 230 kV                       | 112                  |
| New Keystone - Red Willow 345 kV                                                          | NPPD            | Keystone - Ogallala 115 kV                        | 110                  |
| Reconductor Kenzie to McElroy 138 kV                                                      | OKGE            | Kenzie - McElroy 138 kV                           | 2                    |
| Replace wavetraps for Cimarron - Draper 345 kV                                            | OKGE            | Cimarron - Draper 345 kV                          | 36                   |
| Reconductor Pecan Creek - Muskogee 345 kV circuit 1                                       | OKGE            | Muskogee - Pecan Creek 345 kV                     | 23                   |
| Reconductor Pecan Creek - Muskogee 345 kV circuit 2                                       | OKGE            | Muskogee - Pecan Creek 345 kV                     | 16                   |
| New 2nd S3459 345/161 kV transformer                                                      | OPPD            | S1221 - S1255 161 kV                              | 0                    |
| New 2nd Sundown 230/115 kV transformer                                                    | SPS             | Sundown 230/115 kV transformer                    | 0                    |
| New Potter - Tolk 345 kV                                                                  | SPS             | Potter 345/230 kV transformer                     | 111                  |
| New Tolk - Tuco 345 kV                                                                    | SPS             | Sundown - Amoco 230 kV                            | 64                   |
| Reconductor Pioneer Tap to SATMKEC3 115 kV                                                | SUNC            | Pioneer Tap - SATMKEC3 115 kV                     | 12                   |
| Reconductor Essex - Idalia 161 kV                                                         | AECI-SWPA       | Essex - Idalia 161 kV                             | 1                    |
| New S3740 - S3454 345 kV                                                                  | OPPD            | S3455 - S3740 345 kV                              | 28                   |

*Table 9.8: Future 2 Reliability Solutions*

| Reliability Project                                                                       | Project Area(s) | Constrained Element                                                        | Miles Added/<br>Modified |
|-------------------------------------------------------------------------------------------|-----------------|----------------------------------------------------------------------------|--------------------------|
| New Welsh - Lake Hawkins 345 kV, new 345/138 kV transformer at Lake Hawkins               | AEPW            | Welsh - Diana 345 kV                                                       | 44                       |
| New Chamber Springs - S Fayetteville 345 kV, new 345/161 kV transformer at S Fayetteville | AEPW            | Farmington - Chamber Springs 161 kV                                        | 18                       |
| Reconductor Lone Oak - Enogex Wilburton Tap 138 kV                                        | AEPW            | Lone Oak - Enogex Wilburton Tap 138 kV                                     | 1                        |
| Reconductor Weleetka - Weleetka 138 kV                                                    | SWPA-AEPW       | Weleetka - Weleetka 138 kV                                                 | 3                        |
| Reconductor Webber Tap - Osage 138 kV                                                     | AEPW-OKGE       | Webber Tap - Osage 138 kV                                                  | 22                       |
| Upgrade Snyder 138/69 kV transformer                                                      | AEPW            | Snyder 138/69 kV transformer                                               | 0                        |
| Reconductor Altus Jct. - Parklane 138 kV                                                  | AEPW-OMPA       | Altus Jct. - Parklane 138 kV                                               | 3                        |
| Replace CT for Lawton Eastside - Sunnyside 345 kV                                         | AEPW-OKGE       | Lawton Eastside - Sunnyside 345 kV                                         | 72                       |
| Reconductor Lawton 112 & W Gore - Lawton Air Tap 138 kV                                   | AEPW            | Lawton 112 & W Gore - Lawton Air Tap 138 kV                                | 1                        |
| Reconductor Cornville Tap - Paoli 138 kV                                                  | WFEC            | Cornville Tap - Paoli 138 kV                                               | 32                       |
| Reconductor Catoosa - Terra Nitrogen Tap - Verdigris 138 kV                               | AEPW            | Catoosa - Terra Nitrogen Tap 138 kV, Terra Nitrogen Tap - Verdigris 138 kV | 9                        |
| Replace wavetrap for Claremore Transok - Northeastern 138 kV                              | AEPW            | Claremore Transok - Northeastern 138 kV                                    | 13                       |
| Reconductor Owasso 86th - Northeastern - Owasso 109th 138 kV                              | AEPW            | Owasso 109th - Northeastern 138 kV, Owasso 86th - Northeastern 138 kV      | 24                       |
| Reconductor Neosho - Riverton 161 kV                                                      | WERE-EMDE       | Neosho - Riverton 161 kV                                                   | 28                       |
| New Maryville 345/161 kV transformer                                                      | GMO-AECI        | St. Joe - Midway 161 kV                                                    | 0                        |
| Reconductor Clinton - Truman - N Warsaw 161 kV                                            | AECI-SWPA-GMO   | Truman - N Warsaw 161 kV                                                   | 31                       |
| Increase Nashua 345/161 kV transformer size to 650/715 MVA                                | KCPL            | Nashua 345/161 kV transformer                                              | 0                        |
| New Summit - Post Rock 345 kV                                                             | MIDW-WERE       | Smoky Hills - Summit 230 kV                                                | 112                      |
| Reconductor Woodward to Windfarm Switching 138kV                                          | OKGE            | Tatonga - Mathewson 345 kV                                                 | 12                       |
| Reconductor Pecan Creek - Muskogee 345 kV circuit 1                                       | OKGE            | Muskogee - Pecan Creek 345 kV                                              | 23                       |
| Reconductor Pecan Creek - Muskogee 345 kV circuit 2                                       | OKGE            | Muskogee - Pecan Creek 345 kV                                              | 16                       |
| New 2nd S3459 345/161 kV transformer                                                      | OPPD            | S1221 - S1255 161 kV                                                       | 0                        |
| New Potter - Tolk 345 kV                                                                  | SPS             | Potter 345/230 kV transformer                                              | 111                      |
| New Buckner - Beaver 345 kV, new Beaver 345/115 kV transformer                            | SUNC-SPS        | Conestoga - Hitchland 345 kV                                               | 86                       |
| New Tolk - Tuco 345 kV                                                                    | SPS             | Sundown - Amoco 230 kV                                                     | 64                       |
| Reconductor Pioneer Tap to SATMKEC3 115 kV                                                | SUNC            | Pioneer Tap - SATMKEC3 115 kV                                              | 12                       |
| Reconductor North Dodge - East Dodge 115 kV                                               | SUNC            | North Dodge - East Dodge 115 kV                                            | 5                        |
| Replace terminal equipment for Springfield - Clay 161 kV                                  | SWPA-SPRM       | Springfield - Clay 161 kV                                                  | 7                        |

|                                                                                      |          |                                                     |    |
|--------------------------------------------------------------------------------------|----------|-----------------------------------------------------|----|
| Reconductor Russellville - Dardanelle 161 kV                                         | EES-SWPA | Russellville - Dardanelle 161 kV                    | 3  |
| Rebuild JEC - Auburn - Swissvale 230 kV to 345 kV, new Auburn 345/115 kV transformer | WERE     | Goodyear Jct. - Northland 115 kV                    | 47 |
| New Wolf Creek - Neosho 345 kV line                                                  | WERE     | Morgan - Stockton 161 kV, Centennial - Paola 161 kV | 99 |
| Reconductor Butler - Midian 138kV                                                    | WERE     | Butler - Midian 138 kV                              | 3  |
| Reconductor El Paso - Farber 138 kV                                                  | WERE     | El Paso - Farber 138 kV                             | 3  |
| Reconductor Kelly - King Hill 115 kV                                                 | WERE     | Kelly - King Hill 115 kV                            | 10 |
| New S3740 - S3454 345 kV                                                             | OPPD     | S3455 - S3740 345 kV                                | 28 |

Table 9.9: Future 3 Reliability Solutions

| Reliability Project                                           | Project Area(s) | Constrained Element                               | Miles Added/Modified |
|---------------------------------------------------------------|-----------------|---------------------------------------------------|----------------------|
| Reconductor Carnegie - Hobart Junction 138 kV                 | AEPW            | Carnegie - Hobart Junction 138 kV                 | 26                   |
| Replace wavetraps for Prairie Lee - Blue Springs South 161 kV | GMO             | Prairie Lee - Blue Springs South 161 kV           | 3                    |
| Reconductor Clinton - Truman - N Warsaw 161 kV                | AECI-SWPA-GMO   | Clinton - Truman 161 kV, Truman - N Warsaw 161 kV | 31                   |
| Reconductor Missouri City - Eckles Road 161 kV                | AECI-INDN       | Missouri City - Eckles Road 161 kV                | 6                    |
| Increase Nashua 345/161 kV transformer size to 650/715 MVA    | KCPL            | Nashua 345/161 kV transformer                     | 0                    |
| New Summit - Post Rock 345 kV                                 | MIDW-WERE       | Smoky Hills - Summit 230 kV                       | 112                  |
| Replace wavetraps for Cimarron - Draper 345 kV                | OKGE            | Cimarron - Draper 345 kV                          | 36                   |
| Replace wavetraps for Jensen Tap - Jensen 138 kV              | OKGE            | Jensen Tap - Jensen 138 kV                        | 5                    |
| New Potter - Tolk 345 kV                                      | SPS             | Potter 345/230 kV transformer                     | 111                  |
| Reconductor Essex - Idalia 161 kV                             | AECI-SWPA       | Essex - Idalia 161 kV                             | 1                    |
| Reconductor Bull Shoals - Midway 161 kV                       | SWPA-EES        | Bull Shoals - Midway 161 kV                       | 7                    |
| Replace terminal equipment for Springfield - Clay 161 kV      | SWPA-SPRM       | Springfield - Clay 161 kV                         | 7                    |
| Reconductor Middleton Tap - Creswell 138 kV                   | OKGE-WERE       | Middleton Tap - Creswell 138 kV                   | 9                    |

Table 9.10: Future 4 Reliability Solutions



| Reliability Project                                                                       | Project Area(s) | Constrained Element                                                                   | Miles Added/Modified |
|-------------------------------------------------------------------------------------------|-----------------|---------------------------------------------------------------------------------------|----------------------|
| New Chamber Springs - S Fayetteville 345 kV, new 345/161 kV transformer at S Fayetteville | AEPW            | Farmington - Chamber Springs 161 kV                                                   | 18                   |
| Reconductor Avoca - Beaver 161 kV                                                         | AEPW            | Avoca - Beaver 161 kV                                                                 | 6                    |
| Reconductor Bonanza - Hackett 161 kV                                                      | AEPW            | Hackett - Bonanza 161 kV                                                              | 2                    |
| Reconductor Clinton - Truman - N Warsaw 161 kV                                            | AECI-SWPA-GMO   | Truman - N Warsaw 161 kV                                                              | 31                   |
| New Wolf Creek - Neosho 345 kV line                                                       | WERE            | Morgan - Stockton 161 kV, Litchfield - Franklin 161 kV, Marmaton - Centerville 161 kV | 99                   |
| Increase Nashua 345/161 kV transformer size to 650/715 MVA                                | KCPL            | Nashua 345/161 kV transformer                                                         | 0                    |
| Reconductor Beatrice - Harbine 115 kV                                                     | NPPD            | Beatrice - Harbine 115 kV                                                             | 14                   |
| New Maryville 345/161 kV transformer                                                      | GMO-AECI        | St. Joe - Midway 161 kV                                                               | 0                    |
| Reconductor Neosho - Riverton 161 kV                                                      | WERE-EMDE       | Neosho - Riverton 161 kV                                                              | 28                   |
| Reconductor Harper - Milan Tap 138 kV                                                     | SUNC            | Harper - Milan Tap 138 kV                                                             | 22                   |
| Reconductor North Dodge - East Dodge 115 kV                                               | SUNC            | North Dodge - East Dodge 115 kV                                                       | 5                    |
| New S3740 - S3454 345 kV                                                                  | OPPD            | S3455 - S3740 345 kV                                                                  | 28                   |
| Reconductor Pecan Creek - Muskogee 345 kV circuit 1                                       | OKGE            | Muskogee - Pecan Creek 345 kV                                                         | 23                   |
| Reconductor Pecan Creek - Muskogee 345 kV circuit 2                                       | OKGE            | Muskogee - Pecan Creek 345 kV                                                         | 16                   |
| New 2nd S3459 345/161 kV transformer                                                      | OPPD            | S1221 - S1255 161 kV                                                                  | 0                    |
| New 2nd Sundown 230/115 kV transformer                                                    | SPS             | Sundown 230/115 kV transformer                                                        | 0                    |
| New Tolk - Tuco 345 kV                                                                    | SPS             | Sundown - Amoco 230 kV                                                                | 64                   |
| Reconductor Cimarron River Tap - East Liberal - Texas Co 115 kV                           | SUNC-SPS        | Cimarron River Tap - East Liberal 115 kV                                              | 12                   |
| New 2nd Holcomb 345/115 kV transformer                                                    | SUNC            | Holcomb 345/115 kV transformer                                                        | 0                    |
| Reconductor Essex - Idalia 161 kV                                                         | AECI-SWPA       | Essex - Idalia 161 kV                                                                 | 1                    |
| Reconductor Missouri City - Eckles Road 161 kV                                            | AECI-INDN       | Missouri City - Eckles Road 161 kV                                                    | 6                    |
| Reconductor Oologah - Northeastern 138 kV                                                 | AECI-AEPW       | Oologah - Northeastern 138 kV                                                         | 3                    |
| Reconductor Reves Road - Hackett 161 kV                                                   | AEPW            | Reves Road - Hackett 161 kV                                                           | 5                    |
| Reconductor Weleetka - Weleetka 138 kV                                                    | SWPA-AEPW       | Weleetka - Weleetka 138 kV                                                            | 3                    |
| Reconductor Woodward - Windfarm Switching 138 kV                                          | OKGE            | Woodward - Windfarm Switching 138 kV                                                  | 12                   |
| Replace wavetraps for Jensen Tap - Jensen 138 kV                                          | OKGE            | Jensen Tap - Jensen 138 kV                                                            | 5                    |
| Replace terminal equipment for Midwest - Franklin 138 kV                                  | OKGE-WFEC       | Midwest - Franklin 138 kV                                                             | 1                    |

|                                                    |           |                                        |    |
|----------------------------------------------------|-----------|----------------------------------------|----|
| New 2nd Hitchland 230/115 kV transformer           | SPS       | Hitchland 230/115 kV transformer       | 0  |
| Reconductor South Dodge - West Dodge 115 kV        | SUNC      | South Dodge - West Dodge 115 kV        | 9  |
| New 2nd Victory Hill 230/115 kV transformer        | NPPD      | Victory Hill 230/115 kV transformer    | 0  |
| Reconductor Allen - Lubbock South 115 kV           | SPS       | Allen - Lubbock South 115 kV           | 6  |
| Reconductor Blue Springs East - Duncan Road 161 kV | GMO       | Blue Springs East - Duncan Road 161 kV | 2  |
| Reconductor Mingo - Red Willow 345 kV              | SUNC-NPPD | Mingo - Red Willow 345 kV              | 76 |
| Reconductor Great Bend Tap - Seward 115 kV         | SUNC      | Great Bend Tap - Seward 115 kV         | 12 |
| Reconductor East Manhattan - JEC 230 kV            | WERE      | East Manhattan - JEC 230 kV            | 27 |
| Reconductor Tuco - Carlisle 230 kV                 | SPS       | Tuco - Carlisle 230 kV                 | 27 |
| Reconductor Stanton - Indiana 115 kV               | SPS       | Stanton - Indiana 115 kV               | 1  |

*Table 9.11: Future 5 Reliability Solutions*

## Section 10: Policy Needs and Solutions

### 10.1: Methodology

Policy needs and their corresponding transmission solutions were developed based on the curtailment of renewable energy that has been installed to meet a Renewable Energy Standard (RES) policy target or mandate in each future. A wind farm was identified as a policy need when the annual energy output was less than 97% of the scheduled energy output, due to congestion. Targeted energy is based on maximum capacity, capacity factor and generation profile. For all futures assessed, the curtailment results were based on a full year Security Constrained Economic Dispatch (SCED) simulation which included all identified reliability projects. Policy needs primarily reflect the inability to dispatch wind generation due to congestion. This requires the addition of new transmission projects onto the SPP system to mitigate these problems.

After reliability projects were incorporated into the models, Table 10.1 shows the number of wind farms by area not meeting the energy output requirement of 97% of targeted energy per future.

| Area  | F1 | F2 | F3 | F4 | F5 |
|-------|----|----|----|----|----|
| MIDW  | -  | -  | 1  | -  | -  |
| MKEC  | 1  | 5  | 7  | 4  | 1  |
| NPPD  | -  | 1  | 2  | -  | -  |
| OKGE  | -  | -  | -  | -  | -  |
| OPPD  | -  | -  | 2  | -  | -  |
| SUNC  | -  | 4  | 6  | -  | -  |
| SPS   | -  | -  | 4  | -  | -  |
| WFEC  | -  | -  | 1  | -  | -  |
| WRI   | 1  | 1  | 1  | 1  | 1  |
| TOTAL | 2  | 11 | 24 | 5  | 2  |

*Table 10.1: Number of Wind Farms Curtailing*

Once policy needs were identified, potential transmission solutions targeted at reducing congestion around the identified wind farms were developed. Transmission solutions were developed based on congestion results as reported by PROMOD IV<sup>®</sup>. Transmission solutions could be targeted at a specific wind farm or at a region where multiple wind farms were identified based on the particular future. The full year SCED simulation was then executed with the proposed transmission solutions implemented. All wind farms within the SPP footprint were then once again checked to confirm that the annual energy output exceeded 97% of the scheduled energy output. New or alternative transmission solutions were then developed for any wind farms with less than 97% of the scheduled energy output.

### 10.2: Future 1 Needs and Solutions

In Future 1, existing state targets and mandates were utilized for expected wind generation. Policy needs were minimal with the inclusion of the reliability projects. Two wind farms were identified as not meeting 97% of their scheduled energy output due to congestion. Figure 10.1 shows the location of the Future 1 policy needs in relation to the SPP footprint.

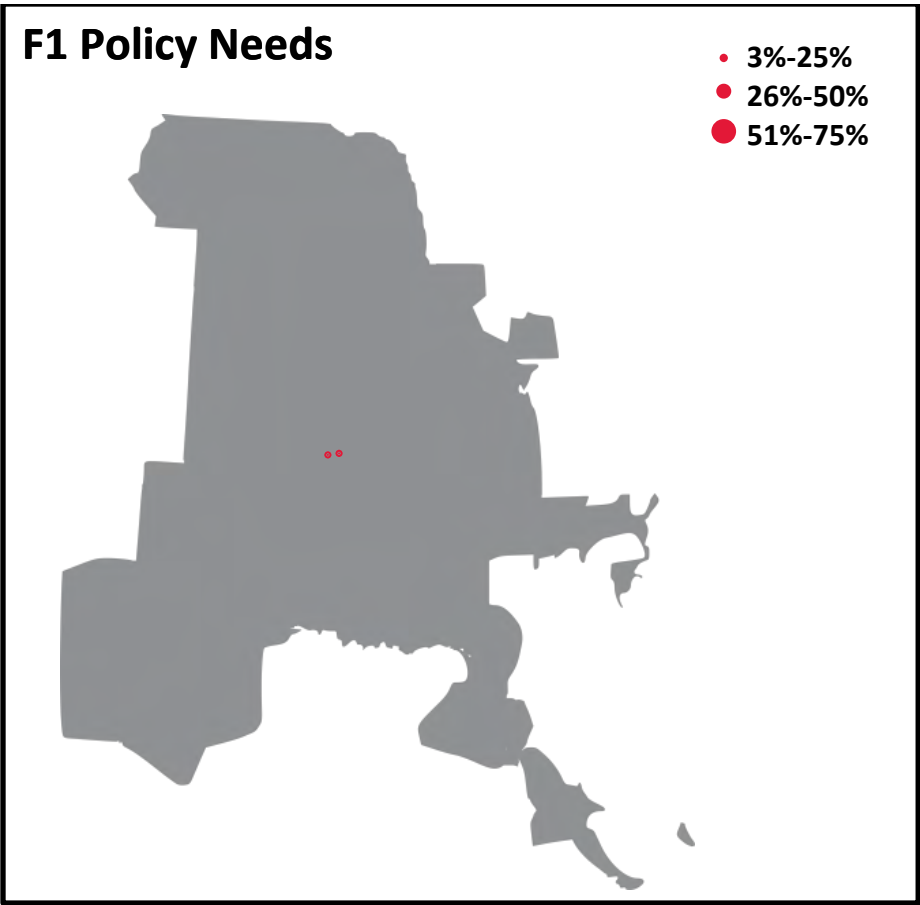


Figure 10.1: Future 1 Policy Needs

Both wind farms were identified in the 3%-25% curtailment range. Since both wind farms were in the same local area, only one transmission solution (non-EHV) was necessary to address the need.

| Policy Project                            | Project Area(s) | Miles Added/Modified |
|-------------------------------------------|-----------------|----------------------|
| Reconductor Milan Tap - Clearwater 138 kV | SUNC-WERE       | 12                   |

Table 10.2: Future 1 Policy Projects

10.3: Future 2 Needs and Solutions

With an assumed federal Renewable Energy Standard (RES) policy of 20 percent of energy served via renewable energy, the installed nameplate wind capacity increases by approximately 7 GW beyond the Business as Usual wind capacity of 9 GW. The additional 7 GW of wind capacity is located in similar geographic locations as the 9 GW of Business as Usual wind, which focused transmission congestion to the same relative area. There were 30 wind farms modeled in Future 2, as opposed to 25 wind farms modeled in Future 1. Some of the Future 1 wind farms had additional capacity in Future 2, and the additional wind sites added in Future 2 were in similar geographic locations as Future 1 wind sites. Future 2 policy needs increased substantially in comparison with Future 1. The majority of curtailment was seen in South Central and South West Kansas. Eleven wind farms were identified as not meeting 97% of their scheduled energy output. Figure 10.2 shows the location of the Future 2 policy needs in relation to the footprint.

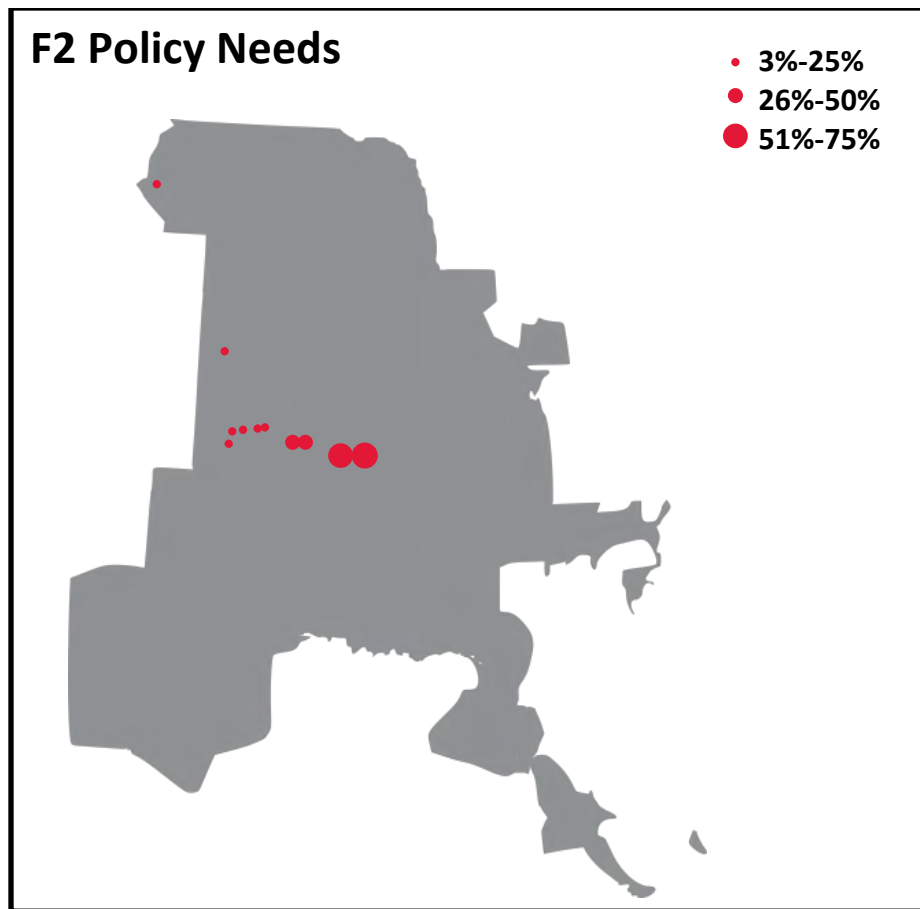


*Figure 10.2: Future 2 Policy Needs*

The two wind farms identified in Future 1 increased to a curtailment range of 51%-75%. Nine more wind farms were identified in Future 2, two of which showed a curtailment range of 26%-50% and seven of which showed a curtailment range of 3%-25%. Proposed transmission solutions for the Future 2 policy needs used a combination of new EHV projects and upgrades of existing facilities.

| Policy Project                                                                                                                                                                                | Project Area(s) | Miles Added/<br>Modified |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------------------|
| Rebuild Spearville - Great Bend - Circle - Reno 230 kV as Spearville - Great Bend - Rice - Circle - Reno 345 kV double circuit, add 345/230 transformers at Great Bend, Circle, and Rice      | MIDW-WERE-SUNC  | 273                      |
| New Rice - Summit 345 kV double circuit                                                                                                                                                       | MIDW-WERE       | 120                      |
| New 2nd Victory Hill 230/115 kV transformer                                                                                                                                                   | NPPD            | 0                        |
| Reconductor Victory Hill - Crawford - Chadron - Wayside 115 kV                                                                                                                                | NPPD            | 96                       |
| New Woodward - Woodring 345 kV double circuit                                                                                                                                                 | OKGE            | 204                      |
| New Thistle - Viola Tap 345 kV double circuit                                                                                                                                                 | SUNC-WERE       | 90                       |
| New Thistle - Flat Ridge 345 kV, new Flat Ridge 345/138 kV transformer                                                                                                                        | SUNC            | 5                        |
| New Ironwood - North Dodge 345 kV, new North Dodge 345/115 kV transformer                                                                                                                     | SUNC            | 16                       |
| New Mingo - Post Rock 345 kV double circuit                                                                                                                                                   | SUNC-MIDW       | 210                      |
| New North Dodge - West Dodge 345 kV, new West Dodge 345/115 kV transformer                                                                                                                    | SUNC            | 10                       |
| Reconductor Haggard - GycoTap - West Dodge - South Dodge - Fort Dodge - DC Beef - East Dodge - North Dodge - NW Dodge - West Dodge 115 kV, reconductor Ingalls - Pierceville - Plymell 115 kV | SUNC            | 74                       |
| New Viola Tap - Neosho 345 kV double circuit                                                                                                                                                  | WERE            | 426                      |

*Table 10.3: Future 2 Policy Projects*

#### **10.4: Future 3 Needs and Solutions**

Future 3 increases the installed nameplate wind capacity across the SPP footprint by an additional 10 GW above Future 2 levels. This is a 180 percent increase over Future 1 installed capacity and a 56 percent increase over Future 2 installed capacity. Future 3 included a significant escalation in policy needs in comparison with Futures 1 and 2. Similar to Future 2, the majority of curtailment was seen in South Central and South West Kansas. Twenty-four wind farms were identified as not meeting 97% of their scheduled energy output. Figure 10.3 shows the location of the Future 3 policy needs in relation to the footprint.

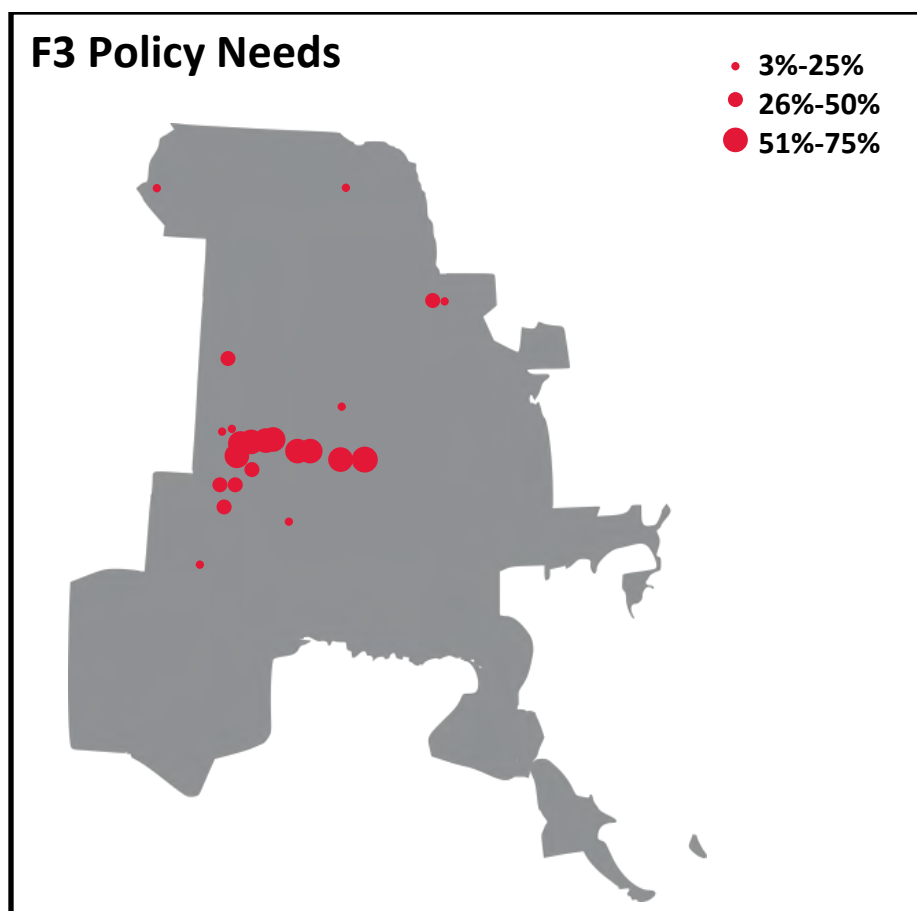


*Figure 10.3: Future 3 Policy Needs*

Nine wind farms were identified in curtailment range of 51%-75%, seven wind farms were identified in curtailment range of 26%-50%, and eight were identified in curtailment range of 3%-25%. Similar to Future 2, proposed transmission solutions for the Future 3 policy needs used a combination of new EHV projects and upgrades of existing facilities. The new EHV projects were developed to provide additional paths to, and, or around the curtailed wind farms to relieve congestion on the transmission system near the wind farms. Major EHV projects were considered in exporting the wind energy outside the footprint.



| Policy Project                                                               | Project Area(s)    | Miles Added/Modified |
|------------------------------------------------------------------------------|--------------------|----------------------|
| Reconductor Holt - Grand Island 345 kV                                       | NPPD               | 85                   |
| New Holt - Raun - Hazelton 345 kV double circuit                             | NPPD-MEC-ALTW      | 842                  |
| New Woodward - Woodring 345 kV double circuit                                | OKGE               | 204                  |
| New Thistle - Flat Ridge 345 kV, new Flat Ridge 345/138 kV transformer       | SUNC               | 5                    |
| New Ironwood - North Dodge 345 kV, new North Dodge 345/115 kV transformer    | SUNC               | 16                   |
| New Mingo - Post Rock 345 kV double circuit                                  | SUNC-MIDW          | 210                  |
| New North Dodge - West Dodge 345 kV, new West Dodge 345/115 kV transformer   | SUNC               | 10                   |
| New Woodward - Sooner Wind 345 kV, new 345/138 kV transformer at Sooner Wind | OKGE               | 12                   |
| New Elk City - Canadian Hills Wind - Mathewson 345 kV                        | OKGE - AEPW        | 114                  |
| New Mathewson - Shelby 600 kV DC bi-pole                                     | OKGE - TVA         | 700                  |
| New Spearville - Palmyra Tap - Sullivan 600 kV DC double circuit             | SUNC - AMMO - AEPW | 760                  |

*Table 10.4: Future 3 Policy Projects*

## **10.5: Future 4 Needs and Solutions**

Similar to Future 2, Future 4 includes the 20% federal RES mandate. However, load reduction due to demand response and energy conservation helps relieve some of the congestion created by the increase in nameplate wind capacity. Future 4 showed a minor increase in policy needs in comparison with Future 1 but a decrease in policy needs in comparison to Future 2. The majority of curtailment was seen in South Central and South West Kansas. Five wind farms were identified as not meeting 97% of their scheduled energy output. Figure 10.4 shows the location of the Future 4 policy needs in relation to the footprint.

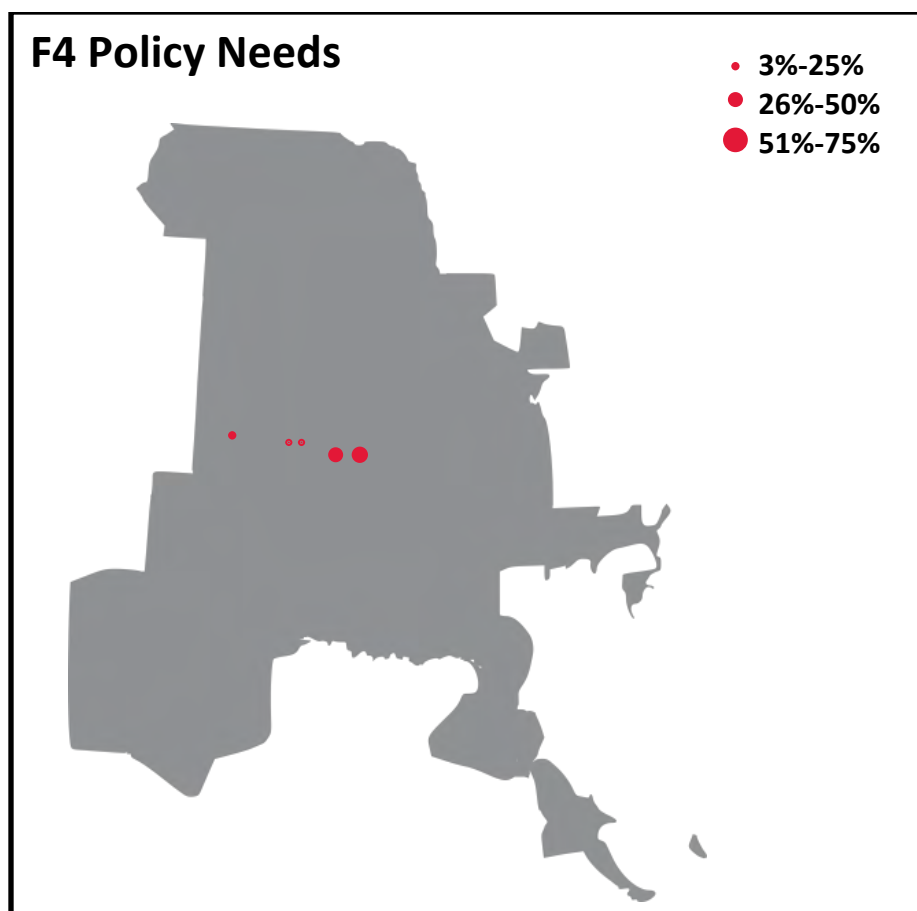


*Figure 10.4: Future 4 Policy Needs*

The two wind farms identified in Future 1 increased to a curtailment range of 51%-75%. Three additional wind farms were identified in Future 4, all of which showed a curtailment range of 3%-25%. Proposed transmission solutions for the Future 4 policy needs used a combination of new EHV projects and upgrades of existing facilities. The new EHV projects were developed to provide additional paths to, and, or around the curtailed wind farms to relieve congestion on the transmission system near the wind farms.

| Policy Project                                                                                                                                                                                | Project Area(s) | Miles Added/Modified |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------------------|
| Reconductor Haggard - GycoTap - West Dodge - South Dodge - Fort Dodge - DC Beef - East Dodge - North Dodge - NW Dodge - West Dodge 115 kV, reconductor Ingalls - Pierceville - Plymell 115 kV | SUNC            | 74                   |
| New Ironwood - North Dodge 345 kV, new North Dodge 345/115 kV transformer                                                                                                                     | SUNC            | 16                   |
| New North Dodge - West Dodge 345 kV, new West Dodge 345/115 kV transformer                                                                                                                    | SUNC            | 10                   |
| New Thistle - Flat Ridge 345 kV, new Flat Ridge 345/138 kV transformer                                                                                                                        | SUNC            | 5                    |
| New Thistle - Viola Tap 345 kV double circuit                                                                                                                                                 | SUNC-WERE       | 90                   |
| New 2nd Victory Hill 230/115 kV transformer                                                                                                                                                   | NPPD            | 0                    |
| Reconductor Victory Hill - Crawford - Chadron - Wayside 115 kV                                                                                                                                | NPPD            | 96                   |
| Rebuild Spearville - Great Bend - Circle - Reno 230 kV as Spearville - Great Bend - Circle - Reno 345 kV double circuit, add 345/230 transformers at Great Bend and Circle                    | WERE-SUNC       | 267                  |

*Table 10.5: Future 4 Policy Projects*

## **10.6: Future 5 Needs and Solutions**

Future 5 was similar to Future 1 in that existing state targets and mandates were utilized for expected wind generation. Policy needs were minimal with the inclusion of the reliability projects. Two wind farms were identified as not meeting 97% of their scheduled energy output due to congestion. Figure 10.5 shows the location of the Future 5 policy needs in relation to the SPP footprint.

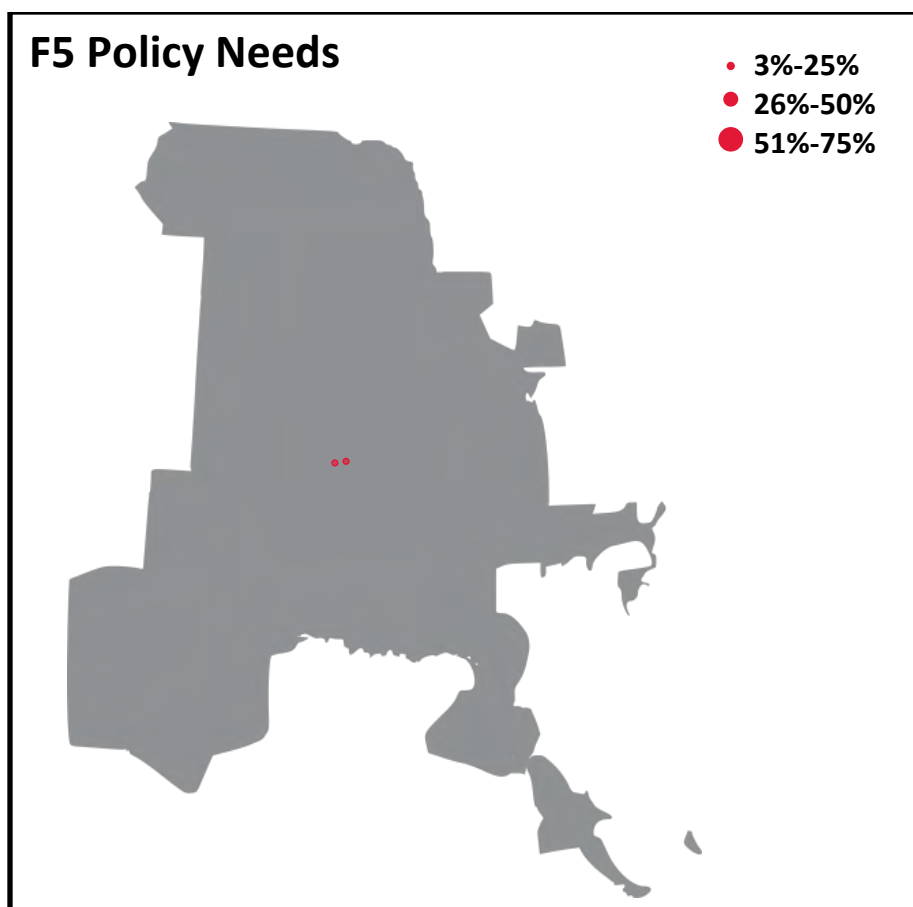


*Figure 10.5: Future 5 Policy Projects*

Both wind farms were identified in the 3%-25% curtailment range. Since both wind farms were in the same local area, only one transmission solution (non-EHV) was necessary to address the need. This project is identical to the Future 1 policy project.

| Policy Project                            | Project Area(s) | Miles Added/Modified |
|-------------------------------------------|-----------------|----------------------|
| Reconductor Milan Tap - Clearwater 138 kV | SUNC-WERE       | 12                   |

*Table 10.6: Future 5 Policy Projects*

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## Section 11: Economic Needs and Solutions

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### **11.1: Background**

Following the identification of reliability and policy transmission projects, any project that relieved the remaining congestion or was suggested by stakeholders as a potential economic project was screened to determine whether or not it provided economic value. An economic project is justified when its benefits to SPP stakeholders are greater than the cost. Therefore any justified economic project in the 2013 ITP20 must have a 40-year benefit-to-cost (B/C) ratio greater than 1. Benefits were measured as the difference in the Adjusted Production Cost (APC) with and without the potential economic project. Reliability and policy projects were included in runs both with and without the potential economic project.

### **11.2: Economic Needs**

To assess economic needs, a security constrained unit commitment and economic dispatch (SCUC/SCED) were performed for the full study year, based on the transmission constraints defined for the system. The SCED derived nodal Locational Marginal Prices (LMPs) by dispatching generation economically. LMPs reflect the congestion occurring on the transmission system's binding constraints. The simulation results showed which constraints caused the most congestion, and the additional cost of dispatching around these constraints. The following process was used:

1. Binding constraints were ranked from most expensive to least expensive, based on the average shadow price of the congestion over the full year.
2. The top 15 most expensive constraints<sup>22</sup> in the SPP system were identified as the economic needs of the system.
3. Potential economic project solutions were developed based on this list of 15 constraints.

This procedure was performed for each future to identify the economic needs specific to each future.

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<sup>22</sup> This specific criteria was identified in the study scope, prior to analysis of economic needs. The top 15 binding constraints were chosen to be targeted in order to better understand what parts of the system would be best suited for the testing and development of economic projects. Parts of the system with minimal congestion are less likely to have project solutions with B/C ratios greater than 1.0.

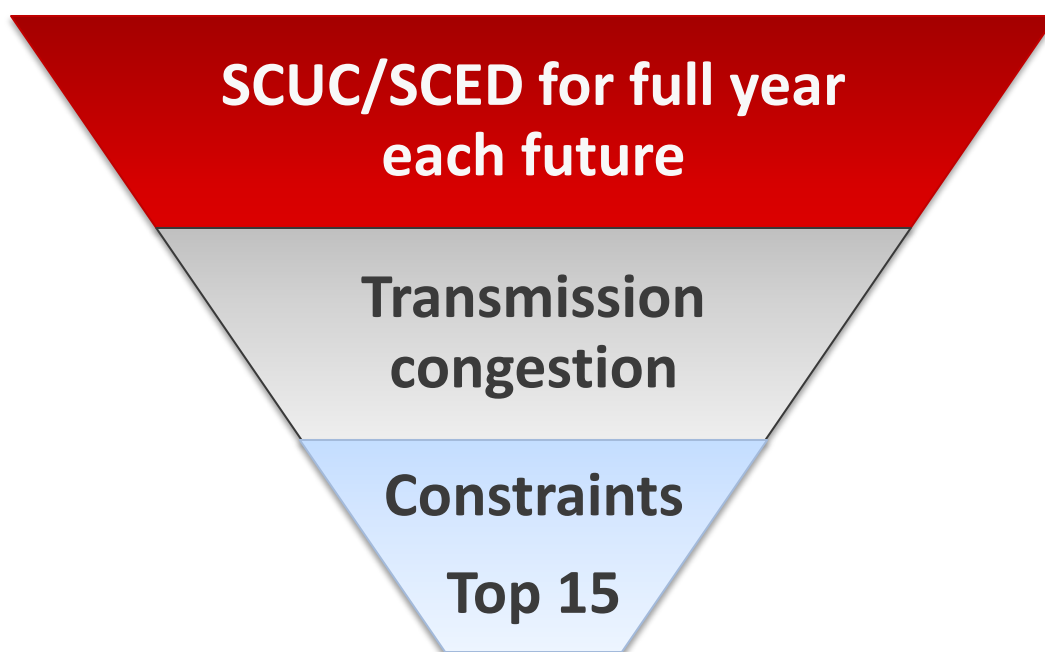


*Figure 11.1: Developing Economic Needs*

If generation connected to a transformer caused enough congestion at the transformer to make it a Top 15 constraint, then that economic need was ignored since the placement of the generator at a different bus of the transformer could mitigate the need.

Identification of the Top 15 constraints was conducted without the inclusion of ITP20 reliability or policy projects in the models. Therefore, some of the Top 15 needs that arose have already been addressed through reliability or policy projects. Table 11.1- Table 11.5 show the economic needs by future. All shadow prices are in \$/MWh. The congestion score is the product of the binding hours and average shadow price during binding hours, to provide an average shadow price across all hours of the year.

| Constraint                          | Constraint Area(s) | Event (Contingency)                | Binding Hours | Avg Shadow Price | Congestion Score |
|-------------------------------------|--------------------|------------------------------------|---------------|------------------|------------------|
| Avoca - East Rogers 161 kV          | AEPW               | Shipe Road - Kings River 345 kV    | 5,686         | \$361            | 2,052,355        |
| Essex - Idalia 161 kV               | AECI-SWPA          | New Madrid 345/161 transformer     | 2,518         | \$531            | 1,338,089        |
| Harper - Milan Tap 138 kV           | AEPW               | Wichita - Flat Ridge 345 kV        | 3,770         | \$307            | 1,157,865        |
| S1221 - S1255 161 kV                | OPPD               | S3459 345/161 transformer          | 802           | \$739            | 592,329          |
| Sundown - Amoco 230 kV              | SPS                | Tuco - Amoco 345 kV                | 3,110         | \$155            | 480,893          |
| Morgan - Stockton 161 kV            | AECI-SWPA          | Neosho - LaCygne 345 kV            | 2,651         | \$181            | 478,804          |
| Springfield - Clay 161 kV           | SWPA-SPRM          | Huben - Morgan 345 kV              | 1,140         | \$408            | 465,152          |
| Clinton - Truman 161 kV             | AECI-SWPA          | Neosho - LaCygne 345 kV            | 616           | \$654            | 402,644          |
| Truman - N Warsaw 161 kV            | SWPA-GMO           | Overton - Sibley 345 kV            | 1,599         | \$237            | 378,579          |
| Chaves - Eddy 230 kV                | SPS                | Tolk - Mescalero Ridge 345 kV      | 6,151         | \$55             | 337,169          |
| Victory Hill 230/115 kV transformer | NPPD               | Stegall - Wayside 230 kV           | 1,230         | \$264            | 324,696          |
| Wolfforth - Terry County 115 kV     | SPS                | Tuco - Amoco 345 kV                | 395           | \$683            | 269,825          |
| Sundown 230/115 kV transformer      | SPS                | Amoco - Hobbs 345 kV               | 2,461         | \$92             | 226,271          |
| North Platte - Stockville 115 kV    | NPPD               | Gentleman - Red Willow 345 kV      | 892           | \$228            | 202,996          |
| Farmington - Chamber Springs 161 kV | AEPW               | Chamber Springs - Tontitown 345 kV | 432           | \$394            | 170,263          |

Table 11.1: Future 1 Economic Needs

| Constraint                          | Constraint Area(s) | Event (Contingency)                | Binding Hours | Avg Shadow Price | Congestion Score |
|-------------------------------------|--------------------|------------------------------------|---------------|------------------|------------------|
| Harper - Milan Tap 138 kV           | AEPW               | Wichita - Flat Ridge 345 kV        | 6,051         | \$664            | 4,020,716        |
| Avoca - East Rogers 161 kV          | AEPW               | Shipe Road - Kings River 345 kV    | 3,817         | \$269            | 1,027,345        |
| Essex - Idalia 161 kV               | AECI-SWPA          | New Madrid 345/161 transformer     | 2,515         | \$361            | 908,618          |
| S1221 - S1255 161 kV                | OPPD               | S3459 345/161 transformer          | 758           | \$892            | 676,165          |
| Morgan - Stockton 161 kV            | AECI-SWPA          | Morgan - Brookline 345 kV          | 1,793         | \$305            | 546,001          |
| Morgan - Stockton 161 kV            | AECI-SWPA          | Neosho - LaCygne 345 kV            | 2,830         | \$192            | 542,840          |
| Sundown - Amoco 230 kV              | SPS                | Tuco - Amoco 345 kV                | 2,375         | \$140            | 333,459          |
| Wolfforth - Terry County 115 kV     | SPS                | Tuco - Amoco 345 kV                | 545           | \$596            | 325,071          |
| Clinton - Truman 161 kV             | AECI-SWPA          | Neosho - LaCygne 345 kV            | 796           | \$394            | 313,798          |
| Truman - N Warsaw 161 kV            | SWPA-GMO           | Overton - Sibley 345 kV            | 1,284         | \$224            | 287,736          |
| Southwestern - Washita 138 kV       | AEPW-WFEC          | Lawton Eastside - Gracemont 345 kV | 3,040         | \$84             | 254,878          |
| Sundown 230/115 kV transformer      | SPS                | Amoco - Hobbs 345 kV               | 2,606         | \$90             | 233,541          |
| Springfield - Clay 161 kV           | SWPA-SPRM          | Huben - Morgan 345 kV              | 596           | \$384            | 229,080          |
| Victory Hill 230/115 kV transformer | NPPD               | Stegall - Wayside 230 kV           | 944           | \$221            | 209,082          |
| Mingo 345/115 kV transformer        | SUNC               | Mingo - Setab 345 kV               | 2,329         | \$89             | 207,771          |

Table 11.2: Future 2 Economic Needs

| Constraint                          | Constraint Area(s) | Event (Contingency)                | Avg           |              |                  |
|-------------------------------------|--------------------|------------------------------------|---------------|--------------|------------------|
|                                     |                    |                                    | Binding Hours | Shadow Price | Congestion Score |
| Harper - Milan Tap 138 kV           | AEPW               | Wichita - Flat Ridge 345 kV        | 7,021         | \$1,186      | 8,323,724        |
| Avoca - East Rogers 161 kV          | AEPW               | Shipe Road - Kings River 345 kV    | 4,107         | \$293        | 1,201,647        |
| S1221 - S1255 161 kV                | OPPD               | S3459 345/161 transformer          | 840           | \$793        | 665,848          |
| Truman - N Warsaw 161 kV            | SWPA-GMO           | Overton - Sibley 345 kV            | 1,857         | \$246        | 456,642          |
| Springfield - Clay 161 kV           | SWPA-SPRM          | Huben - Morgan 345 kV              | 1,085         | \$392        | 425,618          |
| Potter 345/230 kV transformer       | SPS                | Woodward EHV - Border 345 kV       | 3,394         | \$120        | 407,936          |
| Wolfforth - Terry County 115 kV     | SPS                | Tuco - Amoco 345 kV                | 374           | \$999        | 373,623          |
| Mingo 345/115 kV transformer        | SUNC               | Mingo - Setab 345 kV               | 2,702         | \$133        | 360,560          |
| Southwestern - Washita 138 kV       | AEPW-WFEC          | Lawton Eastside - Gracemont 345 kV | 3,781         | \$92         | 345,992          |
| Sundown - Amoco 230 kV              | SPS                | Tuco - Amoco 345 kV                | 1,789         | \$146        | 260,770          |
| Victory Hill 230/115 kV transformer | NPPD               | Stegall - Wayside 230 kV           | 1,160         | \$224        | 259,497          |
| Sundown 230/115 kV transformer      | SPS                | Amoco - Hobbs 345 kV               | 2,220         | \$104        | 231,949          |
| Chaves - Eddy 345 kV                | SPS                | Mescalero Ridge - Eddy 345 kV      | 4,408         | \$46         | 202,486          |
| Farmington - Chamber Springs 161 kV | AEPW               | Chamber Springs - Tontitown 345 kV | 395           | \$381        | 150,442          |
| Goodyear Jct. - Northland 115 kV    | WERE               | Hoyt - Stranger Creek 345 kV       | 438           | \$254        | 111,444          |

Table 11.3: Future 3 Economic Needs

| Constraint                          | Constraint Area(s) | Event (Contingency)                | Avg           |              |                  |
|-------------------------------------|--------------------|------------------------------------|---------------|--------------|------------------|
|                                     |                    |                                    | Binding Hours | Shadow Price | Congestion Score |
| Harper - Milan Tap 138 kV           | AEPW               | Wichita - Flat Ridge 345 kV        | 5,569         | \$883        | 4,919,829        |
| Avoca - East Rogers 161 kV          | AEPW               | Shipe Road - Kings River 345 kV    | 5,311         | \$231        | 1,225,180        |
| Springfield - Clay 161 kV           | SWPA-SPRM          | Huben - Morgan 345 kV              | 1,754         | \$246        | 432,200          |
| Essex - Idalia 161 kV               | AECI-SWPA          | New Madrid 345/161 transformer     | 2,714         | \$139        | 375,921          |
| Southwestern - Washita 138 kV       | AEPW-WFEC          | Lawton Eastside - Gracemont 345 kV | 2,708         | \$123        | 332,022          |
| Jensen Tap - Jensen 138 kV          | OKGE               | Elk City - Gracemont 345 kV        | 2,638         | \$90         | 237,625          |
| S1221 - S1255 161 kV                | OPPD               | S3459 345/161 transformer          | 520           | \$385        | 200,150          |
| Chaves - Eddy 345 kV                | SPS                | Mescalero Ridge - Eddy 345 kV      | 6,095         | \$33         | 199,911          |
| Potter 345/230 kV transformer       | SPS                | Woodward EHV - Border 345 kV       | 2,499         | \$77         | 192,369          |
| Litchfield - Franklin 161 kV        | WERE               | Neosho - LaCygne 345 kV            | 4,878         | \$38         | 187,440          |
| Tuco - Jones 230 kV                 | SPS                | Tuco - Amoco 345 kV                | 5,997         | \$27         | 162,116          |
| North Dodge - East Dodge 115 kV     | SUNC               | Base Case                          | 2,818         | \$38         | 106,970          |
| Victory Hill 230/115 kV transformer | NPPD               | Stegall - Wayside 230 kV           | 571           | \$149        | 85,081           |
| St. Joe - Midway 161 kV             | GMO                | Fairport - St. Joe 345 kV          | 1,397         | \$56         | 78,798           |
| Sundown - Amoco 230 kV              | SPS                | Tuco - Amoco 345 kV                | 247           | \$275        | 67,905           |

Table 11.4: Future 4 Economic Needs



| Constraint                             | Constraint Area(s) | Event (Contingency)                | Binding Hours | Avg Shadow Price | Congestion Score |
|----------------------------------------|--------------------|------------------------------------|---------------|------------------|------------------|
| Essex - Idalia 161 kV                  | AECI-SWPA          | New Madrid 345/161 transformer     | 4,335         | \$496            | 2,150,470        |
| Morgan - Stockton 161 kV               | AECI-SWPA          | Morgan - Brookline 345 kV          | 2,962         | \$289            | 856,458          |
| Harper - Milan Tap 138 kV              | AEPW               | Wichita - Flat Ridge 345 kV        | 2,548         | \$283            | 719,968          |
| S1221 - S1255 161 kV                   | OPPD               | S3459 345/161 transformer          | 859           | \$603            | 518,196          |
| Avoca - East Rogers 161 kV             | AEPW               | Shipe Road - Kings River 345 kV    | 1,687         | \$240            | 404,994          |
| Victory Hill 230/115 kV transformer    | NPPD               | Stegall - Wayside 230 kV           | 1,079         | \$341            | 368,291          |
| North Platte - Stockville 115 kV       | NPPD               | Gentleman - Red Willow 345 kV      | 1,411         | \$234            | 329,620          |
| Farmington - Chamber Springs 161 kV    | AEPW               | Chamber Springs - Tontitown 345 kV | 605           | \$456            | 275,582          |
| Sundown 230/115 kV transformer         | SPS                | Amoco - Hobbs 345 kV               | 1,303         | \$186            | 242,160          |
| JEC - East Manhattan 230 kV            | WERE               | JEC - Summit 345 kV                | 1,823         | \$126            | 229,747          |
| Blue Springs East - Duncan Road 161 kV | GMO                | Pleasant Hill - Sibley 345 kV      | 2,436         | \$73             | 178,152          |
| North Dodge - East Dodge 115 kV        | SUNC               | Base Case                          | 3,857         | \$35             | 136,191          |
| Haynes - North Liberal Tap 115 kV      | SUNC               | Conestoga - Hitchland 345 kV       | 3,651         | \$32             | 115,366          |
| Truman - N Warsaw 161 kV               | SWPA-GMO           | Overton - Sibley 345 kV            | 284           | \$363            | 103,081          |
| Tuco - Jones 230 kV                    | SPS                | Tuco - Amoco 345 kV                | 3,727         | \$26             | 96,047           |

Table 11.5: Future 5 Economic Needs

The tables above indicate that several constraints are top 15 constraints in multiple futures. This suggests that there are some similar congestion points across all futures.

### 11.3: Economic Solutions

Economic projects were proposed based on their potential to mitigate congestion of the top 15 constraints and stakeholder recommendations. For each economic project, the APC for the SPP footprint was calculated with and without the proposed economic project for all 8,760 hours of 2033. The change in APC with the project in-service was considered the one-year benefit. The one-year benefit was divided by the one-year carrying charge of the project to develop a B/C ratio for each project. Any project that had a B/C ratio less than 1 was removed from further consideration. For the projects with a B/C ratio greater than 1, the 40-year B/C ratio and net benefit were computed.

While lower voltage projects (100 kV – 300 kV) were considered as solutions for reliability and policy needs, only EHV projects were tested as potential economic solutions. All EHV reliability and policy projects were included in base and change case runs for the testing of economic solutions. Although they were identified as the preferred solutions, lower voltage reliability projects will not be included in any ITP20 portfolios, and the needs are expected to be addressed in future ITP10 and ITPNT studies.

In addition to projects targeting the top 15 constraints, all EHV reliability and policy projects from Future 1 were analyzed for economic benefit.

#### Future 1 Economic Projects

Table 11.6 shows the economic projects that were analyzed in Future 1. When testing projects that were not already included as reliability or policy projects, all reliability and policy projects were included in the base and change cases. When testing the economic value of projects that were previously identified as reliability or policy projects, the base case included all reliability and policy projects minus the project under test, while the change case included all reliability and policy projects including the project under test. Reliability and policy projects were included in the base and change cases in order to provide a more conservative approach to calculating their benefit; if the reliability and policy projects

are expected to be built in the 20 year horizon, the benefit of economic projects for that time frame should be measured with these already in the model.

| Project Tested                                                                                         | Project Area(s) | B/C > 1.0? |
|--------------------------------------------------------------------------------------------------------|-----------------|------------|
| New Jasper - Monett City 345 kV                                                                        | AECI-EMDE       | ✗          |
| New JEC - Matters Corner 345 kV, new Matters Corner 345/115 kV transformer                             | WERE            | ✗          |
| New JEC - Matters Corner - Elm Creek 345 kV, new Matters Corner 345/115 kV transformer                 | WERE-SUNC       | ✗          |
| Rebuild JEC - E Manhattan N Manhattan - Elm Creek 230 kV to 345 kV                                     | WERE-SUNC       | ✗          |
| New Cass - S3454 345 kV                                                                                | OPPD            | ✗          |
| New 2nd S3459 345/161 kV transformer                                                                   | OPPD            | ✓          |
| New LaCygne - Morgan 345 kV                                                                            | KCPL-AECI       | ✓          |
| New Wolf Creek - Neosho 345 kV                                                                         | WERE            | ✓          |
| New Morgan 345/161 kV transformer                                                                      | AECI            | ✗          |
| New Stegall - Cherry 345 kV                                                                            | WAPA-NPPD       | ✗          |
| New Stegall - Scottsbluff - Victory Hill 345 kV, new Stegall 345/115 transformer                       | WAPA-NPPD       | ✗          |
| New Stegall - Victory Hill 345 kV, new 345/115 kV transformer at Victory Hill                          | WAPA-NPPD       | ✗          |
| New Stegall - Victory Hill - Alliance 345 kV, new 345/115 kV transformers at Victory Hill and Alliance | WAPA-NPPD       | ✗          |
| New Tolk - Potter 345 kV                                                                               | SPS             | ✗          |
| New Tolk - Amoco 345 kV                                                                                | SPS             | ✗          |
| New Chamber Springs - S Fayetteville 345 kV, new S Fayetteville 345/161 kV transformer                 | AEPW            | ✓          |
| New Keystone - Red Willow 345 kV                                                                       | NPPD            | ✗          |
| New Tolk - Tuco 345 kV                                                                                 | SPS             | ✗          |
| Rebuild JEC - Auburn - Swissvale 230 kV to 345 kV, new Auburn 345/115 kV transformer                   | WERE            | ✗          |
| Rebuild Spearville - Great Bend - Reno 230 kV to 345 kV                                                | SUNC-WERE       | ✗          |
| Reconductor Clinton - Truman - N Warsaw 161 kV                                                         | AECI-SWPA       | ✓          |

Table 11.6: Economic Projects Screened in Future 1

Note that LaCygne – Morgan 345 kV and Wolf Creek – Neosho 345 kV are alternative projects; each project provides a B/C ratio > 1.0 only when the other is excluded from the runs. While both projects mitigate the same reliability needs, Wolf Creek – Neosho 345 kV has the higher economic benefit and is the project included in the Future 1 portfolio (see Table 13.3 for comparison of projects).

Four Future 1 reliability projects are also economic projects. Their primary classification going forward is as economic projects. They are the only economic projects in Future 1, since no other projects screened provided a one-year B/C > 1.0. Table 11.7 shows the economic projects for Future 1.

| Economic Project                                                                       | Project Area(s) | Constrained Element                                                               | Miles Added/Modified | One Year B/C |
|----------------------------------------------------------------------------------------|-----------------|-----------------------------------------------------------------------------------|----------------------|--------------|
| New Chamber Springs - S Fayetteville 345 kV, new S Fayetteville 345/161 kV transformer | AEPW            | Farmington - Chamber Springs 161 kV                                               | 18                   | 3.73         |
| New Wolf Creek - Neosho 345 kV                                                         | WERE            | Morgan - Stockton 161 kV, Litchfield - Franklin 161 kV, Centennial - Paola 161 kV | 99                   | 1.41         |
| New 2nd S3459 345/161 kV transformer                                                   | OPPD            | S1221 - S1255 161 kV                                                              | 0                    | 27.76        |

*Table 11.7: Future 1 Economic Projects*

### Future 2 Economic Projects

Most of the top 15 economic needs in Future 2 were addressed by reliability and policy projects. This means that in addition to mitigating reliability and policy needs, these projects also captured most of the opportunities for economic benefit. Three potential projects were tested for economic benefit, with none having a one-year B/C greater than 1.0.

| Project Tested                    | Project Area(s) | B/C > 1.0? |
|-----------------------------------|-----------------|------------|
| New Morgan 345/161 kV transformer | AECI            | ✗          |
| New Tolk - Amoco 345 kV           | SPS             | ✗          |
| New Amoco - New Deal 345 kV       | SPS             | ✗          |

*Table 11.8: Economic Projects Screened in Future 2*

### Future 3 Economic Projects

Most of the top 15 economic needs in Future 3 were addressed by reliability and policy projects. This means that in addition to mitigating reliability and policy needs, these projects also captured most of the opportunities for economic benefit. Two potential projects were tested for economic benefit, with neither having a one-year B/C greater than 1.0.

| Project Tested              | Project Area(s) | B/C > 1.0? |
|-----------------------------|-----------------|------------|
| New Amoco - New Deal 345 kV | SPS             | ✗          |
| New Tolk - Amoco 345 kV     | SPS             | ✗          |

*Table 11.9: Economic Projects Screened in Future 3*

### Future 4 Economic Projects

Six potential economic projects were tested in Future 4 based on the top 15 economic needs.

| Project Tested                                                          | Project Area(s) | B/C > 1.0? |
|-------------------------------------------------------------------------|-----------------|------------|
| New 2nd S3459 345/161 kV transformer                                    | OPPD            | ✓          |
| New LaCygne - Morgan 345 kV                                             | KCPL-AECI       | ✗          |
| New Wolf Creek - Neosho 345 kV                                          | WERE            | ✗          |
| New Tolk - Amoco 345 kV                                                 | SPS             | ✗          |
| Reconductor Oneta - OEC 345 kV                                          | AEPW            | ✗          |
| Rebuild Tuco - Jones 230 kV to 345 kV, new Jones 345/230 kV transformer | SPS             | ✓          |

Table 11.10: Economic Projects Screened in Future 4

Two of the projects had a one-year B/C greater than 1.0 and were included as economic projects for Future 4.

| Economic Project                                                        | Project Area(s) | Constrained Element  | Miles Added/Modified | One Year B/C |
|-------------------------------------------------------------------------|-----------------|----------------------|----------------------|--------------|
| New 2nd S3459 345/161 kV transformer                                    | OPPD            | S1221 - S1255 161 kV | 0                    | 4.02         |
| Rebuild Tuco - Jones 230 kV to 345 kV, new Jones 345/230 kV transformer | SPS             | Tuco - Jones 230 kV  | 30                   | 2.26         |

Table 11.11: Future 4 Economic Projects

### Future 5 Economic Projects

Four potential economic projects were tested in Future 5 based on the top 15 economic needs.

| Project Tested                                                                         | Project Area(s) | B/C > 1.0? |
|----------------------------------------------------------------------------------------|-----------------|------------|
| New 2nd S3459 345/161 kV transformer                                                   | OPPD            | ✓          |
| New Chamber Springs - S Fayetteville 345 kV, new S Fayetteville 345/161 kV transformer | AEPW            | ✗          |
| New Keystone - Red Willow 345 kV                                                       | NPPD            | ✗          |
| New Wolf Creek - Neosho 345 kV                                                         | WERE            | ✗          |

Table 11.12: Economic Projects Screened in Future 5

One of the projects had a one-year B/C greater than 1.0 and was included as an economic project for Future 5. This economic project is also a reliability project; its primary classification going forward will be as an economic project.

| Economic Project                     | Project Area(s) | Constrained Element  | Miles Added/Modified | One Year B/C |
|--------------------------------------|-----------------|----------------------|----------------------|--------------|
| New 2nd S3459 345/161 kV transformer | OPPD            | S1221 - S1255 161 kV | 0                    | 20.80        |

Table 11.13: Future 5 Economic Projects

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## Section 12: Stability Needs and Projects

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### **12.1: Introduction**

A voltage stability assessment was conducted on the base case model (no new transmission) to assess the transfer limit (MW) due to transfer of wind west to east across the SPP footprint. Additionally, a stability analysis was conducted for the 2013 ITP20 solution set to assess system stability by examining thermal and voltage performance. Thermal and voltage performance are normally assessed through the tools of steady state contingency analysis; however, this analysis does not determine the distance to and the location of voltage collapse or instability. These must be determined by examining voltage performance during power transfer into a load area or across an interface.

### **12.2: Objectives**

The objective of the 2013 ITP20 Stability Analysis is twofold:

#### **Stability Assessment:**

The stability assessment consists of a wind dispatch analysis to confirm that the dispatched wind generation in the 2013 ITP20 2023 Summer-Peak case<sup>23</sup> in all futures can be dispatched without the occurrence of voltage collapse or thermal violations. This will determine what is needed to avoid these violations.

#### **Stability Analysis:**

The voltage stability analysis was conducted for the final portfolio in 2013 ITP20 2023 Summer-Peak case to assess thermal and voltage violations. The results of this final stability analysis are detailed in Section 17.2: .

### **12.3: Stability Assessment**

Stability assessments of long and short-term planning efforts by SPP Staff provided important insights into the viability and robustness of planning solutions. A wind transfer assessment was required as part of the 2013 ITP20 planning effort. Specifically, the request was made to determine the amount of wind that could be dispatched in the 2023 Summer-Peak Base Case for all the futures that will allow sufficient margin to voltage collapse. An N-1 analysis was performed involving all the 345 kV transmission lines and transformers to determine if voltage collapse and thermal violations occurred before flow limits were exceeded. Voltage collapse and thermal analysis was performed using the Voltage Security Assessment Tool (VSAT).

#### **Methodology**

The method employed to determine the amount of wind generation that could be accommodated in the ITP20 Study for all futures was accomplished in two parts:

1. Increasing wind and decreasing conventional (i.e. coal, gas, etc.) generation in the SPP footprint

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<sup>23</sup> A 2023 summer peak model was utilized because there is not a 2033 off peak model to use. A 2023 summer peak model should have similar load to a 2033 off-peak (high wind) hour.

2. Increasing wind generation in the SPP region and increasing the load in load pockets outside of the SPP region

Table 12.1 shows the maximum capacity of wind generation per future.

| <b>FUTURE</b> | <b>WIND GENERATION<br/>(GW)</b> |
|---------------|---------------------------------|
| 1             | 9.2                             |
| 2             | 16.4                            |
| 3             | 25.6                            |
| 4             | 15.4                            |
| 5             | 9.2                             |

*Table 12.1: Wind generation per future*

To prepare for the first procedure (wind and conventional generation in the SPP Footprint), wind generation was reduced to minimum levels while conventional generation was simultaneously increased to meet SPP load requirements, and the case was saved. The saved case was used as the starting point for the transfer study. The wind was increased while the conventional generation was decreased until voltage collapse occurred. All branches and transformers were monitored to detect thermal violations, overloading the elements by more than 105%.

In the second procedure (Wind generation in the SPP region and load pockets outside of the SPP region), wind in the SPP region and the load in the external areas were increased until voltage collapse or thermal violations occurred, following the same methodology presented in the first procedure.

A contingency file was created that provided outages on all branches and transformers above 300 kV, as well as all flowgate contingencies in the SPP region, per the latest NERC event file and member suggestions. Monitored elements included all interfaces, circuits, and flowgates in the SPP region that are contained in the NERC Book of Flowgates as well as those additional flowgates that were added by members.

Existing conventional generation within the SPP region was decreased to offset the wind increase. In general, base load units were not scaled. Modal analysis was performed at the point of a maximum stable transfer with and without the contingency.

The reactive power generated by the wind farms was limited to avoid unrealistic transfers due to lack of or over generation of reactive power.

In both analyses, the amount of wind transferred represented the worst case scenario in each future. Based on this assumption, the thermal violations were treated not as a need, but as an indicator of possible violations when this event occurs. In other words, all the wind generators in the SPP footprint have to be dispatched at one hundred percent of their capacity simultaneously. The main reason to only select overloads above one hundred and five percent, is to reduce the amount of indicators of violations in the system due to the unrealistic probability of maximum wind dispatch occurring. Most of the constraints detected during the stability assessment will be mitigated by projects used to mitigate economic, reliability, and policy needs. The stability needs have a reduced impact to developing projects for the 2013 ITP20 study.

The results shown in

| FUTURE | TRANSFER (GW) |
|--------|---------------|
| 1      | 9.2           |
| 2      | 12.9          |
| 3      | 11.9          |
| 4      | 12.9          |
| 5      | 9.2           |

Table 12.2 summarize maximum wind generation transfers where voltage collapse occurs in the 2013 ITP20 Base Case in all futures, increasing wind generation and reducing conventional generation.

| FUTURE | TRANSFER (GW) |
|--------|---------------|
| 1      | 9.2           |
| 2      | 12.9          |
| 3      | 11.9          |
| 4      | 12.9          |
| 5      | 9.2           |

Table 12.2: Wind transfers limit based on voltage collapse

## 12.4: Results

Additional EHV transmission lines were added in Future 3 to mitigate the voltage collapse and increase the wind transfers to the maximum transfer desired. These additions are shown in Table 12.3.

| Stability Project                               | Project Area(s) | Miles Added/<br>Modified |
|-------------------------------------------------|-----------------|--------------------------|
| Reconductor L.E.S. - Sunnyside 345 kV circuit 1 | AEPW-OKGE       | 72                       |
| New L.E.S. to Sunnyside 345 kV circuit 2        | AEPW-OKGE       | 72                       |
| New Elk City - Border 345 kV                    | AEPW-OKGE       | 41                       |
| New L.E.S. - Gracemont 345 kV circuit 2         | AEPW-OKGE       | 36                       |
| New Potter - Elk City 345 kV                    | SPS-AEPW        | 148                      |

Table 12.3: Future 3 Stability Projects - Line

Reactive support is also needed in all futures to increase the wind transfers and boost the voltage in the SPP area. In Future 3 specifically, the only way to sink 15 GW into the SPP area and export 10 GW of wind to external areas is by adding a substantial amount of Static VAR Compensators (SVCs) in the SPP footprint. Figure 12.1 shows the SVC additions by future, and Table 12.4 shows locations of SVC additions for all futures. Stability projects are classified as policy projects, as they are needed to facilitate wind transfer to meet renewable policy requirements.

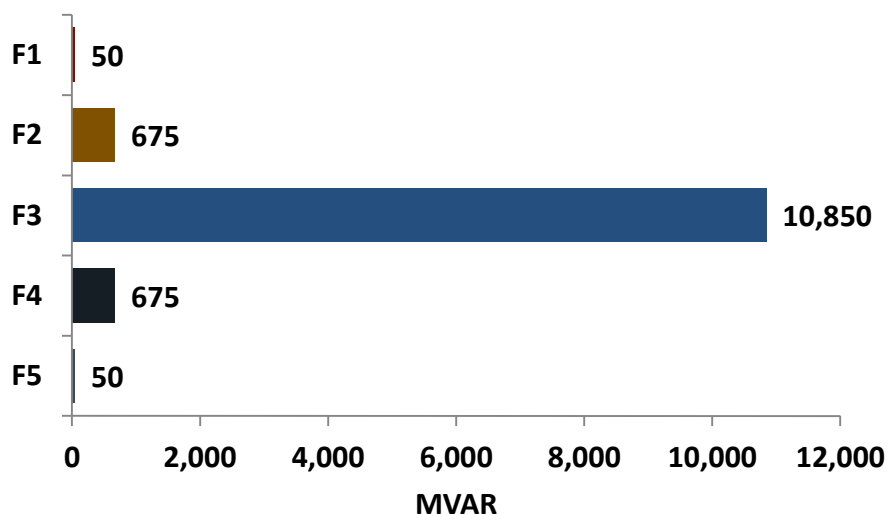


Figure 12.1: SVC Additions by Future

| Location of SVC Addition | Project Area | MVAR | Future(s)  |
|--------------------------|--------------|------|------------|
| Elk City 345 kV          | AEPW         | 200  | F2, F4     |
| Elk City 345 kV          | AEPW         | 850  | F3         |
| Beaver Co 345 kV         | SPS          | 650  | F3         |
| Cherry Co 345 kV         | NPPD         | 500  | F3         |
| Conestoga 345 kV         | SPS          | 400  | F3         |
| Finney 345 kV            | SPS          | 200  | F2, F3, F4 |
| Gracemont 345 kV         | OKGE         | 600  | F3         |
| Hitchland 345 kV         | SPS          | 350  | F3         |
| Holt Co 345 kV           | NPPD         | 600  | F3         |
| Mingo 345 kV             | SUNC         | 200  | F2, F3, F4 |
| Shamrock 138 kV          | AEPW         | 25   | F3         |
| Spearville 345 kV        | SUNC         | 1000 | F3         |
| Tuco 345 kV              | SPS          | 500  | F3         |
| Victory Hill 230 kV      | NPPD         | 50   | F1         |
| Victory Hill 230 kV      | NPPD         | 25   | F3         |
| Victory Hill 230 kV      | NPPD         | 75   | F2, F4     |
| Woodring 345 kV          | OKGE         | 700  | F3         |
| Woodward EHV 345 kV      | OKGE         | 1200 | F3         |
| Fort Smith 500 kV        | OKGE         | 25   | F3         |
| Mathewson 345 kV         | OKGE         | 1000 | F3         |
| Franks 345 kV            | AECI         | -200 | F3         |
| AEP GBE HVDC 345 kV      | AEP          | 650  | F3         |
| SPP GBE HVDC 345 kV      | SUNC         | 1400 | F3         |
| Thomas Hill 22 kV        | AECI         | 200  | F3         |
| WPL City 69 kV           | AECI         | -50  | F3         |
| Purdy South              | EMDE         | 25   | F3         |

Table 12.4: Stability Projects - SVC



Reliability and policy needs in Future 3 were mitigated with reliability and policy projects; however, this specific Future indicated the need for a 765 kV loop in the SPP footprint if we are to dispatch 25 GW of wind simultaneously while avoiding a high number of SVCs. The SVCs indicate the need for more transmission lines in this scenario. However, due to the aggressive nature of this stability analysis, in which all wind is gradually ramped up to 100% capacity factor, SVC's are utilized here rather than additional transmission.

The wind dispatch in the 2013 ITP20 Future 1 is feasible from a voltage stability viewpoint. There was no voltage instability in the load areas in Future 1 within SPP and all the wind transfers from west to east reached the maximum capacity without voltage collapse.

## Section 13: Future Portfolios

Reliability, policy, and economic projects for each future were grouped together into portfolios unique to each future. In assessing needs and project solutions, there was some overlap among the classification of projects. Some reliability projects were also good economic projects, for example, because relieving significant congestion of a single constraint can mitigate a reliability problem and provide significant economic benefit. Some policy projects were also economic projects, because relieving congestion of wind generation can enable renewable policy mandates to be met, and provide significant economic benefit due to cheaper wind resources displacing more expensive generation. Despite this overlap among the classification of certain projects, each project was classified as primarily reliability, policy, or economic, based on the primary need it targets, and the primary benefit it provides.

### 13.1: Project Solutions from Previous ITP Studies

Many of the project solutions that were developed matched approved solutions from previous ITP studies that did not receive NTCs. Projects that were issued ATP's in the 2012 ITP10 were not included in the base case model for the 2013 ITP20. As a result, many of the same needs and solutions arose again in the 2013 ITP20. Table 13.1 shows 2013 ITP20 projects that were included in at least one future for which an equivalent project was included in the 2012 ITP10 approved portfolio and received an ATP.

| 2013 ITP20 Solution                                                                       | Future(s)      | 2012 ITP10 Approved ATP Solution                                               |
|-------------------------------------------------------------------------------------------|----------------|--------------------------------------------------------------------------------|
| New Chamber Springs - S Fayetteville 345 kV, new 345/161 kV transformer at S Fayetteville | F1, F2, F3, F5 | Reconductor Chamber Springs - Farmington 161 kV                                |
| New Welsh - Lake Hawkins 345 kV, new 345/138 kV transformer at Lake Hawkins               | F3             | New Welsh - Lake Hawkins 345 kV, new 345/138 kV transformer at Lake Hawkins    |
| Replace wavetrapp for Prairie Lee - Blue Springs South 161 kV                             | F1, F4         | Reconductor/substation equipment upgrade for Prairie Lee - Blue Springs 161 kV |
| Reconductor Harper - Milan Tap - Clearwater 138 kV                                        | F1, F5         | Reconductor Harper - Milan Tap - Clearwater 138 kV                             |
| Reconductor Woodward to Windfarm 138kV                                                    | F3, F5         | Reconductor/substation equipment upgrade for Woodward - Windfarm 138 kV        |

*Table 13.1: 2013 ITP20 Projects with Equivalent 2012 ITP10 Approved Solutions*

Table 13.2 shows 2013 ITP20 projects that were included in at least one future for which an equivalent project was included in the 2010 ITP20 approved Cost Effective Plan.

| 2013 ITP20 Solution                                                                     | Future(s)      | 2010 ITP20 Approved Solution |
|-----------------------------------------------------------------------------------------|----------------|------------------------------|
| New Potter - Tolk 345 kV                                                                | F2, F3, F4     | New Potter - Tolk 345 kV     |
| New S3740 - S3454 345 kV                                                                | F1, F2, F3, F5 | New S3740 - S3454 345 kV     |
| Rebuild JEC - Auburn - Swissvale 230 kV to 345 kV, new 345/115 kV transformer at Auburn | F1, F3         | New JEC - Iatan 345 kV       |
| New Mingo - Post Rock 345 kV double circuit                                             | F2, F3         | New Mingo - Post Rock 345 kV |

|                                                                                                                                    |                    |                                                                                                    |
|------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------------------------------------------------------------------------------------------------|
| Rebuild Spearville - Great Bend - Circle - Reno 230 kV to 345 kV double circuit, add 345/230 transformers at Great Bend and Circle | F2, F4             | New Spearville - Mullergren - Circle - Reno 345 kV, new Mullergren and Circle 345/230 transformers |
|                                                                                                                                    | F1, F2, F3, F4, F5 |                                                                                                    |
| New S3459 345/161 kV transformer                                                                                                   |                    | New S3459 345/161 kV transformer                                                                   |
| New Keystone - Red Willow 345 kV                                                                                                   | F1, F2             | New Keystone - Ogallala 345 kV, new 345/115 kV transformer at Ogallala                             |
| New Woodward - Woodring 345 kV double circuit                                                                                      | F2, F3             | New Woodward - Woodring 345 kV                                                                     |
| Reconductor Grand Island - Holt 345 kV                                                                                             | F3                 | Reconductor Grand Island - Wheeler 345 kV                                                          |

*Table 13.2: 2013 ITP20 Projects with Equivalent 2010 ITP20 Approved Solutions*

### **13.2: Treatment of Lower Voltage Solutions**

As described in Section 8.2: , lower voltage solutions (100 kV – 300 kV) were considered and developed alongside EHV solutions to mitigate reliability and policy needs. However, since the final ITP20 expansion plan is intended to consist of primarily EHV solutions, the lower voltage solutions (with the exception of Clinton – Truman – N Warsaw 161 kV reconductor) have been left out of the Future Portfolios and the final Consolidated Portfolio. The needs they are targeting will be addressed in future ITP10 and ITPNT studies, should they continue to arise in those studies.

Seams projects provide an opportunity to distribute the cost of a transmission project beyond the SPP region if it provides value to a neighboring transmission provider. Therefore, the Clinton – Truman – N Warsaw 161 kV reconductor project is included in the Future Portfolios and the final Consolidated Portfolio. This project provides SPP with an additional opportunity to collaborate with one of our seams neighbors to address a joint need.

### **13.3: Future 1 Portfolio**

Reliability, policy, and economic projects developed for Future 1 were grouped together into a single Future 1 Grouping D portfolio.

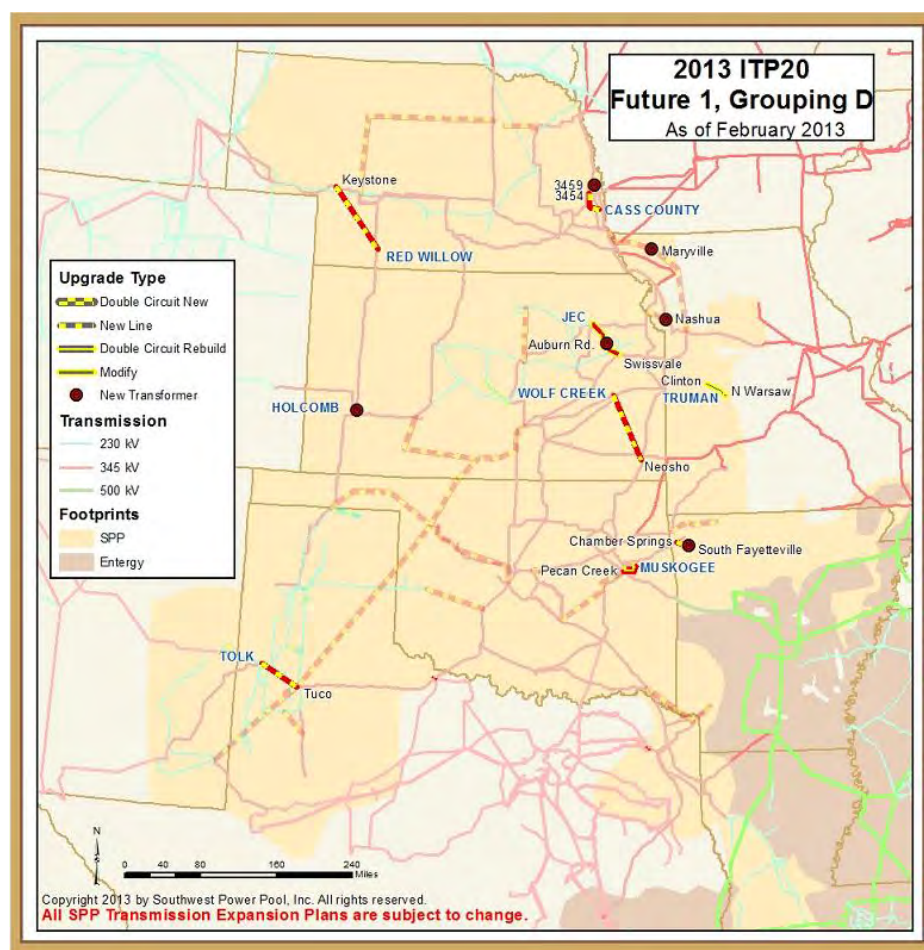


Figure 13.1: Future 1 Grouping D

### Future 1 Grouping D

Total Cost: \$560M  
 Reliability Cost: \$396M  
 Policy Cost: \$0  
 Economic Cost: \$164M

Total Mileage: 436  
 Reliability Miles: 319  
 Policy Miles: 0  
 Economic Miles: 117

Total Transformers: 6

Unlike the other futures, Future 1 showed minimal need for any policy projects due to the lower forecasted wind levels. The only policy project that was needed was a reconductor of the Harper – Milan Tap – Clearwater 138 kV system, and this project was left out of the Future 1 portfolio because it is a lower voltage solution.

In the Future 1 analysis, LaCygne – Morgan 345 kV and Wolf Creek – Neosho 345 kV both mitigated multiple reliability needs and provided economic benefit when tested independently from each other, as shown in Table 13.3.

|                         |                                                               | Wolf Creek - Neosho 345 kV | LaCygne - Morgan 345 kV |
|-------------------------|---------------------------------------------------------------|----------------------------|-------------------------|
| <b>Estimated Length</b> |                                                               | 99 miles                   | 118 miles               |
| <b>Reliability</b>      | Mitigates Paolo - Centennial 161 ftlo LaCygne - Neosho 345    | Y                          | Y                       |
|                         | Mitigates Franklin - Litchfield 161 ftlo LaCygne - Neosho 345 | Y                          | Y                       |
|                         | Mitigates Morgan - Stockton 161 ftlo LaCygne - Neosho 345     | Y                          | Y                       |
| <b>Economic</b>         | 40-Year B/C                                                   | 2.94                       | 2.25                    |
|                         | 40-Year Net Benefit                                           | \$366M                     | \$282M                  |

*Table 13.3: Comparison of Wolf Creek – Neosho and LaCygne – Morgan Projects*

Individually LaCygne – Morgan 345 kV and Wolf Creek – Neosho 345 kV are each cost effective solutions to mitigate multiple reliability issues and provide economic value. However, both projects are not needed concurrently. Wolf Creek – Neosho 345 kV was chosen for the Future 1 portfolio because it provided a greater economic benefit. However, LaCygne – Morgan 345 kV is a seams project, and would provide the potential for reduced costs due to cost sharing with our seams neighbor, AECI. The LaCygne – Morgan 345 kV project also avoids environmentally sensitive regions in Southeast Kansas. SPP has reviewed this project with AECI, and AECI will evaluate the value this project provides to AECI. Although Wolf Creek – Neosho 345 kV is included as the preferred solution in the 2013 ITP20 study, the LaCygne – Morgan 345 kV alternative project is likely to be assessed as well in future studies.

Table 13.4 shows details for all Future 1 portfolio projects.

| Project                                                                                   | Area(s)       | Type        | Mileage | Cost          |
|-------------------------------------------------------------------------------------------|---------------|-------------|---------|---------------|
| New Chamber Springs - S Fayetteville 345 kV, new 345/161 kV transformer at S Fayetteville | AEPW          | Economic    | 18      | \$33,895,800  |
| Reconductor Clinton - Truman - N Warsaw 161 kV                                            | AECI-SWPA-GMO | Economic    | 31      | \$16,784,175  |
| New Maryville 345/161 kV transformer                                                      | GMO-AECI      | Reliability | 0       | \$12,600,000  |
| Increase Nashua 345/161 kV transformer size to 650/715 MVA                                | KCPL          | Reliability | 0       | \$12,600,000  |
| New Keystone - Red Willow 345 kV                                                          | NPPD          | Reliability | 110     | \$130,141,000 |
| Reconductor Pecan Creek - Muskogee 345 kV circuit 1                                       | OKGE          | Reliability | 23      | \$20,408,475  |
| Reconductor Pecan Creek - Muskogee 345 kV circuit 2                                       | OKGE          | Reliability | 16      | \$14,197,200  |
| New 2nd S3459 345/161 kV transformer                                                      | OPPD          | Economic    | 0       | \$12,600,000  |
| New Wolf Creek - Neosho 345 kV line                                                       | WERE          | Economic    | 99      | \$117,126,900 |
| New Tolk - Tuco 345 kV                                                                    | SPS           | Reliability | 64      | \$75,718,400  |
| New 2nd Holcomb 345/115 kV transformer                                                    | SUNC          | Reliability | 0       | \$12,600,000  |
| New S3740 - S3454 345 kV                                                                  | OPPD          | Reliability | 28      | \$33,126,800  |
| Rebuild JEC - Auburn - Swissvale 230 kV to 345 kV, new Auburn 345/115 kV transformer      | WERE          | Reliability | 47      | \$68,205,700  |
| Total                                                                                     |               |             | 436     | \$560,004,450 |

*Table 13.4: Future 1 Portfolio Projects*

### 13.4: Future 2 Portfolio

Reliability, policy, and economic projects developed for Future 2 were grouped together into a single Future 2 Grouping D portfolio.

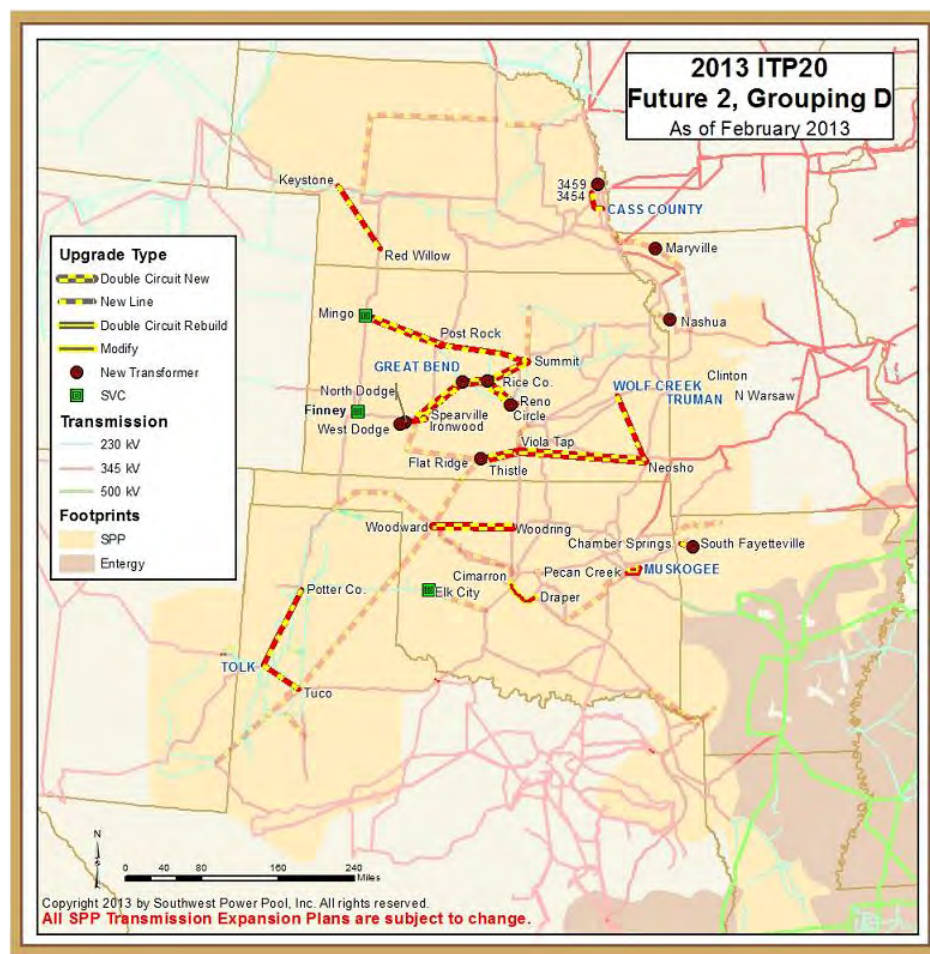


Figure 13.2: Future 2 Grouping D

#### Future 2 Grouping D

Total Cost: \$2.5B

Reliability Cost: \$642M

Policy Cost: \$1.8B

Economic Cost: \$0

Total Mileage: 2,002

Reliability Miles: 536

Policy Miles: 1,466

Economic Miles: 0

Total Transformers: 10

Future 2 had a similar number of reliability projects as Futures 1 and 3. However, Future 2 had significantly more policy projects than Future 1, with over 1,300 miles of policy project upgrades at a cost of \$1.7B. These upgrades are needed to deliver the 16 GW of projected Future 2 wind within the SPP system to load centers.



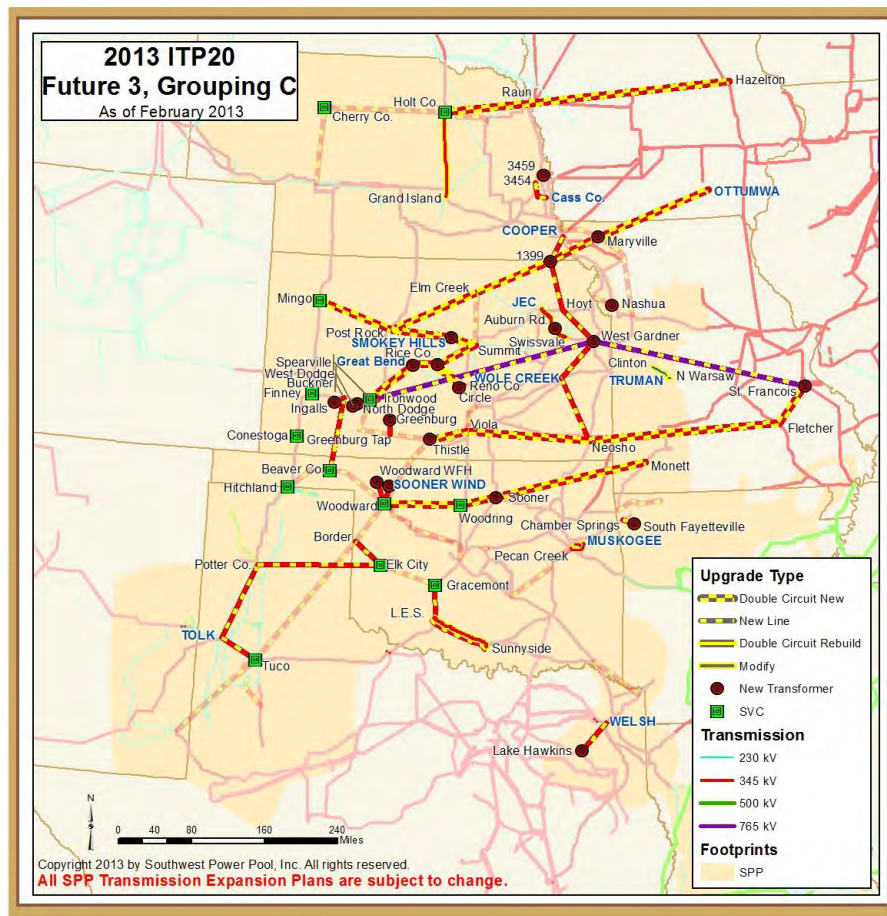
Table 13.5 shows details for all Future 2 portfolio projects.

| Project                                                                                                                                                                                  | Area(s)        | Type        | Mileage | Cost            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------------|---------|-----------------|
| New Chamber Springs - S Fayetteville 345 kV, new 345/161 kV transformer at S Fayetteville                                                                                                | AEPW           | Reliability | 18      | \$33,895,800    |
| Reconductor Clinton - Truman - N Warsaw 161 kV                                                                                                                                           | AECI-SWPA-GMO  | Reliability | 31      | \$16,784,175    |
| New Maryville 345/161 kV transformer                                                                                                                                                     | GMO-AECI       | Reliability | 0       | \$12,600,000    |
| Increase Nashua 345/161 kV transformer size to 650/715 MVA                                                                                                                               | KCPL           | Reliability | 0       | \$12,600,000    |
| New Keystone - Red Willow 345 kV                                                                                                                                                         | NPPD           | Reliability | 110     | \$130,141,000   |
| Reconductor Pecan Creek - Muskogee 345 kV circuit 1                                                                                                                                      | OKGE           | Reliability | 23      | \$20,408,475    |
| Reconductor Pecan Creek - Muskogee 345 kV circuit 2                                                                                                                                      | OKGE           | Reliability | 16      | \$14,197,200    |
| New 2nd S3459 345/161 kV transformer                                                                                                                                                     | OPPD           | Reliability | 0       | \$12,600,000    |
| New Wolf Creek - Neosho 345 kV line                                                                                                                                                      | WERE           | Reliability | 99      | \$117,126,900   |
| New Tolk - Tuco 345 kV                                                                                                                                                                   | SPS            | Reliability | 64      | \$75,718,400    |
| New S3740 - S3454 345 kV                                                                                                                                                                 | OPPD           | Reliability | 28      | \$33,126,800    |
| Elk City 345 kV - 200 MVAR addition                                                                                                                                                      | AEPW           | Policy      | 0       | \$6,000,000     |
| Rebuild Spearville - Great Bend - Circle - Reno 230 kV as Spearville - Great Bend - Rice - Circle - Reno 345 kV double circuit, add 345/230 transformers at Great Bend, Circle, and Rice | MIDW-WERE-SUNC | Policy      | 273     | \$361,235,878   |
| New Rice - Summit 345 kV double circuit                                                                                                                                                  | MIDW-WERE      | Policy      | 120     | \$141,972,000   |
| New Woodward - Woodring 345 kV double circuit                                                                                                                                            | OKGE           | Policy      | 204     | \$241,352,400   |
| New Thistle - Viola Tap 345 kV double circuit                                                                                                                                            | SUNC-WERE      | Policy      | 90      | \$106,479,000   |
| New Thistle - Flat Ridge 345 kV, new Flat Ridge 345/138 kV transformer                                                                                                                   | SUNC           | Policy      | 5       | \$18,870,430    |
| New Ironwood - North Dodge 345 kV, new North Dodge 345/115 kV transformer                                                                                                                | SUNC           | Policy      | 16      | \$31,056,360    |
| New Mingo - Post Rock 345 kV double circuit                                                                                                                                              | SUNC-MIDW      | Policy      | 210     | \$248,451,000   |
| New North Dodge - West Dodge 345 kV, new West Dodge 345/115 kV transformer                                                                                                               | SUNC           | Policy      | 10      | \$24,431,000    |
| New Viola Tap - Neosho 345 kV double circuit                                                                                                                                             | WERE           | Policy      | 426     | \$504,000,600   |
| Finney 345 kV - 200 MVAR addition                                                                                                                                                        | SPS            | Policy      | 0       | \$6,000,000     |
| Mingo 345 kV - 200 MVAR addition                                                                                                                                                         | SUNC           | Policy      | 0       | \$6,000,000     |
| New Summit - Post Rock 345 kV                                                                                                                                                            | MIDW-WERE      | Policy      | 112     | \$132,507,200   |
| Replace wavetraps for Cimarron - Draper 345 kV                                                                                                                                           | OKGE           | Reliability | 36      | \$31,943,700    |
| New Potter - Tolk 345 kV                                                                                                                                                                 | SPS            | Reliability | 111     | \$131,324,100   |
| Total                                                                                                                                                                                    |                |             | 2,002   | \$2,470,822,418 |

*Table 13.5: Future 2 Portfolio Projects*

### **13.5: Future 3 Portfolio**

Two different groupings of reliability, policy, and economic projects were developed to meet the needs of Future 3. The Future 3 Grouping C portfolio consists solely of AC projects, while Future 3 Grouping D includes two HVDC projects, in addition to AC projects. These HVDC projects are policy projects, and led to a reduction of the AC policy projects needed to export wind in Grouping C.



### Future 3 Grouping C

Total Cost: \$9.0B

Reliability Cost: \$937M

Policy Cost: \$8.05B

Economic Cost: \$0

Total Mileage: 6,766

Reliability Miles: 762

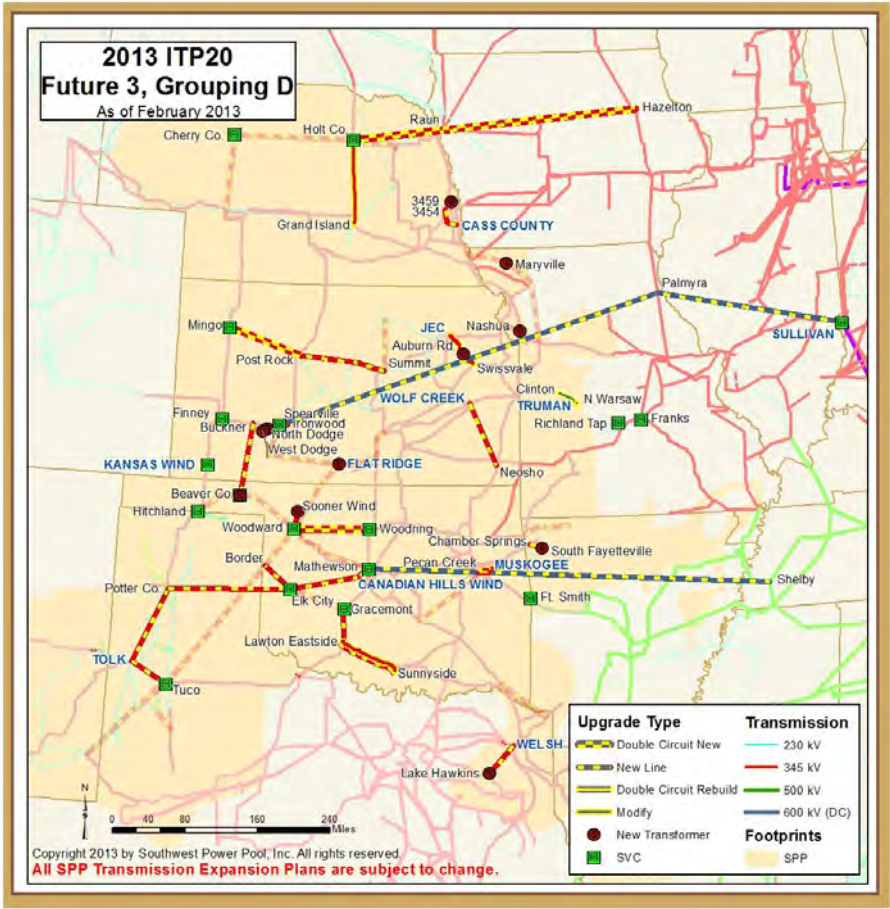
Policy Miles: 6,004

Economic Miles: 0

Total Transformers: 22

Figure 13.3: Future 3 Grouping C





**Future 3 Grouping D**

Total Cost: \$7.5B  
Reliability Cost: \$937M  
Policy Cost: \$6.59B  
Economic Cost: \$0

Total Mileage: 3,904  
Reliability Miles: 762  
Policy Miles: 3,140  
Economic Miles: 0

Total Transformers: 11

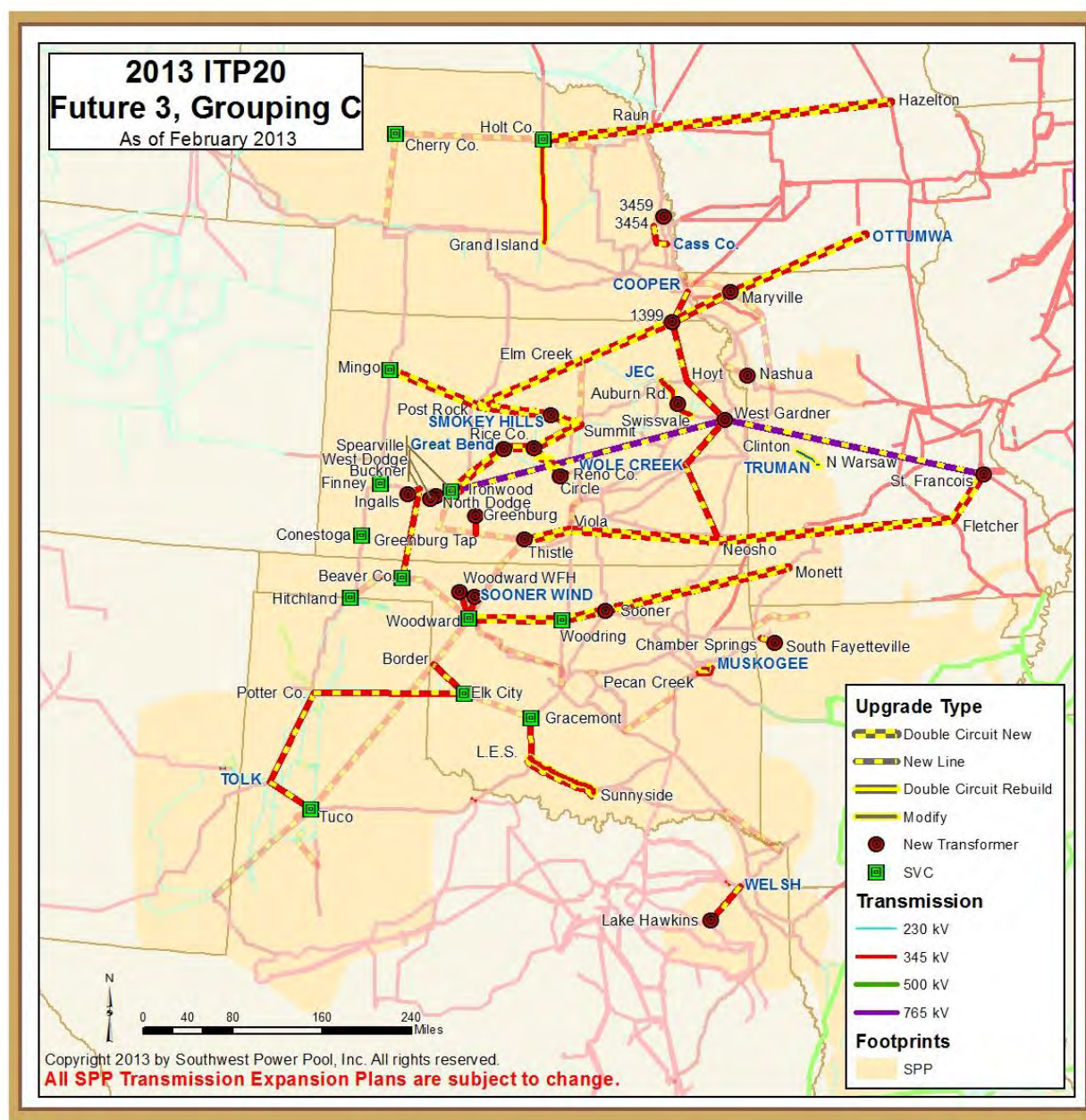
Figure 13.4: Future 3 Grouping D

The economic benefits and costs of the policy projects in Groupings C and D were analyzed, and are shown in Table 13.6:

|                     | Grouping C | Grouping D |
|---------------------|------------|------------|
| 40-Year NPV Cost    | \$8.0B     | \$6.6B     |
| 40-Year NPV Benefit | \$10.3B    | \$12.7B    |
| 40-Year B/C Ratio   | 1.28       | 1.93       |

Table 13.6: Comparison of Future 3 Groupings C and D

In discussing different solutions with ESWG, there was agreement to include both Grouping C and D as Future 3 portfolios in the 2013 ITP20 report. Both are viable options, and plans are shown considering different technologies (AC and HVDC). The Future 3 portfolios have the most transmission projects and highest cost of any Future



portfolio. While this Future resulted in a similar number of reliability needs and projects as Futures 1 and 2, it has significantly more policy projects than any other Future. These projects are required to mitigate significant curtailment of the 25 GW of installed wind, and to enable the export of 10 GW of that installed wind. Although there are no projects classified as economic projects, the numerous policy projects are projecting significant economic benefit as a whole, showing a 40-year Net Present Value (NPV) benefit of \$10 – 13 billion.

Table 13.7 shows details for all Future 3 Grouping C projects, and Table 13.8 shows details for all Future 3 Grouping D projects.

| Project                                                                                   | Area(s)                   | Type        | Mileage | Cost          |
|-------------------------------------------------------------------------------------------|---------------------------|-------------|---------|---------------|
| New Welsh - Lake Hawkins 345 kV, new 345/138 kV transformer at Lake Hawkins               | AEPW                      | Reliability | 55      | \$77,670,500  |
| New Chamber Springs - S Fayetteville 345 kV, new 345/161 kV transformer at S Fayetteville | AEPW                      | Reliability | 18      | \$33,895,800  |
| Replace CT for Lawton Eastside - Sunnyside 345 kV                                         | AEPW-OKGE                 | Reliability | 72      | \$63,887,400  |
| New Maryville 345/161 kV transformer                                                      | GMO-AECI                  | Reliability | 0       | \$12,600,000  |
| Reconductor Clinton - Truman - N Warsaw 161 kV                                            | AECI-SWPA-GMO             | Reliability | 31      | \$16,784,175  |
| Increase Nashua 345/161 kV transformer size to 650/715 MVA                                | KCPL                      | Reliability | 0       | \$12,600,000  |
| New Summit - Post Rock 345 kV                                                             | MIDW-WERE                 | Reliability | 112     | \$132,507,200 |
| Reconductor Pecan Creek - Muskogee 345 kV circuit 1                                       | OKGE                      | Reliability | 23      | \$20,408,475  |
| Reconductor Pecan Creek - Muskogee 345 kV circuit 2                                       | OKGE                      | Reliability | 16      | \$14,197,200  |
| New 2nd S3459 345/161 kV transformer                                                      | OPPD                      | Reliability | 0       | \$12,600,000  |
| New Potter - Tolk 345 kV                                                                  | SPS                       | Reliability | 111     | \$131,324,100 |
| New Buckner - Beaver 345 kV, new Beaver 345/115 kV transformer                            | SUNC-SPS                  | Reliability | 86      | \$114,346,600 |
| New Tolk - Tuco 345 kV                                                                    | SPS                       | Reliability | 64      | \$75,718,400  |
| Rebuild JEC - Auburn - Swissvale 230 kV to 345 kV, new Auburn 345/115 kV transformer      | WERE                      | Reliability | 47      | \$68,205,700  |
| New Wolf Creek - Neosho 345 kV line                                                       | WERE                      | Reliability | 99      | \$117,126,900 |
| New S3740 - S3454 345 kV                                                                  | OPPD                      | Reliability | 28      | \$33,126,800  |
| Reconductor Holt - Grand Island 345 kV                                                    | NPPD                      | Policy      | 85      | \$75,156,428  |
| New Holt - Raun - Hazelton 345 kV double circuit                                          | NPPD-MEC-ALTW             | Policy      | 842     | \$996,170,200 |
| New Woodward - Woodring 345 kV double circuit                                             | OKGE                      | Policy      | 204     | \$241,352,400 |
| New Thistle - Flat Ridge 345 kV, new Flat Ridge 345/138 kV transformer                    | SUNC                      | Policy      | 5       | \$18,870,430  |
| New Ironwood - North Dodge 345 kV, new North Dodge 345/115 kV transformer                 | SUNC                      | Policy      | 16      | \$31,056,360  |
| New Mingo - Post Rock 345 kV double circuit                                               | SUNC-MIDW                 | Policy      | 210     | \$248,451,000 |
| New North Dodge - West Dodge 345 kV, new West Dodge 345/115 kV transformer                | SUNC                      | Policy      | 10      | \$24,431,000  |
| New Woodward - Sooner Wind 345 kV, new 345/138 kV transformer at Sooner Wind              | OKGE                      | Policy      | 12      | \$26,880,017  |
| New Woodring - Monett 345 kV double circuit                                               | OKGE - EMDE               | Policy      | 594     | \$702,761,400 |
| New Rice - Summit 345 kV double circuit                                                   | MIDW - WERE               | Policy      | 120     | \$141,972,000 |
| Reconductor L.E.S. - Sunnyside 345 kV circuit 1                                           | AEPW-OKGE                 | Policy      | 72      | \$63,505,850  |
| New L.E.S. to Sunnyside 345 kV circuit 2                                                  | AEPW-OKGE                 | Policy      | 72      | \$84,674,467  |
| New Elk City - Border 345 kV                                                              | AEPW-OKGE                 | Policy      | 41      | \$48,270,480  |
| New L.E.S. - Gracemont 345 kV circuit 2                                                   | AEPW-OKGE                 | Policy      | 36      | \$42,638,924  |
| New Potter - Elk City 345 kV                                                              | SPS-AEPW                  | Policy      | 148     | \$175,098,800 |
| New Cooper - S1399 - Hoyt - West Gardner 345 kV, new 345/161 kV transformer at S1399      | NPPD - OPPD - WERE - KCPL | Policy      | 152     | \$192,431,200 |
| New Woodward - Woodward WFH 345 kV, new 345/138 kV transformer at Woodward WFH            | WFEC - OKGE               | Policy      | 24      | \$40,994,400  |

|                                                                                                                                                                                         |                                             |        |       |                 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|--------|-------|-----------------|
|                                                                                                                                                                                         | SUNC -<br>OPPD -<br>GMO -<br>MIDW -<br>ALTW | Policy | 930   | \$1,100,283,000 |
| New Post Rock - Elm Creek - S1399 - Maryville - Ottumwa 345 kV double circuit                                                                                                           |                                             |        |       |                 |
| New Viola Tap - Neosho - Fletcher - St. Francois 345 kV double circuit                                                                                                                  | WERE - AECI                                 | Policy | 1,060 | \$1,254,086,000 |
| New West Gardner - Wolf Creek 345 kV                                                                                                                                                    | WERE - KCPL                                 | Policy | 75    | \$88,732,500    |
|                                                                                                                                                                                         | SUNC -<br>WERE                              | Policy | 90    | \$106,479,000   |
| New Thistle - Viola Tap 345 kV double circuit                                                                                                                                           |                                             |        |       |                 |
| New Spearville - West Gardner - St. Francois 765 kV, new 765/345 kV transformers at Spearville, West Gardner, and St. Francois                                                          | SUNC - KCPL<br>- AMMO                       | Policy | 590   | \$1,451,887,500 |
|                                                                                                                                                                                         |                                             |        |       |                 |
| New Greensburg Tap on Clark Co - Thistle 345 kV double circuit, new Greenburg - Greensburg Tap 345 kV double circuit, new 345/115 kV transformer at Greensburg                          | SUNC                                        | Policy | 220   | \$69,388,800    |
| New Buckner - Ingalls 345 kV, new 345/115 kV transformer at Ingalls                                                                                                                     | SUNC                                        | Policy | 12    | \$26,797,200    |
|                                                                                                                                                                                         | SUNC -<br>MIDW -<br>WERE                    | Policy | 112   | \$145,107,200   |
| New Summit - Smoky Hills - Post Rock 345 kV circuit 2, new 345/230 kV transformer at Smoky Hills                                                                                        |                                             |        |       |                 |
| Rebuild Spearville - Great Bend - Circle - Reno 230 kV as Spearville - Great Bend - Rice - Circle - Reno 345 kV double circuit, add 345/230 kV transformers at Great Bend, Rice, Circle | MIDW -<br>WERE -<br>SUNC                    | Policy | 273   | \$361,235,878   |
| Cherry Co 345 kV - 575 MVAR addition                                                                                                                                                    | NPPD                                        | Policy | 0     | \$17,250,000    |
| Holt Co 345 kV - 825 MVAR addition                                                                                                                                                      | NPPD                                        | Policy | 0     | \$24,750,000    |
| Woodward 345 kV - 1,500 MVAR addition                                                                                                                                                   | OKGE                                        | Policy | 0     | \$45,000,000    |
| Hitchland 345 kV - 425 MVAR addition                                                                                                                                                    | SPS                                         | Policy | 0     | \$12,750,000    |
| Elk City 345 kV - 850 MVAR addition                                                                                                                                                     | AEPW                                        | Policy | 0     | \$25,500,000    |
| Woodring 345 kV - 1,000 MVAR addition                                                                                                                                                   | OKGE                                        | Policy | 0     | \$30,000,000    |
| Gracemont 345 kV - 1,000 MVAR addition                                                                                                                                                  | OKGE                                        | Policy | 0     | \$30,000,000    |
| Finney 345 kV - 200 MVAR addition                                                                                                                                                       | SPS                                         | Policy | 0     | \$6,000,000     |
| Conestoga 345 kV - 425 MVAR addition                                                                                                                                                    | SPS                                         | Policy | 0     | \$12,750,000    |
| Tuco 345 kV - 600 MVAR addition                                                                                                                                                         | SPS                                         | Policy | 0     | \$18,000,000    |
| Beaver Co 345 kV - 975 MVAR addition                                                                                                                                                    | SPS                                         | Policy | 0     | \$29,250,000    |
| Mingo 345 kV - 200 MVAR addition                                                                                                                                                        | SUNC                                        | Policy | 0     | \$6,000,000     |
| Spearville 345 kV - 1000 MVAR addition                                                                                                                                                  | SUNC                                        | Policy | 0     | \$30,000,000    |
| Total                                                                                                                                                                                   |                                             |        | 6,767 | \$8,982,961,684 |

Table 13.7: Future 3 Grouping C Projects



| Project                                                                                   | Area(s)            | Type        | Mileage | Cost            |
|-------------------------------------------------------------------------------------------|--------------------|-------------|---------|-----------------|
| New Welsh - Lake Hawkins 345 kV, new 345/138 kV transformer at Lake Hawkins               | AEPW               | Reliability | 55      | \$77,670,500    |
| New Chamber Springs - S Fayetteville 345 kV, new 345/161 kV transformer at S Fayetteville | AEPW               | Reliability | 18      | \$33,895,800    |
| Replace CT for Lawton Eastside - Sunnyside 345 kV                                         | AEPW-OKGE          | Reliability | 72      | \$63,887,400    |
| New Maryville 345/161 kV transformer                                                      | GMO-AECI           | Reliability | 0       | \$12,600,000    |
| Reconductor Clinton - Truman - N Warsaw 161 kV                                            | AECI-SWPA-GMO      | Reliability | 31      | \$16,784,175    |
| Increase Nashua 345/161 kV transformer size to 650/715 MVA                                | KCPL               | Reliability | 0       | \$12,600,000    |
| New Summit - Post Rock 345 kV                                                             | MIDW-WERE          | Reliability | 112     | \$132,507,200   |
| Reconductor Pecan Creek - Muskogee 345 kV circuit 1                                       | OKGE               | Reliability | 23      | \$20,408,475    |
| Reconductor Pecan Creek - Muskogee 345 kV circuit 2                                       | OKGE               | Reliability | 16      | \$14,197,200    |
| New 2nd S3459 345/161 kV transformer                                                      | OPPD               | Reliability | 0       | \$12,600,000    |
| New Potter - Tolk 345 kV                                                                  | SPS                | Reliability | 111     | \$131,324,100   |
| New Buckner - Beaver 345 kV, new Beaver 345/115 kV transformer                            | SUNC-SPS           | Reliability | 86      | \$114,346,600   |
| New Tolk - Tuco 345 kV                                                                    | SPS                | Reliability | 64      | \$75,718,400    |
| Rebuild JEC - Auburn - Swissvale 230 kV to 345 kV, new Auburn 345/115 kV transformer      | WERE               | Reliability | 47      | \$68,205,700    |
| New Wolf Creek - Neosho 345 kV line                                                       | WERE               | Reliability | 99      | \$117,126,900   |
| New S3740 - S3454 345 kV                                                                  | OPPD               | Reliability | 28      | \$33,126,800    |
| Reconductor Holt - Grand Island 345 kV                                                    | NPPD               | Policy      | 85      | \$75,156,428    |
| New Holt - Raun - Hazelton 345 kV double circuit                                          | NPPD-MEC-ALTW      | Policy      | 842     | \$996,170,200   |
| New Woodward - Woodring 345 kV double circuit                                             | OKGE               | Policy      | 204     | \$241,352,400   |
| New Thistle - Flat Ridge 345 kV, new Flat Ridge 345/138 kV transformer                    | SUNC               | Policy      | 5       | \$18,870,430    |
| New Ironwood - North Dodge 345 kV, new North Dodge 345/115 kV transformer                 | SUNC               | Policy      | 16      | \$31,056,360    |
| New Mingo - Post Rock 345 kV double circuit                                               | SUNC-MIDW          | Policy      | 210     | \$248,451,000   |
| New North Dodge - West Dodge 345 kV, new West Dodge 345/115 kV transformer                | SUNC               | Policy      | 10      | \$24,431,000    |
| New Woodward - Sooner Wind 345 kV, new 345/138 kV transformer at Sooner Wind              | OKGE               | Policy      | 12      | \$26,880,017    |
| New Elk City - Canadian Hills Wind - Mathewson 345 kV                                     | OKGE - AEPW        | Policy      | 114     | \$134,873,400   |
| New Mathewson - Shelby 600 kV DC bi-pole                                                  | OKGE - TVA         | Policy      | 515     | \$1,730,000,000 |
| New Spearville - Palmyra Tap - Sullivan 600 kV DC bi-pole                                 | SUNC - AMMO - AEPW | Policy      | 760     | \$2,320,000,000 |
| Reconductor L.E.S. - Sunnyside 345 kV circuit 1                                           | AEPW-OKGE          | Policy      | 72      | \$63,505,850    |
| New L.E.S. to Sunnyside 345 kV circuit 2                                                  | AEPW-OKGE          | Policy      | 72      | \$84,674,467    |
| New Elk City - Border 345 kV                                                              | AEPW-OKGE          | Policy      | 41      | \$48,270,480    |
| New L.E.S. - Gracemont 345 kV circuit 2                                                   | AEPW-OKGE          | Policy      | 36      | \$42,638,924    |
| New Potter - Elk City 345 kV                                                              | SPS-AEPW           | Policy      | 148     | \$175,098,800   |
| Elk City 345 kV - 850 MVAR addition                                                       | AEPW               | Policy      | 0       | \$25,500,000    |
| Beaver Co 345 kV - 650 MVAR addition                                                      | SPS                | Policy      | 0       | \$19,500,000    |
| Cherry Co 345 kV - 500 MVAR addition                                                      | NPPD               | Policy      | 0       | \$15,000,000    |

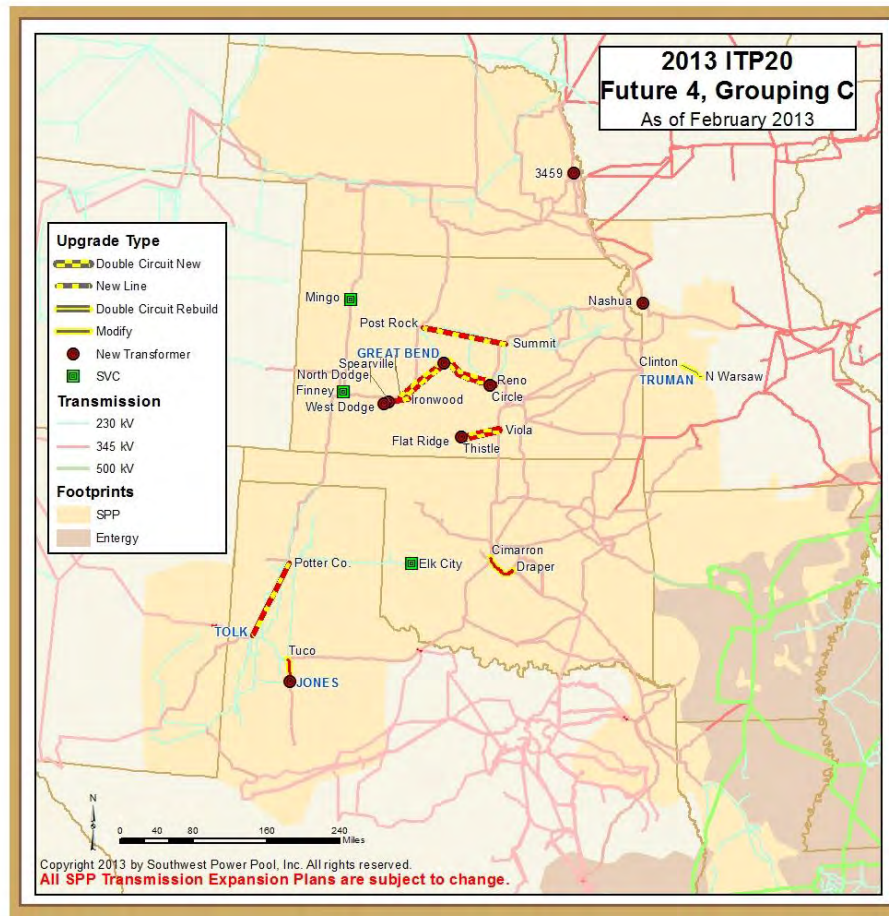
## Section 13: Future Portfolios

Southwest Power Pool, Inc.

|                                           |      |        |       |                 |
|-------------------------------------------|------|--------|-------|-----------------|
| Conestoga 345 kV - 400 MVAR addition      | SPS  | Policy | 0     | \$12,000,000    |
| Finney 345 kV - 200 MVAR addition         | SPS  | Policy | 0     | \$6,000,000     |
| Gracemont 345 kV - 600 MVAR addition      | OKGE | Policy | 0     | \$18,000,000    |
| Hitchland 345 kV - 350 MVAR addition      | SPS  | Policy | 0     | \$10,500,000    |
| Holt Co 345 kV - 600 MVAR addition        | NPPD | Policy | 0     | \$18,000,000    |
| Mingo 345 kV - 200 MVAR addition          | SUNC | Policy | 0     | \$6,000,000     |
| Spearville 345 kV - 1,000 MVAR addition   | SUNC | Policy | 0     | \$30,000,000    |
| Tuco 345 kV - 500 MVAR addition           | SPS  | Policy | 0     | \$15,000,000    |
| Woodring 345 kV - 700 MVAR addition       | OKGE | Policy | 0     | \$21,000,000    |
| Woodward EHV 345 kV - 1,200 MVAR addition | OKGE | Policy | 0     | \$36,000,000    |
| Fort Smith 500 kV - 25 MVAR addition      | OKGE | Policy | 0     | \$750,000       |
| Mathewson 345 kV - 1,000 MVAR addition    | OKGE | Policy | 0     | \$30,000,000    |
| Franks 345 kV - (-200) MVAR addition      | AECI | Policy | 0     | \$6,000,000     |
| AEP GBE HVDC 345 kV - 650 MVAR addition   | AEP  | Policy | 0     | \$19,500,000    |
| SPP GBE HVDC 345 kV - 1,400 MVAR addition | SUNC | Policy | 0     | \$42,000,000    |
| Total                                     |      |        | 3,904 | \$7,529,179,006 |

*Table 13.8: Future 3 Grouping D Projects***13.6: Future 4 Portfolio**

Reliability, policy, and economic projects developed for Future 4 were grouped together into a single Future 4 Grouping C portfolio.



### Future 4 Grouping C

Total Cost: \$926M

Reliability Cost: \$325M

Policy Cost: \$540M

Economic Cost: \$61M

Total Mileage: 708

Reliability Miles: 290

Policy Miles: 388

Economic Miles: 30

Total Transformers: 8

*Figure 13.5: Future 4 Grouping C*

Future 4 has 15 GW of wind installed in SPP, very similar to Future 2. As a result, there are more policy projects in this future than there are in the Business as Usual future. However, Future 4 has fewer policy projects than Futures 2 and 3, and has fewer reliability projects than Futures 1, 2, and 3. The driver behind fewer needs and projects in Future 4 is the more aggressive demand response and energy efficiency programs assumed in this future, resulting in decreases in peak load and energy. With decreased load and decreased generation running in Future 4, there is less congestion.

Table 13.9 shows details for all Future 4 portfolio projects.

| Project                                                                                                                                                                    | Area(s)       | Type        | Mileage | Cost          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------------|---------|---------------|
| Reconductor Clinton - Truman - N Warsaw 161 kV                                                                                                                             | AECI-SWPA-GMO | Reliability | 31      | \$16,784,175  |
| Increase Nashua 345/161 kV transformer size to 650/715 MVA                                                                                                                 | KCPL          | Reliability | 0       | \$12,600,000  |
| New Summit - Post Rock 345 kV                                                                                                                                              | MIDW-WERE     | Reliability | 112     | \$132,507,200 |
| Replace wavetraps for Cimarron - Draper 345 kV                                                                                                                             | OKGE          | Reliability | 36      | \$31,943,700  |
| New Potter - Tolk 345 kV                                                                                                                                                   | SPS           | Reliability | 111     | \$131,324,100 |
| New Ironwood - North Dodge 345 kV, new North Dodge 345/115 kV transformer                                                                                                  | SUNC          | Policy      | 16      | \$31,056,360  |
| New North Dodge - West Dodge 345 kV, new West Dodge 345/115 kV transformer                                                                                                 | SUNC          | Policy      | 10      | \$24,431,000  |
| New Thistle - Flat Ridge 345 kV, new Flat Ridge 345/138 kV transformer                                                                                                     | SUNC          | Policy      | 5       | \$18,870,430  |
| New Thistle - Viola Tap 345 kV double circuit                                                                                                                              | SUNC-WERE     | Policy      | 90      | \$106,479,000 |
| Rebuild Spearville - Great Bend - Circle - Reno 230 kV as Spearville - Great Bend - Circle - Reno 345 kV double circuit, add 345/230 transformers at Great Bend and Circle | WERE-SUNC     | Policy      | 267     | \$341,560,940 |
| Elk City 345 kV - 200 MVAR addition                                                                                                                                        | AEPW          | Policy      | 0       | \$6,000,000   |
| Finney 345 kV - 200 MVAR addition                                                                                                                                          | SPS           | Policy      | 0       | \$6,000,000   |
| Mingo 345 kV - 200 MVAR addition                                                                                                                                           | SUNC          | Policy      | 0       | \$6,000,000   |
| New 2nd S3459 345/161 kV transformer                                                                                                                                       | OPPD          | Economic    | 0       | \$12,600,000  |
| Rebuild Tuco - Jones 230 kV to 345 kV, new Jones 345/230 kV transformer                                                                                                    | SPS           | Economic    | 30      | \$48,093,000  |
| Total                                                                                                                                                                      |               |             | 708     | \$926,249,905 |

*Table 13.9: Future 4 Portfolio Projects*

### **13.7: Future 5 Portfolio**

Reliability, policy, and economic projects developed for Future 5 were grouped together into a single Future 5 Grouping A portfolio.



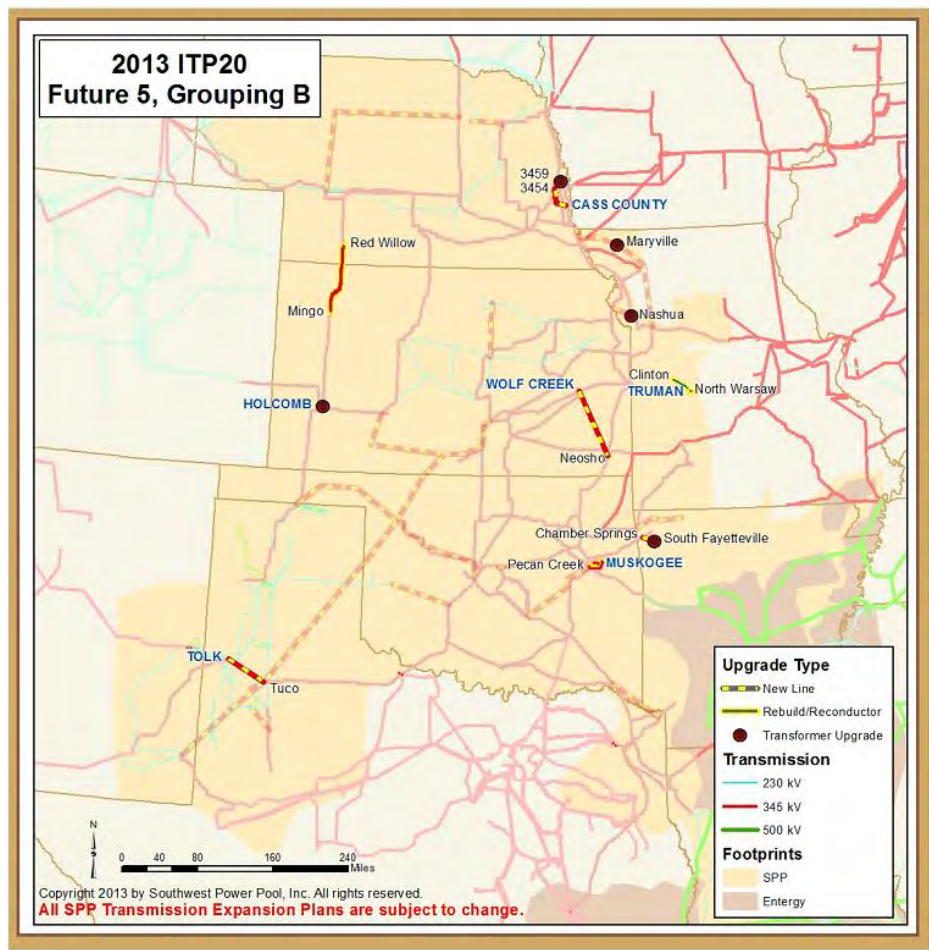


Figure 13.6: Future 5 Grouping B

**Future 5 Grouping B**

Total Cost: \$429M  
Reliability Cost: \$416M  
Policy Cost: \$0  
Economic Cost: \$13M

Total Mileage: 355  
Reliability Miles: 355  
Policy Miles: 0  
Economic Miles: 0

Total Transformers: 5

The Future 5 portfolio was very similar to the Future 1 portfolio. There are no EHV policy projects in the Future 5 portfolio due to the lower wind capacity assumed. The system behavior of Future 5 was very similar to Future 1, while the main differences are due to the additional MISO constraints and the additional MISO generation included in the Future 5 resource plan. The additional MISO generation exceeds the future MISO generation additions that SPP included in Future 1. This change led to MISO serving more of their own load in Future 5, due to the extra generation available and the additional constraints that reduced SPP exports serving MISO load. This in turn led to SPP running less generation and having fewer exports in Future 5.

Table 13.10 shows details for all Future 5 portfolio projects.

| Project                                                                                   | Area(s)       | Type        | Mileage | Cost          |
|-------------------------------------------------------------------------------------------|---------------|-------------|---------|---------------|
| New Chamber Springs - S Fayetteville 345 kV, new 345/161 kV transformer at S Fayetteville | AEPW          | Reliability | 18      | \$33,895,800  |
| Reconductor Clinton - Truman - N Warsaw 161 kV                                            | AECI-SWPA-GMO | Reliability | 31      | \$16,784,175  |
| New Maryville 345/161 kV transformer                                                      | GMO-AECI      | Reliability | 0       | \$12,600,000  |
| Increase Nashua 345/161 kV transformer size to 650/715 MVA                                | KCPL          | Reliability | 0       | \$12,600,000  |
| Reconductor Mingo - Red Willow 345 kV                                                     | NPPD          | Reliability | 76      | \$67,135,010  |
| Reconductor Pecan Creek - Muskogee 345 kV circuit 1                                       | OKGE          | Reliability | 23      | \$20,408,475  |
| Reconductor Pecan Creek - Muskogee 345 kV circuit 2                                       | OKGE          | Reliability | 16      | \$14,197,200  |
| New 2nd S3459 345/161 kV transformer                                                      | OPPD          | Economic    | 0       | \$12,600,000  |
| New Wolf Creek - Neosho 345 kV line                                                       | WERE          | Reliability | 99      | \$117,126,900 |
| New Tolk - Tuco 345 kV                                                                    | SPS           | Reliability | 64      | \$75,718,400  |
| New 2nd Holcomb 345/115 kV transformer                                                    | SUNC          | Reliability | 0       | \$12,600,000  |
| New S3740 - S3454 345 kV                                                                  | OPPD          | Reliability | 28      | \$33,126,800  |
| Total                                                                                     |               |             | 355     | \$428,792,760 |

*Table 13.10: Future 5 Portfolio Projects*

## Section 14: Consolidated Portfolio

### 14.1: Development

The five Future portfolios were consolidated into a single final portfolio to be analyzed across all futures.

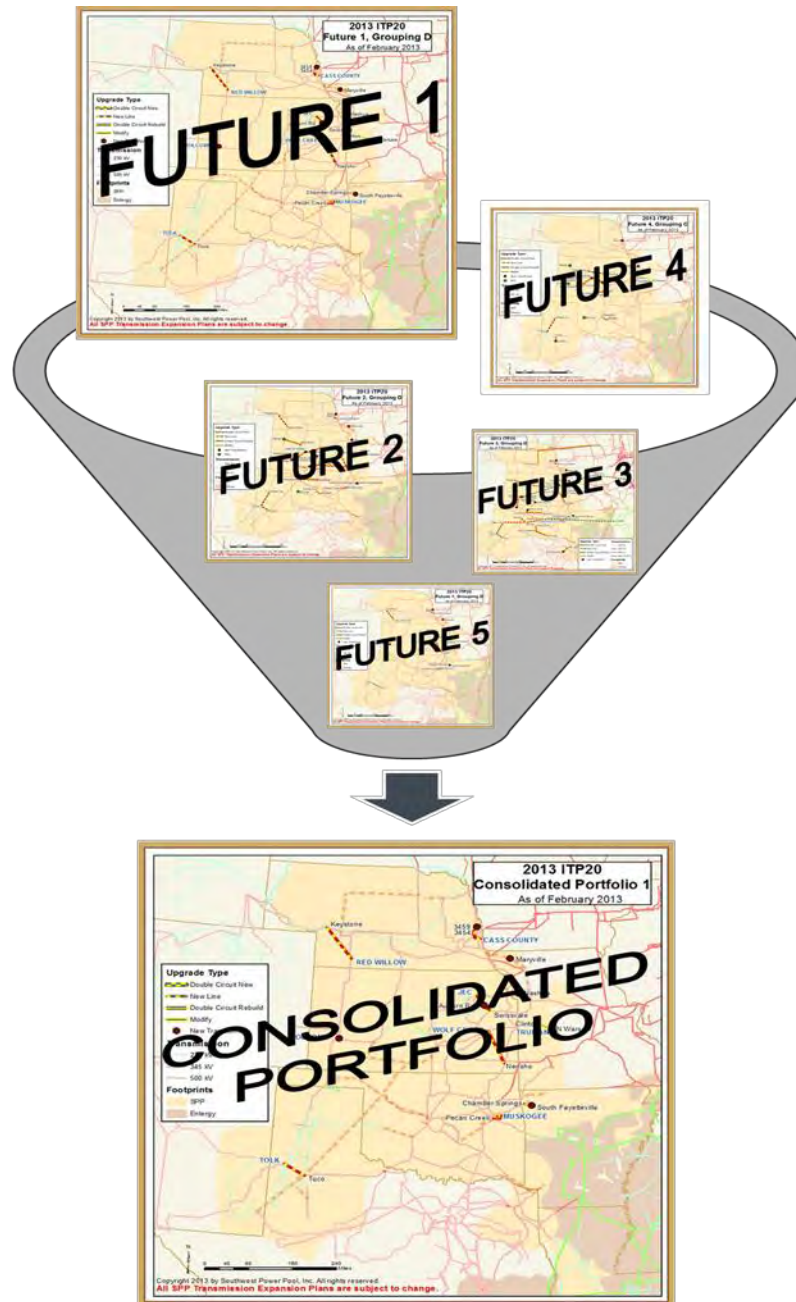


Figure 14.1: Consolidation of Portfolios

This Consolidated Portfolio was developed by weighting each of the futures based on their probability and magnitude of impact. Each future was weighted using a percentage, such that the sum of weights for all futures was 100%. A threshold value of 60% was used along with the weights to consolidate projects across futures. The weightings of each future and the threshold, as approved by the ESWG, are shown in Table 14.1. This table also shows two examples of how projects are treated using these values.

| Portfolio    | Weighting | Threshold | Project X | Project Y |
|--------------|-----------|-----------|-----------|-----------|
| Future 1     | 50%       |           | ✓         | ✗         |
| Future 2     | 15%       |           | ✗         | ✓         |
| Future 3     | 10%       |           | ✓         | ✓         |
| Future 4     | 15%       |           | ✗         | ✓         |
| Future 5     | 10%       |           | ✓         | ✗         |
| Total        | 100%      |           | 70%       | 40%       |
| Consolidated |           | 60%       | ✓         | ✗         |

*Table 14.1: Weightings and Threshold for Consolidated Portfolio Development*

Project X is in the Futures 1, 3, and 5 Portfolios, and has a summed weighting of 70%. This exceeds the 60% threshold to be included in the Consolidated Portfolio. Project Y is in the Futures 2, 3, and 4 Portfolios, and has a summed weighting of 40%. This does not meet the 60% threshold, and the project would not be included in the Consolidated Portfolio. Using these weightings, a project will not be included in the Consolidated Portfolio if it is not included in the Future 1 Portfolio. All of the projects that were included in the Future 1 portfolio were also included in at least one other Future Portfolio. As a result, the Consolidated Portfolio projects are equivalent to the Future 1 Portfolio projects.

## 14.2: Projects

The Consolidated Portfolio projects are shown in Table 14.2.

| Project                                                                                   | Area(s)       | Type        | Future(s)          | Mileage | Cost          |
|-------------------------------------------------------------------------------------------|---------------|-------------|--------------------|---------|---------------|
| New Chamber Springs - S Fayetteville 345 kV, new 345/161 kV transformer at S Fayetteville | AEPW          | Economic    | F1, F2, F3, F5     | 18      | \$33,895,800  |
| Reconductor Clinton - Truman - N Warsaw 161 kV                                            | AECI-SWPA-GMO | Reliability | F1, F2, F3, F4, F5 | 31      | \$16,784,175  |
| New Maryville 345/161 kV transformer                                                      | GMO-AECI      | Reliability | F1, F2, F3, F5     | 0       | \$12,600,000  |
| Increase Nashua 345/161 kV transformer size to 650/715 MVA                                | KCPL          | Reliability | F1, F2, F3, F4, F5 | 0       | \$12,600,000  |
| New Keystone - Red Willow 345 kV                                                          | NPPD          | Reliability | F1, F2             | 110     | \$130,141,000 |
| Reconductor Pecan Creek - Muskogee 345 kV circuit 1                                       | OKGE          | Reliability | F1, F2, F3, F5     | 23      | \$20,408,475  |
| Reconductor Pecan Creek - Muskogee 345 kV circuit 2                                       | OKGE          | Reliability | F1, F2, F3, F5     | 16      | \$14,197,200  |
| New 2nd S3459 345/161 kV transformer                                                      | OPPD          | Economic    | F1, F2, F3, F4, F5 | 0       | \$12,600,000  |
| New Wolf Creek - Neosho 345 kV line                                                       | WERE          | Economic    | F1, F2, F3, F5     | 99      | \$117,126,900 |
| New Tolk - Tuco 345 kV                                                                    | SPS           | Reliability | F1, F2, F3, F5     | 64      | \$75,718,400  |
| New 2nd Holcomb 345/115 kV transformer                                                    | SUNC          | Reliability | F1, F5             | 0       | \$12,600,000  |
| New S3740 - S3454 345 kV                                                                  | OPPD          | Reliability | F1, F2, F3, F5     | 28      | \$33,126,800  |
| Rebuild JEC - Auburn - Swissvale 230 kV to 345 kV, new Auburn 345/115 kV transformer      | WERE          | Reliability | F1, F3             | 47      | \$68,205,700  |
| Total                                                                                     |               |             |                    | 436     | \$560,004,450 |

*Table 14.2: Consolidated Portfolio Projects*

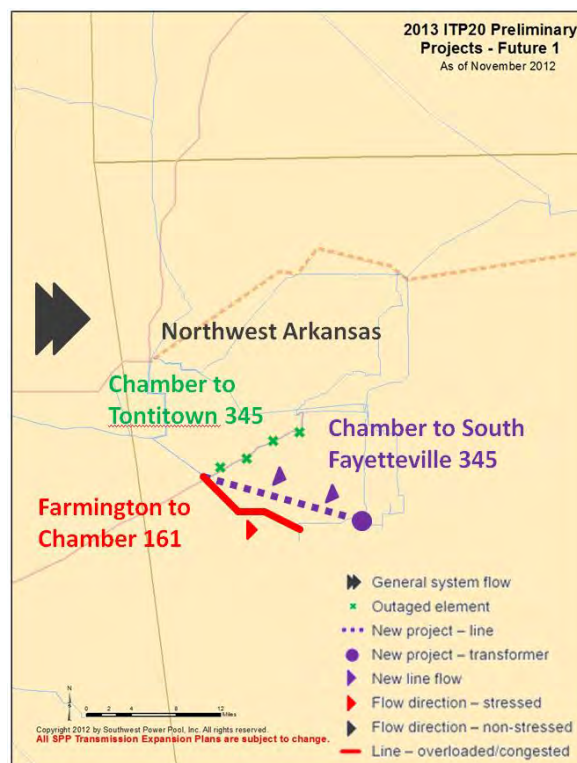


The project details that follow summarize the 2033 system behavior both with and without each project for Future 1.

### Chamber Springs – South Fayetteville 345 kV

Northwest Arkansas shows a general west to east flow of power. When the Chamber Springs – Tontitown 345 kV line is in outage, there is a 161 kV line from Chamber Springs – Farmington – South Fayetteville that delivers most of the power east to south Fayetteville and east Fayetteville, resulting in congestion of the Chamber Springs – Farmington 161 kV line. This constraint is a reliability need for the Summer Peak hour, and is also a Top 15 economic need.

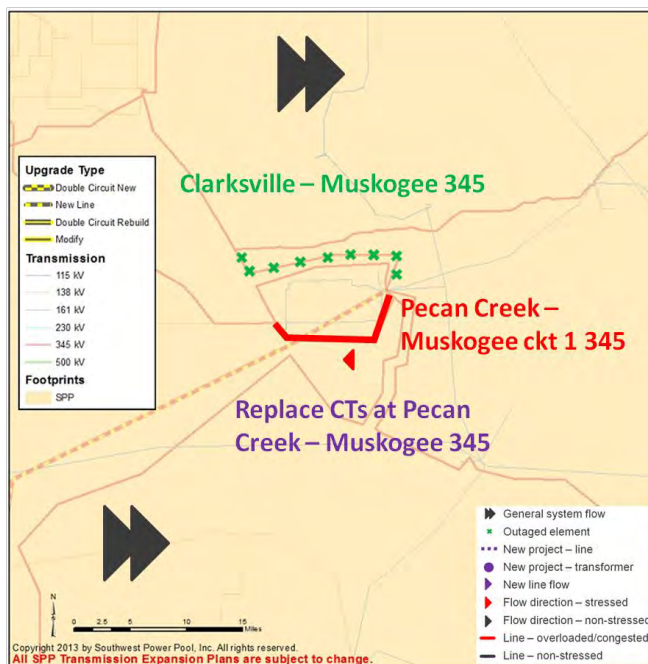
The addition of the 18 mile Chamber Springs – South Fayetteville 345 kV line and 345/161 kV transformer at south Fayetteville provides a more robust path to serve load across south Fayetteville and east Fayetteville for the loss of Chamber Springs – Tontitown 345 kV. It also provides future flexibility for a 345 kV loop around the Northwest Arkansas area, if that need should arise. This project mitigates the reliability need, and has a one-year B/C ratio of 3.73.



### Pecan Creek – Muskogee 345 kV

Eastern Oklahoma shows a general west to east flow of power. Muskogee has significant generation; on the 345 kV system, power flows from Muskogee outward to Clarksville, Fort Smith, Canadian River, and Pecan Creek. For the outage of Clarksville – Muskogee 345 kV, there is increased power flow on the two circuits from Muskogee – Pecan Creek, causing binding constraints on these lines.

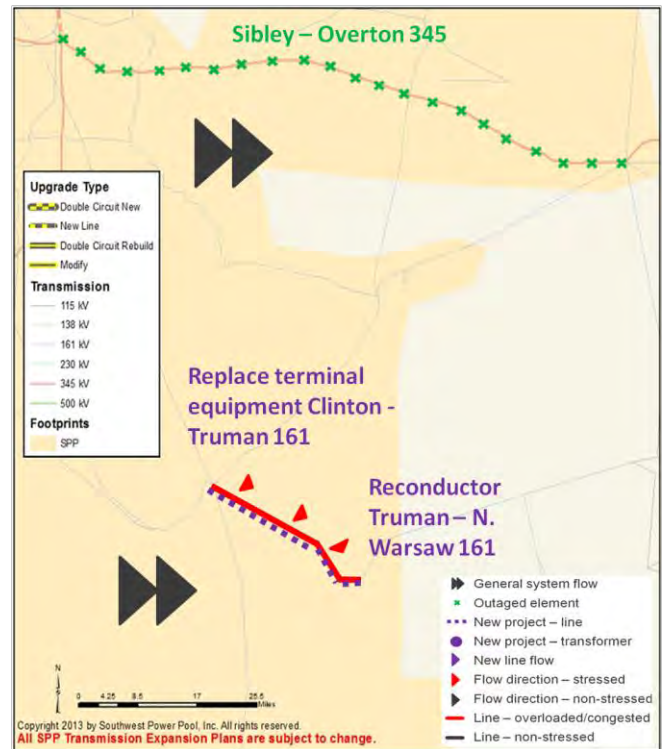
The reconductor of Pecan Creek and Muskogee will increase the limits on these 345 kV lines from 717/717 MVA to 1195/1195 MVA, mitigating the congestion.



### Clinton – Truman – N Warsaw 161 kV

On the east side of Kansas City, Missouri shows a general west to east flow of power. The only EHV lines to facilitate this flow of power are Sibley–Overton 345 kV and Neosho – Morgan – Huben 345 kV. When the Sibley – Overton 345 kV line is in outage, there is significant west to east flow on the underlying 161 kV system, particularly the Clinton – Truman and Truman – N Warsaw 161 kV lines. These two constraints are both Top 15 economic needs, and Truman – N Warsaw 161 kV is a binding constraint for the Summer Peak and Winter Peak hours.

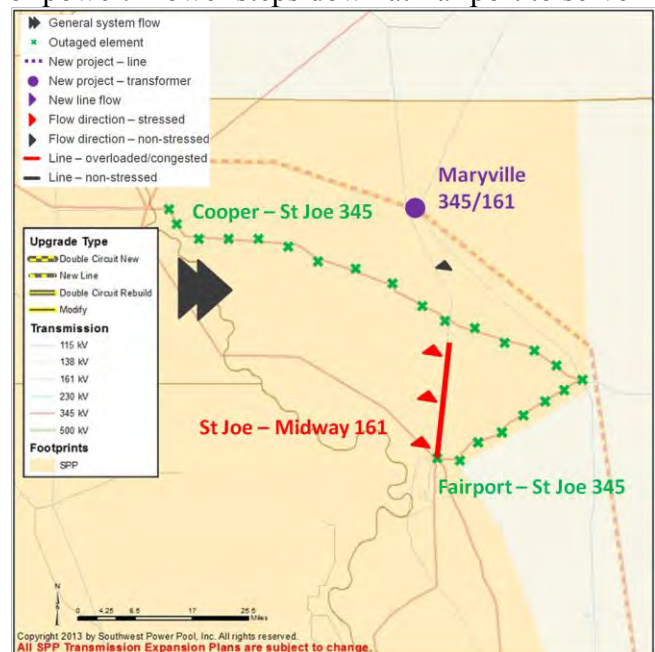
Upgrading the 31 mile Clinton – Truman – N Warsaw 161 kV line and substation equipment mitigates the west to east congestion on this line, provides a one-year benefit of \$25.9M, and provides a one-year B/C of 8.87. This project includes a reconductor of the two mile Truman – N Warsaw 161 kV, and substation equipment upgrades at Truman 161 kV. This lower voltage project is included in the 2013 ITP20 Consolidated Portfolio since there is a potential to share the cost with AECI. SPP has reviewed this project with AECI. Throughout 2013 SPP will work with AECI to evaluate the potential benefit that this project may provide to both regions.



### Maryville 345/161 kV Transformer

Northwest Missouri shows a general west to east flow of power. Power steps down at Fairport to serve the 161 kV system in this area. When the two 345 kV lines into Fairport are in outage (Cooper – Fairport 345 kV and St. Joe – Fairport 345 kV), flows increase on some of the 161 kV lines. St. Joe – Midway 161 kV is binding for the loss of these two lines, due to south to north flows to serve load in the Maryville area.

The addition of the Maryville 345/161 kV transformer along with the Nebraska City – Sibley 345 kV line (NTC's issued in 2010) mitigates the congestion of the St. Joe – Midway 161 kV reliability need. It does so by providing counter flow to the south to north flows on the 161 kV systems that are serving load in the Maryville area.

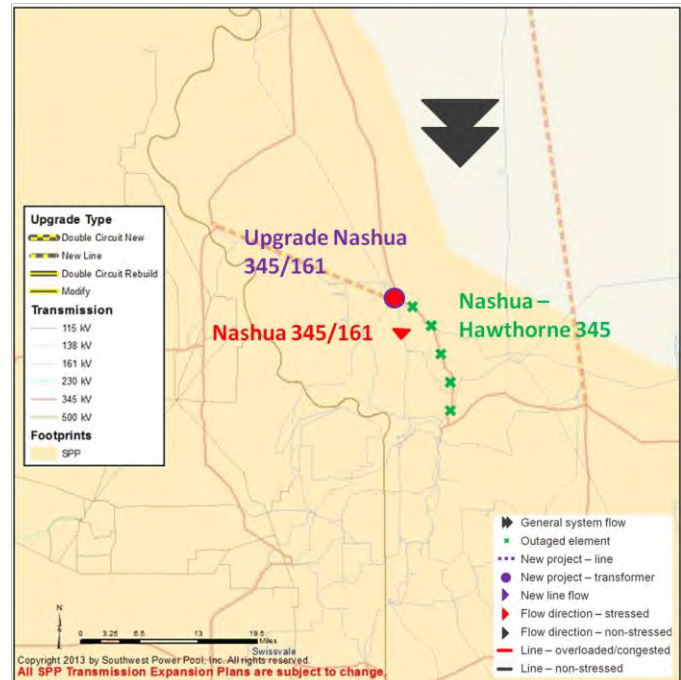




### Upgrade Nashua 345/161 kV Transformer

The north side of Kansas City shows a general north to south flow of power into the city. The Nashua – Hawthorne 345 kV line delivers significant power south to Hawthorne, where it steps down to the 161 kV system in Kansas City. When the Nashua – Hawthorne 345 kV line is out of service, it causes increased power flow to step down at the Nashua 345/161 kV transformer to serve the load in northern Kansas City. This transformer is a binding reliability need.

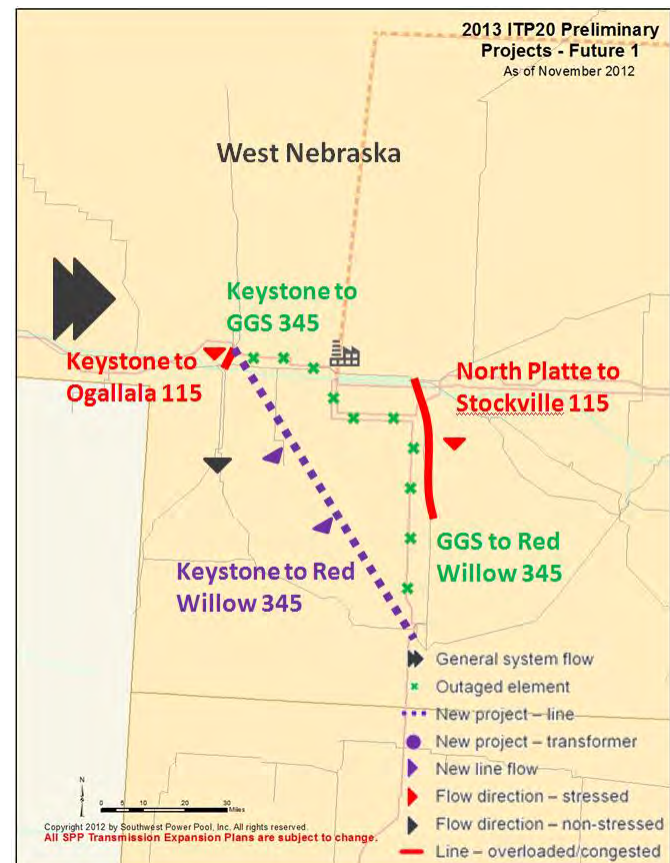
Upgrading the Nashua 345/161 kV transformer to 650/715 MVA provides the necessary capacity to mitigate the congestion at this transformer due to the loss of the Nashua – Hawthorne 345 kV line.



### Keystone – Red Willow 345 kV

Western Nebraska shows a general west to east flow of power, due largely to the Laramie River generation in Wyoming and the Gerald Gentleman generation. There is also some north to south flow from the Gerald Gentleman area. When one of the Gentleman – Red Willow 345 kV or Gentleman – Keystone 345 kV lines is out of service, there is significant north to south flow on the 115 kV network in this area. Two separate elements in this 115 kV network experience congestion: Keystone – Ogallala 115 kV is binding for the Summer Peak hour, and North Platte – Stockville 115 kV is a Top 15 economic need.

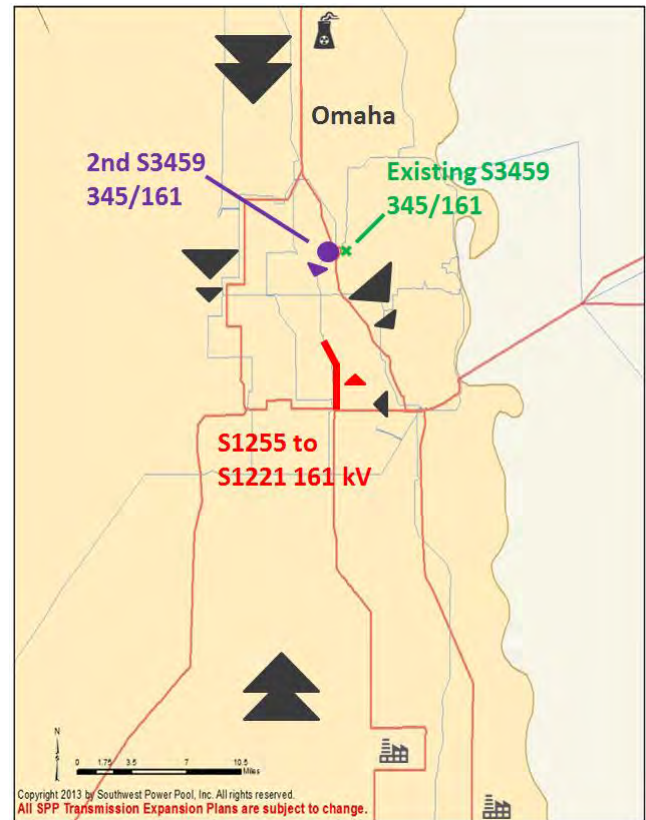
The addition of the 110 mile Keystone – Red Willow 345 kV line provides an alternative north to south EHV path when one of the Gentleman – Red Willow 345 kV or Gentleman – Keystone 345 kV lines go out of service. This relieves the congestion on the underlying 115 kV system at Keystone – Ogallala and at North Platte – Stockville.



### S3459 345/161 kV Transformer

Omaha Nebraska shows a general north to south flow of power into the city from Ft. Calhoun and Raun generation, and a south to north flow of power into the city from Cass Co and Nebraska City generation. When the S3459 345/161 kV transformer is out of service, much of the power flowing on EHV network from the north into the city must loop around to the south to step down to a lower voltage level. This is the same area in which power is being delivered from the Cass Co and Nebraska City generators in the south, creating a large bottleneck in this area. The S1221 – S1255 161 kV line delivers much of the power that flows into central Omaha. This is an area of heavy congestion, as it is a top 5 economic need and is a reliability need for the Summer Peak hour.

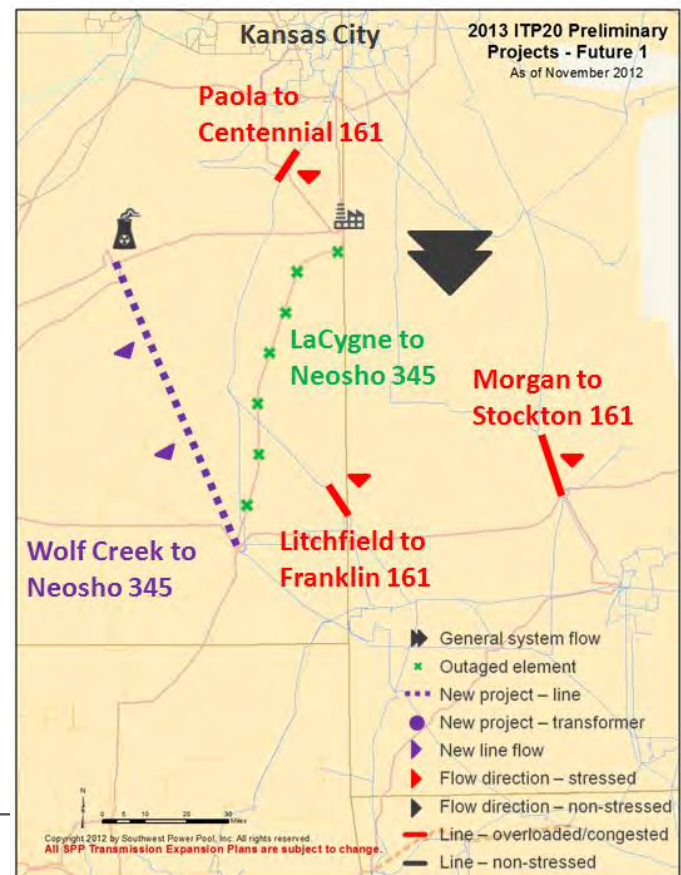
The addition of a second S3459 345/161 kV transformer provides a backup to the first transformer going out of service. An EHV transformer in this area is critical, as it helps deliver power from the north to the load in central Omaha without the need for power to loop around to south Omaha to step down to lower voltage. This project mitigates the reliability need and has a one-year B/C ratio of 27.76.



### Wolf Creek – Neosho 345 kV

The area south of Kansas City shows a general north to south flow of power. The large Wolf Creek and LaCygne generators deliver significant power south on the LaCygne – Neosho 345 kV line. When this line is out of service, the large flows on the underlying 161 kV network result in three different elements binding as reliability needs: Paola – Centennial 161 kV, Litchfield – Franklin 161 kV, and Morgan – Stockton 161 kV. Morgan – Stockton 161 kV is also a Top 15 economic need.

The addition of the 99 mile Wolf Creek – Neosho 345 kV line mitigates congestion on all three of these 161 kV elements by providing an alternative EHV path for north to south flow when LaCygne – Neosho 345 kV is out of service. This project also has a one-year B/C ratio of 1.41.

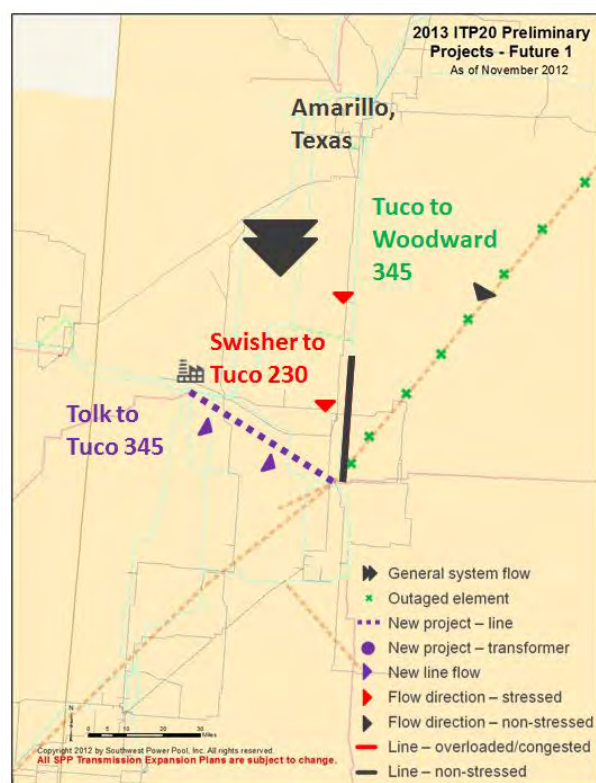




### Tolk – Tuco 345 kV

North Texas shows a general north to south flow of power. When the Tuco – Woodward 345 kV line is out of service, the 230 kV and 115 kV lines between Amarillo and Lubbock have large north to south flows. The Swisher – Tuco 230 kV line is binding in the High Wind hour for this contingency.

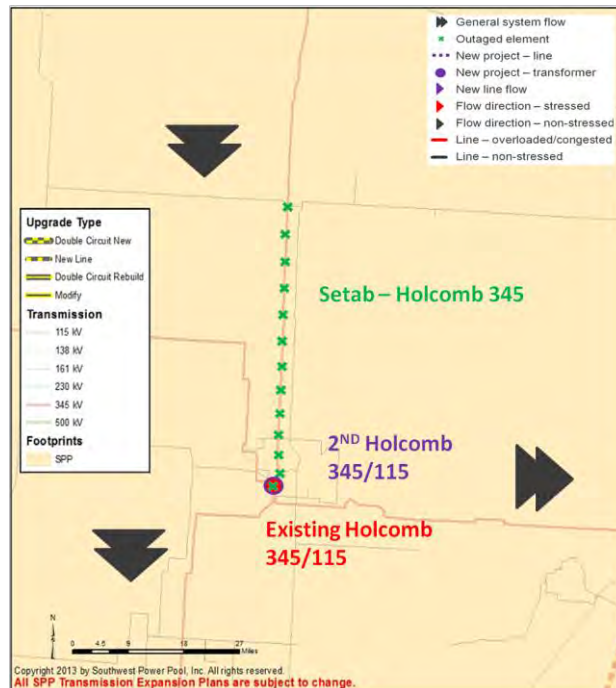
The addition of the 64 mile Tolk – Tuco 345 kV line allows for the large Tolk generator to deliver power east to Tuco. This relieves the north to south congestion of the Swisher – Tuco 230 kV line by delivering power west to east from the Tolk generation.



### Holcomb 345/115 kV Transformer

West Kansas shows a general north to south flow of power, and a west to east flow of power. Holcomb has significant generation. Some serves local load through the 115 kV system, and some steps up to the 345 kV system to deliver power to the south and to the west. When the Setab – Holcomb 345 kV line is out of service, there is significant power stepping up on the Holcomb 345/115 kV transformer, causing it to overload.

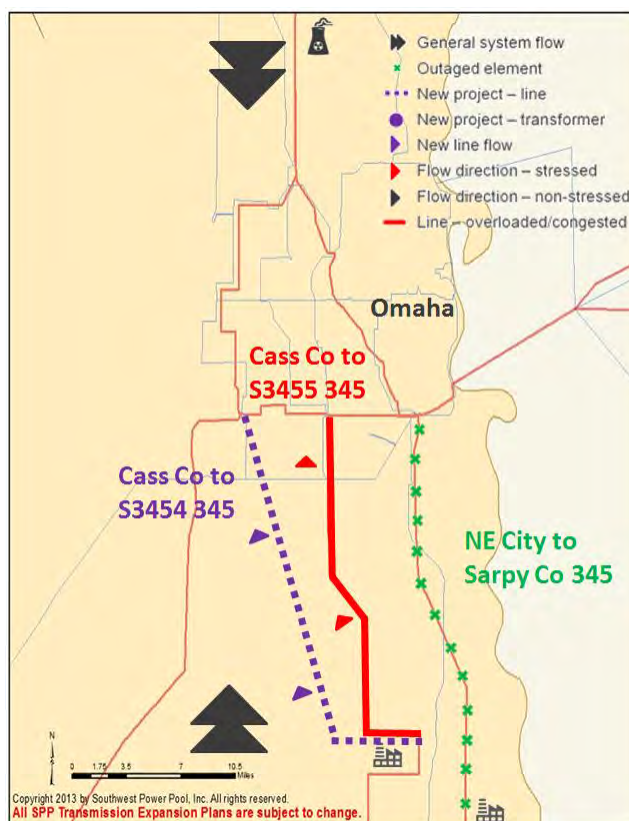
The addition of the 2<sup>nd</sup> Holcomb 345/115 kV transformer allows for greater power transfer to the 345 kV system, to serve loads to the east and to the south. This project relieves the congestion at the existing Holcomb 345/115 kV transformer and mitigates the reliability need.



**S3740 – S3454 345 kV**

Omaha, Nebraska shows a general south to north flow of power into the city from Cass Co and Nebraska City generation. When the Nebraska City – Sarpy Co 345 kV line is out of service, the S3740 – S3455 345 kV line is the primary path for the Nebraska City and Cass Co generation that is delivered to Omaha, causing a binding constraint in the Summer Peak hour.

The addition of the 28 mile S3740 (Cass Co) – S3454 (SW Omaha) 345 kV line creates an alternative path for the Nebraska City and Cass Co generation to be delivered to Omaha, mitigating this reliability need for the loss of the Nebraska City – Sarpy 345 kV line.

**JEC – Auburn – Swissvale 345 kV**

The area west of Kansas City shows a general west to east flow of power. When the Hoyt – Stranger Creek 345 kV line is out of service, much of the west to east flow of power on the JEC – Hoyt – Stranger 345 kV line then steps down to the 115 kV system at Hoyt. This causes large flows on the 115 kV system, and the Goodyear – Northland 115 kV line is a reliability need for the Summer Peak hour.

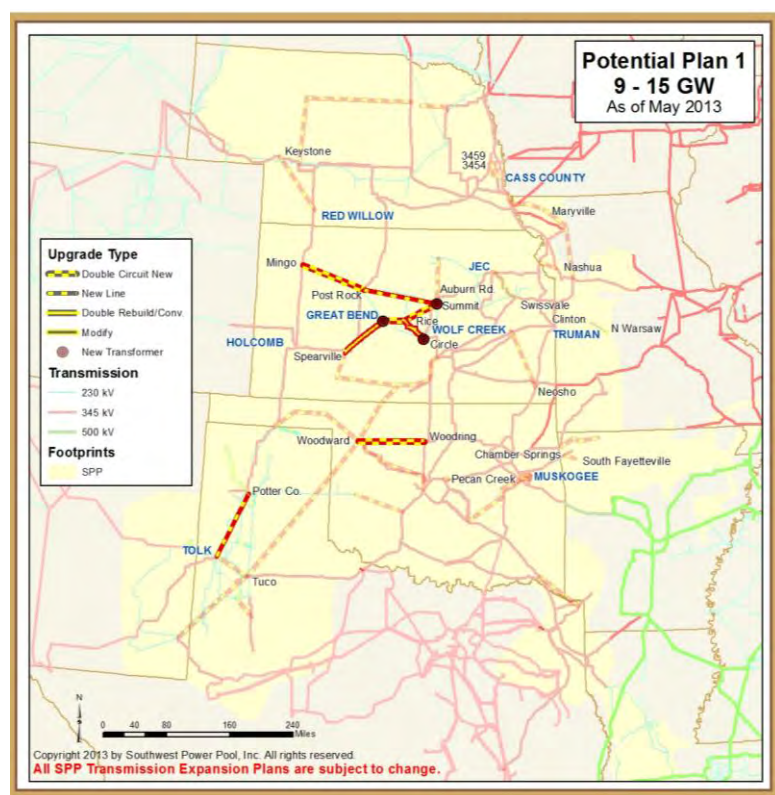
A rebuild of the 47 mile JEC – Auburn– Swissvale 230 kV line to 345 kV, along with a 345/115 kV transformer at Auburn, provides an additional west to east path for delivering power to Lawrence and Kansas City when one of the JEC – Hoyt or Hoyt – Stranger Creek 345 kV lines is out of service. This project mitigates the Goodyear – Northland 115 kV reliability need by providing counter flow north of Swissvale to the Lawrence area.



## Section 15: Potential Project Plans

Portfolios for Futures 2 – 4 include numerous projects that are not included in the Consolidated Portfolio. These additional projects are needed for the delivery of increased wind generation in these futures. Three groupings of potential projects were developed, highlighting projects that would be needed to facilitate additional wind capacity beyond the 9 GW of wind assumed in Future 1. These groupings do not include all upgrades necessary to meet the high wind needs of all futures. Instead they highlight the main areas of transmission expansion that would be needed in higher wind scenarios.

Potential Plan 1 includes projects shown to be needed in most or all of Futures 2 – 4 to help accommodate increased wind levels of 9 – 15 GW in SPP.



### Potential Plan 1

9 – 15 GW Wind

Incremental Cost: \$1.3B

Figure 15.1: Potential Plan 1

Potential Plan 2 includes additional AC upgrades needed for 15 – 25 GW of wind in SPP. These upgrades are geared toward wind exports, similar to Future 3.



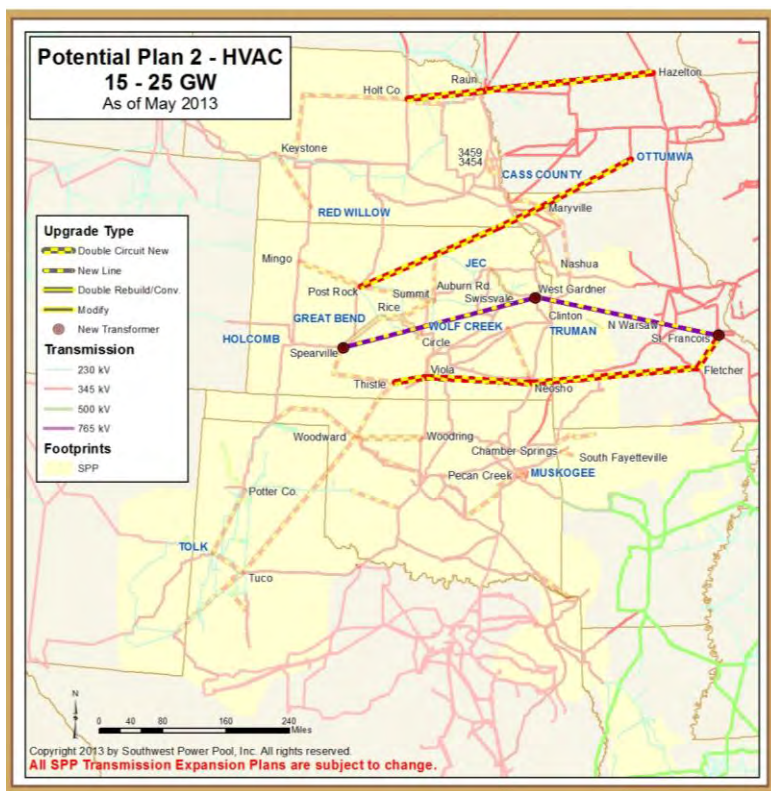


Figure 15.2: Potential Plan 2

## Potential Plan 2

15 – 25 GW Wind

Incremental Cost: \$4.9B

Potential Plan 3, similar to Potential Plan 2, includes upgrades needed to support 15 – 25 GW of wind capacity in SPP. These upgrades are geared toward wind exports, similar to Future 3. The Potential Plan 3 upgrades are primarily DC projects, and include two HVDC lines from wind-rich areas in the western portions of SPP to higher load areas east of SPP.

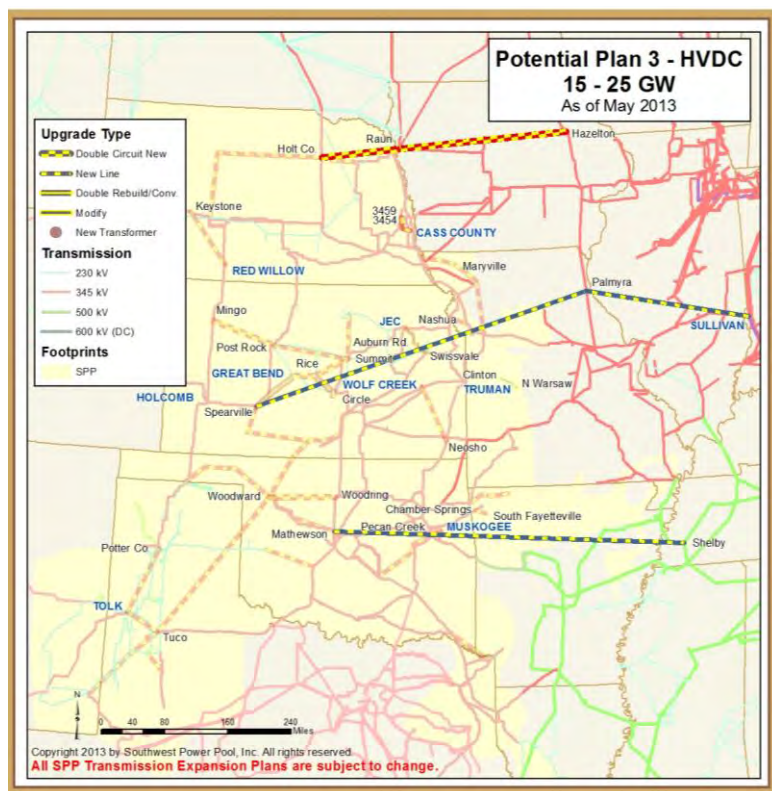


Figure 15.3: Potential Plan 3

### Potential Plan 3

15 – 25 GW Wind

Incremental Cost: \$5.1B

Although Potential Plan projects are not included in the recommended Consolidated Portfolio, these plans show projects that would be valuable to SPP should the “business as usual” change to include higher wind levels.



## Section 16: Benefits

Multiple metrics were used to identify benefits for the Consolidated Portfolio. The ESWG directed that the 2013 ITP20 benefit/cost results be focused on the final portfolio projects, including reliability, policy and economic projects. The benefit structure shown in Figure 16.1 illustrates the benefit metrics that were calculated as incremental benefit due to the Consolidated Portfolio projects.

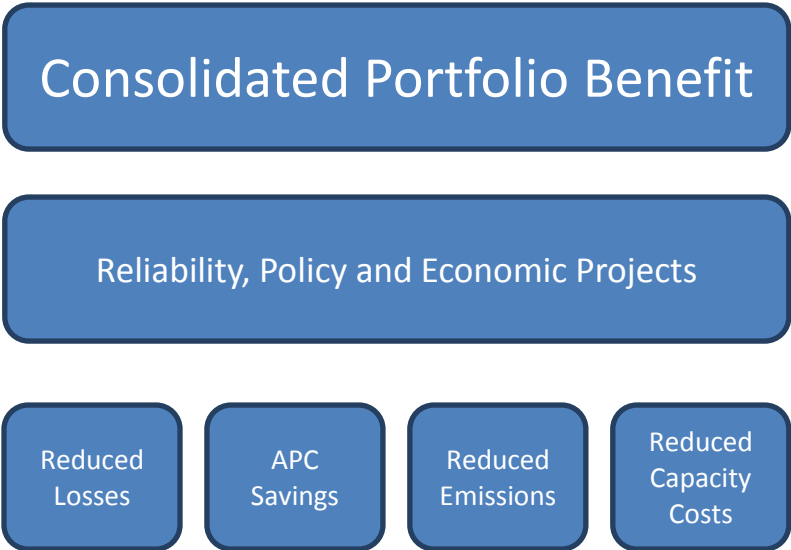
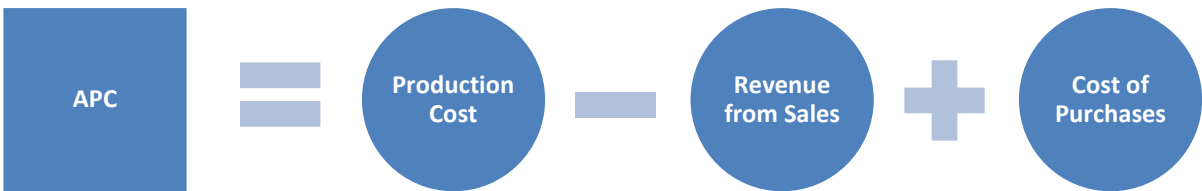


Figure 16.1: Benefit Hierarchy

### 16.1: APC Savings

Adjusted Production Cost (APC) is a measure of the impact on production cost savings by Locational Marginal Prices (LMP), accounting for purchases and sales of energy between each area of the transmission grid. APC is determined from using a production cost modeling tool that accounts for hourly commitment and dispatch profiles during the simulation year. The calculation, performed on an hourly basis, is as follows:



$$\begin{aligned} \text{Revenue from Sales} &= \text{MW Exported} \times \text{Zonal LMP}_{\text{Gen Weighted}} \\ \text{Cost of Purchases} &= \text{MW Imported} \times \text{Zonal LMP}_{\text{Load Weighted}} \end{aligned}$$

Figure 16.2: APC Calculation

APC captures the monetary cost associated with fuel prices, run times, grid congestion, unit operating costs, energy purchases, energy sales, and other factors that directly relate to energy production by

generating resources in the SPP footprint. Additional transmission projects aim to relieve system congestion and reduce costs via some combination of a more economical generation dispatch, more economical purchases, and optimal revenue from sales.

To calculate the benefits over the expected 40-year life of the projects<sup>24</sup>, three years were analyzed, 2023, 2028 and 2033, and the APC savings calculated. To determine the annual growth for each of the 40 years:

- The slope between the three points was used to extrapolate the benefits for every year beyond 2033 over a 40-year timeframe, with a terminal value used after year 20.
- Each year's benefit was then discounted to 2033 using an 8% discount rate.
- The sum of all discounted 2033 benefits was further deflated to 2013, using a 2.5% inflation rate and presented as the Net Present Value (NPV) benefit.
- Project cost were depreciated linearly over the 40-year timeframe
- Each year's depreciated costs were then discounted and deflated to 2013 using the same assumptions (8% discount rate and 2.5% inflation rate) that were used to develop the 40-Year benefit results.

Four different values are calculated and shown in Table 16.1 for each future:

- Benefit
  - 40-Year Net Present Value (NPV) benefit showing the full APC benefit expected over the 40 year lifetime of the transmission projects
- Cost
  - 40-Year NPV costs showing the full costs expected to be paid over the 40 year lifetime of the transmission projects
- Net Benefit
  - Benefit minus cost
- B/C
  - Benefit divided by cost

|             | Future 1 | Future 2 | Future 3 | Future 4 | Future 5 |
|-------------|----------|----------|----------|----------|----------|
| Benefit     | \$2.36   | \$2.00   | \$2.76   | \$1.48   | \$2.11   |
| Cost        | \$0.85   | \$0.85   | \$0.85   | \$0.85   | \$0.85   |
| Net Benefit | \$1.51   | \$1.16   | \$1.91   | \$0.63   | \$1.26   |
| B/C         | 2.79     | 2.37     | 3.26     | 1.75     | 2.49     |

*Table 16.1: APC Results for SPP (\$ are in Billions)*

Figure 16.3 shows the APC benefit and B/C by future. The dashed line shows the point at which APC benefit matches the cost of the projects ( $B/C = 1.0$ ). The Consolidated Portfolio provides the SPP region with APC benefits that exceed the costs, for all futures.

<sup>24</sup> The SPP OATT requires that the portfolio be evaluated using a forty-year financial analysis.

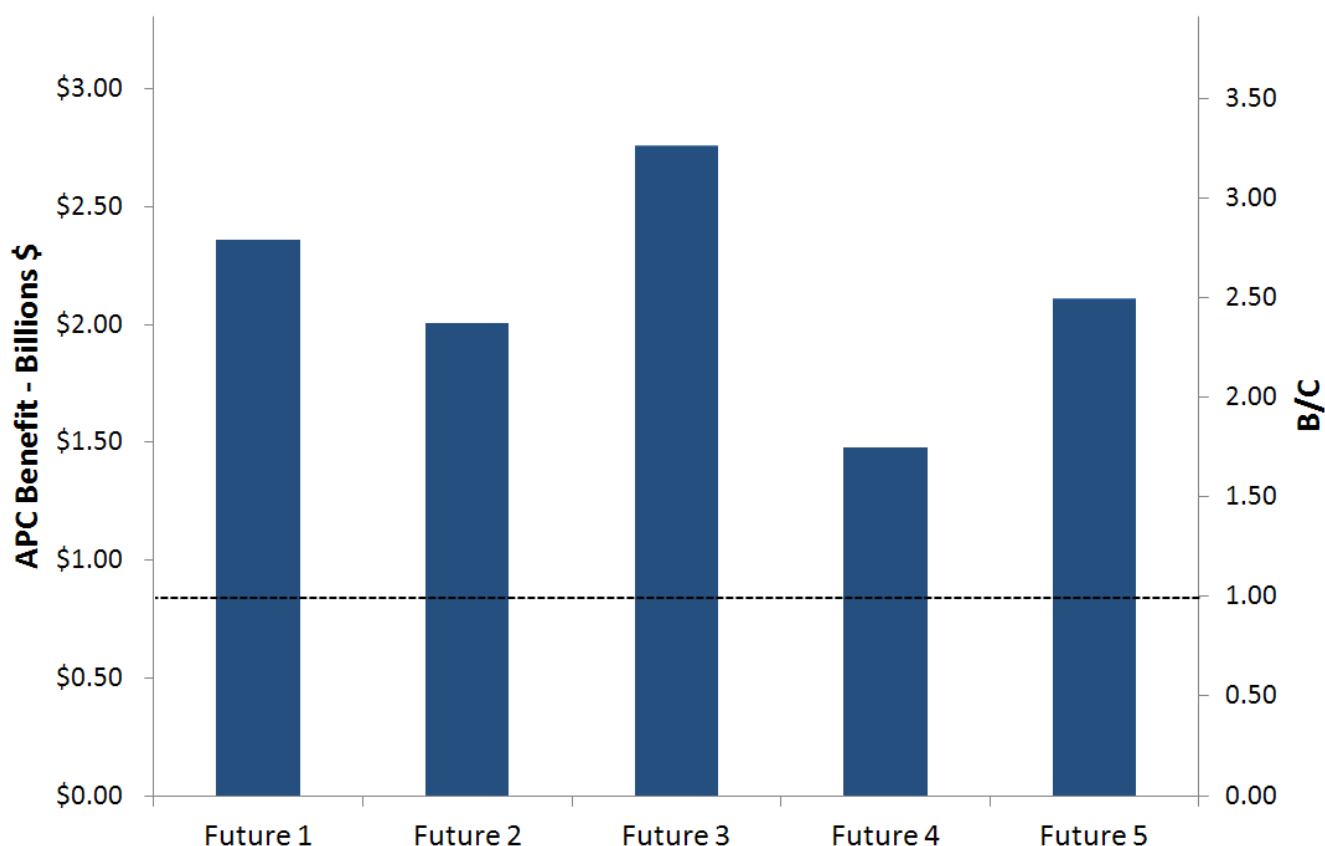


Figure 16.3: APC Benefits and B/C for SPP

## 16.2: Reduced Emissions

Additional transmission may result in a lower fossil fuel burn (for example, less coal-intensive generation), resulting in less SO<sub>2</sub>, NO<sub>x</sub>, and CO<sub>2</sub> emissions. Such a reduction in emissions is a benefit that is already monetized through the APC savings metric, based on the assumed allowance prices for these effluents. (Note that a CO<sub>2</sub> allowance price is only utilized in Future 4).

The allowance market dynamics that take place separately from events in the energy market is not considered in this metric. Rather, a simplified approach, that assumes allowances are sold and purchased at known market clearing price, is applied and these allowance prices are included in the calculation of marginal production costs.

The changes in emissions associated with the Consolidated Portfolio are shown in Table 16.2 for all futures. Note that negative values for decreases in emissions indicate increases in emissions. The results indicated that emissions increased in all futures except Future 4 when the Consolidated Portfolio was added.

| Future | Effluent        | Unit of Measure   | Base | Consolidated Portfolio | Decrease in Emissions | % Decrease in Emissions |
|--------|-----------------|-------------------|------|------------------------|-----------------------|-------------------------|
| F1     | NO <sub>x</sub> | Thousands of Tons | 149  | 150                    | -1.85                 | -1.2%                   |
| F2     | NO <sub>x</sub> | Thousands of Tons | 142  | 144                    | -1.79                 | -1.3%                   |
| F3     | NO <sub>x</sub> | Thousands of Tons | 138  | 140                    | -2.28                 | -1.7%                   |
| F4     | NO <sub>x</sub> | Thousands of Tons | 95   | 94                     | 1.02                  | 1.1%                    |
| F5     | NO <sub>x</sub> | Thousands of Tons | 94   | 96                     | -1.92                 | -2.0%                   |
| F1     | SO <sub>2</sub> | Thousands of Tons | 196  | 198                    | -2.50                 | -1.3%                   |
| F2     | SO <sub>2</sub> | Thousands of Tons | 183  | 185                    | -2.32                 | -1.3%                   |
| F3     | SO <sub>2</sub> | Thousands of Tons | 175  | 178                    | -3.11                 | -1.8%                   |
| F4     | SO <sub>2</sub> | Thousands of Tons | 119  | 118                    | 1.07                  | 0.9%                    |
| F5     | SO <sub>2</sub> | Thousands of Tons | 131  | 133                    | -2.64                 | -2.0%                   |
| F1     | CO <sub>2</sub> | Millions of Tons  | 228  | 231                    | -2.75                 | -1.2%                   |
| F2     | CO <sub>2</sub> | Millions of Tons  | 213  | 216                    | -2.78                 | -1.3%                   |
| F3     | CO <sub>2</sub> | Millions of Tons  | 209  | 212                    | -3.68                 | -1.8%                   |
| F4     | CO <sub>2</sub> | Millions of Tons  | 176  | 176                    | 0.14                  | 0.1%                    |
| F5     | CO <sub>2</sub> | Millions of Tons  | 130  | 131                    | -1.51                 | -1.2%                   |

*Table 16.2: Reduction in Emissions with Consolidated Portfolio (2033)*

The change in emission rates for each future is shown in Table 16.3.

| Future | Effluent        | Unit of Measure | Base | Consolidated Portfolio | Decrease in Emission Rate | % Decrease in Emission Rate |
|--------|-----------------|-----------------|------|------------------------|---------------------------|-----------------------------|
| F1     | NO <sub>x</sub> | Lbs/GWh Gen     | 991  | 993                    | -1.70                     | -0.2%                       |
| F2     | NO <sub>x</sub> | Lbs/GWh Gen     | 1039 | 1040                   | -1.25                     | -0.1%                       |
| F3     | NO <sub>x</sub> | Lbs/GWh Gen     | 1035 | 1035                   | -0.59                     | -0.1%                       |
| F4     | NO <sub>x</sub> | Lbs/GWh Gen     | 737  | 726                    | 11.07                     | 1.5%                        |
| F5     | NO <sub>x</sub> | Lbs/GWh Gen     | 676  | 685                    | -9.76                     | -1.4%                       |
| F1     | SO <sub>2</sub> | Lbs/GWh Gen     | 1305 | 1308                   | -2.67                     | -0.2%                       |
| F2     | SO <sub>2</sub> | Lbs/GWh Gen     | 1340 | 1342                   | -1.67                     | -0.1%                       |
| F3     | SO <sub>2</sub> | Lbs/GWh Gen     | 1314 | 1317                   | -2.34                     | -0.2%                       |
| F4     | SO <sub>2</sub> | Lbs/GWh Gen     | 922  | 910                    | 12.19                     | 1.3%                        |
| F5     | SO <sub>2</sub> | Lbs/GWh Gen     | 936  | 949                    | -13.37                    | -1.4%                       |
| F1     | CO <sub>2</sub> | Lbs/MWh Gen     | 1523 | 1525                   | -2.06                     | -0.1%                       |
| F2     | CO <sub>2</sub> | Lbs/MWh Gen     | 1563 | 1565                   | -2.52                     | -0.2%                       |
| F3     | CO <sub>2</sub> | Lbs/MWh Gen     | 1567 | 1569                   | -2.53                     | -0.2%                       |
| F4     | CO <sub>2</sub> | Lbs/MWh Gen     | 1360 | 1353                   | 6.96                      | 0.5%                        |
| F5     | CO <sub>2</sub> | Lbs/MWh Gen     | 927  | 932                    | -5.36                     | -0.6%                       |

*Table 16.3: Change in Emission Rates (2033)*

These rates indicate the pounds of effluent released per GWh of total generation in the region. The results indicate an increase in emission rates for all futures except Future 4 when the Consolidated Portfolio was added.

Further analysis shows that SPP is generating more and exporting more when the Consolidated Portfolio is in place. Figure 16.4 shows the increases in generation by type under Future 1 for the SPP footprint when the Consolidated Portfolio is in place.

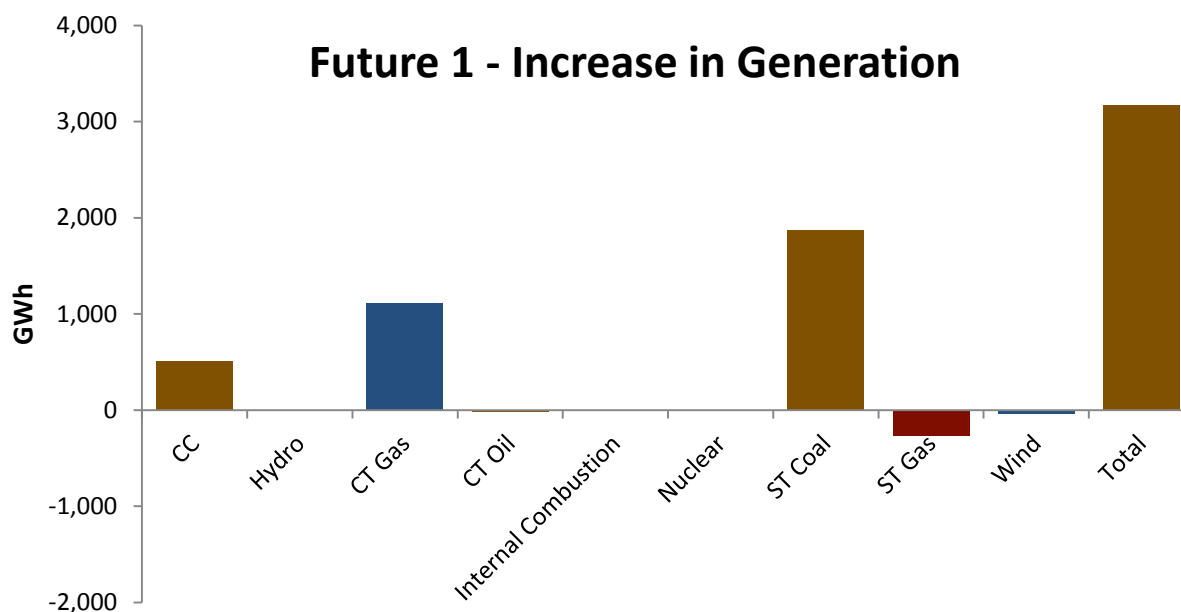


Figure 16.4: Future 1- Increase in Generation with Consolidated Portfolio (2033)

The inclusion of the Consolidated Portfolio leads to over 3,000 GWh of additional generation for 2033, including over 1,800 GWh of additional coal for 2033. The increase in generation associated with additional energy exports leads to increased emissions. Thus there is no reduced emissions benefit in Futures 1, 2, 3, and 5. Future 4 shows reduced emissions with the Consolidated Portfolio in place, because the carbon tax assumed in this future restricts increases in coal and other generation with high carbon emissions.

### **16.3: Reduced Losses**

Transmission line losses result from the interaction of line materials with the energy flowing over the line. This constitutes an inefficiency that is inherent to all standard conductors. Line losses across the SPP system are directly related to system impedance. When additional lines are added to create parallel paths within the footprint, losses are reduced. Figure 16.5 shows the annual change in system losses due to the transmission portfolios.



Figure 16.5: Annual Reduction in Losses

The Consolidated Portfolio provides a reduction in annual losses for every future ranging from 17 GWh to 74 GWh.

#### **16.4: Reduced Capacity Cost Due to Losses**

Utilizing approximations provided by the Benefit Analysis Techniques Task Force (BATTf)<sup>25</sup> of \$750 per kW of installed capacity, the savings achieved by reducing the need for capacity through reduction of losses was estimated to be equal to the peak hour decrease in losses of the change case, multiplied by 112% (to account for the reduction in the planning capacity requirement) also multiplied by an assumed net plant carrying charge (NPCC). The calculation is as follows:



Figure 16.6: Calculating Reduced Capacity Cost Due to Losses

<sup>25</sup> The functions performed by the BATTf are today handled by the ESWG.



Figure 16.7 shows the savings due to the decreased capacity needed to cover system losses.

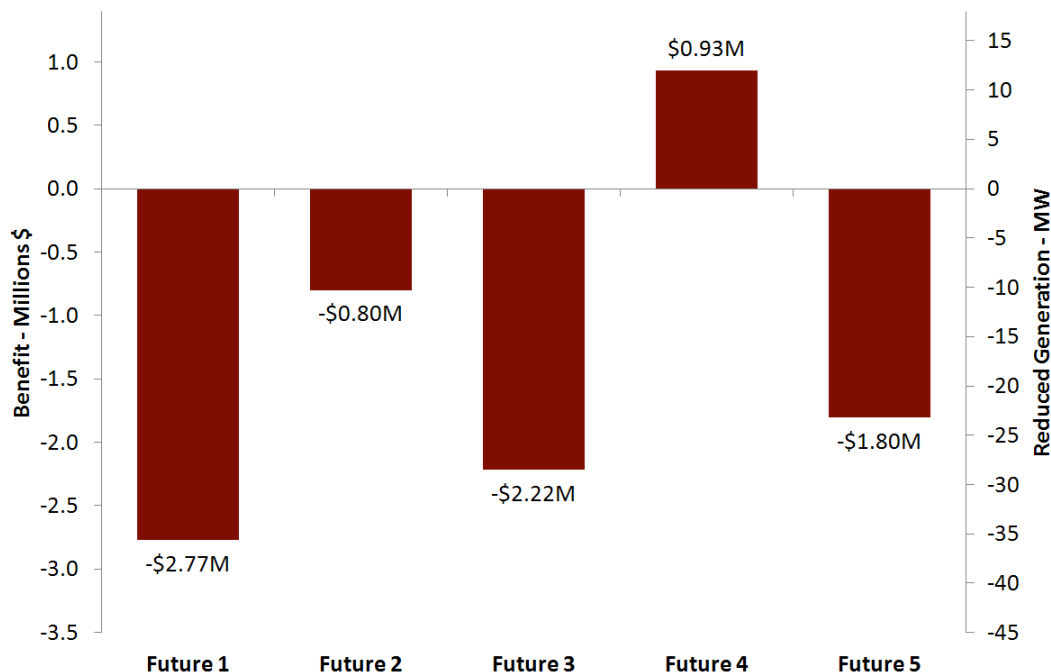


Figure 16.7: Reduced Capacity Cost Savings (\$ millions)

Futures 1, 2, 3, and 5 actually show an increase in peak hour losses with the Consolidated Portfolio, even though they show a decrease in net annual losses. This increase in losses leads to a negative benefit for this metric. Future 4, however, shows a decrease in peak hour losses with the Consolidated Portfolio, leading to a positive benefit of \$930K for reduced capacity costs. While adding a new transmission plan is expected to provide a reduction in losses, there is some fluctuation for the hour to hour figures between increasing and decreasing loss values, while the net annual loss figures are all showing reduced losses with the Consolidated Portfolio. For all futures, it should be noted that the Reduced Capacity Cost savings (or cost) is very minimal compared with APC savings, ranging from only -\$3 million to +\$1 million.

### **16.5: Additional Metrics**

Three additional metrics developed by the MTF were recommended by the ESWG for inclusion in the 2013 ITP20. The ESWG further recommended these new metrics be computed for informational purposes only in this study. Because of this, these metrics are included in the Appendix Section 21: rather than the Benefits section of this report.

### **16.6: Monetized Metric Summary**

The results of the monetized benefit metrics are shown in comparison to the portfolio cost in Table 16.4. The benefits are driven by APC savings, and the reduced capacity costs metric has minimal impact.

|                        | Future 1 | Future 2 | Future 3 | Future 4 | Future 5 |
|------------------------|----------|----------|----------|----------|----------|
| APC Savings            | \$2,357  | \$2,002  | \$2,760  | \$1,478  | \$2,107  |
| Reduced Capacity Costs | -\$3     | -\$1     | -\$2     | \$1      | -\$2     |
| Total Benefit          | \$2,355  | \$2,001  | \$2,757  | \$1,479  | \$2,105  |
| Total Cost (40-Year)   | \$845    | \$845    | \$845    | \$845    | \$845    |
| Net Benefit            | \$1,509  | \$1,156  | \$1,912  | \$634    | \$1,260  |
| B/C                    | 2.79     | 2.37     | 3.26     | 1.75     | 2.49     |

Table 16.4: Monetized Metric Summary (Millions of \$)

## **16.7: Zonal and State APC Benefits and Costs**

The zonal and state breakdown of 40-year APC benefits and costs were computed for the Consolidated Portfolio in Future 1 and are summarized in Table 16.5 and Table 16.6, respectively.

The costs of all projects (economic and reliability) were calculated by zone and state, and compared to the APC savings of the projects by zone and state. Even though reliability projects do not primarily target APC savings, they are still included in the costs here as compared to APC savings.

Project costs were allocated by zone based on the Highway/Byway cost allocation methodology. The Clinton – Truman – N Warsaw 161 kV project is a seams project. If this project were to receive an NTC in the future, it is expected that cost sharing would take place between the SPP RTO, AECI, and SPA. Even though upgrades would take place solely on AECI and SPA facilities, this project provides economic benefit to SPP by enabling the west to east flow of power to neighboring areas. The costs of this project have been assigned solely to SPP in the figures shown in this report, to provide conservative estimates. For illustrative purposes, the costs of this project were allocated by zone using Highway funding, since it is a seams project and does not have a host zone.

| Zone   | NPV Benefit     | NPV Cost      | Net Benefit     | B/C    |
|--------|-----------------|---------------|-----------------|--------|
| AEPW   | \$236,947,164   | \$194,689,101 | \$42,258,064    | 1.22   |
| EMDE   | (\$5,432,474)   | \$23,078,647  | (\$28,511,121)  | (0.24) |
| GMO    | (\$114,646,969) | \$36,858,206  | (\$151,505,175) | (3.11) |
| GRDA   | (\$20,904,825)  | \$17,245,583  | (\$38,150,408)  | (1.21) |
| KCPL   | \$825,841,736   | \$69,912,239  | \$755,929,497   | 11.81  |
| LES    | (\$30,047,741)  | \$16,400,211  | (\$46,447,952)  | (1.83) |
| MIDW   | (\$17,128,119)  | \$5,833,065   | (\$22,961,183)  | (2.94) |
| MKEC   | (\$9,186,590)   | \$10,820,758  | (\$20,007,348)  | (0.85) |
| NPPD   | \$93,257,228    | \$57,992,498  | \$35,264,730    | 1.61   |
| OKGE   | \$100,923,910   | \$119,620,094 | (\$18,696,185)  | 0.84   |
| OPPD   | \$1,170,193,994 | \$42,775,808  | \$1,127,418,186 | 27.36  |
| SPCIUT | (\$52,323,686)  | \$13,356,873  | (\$65,680,559)  | (3.92) |
| SUNC   | \$2,254,680     | \$8,876,403   | (\$6,621,723)   | 0.25   |
| SWPS   | \$45,919,679    | \$97,978,579  | (\$52,058,900)  | 0.47   |
| WFEC   | \$5,643,254     | \$28,489,026  | (\$22,845,772)  | 0.20   |
| WRI    | \$126,074,231   | \$101,444,603 | \$24,629,628    | 1.24   |
| Total  | \$2,357,385,471 | \$845,371,691 | \$1,512,013,780 | 2.79   |

Table 16.5: 40-Year APC Benefits &amp; Costs by Zone (\$)

| State | NPV Benefit     | NPV Cost      | Net Benefit     | B/C   |
|-------|-----------------|---------------|-----------------|-------|
| AR    | \$48,100,274    | \$39,521,887  | \$8,578,387     | 1.22  |
| KS    | \$490,159,818   | \$159,833,580 | \$330,326,238   | 3.07  |
| LA    | \$30,092,290    | \$24,725,516  | \$5,366,774     | 1.22  |
| MO    | \$265,292,991   | \$110,347,212 | \$154,945,779   | 2.40  |
| NE    | \$1,233,403,481 | \$117,168,516 | \$1,116,234,964 | 10.53 |
| NM    | \$11,066,643    | \$23,612,838  | (\$12,546,195)  | 0.47  |
| OK    | \$182,788,630   | \$246,062,845 | (\$63,274,216)  | 0.74  |
| TX    | \$96,481,345    | \$124,099,296 | (\$27,617,951)  | 0.78  |
| Total | \$2,357,385,471 | \$845,371,691 | \$1,512,013,780 | 2.79  |

Table 16.6: 40-Year APC Benefits &amp; Costs by State (\$)

## 16.8: Rate Impacts

The rate impact to the average retail residential ratepayer in SPP was computed for the Consolidated Portfolio. With all projects currently staged for 2033, the first year benefits and first year costs were used to calculate rate impacts. Benefits typically grow over time, and costs are depreciated over the 40-year life of the asset. Because 2033 represents the year with the maximum costs and the minimum benefit, the rate impact results are conservative. All 2033 benefits and costs are shown in 2013 \$ using a 2.5% inflation rate.

Rate impact costs and benefits are allocated to the average retail residential ratepayer in each zone using residential retail allocation percentages specific to each zone. Costs and benefits allocated to each zone are divided by zone-specific sales projections to determine the impact per kWh of consumption, and then multiplied by the average monthly consumption in each zone:

$$\text{Rate Impact Cost } \left(\frac{\$}{\text{mo}}\right)_{\text{Zone A}} = \frac{\text{Annual ATRR Cost}_{\text{Zone A}} * \text{Monthly Consumption}_{\text{Zone A}}}{\text{Sales}_{\text{Zone A}}}$$

$$\text{Rate Impact Benefit } \left(\frac{\$}{\text{mo}}\right)_{\text{Zone A}} = \frac{\text{Annual Benefit}_{\text{Zone A}} * \text{Monthly Consumption}_{\text{Zone A}}}{\text{Sales}_{\text{Zone A}}}$$

The retail residential rate impact benefit is subtracted from the retail residential rate impact cost, to obtain a net rate impact cost by zone. If the net rate impact cost is negative, it indicates a net benefit to the zone. The rate impact costs and benefits are shown in Table 16.7.

| Zone   | One-Year ATRR Costs | One-Year Benefit | Rate Impact - Cost | Rate Impact - Benefit | Net Rate Impact Cost (Cost Minus Benefit) |
|--------|---------------------|------------------|--------------------|-----------------------|-------------------------------------------|
| AEPW   | \$20,533,454        | \$10,367,486     | \$0.63             | \$0.32                | \$0.31                                    |
| EMDE   | \$2,434,057         | (\$830,579)      | \$0.38             | (\$0.13)              | \$0.51                                    |
| GMO    | \$3,887,358         | (\$5,491,930)    | \$0.53             | (\$0.75)              | \$1.29                                    |
| GRDA   | \$1,818,856         | (\$664,992)      | \$0.03             | (\$0.01)              | \$0.03                                    |
| KCPL   | \$7,373,498         | \$36,095,797     | \$0.51             | \$2.49                | (\$1.99)                                  |
| LES    | \$1,729,696         | (\$1,026,476)    | \$0.40             | (\$0.24)              | \$0.64                                    |
| MIDW   | \$615,201           | (\$1,434,950)    | \$0.38             | (\$0.88)              | \$1.26                                    |
| MKEC   | \$1,141,243         | (\$723,374)      | \$0.23             | (\$0.15)              | \$0.38                                    |
| NPPD   | \$6,116,348         | \$3,930,450      | \$0.32             | \$0.21                | \$0.12                                    |
| OKGE   | \$12,616,082        | \$4,037,146      | \$0.35             | \$0.11                | \$0.24                                    |
| OPPD   | \$4,511,475         | \$47,941,360     | \$0.39             | \$4.10                | (\$3.71)                                  |
| SPCIUT | \$1,408,722         | (\$2,150,290)    | \$0.34             | (\$0.60)              | \$0.94                                    |
| SPS    | \$10,333,597        | \$8,102,669      | \$0.31             | \$0.37                | (\$0.06)                                  |
| SUNC   | \$936,176           | \$330,869        | \$0.29             | \$0.10                | \$0.18                                    |
| WFEC   | \$3,004,678         | \$333,208        | \$0.30             | \$0.03                | \$0.27                                    |
| WRI    | \$10,699,151        | \$6,336,240      | \$0.48             | \$0.29                | \$0.20                                    |
| Totals | \$89,159,591        | \$105,152,633    |                    |                       | (0.09)                                    |

Table 16.7: Retail Residential Rate Impacts by Zone

There is a monthly net benefit for the average residential ratepayer in SPP of 9 cents. The 9 cents is an average for all SPP zones based on load ratio share. This benefit is representative of a conservative 2033 year in which costs are at their highest while benefits are at their lowest.

## 16.9: Sensitivities

Sensitivities to natural gas price and demand levels were developed by the ESWG to understand the economic impacts associated with variations in certain model inputs. These sensitivities were not used to develop transmission projects or filter out projects. Two confidence intervals were developed using historical market prices and demand levels from the NYMEX and FERC Form No. 714. The standard deviation of the log difference from the normal within the pricing datasets was used to provide a confidence interval. The Natural Gas Price sensitivity had a 95% confidence interval (1.96 standard

deviations) in the positive and negative directions while the Demand Level sensitivity had a 67% confidence interval (1 standard deviation) in the positive and negative directions.

The resulting assumptions are shown in Table 16.8.

| Sensitivity                   | Henry Hub Gas Price<br>2033 (\$/MMBtu) | Peak Demand<br>and Energy |
|-------------------------------|----------------------------------------|---------------------------|
| Expected Natural Gas & Demand | \$5.79 (no change)                     | No change                 |
| High Natural Gas              | \$7.38                                 | No change                 |
| Low Natural Gas               | \$4.19                                 | No change                 |
| High Demand                   | No change                              | 7.5% increase             |
| Low Demand                    | No change                              | 7.5% decrease             |

*Table 16.8: Sensitivities Utilized in 2013 ITP20*

The economic impacts of variation in the model inputs (natural gas price, demand) were captured for the Consolidated Portfolio projects (economic and reliability) within each future. The changes in APC and one-year benefit due to these sensitivities are shown for each future in Figure 16.8 through Figure 16.12.

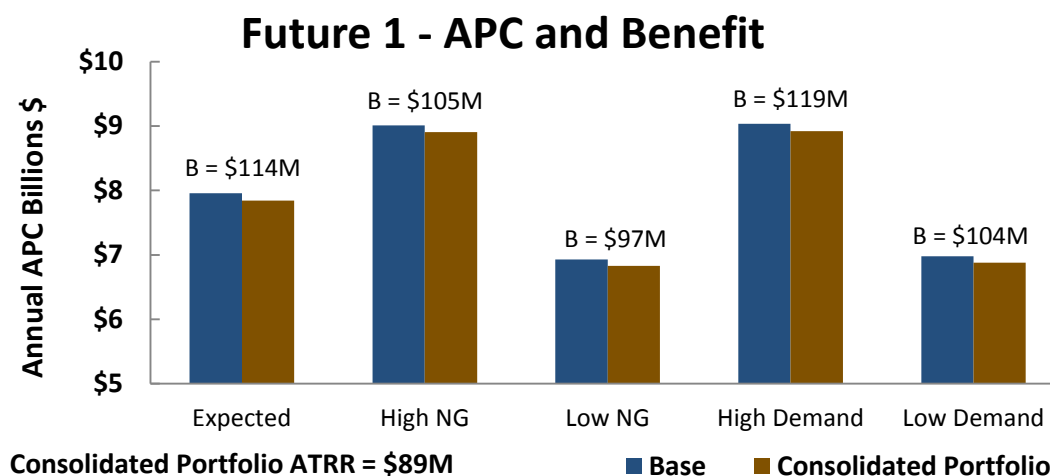


Figure 16.8: Future 1 Sensitivities – APC and Benefit

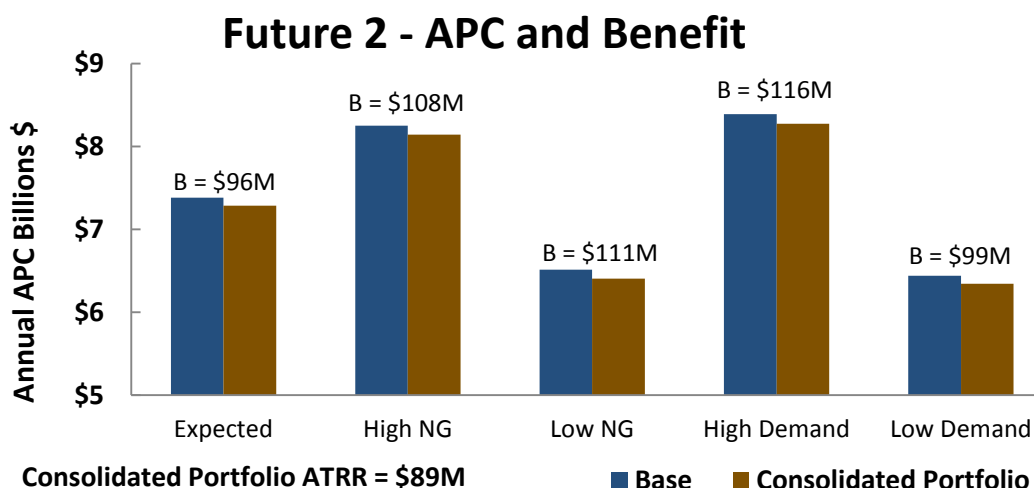


Figure 16.9: Future 2 Sensitivities – APC and Benefit

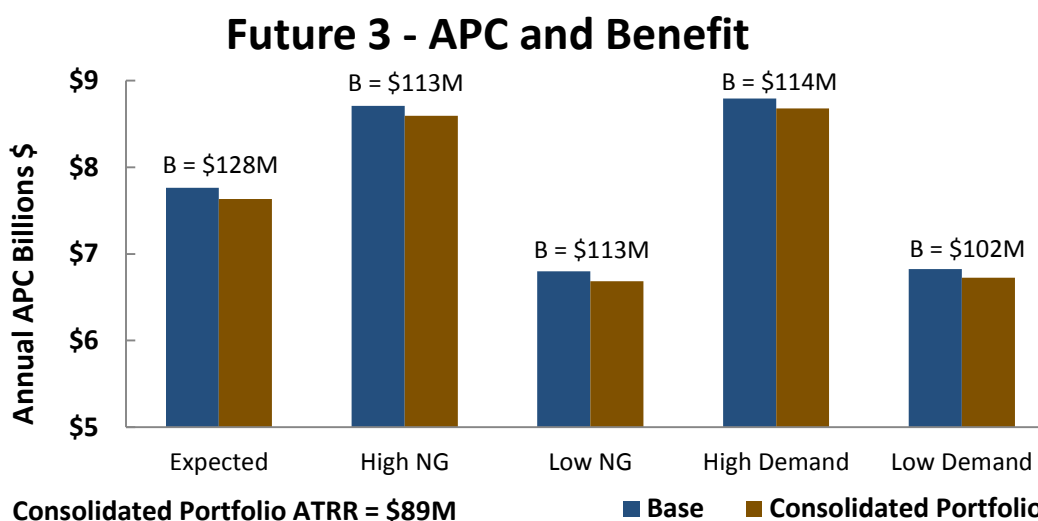


Figure 16.10: Future 3 Sensitivities – APC and Benefit

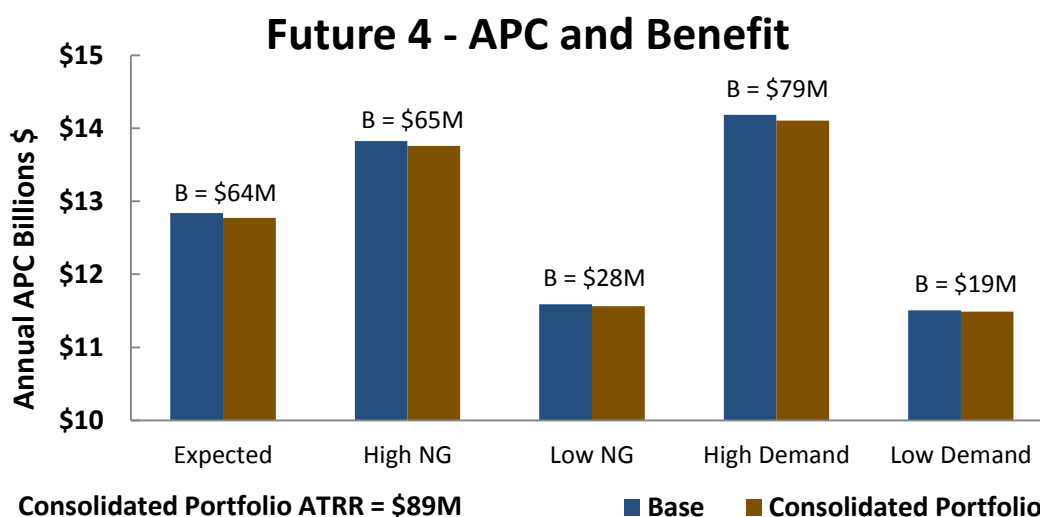


*Figure 16.11: Future 4 Sensitivities – APC and Benefit*

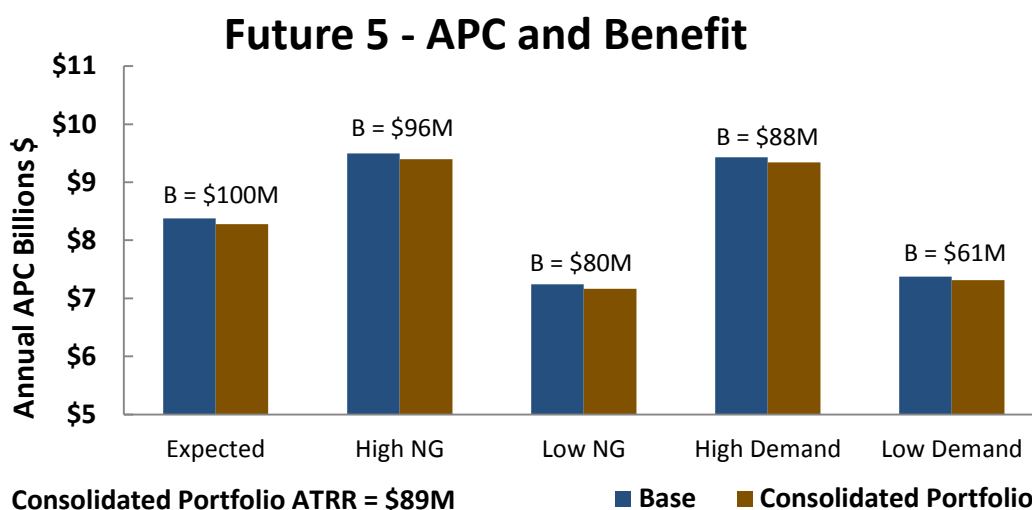


*Figure 16.12: Future 5 Sensitivities – APC and Benefit*

All sensitivity results show one-year benefits and costs, rather than 40-year benefits and costs as shown in Figure 16.3. The results show significant increases in APC for high gas prices or high demand, and significant decreases in APC for low gas prices or low demand. This is true for the base case and the Consolidated Portfolio for all futures. The results also show that the Consolidated Portfolio has positive benefit for all sensitivities in each future. In some of these cases, the one-year benefit is less than the one-year cost of \$89M.

One-year B/C ratios are shown for all sensitivity and non-sensitivity runs in Figure 16.13. It also shows all sensitivities in which the one-year B/C is less than 1.0.



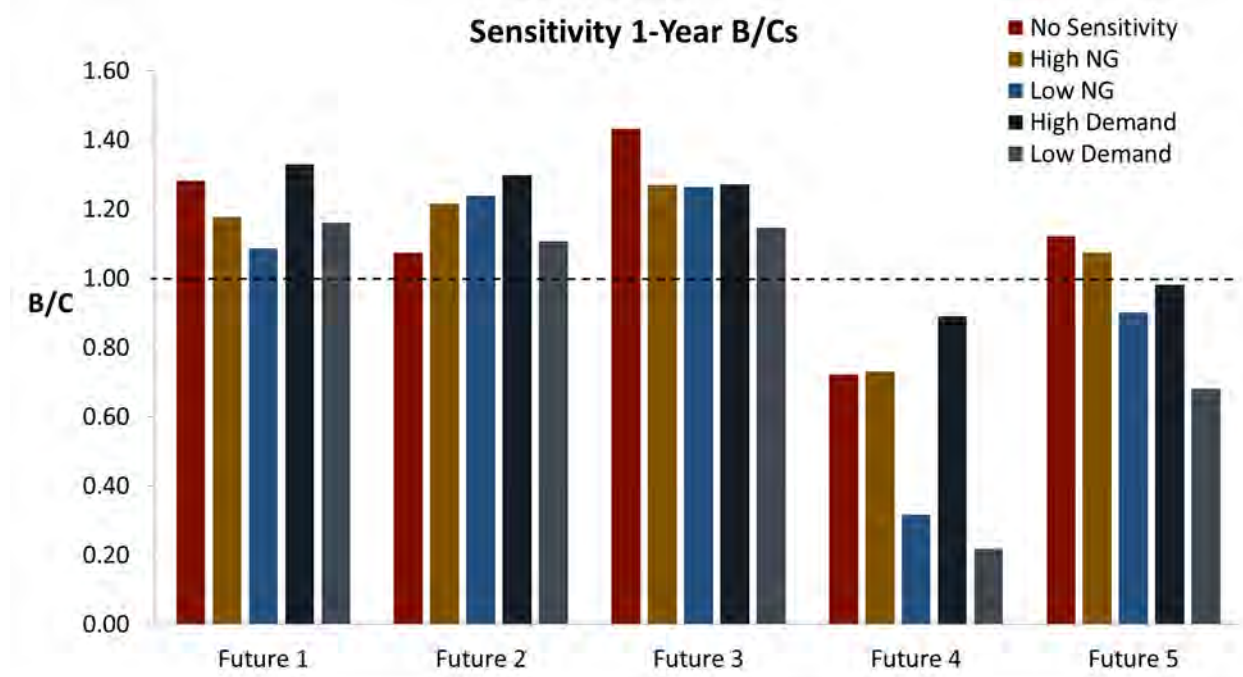


*Figure 16.13: One-Year B/C's for all Futures and Sensitivities*

The non-sensitivity runs all show one-year B/C's that are less than the 40-year B/C's. The one-year B/C's are still greater than 1.0 for all futures except Future 4. Future 4 shows less benefit from the Consolidated Portfolio than the other futures, primarily due to the reduced load and energy in this future. Most sensitivity runs are showing minimal variation in economic benefit for fluctuations in demand or gas prices.

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## Section 17: Final Assessments

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### **17.1: Final Reliability Assessment**

A final reliability assessment was conducted on the Consolidated Portfolio in order to identify the binding and breaching system constraints with the recommended plan in place. This assessment was conducted for informational purposes; there were no additional projects developed as part of the final reliability assessment. The following details guided the final reliability assessment:

- Analyzed the same 4 peak hours that were analyzed for the reliability needs and projects development (Summer Peak, Winter Peak, High Wind, and Low Hydro)
- Analyzed Future 1 for 2033 only
- Analyzed only the Consolidated Portfolio

The results are included in the Appendix Section 20:. The results show a total of 103 binding or breaching facilities:

- 25 of these facilities were mitigated by lower voltage solutions earlier in the study; however, these lower voltage solutions were not included in the final 20-year expansion plan which targets primarily EHV solutions.
- Many of these binding or breaching constraints, or a close variation of them, appear in multiple hours.
- The inclusion of the Consolidated Portfolio will create an alternative dispatch than the dispatch generated from the base case. This change in dispatch will lead to some new binding or breaching constraints than were observed in the main reliability needs and project development phase. A project may mitigate major congestion in one area while creating minor congestion in another area.
- The results show 100 kV and above facilities for which an SPP RTO zone has at least partial ownership of.

### **17.2: Final Stability Assessment**

An assessment was performed to confirm that the wind dispatched for the 2013 ITP20 Consolidated Portfolio 2023 Summer-Peak case<sup>26</sup> can be achieved without the occurrence of voltage instability.

#### **Method**

The method employed to determine the amount of wind generation that could be accommodated in the Consolidated Portfolio was accomplished by reducing wind generation to minimum levels while simultaneously increasing conventional generation to meet SPP load requirements. Next, the wind was incrementally increased up to the 9.2 GW of installed capacity in Future 1, while conventional generation was incrementally decreased. The system was monitored for the voltage collapse point for

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<sup>26</sup> A 2023 summer peak model was utilized because there is not a 2033 off peak model to use. A 2023 summer peak model should have similar load to a 2033 off-peak (high wind) hour.

both normal conditions and contingencies. N-1 contingencies of 345kV facilities were utilized. All 100 kV and above buses in SPP were monitored for voltage collapse.

**Wind Dispatch Achievable with Consolidated Portfolio**

The Future 1 wind dispatch in the ITP20 is feasible from a voltage stability viewpoint. There was no voltage instability in the load areas within SPP. The 2013 ITP20 Consolidated Portfolio can reliably dispatch 9.2 GW of wind.

## Section 18: Conclusion

The 2013 ITP20 Consolidated Portfolio is a grouping of projects that is projected to meet the reliability, policy, and economic needs over a 20-year horizon. The projects in the Consolidated Portfolio were studied through a rigorous process that utilized a diverse array of power system and economic analysis tools to evaluate the need for EHV projects that satisfy needs such as:

- resolving potential criteria violations;
- mitigating known or foreseen congestion;
- enabling renewable energy standards to be met.

Multiple assessment methodologies were used to evaluate the system from different perspectives and encourage confidence in the findings of the study. Study tools and drivers were successfully benchmarked against historical expectations, sensitivities were performed to ensure the viability of the portfolio in multiple scenarios, stakeholders provided continuous feedback concerning the technical details of the modeling needs and projects, inter-regional needs were addressed and discussed with external regions, and a portfolio was designed to respond to SPP's evolving needs.

The Consolidated Portfolio is a primarily EHV backbone system that fulfills the strategic, long-term vision of the ITP20. The ITP20 is not intended to address the lower voltage solutions that will be needed as a result of new EHV backbone projects. The Consolidated Portfolio projects are expected to provide economic benefit across multiple futures scenarios and multiple sensitivities, even though more than half of the projects are primarily addressing reliability needs. The projects are expected to provide \$1.5B in net benefit over the expected 40-year life, with an expected B/C ratio of 2.79. As a result, the average residential customer in SPP will see a decrease in their monthly electric bill of 9¢.

| Name                             | Type                             | Size                  | Focus         |
|----------------------------------|----------------------------------|-----------------------|---------------|
| Keystone – Red Willow            | New Branch                       | 345 kV                | Reliability   |
| Tolk – Tuco                      | New Branch                       | 345 kV                | Reliability   |
| S3459                            | 2nd Transformer                  | 345/161 kV            | Economic      |
| Holcomb                          | 2nd Transformer                  | 345/115 kV            | Reliability   |
| Maryville                        | New Transformer                  | 345/161 kV            | Reliability   |
| Pecan Creek – Muskogee           | Upgrade 2 circuits               | 345 kV                | Reliability   |
| Nashua                           | Upgrade Transformer              | 345/161 kV            | Reliability   |
| JEC – Auburn – Swissvale         | Rebuild (New Auburn transformer) | 345 kV,<br>345/115 kV | Reliability   |
| Clinton – Truman – N Warsaw      | Upgrade Branch                   | 161 kV                | Seams Project |
| S3740 - S3454                    | New Branch                       | 345 kV                | Reliability   |
| Chamber Springs - S Fayetteville | New Branch & Transformer         | 345 KV,<br>345/161 kV | Economic      |
| Wolf Creek - Neosho              | New Branch                       | 345 kV                | Economic      |

*Table 18.1: 2013 ITP20 Projects*

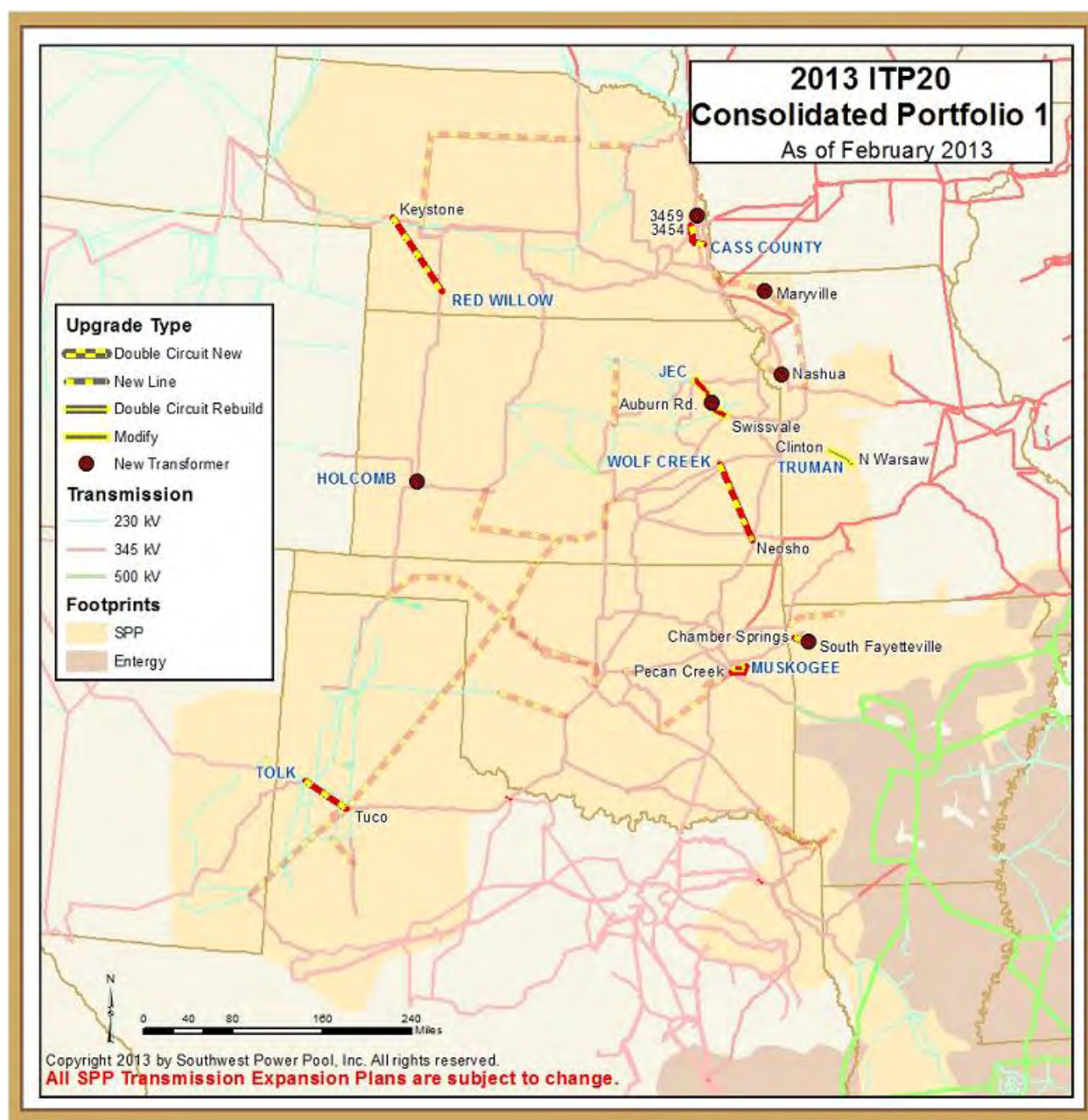


Figure 18.1 2013 ITP20 Consolidated Portfolio

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# PART IV: APPENDICES





## Section 19: Glossary of Terms

The following terms are referred to throughout the report.

| Acronym              | Description                                                     | Acronym      | Description                                       |
|----------------------|-----------------------------------------------------------------|--------------|---------------------------------------------------|
| <b>APC</b>           | Adjusted Production Cost                                        | <b>ITPNT</b> | Integrated Transmission Plan Near-Term Assessment |
| <b>APC-based B/C</b> | Adjusted Production Cost based Benefit to Cost ratio            | <b>ITP10</b> | Integrated Transmission Plan 10-Year Assessment   |
| <b>ATC</b>           | Available Transfer Capability                                   | <b>ITP20</b> | Integrated Transmission Plan 20-Year Assessment   |
| <b>ATSS</b>          | Aggregate Transmission Service Studies                          | <b>JPC</b>   | Joint Planning Committee                          |
| <b>ATRR</b>          | Annual Transmission Revenue Requirement                         | <b>LIP</b>   | Locational Imbalance Price                        |
| <b>BATTF</b>         | Benefit Analysis Techniques Task Force                          | <b>LMP</b>   | Locational Marginal Price                         |
| <b>B/C</b>           | Benefit to Cost Ratio                                           | <b>MDWG</b>  | Model Development Working Group                   |
| <b>BA</b>            | Balancing Authority                                             | <b>MISO</b>  | Midcontinent Independent System Operator, Inc.    |
| <b>BOD</b>           | SPP Board of Directors                                          | <b>MOPC</b>  | Markets and Operations Policy Committee           |
| <b>Carbon Price</b>  | The tax burden associated with the emissions of CO <sub>2</sub> | <b>MTF</b>   | Metrics Task Force                                |
| <b>CAWG</b>          | Cost Allocation Working Group                                   | <b>MVA</b>   | Mega Volt Ampere (10 <sup>6</sup> Volt Ampere)    |
| <b>CFL</b>           | Compact Fluorescent Bulb                                        | <b>MW</b>    | Megawatt (10 <sup>6</sup> Watts)                  |
| <b>CRA</b>           | Charles River Associates                                        | <b>NERC</b>  | North American Electric Reliability Corporation   |
| <b>EHV</b>           | Extra-High Voltage                                              | <b>NOPR</b>  | Notice of Proposed Rulemaking                     |
| <b>EIS</b>           | Energy Imbalance Service                                        | <b>NREL</b>  | National Renewable Energy Laboratory              |
| <b>EPA</b>           | Environmental Protection Agency                                 | <b>NTC</b>   | Notification to Construct                         |

|              |                                                   |             |                                 |
|--------------|---------------------------------------------------|-------------|---------------------------------|
| <b>ESRPP</b> | Entergy SPP RTO Regional Planning Process         | <b>OATT</b> | Open Access Transmission Tariff |
| <b>ESWG</b>  | Economic Studies Working Group                    | <b>PCM</b>  | Production Cost Model           |
| <b>EWITS</b> | Eastern Wind Integration and Transmission Study   | <b>RES</b>  | Renewable Energy Standard       |
| <b>FCITC</b> | First Contingency Incremental Transfer Capability | <b>ROW</b>  | Right of Way                    |
| <b>FERC</b>  | Federal Energy Regulatory Commission              | <b>RSC</b>  | SPP Regional State Committee    |
| <b>GI</b>    | Generation Interconnection                        | <b>RTWG</b> | Regional Tariff Working Group   |
| <b>GIS</b>   | Geographic Information Systems                    | <b>SIL</b>  | Surge Impedance Loading         |
| <b>GW</b>    | Gigawatt ( $10^9$ Watts)                          | <b>SPC</b>  | Strategic Planning Committee    |
| <b>HVDC</b>  | High-Voltage Direct Current                       | <b>SPP</b>  | Southwest Power Pool, Inc.      |
| <b>SPPT</b>  | Synergistic Planning Project Team                 | <b>TSR</b>  | Transmission Service Request    |
| <b>STEP</b>  | SPP Transmission Expansion Plan                   | <b>TVA</b>  | Tennessee Valley Authority      |
| <b>TLR</b>   | Transmission Loading Relief                       | <b>TWG</b>  | Transmission Working Group      |
| <b>TPL</b>   | Transmission Planning NERC Standards              | <b>WITF</b> | Wind Integration Task Force     |
| <b>TO</b>    | Transmission Owner                                |             |                                 |

## Section 20: Final Reliability Assessment Results

This section includes the results for the final reliability assessment described in Section 17.1:

- The binding or breaching constraints highlighted in yellow were mitigated by lower voltage solutions earlier in the study. These lower voltage solutions were not included in the final 20-year expansion plan which targets primarily EHV solutions.
- YBUS represents a 3-winding transformer in PROMOD IV<sup>®</sup> or PAT.

| Constraints                       | Contingency                                 | Flow (MW) | Lower Bound | Upper Bound | Shadow Price (\$/MW) | Violation (MW) | Hour |
|-----------------------------------|---------------------------------------------|-----------|-------------|-------------|----------------------|----------------|------|
| 300075 505434 [1] (AECI-SWPA)     | 69: 5NEWMAD - 7NEWMAD 1 161/345 (AECI)      | 335       | -335        | 335         | -41.06               |                | HW   |
| 300101 505498 [1] 161 (AECI-SWPA) | 256: NEOSHO 7 - LACYGNE7 1 345 (WERE-KCPL)  | -167      | -167        | 167         | 353.94               |                | LH   |
| 301402 541314 [1] 161 (AECI-GMO)  | 9: 7BLACKBERRY - NEOSHO 7 1 345 (AECI-WERE) | -317      | -317        | 317         | 4541.25              |                | SP   |
| 301402 541314 [1] 161 (AECI-GMO)  | 262: 7OVERTON - SIBLEY 7 1 345 (AMMO-GMO)   | -353.88   | -317        | 317         | 6000                 | 36.88          | SP   |
| 301402 541314 [1] 161 (AECI-GMO)  | 74: 7OVERTON - SIBLEY 7 1 345 (AMMO-GMO)    | -353.88   | -317        | 317         | 6000                 | 36.88          | SP   |
| 301402 541314 [1] 161 (AECI-GMO)  | 262: 7OVERTON - SIBLEY 7 1 345 (AMMO-GMO)   | -317      | -317        | 317         | 272.41               |                | WP   |
| 344558 543060 [1] (AMMO-KCPL)     | 74: 7OVERTON - SIBLEY 7 1 345 (AMMO-GMO)    | 189.7     | -167        | 167         | -6000                | 22.7           | SP   |
| 345408 541201 [1] (AMMO-GMO)      | 15: NEOSHO 7 - LACYGNE7 1 345 (WERE-KCPL)   | -993.92   | -956        | 956         | 6000                 | 37.92          | SP   |
| 345408 541201 [1] (AMMO-GMO)      | 17: MUSKOGEE7 - FTSMITH7 1 345 (OKGE)       | -987.2    | -956        | 956         | 6000                 | 31.2           | SP   |
| 345408 541201 [1] (AMMO-GMO)      | Base case                                   | -956      | -956        | 956         | 2303.28              |                | SP   |
| 345408 541201 [1] (AMMO-GMO)      | 9: 7BLACKBERRY - NEOSHO 7 1 345 (AECI-WERE) | -1010.64  | -956        | 956         | 6000                 | 54.64          | SP   |
| 504020 506944 [1] 161 (AEPW)      | 343: CHAMSPR7 345 - SFAYTVL8 345[1] (AEPW)  | -317      | -317        | 317         | 4710.28              |                | SP   |
| 504181 507185 [1] (AEPW)          | Base case                                   | 174.55    | -158        | 158         | -6000                | 16.55          | SP   |
| 505480 506932 [1] (SWPA-AEPW)     | 167: SHIPERD7 - KINGRIV7 1 345 (AEPW)       | 282.77    | -247        | 247         | -6000                | 35.77          | SP   |
| 505486 547472 [1]                 | 260: CHAMSPR7 - CLARKSV7 1 345 (AEPW)       | -222      | -222        | 222         | 4144.83              |                | SP   |

|                                  |               |              |  |                                                    |         |       |      |          |       |    |
|----------------------------------|---------------|--------------|--|----------------------------------------------------|---------|-------|------|----------|-------|----|
| (SWPA-EMDE)                      |               |              |  |                                                    |         |       |      |          |       |    |
| 505492 547479 [1]<br>(SWPA-EMDE) | SPRGFLD5 161- | LAR382 5 161 |  | 9: 7BLACKBERRY - NEOSHO 7 1 345 (AECI-WERE)        | -183.22 | -167  | 167  | 6000     | 16.22 | SP |
| 505492 547479 [1]<br>(SWPA-EMDE) | SPRGFLD5 161- | LAR382 5 161 |  | 342: MON383 7 345 - BROOKLIN 345[1]<br>(EMDE-SPRM) | -168.34 | -167  | 167  | 6000     | 1.34  | SP |
| 505492 547479 [1]<br>(SWPA-EMDE) | SPRGFLD5 161- | LAR382 5 161 |  | 332: FLINTCR7 345 - MON383 7 345[1]<br>(AEPW-EMDE) | -168.34 | -167  | 167  | 6000     | 1.34  | SP |
| 505492 549970 [1]<br>(SWPA-SPRM) | SPRGFLD5 161- | CLAY 161     |  | 74: 7OVERTON - SIBLEY 7 1 345 (AMMO-GMO)           | 167     | -167  | 167  | -68.49   |       | SP |
| 505492 549970 [1]<br>(SWPA-SPRM) | SPRGFLD5 161- | CLAY 161     |  | 196: 7HUBEN - 7MORGAN 1 345 (AECI)                 | 242.12  | -167  | 167  | -6000    | 75.12 | SP |
| 505492 549970 [1]<br>(SWPA-SPRM) | SPRGFLD5 161- | CLAY 161     |  | 196: 7HUBEN - 7MORGAN 1 345 (AECI)                 | 167     | -167  | 167  | -25.8    |       | WP |
| 505522 515339 [1]<br>(SWPA-OKGE) | VAN BUR5 161- | VBI 5 161    |  | 17: MUSKOGEE7 - FTSMITH7 1 345 (OKGE)              | 341.45  | -335  | 335  | -6000    | 6.45  | SP |
| 505592 510902 [1]<br>(SWPA-AEPW) | WELEETK4 138- | WELETK4 138  |  | Base case                                          | -172    | -172  | 172  | 2207.16  |       | SP |
| 507185 507189 [1]<br>161 (AEPW)  | REVESRD5 161- | NHUNTNT5     |  | Base case                                          | 164.68  | -158  | 158  | -6000    | 6.68  | SP |
| 507456 99296 [1]<br>(AEPW)       | TURK 3 115-   | YBUS702 100  |  | 23: 7SAREPT - LONGWD 7 1 /345 (EES-AEPW)           | -202    | -202  | 202  | 615.13   |       | SP |
| 508548 509059 [1]<br>(AEPW)      | KNOXLEE4 138- | CHEROKE4 138 |  | Base case                                          | 225.8   | -214  | 214  | -6000    | 11.8  | SP |
| 508840 99250 [1]<br>(AEPW)       | WILKES 4 138- | YBUS748 100  |  | 333: LONGWD 7 345 - WILKES 7 345[1]<br>(AEPW)      | -493    | -493  | 493  | 5789.19  |       | SP |
| 509059 509087 [1]<br>(AEPW)      | CHEROKE4 138- | TATUM 4 138  |  | Base case                                          | 214     | -214  | 214  | -2177.35 |       | SP |
| 509080 509242 [1]<br>(AEPW)      | OVERTON4 138- | JACKSNV4 138 |  | 168: LEBROCK7 - TENRUSK7 1 345 (AEPW)              | 235     | -235  | 235  | -4448.11 |       | SP |
| 509080 509242 [1]<br>(AEPW)      | OVERTON4 138- | JACKSNV4 138 |  | 269: TENRUSK7 345 - CROCKET7 345(1)<br>(AEPW)      | 235     | -235  | 235  | -6000    | 0     | SP |
| 509786 509804 [1]<br>(AEPW)      | BA.N-ST4 138- | LLANETP4 138 |  | 260: CHAMSPR7 - CLARKSV7 1 345 (AEPW)              | 212     | -212  | 212  | -6000    | 0     | SP |
| 509786 509804 [1]<br>(AEPW)      | BA.N-ST4 138- | LLANETP4 138 |  | 34: CHAMSPR7 - CLARKSV7 1 345 (AEPW)               | 212     | -212  | 212  | -1360.23 |       | SP |
| 509807 509836 [2]<br>(AEPW)      | ONETA--7 345- | OEC 7 345    |  | 281: ONETA--7 345 - OEC 7 345(1) (AEPW)            | -1195   | -1195 | 1195 | 12.24    |       | WP |
| 510877 515055 [1]<br>(AEPW-OKGE) | FIXCT4 138-   | MAUD 4 138   |  | Base case                                          | -89.81  | -88   | 88   | 6000     | 1.81  | SP |
| 511477 521089 [1]<br>(AEPW-WFEC) | S.W.S.-4 138- | WASHITA4 138 |  | 295: L.E.S.-7 - GRACEMNT7 1 345 (AEPW-OKGE)        | -287    | -287  | 287  | 49.37    |       | HW |
| 512650 512750 [1]<br>(GRDA)      | GRDA1 7 345-  | TONECE7 345  |  | 34: CHAMSPR7 - CLARKSV7 1 345 (AEPW)               | 1100.53 | -1064 | 1064 | -6000    | 36.53 | SP |
| 514785 515785 [1]<br>138 (OKGE)  | WOODWRD4 138- | WINDFRM4     |  | Base case                                          | -133    | -133  | 133  | 467.33   |       | SP |

## Section 20: Final Reliability Assessment Results

Southwest Power Pool, Inc.

|                                 |                |              |                                                 |                 |        |      |     |          |       |    |
|---------------------------------|----------------|--------------|-------------------------------------------------|-----------------|--------|------|-----|----------|-------|----|
| 514820 514821 [1]<br>(OKGE)     | JENSEN4 138-   | JENSEN 4 138 | 297: ELKCITY7 345 -<br>(AEPW-OKGE)              | GRACMNT7 345(1) | -191   | -191 | 191 | 25.71    |       | HW |
| 514876 514887 [1]<br>138 (OKGE) | SW134TP4 138-  | WESTMOR4     | Base case                                       |                 | 268    | -268 | 268 | -1141.7  |       | SP |
| 514901 514934 [1]<br>(OKGE)     | CIMARON7 345-  | DRAPER 7 345 | 332: NORTWST7 345 -<br>(OKGE)                   | ARCADIA7 345[1] | 717    | -717 | 717 | -2.24    |       | HW |
| 515008 515009 [1]<br>(OKGE)     | KINZE 4 138-   | MCELROY4 138 | 337: CLEVLND7 345 -<br>(GRDA-OKGE)              | SOONER 7 345[1] | -222   | -222 | 222 | 2635.27  |       | SP |
| 515224 515302 [1]<br>345 (OKGE) | MUSKOGES7 345- | FTSMITH7     | 34: CHAMSPR7 - CLARKSV7 1 345 (AEPW)            |                 | 748.92 | -717 | 717 | -6000    | 31.92 | SP |
| 515224 515302 [1]<br>345 (OKGE) | MUSKOGES7 345- | FTSMITH7     | 169: CLARKSV7 - MUSKOGES7 1 345 (AEPW-<br>OKGE) |                 | 717    | -717 | 717 | -2285.82 |       | SP |
| 515228 515250 [1]<br>(OKGE)     | 5TRIBES5 161-  | HANCOK-5 161 | 17: MUSKOGES7 - FTSMITH7 1 345 (OKGE)           |                 | 228.94 | -223 | 223 | -6000    | 5.94  | SP |
| 523797 98987 [1]<br>(SPS)       | HOWARD 115-    | YBUS1011 100 | Base case                                       |                 | -40    | -40  | 40  | 623.97   |       | SP |
| 523797 98987 [1]<br>(SPS)       | HOWARD 115-    | YBUS1011 100 | Base case                                       |                 | -40    | -40  | 40  | 1.97     |       | LH |
| 523797 98987 [1]<br>(SPS)       | HOWARD 115-    | YBUS1011 100 | Base case                                       |                 | -40    | -40  | 40  | 40.47    |       | WP |
| 524622 98967 [2]<br>(SPS)       | DEAFSMIT 115-  | YBUS1031 100 | Base case                                       |                 | -168   | -168 | 168 | 2960.97  |       | SP |
| 525326 98948 [1]<br>(SPS)       | COX 115-       | YBUS1050 100 | Base case                                       |                 | -84    | -84  | 84  | 748.94   |       | SP |
| 525326 98948 [1]<br>(SPS)       | COX 115-       | YBUS1050 100 | Base case                                       |                 | -84    | -84  | 84  | 0.63     |       | LH |
| 525326 98948 [1]<br>(SPS)       | COX 115-       | YBUS1050 100 | Base case                                       |                 | -84    | -84  | 84  | 20.63    |       | WP |
| 526298 98920 [1]<br>(SPS)       | LUBBCK_E 115-  | YBUS1078 100 | Base case                                       |                 | -84    | -84  | 84  | 637.58   |       | SP |
| 526298 98920 [1]<br>(SPS)       | LUBBCK_E 115-  | YBUS1078 100 | Base case                                       |                 | -84    | -84  | 84  | 124.66   |       | LH |
| 526298 98920 [1]<br>(SPS)       | LUBBCK_E 115-  | YBUS1078 100 | Base case                                       |                 | -84    | -84  | 84  | 42.38    |       | WP |
| 527483 527799 [1]<br>230 (SPS)  | CHAVES_C 230-  | EDDY_NOR     | Base case                                       |                 | 319    | -319 | 319 | -40.51   |       | WP |
| 527799 527800 [1]<br>230 (SPS)  | EDDY_NOR 230-  | EDDY_SOU     | 252: TUCO_INT 345 -<br>(SPS)                    | AMOCO_SS 345(1) | 478    | -478 | 478 | -4.24    |       | LH |
| 530593 98858 [1]<br>(MIDW)      | SMKYP1 6 230-  | YBUS1140 100 | Base case                                       |                 | -115   | -115 | 115 | 526.56   |       | SP |
| 530593 98858 [1]<br>(MIDW)      | SMKYP1 6 230-  | YBUS1140 100 | Base case                                       |                 | -115   | -115 | 115 | 78.8     |       | WP |
| 531378 531472 [1]<br>(SUNC)     | HICKOCK3 115-  | AMOCO 3 115  | Base case                                       |                 | -170   | -170 | 170 | 334.67   |       | SP |
| 531445 98840 [1]                | GRDNCTY3 115-  | YBUS1158 100 | Base case                                       |                 | -41    | -41  | 41  | 296.99   |       | SP |

|                                  |               |              |                                             |                 |         |        |       |          |       |    |
|----------------------------------|---------------|--------------|---------------------------------------------|-----------------|---------|--------|-------|----------|-------|----|
| (SUNC)                           |               |              |                                             |                 |         |        |       |          |       |    |
| 531445 98840 [1] (SUNC)          | GRDNCTY3 115- | YBUS1158 100 | Base case                                   |                 | -41     | -41    | 41    | 12.91    |       | HW |
| 531445 98840 [1] (SUNC)          | GRDNCTY3 115- | YBUS1158 100 | Base case                                   |                 | -41     | -41    | 41    | 44.52    |       | LH |
| 531449 531448 [2] 115 (SUNC)     | HOLCOMB7 345- | HOLCOMB3     | Base case                                   |                 | -435    | -435   | 435   | 367.27   |       | SP |
| 532987 532990 [1] (WERE)         | BUTLER 4 138- | MIDIAN 4 138 | 319: BENTON 7 345 - (WERE)                  | ROSEHIL7 345(1) | -143    | -143   | 143   | 1004.86  |       | SP |
| 539667 98726 [1] (SUNC)          | HAGGARD3 115- | YBUS1272 100 | Base case                                   |                 | -28     | -28    | 28    | 79.39    |       | WP |
| 539673 539760 [1] (SUNC)         | MED-LDG3 115- | BARBER 3 115 | 301: CONESTOG 345 - (SPS)                   | FINNEY 345(1)   | 79.7    | -79.7  | 79.7  | -16.62   |       | HW |
| 539688 539699 [1] 115 (SUNC)     | S-DODGE3 115- | W-DODGE3     | 304: SPERVIL7 345 - (SUNC)                  | BUCKNER7 345(1) | -129.5  | -129.5 | 129.5 | 12.87    |       | HW |
| 539692 539696 [1] (SUNC)         | SEWARD 3 115- | ST-JOHN3 115 | 247: CONESTOG 345 - (SPS)                   | HITCHLAN 345(1) | 87.6    | -87.6  | 87.6  | -4285.39 |       | SP |
| 539695 98738 [1] (SUNC)          | SPEARVL6 230- | YBUS1260 100 | Base case                                   |                 | -75     | -75    | 75    | 22.77    |       | HW |
| 539695 98738 [1] (SUNC)          | SPEARVL6 230- | YBUS1260 100 | Base case                                   |                 | -75     | -75    | 75    | 79.02    |       | LH |
| 542972 542980 [1] (KCPL)         | HAWTH 7 345-  | NASHUA 7 345 | 340: SMARYVL7 345 - (GMO)                   | SIBLEY 7 345[1] | -1136   | -1136  | 1136  | 2829.12  |       | SP |
| 542972 542980 [1] (KCPL)         | HAWTH 7 345-  | NASHUA 7 345 | 176: STRANGR7 - IATAN 7 1 345 (WERE-KCPL)   |                 | -1136   | -1136  | 1136  | 45.66    |       | HW |
| 547468 547480 [1] (EMDE)         | AUR124 5 161- | MON383 5 161 | 9: 7BLACKBERRY - NEOSHO 7 1 345 (AECI-WERE) |                 | -234.68 | -223   | 223   | 6000     | 11.68 | SP |
| 547469 98665 [1] (EMDE)          | RIV4525 161-  | YBUS1333 100 | 9: 7BLACKBERRY - NEOSHO 7 1 345 (AECI-WERE) |                 | 120.19  | -100   | 100   | -6000    | 20.19 | SP |
| 547469 98665 [1] (EMDE)          | RIV4525 161-  | YBUS1333 100 | Base case                                   |                 | 114.41  | -100   | 100   | -6000    | 14.41 | SP |
| 547476 547491 [1] (EMDE)         | ASB349 5 161- | PUR421 5 161 | 9: 7BLACKBERRY - NEOSHO 7 1 345 (AECI-WERE) |                 | 223     | -223   | 223   | -5974.98 |       | SP |
| 599809 533151 [2] (WERE)         | AUBURN 7 345- | AUBURN 3 115 | 38: HOYT 7 - JEC N 7 1 345 (WERE)           |                 | 435     | -435   | 435   | -2248.56 |       | SP |
| 640302 659134 [1] (NPPD)         | OGALALA4 230- | SIDNEY 4 230 | 181: KEYSTON3 - SIDNEY 3 1 345 (NPPD-WAPA)  |                 | -320    | -320   | 320   | 11.12    |       | HW |
| 338813 505460 [1] (EES-EAI-SWPA) | 5MIDWY J 161- | BULL SH5 161 | 78: 8KEO - 8HOLBT 1 500 (EES-EAI-EES)       |                 | -162    | -162   | 162   | 813.66   |       | WP |
| 503912 338875 [1] (AEPW-EES-EAI) | FULTON 115-   | 3PATMOS. 115 | 190: 7SAREPTA% - LONGWD 7 1 345 (AEPW-EES)  |                 | 178.12  | -157   | 157   | -6000    | 21.12 | SP |
| 503912 338875 [1] (AEPW-EES-EAI) | FULTON 115-   | 3PATMOS. 115 | 190: 7SAREPTA% - LONGWD 7 1 345 (AEPW-EES)  |                 | 157     | -157   | 157   | -39.54   |       | HW |
| 503912 338875 [1] (AEPW-EES-EAI) | FULTON 115-   | 3PATMOS. 115 | 190: 7SAREPTA% - LONGWD 7 1 345 (AEPW-EES)  |                 | 157     | -157   | 157   | -0.36    |       | LH |

|                                      |               |              |                                              |         |        |       |          |       |    |
|--------------------------------------|---------------|--------------|----------------------------------------------|---------|--------|-------|----------|-------|----|
| 504000 506931 [1]<br>(AEPW)          | AVOCA 161-    | EROGERS5 161 | 167: SHIPERD7 - KINGRIV7 1 345 (AEPW)        | -225.88 | -220   | 220   | 6000     | 5.88  | SP |
| 504181 507182 [1]<br>(AEPW)          | HACKETT 161-  | BONANZA5 161 | 33: 8ANO - FTSMITH8 1 /500 (EES-OKGE)        | -199.99 | -178   | 178   | 6000     | 21.99 | SP |
| 504181 507182 [1]<br>(AEPW)          | HACKETT 161-  | BONANZA5 161 | Base case                                    | -198.76 | -158   | 158   | 6000     | 40.76 | SP |
| 511458 521116 [1]<br>(AEPW-WFEC)     | ELKCTY-4 138- | RHWIND4 138  | Base case                                    | -144    | -144   | 144   | 20.13    |       | HW |
| 525480 98943 [1]<br>(SPS)            | PLANT_X 115-  | YBUS1055 100 | 171: O.K.U.-7 - L.E.S.-7 1 345 (AEPW)        | -239    | -239   | 239   | 4325.28  |       | SP |
| 527482 527546 [1]<br>(SPS)           | CHAVES_C 115- | SAMSON 115   | Base case                                    | 120     | -120   | 120   | -4403.16 |       | SP |
| 532937 547469 [1]<br>(WERE-EMDE)     | NEOSHO 5 161- | RIV4525 161  | 9: 7BLACKBERRY - NEOSHO 7 1 345 (AECI-WERE)  | 223     | -223   | 223   | -3661.41 |       | SP |
| 532937 547469 [1]<br>(WERE-EMDE)     | NEOSHO 5 161- | RIV4525 161  | 9: 7BLACKBERRY - NEOSHO 7 1 345 (AECI-WERE)  | 223     | -223   | 223   | -230.59  |       | HW |
| 532937 547469 [1]<br>(WERE-EMDE)     | NEOSHO 5 161- | RIV4525 161  | 9: 7BLACKBERRY - NEOSHO 7 1 345 (AECI-WERE)  | 223     | -223   | 223   | -74.33   |       | LH |
| 539652 539672 [1]<br>(SUNC)          | CMRIVTP3 115- | E-LIBER3 115 | 248: CONESTOG 345 - FINNEY 345(1) (SPS)      | 119.5   | -119.5 | 119.5 | -8.28    |       | HW |
| 539652 539672 [1]<br>(SUNC)          | CMRIVTP3 115- | E-LIBER3 115 | 248: CONESTOG 345 - FINNEY 345(1) (SPS)      | 119.5   | -119.5 | 119.5 | -11.39   |       | LH |
| 539668 539675 [1]<br>(SUNC)          | HARPER 4 138- | MILANTP4 138 | 27: WICHITA7 - FLATRDG 7 1 345/ (WERE-SUNC)  | 108.91  | -95.6  | 95.6  | -6000    | 13.31 | SP |
| 539668 539675 [1]<br>(SUNC)          | HARPER 4 138- | MILANTP4 138 | 27: WICHITA7 - FLATRDG 7 1 345/ (WERE-SUNC)  | 95.6    | -95.6  | 95.6  | -156.66  |       | HW |
| 539668 539675 [1]<br>(SUNC)          | HARPER 4 138- | MILANTP4 138 | 41: THISTLE7 - THISTLE4 4 345 /138 (SUNC)    | 95.6    | -95.6  | 95.6  | -93.46   |       | LH |
| 539680 539740 [1]<br>115 (SUNC)      | N-DODGE3 115- | EDODGE 3     | Base case                                    | 83.9    | -83.9  | 83.9  | -10.43   |       | HW |
| 539680 539740 [1]<br>115 (SUNC)      | N-DODGE3 115- | EDODGE 3     | Base case                                    | 83.9    | -83.9  | 83.9  | -38.1    |       | LH |
| 541206 541211 [1]<br>(GMO)           | PRALEE 5 161- | BLSPS 5 161  | 165: SIBLEY 1 345/161 (GMO)                  | 224     | -224   | 224   | -589.64  |       | SP |
| 543031 546742 [1]<br>161 (KCPL-KACY) | SHWNMSN5 161- | METRO 5      | 16: 87TH 7 - CRAIG 7 1 345 (WERE-KCPL)       | -224    | -224   | 224   | 41.22    |       | LH |
| 640349 652510 [1]<br>(NPPD-WAPA)     | SPENCER7 115- | FTRANDL7 115 | Base case                                    | -102.65 | -95    | 95    | 6000     | 7.65  | SP |
| 526435 526460 [1]<br>230 (SPS)       | SUNDOWN 230-  | AMOCO_SS     | 303: TUCO_INT 345 - AMOCO_SS 345(1)<br>(SPS) | 351     | -351   | 351   | -101.25  |       | HW |
| 526435 526460 [1]<br>230 (SPS)       | SUNDOWN 230-  | AMOCO_SS     | 303: TUCO_INT 345 - AMOCO_SS 345(1)<br>(SPS) | 351     | -351   | 351   | -11.59   |       | LH |



## Section 21: Additional Metrics

The Metrics Task Force (MTF) developed new benefit metrics for use in the Regional Cost Allocation Review (RCAR) conducted in 2012 – 2013. The ESWG provided direction to calculate 3 of these new metrics as part of the 2013 ITP20 as well, but for informational purposes only.

### **21.1: Assumed Benefit of Mandated Reliability Projects**

This benefit was only utilized for projects categorized as reliability. This metric assumes that benefits are equal to costs for mandated reliability projects. Treating benefits for mandated reliability projects equal to their costs avoids potential undervaluing of the portfolio value of reliability projects which are mandated and thus not justified solely by other economic benefits.

To calculate the costs over the expected 40-year life of the reliability projects:

- Each project's total cost was multiplied by the expected carrying charge.
- This carrying charge was escalated out to 2033 \$ using a 2.5% inflation rate.
- Costs were depreciated linearly over the 40-year timeframe
- Each year's cost was then discounted using an 8% discount rate.
- The sum of all discounted costs was calculated as the Net Present Value (NPV) cost.
- This 2033 40-year NPV cost was brought back to real dollars using a 2.5% inflation rate.

The Assumed Benefit of Mandated Reliability Projects for the SPP region was equal to the 2013 40-year NPV cost of **\$572M**.

### **21.2: Benefit from Meeting Public Policy Goals**

The benefit of meeting public policy goals in the SPP region related to renewable energy supplies is measured by this metric. Since the Consolidated Portfolio did not include any policy projects, the Benefit from Meeting Public Policy Goals was \$0.

### **21.3: Mitigation of Transmission Outage Costs**

This metric calculates the benefit from new transmission projects by reducing additional congestion during unplanned outages. Standard production cost simulations assume that transmission lines and facilities are available during all hours of the year and that no planned or unexpected outages of transmission facilities will occur. In practice, however, planned and unexpected transmission outages impose non-trivial additional congestion costs on the system. The benefit of reducing this additional congestion is thus not captured in the standard APC metric. The Mitigation of Transmission Outage Costs metric measures the additional value that projects provide in reducing this additional congestion through the following equation:

$$\text{Benefit}_{\text{Mitigation Transmission Outage Costs}} = \text{Benefit}_{\text{With Transmission Outages}} - \text{Benefit}_{\text{No Outages}} = \\ (APC_{\text{Base Case, Transmission Outages}} - APC_{\text{Change Case, Transmission Outages}}) - \\ (APC_{\text{Base Case, No Outages}} - APC_{\text{Change Case, No Outages}})$$

This metric was used to compute one-year benefit only, for Future 1 only. The results are shown in Figure 21.1.

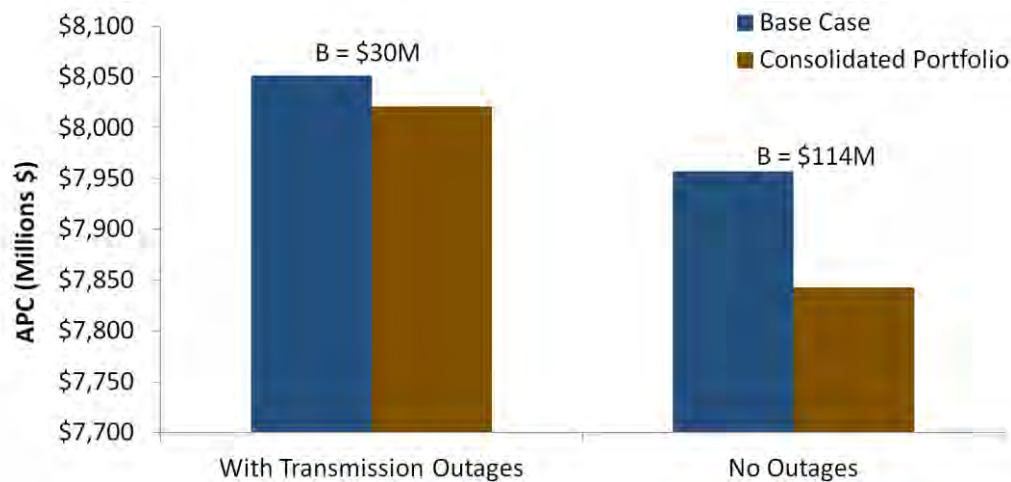


*Figure 21.1: Mitigation of Transmission Outages*

The results show an increase in APC when transmission outages are introduced, as expected. However, the results also show less benefit with transmission outages than with no outages. This leads to a negative benefit for Mitigation of Transmission Outage Costs of **-\$84M**. The Consolidated Portfolio projects were analyzed and optimized to mitigate significant congestion in the runs without outages. When transmission outages are introduced, the system congestion shifts to other areas. This results in the Consolidated Portfolio projects mitigating less congestion in the runs without outages (benefit reduces from \$114M to \$30M).

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# ITP10

## 2015 Integrated Transmission Plan 10-Year Assessment Report

January 20, 2015

Engineering

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## Revision History

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| Date       | Author    | Change Description                          |
|------------|-----------|---------------------------------------------|
| 10/29/2014 | SPP staff | Part one first draft                        |
| 06/20/2014 | SPP staff | Revised draft presented for Internal Review |
| 10/7/2014  | SPP Staff | ESWG Edits incorporated                     |
| 12/29/2014 | SPP Staff | TWG/ESWG Edits Incorporated                 |
|            |           |                                             |
|            |           |                                             |
|            |           |                                             |

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## Executive Summary

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The Integrated Transmission Planning (ITP) process is Southwest Power Pool's iterative three-year study process that includes 20-Year, 10-Year and Near Term Assessments. The 20-Year Assessment identifies transmission projects, generally above 300 kV, needed to provide a grid flexible enough to provide benefits to the region across multiple scenarios. The 10-Year Assessment focuses on facilities 100 kV and above to meet system needs over a ten-year horizon. The Near Term Assessment is performed annually and assesses system upgrades, at all applicable voltage levels, required in the near term planning horizon to address reliability needs. Along with the Highway/Byway cost allocation methodology, the ITP process promotes transmission investment that will meet reliability, economic, and public policy needs<sup>1</sup> intended to create a cost-effective, flexible, and robust transmission network that will improve access to the region's diverse generating resources. This report documents the 10-year Assessment that concludes in December 2015.

Two distinct futures were considered to account for possible variations in system conditions over the assessment's 10-year horizon. These futures consider evolving changes in technology, public policy and climate changes that may influence the transmission system and energy industry as a whole. The futures are presented briefly below and further discussed in Section 3:

1. **Business-As-Usual:** This future includes all statutory/regulatory renewable mandates and goals as well as other energy or capacity as identified in the Policy Survey resulting in 11.5 GW of renewable resources modeled in SPP, load growth projected by load serving entities including the High Priority Incremental Loads, and SPP member-identified generator retirement projections. This future assumes no major changes to policies that are currently in place.
2. **Decreased Base Load Capacity:** This future considers factors that could drive a reduction in existing generation. It will include all assumptions from the Business as Usual future with a decrease in existing base load generation capacity.

The recommended 2015 ITP10 portfolio shown in Figure 0.1 is estimated at **\$273 million** in engineering and construction cost and includes projects needed to meet potential reliability, economic, and policy requirements. These projects, with a total estimated net present value revenue requirement of **\$334 million**, are expected to provide net benefits of approximately **\$1.4 billion** over the life of the projects under a Future 1 scenario containing 10.3 GW of wind capacity expected to be contracted by SPP members.

---

<sup>1</sup> The Highway/Byway cost allocation approving order is *Sw. Power Pool, Inc.*, 131 FERC ¶ 61,252 (2010). The approving order for ITP is *Sw. Power Pool, Inc.*, 132 FERC ¶ 61,042 (2010).

The following projects make up the portfolio:

| Project Description                                                                                        | Area(s)        | Type                   | Future | Mileage | Cost         |
|------------------------------------------------------------------------------------------------------------|----------------|------------------------|--------|---------|--------------|
| New wave trap at Amoco and Sundown, increasing rating on Sundown-Amoco 230 kV line                         | SWPS           | Economic & Reliability | F1     | 0       | \$55,641     |
| Voltage conversion of Iatan-Stranger Creek 161 kV line to 345 kV                                           | KCPL, GMO, WRI | Economic               | F1     | 14      | \$16,119,446 |
| Rebuild North Platte-Stockville-Red Willow 115 kV line to 240/240 MVA, new 345/115 kV transformer at Mingo | NPPD, SUNC     | Economic & Reliability | F1     | 80      | \$53,562,098 |
| New 345/115 kV transformer at Road Runner                                                                  | SWPS           | Reliability            | F1     | 0       | \$5,733,227  |
| Install 2 stages of 14.4 MVAR capacitor banks on the Ochoa 115 kV bus                                      | SWPS           | Reliability            | F1     | 0       | \$1,659,762  |
| Install 2 stages of 14.4 MVAR capacitor banks on the China Draw 115 kV bus and the North Loving 115 kV bus | SWPS           | Reliability            | F1     | 0       | \$3,319,524  |
| New 230/115 kV transformer at Plant X                                                                      | SWPS           | Reliability            | F1     | 0       | \$3,497,095  |
| New wave trap at Amarillo South, increasing rating on Amarillo South-Swisher 230 kV line                   | SWPS           | Reliability            | F2     | 0       | \$27,821     |
| Tap Northwest-Bush 115 kV line at new station, and build new 3 miles of 115 kV line to Hastings            | SWPS           | Reliability            | F1     | 3       | \$7,984,549  |
| Upgrade 230/115 kV transformer at Tuco                                                                     | SWPS           | Reliability            | F1     | 0       | \$3,127,583  |
| Upgrade wave trap and CT on the Park Lane-Seminole 138 kV line                                             | OKGE           | Reliability            | F2     | 0       | \$86,436     |
| Upgrade relays at Sand Springs, increasing ratings on Sand Springs-Prattville 138 kV line                  | AEPW           | Reliability            | F1     | 0       | \$176,290    |
| Tap Reno-Wichita 345 kV line into Moundridge, new 345/138 kV transformer at Moundridge                     | WRI            | Reliability            | F2     | 0       | \$14,722,229 |
| Rebuild Forbes-Underpass North 115 kV line to 218/262 MVA                                                  | WRI            | Reliability            | F1     | 3       | \$7,878,364  |
| Reconductor Gracemont-Anadarko 138 kV line to 286/286 MVA                                                  | OKGE, WRI      | Reliability            | F1     | 5       | \$4,650,558  |
| Rebuild Murray Gill East-Interstate 138 kV line to 286/286 MVA                                             | WRI            | Reliability            | F2     | 6       | \$6,184,325  |
| Reconductor Martin-Pantex North 115 kV line to 240/240 MVA and replace wave trap at Pantex substation      | SWPS           | Reliability            | F1     | 5       | \$3,602,175  |

| Project Description                                                                                                                                                                       | Area(s) | Type        | Future | Mileage | Cost          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------|--------|---------|---------------|
| Reconductor Pantex North-Pantex South 115 kV line to 240/240 MVA                                                                                                                          | SWPS    | Reliability | F1     | 3       | \$1,824,746   |
| Reconductor Highland Park-Pantex South 15 kV line to 240/240 MVA and replace wave trap and switch at Pantex South and Highland Park tap                                                   | SWPS    | Reliability | F1     | 7       | \$3,649,492   |
| Install 14.4 MVar capacitor bank at LE Plains Interchange 115 kV                                                                                                                          | SWPS    | Reliability | F1     | 0       | \$829,881     |
| Install 14.4 MVar capacitor bank at Allred 115 kV                                                                                                                                         | SWPS    | Reliability | F1     | 0       | \$829,881     |
| Replace CT at Claremore 161 kV                                                                                                                                                            | GRDA    | Reliability | F1     | 0       | \$88,560      |
| Install 6 MVar capacitor bank at Grinnell 115 kV                                                                                                                                          | SUNC    | Reliability | F1     | 0       | \$345,784     |
| Rebuild South Shreveport-Wallace Lake 138 kV line to 246/246 MVA                                                                                                                          | AEPW    | Reliability | F1     | 11      | \$10,268,933  |
| Rebuild Broken Bow-Lone Oak 138 kV corridor to 286/286 MVA                                                                                                                                | AEPW    | Reliability | F1     | 77      | \$60,804,427  |
| Install 14.4 MVar capacitor bank at Ellsworth 115 kV                                                                                                                                      | SUNC    | Reliability | F1     | 0       | \$829,881     |
| Install 6 MVar capacitor bank at Mile City 115 kV                                                                                                                                         | WAPA    | Reliability | F1     | 0       | \$345,784     |
| Upgrade wave traps and switches on Cimarron-McClain 345 kV line                                                                                                                           | OKGE    | Reliability | F1     | 0       | \$116,838     |
| New 345/161 kV transformer at S3459                                                                                                                                                       | OPPD    | Reliability | F1     | 0       | \$8,176,238   |
| New 115/69 kV transformer at Lovington                                                                                                                                                    | SWPS    | Reliability | F1     | 0       | \$2,239,599   |
| Rebuild Canyon West-Dawn-Panda 115 kV line to 249/273 MVA                                                                                                                                 | SWPS    | Reliability | F2     | 24      | \$14,194,453  |
| Tap Hitchland-Finney 345 kV line at new substation and install new 345/115 kV transformer, and build new 23 mile 115 kV line from new station to Walkemeyer and continue to North Liberal | SUNC    | Reliability | F1     | 22      | \$36,224,893  |
| Total                                                                                                                                                                                     |         |             |        | 260     | \$273,156,513 |

Table 0.1: 2015 ITP10 Transmission Plan

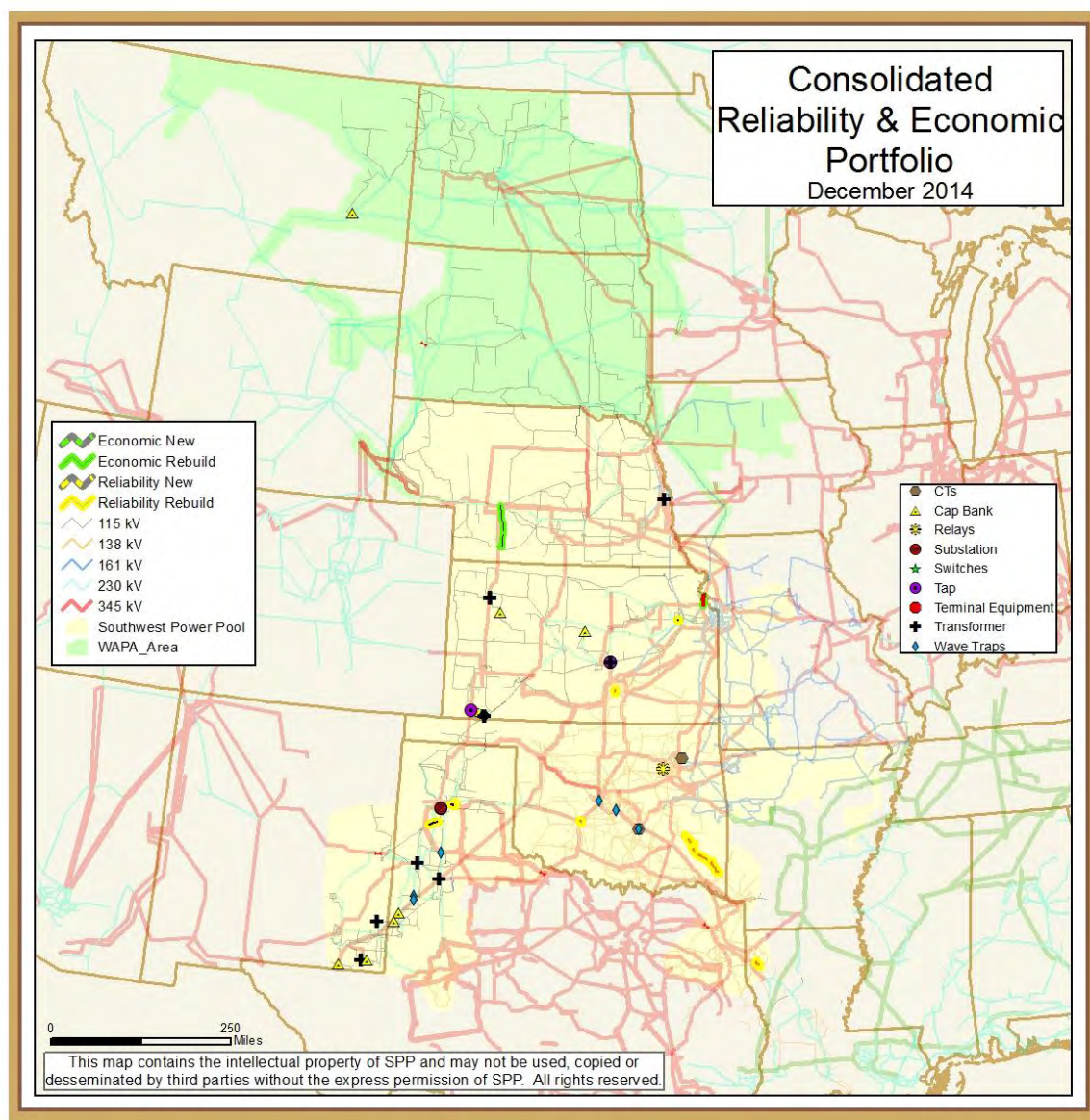


*Figure 0.1: 2015 ITP10 Transmission Plan*



# PART I: STUDY PROCESS



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## Section 1: Introduction

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### **1.1: The 10-Year ITP**

The 10-Year Integrated Transmission Planning Assessment (ITP10) is designed to develop a transmission expansion portfolio containing primarily 100 kV and above projects needed to address reliability needs, support policy initiatives, and enable economic opportunities in the SPP transmission system within the studied ten-year horizon.

ITP10's goals are to:

- Focus on regional transmission needs
- Utilize a value-based approach to analyze 10-year out transmission system needs
- Identify 100 kV and above solutions stemming from such needs as:
  - Resolving potential reliability criteria violations
  - Mitigating known or expected congestion
  - Improving access to markets
  - Meeting expected load growth demands
  - Facilitating or responding to expected facility retirements
- Meet public policy initiatives
- Synergize the Generation Interconnection and Transmission Service Studies with other planning processes
- Assess the zonal benefits of the final portfolio

### **1.2: How to Read This Report**

This report focuses on the year 2024 and is divided into multiple sections.

- **Part I** addresses the concepts behind this study's approach, key procedural steps in development of the analysis, and overarching assumptions used in the study.
- **Part II** demonstrates the findings of the study, empirical results, and conclusions.
- **Part III** addresses the portfolio specific results, describes the projects that merit consideration, and contains recommendations, expected benefits, and costs. Please note that negative numbers here are shown in red and in parentheses.
- **Part IV** contains detailed data and holds the report's appendix material.

## **SPP Footprint**

Within this study, any reference to the SPP footprint refers to the set of Transmission Owners<sup>2</sup> (TO) whose transmission facilities are under the functional control of the SPP Regional Transmission Organization (RTO) unless otherwise noted. The Integrated System (IS) has expressed the intention to join the SPP RTO. The Federal Energy Regulatory Commission (FERC) substantively approved the IS joining SPP, which is slated to occur by October 2015. The IS is assumed to be a part of the SPP RTO for this 10-year out study. The IS includes Western Area Power Administration (WAPA), Basin Electric Power Cooperative, and Heartland Consumers Power District.

Energy markets were also modeled for other regions within the Eastern Interconnection. Notably, Associated Electric Cooperatives Inc. (AECI), Mid-Continent Area Power Pool (MAPP), Tennessee Valley Authority (TVA), and Midcontinent Independent System Operator (MISO) were modeled as external energy markets. Entergy and Cleco were modeled within the MISO energy market.

## **Supporting Documents**

The development of this study was guided by the supporting documents noted below. These documents provide structure for this assessment:

- SPP 2015 ITP10 Scope
- SPP ITP Manual
- SPP Metrics Task Force Report

All referenced reports and documents contained in this report are available on [SPP.org](http://SPP.org)

## **Confidentiality and Open Access**

Proprietary information is frequently exchanged between SPP and its stakeholders in the course of any study and is extensively used during the ITP development process. This report does not contain confidential marketing data, pricing information, marketing strategies, or other data considered not acceptable for release into the public domain. This report does disclose planning and operational matters, including the outcome of certain contingencies, operating transfer capabilities, and plans for new facilities that are considered non-sensitive data.

## **1.3: High Priority Incremental Load Study**

The High Priority Incremental Load Study (HPILS), conducted during the 2015 ITP10 process, evaluated transmission needs resulting from significant incremental load growth expectations in certain parts of SPP.<sup>3</sup> The SPP Board of Directors approved the HPILS portfolio in April 2014. In accordance with the recommendation of the Economic Studies Working Group (ESWG) and Transmission Working Group (TWG) on July 3, 2013, the HPILS projects with a notification to construct (NTC) or a notification to construct with conditions (NTC-C) were included in the 2015 ITP10 model.

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<sup>2</sup> SPP.org > About > Fast Facts > Footprints

<sup>3</sup> [HPILS Final Report](#)

## **1.4: FERC Order 1000**

FERC issued Order 1000 on June 17, 2010. Order 1000 requires the removal of federal right of first refusal (ROFR) for certain transmission projects under the SPP Tariff. To comply with this requirement, SPP developed the Transmission Owner Selection Process (TOSP) to competitively solicit proposals for projects that no longer have ROFR<sup>4</sup>. The TOSP is outlined in Attachment Y of the SPP Tariff. For the ITP process, once the applicable ITP study scope has been approved and the needs assessment performed, SPP shall notify stakeholders of the identified transmission needs and provide a transmission-planning response window of 30 calendar days. During this response window, any stakeholder may submit a Detailed Project Proposal (DPP) pursuant to Section III.8.b. of Attachment O of the SPP Tariff.<sup>5</sup>

In addition, SPP Business Practice 7650 outlines the specific DPP processes associated with Order 1000.

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<sup>4</sup> SPP.org > Engineering > Order 1000

<sup>5</sup> SPP.org > Engineering > Order 1000 > Detailed Project Proposal

## Section 2: Stakeholder Collaboration

Assumptions and procedures for the 2015 ITP10 analysis were developed through SPP stakeholder meetings that took place in 2013 and 2014. The assumptions were presented and discussed through a series of meetings with members, liaison-members, industry specialists, and consultants to facilitate a thorough evaluation. Groups involved in this development included the following:

- Economic Studies Working Group (ESWG)
- Transmission Working Group (TWG)
- Regional Tariff Working Group (RTWG)
- Cost Allocation Working Group (CAWG)
- Markets and Operations Policy Committee (MOPC)
- Strategic Planning Committee (SPC)
- SPP Regional State Committee (RSC)
- SPP Board of Directors (BOD)



SPP staff served as facilitators for these groups and worked closely with the chairs of each group to ensure all views were heard and that SPP's member-driven value proposition was followed.

The ESWG and TWG provided technical guidance and review for inputs, assumptions, and findings. Specifically, the TWG was responsible for technical oversight of the load forecasts, transmission topology inputs, constraint selection criteria, reliability assessments, transmission project impacts stability analysis, and the report. ESWG was responsible for technical oversight of the economic modeling assumptions, futures development, resource plans and siting, metric development and usage, congestion analysis, economic model review, calculation of benefits, and the report.

The strategic and policy guidance for the study was provided by the SPC, MOPC, RSC, and Board of Directors.

### Planning Workshops

In addition to the standard working group meetings, three transmission planning summits were conducted to elicit further input and provide stakeholders with a chance to interact with staff on all related planning topics.

- Key drivers developed by the stakeholders were presented at the planning summit on November 20, 2013.<sup>6</sup>
- Potential upgrades were presented at the planning summit on October 8<sup>th</sup>, 2014.<sup>7</sup>
- Recommended solutions with completed reliability, stability and economic analysis results were presented at the planning summit on December 16<sup>th</sup>, 2014.<sup>8</sup>

<sup>6</sup> SPP.org > Engineering > Transmission Planning > 2013 November Planning Summit

<sup>7</sup> SPP.org > Engineering > Transmission Planning > 2014 October Planning Summit

## Policy Survey

The 2015 ITP10 Policy Survey focused on projected renewable requirements and additions over the next 10 years. In the survey, stakeholders were asked to identify:

- Existing renewable resources
  - Including renewable resources coming online by end of year 2014
- Renewable Statutory/Regulatory Mandates for renewable generation through the year 2024
- Renewable Statutory/Regulatory Goals for renewable generation through the year 2024
- Other Renewables required to promote company policy or reflect planned future generation additions through the year 2024

SPP used the results of the 2015 ITP10 Policy Survey in the development of resource plans for both conventional and renewable resources, as detailed in Resource Expansion Plan. After modeling existing renewables as reported in the survey, each utility was analyzed to determine if the renewable Mandates, Goals and Other generation quantities as reported in the survey were being met. If a utility was short on renewables, additional capacity was added in order to meet the levels specified in the survey.

## Policy Definitions<sup>9</sup>:

- Renewable Statutory/Regulatory Mandate: Any currently effective state or federal statute or local law or any regulatory rule, directive or order which requires that an electric utility,<sup>10</sup> subject to the jurisdiction of that state, federal, or local law or regulatory body, must use a certain level (e.g. percentage) of renewable energy<sup>11</sup> to serve load. As used in this definition, a regulatory body is:
  - 1) Any state or federal regulatory body with authority over rate-setting, resource include planning, and other policy matters for electric utilities within its jurisdiction; or
  - 2) An elected City Council, a publicly-elected Board of Directors, a Board of Directors appointed by a publicly-elected official(s), or other governing body as defined by the appropriate governing statutes with jurisdiction over rates, resource planning and other regulatory matters.
- Renewable Statutory/Regulatory Goal: Any currently effective state or federal statute or local law or any regulatory rule, directive or order which establishes an aspirational goal to promote the use of a certain level (e.g. percentage) of renewable energy to serve load for an electric utility (subject to the jurisdiction of that state, federal, or local law or regulatory body). This definition does not include renewable energy used by a utility pursuant to Renewable Statutory/Regulatory Mandates, as reported above, or Other Renewables as shown below. As used in this definition, a regulatory body is:
  - 1) Any state or federal regulatory body with authority over rate-setting, resource planning, and other policy matters for electric utilities within its jurisdiction; or
  - 2) An elected City Council, a publicly-elected Board of Directors, a Board of Directors appointed by a publicly-elected official(s), or other governing body as defined by the appropriate governing statutes with jurisdiction over rates, resource planning and other regulatory matters.

<sup>8</sup> SPP.org > Engineering > Transmission Planning > 2014 December Planning Summit

<sup>9</sup> As defined during the policy survey development at the ESWG/CAWG meetings

<sup>10</sup> Some municipalities are exempt.

<sup>11</sup> Some states renewable requirements are capacity based instead of energy based. See Table 2.1.

- Other Renewables: Utility company policy which promotes the use of a certain level (e.g. percentage) of renewable energy to serve load or any other renewable resources, not included in the categories defined above.

### Renewable Energy Drivers

Renewable energy and capacity requirements are driven by statutory/regulatory standards and court decisions made within each state of the SPP footprint. A brief summary of these requirements are listed below in Table 2.1:

| State      | Type                   | Source                                                                    | Amount                                                                  |
|------------|------------------------|---------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Kansas     | Statute (Capacity)     | Kansas Statutes 66-1256 - 66-1262                                         | 10% - 2011 - 2015<br>15% - 2016 - 2019<br>20% - 2020                    |
| Missouri   | Statute (Energy)       | R.S. Mo. § 393.1020 et seq.                                               | 2% - 2011 - 2013<br>5% - 2014 - 2017<br>10% - 2018 - 2020<br>15% - 2021 |
| Multiple   | Court Order (Capacity) | United States District Court Order for Turk Settlement (SWEPCO)           | 400 MW of Capacity in SWEPCO Service Territory (AR, LA, or TX)          |
| Nebraska   | State Agency (Energy)  | Public Power District Board Action                                        | 10% - 2020 (NPPD)                                                       |
| New Mexico | Statute (Energy)       | Renewable Energy Act ("REA"), §§ 62-16-1 et seq. NMSA                     | 10% - Current<br>15% - 2015<br>20% - 2020                               |
| Oklahoma   | Statute (Capacity)     | 17 Okl. St. § 801.4                                                       | 15% by 2015                                                             |
| Texas      | Statute (Capacity)     | TEX UT. CODE ANN. § 39.904<br>United States District Court Order (SWEPCO) | 5,256 MW - Current<br>5,880 MW – 2015                                   |

Table 2.1: Renewable Energy Standards by State



## Load and Generation Review

The 2015 ITP10 Load and Generation Review focused on planned conventional generation and load additions in the next 10 years. Stakeholders were asked to identify:

- existing conventional generation
- new conventional generation
- retired conventional generation
- summer peak load
- energy numbers
- load factors

SPP Used the results of the 2015 ITP10 Load and Generation Review, as approved by the ESWG, to update the base economic model and used to update conventional generation information used in resource planning.

## Project Cost Overview

Project costs utilized in the 2015 ITP10 were developed in accordance with the guidelines of the Project Cost Working Group (PCWG). Conceptual Estimates, shown in Table 2.2 below were prepared by SPP based on historical cost information in an SPP database.

| Voltage (kV)  | New Line (\$ Per Mile) | Rebuild (\$ Per Mile) | Reconductor (\$ Per Mile) | Transformers | New Substation |
|---------------|------------------------|-----------------------|---------------------------|--------------|----------------|
| 500           | \$1,518,968            | \$1,102,049           | \$854,593                 | \$12,197,008 | \$18,468,127   |
| 345           | \$1,427,478            | \$1,031,114           | \$760,292                 | \$9,056,700  | \$13,617,362   |
| 345 (Dbl Ckt) | \$2,130,236            | \$1,929,488           | \$1,352,792               | N/A          | N/A            |
| 230           | \$926,905              | \$964,744             | \$676,396                 | \$5,778,860  | \$5,609,010    |
| 161           | \$922,334              | \$902,646             | \$601,758                 | \$3,859,619  | \$4,692,577    |
| 138           | \$917,762              | \$870,466             | \$549,352                 | \$3,390,798  | \$3,528,559    |
| 115           | \$815,550              | \$733,861             | \$499,254                 | \$2,663,963  | \$3,348,304    |
| 69            | \$763,056              | \$733,482             | \$422,990                 | \$1,978,085  | \$2,468,852    |

*Table 2.2: 2015 ITP10 Conceptual Project Cost Estimates*

The Conceptual Project Costs were used for Pre-Phase I, Phase I, and Phase II of the DPP evaluation process to establish a -50 to +100 cost estimate for each project. Once the grouping with the highest net adjusted production cost (APC) benefit for each future was selected, independent SPP cost estimates were used in Phase III of the DPP process to establish the  $\pm 30$  cost for each project.

## Project Solutions

For the 2015 ITP10, needs were not directly addressed with projects proposed by stakeholders as in the past due to the implementation of Order 1000. Under Order 1000, potential projects were submitted through the Detailed Project Proposal (DPP) process during a transmission-planning response window of 30 calendar days. Potential projects submitted outside this window were considered as Non DPP Submittals.

## Section 3: Future Selection

### **3.1: Uncertainty and Important Issues**

Designing a transmission expansion plan to meet future needs is challenging because of the inability to accurately predict the policy environment, future load growth, fuel prices, and technological development over an extended time period. To address these challenges, two distinct sets of assumptions were developed and studied as individual “Futures” for the 2015 ITP10.

### **3.2: Futures Descriptions**

The 2015 ITP10 study was conducted based on a pair of futures. These futures consider evolving changes in technology, public policy and climate changes that may influence the transmission system and energy industry as a whole. By accounting for multiple future scenarios, SPP staff can assess what transmission needs arise for various uncertainties. In all futures, EPA environmental regulations, as known or anticipated at the time of the study, are incorporated.

#### **Future 1: Business as Usual**

This future includes all statutory/regulatory renewable mandates and goals as well as other energy or capacity as identified in the Policy Survey resulting in 11.5 GW of renewable resources modeled in SPP, load growth projected by load serving entities including the High Priority Incremental Loads, and SPP member-identified generator retirement projections. This future assumes no major changes to policies that are currently in place.



#### **Future 2: Decreased Base Load Capacity**

This future considers factors that could drive a reduction in existing generation. It will include all assumptions from the Business as Usual future with a decrease in existing base load generation capacity. This future will retire coal units less than 200 MW, reduce hydro capacity by 20% across the board, and utilize the Palmer Drought Severity Index for an average of August 1934 and August 2012 to simulate a reduction in existing capacity affected by drought conditions: 10% under moderate, 15% under severe, and 20% under extreme conditions. These target reductions were adjusted, as appropriate, based on locational and operational characteristics provided by the unit owners within each zone.



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## Section 4: Study Drivers

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### **4.1: Introduction**

Drivers for the 2015 ITP10 were discussed and developed through the stakeholder process in accordance with the 2015 ITP10 Scope. Stakeholder load, energy, generation, transmission, and market design inputs were carefully considered in determining the need for, and design of, future transmission upgrades.

### **4.2: Load & Energy Outlook**

#### **Peak and Off-Peak Load**

Future electricity usage was forecasted by utilities in the SPP footprint and collected and reviewed by the ESWG. The highest usage, referred to as the system peak, usually occurs in the summer for SPP. The non-coincident peak load, the sum of each Load Serving Entity's peak load, was forecasted to be 60.8 GW for 2019 and 64.4 GW for 2024. The load totals in the 2015 ITP10 include 50/50 (expected) incremental loads from HPILS. Note that all demand figures shown in this section include the loads of the TOs within the SPP footprint as well as all other Load Serving Entities (LSE) within the SPP region. The IS was also included in the SPP region.

Once inputs such as the peak load values, annual energy values, hourly load curves, and hourly wind generation profiles were incorporated into the model, the economic modeling tool calculated the security-constrained unit commitment and security-constrained economic dispatch (SCUC/SCED) for each of the 8,784 hours in the year 2024. This process led to identifying the study's two reliability hours:

- 1) **Summer peak hour** –The summer hour with the highest load
- 2) **Off-peak hour** – The hour with highest ratio of wind output to load, in order to evaluate grid exposure to significant output from these resources.

The results indicated that the summer peak hour for 2024 would occur on July 19 at 5 p.m. and the high wind hour would occur on April 6 at 4 a.m.

#### **Peak Load and Energy**

The sum of energy used throughout a year, referred to as the net energy for load forecast, was estimated by SPP using annual load factor data provided and approved by the ESWG contacts. Annual net energy for load (including losses) was forecasted at 302 TWh for 2019 and 323 TWh for 2024. Tables 1.1 and 1.2 show the breakdown of the peak demand and annual energy totals. The coincident peak load, or the peak load for the entire SPP footprint, was forecasted at 57 GW for 2019 and 61 GW for 2024. Table 4.1 shows the forecasted monthly energy for 2024.

| Load Type                  | Standard<br>Projected Load | HPILS Load     | Total Load     | Total Load |
|----------------------------|----------------------------|----------------|----------------|------------|
|                            | Non-Coincident             | Non-Coincident | Non-Coincident | Coincident |
| <b>2019 Peak Load (GW)</b> | 59.6                       | 1.2            | 60.8           | 57.0       |
| <b>2024 Peak Load (GW)</b> | 62.8                       | 1.6            | 64.4           | 61.0       |

Table 4.1: Breakdown of peak load totals

| Energy Type              | Standard<br>Projected<br>Energy | HPILS Energy | Total<br>Energy |
|--------------------------|---------------------------------|--------------|-----------------|
| 2019 Annual Demand (TWh) | 292.4                           | 9.6          | 302.0           |
| 2024 Annual Demand (TWh) | 310.5                           | 12.8         | 323.3           |

Table 4.2: Breakdown of annual energy totals

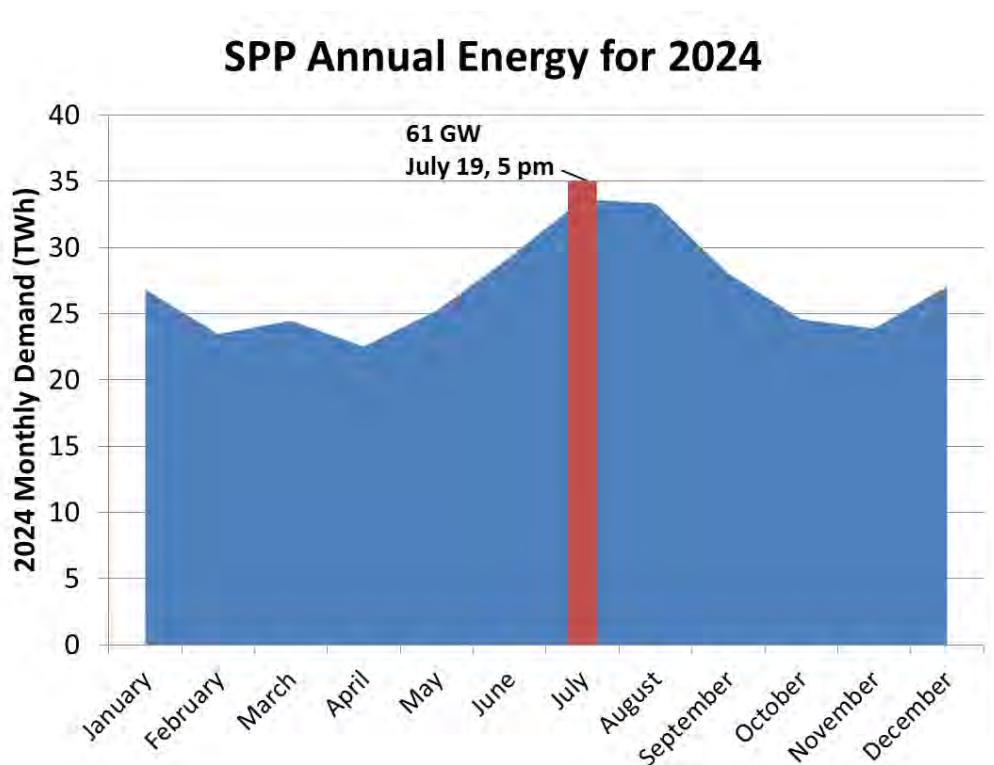


Figure 4.1: 2024 Monthly Energy for SPP

### Diverse Peak Demand Growth Rates

The projections included diverse peak load growth rates for each area. Table 4.3 lists the peak load growth rates, which includes incremental loads, for the key areas in the model. These forecasted values result in an average annual growth rate of 1.16% for SPP.

| Area     | SUNC | MKEC | OKGE | WRI  | AEPW | LES  | GRDA |
|----------|------|------|------|------|------|------|------|
| Rate (%) | 1.81 | 0.93 | 0.89 | 0.72 | 2.70 | 1.16 | 1.93 |

| Area     | KCPL  | MIDW | WFEC | EMDE | GMO   | CUS  | SPS  |
|----------|-------|------|------|------|-------|------|------|
| Rate (%) | -0.14 | 1.37 | 1.08 | 0.80 | -1.18 | 1.00 | 3.02 |

| Area     | NPPD | OPPD | BEPC | HCPD | WAPA | CBPC |
|----------|------|------|------|------|------|------|
| Rate (%) | 1.01 | 1.64 | 2.26 | 0.60 | 0.00 | 0.43 |

Table 4.3: Annual Peak Load Growth Rates for SPP OATT Transmission Owners 2019 - 2024 (%)

### 4.3: Policy Drivers

Emission price forecasts for SO<sub>2</sub> and NO<sub>x</sub> for the study years were based upon Ventyx simulation ready data, specifically, the 2012 Spring Reference Case released in May 2012. No emission price was utilized for CO<sub>2</sub>.

### 4.4: Market Structure

SPP transitioned to a Consolidated Balancing Authority (CBA) and a Day Ahead Market, referred to as SPP's Integrated Marketplace, in March 2014. This market structure is simulated in PROMOD IV and was an assumption utilized across all futures.

### 4.5: Congestion Issues

SPP identified 50 economic needs for the ITP10. Details of these congestion issues and the drivers for those congestion issues are listed in the Economic Needs Section of the Appendix.

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## Section 5: Resource Expansion Plan

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### **5.1: Resource Plan Development**

Identifying the resource outlook for each future is a key component of evaluating the transmission system for a 10-year horizon. Resources are added and retired frequently, and the SPP generation portfolio will not be exactly the same in 10 years as it is today. Resource expansion plans have been developed for the SPP region and neighboring regions for use in the study that include both conventional and renewable generation plans unique to each future.

After completion of the resource plan development, a decision was made to include the IS as part of the SPP system for purposes of this ITP10 analysis. A resource plan has been developed for the IS. Although the IS resource plan was developed and approved separately from the remainder of the SPP resource plan, the resource plans are presented together in this section.

### **5.2: Siting Plan**

The expected location of future generation was considered in areas with appropriate potential, based on input from and approval by the ESWG. The selected locations for new renewable and conventional generation will impact the power flow and will also drive the potential generation dispatch, congestion, thermal violations, and voltage violations.

### **5.3: Conventional Resource Plan**

A conventional resource plan was developed for each future for the years 2019 and 2024.

#### **Generator Review**

An ITP10 generator review was conducted with stakeholders providing inputs for the analysis. This information includes maximum capacities, ownership, retirements, and other operating characteristics of all generators in SPP. The existing generation in the SPP region was updated with this information before development of the resource plan.

#### **Conventional Resource Plan Approach**

SPP Criteria 2.1.9<sup>12</sup> states that each load serving entity must maintain at least a 12% capacity margin, and this requirement is not expected to change with the implementation of the Integrated Marketplace. The resource plan was developed with this same requirement. Projected capacity margins were calculated for each zone using existing generation and 2024 load projections. Each zone's capacity was assessed to ensure that it met the 12% minimum capacity margin requirement. Only 5% of wind nameplate capacity was counted towards the capacity margin requirement due to the unpredictability of wind levels. ESWG approved a resource list of generic prototype generators using assumptions from the EIA Annual Energy Outlook (AEO) 2013. These prototype generators comprise representative parameters of specific generation technologies and were utilized in resource planning simulations to determine the optimum generation mix to add to each zone. All new generation identified in the conventional resource plan were natural gas-fired, comprising a combination of combined cycle and

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<sup>12</sup> SPP.org > Org Groups > Governing Documents > Criteria & Appendices January 30, 2012

fast-start combustion turbine units. Locations of those generating units were vetted with the various zones and all efforts were made to include the Integrated Resource Plans filed by utilities in their respective state(s).

**Generation Siting**

After the required generation additions were determined for each zone, they were sited within the zone based on locations identified for the 2013 ITP20 and HPILS. The ESWG and other stakeholders provided input on potential locations for additional gas generation, along with the associated bus information based on space requirements, proximity to gas pipelines, and existing electric transmission. The stakeholder feedback was incorporated and the overall siting plan was presented and approved by the ESWG.

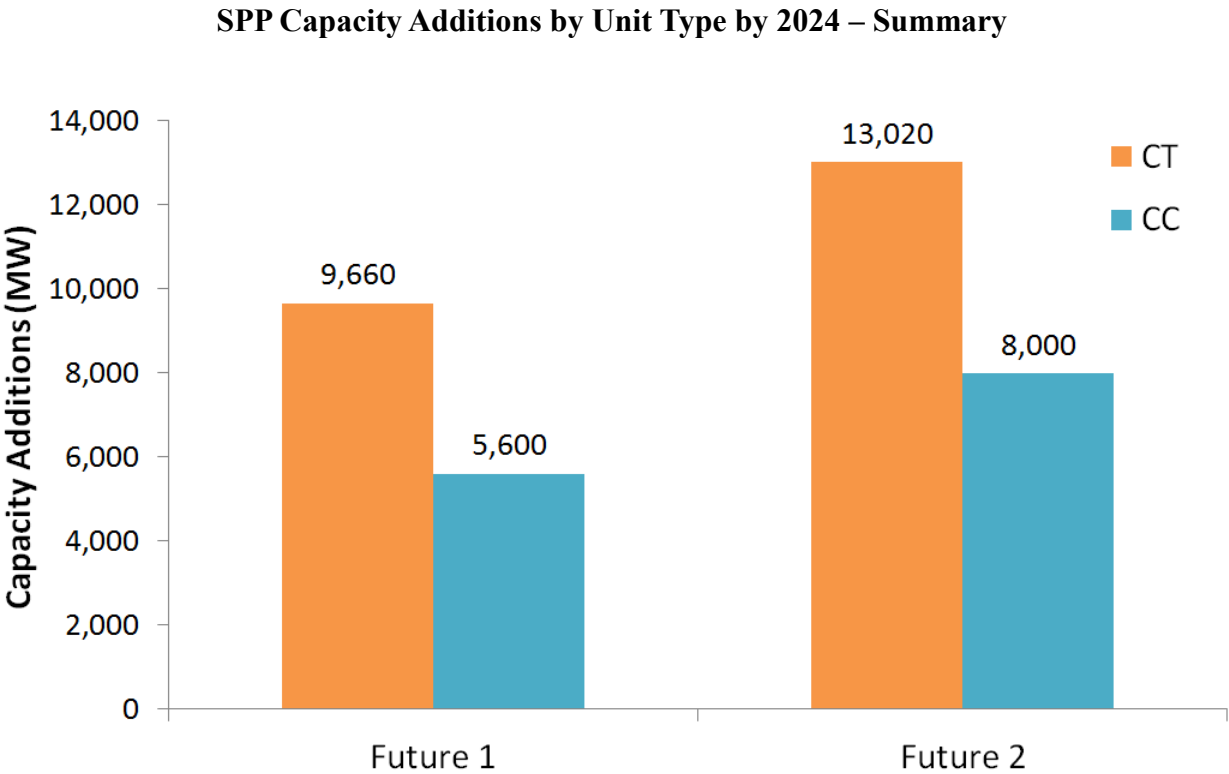


*Figure 5.1: Capacity Additions by Unit Type – Conventional Plan*

Figure 5.1 shows new generation additions by future for the SPP region. Future 1 has 15.3 GW of generation additions, and Future 2 has 21.0 GW of generation additions. More resource additions are needed in Future 2 due to the decreased base load capacity assumptions of this future. Both futures have resource additions comprised of combustion Turbine (CT) units and combined cycle (CC) units. The CC units are generally included because their moderately low capital cost and low operating costs make them the most economically viable technology for meeting energy needs in these futures. CC units were selected primarily in areas that were low in base load generation, and needed the additional energy to serve load. The CT units are generally included because of the very low capital costs associated with these units make them the most economically viable technology for meeting peak capacity requirements. CT units were selected primarily for areas that already have sufficient base load generation, and need the additional capacity to meet the 12% capacity margin requirement.



### Future 1 Conventional Resource Plan for 2024 – SPP

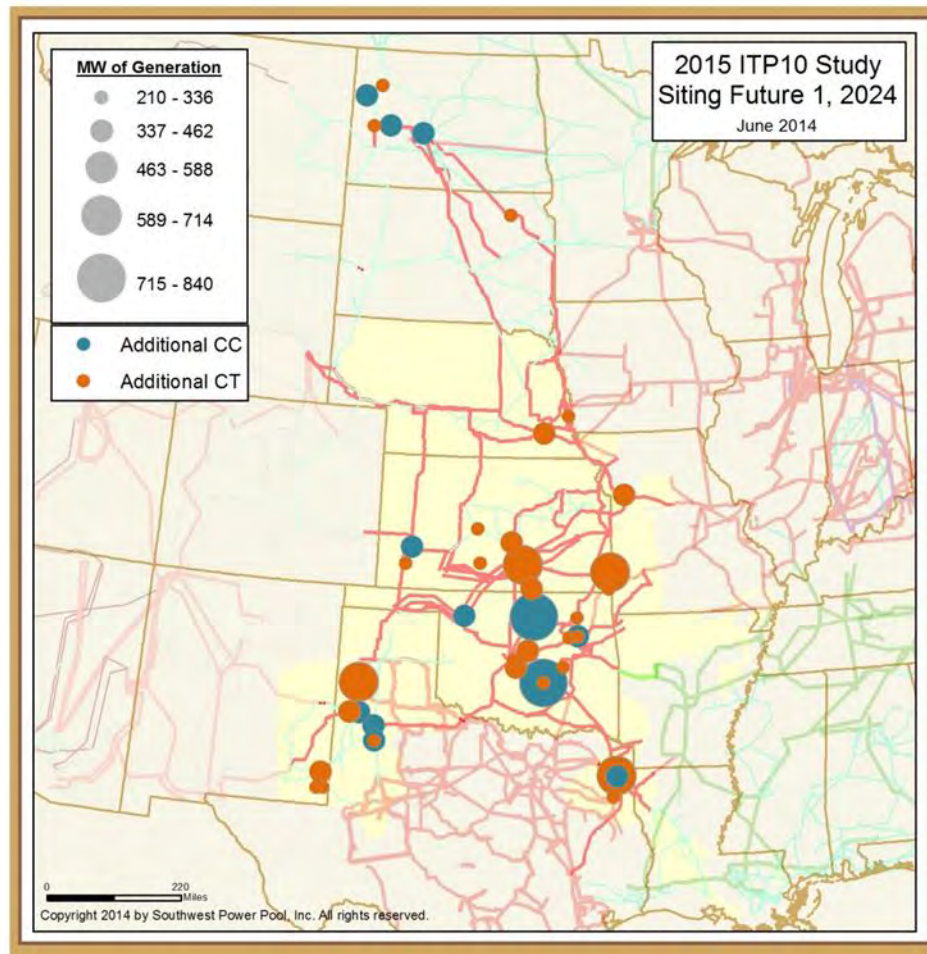


*Figure 5.2: Conventional Generation Additions for Future 1*

Figure 5.2 shows locations and technology type of all new conventional generation added to Future 1.

- Additional Sites
  - 14 Combined Cycle
  - 46 Combustion Turbine
- Additional Capacity
  - 5.6 GW Combined Cycle
  - 9.7 GW Combustion Turbine

## Future 2 Conventional Resource Plan for 2024 – SPP

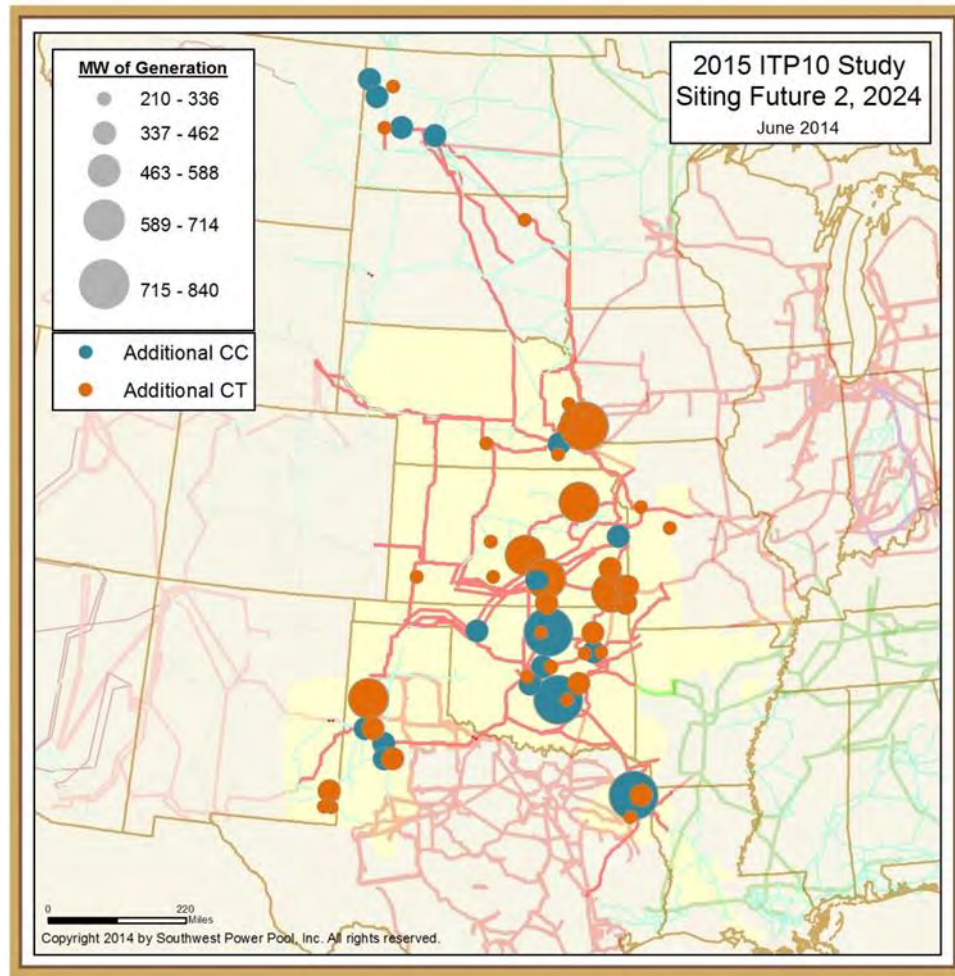


Figure 5.3: Conventional Generation Additions for Future 2

Figure 5.3 shows locations and technology type of all new conventional generation added to Future 2 for 2024.

- Additional Sites
  - 20 Combined Cycle
  - 62 Combustion Turbine
- Additional Capacity
  - 8.0 GW Combined Cycle
  - 13.0 GW Combustion Turbine

### Conventional Resource Plan – External Regions

For Futures 1 and 2, resource plans were also developed for external regions. Each region was assessed to determine the capacity shortfall, and natural gas combined cycle and combustion turbine units were added so that each region met their own capacity margin. New units were interconnected to lines with high transfer capacity. Units were added in AECl, TVA, MISO, WAPA and Saskatchewan Power (SASK). SPP Staff contacted these entities to obtain resource plans for 2019 and 2024. The MISO

resource plan was based on the MISO Transmission Expansion Planning (MTEP13). SPP Staff calculated the resources needed for Entergy and Cleco, as the MTEP13 did not include these regions in their calculations.

#### External Regions Capacity Additions by Unit Type by 2024 – Future 1

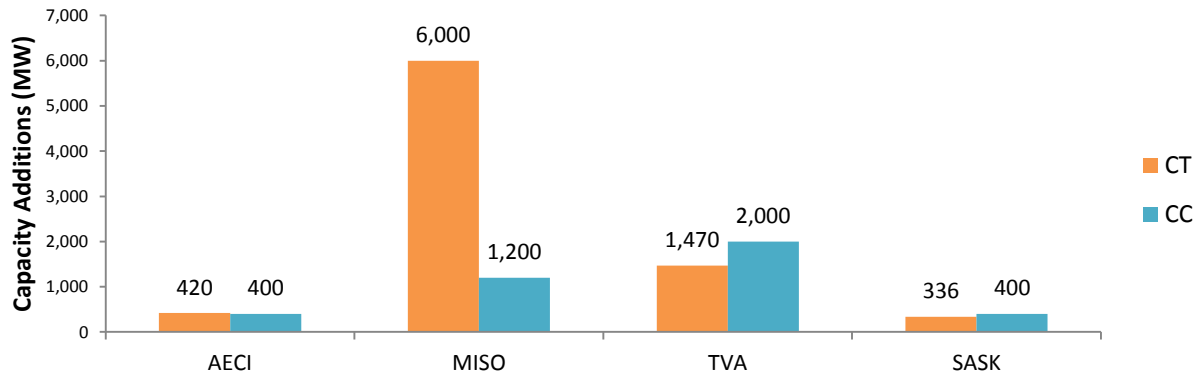


Figure 5.4: Capacity Additions by Unit Type – Conventional Plan Future 1

#### External Regions Capacity Additions by Unit Type by 2024 – Future 2

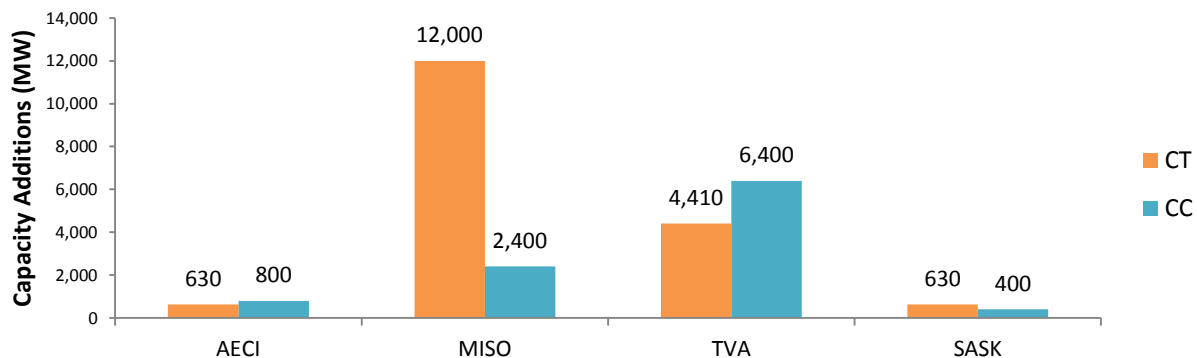


Figure 5.5: Capacity Additions by Unit Type – Conventional Plan Future 2

## 5.4: Renewable Resource Plan

A renewable resource plan was also developed for the years 2019 and 2024. This renewable resource plan applies to all futures.

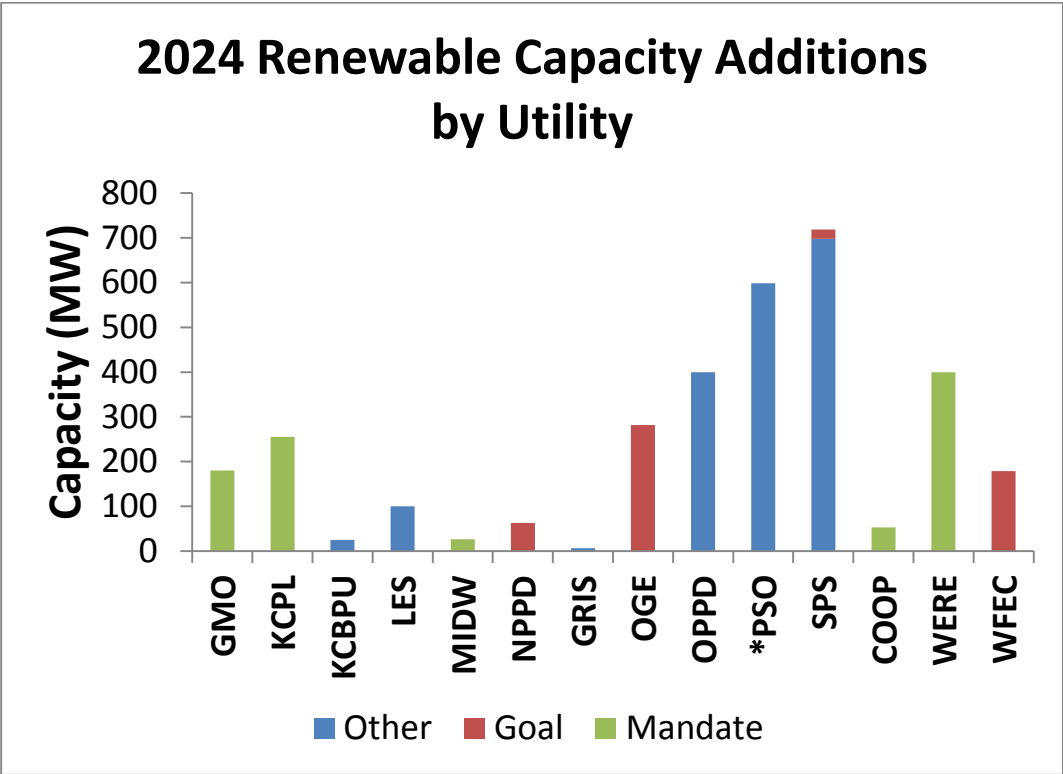
### Existing Wind

The 2015 Policy Survey was used to gather information on existing wind generation in the SPP system for inclusion in the models. Existing wind was defined as wind generation that is in-service or currently in development and expected to be in-service by the end of 2014. Members reported 7.0 GW of existing wind in the SPP region. Another 1.2 GW of existing wind generation is currently contracted for export

with firm service and was modeled accordingly. The total existing wind reported by members that is located within the SPP region is 8.2 GW and was included in the models for all futures.

**Additional Renewables**

The 2015 Policy Survey was used to gather information on members’ state renewable Mandates, Goals, and Other expected renewable additions with which to comply with by 2024. Additional wind generation was added to the system when the existing wind was not sufficient to meet these Mandates, Goals, and Other<sup>13</sup> expectations which include economic purchases. The total additional renewables added in the SPP footprint by 2024 is 3.3 GW with allocations based on the policy survey assumptions. The table below shows wind and solar generation added in both futures:



\* An economic and company goal number.

Table 5.1: SPP Renewable Generation Additions by Utility

**Siting of Additional Renewable Generation**

Generic wind sites were selected by the ESWG based upon the locations utilized in previous ITP studies, as well as, NREL sites because of their potential for high wind output. The 3.3 GW of additional wind was apportioned among 18 wind sites in New Mexico, Texas, Oklahoma, Kansas, Missouri, and Nebraska. The 20.5 MW of additional solar was apportioned among two solar sites to meet solar goals in Texas.

<sup>13</sup> . “Other” is defined as utility company policy which promotes the use of a certain level (e.g. percentage) of renewable energy to serve load or any other renewable resources, not included in Mandates and Goals



### Futures 1 and 2 Renewable Resource Plan for 2024 – SPP

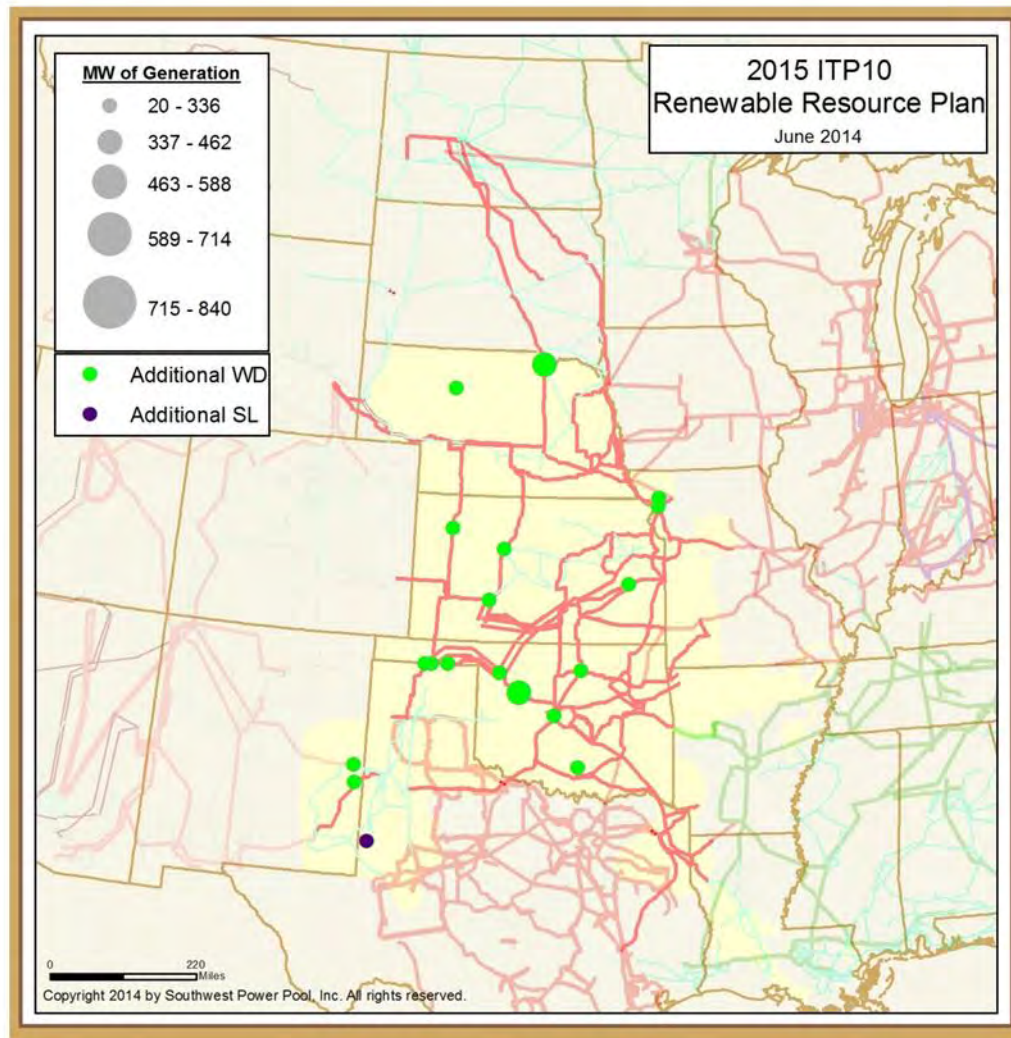


*Figure 5.6: Renewable Resource Plan for Futures 1 and 2*

Figure 5.6 shows the location of all wind generation for the SPP region for Futures 1 and 2.

- Wind Sites
  - 71 Existing
  - 21 New
- Wind Capacity
  - 8.2 GW Existing
  - 3.3 GW New
  - 11.5 GW Total

Additional information and results of the renewable resource plan are shown in Appendix Z, including zonal breakdown of wind, bus locations, and external region details.

**Renewable Resource Plan – External Regions**

Renewable resource plans were also developed for external regions for both futures. MISO provided SPP staff with assumptions regarding renewable generation additions, which includes 5.6 GW in Future 1 and 11.2 GW in Future 2 (including solar and wind) of renewables for MISO. These renewable units were sited at high voltage buses with high transfer capacities. The MISO renewable resource plan was based on the MTEP13, and do not include Energy and Cleco. AECI, TVA and SASK were not included in the renewable resource plan.

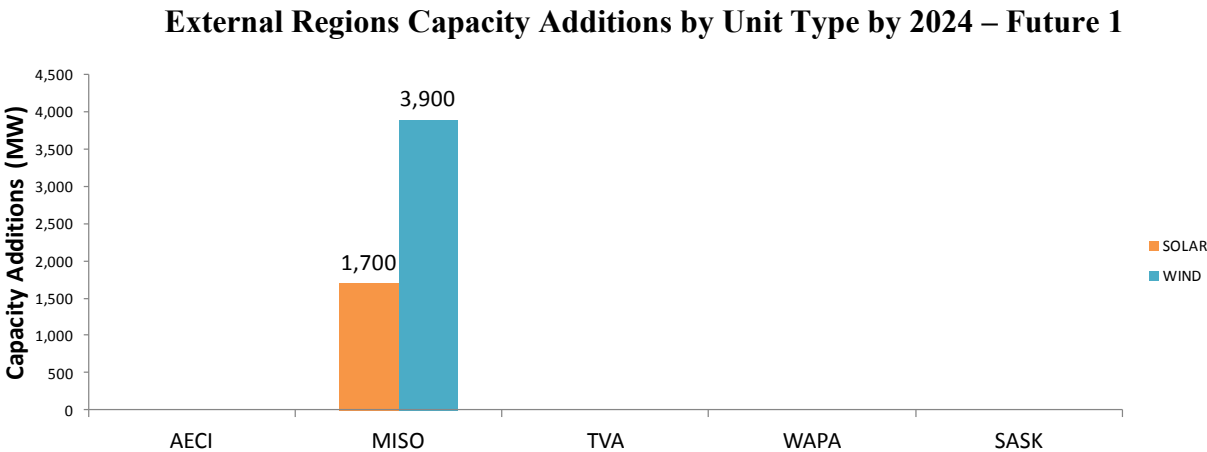


Figure 5.7: Capacity Additions by Unit Type – Renewable Resource Plan Future 1

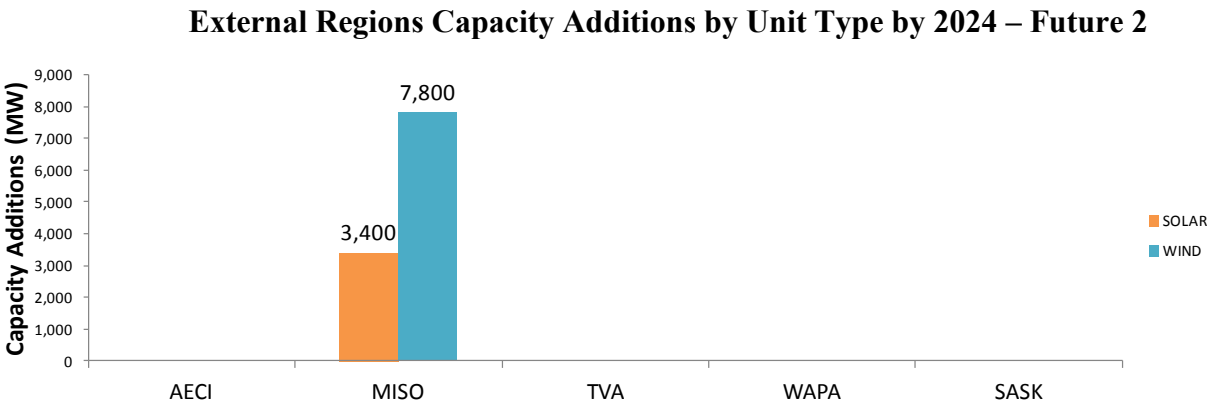


Figure 5.8: Capacity Additions by Unit Type – Renewable Resource Plan Future 2

**5.5: Generator Outlet Facilities**

Once the new resource plan was applied to the models, Generator Outlet Facilities (GOF) were developed where existing transmission facilities were unable to dispatch 100% of the new resource plan. This would allow new generation to go through the Generation Interconnection process to determine what upgrades would be needed for interconnection. The GOF methodology was developed by staff and approved by the TWG and ESWG to ensure that facilities needed to dispatch the resource plans were not included in the Consolidated Portfolio or issued an NTC. GOF facilities were developed by staff and approved by the TWG for each future. These upgrades were then applied to the base model.

| GOF Upgrade                                                                                                                                                                                                          | Future |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| Build CKT2 from Pharaoh - Weleetka 138 kV                                                                                                                                                                            | Both   |
| Build new 12.3 mile 138 kV line from Weleetka - Wetumka with an emergency rating of 162 MVA                                                                                                                          | F2     |
| Tap SWPA Weleetka to GreasyCk. Reconductor 2.6 miles of new 2nd circuit between AEP and SWPA Weleetka subs with 795ACSR. Limit is 800A Wtraps                                                                        | F1     |
| Uprate line from Weleetka - Weleetka from Weleetka Outlets idv.                                                                                                                                                      | F2     |
| Install second transformer at Wilkes (508840)                                                                                                                                                                        | Both   |
| Reconductor Lydia - Welsh 345 kV line to an emergency rating of 1176 MVA                                                                                                                                             | Both   |
| Upgrade terminal equipment to increase rating of Oneta - OEV 345 kV CTK1 and CTK2 to an emergency rating of 1885 MVA                                                                                                 | Both   |
| Rebuild Woodward (514785) to Mooreland (520999) 138 kV to and emergency rating of 465 MVA                                                                                                                            | Both   |
| Reconductor McClain - Draper 345 kV line to an emergency rating of 1792 MVA                                                                                                                                          | F2     |
| Tap Cimaron - Draper 345 kV line and move new McClain generation to high side of the 345/138/13.8 transformer. Rebuild McClain - West Moore 138 kV line to an emergency rating of 571 MVA                            | Both   |
| Upgrade terminal equipment to increase rating of Jones - Lubbock Sth 230 kV CTK 1 and 2 to an emergency rating of 635 MVA                                                                                            | F1     |
| Build new 10 mile 230 kV line Holly - Wadsworth with an emergency rating of 727 MVA                                                                                                                                  | F2     |
| Convert Hobbs – Hob and Plt - Andrews from 230 kV to 345kV operation. Install 1 345/230/13.2 and 1 345/115/13.8 transformers and build new 57.2 mile 345 kV line from Hob and Plt to Roadrunner                      | Both   |
| Build LP-Milwaukee6 (522823) - LP-Southeast 6 (522861) LP-Holly 6 (522870) 230 kV line with a rating of 727 MVA                                                                                                      | F1     |
| Upgrade terminal equipment to increase LP-Holly - Jones 230 kV line to an emergency rating of 502 MVA                                                                                                                | Both   |
| Upgrade LP-Southeast 6 (522861) LP-Holly 6 (522870) 230 kV line with a rating of 727 MVA                                                                                                                             | Both   |
| Reconductor NA_Enrich - Tran-Sub 115 kV to an emergency rating of 304 MVA                                                                                                                                            | Both   |
| Upgrade wavetraps to increase rating of Lubbock_Sth - Wolfforth to an emergency rating of 502 MVA                                                                                                                    | F2     |
| Build 2nd circuit from Heizer to Great Bend 230 kV                                                                                                                                                                   | Both   |
| Install 345/115/13/8 transformer at new Finney TP 7 and build 6.44 mile 115 line to Rubart                                                                                                                           | Both   |
| Reconductor St John - Seward 115 kV to an emergency rating of 239                                                                                                                                                    | Both   |
| Tap Hitchland (523097) - Finney (523853) new bus Finney TP 7 (523100)                                                                                                                                                | Both   |
| Tap Viola - Wichita 345 kV line and build new 15 mile 345 kV line to Gill. Move new generation to high side of new Gill transformer. Also reconductor Gill - El Paso 138 kV line with an emergency rating of 478 MVA | F2     |
| Tap Neosho - Blackberry 345 kV and build 17 Mile double circuit 345 kV line to Franklin. Move new Franklin generation to highside of 345/161/13.8 transformers.                                                      | Both   |
| Move generators at Gill East 138 kV to Gill West 138 kV and Gill South 138 kV                                                                                                                                        | F1     |
| Upgrade Neosho 138/69 kV transformer to a rating of 165 MVA                                                                                                                                                          | F2     |
| Reconductor Marmatan - Neosho 161 kV line to an emergency rating of 223 MVA                                                                                                                                          | F2     |
| Reterminate Waco - Gill West 138 kV at Gill East 138 kV                                                                                                                                                              | F1     |

|                                                                                                |      |
|------------------------------------------------------------------------------------------------|------|
| Upgrade Bus Ties at Gill to an emergency rating of 650 MVA                                     | F1   |
| Rebuild Joplin - Stateline CTK1 to match CTK2 rating                                           | F2   |
| Build new BPS Sub - Hartbine 115kV line                                                        | F2   |
| Reconductor BPS Sub - Clatona 115kV and Clatona - Sheldon 115kV for an emergency rating of 212 | F2   |
| Upgrade wavetraps and switches to increase rating of Centenl - Paola to 334 MVA                | F2   |
| Rebuild Sottowa - Paola to increase emergency rating to 334 MVA                                | F2   |
| Tap S3456 3 - S3458 3 345 kV line and build new 5.8 mile 345 kV line to S3740 3                | F2   |
| Reconductor S3740 - S3455 345 kV line to an emergency rating of 1792                           | F2   |
| Reconductor 84th - Fletcher 115 kV and 84th - Bluff 115 kV to an emergency rating of 390 MVA   | F2   |
| Add 3rd OCE 7 - Oneta 345 kV CTK                                                               | Both |
| Upgrade transformers at NM#4_1                                                                 | F2   |
| Upgrade transformers at OK6_#2 (560722)                                                        | Both |

*Table 5.2: Generator Outlet Facilities added for both futures*



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## Section 6: Analysis Methodology

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### **6.1: Analytical Approaches**

SPP transmission system performance was assessed from different perspectives designed to identify transmission expansion projects necessary to accomplish the reliability, policy, and economic objectives of the SPP RTO. The analysis ensured that the transmission expansion portfolio would:

- Avoid exposure to Category A (system intact) and B (single contingency) SPP standard criteria violations during the operation of the system under high stresses;
- Facilitate the use of renewable energy sources as required by policy mandates and goals; and
- Reduce congestion and increase opportunities for competition within the SPP Integrated Marketplace.

Priority was given to the relief of all of the potential reliability violations seen during two unique system stressing hours (summer peak, light load) and to meet all state renewable policy mandates and goals. The relief of annual congestion and reduction in market prices were pursued where cost-justified. A transmission expansion project was considered cost-justified when it yielded a one-year benefit-to-cost ratio of at least 0.9. In some cases, there was overlap among these priorities. For example, a project may relieve potential reliability violations and reduce annual congestion in a cost-justified manner. This approach was applied to both ITP futures.

#### **SCUC & SCED Analysis for multiple futures**

An assessment was conducted to develop a list of constraints for use in the SCUC & SCED analysis. Elements that, under contingency, limit the incremental transfer of power throughout the system were identified, reviewed, and approved by the TWG. Revisions to the constraint definition studies included modification of the contingency definition based upon terminal equipment, normal and emergency rating changes, and removal of invalid contingencies from the constraint definition.

The constraint list included normal and emergency ratings and was limited to the following types of issues:

- System Intact and N-1 situations<sup>14</sup>
- Existing common right-of way and tower contingencies for 100+ kV facilities<sup>15</sup>
- Thermal loading and voltage stability interfaces
- Contingencies of 100+ kV voltages transmission lines
- Contingencies of transformers with a 100+ kV voltage winding
- Monitored facilities of 100+kV voltages only

Neighboring areas were also analyzed for additional constraints to be added.

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<sup>14</sup> N-1 criterion describes the impact to the system if one element in the system fails or goes out of service

<sup>15</sup> The current NERC Standard TPL-001-0.1 includes outages of any two circuits of a multiple circuit tower line within Category C, and the loss of all transmission lines on a common right-of-way within category D. NERC Standard TPL-001-4 has replaced this standard and includes such outages in Planning event P7 and Table 1 – Steady State & Stability Performance Extreme Events.

All system needs were identified through the use of a SCUC & SCED simulation that accounted for 8,784 hours representing each hour of the year 2024. AC models were developed from two unique system stressing hours of this simulation to determine reliability thermal and voltage needs.

## **6.2: Projecting Congestion & Market Prices**

### **Annual Conditions Reviewed by the ESWG**

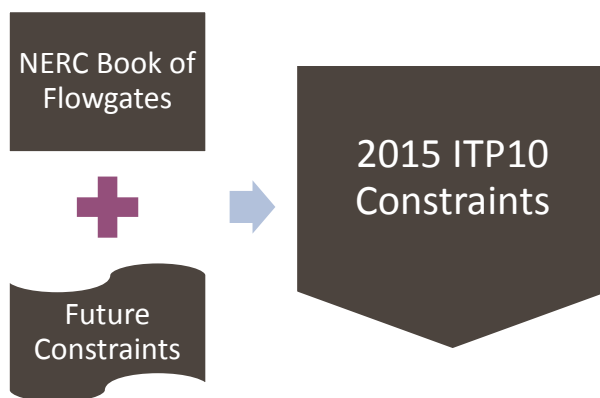
Congestion was assessed on an annual basis for each future considering many variables. Some of these variables change on an hourly basis, such as load demand, wind generation, forced outages of generating plants, and maintenance outages of generating plants. A total of 8,784 hours were evaluated for the year 2024.

Relevant congestion of each constraint was identified through two methods:

- The number of hours congested, and the average shadow price<sup>16</sup> associated with the congestion for all binding hours.
- These two numbers were multiplied together to compute an average congestion cost across all hours of the single year.
- This average congestion cost was used to rank the severity of the congestion for each constraint.

### **Identification of Additional Constraints**

Staff defined the initial list of constraints from the 2013 NERC Book of Flowgates for the SPP, IS, and neighboring regions. Additional constraints were incorporated that would protect facilities from overloads under a number of system conditions. These additional constraints facilitated the capture of both market congestion and economic benefit in expectation of transmission expansion that is not anticipated by the NERC Book of Flowgates.



<sup>16</sup> The “Shadow Price” refers to the savings in congestion costs if the constraint limit in question were increased by 1 MW.

### **6.3: Projecting Potential Criteria Violations**

#### **Reliability Needs**

Two hours that represent situations uniquely stressing the grid were identified to perform a reliability assessment of the System.

- Summer peak (July 19, 5pm) – highest coincident load during summer months
- Light load (April 6, 4am) – highest ratio of wind output to coincident load

AC models were developed for each of the two hours in each future. An N-1 contingency scan was performed for the SPP, IS, and Tier 1 footprints to determine thermal and voltage criteria violations, defined as system reliability needs.

### **6.4: Meeting Policy Requirements**

For policy requirements, SPP focused on satisfying statutory/regulatory renewable mandates and goals within a future through use of renewable generation as defined by the SPP Stakeholders through the 2015 Policy Survey. Each mandate or goal can be defined as a capacity or energy requirement. The primary generation technology required to meet these renewable standards, as provided by the stakeholders, was wind generation. A copy of the survey results can be found in the ESWG meeting materials.<sup>17</sup>

Renewable capacity requirements were met with installation of new generating capacity. Renewable energy requirements were analyzed through simulation of the study year. Renewable generation may experience the effects of congestion and be curtailed by the SCED. Shortfalls in the achievement of the renewable requirements of each future due to this curtailment were identified. Companies within each state that experienced an annual renewable energy output less than required were identified as having a policy need.<sup>18</sup>

### **6.5: Utilization of Past Studies & Stakeholder Expertise for Solutions**

SPP shared potential violations with the stakeholders and interested parties for review. The 2015 ITP10 followed the process added to the SPP Tariff in compliance with FERC Order 1000. Potential solutions to the transmission needs identified by SPP were provided through the DPP process. SPP received approximately 1179 solutions. SPP also collected and analyzed other proposed solutions previously identified in past Planning Studies.<sup>19</sup> All of these potential solutions were evaluated for their own merits.

### **6.6: Treatment of Individual Projects & Groupings**

After assessment of the needs, SPP investigated mitigation of the needs through individual projects by performing the following actions:

- Tested to ensure the project met the identified need.

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<sup>17</sup> [SPP Documents > Org Group Documents > ESWG > ESWG Meeting Materials](#)

<sup>18</sup> This represents a change from previous ITP studies in which shortfalls in renewable energy output were evaluated on an individual resource-by-resource basis, in order to identify policy requirements.

<sup>19</sup> ITP Near-Term, ITP10, ITP20, Transmission Service Studies, Generation Interconnection Studies, High Priority Studies, Coordinated System Planning Studies.

- Measured the impact of the projects upon similar constraints and overloads.
- Identified projects with synergy and that duplicated the value captured by another project.
- Combined reliability, policy, and economic analysis to produce a transmission expansion portfolio of projects.

## **6.7: Determining Recommended Portfolio**

Individual projects within the recommended portfolio provided reliability, economic, and policy benefits within the Future 1. Projects meeting the performance criteria for Future 1 *and* Future 2, outlined in Table 6.1, were included in the recommended portfolio.

| Project Type          | Future 1 Performance                          | Future 2 Performance                  |
|-----------------------|-----------------------------------------------|---------------------------------------|
| <b>F1 Reliability</b> | Mitigate a thermal or voltage violation       | N/A                                   |
| <b>F2 Reliability</b> | Mitigate 90% thermal or 0.92 pu voltage limit | Mitigate thermal or voltage violation |
| <b>F1 Policy</b>      | Meet a policy need                            | N/A                                   |
| <b>F2 Policy</b>      | N/A                                           | N/A                                   |
| <b>F1 Economic</b>    | 1-year B/C $\geq 0.9$                         | N/A                                   |
| <b>F2 Economic</b>    | 1-year B/C $\geq 0.7$                         | 1-year B/C $\geq 0.9$                 |

*Table 6.1: Consolidation Criteria*

Projects mitigating more than one type of need were evaluated against multiple performance criteria. Only one set of criteria is required to be met for a project to be included in the recommended portfolio.

### **Project Staging**

Project staging is the process by which appropriate need dates for new projects are established. Projects in the 2015 ITP10 were staged based on need and/or performance in the staging year, 2019, when compared to the study year, 2024. The result of this analysis is an interpolated need date for each project of the recommended portfolio, between or equal to the study or staging year. For a full description of the staging process see Staging.

## **6.8: Measuring Economic Value**

Monetized metrics are used to measure the value of and facilitate better understanding of the financial impacts of proposed projects. The ESWG chose ten metrics to analyze the recommended portfolio in each Future. While APC benefits were calculated for numerous projects and the final portfolio, the other metrics were calculated only for the consolidated portfolio. For a full description of the benefit metrics see Section 16:.

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## Section 7: Seams Coordination

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### **7.1: ITP Seams Coordination Enhancements**

SPP continues to enhance and refine coordination with neighbors during SPP's regional planning studies, including the ITP10. Enhanced coordination's goal is to better ensure that the planning along the SPP seams is as robust as the transmission planning in the middle of the SPP footprint. To accomplish this, SPP coordinated with its neighbors at every point along the planning process and on the same schedule as SPP staff coordinates with SPP stakeholders. Two 2015 ITP10 seams-planning studies provided additional coordination opportunities and were leveraged in the 2015 ITP10 assessment.

### **7.2: Coordination Activities**

The ITP10 seams coordination focused on SPP's Tier 1 neighbors<sup>20</sup>. Previous sections of this report discuss coordination with SPP's Tier 1 neighbors as it pertains to each specific section. The subsections below provide additional information on that coordination.

#### **Model Development & Resource Plan**

SPP used the Multi-regional Modeling Working Group (MMWG) models as a starting point for its model development. SPP also provided its Tier 1 neighbors with an opportunity to review and provide edits to the ITP10 model. AECI and MISO each provided modeling feedback for their respective footprints. This review was similar to those performed by SPP stakeholders, as the Tier 1 neighbors reviewed load, generation, topology, and other modeling inputs. SPP's neighbors also provided feedback on the resource plan SPP used to model the retirements and generation expansion for 2024 in the ITP10. Since SPP and MISO share their regional planning models, SPP was able to utilize the resource expansion plan MISO used in the MTEP 2013. MISO's expansion plan was supplemented by incorporating additional resources, as needed, for Entergy and Cleco, which were not included in the MTEP 2013.

#### **Congestion Assessment**

While SPP did provide Tier 1 neighbors with its identified transmission needs to determine whether everyone could coordinate on a joint transmission solution. SPP met several times with AECI to discuss transmission needs close to the AECI seam.<sup>21</sup> SPP also shared its transmission-needs list with MISO. The needs along the seam closely aligned with the transmission needs identified in the SPP-MISO Coordinated System Plan Study discussed below.

#### **Coordination with Ongoing Seams Assessments**

Two 2015 ITP10 seams studies are still ongoing. The first is the SPP-AECI Joint Coordinated System Plan Study (AECI Study). The AECI Study focused on identifying and addressing potential reliability needs along the SPP-AECI seam, on either the SPP or AECI system. The AECI Study identified needs closely aligned with those in the ITP10 and the ITPNT, which helped SPP staff coordinate the two

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<sup>20</sup> Note MISO coordinated for those SPP Tier 1 neighbors that are MISO members.

<sup>21</sup> These meetings included face-to-face meetings and teleconferences. AECI came to SPP's office in Little Rock for the specific purpose of discussing potential seams projects in the ITP10.

studies with SPP evaluating all of the solutions proposed in the AECI Study in the 2015 ITP10, and likewise the 2015 ITP10 proposed projects were evaluated in the AECI Study.

The second seams assessment is the SPP-MISO Coordinated System Plan Study (MISO Study). The MISO Study began in early 2014 and will conclude in June 2015. The study's transmission needs were published in October, and it is currently in the solution-development phase. The MISO Study's model-development data was used, where applicable, to enhance and improve the ITP10 modeling. This gave SPP the most recent modeling of the large seam between SPP and MISO. The SPP system's transmission needs identified in the MISO Study are consistent with the analysis performed in the 2015 ITP10.

While both seams assessments were separate studies from the 2015 ITP10, their performance during the 2015 ITP10 encouraged a more focused analysis on the ITP10's seams region through additional updated modeling information, better coordination and exchange of assumptions and data, and an expanded list of proposed transmission solutions.

### **Solution Evaluation**

Evaluating seams transmission solutions includes an additional variable not present when evaluating an SPP regional transmission solution: seams cost sharing. This variable was considered a hurdle for the seams-project planning process in previous ITP assessments; a seams project would provide benefits to regions outside SPP, but SPP's ITP solution development and evaluation process would assume its stakeholders would pay all costs in the SPP region. The 2015 ITP10 addressed this with a more focused evaluation of potential seams projects earlier in the planning process, and by identifying a seams project's cost-sharing levels in order to be the most cost-effective solution.

SPP staff identified projects that could potentially benefit one or more of SPP's neighbors during project screening. The projects with significant potential benefit to SPP and a seams neighbor were then evaluated to determine which cost-sharing level was more cost-effective than SPP's other regional solutions. After compiling this information, SPP approached the applicable seams neighbor and began working with that neighbor to further evaluate the project to determine its benefits to that neighbor.

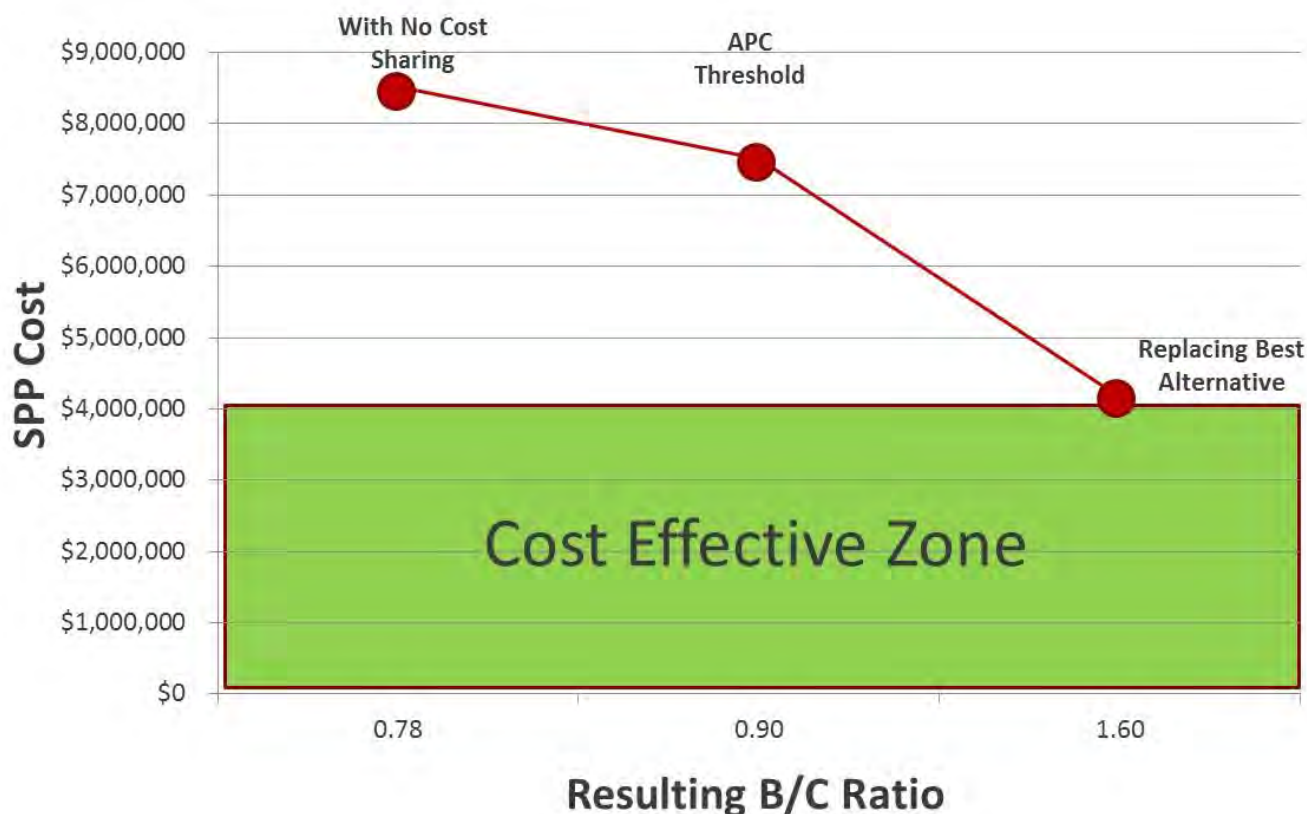


Figure 7.1: Cost Sharing Example

Figure 7.1 above illustrates a generic project that, if SPP approved without a seams partner, would result in an APC B/C ratio of 0.78 which is below the 0.9 B/C ratio threshold used in the ITP10. In order to meet the 0.9 threshold SPP's portion of the costs would have to be reduced by approximately \$1 million. This means a seams partner would have to agree to cost share the project and pay at least 12% of the project cost. In this generic example with the 12% cost sharing, the project would meet the 2015 ITP10 APC threshold. However, it would not be the preferred solution as a regional project provides SPP a B/C ratio just under 1.6. In order for this generic example project to be the preferred solution, it must be more cost effective than the regional solution. For this particular example, SPP's portion of the cost could only be \$4 million for the B/C ratio to surpass the SPP regional solution. The seams partner would need to agree to pay at least 53% of the total project cost. If there is a cost-sharing agreement where the seams partner agrees to pay 53% of the project, then that project would be considered the preferred solution in the 2015 ITP10.

The analysis described above was performed on 17 projects which appeared to provide significant benefits to SPP and an SPP neighbor. AECl expressed interest in several of the projects evaluated therefore, those projects were evaluated further with AECl to identify the specific value provided to AECl, the project feasibility, and total cost-effectiveness. The evaluation of all potential seams projects indicated no seams projects were both viable and more cost-effective than a regional alternative.

Projects that were shown to potentially benefit MISO will be evaluated in the MISO Study.



# PART II: STUDY FINDINGS



## Section 8: Benchmarking

Numerous benchmarks were conducted to ensure the accuracy of the data, including:

1. A model, developed in parallel to the study model that reflected transmission and generation in-service as of 2013
2. A comparison of simulation results from the 2013 model with historical statistics and measurements from SPP Operations, SPP Market Monitoring (MMU), and the U.S. Energy Information Administration (EIA).

### **8.1: Benchmarking Setup**

It was important to create a representation of the system that matches actual operations in 2013 as closely as possible. This depiction of the system also had to keep a lineation with the study model, to ensure confidence in the final results.

SPP benchmarked simulation data against historical data provided by SPP Operations and SPP MMU. Area LIPs (Locational Imbalance Price), interchange values, and generation outages were among the data points provided by these departments. It was unreasonable to expect that the simulation results for the benchmarking model would perfectly match historical operations for the following reasons:

1. In addition to outage-triggering events, such as storms, PROMOD is not able to simulate the market as it was in 2013, and
2. PROMOD replicates the operations of a day-ahead market using a consolidated balancing authority, whereas the market in operation in 2013 was the SPP Energy Imbalance Service (EIS) with 16 separate balancing authorities.

SPP focused more on the shape of price curves, rather than the magnitude of the values. Also, capacity factors by generation type were benchmarked, rather than the magnitude of the generation.

### **8.2: Generator Operations**

#### **Capacity Factor by Unit Type**

Comparing capacity factors enables measuring the similarity in planning simulations and historical operations. This benchmark provides a quality control check of differences in modeled outages and assumptions regarding renewable, intermittent resources.

When compared with capacity factors reported to the EIA in 2013, most of the capacity factors fell near the expected values. The availability of the EIA generation data was limited, as November data was the latest data posted on their website. However, the same time frame was used from the PROMOD simulations (7295 hours as opposed to 8760).

| Unit Type      | 2013 EIA Capacity Factor | PROMOD Capacity Factor |
|----------------|--------------------------|------------------------|
| Nuclear        | 76.3%                    | 93.3%                  |
| Combined Cycle | 36.6%                    | 30.1%                  |
| CT Gas         | 4.1%                     | 6.1%                   |
| Coal           | 69.6%                    | 74.8%                  |
| ST Gas         | 16.4%                    | 7.2%                   |

### Generator Maintenance Outages

Generator maintenance outages in the simulations were compared with historical data provided by SPP Operations. These outages have a direct impact on flowgate congestion, system flows, and the economics of following load levels. The curves from the historical data and the PROMOD simulations complemented each other very well in shape and in magnitude.

### Operating & Spinning Reserve Adequacy

Operational reserve is an important reliability requirement that is modeled to account for capacity that might be needed in the event of a unit failure. Per SPP Criteria, operating reserves must meet a capacity requirement equal to the largest unit in SPP + 50% of the next largest unit in SPP; at least half of this requirement must be fulfilled by spinning reserve. Figure 8.1 shows both parts of this requirement were met and exceeded. The spinning reserve capacity requirement was 826 MW and the total operating reserve capacity requirement was 1,652.5 MW.

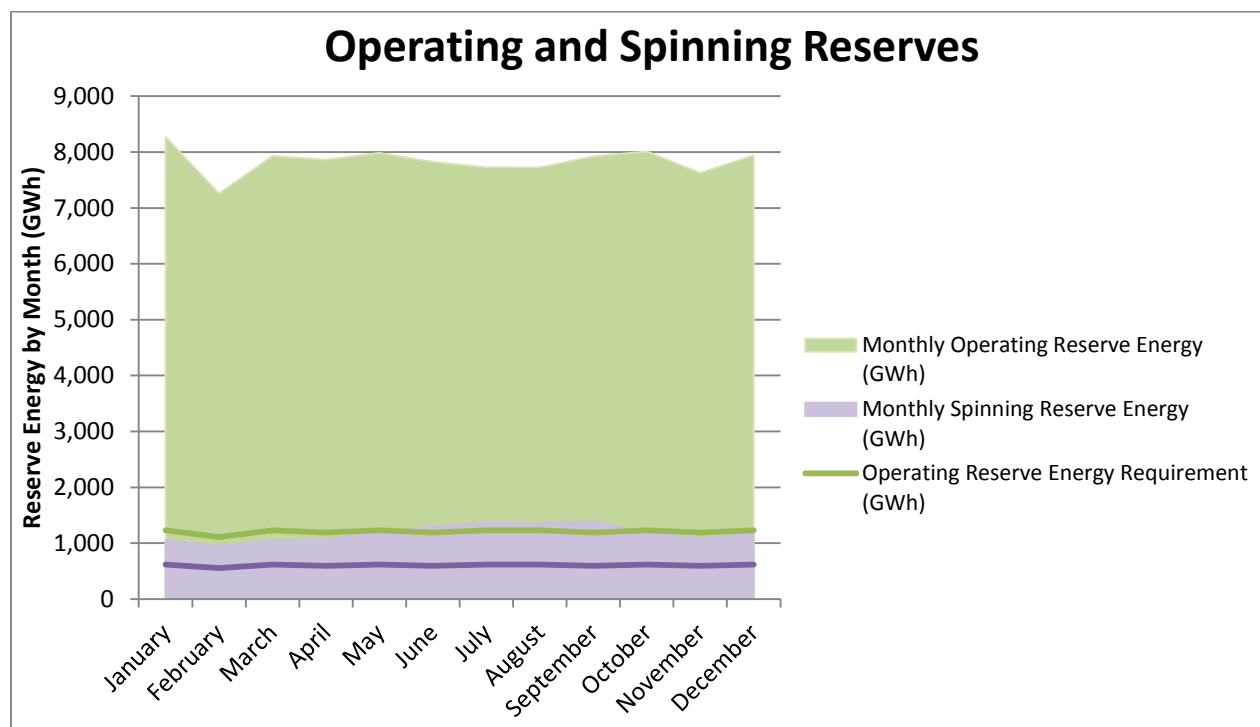


Figure 8.1: Reserve Energy Adequacy

### 8.3: System LMPs

Simulated locational marginal prices (LMPs) were benchmarked against historical LIPs from the SPP Market Monitoring Unit. This data was compared on an average monthly basis by area. Figure 8.2 shows the results of the benchmarking model for the SPP system and the difference in the two curves. Spikes in the summer months were investigated by looking into congestion and other likely drivers. The questionable values were ultimately attributed to the higher volatility of the LMPs in the Integrated Marketplace compared to the LIPs of the EIS market.

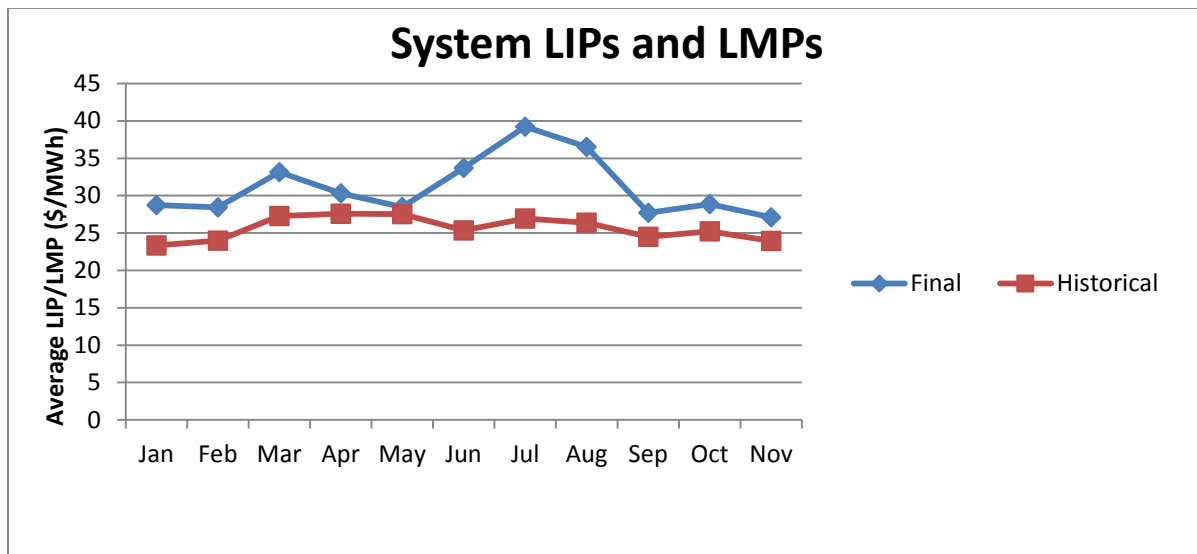


Figure 8.2: LIP/LMP Benchmarking Results

### 8.4: Hurdle Rates

Including hurdle rates between two regions is a modeling technique used to reflect market inefficiencies, such as buying energy from outside one's footprint over utilizing native generation. One goal for this ITP study was to refine hurdle rates between SPP and external regions used in the past. ITP studies have historically used an \$8/MWh commitment hurdle rate and a \$5/MWh dispatch rate for all interfaces to and from SPP.

With recent enhancements to the PROMOD software, defining and testing custom hurdle rates became a feasible option and was implemented in the 2015 ITP10. In order to determine these new hurdle rates, historical tieline flows from SPP Operations were first aggregated to total interchange between SPP and each of the Tier 1 pools: MISO, the Mid-Continent Area Power Pool (MAPP), and the Southeast Electric Reliability Council (SERC). These interchange totals were compared to flows monitored in the PROMOD simulations. Both sets of values were sorted to easily see the differences and similarities in the magnitude of flows and number of hours SPP is exporting to and importing from each region. Hurdle rates were adjusted to and from each region until reasonably comparable results were achieved. Figure 8.3 shows this sorted interchange data from SPP Operations and from the final benchmarking simulation results that implemented the ESWG-approved hurdle rates. Hurdle rates between external regions, outside of the SPP-Tier 1 interfaces described previously, were set to values applied in the 2012 MISO Transmission Expansion Plan (MTEP12) study.

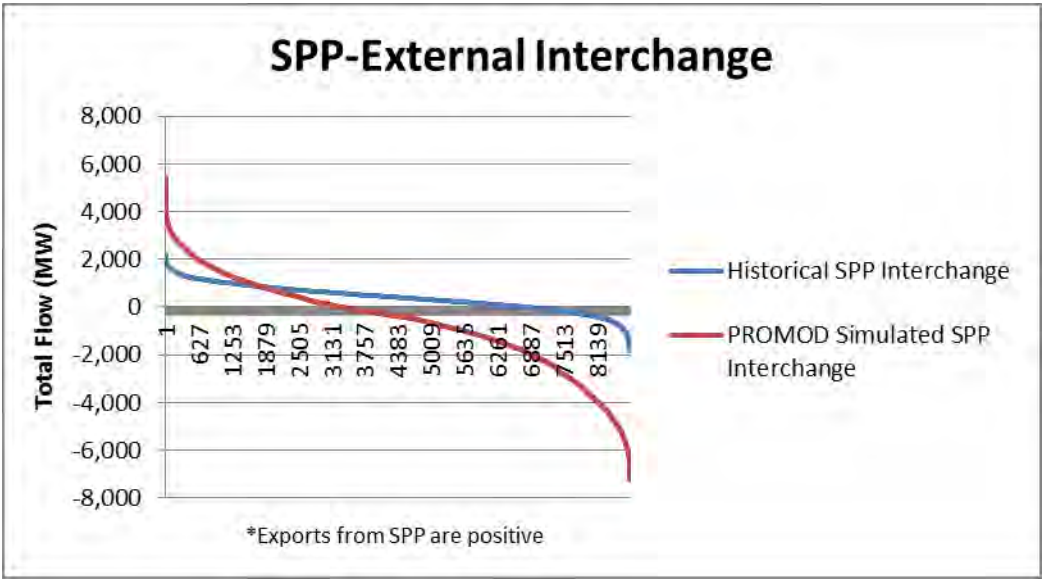


Figure 8.3: Interchange data comparison

|      |      | To    |        |        |        |
|------|------|-------|--------|--------|--------|
|      |      | SPP   | MISO   | MAPP   | SERC   |
| From | SPP  | *     | 10/2.5 | 10/5   | 10/1.5 |
|      | MISO | 10/10 | *      | 10/5.5 | 10/7.4 |
|      | MAPP | 10/10 | 10/6.3 | *      | *      |
|      | SERC | 10/10 | 10/8.3 | *      | *      |

Table 8.1: ESWG-Approved Hurdle Rates

Values displayed are in \$/MWh and are reflective of commitment/dispatch hurdle rates

# **PART III: NEEDS & PROJECT SOLUTIONS**



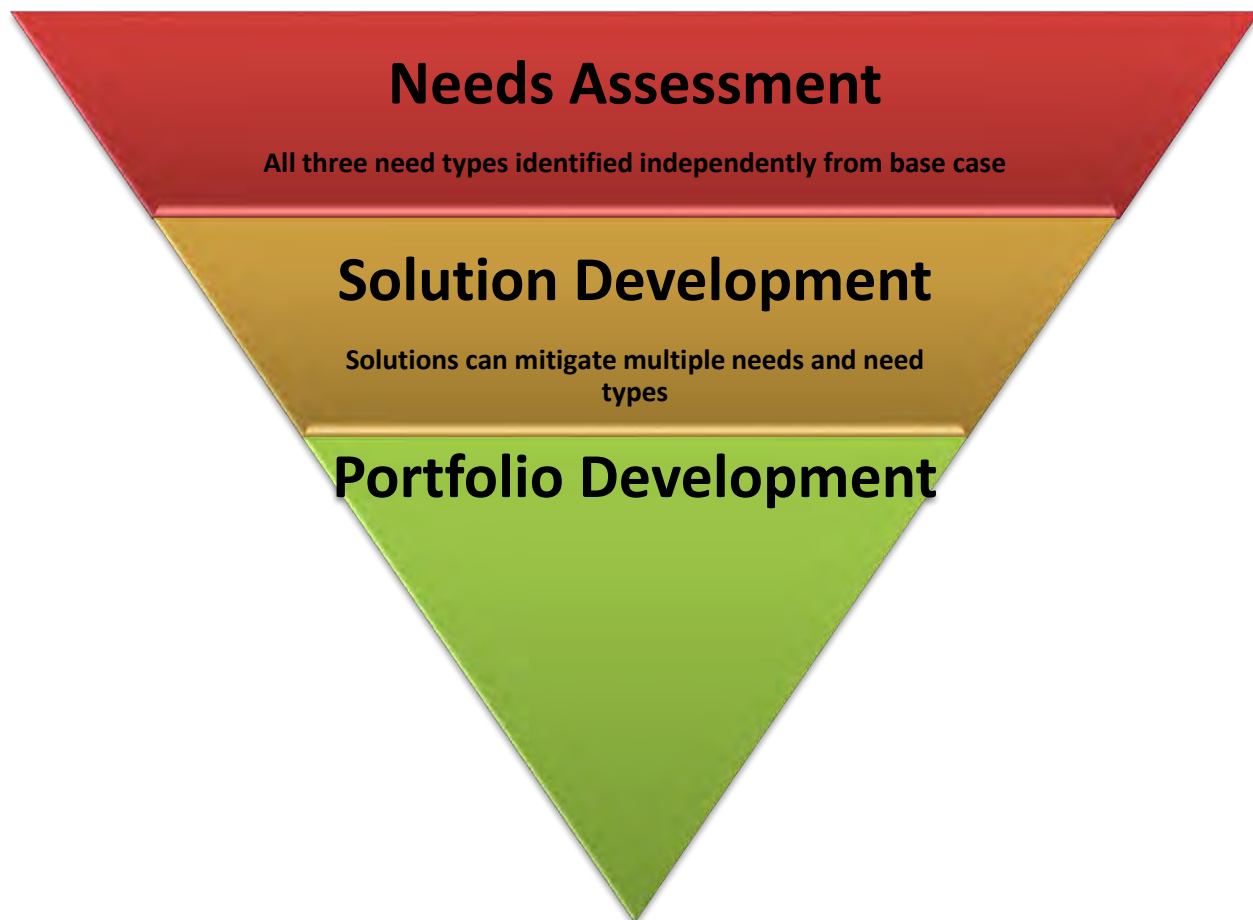
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## Section 9: Overview

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### **9.1: Transmission Needs and Solution Development**

The 2015 ITP10 transmission planning analysis considered three separate types of needs and upgrades: reliability, policy, and economic. Reliability, policy, and economic needs were identified independent of each other. Solutions were then developed for each need and analyzed individually against the base case. Throughout solution development, projects mitigating multiple needs and/or need types were included to develop an efficient portfolio. Thus, a single project could mitigate multiple reliability or economic needs or simultaneously mitigate a reliability and economic need. No policy needs were identified in the 2015 ITP10.





A review of the economic model developed for the Regional Cost Allocation Review (RCAR) II discovered an error related to SPP's implementation of seasonal ratings in PROMOD.<sup>22</sup> The simulation allowed flows up to an entire year's winter line ratings for transmission lines with seasonal rating differences. Working with the software vendor, SPP determined the same error was applicable to the 2015 ITP10 simulations, and implemented an event file change to fix the error.

The error was not discovered until after the needs identification and solution development processes, which include the submittal and evaluation of DPPs, were completed. SPP assessed the impacts of the error and developed a process to move forward with the completion of the 2015 ITP10 that would not jeopardize the integrity of the competitive process nor introduce significant time delays.

Comparing the updated models' results with those from the previous version, Staff identified 1) common needs (those identified in both the original and updated models), 2) new needs that were identified in the updated models, but didn't appear in the previous models, and 3) old needs that were identified in the original models, but no longer appear in the updated models. See the figures below for an illustration.

The plan recommended by SPP was to continue forward with the final portfolios, as determined by the original analysis, for each future and utilize those selected projects to address needs common to both assessments. Projects that did not address common needs were removed from the portfolios. New needs from the updated assessment would be re-evaluated and addressed in upcoming ITP cycles. SPP's recommended plan was approved by the TWG and ESWG on October 29, 2014. As a result, the needs and solutions in the following sections represent that set common to both the original and updated assessments.

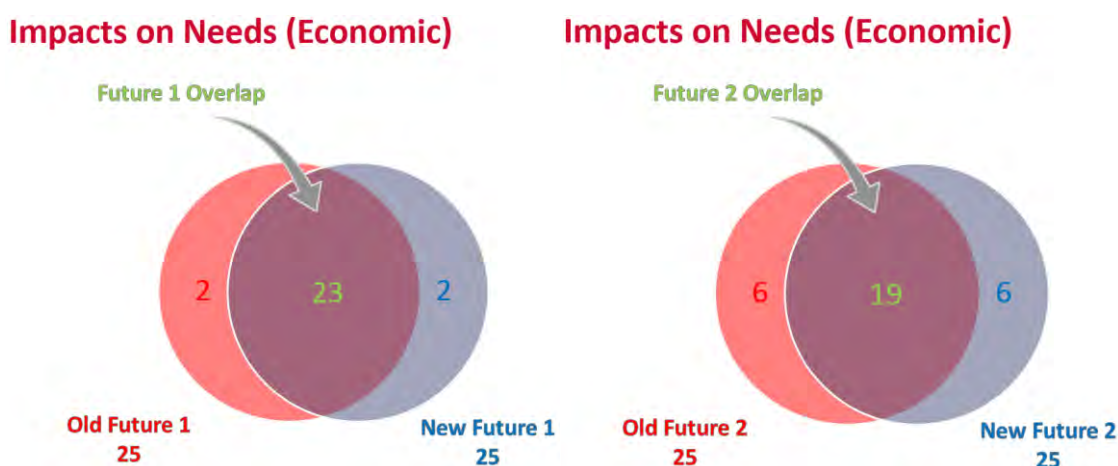


*Figure 9.1: Comparison of economic needs between models*

<sup>22</sup> The RCAR II process is being conducted in parallel with the 2015 ITP10 and used many of the ITP10 models as a starting point for analysis.

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## Section 10: Reliability Needs and Solutions

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### **10.1: Background**

The 2015 ITP10 reliability needs assessment was performed in parallel with the economic and policy needs assessments. All needs were identified using four distinct models. Potential reliability projects including those from SPP Staff, DPPs, and Order 890 submittals, were tested individually in the base model. A reliability project was selected if it addressed either a single reliability need at the least cost or the most reliability needs at the least cost.

### **10.2: Reliability Needs**

Reliability powerflow models were derived from the economic models through a DC to AC conversion. PROMOD dispatch and load profiles were built in to the powerflow models, which then were used in an AC Contingency Calculation (ACCC) analysis.

These powerflow models identified reliability needs based on analysis of four hours representing situations where the transmission system was uniquely stressed. The four hours considered include two different futures, with Future 1 representing Business as Usual<sup>23</sup> and Future 2 representing a Decreased Base Load Capacity.<sup>24</sup> An N-1 contingency scan outaged 69 kV branches and above in the SPP RTO and Tier 1 footprints. Facilities 69 kV and above were monitored to identify needs in the SPP RTO and Tier 1 footprints. Potential violations, in accordance with the SPP Criteria or SPP member criteria, if more restrictive, were identified in each of these hours during the N-1 contingency scans, and labeled as reliability needs. The voltage level for potential violations could be 69 kV, but projects that addressed these potential violations were no lower than 100 kV.

Once the initial list of reliability needs was identified, only valid and applicable SPP Tariff Transmission facilities were considered.

Hours used to determine reliability needs were:

- **Summer peak hour** - represents the highest coincident load during summer months
- **Light Load hour** - represents the highest ratio of wind generation to coincident load (i.e., low load and high wind), based on a market dispatch

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<sup>23</sup> This future included all statutory/regulatory renewable mandates and goals and other energy or capacity as identified in the policy survey, load growth projected by load serving entities through the MDWG model development process, and the impacts of existing regulations. This future assumed no major changes to policies currently in place.

<sup>24</sup> This future considered factors that could drive a reduction in existing generation. It included all assumptions from the Business as Usual future with a decrease in existing base load generation capacity. This future generally retired coal units less than 200 MW, reduced hydro capacity 20% across the board, and utilized the Palmer Drought Severity Index for an average of August 1934 and August 2012 to simulate a reduction in existing capacity affected by drought conditions: 10% under moderate, 15% under severe, and 20% under extreme. These target reductions may have been adjusted based on locational and operational characteristics within each zone.

| HOURLY NAME          | HOURLY SIMULATED    |
|----------------------|---------------------|
| Future 1 Summer Peak | July 19, 2024 17:00 |
| Future 1 Light Load  | April 6, 2024 04:00 |
| Future 2 Summer Peak | July 19, 2024 17:00 |
| Future 2 Light Load  | April 6, 2024 04:00 |

*Table 10.1: Future hours analyzed for Reliability needs*

The types of reliability needs identified in the 2015 ITP10 consist of thermal overload and under-voltage needs. Any valid thermal overload greater than 100%, voltage violation under 0.95 per unit for system intact conditions, or under 0.90 per unit<sup>25</sup> for contingency conditions were included as reliability needs. More restrictive needs based upon SPP Member criteria were considered non-competitive needs and therefore were not included in the final needs list, but were provided to the appropriate SPP Member for solution development. Needs identified for non-SPP Transmission Facilities near the Tier-1 seams were separated from the final needs list to allow for possible joint analysis to be performed and for possible seams project development. With the notification from Ventyx about a PROMOD line ratings software issue, SPP compared two resulting sets of needs, one set using winter ratings for the entire year, and the other set using both winter and summer ratings. This comparison produced a common set of needs and new needs. Common needs are unique needs that were found in both the analysis using winter line ratings year-around, as well as the analysis using both winter and summer line ratings, as appropriate. New needs are those identified only in the revised assessment using appropriate summer and winter line ratings and will be analyzed in future ITP studies as was approved by the TWG and ESWG.

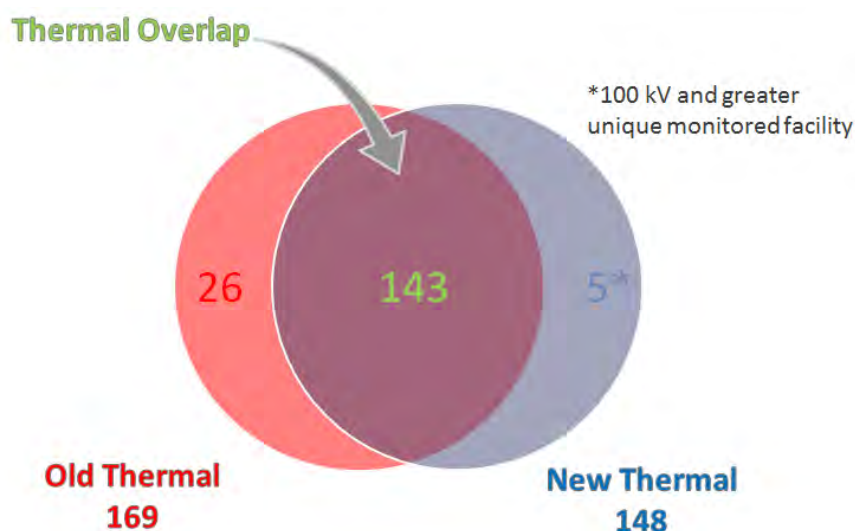


*Figure 10.1: Unique Common Thermal Overload Comparison between models*

<sup>25</sup> This per unit value is the SPP Criteria voltage per unit threshold for classifying voltage violations under contingency conditions. Voltage violations derived from member submitted criteria that was more restrictive than the SPP Criteria was used in place of the SPP Criteria for needs identification.

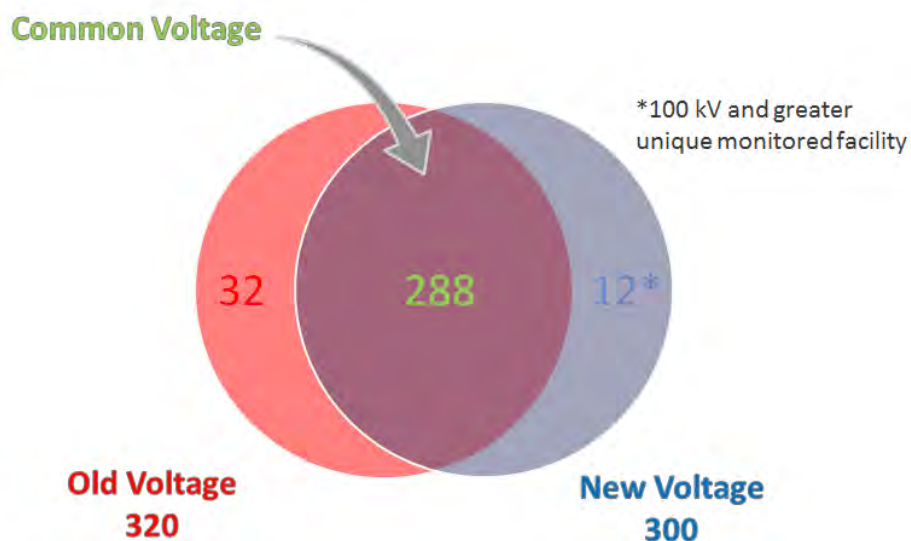


Figure 10.2: Unique Common Voltage Comparison between models

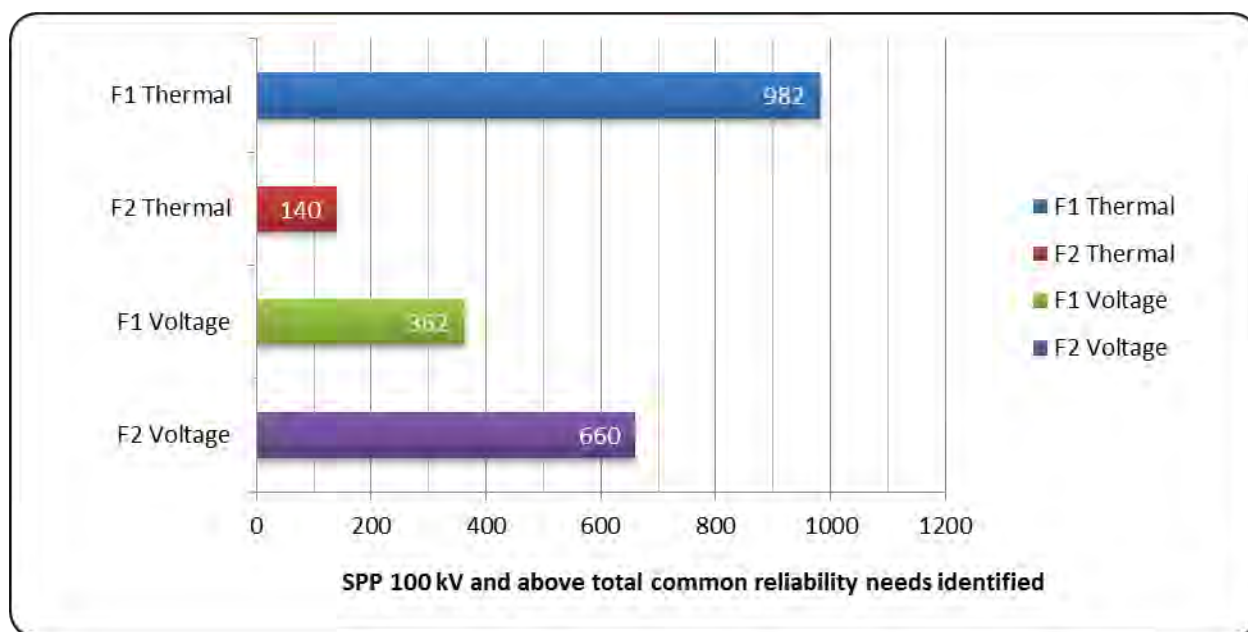


Figure 10.3: Thermal Overload and Voltage Needs Summary by Future

### **10.3: Project Processing Methodology**

In order to comply with FERC’s Order 1000, SPP developed the Transmission Owner Selection Process. In accordance with Attachment O, Section III.8.b, SPP shall notify stakeholders of identified transmission needs and provide a transmission planning response window of thirty (30) days during which any stakeholder may propose a detailed project proposal (“DPP”). SPP shall track each DPP and retain the information submitted pursuant to Attachment O, Section III.8.b(i). The initial 30 day window was opened on May 20, 2014 with the public posting of the final 2015 ITP10 needs list. During this time any stakeholder had the opportunity to provide one or more Detailed Project Proposals (DPPs).

Stakeholders submitted 1,179 DPPs and 56 FERC Order 890 projects. In addition to the DPPs and FERC Order 890 projects, 157 SPP staff solutions were considered to address reliability needs. All together 1,392 projects were evaluated.

In order to efficiently evaluate the high volume of submitted and Staff developed projects that would solve all identified reliability needs within the allotted schedule; a software solution was developed by SPP. This Comprehensive Project Testing tool tested an individual project against each reliability need identified in the Needs Assessment using PSS®E. The output of the tool indicated if the project mitigated the reliability need according to SPP Criteria for both thermal loading or per unit voltage. All automated results were then manually checked for result validation.

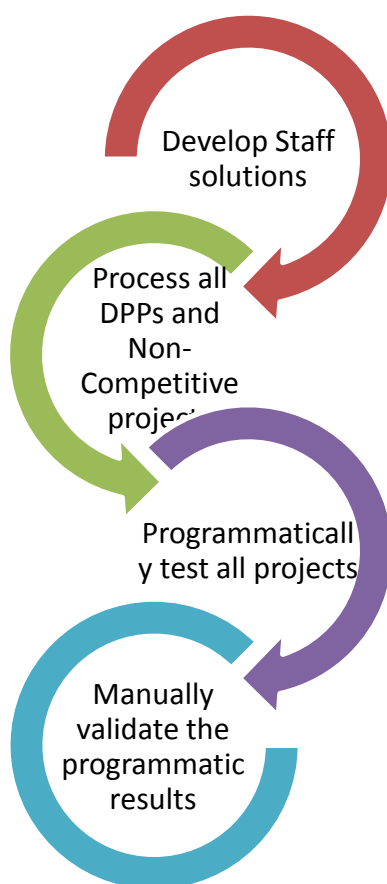


*Figure 10.4: Project processing overview*

## **10.4: Project Selection Methodology**

SPP staff developed a standardized conceptual cost template for assigning project costs to all proposed projects. Once all projects were assigned a cost, each project was compared against all other projects using a least cost metric as well as a separate comparison using a least cost per need metric. In order to perform a comparison of the large number of projects, a programmatic solution was developed by SPP staff. Using this project selection software, a subset of projects was generated that solved all reliability needs in the most cost effective manner. This subset was generated by testing all 1,235 submitted projects and staff solutions to determine which combination of projects addressed all reliability needs at the lowest cost. If two projects solved the same reliability needs, the one that was more cost effective, was selected to move on to the project grouping phase.

In addition, individual projects were combined into a single project and re-evaluated in the project selection process. This process checked whether all reliability needs of the individual projects were met if the combined project was selected as the least cost solution.

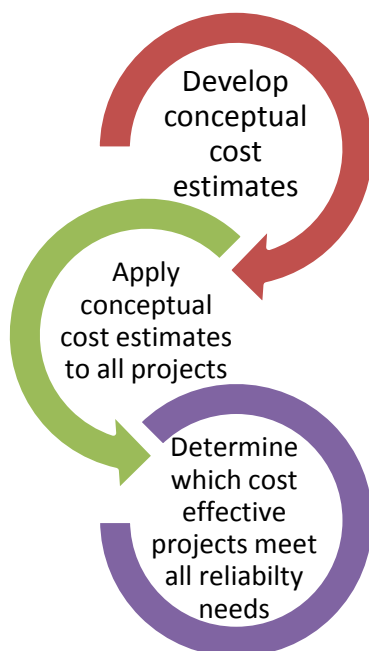


*Figure 10.5: Project Selection overview*

## 10.5: Reliability Groupings

For the Consolidated Portfolio, the following criteria, as listed in the approved 2015 ITP10 scope allows for grouping of Reliability projects from Future 1 and Future 2:

*Reliability projects will be included in the consolidated portfolio if they mitigate a thermal/voltage violation in Future 1. A Future 2 reliability project will be included if it mitigates a thermal violation in Future 2 and mitigates loading above a 90% threshold in Future 1. A Future 2 project that mitigates a voltage limit violation in Future 2 and voltage below 0.92 pu in Future 1 will also be included in the consolidated portfolio.*

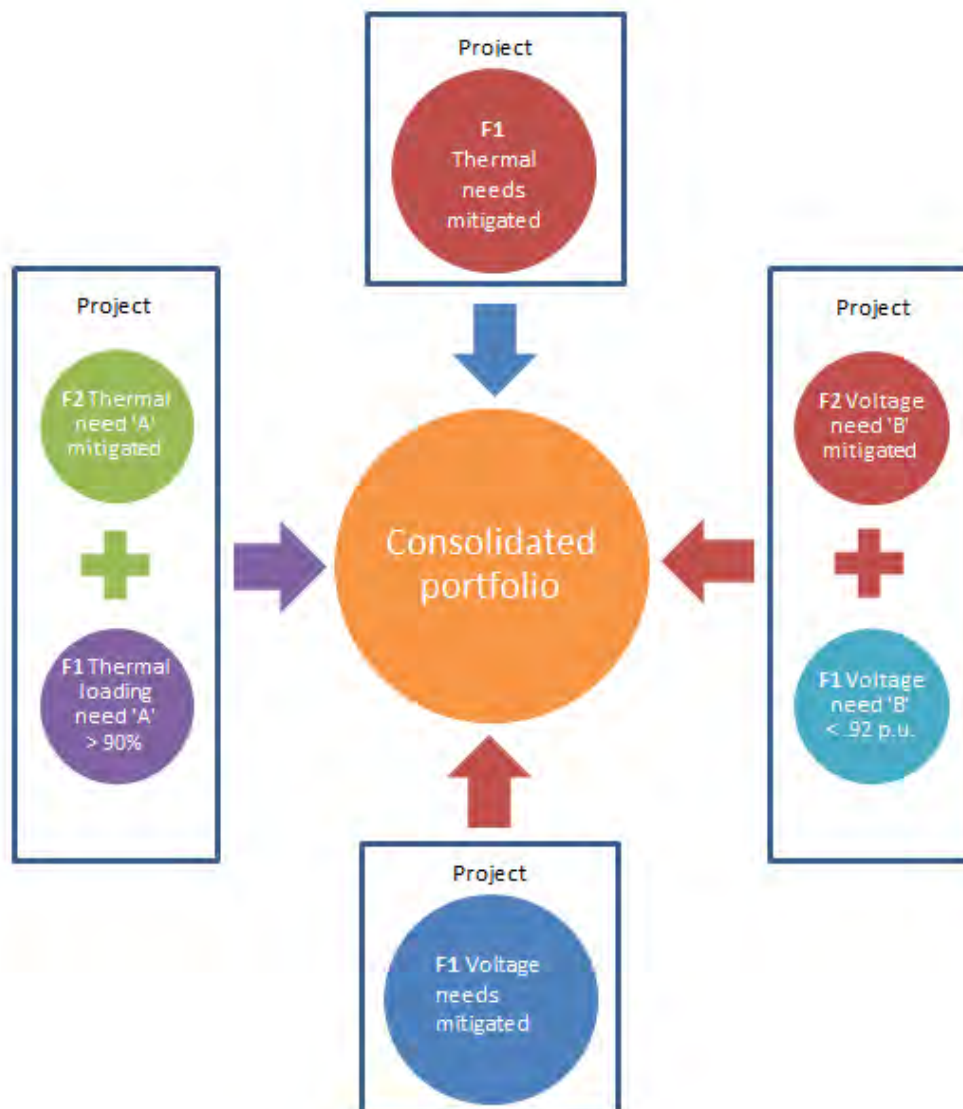


Figure 10.6: Reliability project consolidation methodology

The Consolidated portfolio mix is made up reliability and reliability and economic projects. This table does not include projects that solve economic only needs.

| NUMBER OF PROJECTS | FUTURE | RELIABILITY | RELIABILITY & ECONOMIC |
|--------------------|--------|-------------|------------------------|
| 5                  | 1      | x           |                        |
| 1                  | 1      |             | x                      |
| 5                  | 2      | x           |                        |
| 1                  | 2      |             | x                      |
| 19                 | 1 & 2  | x           |                        |

*Table 10.2: Reliability project consolidation methodology*

All projects that comprise the consolidated portfolio were evaluated for a refined (+/- 30%) cost estimate for each individual project. If a project consisted of multiple upgrades, each upgrade was assigned a specific cost.

## **10.6: Reliability Solutions**

Project solutions were developed by stakeholders and SPP staff. 100 kV and above projects were considered as solutions for reliability needs. All solutions were considered for all reliability needs, and engineering judgment was used to determine the solution that provided the best reliability for the least cost for the region.



## Section 11:Policy Needs and Solutions

### 11.1: Methodology

Policy needs were analyzed based on the curtailment of renewable energy that has been installed to meet a Renewable Energy Standard (RES) mandate or goal. Each entity with a renewable mandate or goal was analyzed for renewable curtailments to determine if they met their mandate or goal. Policy needs are the result of an inability to dispatch renewable generation due to congestion. Any entity not meeting its renewable mandate or goal due to such congestion was identified as having a policy need.

Renewable mandates and goals by entity were determined based on the 2015 Policy Survey. A 3% margin was used in determining the thresholds by entity. This means that if an entity had annual renewable energy generation of at least 97% of their Policy Survey mandate or goal, they were determined to be meeting their renewable requirements, and were not identified as having a policy need.<sup>26</sup> Some mandates and goals were based on installed capacity requirements only. These mandates/goals were not analyzed for curtailment, and were not used to identify policy needs.

Policy projects are developed for any policy needs in order to reduce curtailments such that all entities will meet their renewable mandates or goals.

### 11.2: Policy Needs and Solutions

The policy needs assessment showed the following wind farms experiencing > 3% annual curtailment:

| Wind Farm     | Owner & State | Future | Annual Curtailment (GWh) | Annual Curtailment % |
|---------------|---------------|--------|--------------------------|----------------------|
| Gray County   | GMO, MO       | F1     | 29.3                     | 5.64%                |
| Gray County   | GMO, MO       | F2     | 29.3                     | 5.64%                |
| New Mexico #4 | SPS, NM       | F2     | 76.9                     | 6.91%                |

Table 11.1: Wind Farm Curtailment

In spite of these curtailments, all entities met their overall renewable mandates and goals. **Therefore, there were no policy needs and no policy projects identified in either future.**<sup>27</sup>

<sup>26</sup> This represents a change from previous ITP studies in which shortfalls in renewable energy output were evaluated on an individual resource-by-resource basis, in order to identify policy requirements.

<sup>27</sup> Note that these curtailments did impact the economic needs, and the development of economic projects addressed the APC benefit of relieving any wind curtailments.

## Section 12:Economic Needs and Solutions

### 12.1: Background

The 2015 ITP10 economic needs assessment was performed in parallel with the reliability and policy needs assessments. All needs were identified using a single base model. Potential economic projects from SPP Staff, DPPs, Order 890 submittals, and previous SPP planning studies were tested individually in this base model. An economic project is justified when its economic benefits to SPP stakeholders are projected to be greater than the project cost over the expected life of the asset. The criterion approved by the ESWG for use in the 2015 ITP10 requires an economic project to have a minimum 1-year B/C ratio of 0.9 or greater. This B/C target was selected because the benefit is expected to increase over a project’s assumed 40-year lifespan. Benefits were measured as the difference in the APC, with and without the potential economic project.

### 12.2: Economic Needs

To assess economic needs, a SCUC/SCED were performed for the full study year, based on the transmission constraints defined for the system. The SCED derived nodal LMPs by dispatching generation economically. LMPs reflect the congestion occurring on the transmission system’s binding constraints. The simulation’s results revealed which constraints caused the most congestion and the additional cost of dispatching around those constraints. The following process was used to rank each future’s economic needs:

1. Binding constraints were ranked from highest to lowest congestion score. Congestion score is defined as the product of the constraint’s average shadow price and the number of hours the constraint is binding in 2024.



2. The 25 highest congestion score constraints<sup>28</sup> in the SPP system were identified as the system’s economic needs.
3. Potential economic project solutions were developed based on this list of 25 constraints.

<sup>28</sup> This specific criteria was identified in the study scope, prior to analysis of economic needs. The top 25 binding constraints were chosen to be targeted to better understand what parts of the system would be best suited for the testing and development of economic projects. Parts of the system with minimal congestion are less likely to have project solutions with B/C ratios greater than 0.9.

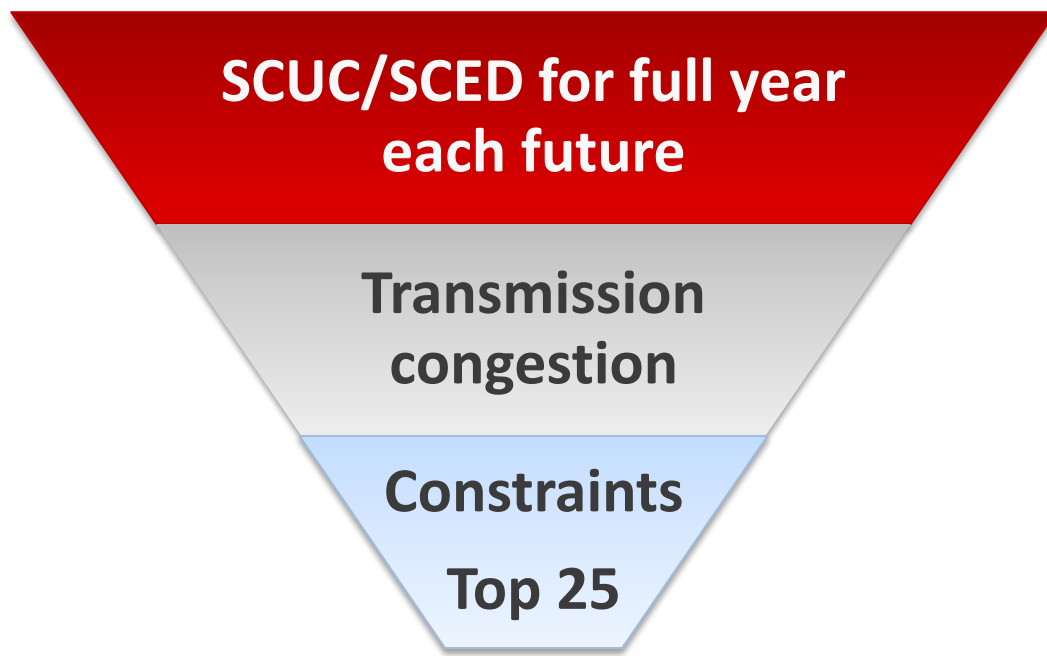


*Figure 12.1: Developing Economic Needs*

If generation sited from the resource plan was connected to a transformer or branch that caused enough congestion at the facility to make it a Top 25 constraint, then that economic need was ignored because the generator's placement at a different bus in the system could mitigate the need.

The Top 25 constraints were identified without including any of the model's reliability or policy projects. Therefore, some of the Top 25 (shown in the Study Drivers Section) economic needs that arose could have already been addressed through reliability or policy projects.

### **12.3: Economic Solutions**

Economic projects were proposed based on stakeholder recommendations and the projects' potential to mitigate the Top 25 constraints' congestion. Economic SPP Staff solutions, DPPs, Order 890 submittals, and projects previously evaluated in SPP planning studies were evaluated based on a multi-phase process vetted through the ESWG.

The APC for each economic project in the SPP footprint was calculated with and without the proposed economic project for all 8,784 hours of 2024. The change in APC with the project in-service was considered the one-year benefit. The one-year benefit was divided by the one-year conceptual cost of the project to develop a B/C ratio for each project. The one-year cost, or the annual transmission revenue requirement (ATRR), used for analysis is a historical average net plant carrying charge (NPCC) multiplied by the total project cost. For this study the NPCC used was 17%.

In addition to projects targeting the Top 25 constraints, all EHV projects targeting reliability needs were also analyzed for their economic benefit. The 2015 ITP10 did not identify policy needs, so no projects targeting a policy need were tested for economic benefit.

All potential 2015 ITP10 economic solutions were evaluated through a number of phases described below. The ESWG approved different cost-sharing assumptions for any projects identified as potential seams projects. It was assumed SPP will bear 80% of the total project cost for those projects; all other B/C ratio criteria remained the same.

### **Pre-Phase 1**

This phase filtered projects prior to PROMOD testing. Before Phase 1, individual projects went through an initial screening to test for reasonableness. The potential annual APC benefit was calculated for each of the economic *needs* by removing each constraint or group of constraints and rerunning the simulation. Based on this calculation, economic projects moved on to Phase 1 for further testing if 75% of the potential APC benefit compared with the estimated 1-year conceptual cost of a project targeting a particular constraint or group of constraints resulting in a 0.5 1-year B/C ratio or greater.

Due to the complexities of the constraints' interactions and the projects developed to mitigate those constraints' congestion all projects targeting economic needs in the 2015 ITP10 were moved on to be evaluated in Phase 1.

### **Phase 1**

Phase 1 considered an individual project's performance in the base case. Projects moved on to Phase 2 for further testing if they provided a 1-year B/C ratio of 0.75 or greater by reducing congestion.

### **Phase 2**

A project's performance, in concert with other potential projects, was considered in Phase 2. Reliability and economic projects were combined into project groupings for each future and evaluated for redundancies. SPP first evaluated a group of projects meeting all reliability needs as a portfolio to determine any potential overlap with economic solutions by measuring system congestion relieved by the portfolio. After the reliability projects were evaluated as a group, SPP developed groupings for economic projects, considering potential redundancies with other project types.

Project groupings were developed based on the projects' performance in Phase 1. Projects for each grouping were selected by ranking the top projects for each need. Rankings were determined by their individual performance under the criteria for each grouping. A project must have provided a reasonable amount of congestion relief to be considered in the ranking for a particular need or set of needs. This relief was based on the mitigation percentage of flowgate congestion cost and was determined on a per flowgate basis for the set of projects being evaluated. For most flowgates, the determined threshold was no less than 60%-70%, some higher. A project selected for a particular need may also provide a certain amount of congestion relief for another need or set of needs. This overlap was evaluated, to determine the most appropriate project(s) for the needs met, on a case by case basis. Typically, if one project met multiple needs and was comparable in cost and performance to multiple projects meeting multiple needs, the single project solution was selected. Not all economic needs had a project selected. Four groupings were considered per future:

- **Cost-Effective:** This group included projects that met the study need in the most cost-effective way. If one project mitigated multiple needs, the project's cost was compared to that of one or more projects mitigating that same group of needs.
- **Highest Gross APC Benefit:** This grouping consisted of the projects that met the needs with the highest gross APC benefit. This grouping did not consider the projects' costs.
- **Highest Net APC Benefit:** This group included the projects that met the needs of each future with the highest net APC benefit. Each project's cost was subtracted from the APC benefit provided to determine the project's net APC benefit.
- **Multi-Variable Grouping:** This optional grouping was proposed to allow SPP to layer multiple criteria in forming additional groups for testing. The experience gained from analyzing projects

for the first three groups was to be used to determine projects included in this grouping. This grouping was not developed.

The above groupings were developed by testing individual project performance, and choosing projects meeting each of the grouping criteria. These chosen projects were then tested together to determine their performance as a group. Ultimately, the grouping with the highest net APC benefit for each future moved on for further analysis.

Projects in the selected grouping were tested individually against the Phase 2 B/C criteria, 1-year B/C of 0.9 or greater. This was done by creating a portfolio of reliability, policy, and economic projects as a reference, and removing each economic project one by one to determine the benefit of the project as a part of the full portfolio. If any project did not meet the threshold, it was removed from the portfolio. Potential replacement projects were evaluated from the pool of ranked projects, if the selected project did not meet the phase 2 criteria. The next highest ranked project was chosen for evaluation. Regardless of whether a viable replacement project was found, each project from the portfolio was retested against the Phase 2 criteria. This analysis continued iteratively until a final portfolio was determined for each future.

### **Phase 3**

Phase 3 consolidated both of the Phase 2 groupings of each future into one final portfolio. Future 1 economic projects with a 1-year B/C ratio greater than 0.9 in Future 1 were included in the consolidated portfolio. Future 2 economic projects with a 1-year B/C ratio greater than 0.9 in Future 2, but that also had a 1-year B/C ratio greater than 0.7 in Future 1, were also included in the consolidated portfolio.

## Section 13: Future Portfolios

Reliability, policy, and economic projects for each future were grouped together into portfolios unique to each future. In assessing needs and project solutions, reliability, policy, and economics were analyzed independently of each other. For Example, some reliability projects were also good economic projects, because relieving a single constraint's significant congestion could mitigate a reliability problem and provide significant economic benefit.

### 13.1: Developing the Portfolios

Reliability and economic project groupings were also developed independently of each other, but assessed for overlap. Reliability projects were incorporated into a cost effective grouping solving reliability needs (as described in Reliability Groupings) for each future. Economic projects addressing economically viable needs were incorporated into multiple groupings for each future and tested incremental to the reliability grouping. Each economic grouping was tested for its net benefit performance, as described in phase 2 of Economic Solutions. Based on this analysis, the economic grouping selected for further analysis in Future 1 was the highest net APC benefit grouping, while the cost effective grouping had the highest net APC in Future 2.

The projects selected for further analysis in each future are listed in Table 13.1 and Table 13.2. With the least cost reliability grouping included as a base, the economic projects were tested individually to determine if they met the Phase 2 B/C criteria.

| Project                                                                                                   | Area           | B/C > 0.9?       |
|-----------------------------------------------------------------------------------------------------------|----------------|------------------|
| New 345/138 kV transformer at Seminole                                                                    | OKGE           | No               |
| New 345/230 kV transformer at Potter County                                                               | SWPS           | No               |
| New wave trap at Amoco and Sundown, increasing rating on Sundown-Amoco 230 kV line                        | SWPS           | Yes              |
| Voltage conversion of Iatan-Stranger Creek 161 kV line to 345 kV                                          | KCPL, GMO, WRI | Yes              |
| Tap Baker-Litchfield 161 kV line into Asbury                                                              | WRI/EDE        | No               |
| Upgrade terminal equipment at Summit 115 kV, upgrading ratings on Summit 230/115 kV transformers          | WRI            | No               |
| Rebuild North Platt-Stockville-Red Willow 115 kV line to 240/240 MVA, new 345/115 kV transformer at Mingo | NPPD/SUNC      | Yes              |
| New Trenton-Strandahl 115 kV line                                                                         | WAPA           | No <sup>29</sup> |
| Rebuild Collins-Stockton-Morgan 161 kV line                                                               | AECI           | No <sup>30</sup> |
| Rebuild Duncan-Blue Springs East 161 kV line                                                              | GMO            | No               |

*Table 13.1: Future 1 Net APC Benefit Economic Grouping*

<sup>29</sup> A model correction to Williston - Judson 115 kV line was submitted near the end of the Phase 2 process, increasing the line ratings such that the selected project was no longer economically viable.

<sup>30</sup> A model correction to the Collins – Stockton – Morgan 161 kV lines was submitted near the end of the Phase 2 process, increasing the line ratings such that the selected project was no longer economically viable.

| Project                                                                                   | Area | B/C > 0.9? |
|-------------------------------------------------------------------------------------------|------|------------|
| New 345/138 kV transformer at Seminole                                                    | OKGE | Yes        |
| New 230/115 kV transformer at Eddy County                                                 | SWPS | Yes        |
| Upgrade 230/115 kV transformer at Carlisle                                                | SWPS | No         |
| Tap Baker-Litchfield 161 kV line into Asbury                                              | EDE  | No         |
| Upgrade relays at Sand Springs, increasing ratings on Sand Springs-Prattville 138 kV line | AEPW | Yes        |
| New 2nd Hoyt-Hoyt Junction South 115 kV line                                              | WAPA | No         |
| Reconductor Northeast-Charlotte 161 kV line                                               | KCPL | No         |
| Rebuild S1221-S1255 161 kV line to 554/554 MVA                                            | SWPS | Yes        |

*Table 13.2: Future 2 Cost Effective Economic Grouping*

Seven of the projects selected for the final grouping in Future 1 did not produce the benefit needed to remain in the final portfolio for Future 1, leaving just three economic projects. Four of the projects selected for the final grouping in Future 2 did not produce the necessary economic benefit, leaving four projects in the final portfolio for Future 2.

### **13.2: Project Solutions from Previous ITP Studies**

Project solutions from previous ITP studies were reviewed and evaluated for performance in the 2015 ITP10. While the system behavior and a few of the 2015 ITP10 system needs were similar to that of the 2013 ITP20, only a handful of projects selected to address needs in the 2015 ITP10 are similar to the projects selected in the 2013 ITP20. Table 13.3 shows 2015 ITP10 upgrades included in at least one future portfolio for which an equivalent upgrade was included in an approved 2013 ITP20 portfolio.

| 2015 ITP10 Solution                               | Future(s) | 2013 ITP20 Approved Solution        |
|---------------------------------------------------|-----------|-------------------------------------|
| New 345/161 kV transformer at S3459               | F1        | New 345/161 kV transformer at S3459 |
| Rebuild North Platte-Stockville-Red Willow 115 kV | F1        | New Keystone - Red Willow 345 kV    |

*Table 13.3: 2015 ITP10 Upgrades with Equivalent 2013 ITP20 Approved Solutions*

### **13.3: Future 1 Portfolio**

The Future 1 Portfolio contains a mixture of Reliability and Economic Projects. It consists of 27 projects, 235 miles of transmission line, and has a 1-year B/C Ratio of 2.9 (calculated on APC only).



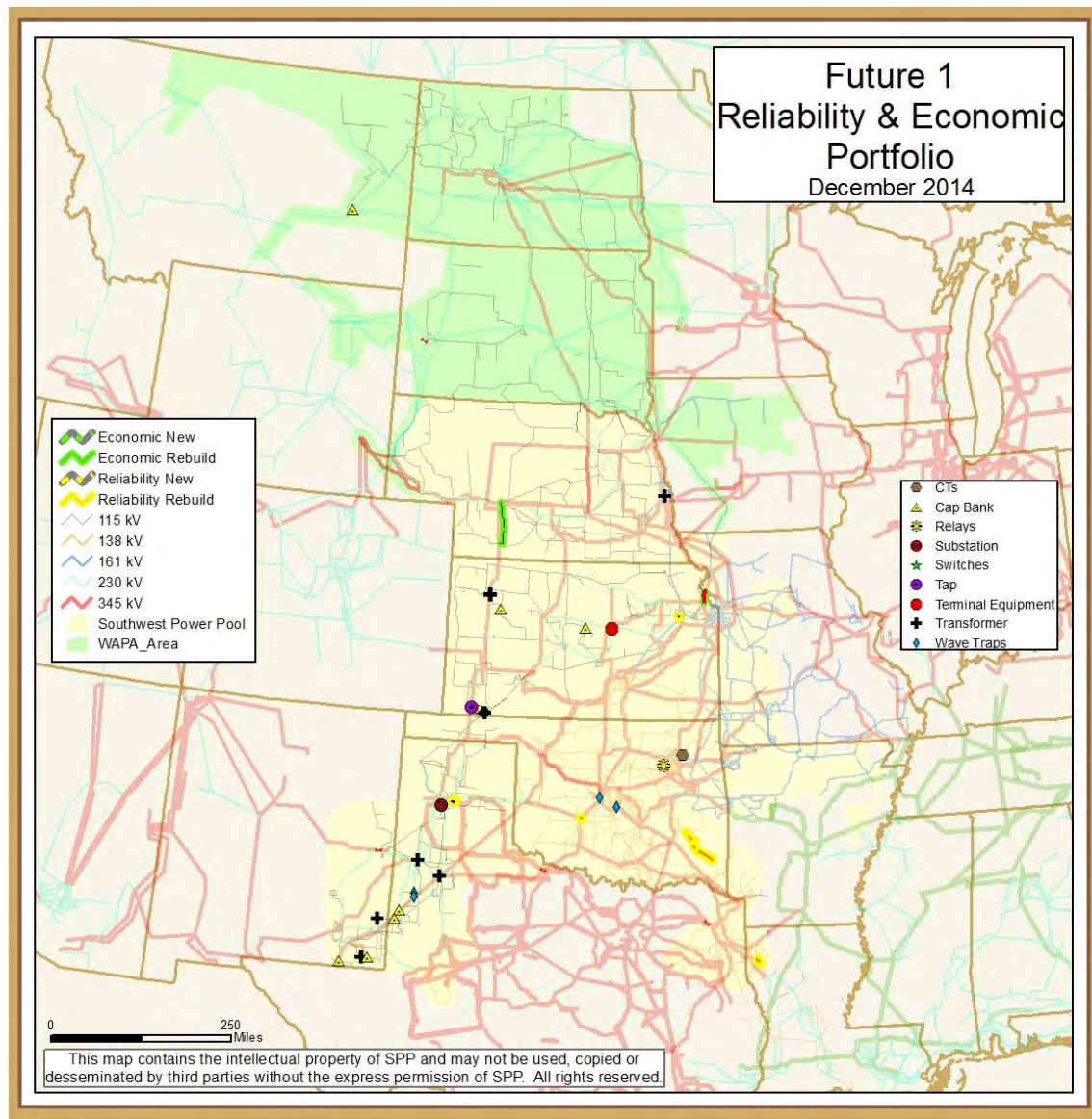


Figure 13.1: Future 1 Portfolio

| 2015 Dollars   | Future 1 Grouping |          |          |
|----------------|-------------------|----------|----------|
|                | Reliability       | Economic | Total    |
| Total Cost     | \$174.3M          | \$69.7M  | \$237.9M |
| Total Projects | 25                | 3        | 27       |
| Total Miles    | 137               | 94       | 231      |
| 1-Year Cost    |                   | \$11.9M  |          |
| APC Benefit    |                   | \$35M    |          |
| B/C Ratio      |                   | 3.0*     |          |

1 upgrade in F1 is included in both the economic and reliability portfolios

\*B/C includes only APC benefit of economic projects

Table 13.4: Future 1 Portfolio Statistics



Table 13.5 shows details for all Future 1 portfolio projects.

| Project                                                                                                                                          | Area       | Type                   | Miles | Cost         |
|--------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------------|-------|--------------|
| Install 14.4 MVar capacitor bank at Allred 115 kV                                                                                                | SWPS       | Reliability            | 0     | \$829,881    |
| Install 14.4 MVar capacitor bank at LE Plains Interchange 115 kV                                                                                 | SWPS       | Reliability            | 0     | \$829,881    |
| Install 2 stages of 14.4 MVar capacitor banks on the China Draw 115 kV bus and the North Loving 115 kV bus                                       | SWPS       | Reliability            | 0     | \$3,319,524  |
| Install 2 stages of 14.4 MVar capacitor banks on the Ochoa 115 kV bus                                                                            | SWPS       | Reliability            | 0     | \$1,659,762  |
| Install 6 MVar capacitor bank at Grinnell 115 kV                                                                                                 | SUNC       | Reliability            | 0     | \$345,784    |
| Install 6 MVar capacitor bank at Mile City 115 kV                                                                                                | WAPA       | Reliability            | 0     | \$345,784    |
| Install 14.4 MVar capacitor bank at Ellsworth 115 kV bus                                                                                         | SUNC       | Reliability            | 0     | \$829,881    |
| New 115/69 kV transformer at Lovington                                                                                                           | SWPS       | Reliability            | 0     | \$2,239,599  |
| New 230/115 kV transformer at Plant X                                                                                                            | SWPS       | Reliability            | 0     | \$3,497,095  |
| New 345/115 kV transformer at Road Runner                                                                                                        | SWPS       | Reliability            | 0     | \$5,733,227  |
| New 345/161 kV transformer at S3459                                                                                                              | OPPD       | Reliability            | 0     | \$8,176,238  |
| New wave trap at Amoco and Sundown, increasing rating on Sundown-Amoco 230 kV line                                                               | SWPS       | Economic               | 0     | \$55,641     |
| Rebuild Broken Bow-Lone Oak 138 kV corridor to 286/286 MVA                                                                                       | AEPW       | Reliability            | 76.7  | \$60,804,427 |
| Rebuild Forbes-Underpass North 115 kV line to 218/262 MVA                                                                                        | WRI        | Reliability            | 3.1   | \$7,878,364  |
| Rebuild North Platt-Stockville-Red Willow 115 kV line to 240/240 MVA, new 345/115 kV transformer at Mingo                                        | NPPD, SUNC | Economic & Reliability | 80    | \$53,562,098 |
| Reconductor Gracemont-Anadarko 138 kV line to 286/286 MVA                                                                                        | OKGE, WFEC | Reliability            | 5.28  | \$4,650,558  |
| Reconductor Highland Park-Pantex South 15 kV line to 240/240 MVA and replace wave trap and switch at Pantex South and Highland Park tap          | SWPS       | Reliability            | 7     | \$3,649,492  |
| Reconductor Martin-Pantex North 115 kV line to 240/240 MVA and replace wave trap at Pantex substation                                            | SWPS       | Reliability            | 5.1   | \$3,602,175  |
| Reconductor Pantex North-Pantex South 115 kV line to 240/240 MVA                                                                                 | SWPS       | Reliability            | 3     | \$1,824,746  |
| Rebuild South Shreveport-Wallace Lake 138 kV line to 246/246 MVA                                                                                 | AEPW       | Reliability            | 11    | \$10,268,933 |
| Replace wave trap at Claremore 161 kV                                                                                                            | GRDA       | Reliability            | 0     | \$88,560     |
| Tap Hitchland-Finney 345 kV line at new substation and install new 345/115 kV transformer, and build new 23 mile 115 kV line from new station to | SUNC       | Reliability            | 23    | \$36,224,893 |

|                                                                                                        |                |              |               |                      |
|--------------------------------------------------------------------------------------------------------|----------------|--------------|---------------|----------------------|
| <b>Walkemeyer</b>                                                                                      |                |              |               |                      |
| <b>Tap Northwest-Bush 115 kV line at new station, and build new 3 miles of 115 kV line to Hastings</b> | SWPS           | Reliability  | 3.1           | \$7,984,549          |
| <b>Upgrade 230/115 kV transformer at Tuco</b>                                                          | SWPS           | Reliability  | 0             | \$3,127,583          |
| <b>Upgrade relays at Sand Springs, increasing ratings on Sand Springs-Prattville 138 kV line</b>       | AEPW           | Reliability  | 0             | \$176,290            |
| <b>Upgrade wave traps and switches on Cimarron-McClain 345 kV line</b>                                 | OKGE           | Reliability  | 0             | \$116,838            |
| <b>Voltage conversion of Iatan-Stranger Creek 161 kV line to 345 kV</b>                                | KCPL, GMO, WRI | Economic     | 14            | \$16,119,446         |
|                                                                                                        |                | <b>Total</b> | <b>231.28</b> | <b>\$237,941,249</b> |

*Table 13.5: Future 1 Portfolio Projects*

### **13.4: Future 2 Portfolio**

Reliability, policy, and economic projects developed for Future 2 were grouped together into a single Future 2 portfolio. The portfolio features 32 projects, 104 miles of transmission line, and a 1-year B/C ratio of 4.5 (includes APC benefits only).

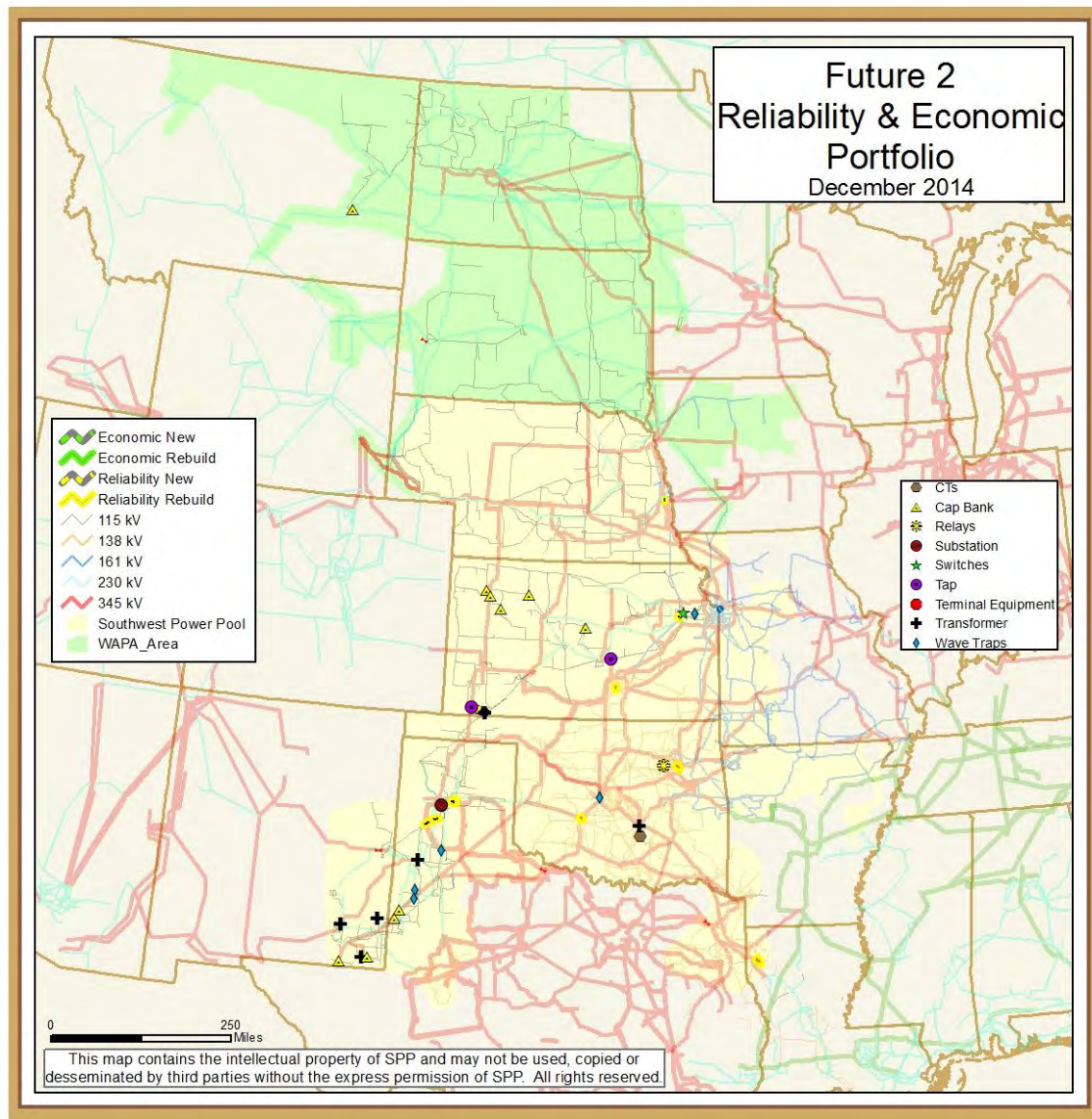


Figure 13.2: Future 2 Portfolio

| 2015 Dollars   | Future 2 Grouping |          |          |
|----------------|-------------------|----------|----------|
|                | Reliability       | Economic | Total    |
| Total Cost     | \$147.2M          | \$20.8M  | \$164.2M |
| Total Projects | 30                | 4        | 32       |
| Total Miles    | 96.9              | 4.1      | 96.9     |
| 1-Year Cost    |                   | \$3.5M   |          |
| APC Benefit    |                   | \$15.8M  |          |
| B/C Ratio      |                   | 4.5*     |          |

2 projects in F2 are included in both the economic and reliability portfolios

\*B/C includes only APC benefit of economic projects

Table 13.6: Future 2 Portfolio Statistics

| Project                                                                                                    | Area       | Type                     | Miles | Cost         |
|------------------------------------------------------------------------------------------------------------|------------|--------------------------|-------|--------------|
| New 345/115 kV transformer at Road Runner                                                                  | SWPS       | Reliability              | 0     | \$5,733,227  |
| Install 2 stages of 14.4 MVar capacitor banks on the Ochoa 115 kV bus                                      | SWPS       | Reliability              | 0     | \$1,659,762  |
| Install 2 stages of 14.4 MVar capacitor banks on the China Draw 115 kV bus and the North Loving 115 kV bus | SWPS       | Reliability              | 0     | \$3,319,524  |
| New wave trap at Amarillo South, increasing rating on Amarillo South-Swisher 230 kV line                   | SWPS       | Reliability              | 0     | \$27,821     |
| Tap Northwest-Bush 115 kV line at Bush Tap, new Bush Tap station, new Bush Tap-Hastings 115 kV line        | SWPS       | Reliability              | 3.1   | \$7,984,549  |
| New wave trap at Amoco and Sundown, increasing rating on Sundown-Amoco 230 kV line                         | SWPS       | Reliability              | 0     | \$55,641     |
| New 345/138 kV transformer at Seminole                                                                     | OKGE       | Economic                 | 0     | \$12,206,436 |
| New 230/115 kV transformer at Eddy County                                                                  | SWPS       | Economic                 | 0     | \$4,742,668  |
| Upgrade wave traps and switches on Cimarron-McClain 345 kV line                                            | OKGE       | Reliability              | 0     | \$116,838    |
| Upgrade wave trap and CT on the Park Lane-Seminole 138 kV line                                             | SWPS       | Reliability              | 0     | \$86,436     |
| Upgrade relays at Sand Springs, increasing ratings on Sand Springs-Prattville 138 kV line                  | AEPW       | Reliability and Economic | 0     | \$176,290    |
| Tap Reno-Wichita 345 kV line into Moundridge, new 345/138 kV transformer at Moundridge                     | WRI        | Reliability              | 0     | \$14,722,229 |
| Rebuild Forbes-Underpass North 115 kV line to 218/262 MVA                                                  | WRI        | Reliability              | 3.1   | \$7,878,364  |
| Upgrade terminal equipment at Tecumseh Hill, increasing ratings of 230/115 kV transformer at Tecumseh Hill | WRI        | Reliability              | 0     | \$162,975    |
| Rebuild S1221-S1255 161 kV line to 554/554 MVA                                                             | OPPD       | Reliability and Economic | 4.1   | \$3,672,317  |
| Reconductor Gracemont-Anadarko 138 kV line to 286/286 MVA                                                  | OKGE, WFEC | Reliability              | 5.28  | \$4,650,558  |
| Rebuild Murray Gill East-Interstate 138 kV line to 286/286 MVA                                             | WRI        | Reliability              | 6.3   | \$6,184,325  |
| Reconductor Martin-Pantex North 115 kV line to 240/240 MVA and replace wave trap at Pantex substation      | SWPS       | Reliability              | 5.14  | \$3,602,175  |
| Reconductor Pantex North-Pantex South 115 kV line to 240/240 MVA                                           | SWPS       | Reliability              | 3.4   | \$1,824,746  |

|                                                                                                                                                                |      |             |              |                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------------|--------------|----------------------|
| <b>Reconductor Highland Park-Pantex South 15 kV line to 240/240 MVA and replace wave trap and switch at Pantex South and Highland Park tap</b>                 | SWPS | Reliability | 6.8          | \$3,649,492          |
| <b>Install 14.4 MVar capacitor bank at LE Plains Interchange 115 kV</b>                                                                                        | SWPS | Reliability | 0            | \$829,881            |
| <b>Install 14.4 MVar capacitor bank at Allred 115 kV</b>                                                                                                       | SWPS | Reliability | 0            | \$829,881            |
| <b>Install 6 MVar capacitor bank at Grinnell 115 kV</b>                                                                                                        | SUNC | Reliability | 0            | \$345,784            |
| <b>Install 6 MVar capacitor bank at Colby 115 kV, 24 MVar capacitor bank at Mingo 115 kV, and 9 MVar capacitor banks at Ross Beach 115 kV</b>                  | NPPD | Reliability | 0            | \$2,270,657          |
| <b>Rebuild South Shreveport-Wallace Lake 138 kV line to 246/246 MVA</b>                                                                                        | AEPW | Reliability | 11.18        | \$10,268,933         |
| <b>Reconductor Broken Arrow-Lynn Lane East Tap 138 kV line to 286/286 MVA</b>                                                                                  | OKGE | Reliability | 7.2          | \$13,317,210         |
| <b>Install 14.4 MVar capacitor bank at Ellsworth 115 kV bus</b>                                                                                                | SUNC | Reliability | 0            | \$829,881            |
| <b>Upgrade wave traps and bus at LEC U3 and Midland Junction 115 kV</b>                                                                                        | WRI  | Reliability | 0            | \$27,821             |
| <b>Install 6 MVar capacitor bank at Mile City 115 kV</b>                                                                                                       | WAPA | Reliability | 0            | \$345,784            |
| <b>New 115/69 kV transformer at Lovington</b>                                                                                                                  | SWPS | Reliability | 0            | \$2,239,599          |
| <b>Rebuild Canyon West-Dawn-Panda 115 kV line to 249/273 MVA</b>                                                                                               | SWPS | Reliability | 22.1         | \$14,194,453         |
| <b>Tap Hitchland-Finney 345 kV line at NewSub1, new 345/115 kV transformer at NewSub, new NewSub station, new NewSub2-Walkemeyer-North Liberal 115 kV line</b> | SUNC | Reliability | 23           | \$36,224,893         |
| <b>Total</b>                                                                                                                                                   |      |             | <b>100.7</b> | <b>\$164,181,150</b> |

Table 13.7: Future 2 Portfolio Projects



## Section 14: Consolidated Portfolio

### 14.1: Development

The Future 1 and 2 portfolios were consolidated into a single final portfolio to be analyzed across both futures.

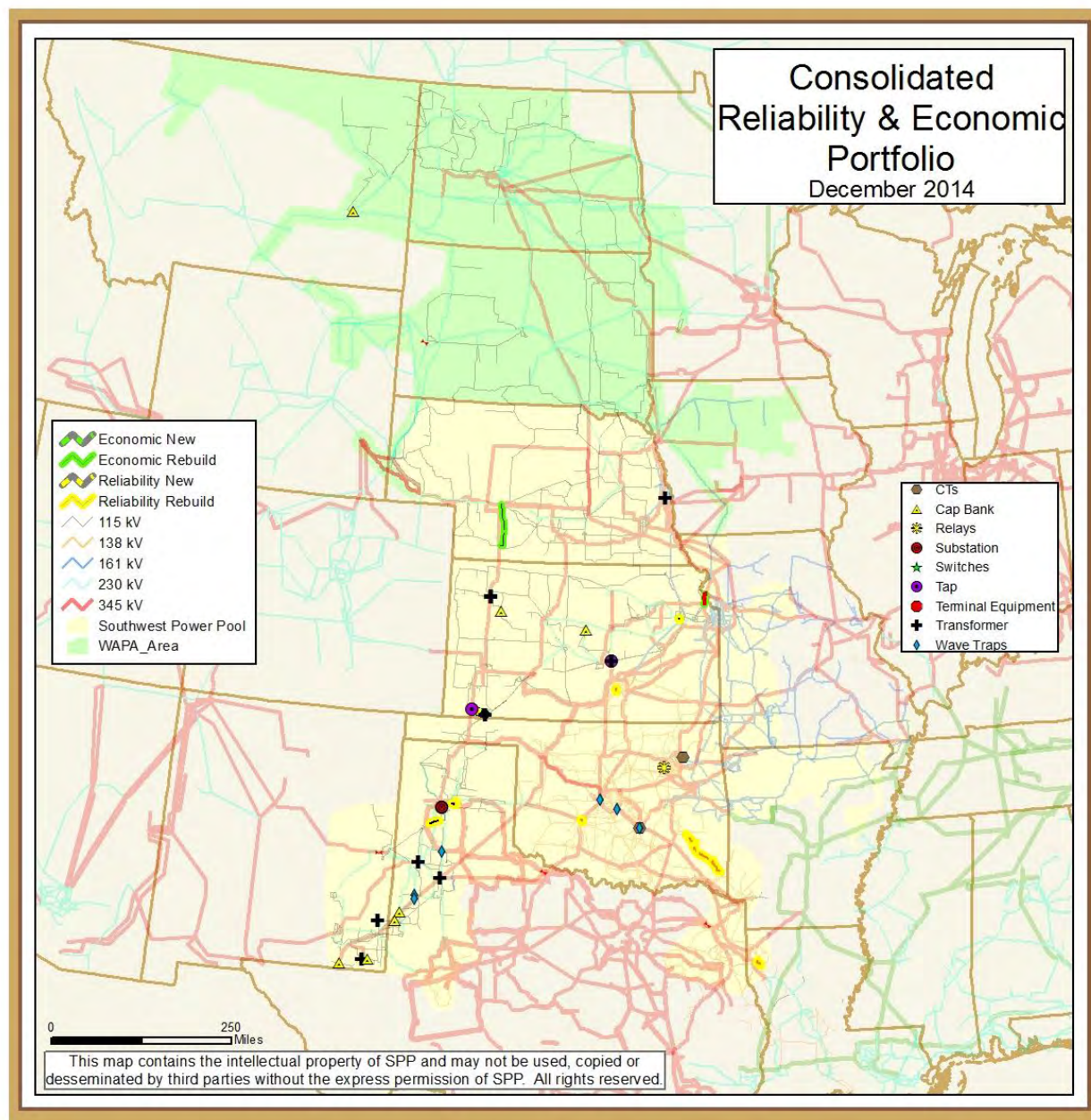


Figure 14.1: Consolidation of Portfolios

| 2015 Dollars          | Consolidated Portfolio |          |          |
|-----------------------|------------------------|----------|----------|
|                       | Reliability            | Economic | Total    |
| <b>Total Cost</b>     | \$209.6M               | \$69.7M  | \$273.2M |
| <b>Total Projects</b> | 31                     | 3        | 32       |
| <b>Total Miles</b>    | 166                    | 94       | 260      |
| <b>1-Year Cost</b>    |                        | \$11.9M  |          |
| <b>APC Benefit</b>    |                        | \$37.8M  |          |
| <b>B/C Ratio</b>      |                        | 3.2*     |          |

2 projects are included in both the economic and reliability portfolios

\*B/C includes only APC benefit of economic projects

*Table 14.1: Consolidated Portfolio Statistics*

The final portfolio for each future was consolidated into a single portfolio.

The consolidation was based on the following criteria:

#### Economic Projects

- Economic projects with a 1-year B/C ratio greater than 0.9 in Future 1 were included in the consolidated portfolio.
- Economic projects with a 1-year B/C ratio greater than 0.7 in Future 1, and a 1-year B/C ratio greater than 0.9 in Future 2 were also included in the consolidated portfolio.

#### Policy Projects

- Policy projects were included in the consolidated portfolio if they met a policy need in Future 1.

#### Reliability Projects

- Reliability projects were included in the consolidated portfolio if they mitigate a thermal/voltage violation in Future 1.
- Future 2 reliability projects were included if they mitigate a thermal violation in Future 2 and mitigate loading above a 90% threshold in Future 1.
- Future 2 projects mitigating a voltage limit violation in Future 2 and voltage below 0.92 pu in Future 1 were included in the consolidated portfolio.

Although projects with significant potential value were eligible to be selected to be part of the consolidated portfolio, no such projects were included.

## 14.2: Projects

The Consolidated Portfolio projects are shown in Table 14.2.

| Project Description                                                                                        | Area(s)        | Type                   | Future | Mileage | Cost         |
|------------------------------------------------------------------------------------------------------------|----------------|------------------------|--------|---------|--------------|
| New wave trap at Amoco and Sundown, increasing rating on Sundown-Amoco 230 kV line                         | SWPS           | Economic & Reliability | F1     | 0       | \$55,641     |
| Voltage conversion of Iatan-Stranger Creek 161 kV line to 345 kV                                           | KCPL, GMO, WRI | Economic               | F1     | 14      | \$16,119,446 |
| Rebuild North Platt-Stockville-Red Willow 115 kV line to 240/240 MVA, new 345/115 kV transformer at Mingo  | NPPD, SUNC     | Economic & Reliability | F1     | 80      | \$53,562,098 |
| New 345/115 kV transformer at Road Runner                                                                  | SWPS           | Reliability            | F1     | 0       | \$5,733,227  |
| Install 2 stages of 14.4 MVAR capacitor banks on the Ochoa 115 kV bus                                      | SWPS           | Reliability            | F1     | 0       | \$1,659,762  |
| Install 2 stages of 14.4 MVAR capacitor banks on the China Draw 115 kV bus and the North Loving 115 kV bus | SWPS           | Reliability            | F1     | 0       | \$3,319,524  |
| New 230/115 kV transformer at Plant X                                                                      | SWPS           | Reliability            | F1     | 0       | \$3,497,095  |
| New wave trap at Amarillo South, increasing rating on Amarillo South-Swisher 230 kV line                   | SWPS           | Reliability            | F2     | 0       | \$27,821     |
| Tap Northwest-Bush 115 kV line at new station, and build new 3 miles of 115 kV line to Hastings            | SWPS           | Reliability            | F1     | 3       | \$7,984,549  |
| Upgrade 230/115 kV transformer at Tuco                                                                     | SWPS           | Reliability            | F1     | 0       | \$3,127,583  |
| Upgrade wave trap and CT on the Park Lane-Seminole 138 kV line                                             | OKGE           | Reliability            | F2     | 0       | \$86,436     |
| Upgrade relays at Sand Springs, increasing ratings on Sand Springs-Prattville 138 kV line                  | AEPW           | Reliability            | F1     | 0       | \$176,290    |
| Tap Reno-Wichita 345 kV line into Moundridge, new 345/138 kV transformer at Moundridge                     | WRI            | Reliability            | F2     | 0       | \$14,722,229 |
| Rebuild Forbes-Underpass North 115 kV line to 218/262 MVA                                                  | WRI            | Reliability            | F1     | 3       | \$7,878,364  |
| Reconductor Gracemont-Anadarko 138 kV line to 286/286 MVA                                                  | OKGE, WRI      | Reliability            | F1     | 5       | \$4,650,558  |
| Rebuild Murray Gill East-Interstate 138 kV line to 286/286 MVA                                             | WRI            | Reliability            | F2     | 6       | \$6,184,325  |
| Reconductor Martin-Pantex North 115 kV line to 240/240 MVA and replace wave trap at Pantex substation      | SWPS           | Reliability            | F1     | 5       | \$3,602,175  |
| Reconductor Pantex North-Pantex South 115 kV line to 240/240 MVA                                           | SWPS           | Reliability            | F1     | 3       | \$1,824,746  |



|                                                                                                                                                                                           |      |             |    |     |               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------------|----|-----|---------------|
| Reconductor Highland Park-Pantex South 15 kV line to 240/240 MVA and replace wave trap and switch at Pantex South and Highland Park tap                                                   | SWPS | Reliability | F1 | 7   | \$3,649,492   |
| Install 14.4 MVar capacitor bank at LE Plains Interchange 115 kV                                                                                                                          | SWPS | Reliability | F1 | 0   | \$829,881     |
| Install 14.4 MVar capacitor bank at Allred 115 kV                                                                                                                                         | SWPS | Reliability | F1 | 0   | \$829,881     |
| Replace wave trap at Claremore 161 kV                                                                                                                                                     | GRDA | Reliability | F1 | 0   | \$88,560      |
| Install 6 MVar capacitor bank at Grinnell 115 kV                                                                                                                                          | SUNC | Reliability | F1 | 0   | \$345,784     |
| Rebuild South Shreveport-Wallace Lake 138 kV line to 246/246 MVA                                                                                                                          | AEPW | Reliability | F1 | 11  | \$10,268,933  |
| Rebuild Broken Bow-Lone Oak 138 kV corridor to 286/286 MVA                                                                                                                                | AEPW | Reliability | F1 | 77  | \$60,804,427  |
| Install 14.4 MVar capacitor bank at Ellsworth 115 kV                                                                                                                                      | SUNC | Reliability | F1 | 0   | \$829,881     |
| Install 6 MVar capacitor bank at Mile City 115 kV                                                                                                                                         | WAPA | Reliability | F1 | 0   | \$345,784     |
| Upgrade wave traps and switches on Cimarron-McClain 345 kV line                                                                                                                           | OKGE | Reliability | F1 | 0   | \$116,838     |
| New 345/161 kV transformer at S3459                                                                                                                                                       | OPPD | Reliability | F1 | 0   | \$8,176,238   |
| New 115/69 kV transformer at Lovington                                                                                                                                                    | SWPS | Reliability | F1 | 0   | \$2,239,599   |
| Rebuild Canyon West-Dawn-Panda 115 kV line to 249/273 MVA                                                                                                                                 | SWPS | Reliability | F2 | 24  | \$14,194,453  |
| Tap Hitchland-Finney 345 kV line at new substation and install new 345/115 kV transformer, and build new 23 mile 115 kV line from new station to Walkemeyer and continue to North Liberal | SUNC | Reliability | F1 | 22  | \$36,224,893  |
| Total                                                                                                                                                                                     |      |             |    | 260 | \$273,156,513 |

*Table 14.2: Consolidated Portfolio Projects*

The project details that follow summarize 2024 system behavior both with and without each project.

### **14.3: Economic Projects**

This section details each of the economic projects in the 2015 ITP10 consolidated portfolio.

#### **Rebuild North Platt-Stockville-Red Willow 115 kV line to 240/240 MVA, new 345/115 kV transformer at Mingo**

The western SPP corridor shows a general north to south flow of power from Nebraska into Kansas. The Gentleman to Red Willow 345 kV line carries much of the power flows in this area. An outage of this line causes flow to be redirected to the North Platte to Stockville 115 kV line and the model will bind this constraint at its maximum rating when the north to south system flows are high (need 2015ITP10-E1N0003). Rebuilding the North Platte to Stockville line increases the limits and allows the power to flow unimpeded by the flowgate. The Stockville to Red Willow segment must also be rebuilt as a part of this project so that the congestion isn't just pushed to the next element of the transmission system.

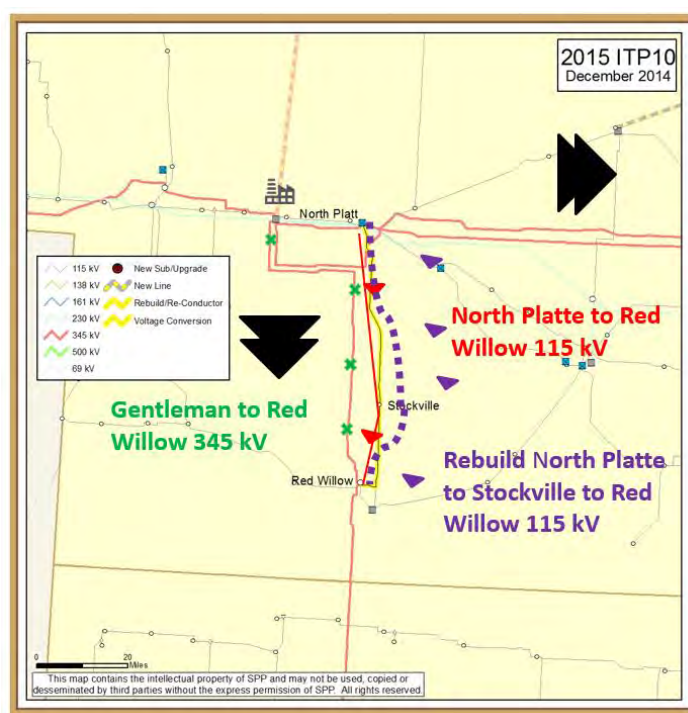


*Figure 14.2: Rebuild North Platt-Stockville-Red Willow*

This increase in north to south flows created by the rebuild of the North Platte to Red Willow corridor when the Gentleman to Red Willow 345 kV line is out of service, as well as the system intact conditions under high north to south bias hours cause congestion to be pushed south into Kansas. This is particularly realized when power is forced to step down from the 345 kV system to the 115 kV system at the Mingo substation when there is an outage of the Mingo to Setab 345 kV which runs to the south out of Mingo. The increase in power flowing on the Mingo transformer under this contingency from power trying to keep moving south and somewhat east cause the model to bind the existing transformer (Need 2015ITP10-E1N0008). Adding a second 345/115 kV transformer splits the duty and allows the power to step down to the lower voltage, unimpeded by the flowgate.

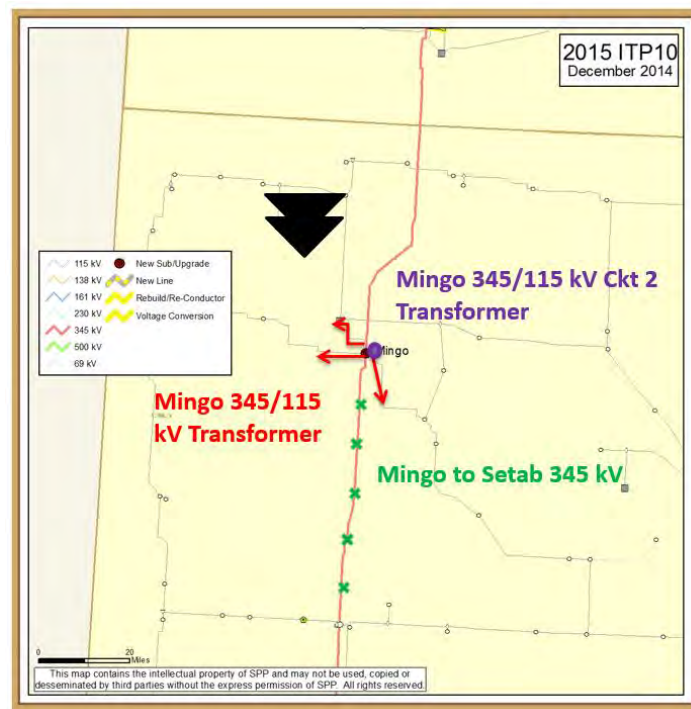


*Figure 14.3: New Transformer at Mingo*

### Voltage conversion of Iatan-Stranger Creek 161 kV line to 345 kV

The Kansas City area experiences general north to south system flows on the EHV network from generation in the north, Cooper nuclear in Nebraska, loop flows from first tier systems, and the Iatan coal plant. The 345 network surrounding Kansas City allows for flows passing through to the south as well as multiple access points for power to step down and serve demand in the city. The western side of the EHV loop around the city normally experiences slightly more flow than the eastern side. When an outage of the Iatan-Stranger Creek 345 kV line occurs, the flow moving south gets redirected to the eastern side of the loop where power begins to step down in greater amounts (needs 2015ITP10-E1N0001 and 2015ITP10-E1N0015). The Hawthorne substation is located more centrally to the load in the city than any other 345/161 kV stepdown on the eastern side, attracting additional flows on the 161 kV system at that point. This additional flow on the 161 kV near Hawthorne causes heavy congestion on the Northeast to Charlotte 161 kV line.

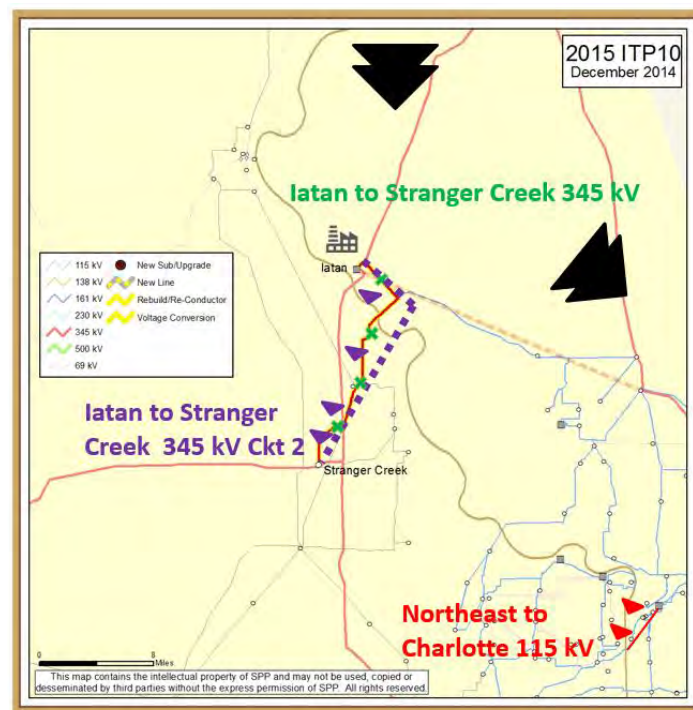


Figure 14.4: Voltage conversion of Iatan-Stranger Creek

When an outage of the Hawthorn to Nashua 345 kV occurs, cutting off the ability of the eastern part of the Kansas City EHV loop to be utilized for the flows from the north, the power is redirected to the west causing additional congestion on the Iatan to Stranger 345 kV line, the main outlet to move power to the south on the western side of the loop.

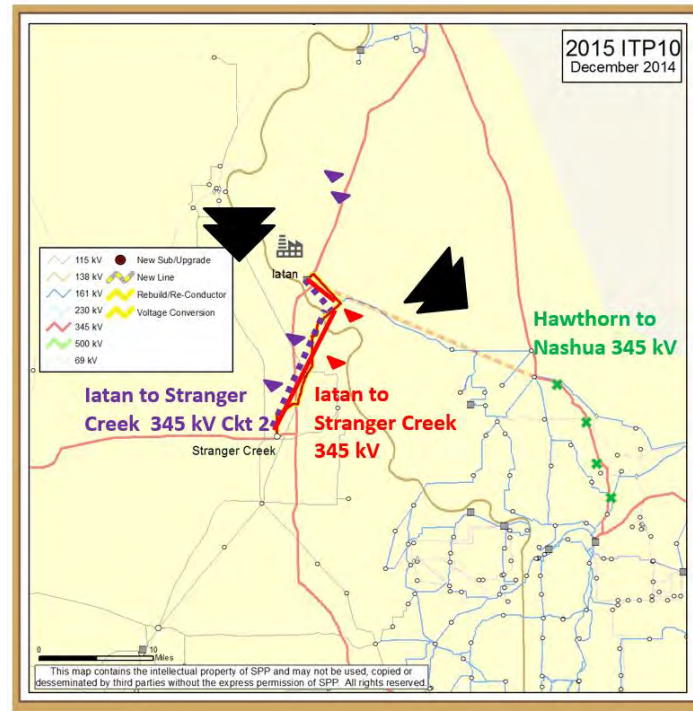


Figure 14.5: Voltage conversion of Iatan-Stranger Creek

In a parallel path to the existing Iatan to Stranger 345 kV line, is an existing 161 kV Iatan to Stranger which was partially built for 345 kV operation specifications. By rebuilding a portion of this line and converting it to 345 kV operation, the outage of the existing 345 kV line is mitigated with a parallel path that relieves congestion on the 161 kV system in the city and the parallel 345 kV creates an increase in capacity sufficient to handle the increase in flows on the western side of the loop when the Hawthorn to Nashua 345 kV experiences an outage.

### New wave trap at Amoco and Sundown, increasing rating on Sundown-Amoco 230 kV line

The Amoco/Sundown area of the Texas Panhandle has a general north to south power flow bias. There are a number of loads served on the 115 kV system from Sundown. When the Sundown 230/115 kV transformer is out of service, power has to flow south to Yoakum 230 kV in order to step down to the 115 kV system causing congestion on the Sundown to Amoco 230 kV line (need 2015ITP10-E1N0009).

By replacing wave traps at the Sundown and Amoco stations, the Sundown to Amoco 230 kV line can accommodate an increase in power flows in order to serve load at Amoco Switching Station, and the additional power necessary to flow south to Yoakum in order to step down to the 115 kV system and serve loads in the Sundown area.

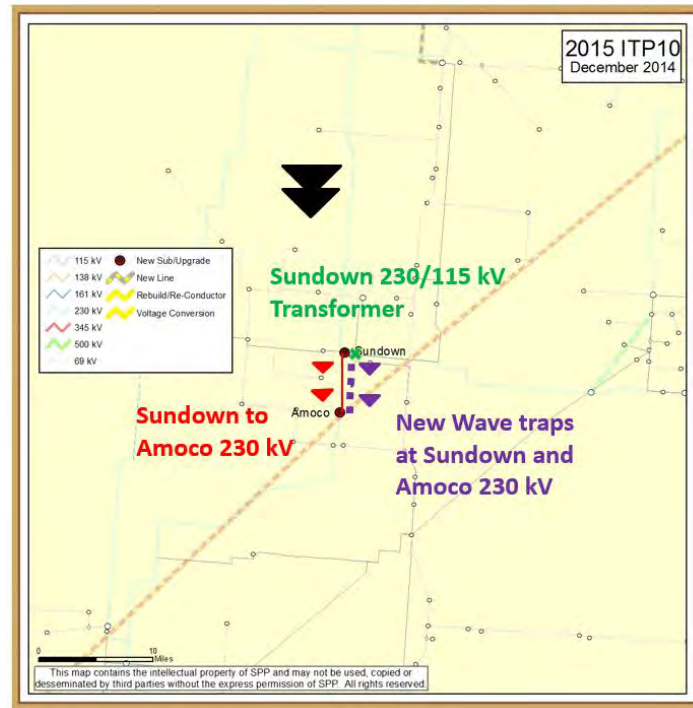


Figure 14.6: New wave trap at Amoco and Sundown



## 14.4: Reliability Projects

This section details each of the major reliability projects in the 2015 ITP10 consolidated portfolio. Each of the projects discussed below have an SPP generated cost estimate greater than \$15 million and are needed for Regional Reliability.

### Rebuild Broken Bow – Lone Oak 138 kV line

This project consists of rebuilding the 138 kV line corridor from Broken Bow to Lone Oak. The project upgrades the 16 miles of line from Broken Bow to Bethel to Nashoba to Clayton to Sardis to Enowilt Wilburton Tap (Enowilt) to Lone Oak to an updated rating of 286 MVA. This project has a need date of 2023. This project addresses the overloads of Clayton – Nashoba 138 kV, Clayton – Sardis 138 kV, Enowilt – Lone Oak 138 kV, and Enowilt – Sardis 138 kV for the outage of the Pittsburg – Valliant 345 kV line.

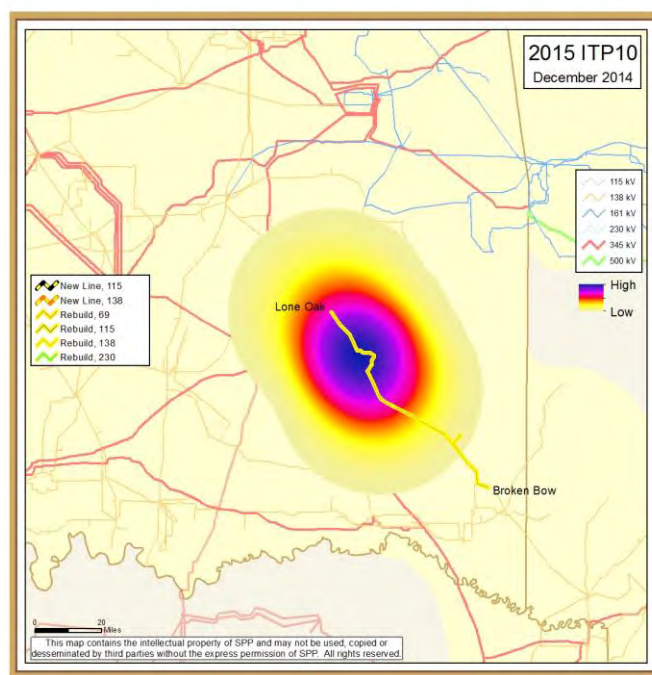


Figure 14.7: Rebuild Broken Bow – Lone Oak



### Tap Hitchland – Finney 345 kV and NewSub – Walkemeyer – North Liberal 115 kV

This project consists of tapping the Hitchland to Finney 345 kV line and adding a new substation with a 345/115 kV Transformer. A new 1 mile NewSub to Walkemeyer 115 kV line will be added. Also a Walkemeyer to North Liberal 21 mile 115 kV line will be added. The need date for this project is June of 2019. This project will address the overload of the Pioneer Tap – CTU Sublette – Haskell – Seward – Cimarron River Plant – Hayne 115 kV lines and area low voltage for the outage of Hugoton – Pioneer Tap 115 kV line. Other contingencies in the area caused overloading and low voltage in the Southwest Kansas area which was addressed by this project.

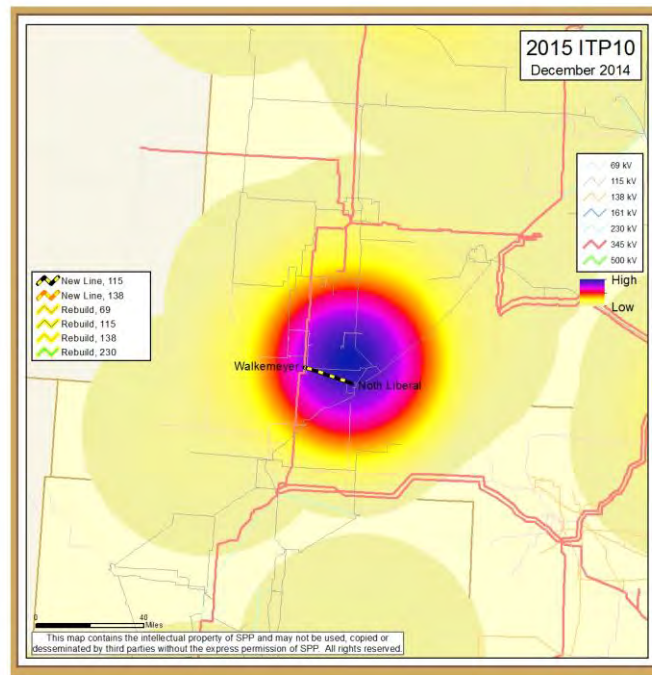


Figure 14.8: Walkemeyer – North Liberal

## Section 15: Staging

A project need date is determined, or staged, based on the project's classification(s) and the future from which the project was derived during the consolidation process. In this study, a project can be classified as economic, policy, or reliability depending on which of these needs it mitigated. Multiple classifications could be carried by a single project if it mitigated multiple need types. For example, if a single project simultaneously mitigated economic and reliability needs, per the criteria described on pages 49 through 61 of this report, the project would be classified as both economic and reliability. Multiple classification projects were staged to meet the earliest need date established through the project classification process, as described below. Consolidated portfolio projects derived from Future 2 were staged in 2024. Staging was conducted in the Future 1 model and project lead times were determined according to historical expectations and stakeholder review.

### 15.1: Staging Reliability Projects

Reliability projects were staged between 2019 and 2024. The process to stage reliability projects utilized AC models representing the summer peak hour in Future 1 for two years: 2019 and 2024. These AC models have the economic dispatch as determined by the DC economic models. Thermal projects were staged based on linear interpolation of thermal loadings from 2019 to 2024. The year in which the loading of the overloaded facility exceeded 100% was identified as the need date. Figure 15.1 provides an example of this interpolation process. Similar to the thermal staging process, voltage needs were also staged based on linear interpolation of voltage per unit from 2019 to 2024. The year in which the voltage was less than 0.95 per unit for base case conditions, or less than 0.90 per unit for contingency conditions was identified as the need date. In the case where a project mitigated thermal and voltage needs, the project was staged to meet the earliest occurrence of either the thermal or voltage need.

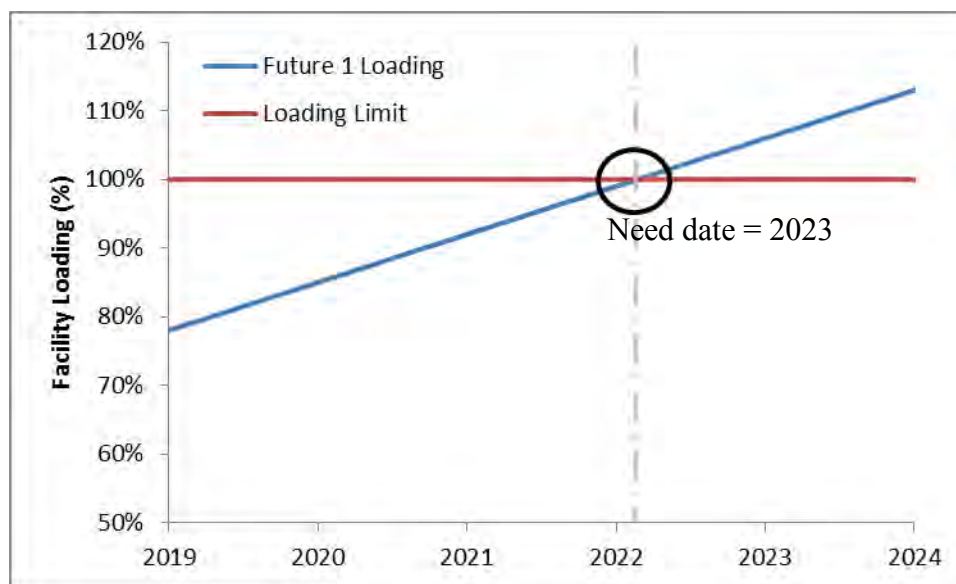


Figure 15.1: Project Staging Interpolation Example

### 15.2: Staging Economic Projects

The security constrained economic simulation was used to perform a production cost analysis for the years 2019 and 2024 using the Future 1 model. The 1-year B/C ratio for these two years was determined

for each of the economic upgrades in the consolidated portfolio. The base case for each model year consisted of the Future 1 model plus reliability projects needed by the respective year. The incremental benefit of each economic project was calculated with the project considered in addition to the base case. The change in the B/C over time was interpolated from the two points in order to determine the staging dates. Economic upgrades were given an in-service date for the first year that their B/C was greater than 1.0 in Future 1.

### **15.3: Staging Policy Upgrades**

Policy projects were to be staged in order to meet renewable requirements. In this study, no policy needs were identified.

### **15.4: Project Staging Results**

As a result of the staging process, 16 projects will be recommended for NTCs. Table 15.1 below provides the staging data for each project in the consolidated portfolio.

| <b>Project Description</b>                                                                                                              | <b>Lead Time<br/>(Months)</b> | <b>ITP10<br/>Need Date</b> | <b>NTC</b> |
|-----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|----------------------------|------------|
| New wave trap at Amoco and Sundown, increasing rating on Sundown-Amoco 230 kV line                                                      | 18                            | 1/1/2019                   | Yes        |
| Voltage conversion of Iatan-Stranger Creek 161 kV line to 345 kV                                                                        | 36                            | 1/1/2019                   | Yes        |
| Rebuild North Platt-Stockville-Red Willow 115 kV line to 240/240 MVA, new 345/115 kV transformer at Mingo*                              | 30                            | 1/1/2019                   | Yes*       |
| New 345/115 kV transformer at Road Runner                                                                                               | 24                            | 6/1/2019                   | No         |
| Install 2 stages of 14.4 MVar capacitor banks on the Ochoa 115 kV bus                                                                   | 24                            | 6/1/2020                   | Yes        |
| Install 2 stages of 14.4 MVar capacitor banks on the China Draw 115 kV bus and the North Loving 115 kV bus                              | 24                            | 6/1/2022                   | No         |
| New 230/115 kV transformer at Plant X                                                                                                   | 24                            | 6/1/2022                   | No         |
| New wave trap at Amarillo South, increasing rating on Amarillo South-Swisher 230 kV line                                                | 18                            | 6/1/2024                   | No         |
| Tap Northwest-Bush 115 kV line at Bush Tap, new Bush Tap station, new Bush Tap-Hastings 115 kV line                                     | 30                            | 6/1/2022                   | No         |
| Upgrade 230/115 kV transformer at Tuco                                                                                                  | 24                            | 6/1/2022                   | No         |
| Upgrade wave trap and CT on the Park Lane-Seminole 138 kV line                                                                          | 18                            | 6/1/2024                   | No         |
| Upgrade relays at Sand Springs, increasing ratings on Sand Springs-Prattville 138 kV line                                               | 18                            | 6/1/2023                   | No         |
| Tap Reno-Wichita 345 kV line into Moundridge, new 345/138 kV transformer at Moundridge                                                  | 24                            | 6/1/2024                   | No         |
| Rebuild Forbes-Underpass North 115 kV line to 218/262 MVA                                                                               | 24                            | 6/1/2021                   | No         |
| Reconductor Gracemont-Anadarko 138 kV line to 286/286 MVA                                                                               | 24                            | 4/1/2019                   | Yes        |
| Rebuild Murray Gill East-Interstate 138 kV line to 286/286 MVA                                                                          | 24                            | 6/1/2024                   | No         |
| Reconductor Martin-Pantex North 115 kV line to 240/240 MVA and replace wave trap at Pantex substation                                   | 24                            | 4/1/2019                   | Yes        |
| Reconductor Pantex North-Pantex South 115 kV line to 240/240 MVA                                                                        | 24                            | 4/1/2019                   | Yes        |
| Reconductor Highland Park-Pantex South 15 kV line to 240/240 MVA and replace wave trap and switch at Pantex South and Highland Park tap | 24                            | 4/1/2019                   | Yes        |
| Install 14.4 MVar capacitor bank at LE Plains Interchange 115 kV                                                                        | 24                            | 6/1/2019                   | Yes        |
| Install 14.4 MVar capacitor bank at Allred 115 kV                                                                                       | 24                            | 6/1/2021                   | No         |

| Staging                                                                                                                                                 | Southwest Power Pool, Inc. |          |     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|----------|-----|
| Replace wave trap at Claremore 161 kV                                                                                                                   | 18                         | 6/1/2019 | Yes |
| Install 6 MVar capacitor bank at Grinnell 115 kV                                                                                                        | 24                         | 6/1/2023 | No  |
| Rebuild South Shreveport-Wallace Lake 138 kV line to 246/246 MVA                                                                                        | 24                         | 6/1/2019 | Yes |
| Rebuild Broken Bow-Lone Oak 138 kV corridor to 286/286 MVA                                                                                              | 30                         | 4/1/2023 | No  |
| Ellsworth 115 kV Cap Bank                                                                                                                               | 24                         | 6/1/2019 | Yes |
| Install 6 MVar capacitor bank at Mile City 115 kV                                                                                                       | 24                         | 6/1/2019 | Yes |
| Upgrade wave traps and switches on Cimarron-McClain 345 kV line                                                                                         | 18                         | 4/1/2019 | Yes |
| New 345/161 kV transformer at S3459                                                                                                                     | 24                         | 6/1/2019 | Yes |
| New 115/69 kV transformer at Lovington                                                                                                                  | 24                         | 6/1/2020 | No  |
| Rebuild Canyon West-Dawn-Panda 115 kV line to 249/273 MVA                                                                                               | 30                         | 6/1/2024 | No  |
| Tap Hitchland-Finney 345 kV line at NewSub1, new 345/115 kV transformer at NewSub, new NewSub station, new NewSub2-Walkemeyer-North Liberal 115 kV line | 36                         | 6/1/2019 | Yes |
| *The 2nd Mingo transformer upgrade is the sole portion of the noted project recommended for NTC.                                                        |                            |          |     |

*Table 15.1: ITP10 2015 Project Staging Results*

## Section 16: Benefits

Benefit metrics were used to measure the value and economic impacts of the Consolidated Portfolio. The ESWG directed that the 2015 ITP10 benefit-to-cost ratios be calculated for the final portfolio of projects, including reliability and economic projects. The benefit structure shown in Figure 16.1 illustrates the metrics calculated as the incremental benefit of the projects included in the Consolidated Portfolio.

| Metric Description                                                |
|-------------------------------------------------------------------|
| APC Savings                                                       |
| Reduction of Emissions Rates and Values                           |
| Savings Due to Lower Ancillary Service Needs and Production Costs |
| Avoided or Delayed Reliability Projects                           |
| Capacity Cost Savings Due to Reduced On-Peak Transmission Losses  |
| Assumed Benefit of Mandated Reliability Projects                  |
| Benefit from Meeting Public Policy Goals (Public Policy Benefits) |
| Mitigation of Transmission Outage Costs                           |
| Increased Wheeling Through and Out Revenues                       |
| Marginal Energy Losses Benefits                                   |

Figure 16.1: Benefit Metrics for the 2015 ITP10

### 16.1: APC Savings

Adjusted Production Cost (APC) is a measure of the impact on production cost savings, considering purchases and sales of energy between each area of the transmission grid. The APC metric is determined using a production cost modeling tool that accounts for hourly commitment and dispatch profiles for the simulation year. The calculation, performed on an hourly basis, is summarized in

Figure 16.2.

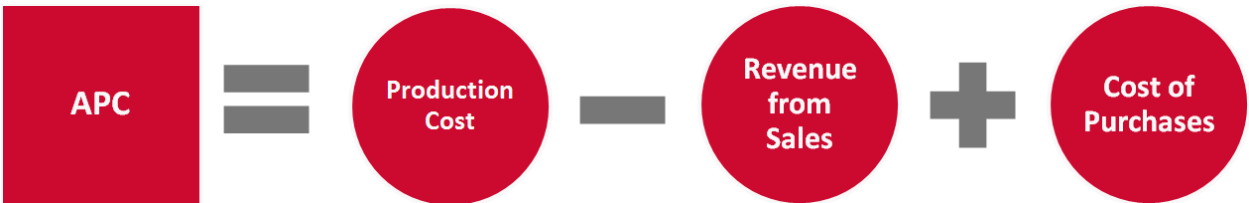


Figure 16.2: APC Calculation

APC captures the monetary cost associated with fuel prices, run times, grid congestion, and unit operating costs, energy purchases, energy sales, and other factors that directly relate to energy production by generating resources in the SPP footprint. Additional transmission projects aim to relieve system congestion and reduce costs through a combination of a more economical generation dispatch, more economical purchases, and optimal revenue from sales.

To calculate benefits over the expected 40-year life of the projects<sup>31</sup>, two years were analyzed, 2019 and 2024, and the APC savings were calculated accordingly for these years. The benefits are extrapolated for the initial 20-year period based on the slope between the two points and after that assumed to grow at an inflation rate of 2.5% per year. Each year's benefit was then discounted to 2019 using an 8% discount rate, and a 2.5% inflation rate from 2019 back to 2015. The sum of all discounted benefits was presented as the Net Present Value (NPV) benefit. This calculation was performed for every zone.

Figure 16.3 shows the regional APC savings for the Consolidated Portfolio over 40 years, and Table 16.1 provides the zonal breakdown and the NPV estimates. Future 1 has higher congestion compared to Future 2. Therefore, the proposed projects in the Consolidated Portfolio provide more congestion relief in Future 1 than in Future 2, resulting in larger APC savings.

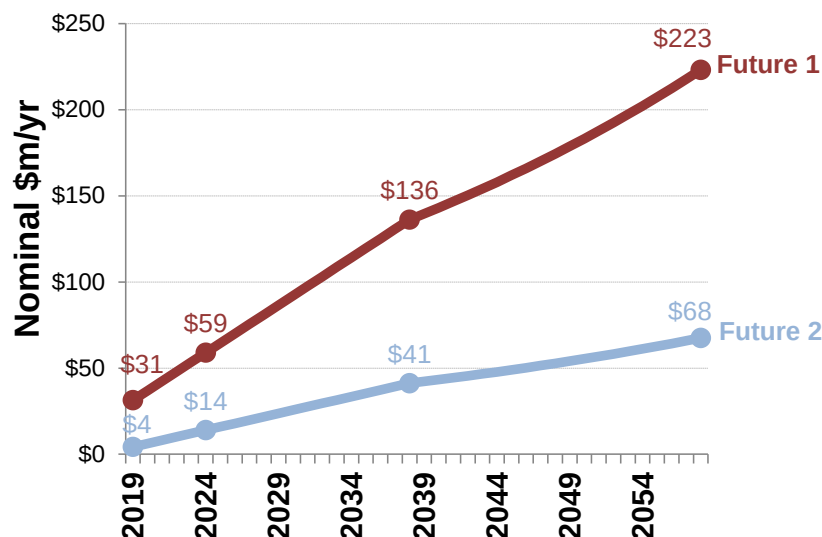


Figure 16.3: Regional APC Savings Estimated for the 40-year Study Period

<sup>31</sup> The SPP OATT requires that the portfolio be evaluated using a 40-year financial analysis.

|                  | Future 1           |                    |                         | Future 2           |                    |                         |
|------------------|--------------------|--------------------|-------------------------|--------------------|--------------------|-------------------------|
|                  | 2019<br>(nom. \$m) | 2024<br>(nom. \$m) | 40-yr NPV<br>(2015 \$m) | 2019<br>(nom. \$m) | 2024<br>(nom. \$m) | 40-yr NPV<br>(2015 \$m) |
| AEPW             | \$1.0              | \$0.3              | (\$4.6)                 | \$1.8              | \$0.9              | \$2.0                   |
| CUS              | \$0.1              | \$0.1              | \$1.6                   | (\$0.0)            | (\$0.1)            | (\$0.9)                 |
| EDE              | \$0.2              | \$0.4              | \$7.5                   | \$0.1              | \$0.0              | (\$0.4)                 |
| GMO              | (\$0.3)            | (\$0.1)            | (\$0.2)                 | (\$0.1)            | (\$0.3)            | (\$4.3)                 |
| GRDA             | (\$0.3)            | (\$0.8)            | (\$15.8)                | \$0.0              | (\$0.0)            | (\$1.1)                 |
| KCPL             | \$4.8              | \$11.0             | \$202.8                 | \$0.5              | \$0.8              | \$13.2                  |
| LES              | \$0.0              | (\$0.1)            | (\$2.0)                 | (\$0.0)            | (\$0.3)            | (\$5.6)                 |
| MIDW             | \$3.4              | \$2.0              | \$9.8                   | \$0.3              | \$0.1              | (\$0.2)                 |
| MKEC             | \$4.0              | \$4.4              | \$56.6                  | \$1.2              | \$1.5              | \$20.0                  |
| NPPD             | \$6.3              | \$9.2              | \$143.4                 | \$0.9              | \$0.8              | \$9.2                   |
| OKGE             | (\$0.3)            | \$1.8              | \$44.3                  | \$0.3              | (\$0.0)            | (\$3.8)                 |
| OPPD             | \$1.9              | \$4.3              | \$77.5                  | \$0.2              | \$6.6              | \$149.8                 |
| SUNC             | \$2.7              | \$2.8              | \$34.4                  | \$0.4              | \$0.4              | \$5.7                   |
| SWPS             | \$1.5              | \$10.3             | \$222.3                 | (\$1.9)            | \$1.7              | \$60.1                  |
| WEFA             | (\$0.6)            | (\$1.2)            | (\$20.5)                | \$0.1              | \$0.3              | \$5.4                   |
| WRI              | \$7.4              | \$13.6             | \$234.9                 | \$0.6              | \$1.3              | \$24.0                  |
| <b>Sub-Total</b> | <b>\$31.7</b>      | <b>\$57.9</b>      | <b>\$991.8</b>          | <b>\$4.2</b>       | <b>\$13.8</b>      | <b>\$273.2</b>          |
| BASIN            | (\$2.4)            | (\$2.8)            | (\$37.9)                | (\$0.1)            | \$0.1              | \$3.0                   |
| HCPD             | \$0.5              | \$0.8              | \$14.4                  | \$0.1              | \$0.1              | \$1.2                   |
| WAPA             | \$2.8              | \$4.7              | \$77.1                  | \$0.2              | \$0.2              | \$1.5                   |
| CBPC             | (\$1.2)            | (\$1.7)            | (\$25.3)                | (\$0.2)            | (\$0.2)            | (\$1.9)                 |
| <b>Sub-Total</b> | <b>(\$0.3)</b>     | <b>\$1.1</b>       | <b>\$28.3</b>           | <b>\$0.0</b>       | <b>\$0.2</b>       | <b>\$3.7</b>            |
| <b>TOTAL</b>     | <b>\$31.4</b>      | <b>\$59.0</b>      | <b>\$1,020.1</b>        | <b>\$4.3</b>       | <b>\$14.0</b>      | <b>\$276.9</b>          |

Table 16.1: APC Savings by Zone

## 16.2: Reduction of Emission Rates and Values

Additional transmission may result in a lower fossil-fuel burn (for example, less coal-intensive generation), resulting in less SO<sub>2</sub>, NO<sub>x</sub>, and CO<sub>2</sub> emissions. Such a reduction in emissions is a benefit that is already monetized through the APC savings metric, based on the assumed allowance prices for these effluents. Note that neither ITP10 future assumes any allowance prices for CO<sub>2</sub>.

## 16.3: Savings Due to Lower Ancillary Service Needs and Production Costs

Ancillary Services (A/S) such as spinning reserves, ramping (up/down), regulation, and 10-minute quick start are essential for the reliable operation of the electrical system. Additional transmission can decrease the A/S costs by: (a) reducing the A/S quantity needed, or (b) reducing the procurement costs for that quantity.

The A/S needs in SPP are determined according to SPP's market protocols and currently do not change based on transmission. Therefore, the savings associated with the "quantity" effect are assumed to be zero.

The costs of providing A/S are captured in the APC metrics since the production cost simulations set aside the static levels of resources to provide regulation and spinning reserves. As a result, the benefits



related to “procurement cost” effect are already included as a part of the APC savings presented in this report.

#### **16.4: Avoided or Delayed Reliability Projects**

Potential reliability needs are reviewed to determine if the upgrades proposed for economic or policy reasons defer or replace any reliability upgrades. The avoided or delayed reliability project benefit represents the costs associated with these additional reliability upgrades that would otherwise have to be pursued.

To estimate the avoided or delayed reliability projects benefit for the Consolidated Portfolio, the 2019 and 2024 powerflow models developed for Futures 1 and 2 are utilized. Excluding the proposed economic projects from these models did not result in thermal overloads in any of the model runs. Therefore, no avoided or delayed reliability projects were identified, and the associated benefits are estimated to be zero.

#### **16.5: Capacity Cost Savings Due to Reduced On-Peak Transmission Losses**

Transmission line losses result from the interaction of line materials with the energy flowing over the line. This constitutes an inefficiency that is inherent to all standard conductors. Line losses across the SPP system are directly related to system impedance. Transmission projects often reduce the losses during peak load conditions, which lowers the costs associated with additional generation capacity needed to meet the capacity requirements.

The capacity cost savings for the Consolidated Portfolio are calculated based on the on-peak losses estimated in the 2019 and 2024 powerflow models. The loss reductions are then multiplied by 112% to estimate the reduction in installed capacity requirements. The value of capacity savings is monetized by applying a net cost of new entry (net CONE) of \$82/kW-yr in 2015 dollars.

The net CONE value was calculated as the difference between an estimated gross CONE value and the expected operating margins (energy market revenues net of variable operating costs, also referred to as “net market revenues”) for a combustion turbine. A gross CONE value of \$85/kW-yr was obtained by levelizing the capital and fixed operating costs of a new advanced combustion turbine as reported in EIA’s Annual Energy Outlook 2014. Net market revenues of \$3/kW-yr were estimated based on the historical data for the margins of gas-fired combustion turbines, as provided in SPP’s 2013 State of Market Report.

Table 16.2 summarizes the on-peak loss reductions and associated capacity savings for the region in each study year for Futures 1 and 2.

|          | <b>2019</b>               |                             |                                   | <b>2024</b>               |                             |                                   |
|----------|---------------------------|-----------------------------|-----------------------------------|---------------------------|-----------------------------|-----------------------------------|
|          | Loss<br>Reduction<br>(MW) | Capacity<br>Savings<br>(MW) | Capacity<br>Savings<br>(nom. \$m) | Loss<br>Reduction<br>(MW) | Capacity<br>Savings<br>(MW) | Capacity<br>Savings<br>(nom. \$m) |
| Future 1 | 14.4                      | 16.1                        | <b>\$1.5</b>                      | 23.1                      | 25.9                        | <b>\$2.6</b>                      |
| Future 2 | 15.2                      | 17.0                        | <b>\$1.5</b>                      | 21.0                      | 23.5                        | <b>\$2.4</b>                      |

*Table 16.2: On-Peak Loss Reduction and Associated Capacity Cost Savings*

The 40-year benefits are estimated by extrapolating the results for the first 20 years using the slope between the two points and applying inflation after that. This calculation was performed for every zone separately. Figure 16.4 shows the zonal distribution of the NPV of this benefit, which sums up to **\$45 million** in Future 1 and **\$39 million** in Future 2 for the entire SPP footprint.

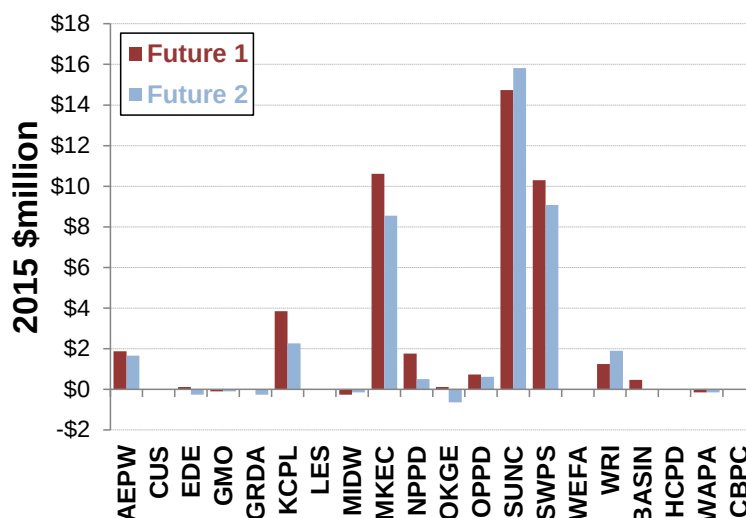


Figure 16.4: Capacity Cost Savings by Zone (40-year NPV)

## 16.6: Assumed Benefit of Mandated Reliability Projects

This metric monetizes the reliability benefits of the mandated reliability projects. As recommended by the September 2012 MTF report and reaffirmed by the ESWG in 2014, the regional benefits are assumed to be equal to 40-year NPV of ATRRs for the reliability projects, adding up to **\$284 million** in 2015 dollars.

The ESWG<sup>32</sup> and BOD<sup>33</sup> approved an allocation of region-wide benefits based on a hybrid approach to reflect different characteristics of higher and lower voltage reliability upgrades:

- **300 kV or above:** 1/3 System Reconfiguration and 2/3 Load Ratio Share,
- **Between 100 kV and 300 kV:** 2/3 System Reconfiguration and 1/3 Load Ratio Share, and
- **Below 100 kV:** 100% System Reconfiguration.

The system reconfiguration approach utilizes the powerflow models to measure the incremental flows shifted onto the existing system during outage of the proposed reliability upgrade. This is used as a proxy for how much each upgrade reduces the flows on the existing transmission facilities owned by the zones. Results from the production cost simulations are used to determine hourly flow direction on the upgrades and then applied as weighting factors for the powerflow results.

<sup>32</sup> <http://www.spp.org/publications/ESWGMinutes>

<sup>33</sup> <http://www.spp.org/publications/BOCMCMMinutes>

Table 16.3 and Table 16.4 summarize the system reconfiguration analysis results and the benefit allocation factors for different voltage levels. Figure 16.5 plots the overall zonal benefits calculated by applying these allocation factors.

| All Projects             |                                 | < 100 kV       | 100–300 kV      |                  |                  | > 300 kV        |                  |                  |
|--------------------------|---------------------------------|----------------|-----------------|------------------|------------------|-----------------|------------------|------------------|
| <b>SPP-wide Benefits</b> |                                 |                |                 |                  |                  |                 |                  |                  |
| Total                    | \$240.7                         | \$1.7          | \$211.9         |                  |                  | \$27.0          |                  |                  |
| Analyzed*                | \$240.7                         | \$1.7          | \$211.9         |                  |                  | \$27.0          |                  |                  |
| <b>Zone</b>              | <b>Approved Hybrid Approach</b> | <b>100% SR</b> | <b>66.7% SR</b> | <b>33.3% LRS</b> | <b>Wtd. Avg.</b> | <b>33.3% SR</b> | <b>66.7% LRS</b> | <b>Wtd. Avg.</b> |
| AEPW                     | 18.6%                           | 0.0%           | 19.0%           | 20.3%            | 19.4%            | 0.1%            | 20.3%            | 13.6%            |
| CUS                      | 1.4%                            | 0.0%           | 1.6%            | 1.4%             | 1.5%             | 0.0%            | 1.4%             | 0.9%             |
| EDE                      | 1.5%                            | 0.0%           | 1.1%            | 2.3%             | 1.5%             | 0.1%            | 2.3%             | 1.6%             |
| GMO                      | 2.0%                            | 0.0%           | 1.0%            | 3.8%             | 2.0%             | 0.3%            | 3.8%             | 2.7%             |
| GRDA                     | 1.0%                            | 0.0%           | 0.5%            | 1.8%             | 0.9%             | 0.3%            | 1.8%             | 1.3%             |
| KCPL                     | 3.2%                            | 0.0%           | 0.9%            | 7.1%             | 3.0%             | 0.2%            | 7.1%             | 4.8%             |
| LES                      | 1.2%                            | 0.0%           | 0.9%            | 1.8%             | 1.2%             | 0.3%            | 1.8%             | 1.3%             |
| MIDW                     | 0.5%                            | 0.0%           | 0.4%            | 0.8%             | 0.5%             | 0.1%            | 0.8%             | 0.6%             |
| MKEC                     | 6.7%                            | 0.0%           | 10.3%           | 1.3%             | 7.3%             | 5.1%            | 1.3%             | 2.6%             |
| NPPD                     | 3.3%                            | 0.0%           | 1.6%            | 6.3%             | 3.2%             | 1.1%            | 6.3%             | 4.5%             |
| OKGE                     | 9.8%                            | 0.0%           | 8.4%            | 13.0%            | 10.0%            | 1.6%            | 13.0%            | 9.2%             |
| OPPD                     | 3.9%                            | 0.0%           | 3.0%            | 4.9%             | 3.6%             | 7.7%            | 4.9%             | 5.8%             |
| SUNC                     | 8.5%                            | 0.0%           | 12.4%           | 1.0%             | 8.6%             | 24.3%           | 1.0%             | 8.8%             |
| SPS                      | 16.9%                           | 100.0%         | 19.5%           | 12.0%            | 17.0%            | 9.3%            | 12.0%            | 11.1%            |
| WFEC                     | 5.8%                            | 0.0%           | 7.9%            | 3.1%             | 6.3%             | 0.1%            | 3.1%             | 2.1%             |
| WR                       | 11.4%                           | 0.0%           | 9.8%            | 10.3%            | 10.0%            | 48.9%           | 10.3%            | 23.2%            |
| <b>Sub-Total</b>         | <b>95.9%</b>                    | <b>100.0%</b>  | <b>98.4%</b>    | <b>91.4%</b>     | <b>96.1%</b>     | <b>99.2%</b>    | <b>91.4%</b>     | <b>94.0%</b>     |
| BASIN                    | 3.1%                            | 0.0%           | 0.1%            | 8.3%             | 2.8%             | 0.0%            | 8.3%             | 5.5%             |
| HCPD                     | 0.1%                            | 0.0%           | 0.0%            | 0.4%             | 0.1%             | 0.0%            | 0.4%             | 0.2%             |
| WAPA                     | 0.9%                            | 0.0%           | 1.4%            | 0.0%             | 1.0%             | 0.8%            | 0.0%             | 0.3%             |
| CBPC                     | 0.0%                            | 0.0%           | 0.0%            | 0.0%             | 0.0%             | 0.0%            | 0.0%             | 0.0%             |
| <b>Sub-Total</b>         | <b>4.1%</b>                     | <b>0.0%</b>    | <b>1.6%</b>     | <b>8.6%</b>      | <b>3.9%</b>      | <b>0.8%</b>     | <b>8.6%</b>      | <b>6.0%</b>      |
| <b>TOTAL</b>             | <b>100.0%</b>                   | <b>100.0%</b>  | <b>100.0%</b>   | <b>100.0%</b>    | <b>100.0%</b>    | <b>100.0%</b>   | <b>100.0%</b>    | <b>100.0%</b>    |

Table 16.3: System Reconfiguration Analysis Results and Benefit Allocation Factors (Future 1) – 2015\$ Millions

| All Projects             |                                 | < 100 kV       | 100–300 kV      |                  |                  | > 300 kV        |                  |                  |
|--------------------------|---------------------------------|----------------|-----------------|------------------|------------------|-----------------|------------------|------------------|
| <b>SPP-wide Benefits</b> |                                 |                |                 |                  |                  |                 |                  |                  |
| Total                    |                                 | \$240.7        | \$211.9         |                  |                  | \$27.0          |                  |                  |
| Analyzed*                |                                 | \$240.7        | \$211.9         |                  |                  | \$27.0          |                  |                  |
| <b>Zone</b>              | <b>Approved Hybrid Approach</b> | <b>100% SR</b> | <b>66.7% SR</b> | <b>33.3% LRS</b> | <b>Wtd. Avg.</b> | <b>33.3% SR</b> | <b>66.7% LRS</b> | <b>Wtd. Avg.</b> |
| AEPW                     | 15.4%                           | 0.0%           | 13.5%           | 20.3%            | 15.7%            | 0.1%            | 20.3%            | 13.6%            |
| CUS                      | 2.3%                            | 0.0%           | 3.1%            | 1.4%             | 2.5%             | 0.0%            | 1.4%             | 0.9%             |
| EDE                      | 1.8%                            | 0.0%           | 1.5%            | 2.3%             | 1.8%             | 0.3%            | 2.3%             | 1.6%             |
| GMO                      | 4.2%                            | 0.0%           | 4.7%            | 3.8%             | 4.4%             | 0.8%            | 3.8%             | 2.8%             |
| GRDA                     | 1.4%                            | 0.0%           | 1.3%            | 1.8%             | 1.5%             | 0.3%            | 1.8%             | 1.3%             |
| KCPL                     | 4.6%                            | 0.0%           | 3.5%            | 7.1%             | 4.7%             | 0.1%            | 7.1%             | 4.8%             |
| LES                      | 1.3%                            | 0.0%           | 1.1%            | 1.8%             | 1.3%             | 0.5%            | 1.8%             | 1.4%             |
| MIDW                     | 2.0%                            | 0.0%           | 2.9%            | 0.8%             | 2.2%             | 0.5%            | 0.8%             | 0.7%             |
| MKEC                     | 6.8%                            | 1.0%           | 10.2%           | 1.3%             | 7.2%             | 9.9%            | 1.3%             | 4.2%             |
| NPPD                     | 4.5%                            | 0.0%           | 3.7%            | 6.3%             | 4.5%             | 1.8%            | 6.3%             | 4.8%             |
| OKGE                     | 7.1%                            | 1.0%           | 3.8%            | 13.0%            | 6.9%             | 0.5%            | 13.0%            | 8.9%             |
| OPPD                     | 4.3%                            | 0.0%           | 3.8%            | 4.9%             | 4.2%             | 7.5%            | 4.9%             | 5.8%             |
| SUNC                     | 7.4%                            | 0.0%           | 10.4%           | 1.0%             | 7.2%             | 26.0%           | 1.0%             | 9.3%             |
| SPS                      | 14.3%                           | 97.9%          | 15.6%           | 12.0%            | 14.4%            | 1.2%            | 12.0%            | 8.4%             |
| WFEC                     | 4.9%                            | 0.0%           | 6.4%            | 3.1%             | 5.3%             | 0.1%            | 3.1%             | 2.1%             |
| WR                       | 12.8%                           | 0.0%           | 12.3%           | 10.3%            | 11.6%            | 49.2%           | 10.3%            | 23.3%            |
| <b>Sub-Total</b>         | <b>95.4%</b>                    | <b>100.0%</b>  | <b>97.6%</b>    | <b>91.4%</b>     | <b>95.5%</b>     | <b>98.8%</b>    | <b>91.4%</b>     | <b>93.9%</b>     |
| BASIN                    | 3.3%                            | 0.0%           | 0.5%            | 8.3%             | 3.1%             | 0.0%            | 8.3%             | 5.5%             |
| HCPD                     | 0.1%                            | 0.0%           | 0.0%            | 0.4%             | 0.1%             | 0.0%            | 0.4%             | 0.2%             |
| WAPA                     | 1.1%                            | 0.0%           | 1.9%            | 0.0%             | 1.2%             | 1.1%            | 0.0%             | 0.4%             |
| CBPC                     | 0.0%                            | 0.0%           | 0.0%            | 0.0%             | 0.0%             | 0.0%            | 0.0%             | 0.0%             |
| <b>Sub-Total</b>         | <b>4.6%</b>                     | <b>0.0%</b>    | <b>2.4%</b>     | <b>8.6%</b>      | <b>4.5%</b>      | <b>1.2%</b>     | <b>8.6%</b>      | <b>6.1%</b>      |
| <b>TOTAL</b>             | <b>100.0%</b>                   | <b>100.0%</b>  | <b>100.0%</b>   | <b>100.0%</b>    | <b>100.0%</b>    | <b>100.0%</b>   | <b>100.0%</b>    | <b>100.0%</b>    |

Table 16.4: System Reconfiguration Analysis Results and Benefit Allocation Factors (Future 2) – 2015\$ Millions

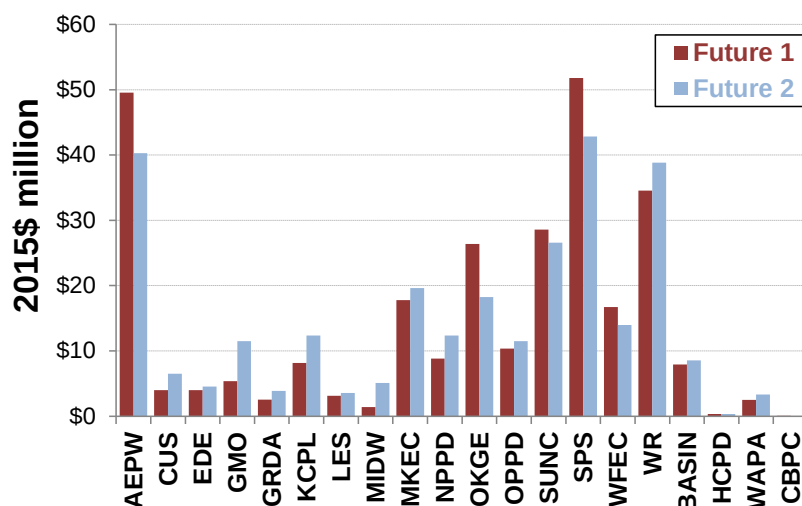


Figure 16.5: Mandated Reliability Project Benefits by Zone (40-year NPV)

## **16.7: Benefit from Meeting Public Policy Goals**

This metric represents the economic benefits provided by the transmission upgrades for facilitating public policy goals. For the purpose of this study, the scope is limited to meeting public policy goals related to renewable energy and the system-wide benefits are assumed to be equal to the cost of policy projects.

Since no policy projects are identified as a part of the Consolidated Portfolio, the associated benefits are estimated to be zero.

## **16.8: Mitigation of Transmission Outage Costs**

The standard production cost simulations used to estimate APC savings assume that transmission lines and facilities are available during all hours of the year, and thereby ignore the added congestion-relief and production cost benefits of new transmission facilities during the planned and unplanned outages of existing transmission facilities.

To estimate the incremental savings associated with the mitigation of transmission outage costs, the production cost simulations can be augmented for a realistic level of transmission outages. Due to the significant effort that would be needed to develop these augmented models for each case, the findings from the RCAR study were used to calculate this benefit metric for the Consolidated Portfolio as a part of this ITP10 effort.

In the RCAR analysis, adding a subset of historical transmission outage events to the production cost simulations increased the APC savings by 11.3%.<sup>34,35</sup> Applying this ratio to the APC savings estimated for the Consolidated Portfolio translates to a 40-year NPV of benefits of **\$115 million** for Future 1 and **\$31 million** for Future 2 in 2015 dollars.

This incremental benefit is allocated to zones based on their load ratio share, because it is difficult to develop normalized transmission outage data that reliably reflects the outage events expected in each zone over the study horizon. Using load ratio shares as an allocation approach for this metric was initially recommended by the MTF and then approved by the ESWG. Figure 16.6 shows the outage mitigation benefits allocated to each SPP zone.

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<sup>34</sup> [SPP Regional Cost Allocation Review Report, October 8, 2013 \(pp. 36–37\).](#)

<sup>35</sup> As directed by ESWG, SPP will periodically review historical outage data and update additional APC savings ratio for future studies. Although the outage data was not updated for the 2015 ITP10, it is being reviewed and updated for the RCAR II Assessment.

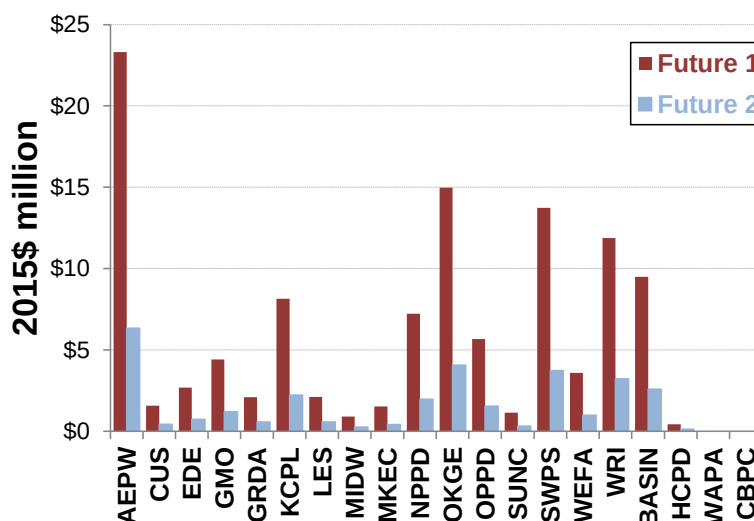


Figure 16.6: Transmission Outage Cost Mitigation Benefits by Zone (40-year NPV)

## 16.9: Increased Wheeling Through and Out Revenues

Increasing ATC with a neighboring region improves import and export opportunities for the SPP footprint. Increased inter-regional transmission capacity that allow for increased through and out transactions will also increase SPP wheeling revenues.

To estimate how increased ATC could affect the wheeling services sold, the historical long-term firm transmission service requests (TSR) allowed by the historical NTC projects are analyzed and compared against the ATC increase in the 2014 powerflow models estimated based on a First Contingency Incremental Transfer Capacity (FCITC) analysis. As summarized in Table 16.5, the NTC projects that have been put in-service under SPP's Highway/Byway cost allocation enabled 13 long-term TSRs to be sold between 2010 and 2014. The amount of capacity granted for these TSRs add up to 1,202 MW and the associated wheeling revenues are estimated to be \$31 million annually based on current SPP tariff rates. The results of the FCITC analysis are summarized in Table 16.6. The export ATC increase in the 2014 powerflow models is calculated to be 1,142 MW which is comparable to the amount of firm capacity granted for the incremental TSRs sold historically.

| Point of Delivery | Number of Firm PtP Service Requests | MW Capacity Granted | 2014 Wheeling Revenues in \$million |                 |                         |               |
|-------------------|-------------------------------------|---------------------|-------------------------------------|-----------------|-------------------------|---------------|
|                   |                                     |                     | Sch 7 Zonal                         | Sch 11 Reg-Wide | Sch 11 Thru & Out Zonal | TOTAL         |
| AECI              | 5                                   | 515                 | \$5.4                               | \$4.8           | \$2.4                   | <b>\$12.6</b> |
| MISO              | 2                                   | 101                 | \$1.1                               | \$0.9           | \$0.5                   | <b>\$2.5</b>  |
| Entergy           | 6                                   | 586                 | \$8.1                               | \$5.5           | \$2.7                   | <b>\$16.3</b> |
| <b>TOTAL</b>      | <b>13</b>                           | <b>1,202</b>        | <b>\$14.6</b>                       | <b>\$11.2</b>   | <b>\$5.5</b>            | <b>\$31.3</b> |

Table 16.5: Estimated Wheeling Revenues from Incremental Long-Term TSRs Sold (2010–2014)

|                                                         |                 |
|---------------------------------------------------------|-----------------|
| Export ATC in 2014 Base Case                            | 1,287 MW        |
| Export ATC in 2014 Change Case                          | 2,429 MW        |
| <b>Increase in Export ATC due to NTCs</b>               | <b>1,142 MW</b> |
| Incremental TSRs Sold due to NTCs                       | 1,202 MW        |
| <b>TSRs Sold as a Percent of Increase in Export ATC</b> | <b>105%</b>     |

Table 16.6: Historical Ratio of TSRs Sold against Increase in Export ATC

The 2019 and 2024 powerflow models are utilized for the FCITC analysis. The ratio of TSRs sold as a percent of increase in export ATC is capped at 100%, as incremental TSR sales would not be expected to exceed the amount of increase in export ATC. The Consolidated Portfolio did not increase the export ATCs in Future 1, and accordingly, no wheeling revenue benefits are estimated for that future. In Future 2, the proposed upgrades increase the export ATC by 41 MW in 2019 and 52 MW in 2024. Applying the historical ratio suggests that the Consolidated Portfolio could enable incremental TSRs by the same amount, generating additional wheeling revenues of \$1–2 million annually in that future.

$$\text{Increased Wheeling Rev} \left( \frac{\$}{\text{yr}} \right) = \left( \frac{\text{Hist. Wheeling Revenues} \left( \frac{\$}{\text{yr}} \right)}{\text{Hist. TSR Sold (MW)}} \right) \times \left( \frac{\text{Hist. TSR Sold (MW)}}{\text{Hist. ATC Increase (MW)}} \right) \times (\text{ATC Increase Due to ITP10 Proj. (MW)})$$

These revenues are extrapolated for the first 20 years using the slope between the two points and after that assumed to grow at the rate of inflation.

The 40-year NPV of benefits is estimated to be **zero** in Future 1 and **\$27 million** in Future 2. These benefits are allocated based on the current revenue sharing method in SPP tariff. Figure 16.7 shows the distribution of wheeling revenue benefits for each SPP zone.

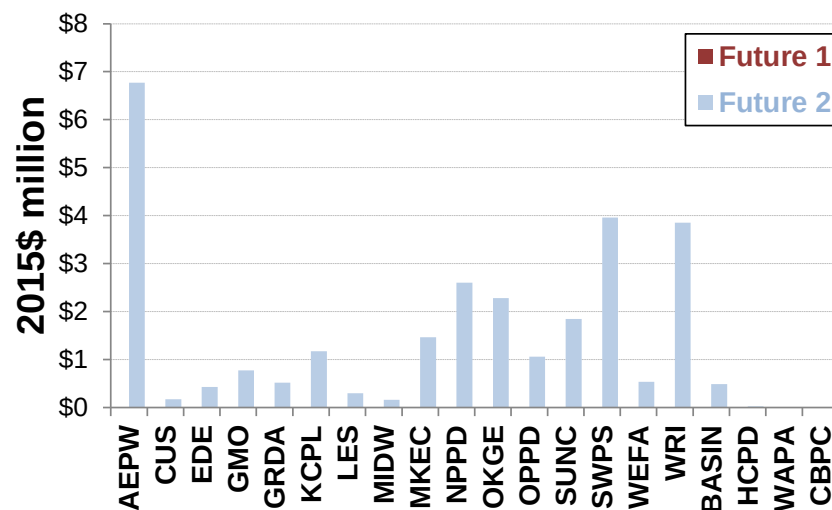


Figure 16.7: Increased Wheeling Revenue Benefits by Zone (40-year NPV)



## 16.10: Marginal Energy Losses Benefit

The standard production cost simulations used to estimate APC do not reflect the impact of transmission upgrades on the MWh quantity of transmission losses. To make run-times more manageable, the load in market simulations is “grossed up” for average transmission losses for each zone. These loss assumptions do not change with additional transmission. Therefore, the traditional APC metric does not capture the benefits from reduced MWh quantity of losses.

The benefits related to reduced transmission losses can be estimated through post-processing of the production cost simulation results for the change in the weighted average Marginal Loss Component (MLC) of LMPs for generation and load in each SPP zone. Table 16.7 below summarizes the loss reductions and associated production cost savings using the approach that was initially recommended by the MTF, and later refined for inter-zonal transfers and approved by the ESWG.<sup>36</sup> Figure 16.8 shows the zonal distribution of the NPV of benefits.

- In Future 1, the Consolidated Portfolio is estimated to increase the estimated energy losses in SPP by approximately 115,000 MWh/yr, which translates to negative benefits (-\$4 million annually in both study years and -\$50 million in NPV terms).
  - Negative savings are possible if the upgrades reduce congestion and increase inter-zonal transfers, transmission flows, and the associated losses due to inter-zonal transfers. The SPS zone is the main source of the negative savings in Future 1, and they are net importers both with and without the Consolidated Portfolio upgrades. However, the imports are greater with the upgrades. The upgrades provide congestion relief, which allows SPS access to cheaper resources located farther away. As a result, SPS sees APC savings but this gets partially offset by higher losses from being served by generation farther away.
- In Future 2, the calculated loss savings are minimal in 2019 and approximately 44,000 MWh/yr in 2024. System-wide benefits are estimated to be positive (\$0.2 million in 2019, \$2.6 million in 2024, and \$58 million in NPV terms).

|          | 2019                       |                                 | 2024                       |                                 | 40-yr                           |
|----------|----------------------------|---------------------------------|----------------------------|---------------------------------|---------------------------------|
|          | Loss<br>Reduction<br>(MWh) | Energy<br>Savings<br>(nom. \$m) | Loss<br>Reduction<br>(MWh) | Energy<br>Savings<br>(nom. \$m) | NPV of<br>Savings<br>(2015 \$m) |
| Future 1 | (111,488)                  | (\$4.4)                         | (114,140)                  | (\$4.3)                         | (\$50.7)                        |
| Future 2 | (1,812)                    | \$0.2                           | 44,036                     | \$2.6                           | \$58.4                          |

Table 16.7: Energy Loss Reduction and Associated Production Cost Savings

<sup>36</sup> <http://www.spp.org/publications/ESWGMinutes>

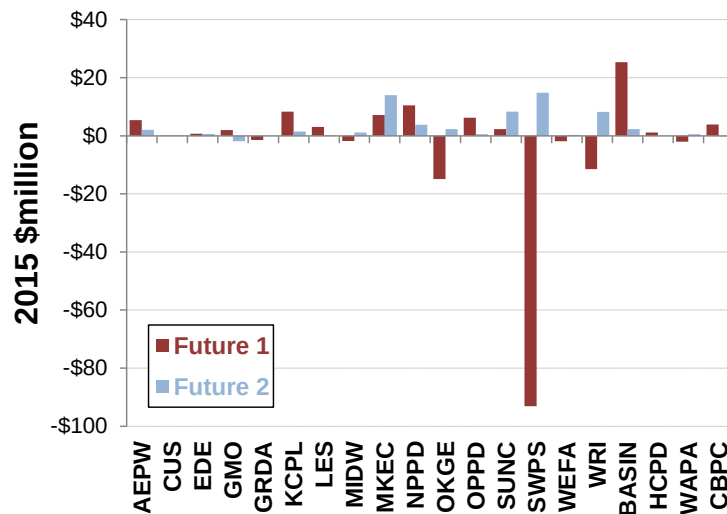


Figure 16.8: Energy Losses Benefit by Zone (40-year NPV)

### 16.11: Summary

Table 16.8 and Table 16.9 summarize the 40-year NPV of the estimated benefit metrics and costs (in 2015 dollars) and the resulting benefit-to-cost (B/C) ratios for each SPP zone.

For the region, the B/C ratio is estimated to be approximately 4.1 in Future 1 and about 2.0 in Future 2. Higher B/C ratio in Future 1 is driven by the APC savings due to higher congestion-relief provided by the Consolidated Portfolio.

| Present Value of 40-yr Benefits for the 2019-2058 Period (in 2015 \$million) |                                         |                                              |                                                  |                                          |                                           |                                             |                                 |        | Total Benefits | Present Value of 40-yr ATRRs (in 2015 \$million) | Est. Benefit/ Cost Ratio |
|------------------------------------------------------------------------------|-----------------------------------------|----------------------------------------------|--------------------------------------------------|------------------------------------------|-------------------------------------------|---------------------------------------------|---------------------------------|--------|----------------|--------------------------------------------------|--------------------------|
| APC Savings                                                                  | Avoided or Delayed Reliability Projects | Capacity Savings from Reduced On-peak Losses | Assumed Benefit of Mandated Reliability Projects | Benefit from Meeting Public Policy Goals | Mitigation of Trans- mission Outage Costs | Increased Wheeling Through and Out Revenues | Marginal Energy Losses Benefits |        |                |                                                  |                          |
| AEPW                                                                         | (\$5)                                   | \$0                                          | \$2                                              | \$45                                     | \$0                                       | \$23                                        | \$0                             | \$5    | \$71           | \$79                                             | 0.90                     |
| CUS                                                                          | \$2                                     | \$0                                          | \$0                                              | \$3                                      | \$0                                       | \$2                                         | \$0                             | \$0    | \$7            | \$2                                              | 3.22                     |
| EDE                                                                          | \$8                                     | \$0                                          | \$0                                              | \$4                                      | \$0                                       | \$3                                         | \$0                             | \$1    | \$15           | \$3                                              | 4.20                     |
| GMO                                                                          | (\$0)                                   | \$0                                          | (\$0)                                            | \$5                                      | \$0                                       | \$4                                         | \$0                             | \$2    | \$11           | \$6                                              | 1.90                     |
| GRDA                                                                         | (\$16)                                  | \$0                                          | \$0                                              | \$2                                      | \$0                                       | \$2                                         | \$0                             | (\$1)  | (\$13)         | \$3                                              | (4.35)                   |
| KCPL                                                                         | \$203                                   | \$0                                          | \$4                                              | \$8                                      | \$0                                       | \$8                                         | \$0                             | \$8    | \$231          | \$11                                             | 21.69                    |
| LES                                                                          | (\$2)                                   | \$0                                          | \$0                                              | \$3                                      | \$0                                       | \$2                                         | \$0                             | \$3    | \$6            | \$3                                              | 2.17                     |
| MIDW                                                                         | \$10                                    | \$0                                          | (\$0)                                            | \$1                                      | \$0                                       | \$1                                         | \$0                             | (\$2)  | \$10           | \$1                                              | 8.33                     |
| MKEC                                                                         | \$57                                    | \$0                                          | \$11                                             | \$16                                     | \$0                                       | \$2                                         | \$0                             | \$7    | \$92           | \$2                                              | 46.37                    |
| NPPD                                                                         | \$143                                   | \$0                                          | \$2                                              | \$8                                      | \$0                                       | \$7                                         | \$0                             | \$10   | \$171          | \$43                                             | 3.95                     |
| OKGE                                                                         | \$44                                    | \$0                                          | \$0                                              | \$24                                     | \$0                                       | \$15                                        | \$0                             | (\$15) | \$68           | \$23                                             | 2.91                     |
| OPPD                                                                         | \$77                                    | \$0                                          | \$1                                              | \$9                                      | \$0                                       | \$6                                         | \$0                             | \$6    | \$99           | \$11                                             | 8.85                     |
| SUNC                                                                         | \$34                                    | \$0                                          | \$15                                             | \$21                                     | \$0                                       | \$1                                         | \$0                             | \$2    | \$73           | \$44                                             | 1.67                     |
| SWPS                                                                         | \$222                                   | \$0                                          | \$10                                             | \$41                                     | \$0                                       | \$14                                        | \$0                             | (\$93) | \$194          | \$54                                             | 3.57                     |
| WEFA                                                                         | (\$21)                                  | \$0                                          | \$0                                              | \$14                                     | \$0                                       | \$4                                         | \$0                             | (\$2)  | (\$5)          | \$5                                              | (1.03)                   |
| WRI                                                                          | \$235                                   | \$0                                          | \$1                                              | \$27                                     | \$0                                       | \$12                                        | \$0                             | (\$11) | \$264          | \$30                                             | 8.76                     |
| IS                                                                           | \$28                                    | \$0                                          | \$0                                              | \$10                                     | \$0                                       | \$10                                        | \$0                             | \$28   | \$77           | \$13                                             | 5.82                     |
| TOTAL                                                                        | \$1,020                                 | \$0                                          | \$45                                             | \$241                                    | \$0                                       | \$115                                       | \$0                             | (\$51) | \$1,370        | \$334                                            | 4.10                     |

Table 16.8: Estimated 40-year NPV of Benefit Metrics and Costs – Zonal (Future 1)

| Present Value of 40-yr Benefits for the 2019-2058 Period (in 2015 \$million) |                                         |                                              |                                                  |                                          |                                          |                                             |                                 |       | Total Benefits | Present Value of 40-yr ATRRs (in 2015 \$million) | Est. Benefit/Cost Ratio |
|------------------------------------------------------------------------------|-----------------------------------------|----------------------------------------------|--------------------------------------------------|------------------------------------------|------------------------------------------|---------------------------------------------|---------------------------------|-------|----------------|--------------------------------------------------|-------------------------|
| APC Savings                                                                  | Avoided or Delayed Reliability Projects | Capacity Savings from Reduced On-peak Losses | Assumed Benefit of Mandated Reliability Projects | Benefit from Meeting Public Policy Goals | Mitigation of Trans-mission Outage Costs | Increased Wheeling Through and Out Revenues | Marginal Energy Losses Benefits |       |                |                                                  |                         |
| AEPW                                                                         | \$2                                     | \$0                                          | \$2                                              | \$37                                     | \$0                                      | \$6                                         | \$6                             | \$2   | \$55           | \$79                                             | 0.70                    |
| CUS                                                                          | (\$1)                                   | \$0                                          | \$0                                              | \$6                                      | \$0                                      | \$0                                         | \$0                             | \$0   | \$5            | \$2                                              | 2.66                    |
| EDE                                                                          | (\$0)                                   | \$0                                          | (\$0)                                            | \$4                                      | \$0                                      | \$1                                         | \$0                             | \$1   | \$5            | \$3                                              | 1.52                    |
| GMO                                                                          | (\$4)                                   | \$0                                          | (\$0)                                            | \$10                                     | \$0                                      | \$1                                         | \$1                             | (\$2) | \$6            | \$6                                              | 1.01                    |
| GRDA                                                                         | (\$1)                                   | \$0                                          | (\$0)                                            | \$3                                      | \$0                                      | \$1                                         | \$0                             | (\$0) | \$3            | \$3                                              | 1.05                    |
| KCPL                                                                         | \$13                                    | \$0                                          | \$2                                              | \$11                                     | \$0                                      | \$2                                         | \$1                             | \$1   | \$31           | \$11                                             | 2.95                    |
| LES                                                                          | (\$6)                                   | \$0                                          | \$0                                              | \$3                                      | \$0                                      | \$1                                         | \$0                             | \$0   | (\$1)          | \$3                                              | (0.52)                  |
| MIDW                                                                         | (\$0)                                   | \$0                                          | (\$0)                                            | \$5                                      | \$0                                      | \$0                                         | \$0                             | \$1   | \$6            | \$1                                              | 5.07                    |
| MKEC                                                                         | \$20                                    | \$0                                          | \$9                                              | \$16                                     | \$0                                      | \$0                                         | \$1                             | \$14  | \$61           | \$2                                              | 30.64                   |
| NPPD                                                                         | \$9                                     | \$0                                          | \$1                                              | \$11                                     | \$0                                      | \$2                                         | \$2                             | \$4   | \$29           | \$43                                             | 0.67                    |
| OKGE                                                                         | (\$4)                                   | \$0                                          | (\$1)                                            | \$17                                     | \$0                                      | \$4                                         | \$2                             | \$2   | \$21           | \$23                                             | 0.90                    |
| OPPD                                                                         | \$150                                   | \$0                                          | \$1                                              | \$10                                     | \$0                                      | \$2                                         | \$1                             | \$1   | \$164          | \$11                                             | 14.59                   |
| SUNC                                                                         | \$6                                     | \$0                                          | \$16                                             | \$18                                     | \$0                                      | \$0                                         | \$2                             | \$8   | \$50           | \$44                                             | 1.13                    |
| SWPS                                                                         | \$60                                    | \$0                                          | \$9                                              | \$34                                     | \$0                                      | \$4                                         | \$4                             | \$15  | \$126          | \$54                                             | 2.32                    |
| WEFA                                                                         | \$5                                     | \$0                                          | \$0                                              | \$12                                     | \$0                                      | \$1                                         | \$1                             | \$0   | \$19           | \$5                                              | 4.06                    |
| WRI                                                                          | \$24                                    | \$0                                          | \$2                                              | \$31                                     | \$0                                      | \$3                                         | \$4                             | \$8   | \$72           | \$30                                             | 2.39                    |
| IS                                                                           | \$4                                     | \$0                                          | (\$0)                                            | \$11                                     | \$0                                      | \$3                                         | \$0                             | \$3   | \$20           | \$13                                             | 1.55                    |
| TOTAL                                                                        | \$277                                   | \$0                                          | \$39                                             | \$241                                    | \$0                                      | \$31                                        | \$27                            | \$58  | \$673          | \$334                                            | 2.01                    |

Table 16.9: Estimated 40-year NPV of Benefit Metrics and Costs – Zonal (Future 2)

| Present Value of 40-yr Benefits for the 2019-2058 Period (in 2015 \$million) |                                         |                                              |                                                  |                                          |                                           |                                             |                                 |        | Total Benefits | Present Value of 40-yr ATRRs (in 2015 \$million) | Est. Benefit/ Cost Ratio |
|------------------------------------------------------------------------------|-----------------------------------------|----------------------------------------------|--------------------------------------------------|------------------------------------------|-------------------------------------------|---------------------------------------------|---------------------------------|--------|----------------|--------------------------------------------------|--------------------------|
| APC Savings                                                                  | Avoided or Delayed Reliability Projects | Capacity Savings from Reduced On-peak Losses | Assumed Benefit of Mandated Reliability Projects | Benefit from Meeting Public Policy Goals | Mitigation of Trans- mission Outage Costs | Increased Wheeling Through and Out Revenues | Marginal Energy Losses Benefits |        |                |                                                  |                          |
| Arkansas                                                                     | \$5                                     | \$0                                          | \$0                                              | \$12                                     | \$0                                       | \$7                                         | \$0                             | (\$1)  | \$23           | \$19                                             | 1.24                     |
| Iowa                                                                         | (\$14)                                  | \$0                                          | \$0                                              | \$1                                      | \$0                                       | \$1                                         | \$0                             | \$5    | (\$7)          | \$1                                              | -8.58                    |
| Kansas                                                                       | \$435                                   | \$0                                          | \$28                                             | \$69                                     | \$0                                       | \$20                                        | \$0                             | \$0    | \$553          | \$83                                             | 6.68                     |
| Louisiana                                                                    | (\$1)                                   | \$0                                          | \$0                                              | \$6                                      | \$0                                       | \$3                                         | \$0                             | \$1    | \$9            | \$11                                             | 0.90                     |
| Minnesota                                                                    | \$2                                     | \$0                                          | \$0                                              | \$0                                      | \$0                                       | \$0                                         | \$0                             | \$0    | \$2            | \$0                                              | 11.10                    |
| Missouri                                                                     | \$112                                   | \$0                                          | \$2                                              | \$16                                     | \$0                                       | \$13                                        | \$0                             | \$7    | \$149          | \$16                                             | 9.09                     |
| Montana                                                                      | \$7                                     | \$0                                          | \$0                                              | \$1                                      | \$0                                       | \$0                                         | \$0                             | \$1    | \$9            | \$1                                              | 13.98                    |
| Oklahoma                                                                     | \$6                                     | \$0                                          | \$1                                              | \$56                                     | \$0                                       | \$29                                        | \$0                             | (\$16) | \$76           | \$62                                             | 1.22                     |
| Nebraska                                                                     | \$234                                   | \$0                                          | \$3                                              | \$22                                     | \$0                                       | \$16                                        | \$0                             | \$22   | \$296          | \$59                                             | 5.05                     |
| New Mexico                                                                   | \$61                                    | \$0                                          | \$3                                              | \$11                                     | \$0                                       | \$4                                         | \$0                             | (\$26) | \$53           | \$15                                             | 3.57                     |
| North Dakota                                                                 | (\$10)                                  | \$0                                          | \$0                                              | \$4                                      | \$0                                       | \$5                                         | \$0                             | \$12   | \$11           | \$6                                              | 1.72                     |
| South Dakota                                                                 | \$30                                    | \$0                                          | \$0                                              | \$3                                      | \$0                                       | \$3                                         | \$0                             | \$7    | \$42           | \$4                                              | 11.21                    |
| Texas                                                                        | \$154                                   | \$0                                          | \$8                                              | \$40                                     | \$0                                       | \$15                                        | \$0                             | (\$64) | \$153          | \$58                                             | 2.65                     |
| Wyoming                                                                      | (\$0)                                   | \$0                                          | \$0                                              | \$0                                      | \$0                                       | \$0                                         | \$0                             | \$0    | \$0            | \$0                                              | 0.38                     |
| TOTAL                                                                        | \$1,020                                 | \$0                                          | \$45                                             | \$241                                    | \$0                                       | \$115                                       | \$0                             | (\$51) | \$1,370        | \$334                                            | 4.10                     |

Table 16.10: Estimated 40-year NPV of Benefit Metrics and Costs – State (Future 1)

| Present Value of 40-yr Benefits for the 2019-2058 Period (in 2015 \$million) |                                         |                                              |                                                  |                                          |                                           |                                             |                                 |       | Total Benefits | Present Value of 40-yr ATRRs (in 2015 \$million) | Est. Benefit/ Cost Ratio |
|------------------------------------------------------------------------------|-----------------------------------------|----------------------------------------------|--------------------------------------------------|------------------------------------------|-------------------------------------------|---------------------------------------------|---------------------------------|-------|----------------|--------------------------------------------------|--------------------------|
| APC Savings                                                                  | Avoided or Delayed Reliability Projects | Capacity Savings from Reduced On-peak Losses | Assumed Benefit of Mandated Reliability Projects | Benefit from Meeting Public Policy Goals | Mitigation of Trans- mission Outage Costs | Increased Wheeling Through and Out Revenues | Marginal Energy Losses Benefits |       |                |                                                  |                          |
| Arkansas                                                                     | (\$0)                                   | \$0                                          | \$0                                              | \$10                                     | \$0                                       | \$2                                         | \$2                             | \$1   | \$14           | \$19                                             | 0.74                     |
| Iowa                                                                         | (\$1)                                   | \$0                                          | (\$0)                                            | \$1                                      | \$0                                       | \$0                                         | \$0                             | \$0   | (\$0)          | \$1                                              | -0.15                    |
| Kansas                                                                       | \$56                                    | \$0                                          | \$27                                             | \$76                                     | \$0                                       | \$5                                         | \$8                             | \$32  | \$204          | \$83                                             | 2.47                     |
| Louisiana                                                                    | \$0                                     | \$0                                          | \$0                                              | \$5                                      | \$0                                       | \$1                                         | \$1                             | \$0   | \$7            | \$11                                             | 0.70                     |
| Minnesota                                                                    | \$0                                     | \$0                                          | (\$0)                                            | \$0                                      | \$0                                       | \$0                                         | \$0                             | \$0   | \$0            | \$0                                              | 1.86                     |
| Missouri                                                                     | \$1                                     | \$0                                          | \$1                                              | \$25                                     | \$0                                       | \$3                                         | \$2                             | (\$0) | \$32           | \$16                                             | 1.96                     |
| Montana                                                                      | \$0                                     | \$0                                          | (\$0)                                            | \$1                                      | \$0                                       | \$0                                         | \$0                             | \$0   | \$1            | \$1                                              | 2.10                     |
| Oklahoma                                                                     | \$3                                     | \$0                                          | \$0                                              | \$46                                     | \$0                                       | \$8                                         | \$6                             | \$3   | \$66           | \$62                                             | 1.07                     |
| Nebraska                                                                     | \$154                                   | \$0                                          | \$1                                              | \$26                                     | \$0                                       | \$4                                         | \$4                             | \$5   | \$194          | \$59                                             | 3.31                     |
| New Mexico                                                                   | \$17                                    | \$0                                          | \$2                                              | \$9                                      | \$0                                       | \$1                                         | \$1                             | \$4   | \$35           | \$15                                             | 2.32                     |
| North Dakota                                                                 | \$2                                     | \$0                                          | (\$0)                                            | \$4                                      | \$0                                       | \$1                                         | \$0                             | \$1   | \$8            | \$6                                              | 1.37                     |
| South Dakota                                                                 | \$2                                     | \$0                                          | (\$0)                                            | \$3                                      | \$0                                       | \$1                                         | \$0                             | \$1   | \$7            | \$4                                              | 1.89                     |
| Texas                                                                        | \$43                                    | \$0                                          | \$7                                              | \$34                                     | \$0                                       | \$4                                         | \$4                             | \$11  | \$102          | \$58                                             | 1.77                     |
| Wyoming                                                                      | \$0                                     | \$0                                          | \$0                                              | \$0                                      | \$0                                       | \$0                                         | \$0                             | \$0   | \$0            | \$0                                              | 1.29                     |
| TOTAL                                                                        | \$277                                   | \$0                                          | \$39                                             | \$241                                    | \$0                                       | \$31                                        | \$27                            | \$58  | \$673          | \$334                                            | 2.01                     |

Table 16.11: Estimated 40-year NPV of Benefit Metrics and Costs – State (Future 2)

## 16.12: Rate Impacts

The rate impact to the average retail residential ratepayer in SPP was estimated for the Consolidated Portfolio. Rate impact costs and benefits<sup>37</sup> are allocated to an average retail residential ratepayer based on an estimated residential consumption of 1,000 kWh per month. Benefits and costs for the 2024 study year were used to calculate rate impacts. All 2024 benefits and were adjusted to 2015 \$ using a 2.5% inflation rate.

The retail residential rate impact benefit is subtracted from the retail residential rate impact cost, to obtain a net rate impact cost by zone. If the net rate impact cost is negative, it indicates a net benefit to the zone. The rate impact costs and benefits are shown in Table 16.12. There is a monthly net benefit for the average SPP residential ratepayer of **5 cents per kWh**.

<sup>37</sup> APC Savings are the only benefit included in the rate impact calculations.

| Zone                           | One-Year<br>ATRR Costs | One-Year<br>Benefit | Rate Impact -<br>Cost | Rate Impact -<br>Benefit | Net Impact: Cost<br>Less Benefit |
|--------------------------------|------------------------|---------------------|-----------------------|--------------------------|----------------------------------|
| American Electric Power        | \$8,895,937            | \$221,218           | \$0.17                | \$0.00                   | \$0.16                           |
| City Utilities of Springfield  | \$198,214              | \$79,900            | \$0.06                | \$0.02                   | \$0.04                           |
| Empire District Electric       | \$337,955              | \$343,580           | \$0.06                | \$0.06                   | (\$0.00)                         |
| Grand River Dam Authority      | \$283,545              | (\$661,023)         | \$0.05                | (\$0.11)                 | \$0.16                           |
| Greater Missouri Operations    | \$556,065              | (\$110,473)         | \$0.07                | (\$0.01)                 | \$0.08                           |
| Kansas City Power & Light      | \$1,027,400            | \$8,833,340         | \$0.07                | \$0.57                   | (\$0.50)                         |
| Lincoln Electric System        | \$265,860              | (\$57,185)          | \$0.07                | (\$0.01)                 | \$0.08                           |
| Mid-Kansas Electric            | \$191,635              | \$3,489,151         | \$0.05                | \$0.87                   | (\$0.82)                         |
| Midwest Energy, Inc.           | \$113,627              | \$1,623,167         | \$0.05                | \$0.73                   | (\$0.68)                         |
| Nebraska Public Power District | \$3,821,408            | \$7,345,848         | \$0.22                | \$0.43                   | (\$0.21)                         |
| Oklahoma Gas and Electric      | \$2,224,279            | \$1,401,473         | \$0.06                | \$0.04                   | \$0.02                           |
| Omaha Public Power District    | \$1,044,250            | \$3,403,180         | \$0.08                | \$0.24                   | (\$0.17)                         |
| Southwestern Public Service    | \$5,936,703            | \$8,241,180         | \$0.13                | \$0.18                   | (\$0.05)                         |
| Sunflower Electric             | \$3,810,188            | \$2,230,104         | \$0.93                | \$0.54                   | \$0.39                           |
| Upper Missouri Zone            | \$1,272,462            | \$852,049           | \$0.04                | \$0.03                   | \$0.01                           |
| Westar Energy                  | \$3,021,404            | \$10,922,556        | \$0.09                | \$0.31                   | (\$0.23)                         |
| Western Farmers                | \$451,771              | (\$932,679)         | \$0.05                | (\$0.09)                 | \$0.14                           |
| <b>TOTAL</b>                   | <b>33,452,703</b>      | <b>47,225,386</b>   | <b>\$0.11</b>         | <b>\$0.16</b>            | <b>(\$0.05)</b>                  |

Table 16.12: 2024 Retail Residential Rate Impacts by Zone (2015 \$ & \$/MWh)

## Section 17: Sensitivities

A group of sensitivities were developed by the ESWG to understand the economic impacts associated with variations in certain model inputs. These sensitivities were not used to develop transmission projects or filter out projects; they measure the performance of the Consolidated Portfolio projects (economic and reliability) under different input assumptions. The following sensitivities were performed using Future 1 as a base:

- High Natural Gas Price
- Low Natural Gas Price
- High Demand
- Low Demand
- Increased Input Prices
- HVDC Projects
  - Tres Amigas HVDC Tie
  - Plains and Eastern Clean Line HVDC Project

The economic impacts of variations in the model inputs (natural gas price, demand) were captured for the Consolidated Portfolio projects. One-year B/C ratios are shown for all sensitivity and non-sensitivity runs in Figure 17.1, with benefits based on APC savings only. It also shows all sensitivities in which the one-year B/C is less than 1.0.

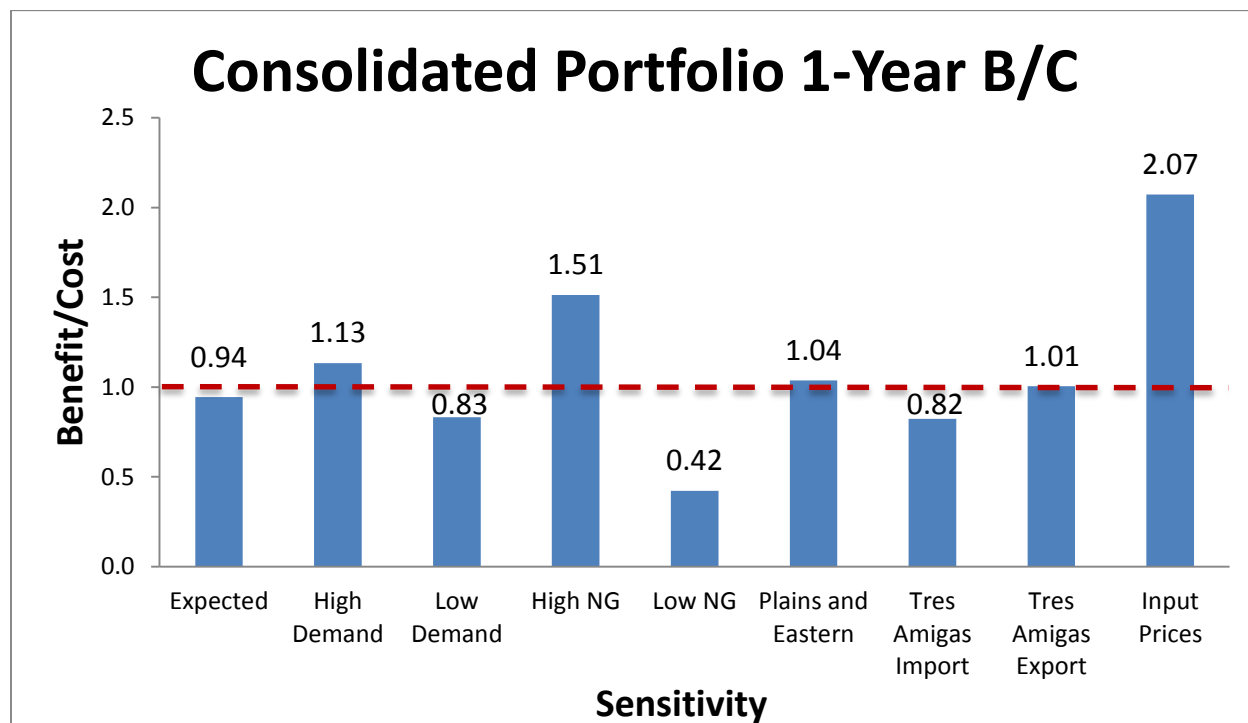


Figure 17.1: Future 1 Sensitivities – APC Benefit

All sensitivity results show one-year benefits and costs, rather than 40-year benefits and costs. The results show the highest one-year B/Cs under the increased input prices and high gas prices assumptions. The lowest one-year B/Cs result from the low gas prices, Tres Amigas import, and low demand sensitivities. The results also show that the Consolidated Portfolio has positive APC benefits for all sensitivities. In some of these cases, the one-year benefit is less than the one-year cost of \$58M. For detailed discussion on these results, see the following sections.

### **Demand and Natural Gas**

Two confidence intervals were developed using historical market prices and demand levels from the NYMEX and FERC Form No. 714. The standard deviation of the log difference from the normal within the pricing data sets was used to provide a confidence interval. The Natural Gas Price sensitivity had a 95% confidence interval (1.96 standard deviations) in the positive and negative directions, while the Demand Level sensitivity had a 67% confidence interval (1 standard deviation) in the positive and negative directions.

The resulting assumptions are shown in Table 17.1 and Figure 17.2

| Sensitivity          | Peak Demand and Energy <sup>38</sup> | Natural Gas Price 2024 (\$/MMBtu) <sup>39</sup> |
|----------------------|--------------------------------------|-------------------------------------------------|
| Expected Demand & NG | No change                            | \$6.83 (No change)                              |
| High Demand          | 7.8% Increase                        | No change                                       |
| Low Demand           | 7.8% Decrease                        | No change                                       |
| High Natural Gas     | No change                            | \$8.69                                          |
| Low Natural Gas      | No change                            | \$4.96                                          |

Table 17.1: Natural Gas and Demand Changes (2024)

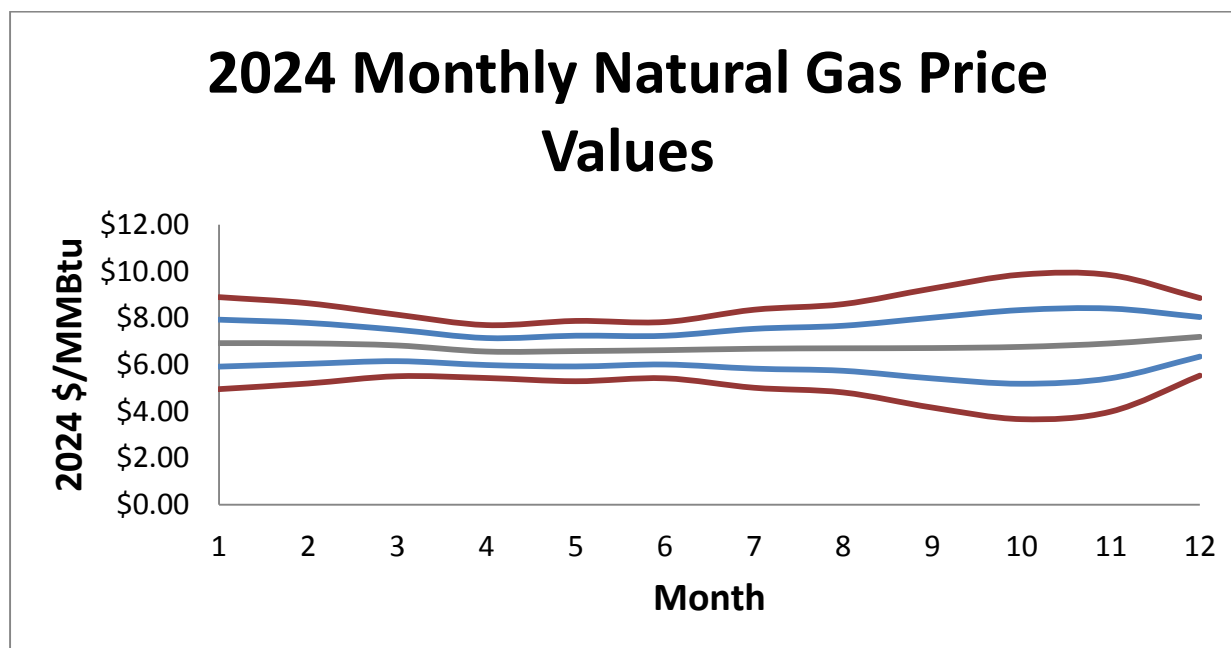


Figure 17.2: Monthly Natural Gas Price Values (2024)

The change in peak demand and energy shown in Table 17.1 reflect the SPP regional average volatility based on historical data. The volatility numbers and resulting high and low bands were calculated and implemented on the Demand Group (load company) level. These high and low bands show a deviation from the projected 2024 load forecasts developed by the Model Development Working Group (MDWG) and reviewed by the ESWG. For those companies which data was not available, the SPP regional average confidence interval was used.

<sup>38</sup> SPP Regional Average

<sup>39</sup> Henry Hub 2024 monthly average



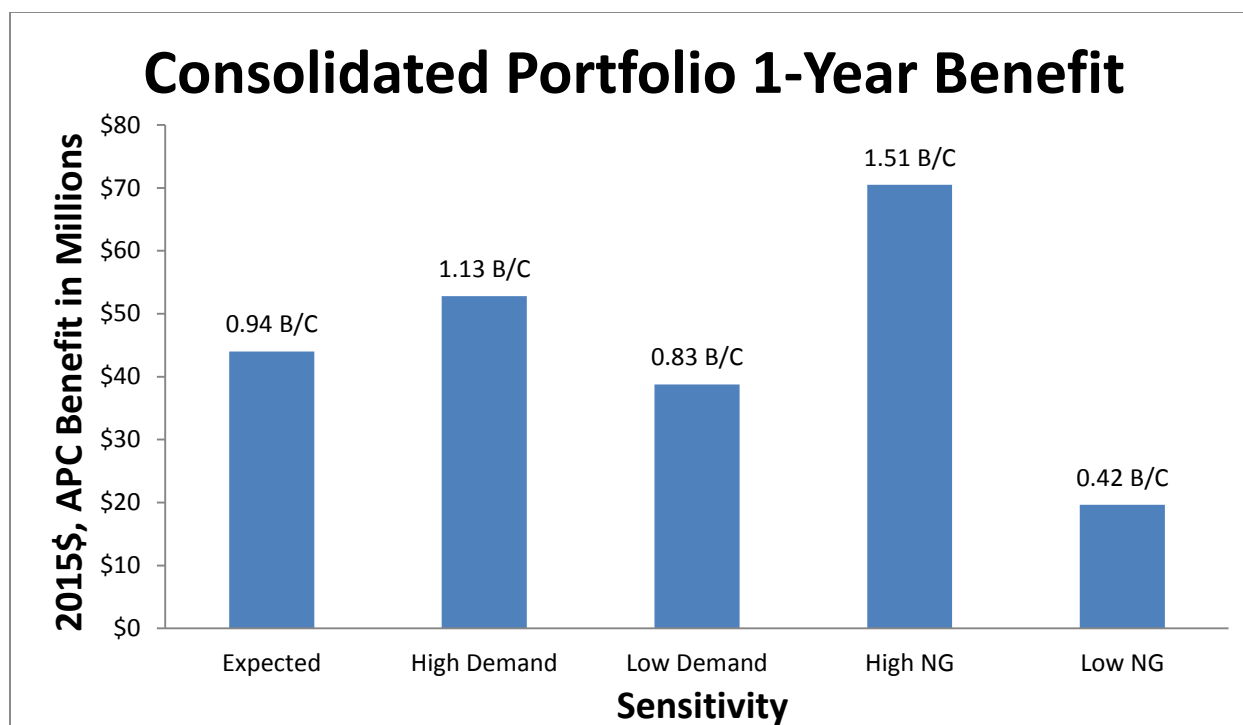


*Figure 17.3: One-Year APC Benefits of Consolidated Portfolio for Demand and Natural Gas Sensitivities*

These high and low band values were included as inputs to the Future 1 base model and the model evaluating the final consolidated portfolio. The results of the demand and natural gas sensitivities are reflected in Figure 17.3 and show an increase in APC benefit for the high demand and high natural gas cases. Low demand and low natural gas assumptions result in less APC benefit than the expected case.

An increase in demand creates an increase in congestion on the SPP system which allows more congestion costs for the consolidated portfolio to mitigate, thus increasing the benefit. The opposite is true for the low demand case. An increase in gas prices has a similar result of an increase in demand, but reflects an increase in price of overall energy, not necessarily an increase in congestion on the system. The high natural gas sensitivity shows the ability of the portfolio to reduce overall energy costs, by allowing cheaper generation to dispatch that was previously trapped by the model constraints. This is the same effect of the portfolio performance in the expected case, but is amplified by the increase in energy prices, thus showing more benefit. The low natural gas sensitivity has the opposite effect.

### **Increased Input Prices**

This sensitivity was driven by considering multiple factors that could result in increased fuel prices, for example, more restrictive regulations over shale fracturing, and a carbon tax on fossil unit emissions. It assumes a threefold increase of natural gas prices and a \$36/ton carbon tax. As a reaction to the increased energy prices, the sensitivity also assumes a reduction in the rate of load growth of 1% per year. Because the drivers of this sensitivity could result in a potential shift in resource fleets in the future, the reduction of emissions and emission rates metric was calculated in addition to the APC benefits for the portfolio.

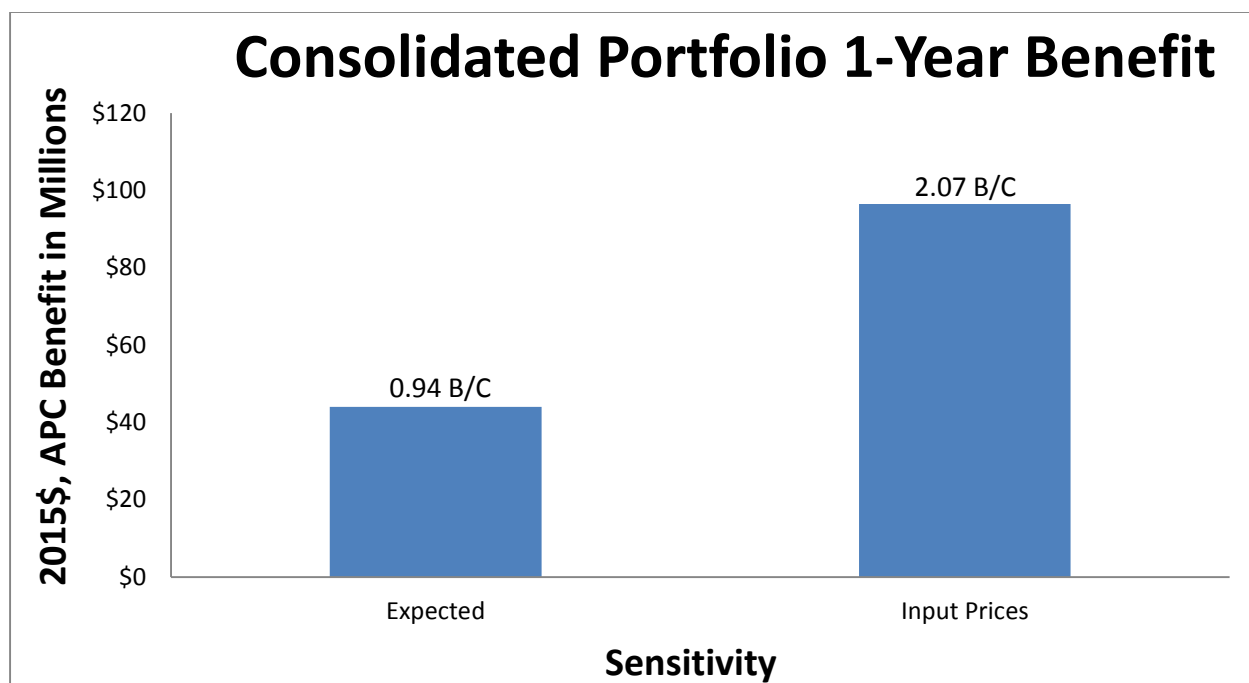


*Figure 17.4: One -Year APC Benefits of Consolidated Portfolio for Increased Input Prices Sensitivity*

Assuming increased natural gas prices and a tax on carbon emissions result in the consolidated portfolio having more than twice the APC benefit of the base case, as seen in *Figure 17.4*. These results are very similar to the high natural gas sensitivity. While the overall cost in energy has increased, the final portfolio still allows for a reduction in energy costs by allowing cheaper generation to dispatch. The fact that both the price of coal and gas were effectively increased in a similar fashion, the resulting resource mix does not change with or without the final portfolio. The carbon tax coupled with the tripling of natural gas prices as an input does not allow for gas to become more competitive than coal. In addition, this sensitivity did not consider an adjustment to the resource plan included in the Future 1 assessment, thus did not realize the potential for a shift in resource fleets to other energy sources, e.g. wind.

Figure 17.5 and Figure 17.6 show a change in emissions and emission rates, respectively, realized by the consolidated portfolio in this sensitivity.

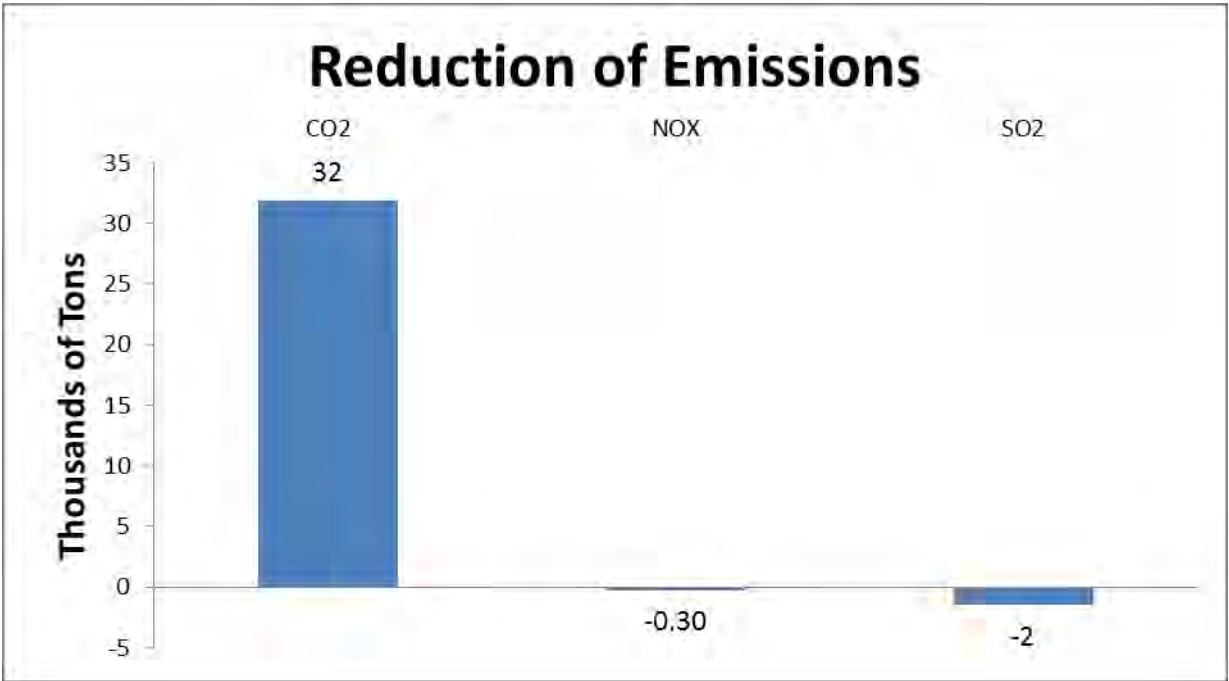


Figure 17.5: Reduction of Emissions in the Increased Input Prices Sensitivity

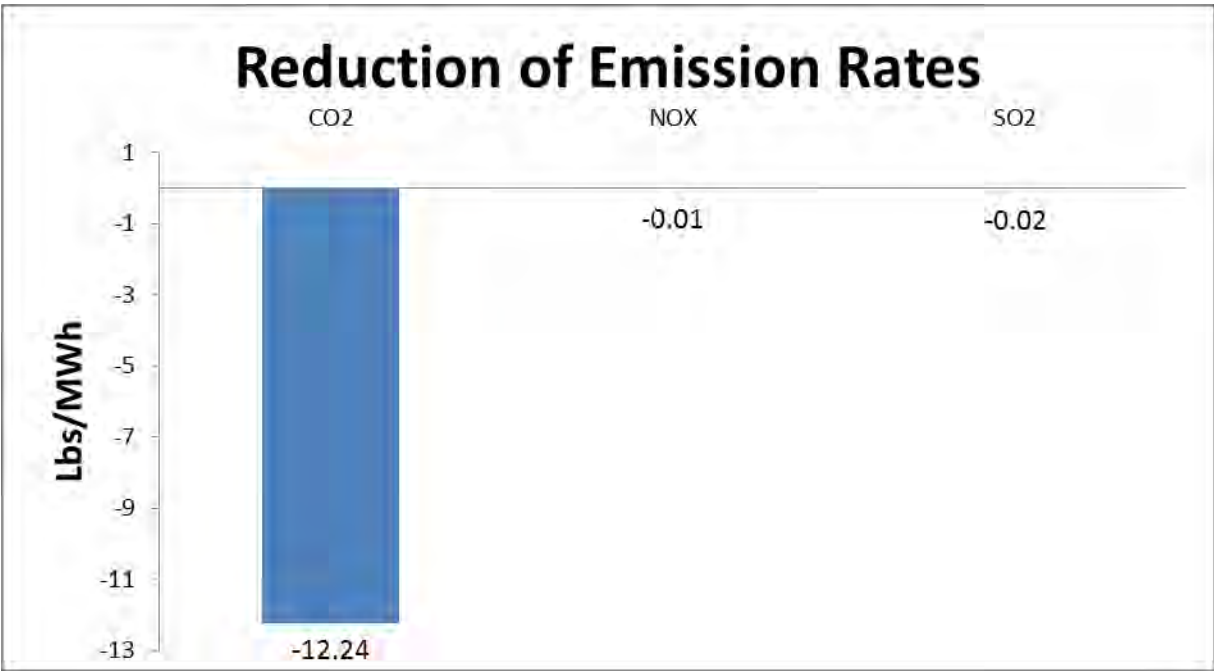


Figure 17.6: Reduction of Emission Rates in the Increased Input Prices Sensitivity

Figure 17.5 shows that the final portfolio allowed for a raw reduction in CO2 with slight increases in NOX and SO2 within the SPP footprint. This is somewhat counter to the reduction of emission rates shown in Figure 17.6 for CO2, which shows an increase in Lbs/MWh for plants within SPP. This is due to the ability of the portfolio to allow more imports from cheaper generation external to the SPP, offsetting slightly more expensive SPP resources. While allowing for more imports, the portfolio also increases emissions of the fleet within SPP. This is driven by the fact that the overall dispatched

resource mix of SPP units changes only slightly, actually allowing more and cheaper coal generation to dispatch.

**HVDC Projects**

In order to understand the flexibility of the Consolidated Portfolio to mitigate unforeseen congestion under the potential integration of HVDC projects, the Tres Amigas HVDC interconnection tie and the Plains and Eastern Clean Line HVDC transmission line were independently included in this set of sensitivities.

The Tres Amigas HVDC project is an interconnection tie expected to connect the Western Interconnection, the Eastern Interconnection, and ERCOT. Located in Clovis, NM, this project is expected to connect to the SPP footprint via the Southwestern Public Service Company transmission system. The portfolio was evaluated under the assumption that the Tres Amigas tie has a 750MW capacity capability with the Eastern Interconnection and the ability to import or export across the tie.

The Plains and Eastern Clean Line project is a 711 mile HVDC transmission line expected to deliver wind power from the Oklahoma panhandle to utilities in the mid-south and southeastern US. The line is expected to connect to the SPP system near Guymon, OK and deliver wind energy to multiple points, ending near Memphis, TN. The portfolio was evaluated under the assumption that the HVDC line would garner customers from the SPP region, requesting transfer of an aggregate 2,000 MW of maximum nameplate power across the line. An energy profile matching that of wind resources in the Hitchland area of the SPS system was utilized for this sensitivity.

The impact of the HVDC projects on the APC benefit associated with the Consolidated Portfolio is shown in Figure 17.7.

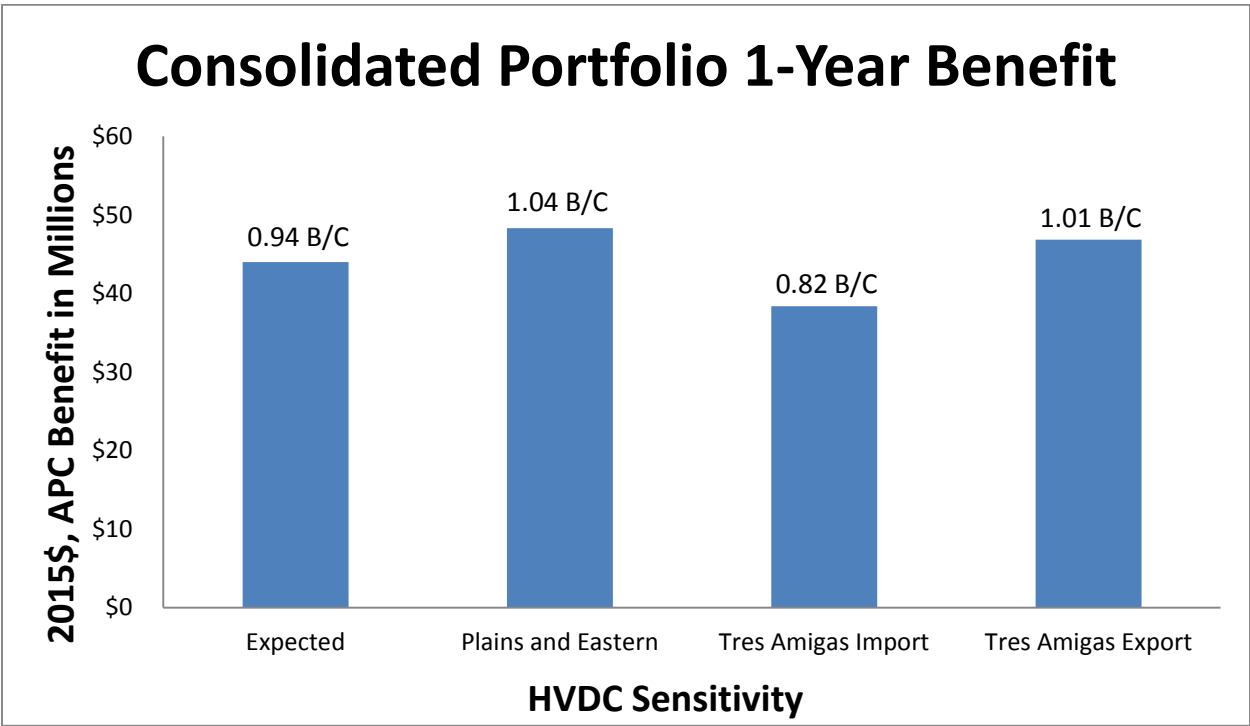


*Figure 17.7: One-Year APC Benefits of Consolidated Portfolio for HVDC Project Sensitivities*

The benefit of the Consolidated Portfolio increases under the Plains and Eastern Clean Line and Tres Amigas Export sensitivities. This is due to the increase in congestion caused by power flows utilizing these projects similar to that of the base Future 1 model. Both sensitivities increase flows from north to

south, further aggravating the general north to south system flows of the SPP footprint. The Consolidated Portfolio is able to mitigate a portion of this increased congestion, thus producing more benefit in a single study year than seen in the base Future 1 model in that same study year.

The benefit of the Consolidated Portfolio decreases under the Tres Amigas Import sensitivity. This is due to anticipated mitigation of congestion through the injection of power in the SPS area by the Tres Amigas project when importing power into the SPP grid, which pushes back against the typical north to south flows of the SPP system. This mitigation of congestion in some areas provides less economic opportunity and lowers the overall benefit of the Consolidated Portfolio within the single study year chosen.

# PART IV: APPENDICES



## Section 18: Glossary of Terms

The following terms are referred to throughout the report.

| Acronym              | Description                                              | Acronym      | Description                                     |
|----------------------|----------------------------------------------------------|--------------|-------------------------------------------------|
| <b>APC</b>           | Adjusted Production Cost                                 | <b>LMP</b>   | Locational Marginal Price                       |
| <b>APC-based B/C</b> | Adjusted Production Cost based Benefit to Cost ratio     | <b>LSE</b>   | Load Serving Entity                             |
| <b>ATC</b>           | Available Transfer Capability                            | <b>MDWG</b>  | Model Development Working Group                 |
| <b>ATRR</b>          | Annual Transmission Revenue Requirement                  | <b>MISO</b>  | Midcontinent Independent System Operator, Inc.  |
| <b>B/C</b>           | Benefit to Cost Ratio                                    | <b>MOPC</b>  | Markets and Operations Policy Committee         |
| <b>CBA</b>           | Consolidated Balancing Authority                         | <b>MTF</b>   | Metrics Task Force                              |
| <b>BOD</b>           | SPP Board of Directors                                   | <b>MVA</b>   | Mega Volt Ampere ( $10^6$ Volt Ampere)          |
| <b>Carbon Price</b>  | The tax burden associated with CO <sub>2</sub> emissions | <b>MW</b>    | Megawatt ( $10^6$ Watts)                        |
| <b>CAWG</b>          | Cost Allocation Working Group                            | <b>NCS</b>   | Non Competitive Solutions                       |
| <b>DPP</b>           | Detailed Project Proposal                                | <b>NERC</b>  | North American Electric Reliability Corporation |
| <b>EHV</b>           | Extra-High Voltage                                       | <b>NREL</b>  | National Renewable Energy Laboratory            |
| <b>EIS</b>           | Energy Imbalance Service                                 | <b>NTC</b>   | Notification to Construct                       |
| <b>EPA</b>           | Environmental Protection Agency                          | <b>NTC-C</b> | Notification to Construct with Conditions       |
| <b>ESWG</b>          | Economic Studies Working Group                           | <b>OATT</b>  | Open Access Transmission Tariff                 |
| <b>FCITC</b>         | First Contingency Incremental Transfer Capability        | <b>RES</b>   | Renewable Energy Standard                       |
| <b>FERC</b>          | Federal Energy Regulatory Commission                     | <b>RSC</b>   | SPP Regional State Committee                    |
| <b>GI</b>            | Generation Interconnection                               | <b>RTWG</b>  | Regional Tariff Working Group                   |
| <b>GOF</b>           | Generator Outlet Facilities                              | <b>SPC</b>   | Strategic Planning Committee                    |
| <b>GW</b>            | Gigawatt ( $10^9$ Watts)                                 | <b>SPP</b>   | Southwest Power Pool, Inc.                      |
| <b>HPILS</b>         | High Priority Incremental Load Study                     | <b>STEP</b>  | SPP Transmission Expansion Plan                 |
| <b>HVDC</b>          | High-Voltage Direct Current                              | <b>TPL</b>   | Transmission Planning NERC Standards            |
| <b>IS</b>            | Integrated System                                        | <b>TO</b>    | Transmission Owner                              |
| <b>ITPNT</b>         | Integrated Transmission Plan Near-Term Assessment        | <b>TOSP</b>  | Transmission Owner Selection Process            |
| <b>ITP10</b>         | Integrated Transmission Plan 10-Year Assessment          | <b>TSR</b>   | Transmission Service Request                    |
| <b>ITP20</b>         | Integrated Transmission Plan 20-Year Assessment          | <b>TVA</b>   | Tennessee Valley Authority                      |
| <b>LIP</b>           | Locational Imbalance Price                               | <b>TWG</b>   | Transmission Working Group                      |



## Section 19: Final Assessments

### 19.1: Final Stability Assessment

An assessment was performed to confirm the wind dispatched for 2015 ITP10 Consolidated Portfolio 2024 Summer Peak case in Futures 1 and 2 can be achieved without the occurrence of voltage instability. The transfer limit (MW) due to transfer of wind to the Tier 1 areas from the SPP footprint was also assessed.

#### Method

To determine the amount of wind generation that could be accommodated in the ITP10 study for Futures 1 and 2, wind<sup>40</sup> generation in SPP was increased and conventional (i.e. coal, gas, etc.) generation in the Tier 1 footprint was decreased. The plant total wind, used in the study, equated to 12.9 GW, as shown in Table 19.1. The wind transfer units were located in SPP, WAPA, and ALTW. Designated wind plants with long-term firm transmission service to external entities delivered 1,174 MW to SOCO, Entergy, and AECI, as detailed in Table 19.2. After these transfers were included in the base case assumptions, these plants had an additional 472 MW of generation capacity remaining to participate in the wind transfer to Tier 1.

| Future | Wind Generation (GW) |
|--------|----------------------|
| 1      | 12.9                 |
| 2      | 12.9                 |

Table 19.1: Wind Generation per Future

| From Area | To Area | Transfer MW |
|-----------|---------|-------------|
| SPS       | SOCO    | 206         |
| OKGE/WFEC | Entergy | 302         |
| WRI/SUNC  | Entergy | 366         |
| WRI       | AECI    | 300         |
| TOTAL =   |         | 1,174       |

Table 19.2: Modeled Wind generation per future

To prepare for the wind transfer all SPP wind transfer units that were initially off in the base cases were turned on. The SPP wind was increased while the Tier 1 conventional generation was decreased until voltage collapse occurred in the pre-contingency models.<sup>29</sup> N-1 contingencies of 345 kV and 500 kV facilities were also analyzed for maximum power transfer. A large volume of 345 kV N-1 outages were analyzed, 222 transformers and 321 lines.

<sup>40</sup> Transfer step size is 100 MW. Nebraska Entity (NE) EHV line reactors are ON in the base cases.

### Consolidated Portfolio Wind Dispatch

Each Future was evaluated for increasing wind transfer amounts to determine different voltage collapse points of the transmission system, with the final consolidated portfolio in service. Wind plants were increased in 100 MW increments, beginning with the base wind dispatch of the AC model for each specific hour analyzed. In order to reach collapse points which may occur higher than the total installed wind capacity for SPP, existing sites were scaled on a pro-rata basis above their maximum capacity. Multiple transfer limits were determined based on the worst N-1 contingency and independently evaluating the next worst contingency to determine the top 5 MW transfer limits. A single limit may have been reached by one contingency or multiple different contingencies evaluated independently. The maximum transfer limit for system intact conditions was also determined for each Future.

Future 1 wind transfer in the ITP10 consolidated portfolio caused voltage collapse for one N-1 event each at 13.09 GW, 13.69 GW, and 13.79 GW, respectively. The same scenario with Future 1 wind transfer in the ITP 10 consolidated portfolio caused voltage collapse at 13.99 GW for four events and 14.09 GW for 87 events. A wind transfer of 14.19 GW caused voltage collapse under no contingency conditions.

Future 2 wind transfer in the ITP10 consolidated portfolio caused voltage collapse at 12.97 GW for one N-1 event, 13.07 GW for two N-1 events, 13.17 GW for three N-1 events, 13.27 GW for one N-1 event, 13.37 GW for 17 N-1 events, and 13.47 GW for 137 N-1 events. A wind transfer of 13.57 GW caused voltage collapse under no contingency conditions.

A summary of voltage collapse wind transfer limits with outages is in Table 19.3.

| Future | Wind Power | N-1                                        |         |         |         |         | N-0                   |
|--------|------------|--------------------------------------------|---------|---------|---------|---------|-----------------------|
|        | Peak (MW)  | Wind Power (MW) Scaled to Voltage Collapse |         |         |         |         | Maximum Transfer (MW) |
|        |            | Limit 1                                    | Limit 2 | Limit 3 | Limit 4 | Limit 5 |                       |
| F1     | 12,858     | 13,088                                     | 13,688  | 13,788  | 13,988  | 14,088  | 14,188                |
| F2     | 12,858     | 12,968                                     | 13,068  | 13,168  | 13,268  | 13,368  | 13,568                |

Table 19.3: Modeled Wind generation per future

Future 1 and 2 detailed transfer limits with outages are in Table 19.4 and Table 19.5 respectively.

| Wind Dispatch MW | Outage         |                |             |       | ID |
|------------------|----------------|----------------|-------------|-------|----|
|                  | Bus 1          | Bus 2          | Transformer | Bus 3 |    |
| 13,088           | HOYT 7 345.    | JEC N 7 345.   |             |       | 1  |
| 13,688           | STILWEL7 345.  | LACYGNE7 345.  |             |       | 1  |
| 13,788           | HOYT 7 345.    | STRANGR7 345.  |             |       | 1  |
| 13,988           | PITTSB-7 345.  | VALIANT7 345.  |             |       | 1  |
| 13,988           | PITTSB-7 345.  | SEMINOL7 345.  |             |       | 1  |
| 13,988           | O.K.U.-7 345.  | TUCO_INT 7345. |             |       | 1  |
| 13,988           | MUSKOG7 345.   | FTSMITH7 345.  |             |       | 1  |
| 14,088           | WILKES CC 345. | WILKES 7 345.  |             |       | 1  |
| 14,088           | HOBANDPLT 345. | RDRUNNER 7345. |             |       | 1  |

| Wind Dispatch MW | Bus 1          | Bus 2            | Transformer Bus 3 | ID |
|------------------|----------------|------------------|-------------------|----|
| 14,088           | 8ANO 500.      | FTSMITH8 500.    |                   | 1  |
| 14,088           | 7OVERTON 345.  | SIBLEY 7 345.    |                   | 1  |
| 14,088           | FLINTCR7 345.  | TONECE7 345.     |                   | 1  |
| 14,088           | FLINTCR7 345.  | BROOKLINE 7345.  |                   | 1  |
| 14,088           | CHAMSPR7 345.  | CLARKSV7 345.    |                   | 1  |
| 14,088           | SHIPERD7 345.  | KINGRIV7 345.    |                   | 1  |
| 14,088           | LYDIA 7 345.   | VALIANT7 345.    |                   | 1  |
| 14,088           | R.S.S.-7 345.  | REDBUD 7 345.    |                   | 1  |
| 14,088           | T.NO.--7 345.  | CLEVLND7 345.    |                   | 1  |
| 14,088           | DELWARE7 345.  | NEOSHO 7 345.    |                   | 1  |
| 14,088           | PITTSB-7 345.  | JOHNCO 7 345.    |                   | 1  |
| 14,088           | O.K.U.-7 345.  | L.E.S.-7 345.    |                   | 1  |
| 14,088           | CHISHOLM7 345. | GRACMNT7 345.    |                   | 1  |
| 14,088           | GRDA1 7 345.   | TONECE7 345.     |                   | 1  |
| 14,088           | CLEVLND7 345.  | SOONER 7 345.    |                   | 1  |
| 14,088           | MINCO 7 345.   | GRACMNT7 345.    |                   | 1  |
| 14,088           | NORTWST7 345.  | ARCADIA7 345.    |                   | 1  |
| 14,088           | NORTWST7 345.  | MATHWSN7 345.    |                   | 1  |
| 14,088           | CIMARON7 345.  | MCCLAIN TP7 345. |                   | 1  |
| 14,088           | DRAPER 7 345.  | MCCLAIN TP7 345. |                   | 1  |
| 14,088           | MUSKOG7 345.   | C-RIVER7 345.    |                   | 1  |
| 14,088           | WWRDEHV7 345.  | TATONGA7 345.    |                   | 1  |
| 14,088           | WWRDEHV7 345.  | TATONGA7 345.    |                   | 2  |
| 14,088           | WWRDEHV7 345.  | BEAVER CO 345.   |                   | 1  |
| 14,088           | WWRDEHV7 345.  | BEAVER CO 345.   |                   | 2  |
| 14,088           | TATONGA7 345.  | MATHWSN7 345.    |                   | 1  |
| 14,088           | TATONGA7 345.  | MATHWSN7 345.    |                   | 2  |
| 14,088           | FINNEY 7345.   | LAMAR7 345.      |                   | 1  |
| 14,088           | POSTROCK7 345. | SPERVIL7 345.    |                   | 1  |
| 14,088           | POSTROCK7 345. | AXTELL 3 345.    |                   | 1  |
| 14,088           | MINGO 7 345.   | SETAB 7 345.     |                   | 1  |
| 14,088           | MINGO 7 345.   | REDWILO3 345.    |                   | 1  |
| 14,088           | SPERVIL7 345.  | BUCKNER7 345.    |                   | 1  |
| 14,088           | SPERVIL7 345.  | CLARKCOUNTY7345. |                   | 1  |
| 14,088           | JEC N 7 345.   | GEARY 7 345.     |                   | 1  |
| 14,088           | JEC N 7 345.   | MORRIS 7 345.    |                   | 1  |
| 14,088           | EMPEC 7 345.   | LANG 7 345.      |                   | 1  |
| 14,088           | EMPEC 7 345.   | WICHITA7 345.    |                   | 1  |
| 14,088           | RENO 7 345.    | SUMMIT 7 345.    |                   | 1  |
| 14,088           | STRANGR7 345.  | IATAN 7 345.     |                   | 1  |

| Wind Dispatch MW | Bus 1            | Bus 2            | Transformer | Bus 3 | ID |
|------------------|------------------|------------------|-------------|-------|----|
| 14,088           | STRANGR7 345.    | IATAN 7 345.     |             |       | 2  |
| 14,088           | SUMMIT 7 345.    | ELMCREEK7 345.   |             |       | 1  |
| 14,088           | MOUNDRG7 345.    | WICHITA7 345.    |             |       | 1  |
| 14,088           | CANEYRV7 345.    | NEOSHO 7 345.    |             |       | 1  |
| 14,088           | CANEYRV7 345.    | LATHAMS7 345.    |             |       | 1  |
| 14,088           | BENTON 7 345.    | ROSEHIL7 345.    |             |       | 1  |
| 14,088           | BENTON 7 345.    | WICHITA7 345.    |             |       | 1  |
| 14,088           | BENTON 7 345.    | WOLFCRK7 345.    |             |       | 1  |
| 14,088           | WICHITA7 345.    | VIOLA 7 345.     |             |       | 1  |
| 14,088           | WICHITA7 345.    | THISTLE7 345.    |             |       | 1  |
| 14,088           | WICHITA7 345.    | THISTLE7 345.    |             |       | 2  |
| 14,088           | WOLFCRK7 345.    | ANDERSONCO 345.  |             |       | 1  |
| 14,088           | CLARKCOUNTY7345. | THISTLE7 345.    |             |       | 1  |
| 14,088           | CLARKCOUNTY7345. | THISTLE7 345.    |             |       | 2  |
| 14,088           | CLARKCOUNTY7345. | IRONWOOD7 345.   |             |       | 1  |
| 14,088           | MULLNCR7 345.    | SIBLEY 7 345.    |             |       | 1  |
| 14,088           | PECULR 7 345.    | PHILL 7 345.     |             |       | 1  |
| 14,088           | PECULR 7 345.    | STILWEL7 345.    |             |       | 1  |
| 14,088           | ST JOE 3 345.    | NASHUA 7 345.    |             |       | 1  |
| 14,088           | ST JOE 3 345.    | G10-056T 345.    |             |       | 1  |
| 14,088           | PHILL 7 345.     | SIBLEY 7 345.    |             |       | 1  |
| 14,088           | W.GRDNR7 345.    | CRAIG 7 345.     |             |       | 1  |
| 14,088           | W.GRDNR7 345.    | LACYGNE7 345.    |             |       | 1  |
| 14,088           | LACYGNE7 345.    | ANDERSONCO 345.  |             |       | 1  |
| 14,088           | GRPRWND7 345.    | FTTHOMP3 345.    |             |       | 1  |
| 14,088           | RAUN 3 345.      | HOSKINS3 345.    |             |       | 1  |
| 14,088           | AXTELL 3 345.    | PAULINE3 345.    |             |       | 1  |
| 14,088           | GENTLMN3 345.    | REDWILO3 345.    |             |       | 1  |
| 14,088           | GENTLMN3 345.    | SWEET W3 345.    |             |       | 2  |
| 14,088           | GENTLMN3 345.    | CHERRY3 345.     |             |       | 1  |
| 14,088           | MCCOOL 3 345.    | MOORE 3 345.     |             |       | 1  |
| 14,088           | MCCOOL 3 345.    | GR ISLD3 345.    |             |       | 1  |
| 14,088           | MOORE 3 345.     | PAULINE3 345.    |             |       | 1  |
| 14,088           | SWEET W3 345.    | GR ISLD3 345.    |             |       | 1  |
| 14,088           | HOLT.CO3 345.    | GR ISLD3 345.    |             |       | 1  |
| 14,088           | LARAMIE3 345.    | STEGALL3 345.    |             |       | 1  |
| 14,088           | CHISHOLM7 345.   | CHISHOLM6 230.   | CHISHOLM1   | 13.2  | 1  |
| 14,088           | FTSMITH7 345.    | FTSMITH8 500.    | FTSMTH11    | 13.8  | 1  |
| 14,088           | POTASH_JCT 7345. | POTASH_JCT 3115. | POTASH_TR4  | 113.2 | 1  |
| 14,088           | POSTROCK7 345.   | POSTROCK6 230.   | POSTROCK1   | 13.8  | 1  |

| Wind<br>Dispatch<br>MW | Bus 1           | Bus 2         | Transformer | Bus 3 | ID |
|------------------------|-----------------|---------------|-------------|-------|----|
| 14,088                 | HOYT 7 345.     | HOYT 3 115.   | HOYT 1      | 14.4  | 1  |
| 14,088                 | GEARY 7 345.    | GEARY 3 115.  | GEARY1X1    | 13.8  | 1  |
| 14,088                 | LANG 7 345.     | LANG 3 115.   | LANG 1      | 14.4  | 1  |
| 14,088                 | SUMMIT 7 345.   | SUMMIT 6 230. | SUMMIT 1    | 14.4  | 1  |
| 14,088                 | REDWILO7 115.   | REDWILO3 345. | REDWILO9    | 13.8  | 1  |
| 14,188                 | Pre Contingency |               |             |       |    |

*Table 19.4: Future 1 Voltage Collapse Transfers*

| Outage                 |            |       |            |       |                      |    |
|------------------------|------------|-------|------------|-------|----------------------|----|
| Wind<br>Dispatch<br>MW | Bus 1      |       | Bus 2      |       | Transformer Bus<br>3 | ID |
| 12,968                 | MUSKOGE7   | 345.  | FTSMITH7   | 345.  |                      | 1  |
| 13,068                 | CHAMSPR7   | 345.  | CLARKSV7   | 345.  |                      | 1  |
| 13,068                 | HOYT 7     | 345.  | JEC N 7    | 345.  |                      | 1  |
| 13,168                 | PITTSB-7   | 345.  | VALIANT7   | 345.  |                      | 1  |
| 13,168                 | PITTSB-7   | 345.  | SEMINOL7   | 345.  |                      | 1  |
| 13,168                 | GRDA1 7    | 345.  | TONECE7    | 345.  |                      | 1  |
| 13,268                 | 8ANO       | 500.  | FTSMITH8   | 500.  |                      | 1  |
| 13,368                 | O.K.U.-7   | 345.  | L.E.S.-7   | 345.  |                      | 1  |
| 13,368                 | O.K.U.-7   | 345.  | TUCO_INT   | 7345. |                      | 1  |
| 13,368                 | CHISHOLM7  | 345.  | GRACMNT7   | 345.  |                      | 1  |
| 13,368                 | CLEVLND7   | 345.  | SOONER 7   | 345.  |                      | 1  |
| 13,368                 | MINCO 7    | 345.  | GRACMNT7   | 345.  |                      | 1  |
| 13,368                 | WWRDEHV7   | 345.  | BORDER     | 7345. |                      | 1  |
| 13,368                 | TATONGA7   | 345.  | MATHWSN7   | 345.  |                      | 1  |
| 13,368                 | TATONGA7   | 345.  | MATHWSN7   | 345.  |                      | 2  |
| 13,368                 | BORDER     | 7345. | TUCO_INT   | 7345. |                      | 1  |
| 13,368                 | HITCHLAND  | 7345. | WALKTAP7   | 345.  |                      | 1  |
| 13,368                 | FINNEY     | 7345. | HOLCOMB7   | 345.  |                      | 1  |
| 13,368                 | POSTROCK7  | 345.  | SPERVIL7   | 345.  |                      | 1  |
| 13,368                 | POSTROCK7  | 345.  | AXTELL 3   | 345.  |                      | 1  |
| 13,368                 | HOLCOMB7   | 345.  | SETAB 7    | 345.  |                      | 1  |
| 13,368                 | MINGO 7    | 345.  | SETAB 7    | 345.  |                      | 1  |
| 13,368                 | MINGO 7    | 345.  | REDWILO3   | 345.  |                      | 1  |
| 13,368                 | LACYGNE7   | 345.  | ANDERSONCO | 345.  |                      | 1  |
| 13,468                 | CCS4 CC    | 345.  | WILKES 7   | 345.  |                      | 1  |
| 13,468                 | CCS3 CC    | 345.  | WILKES 7   | 345.  |                      | 1  |
| 13,468                 | HOBANDPLT  | 345.  | RDRUNNER   | 7345. |                      | 1  |
| 13,468                 | 7FAIRPT    | 345.  | ST JOE 3   | 345.  |                      | 1  |
| 13,468                 | 7FAIRPT    | 345.  | COOPER 3   | 345.  |                      | 1  |
| 13,468                 | 7SPORTSMAN | 345.  | GRDA1 7    | 345.  |                      | 1  |
| 13,468                 | 7OVERTON   | 345.  | SIBLEY 7   | 345.  |                      | 1  |
| 13,468                 | FLINTCR7   | 345.  | SHIPERD7   | 345.  |                      | 1  |
| 13,468                 | FLINTCR7   | 345.  | TONECE7    | 345.  |                      | 1  |
| 13,468                 | FLINTCR7   | 345.  | BROOKLINE  | 7345. |                      | 1  |
| 13,468                 | SHIPERD7   | 345.  | KINGRIV7   | 345.  |                      | 1  |
| 13,468                 | NWTXARK7   | 345.  | VALIANT7   | 345.  |                      | 1  |
| 13,468                 | LYDIA 7    | 345.  | WELSH 7    | 345.  |                      | 1  |
| 13,468                 | LYDIA 7    | 345.  | VALIANT7   | 345.  |                      | 1  |
| 13,468                 | CLARKSV7   | 345.  | ONETA--7   | 345.  |                      | 1  |

| Wind Dispatch MW | Bus 1            | Bus 2            | Transformer Bus 3 | ID |
|------------------|------------------|------------------|-------------------|----|
| 13,468           | WEKIWA-7 345.    | T.NO.--7 345.    |                   | 1  |
| 13,468           | R.S.S.-7 345.    | REDBUD 7 345.    |                   | 1  |
| 13,468           | R.S.S.-7 345.    | PECANCK7 345.    |                   | 1  |
| 13,468           | T.NO.--7 345.    | CLEVLND7 345.    |                   | 1  |
| 13,468           | DELWARE7 345.    | N.E.S.-7 345.    |                   | 1  |
| 13,468           | DELWARE7 345.    | NEOSHO 7 345.    |                   | 1  |
| 13,468           | PITTSB-7 345.    | JOHNCO 7 345.    |                   | 1  |
| 13,468           | PITTSB-7 345.    | C-RIVER7 345.    |                   | 1  |
| 13,468           | L.E.S.-7 345.    | GRACMNT7 345.    |                   | 1  |
| 13,468           | WOODRNG7 345.    | SOONER 7 345.    |                   | 1  |
| 13,468           | MINCO 7 345.     | CIMARON7 345.    |                   | 1  |
| 13,468           | SOONER 7 345.    | SPRNGCK7 345.    |                   | 1  |
| 13,468           | JOHNCO 7 345.    | SUNNYS7 345.     |                   | 1  |
| 13,468           | NORTWST7 345.    | SPRNGCK7 345.    |                   | 1  |
| 13,468           | NORTWST7 345.    | ARCADIA7 345.    |                   | 1  |
| 13,468           | CIMARON7 345.    | MCCLAIN TP7 345. |                   | 1  |
| 13,468           | ARCADIA7 345.    | SEMINOL7 345.    |                   | 1  |
| 13,468           | DRAPER 7 345.    | MCCLAIN TP7 345. |                   | 1  |
| 13,468           | MUSKOG7 345.     | C-RIVER7 345.    |                   | 1  |
| 13,468           | WWRDEHV7 345.    | TATONGA7 345.    |                   | 1  |
| 13,468           | WWRDEHV7 345.    | TATONGA7 345.    |                   | 2  |
| 13,468           | WWRDEHV7 345.    | THISTLE7 345.    |                   | 1  |
| 13,468           | WWRDEHV7 345.    | THISTLE7 345.    |                   | 2  |
| 13,468           | WWRDEHV7 345.    | BEAVER CO 345.   |                   | 1  |
| 13,468           | WWRDEHV7 345.    | BEAVER CO 345.   |                   | 2  |
| 13,468           | HUNTERS7 345.    | RENFROW7 345.    |                   | 1  |
| 13,468           | RENFROW7 345.    | VIOLA 7 345.     |                   | 1  |
| 13,468           | HITCHLAND 7345.  | POTTER_CO 7345.  |                   | 1  |
| 13,468           | FINNEY TP 7 345. | FINNEY 7345.     |                   | 1  |
| 13,468           | FINNEY TP 7 345. | WALKTAP7 345.    |                   | 1  |
| 13,468           | FINNEY 7345.     | LAMAR7 345.      |                   | 1  |
| 13,468           | HOBBS_INT 7345.  | POTASH_JCT 7345. |                   | 1  |
| 13,468           | POTASH_JCT 7345. | NLOV_PLT 7345.   |                   | 1  |
| 13,468           | SPERVIL7 345.    | BUCKNER7 345.    |                   | 1  |
| 13,468           | SPERVIL7 345.    | CLARKCOUNTY7345. |                   | 1  |
| 13,468           | HOYT 7 345.      | STRANGR7 345.    |                   | 1  |
| 13,468           | GEARY 7 345.     | SUMMIT 7 345.    |                   | 1  |
| 13,468           | EMPEC 7 345.     | SWISVAL7 345.    |                   | 1  |
| 13,468           | EMPEC 7 345.     | WICHITA7 345.    |                   | 1  |
| 13,468           | RENO 7 345.      | SUMMIT 7 345.    |                   | 1  |



| Wind Dispatch MW | Bus 1            | Bus 2            | Transformer Bus 3 | ID |
|------------------|------------------|------------------|-------------------|----|
| 13,468           | RENO 7 345.      | MOUNDRG7 345.    |                   | 1  |
| 13,468           | STRANGR7 345.    | 87TH 7 345.      |                   | 1  |
| 13,468           | STRANGR7 345.    | IATAN 7 345.     |                   | 1  |
| 13,468           | SUMMIT 7 345.    | ELMCREEK7 345.   |                   | 1  |
| 13,468           | SWISVAL7 345.    | W.GRDNR7 345.    |                   | 1  |
| 13,468           | 87TH 7 345.      | CRAIG 7 345.     |                   | 1  |
| 13,468           | MOUNDRG7 345.    | WICHITA7 345.    |                   | 1  |
| 13,468           | CANEYRV7 345.    | LATHAMS7 345.    |                   | 1  |
| 13,468           | BENTON 7 345.    | WICHITA7 345.    |                   | 1  |
| 13,468           | BENTON 7 345.    | WOLFCRK7 345.    |                   | 1  |
| 13,468           | NEOSHO 7 345.    | FRANKLIN TP7345. |                   | 1  |
| 13,468           | ROSEHIL7 345.    | WOLFCRK7 345.    |                   | 1  |
| 13,468           | ROSEHIL7 345.    | LATHAMS7 345.    |                   | 1  |
| 13,468           | ROSEHIL7 345.    | SOONTAP7 345.    |                   | 1  |
| 13,468           | WICHITA7 345.    | THISTLE7 345.    |                   | 1  |
| 13,468           | WICHITA7 345.    | THISTLE7 345.    |                   | 2  |
| 13,468           | WOLFCRK7 345.    | ANDERSONCO 345.  |                   | 1  |
| 13,468           | CLARKCOUNTY7345. | THISTLE7 345.    |                   | 1  |
| 13,468           | CLARKCOUNTY7345. | THISTLE7 345.    |                   | 2  |
| 13,468           | CLARKCOUNTY7345. | IRONWOOD7 345.   |                   | 1  |
| 13,468           | MULLNCR7 345.    | SIBLEY 7 345.    |                   | 1  |
| 13,468           | PECULR 7 345.    | PHILL 7 345.     |                   | 1  |
| 13,468           | ST JOE 3 345.    | EASTOWN7 345.    |                   | 1  |
| 13,468           | ST JOE 3 345.    | NASHUA 7 345.    |                   | 1  |
| 13,468           | PHILL 7 345.     | SIBLEY 7 345.    |                   | 1  |
| 13,468           | EASTOWN7 345.    | IATAN 7 345.     |                   | 1  |
| 13,468           | W.GRDNR7 345.    | CRAIG 7 345.     |                   | 1  |
| 13,468           | W.GRDNR7 345.    | LACYGNE7 345.    |                   | 1  |
| 13,468           | STILWEL7 345.    | LACYGNE7 345.    |                   | 1  |
| 13,468           | HAWTH 7 345.     | NASHUA 7 345.    |                   | 1  |
| 13,468           | CHAVESCO 345.    | NM#4T 345.       |                   | 1  |
| 13,468           | GRPRWND7 345.    | FTTHOMP3 345.    |                   | 1  |
| 13,468           | CBLUFFS3 345.    | S3456 3 345.     |                   | 1  |
| 13,468           | ATCHSNT3 345.    | COOPER 3 345.    |                   | 1  |
| 13,468           | RAUN 3 345.      | HOSKINS3 345.    |                   | 1  |
| 13,468           | AXTELL 3 345.    | PAULINE3 345.    |                   | 1  |
| 13,468           | AXTELL 3 345.    | SWEET W3 345.    |                   | 1  |
| 13,468           | COOPER 3 345.    | MOORE 3 345.     |                   | 1  |
| 13,468           | GENTLMN3 345.    | REDWILO3 345.    |                   | 1  |
| 13,468           | GENTLMN3 345.    | SWEET W3 345.    |                   | 1  |

| Wind Dispatch MW | Bus 1           | Bus 2            | Transformer Bus 3 | ID |
|------------------|-----------------|------------------|-------------------|----|
| 13,468           | GENTLMN3 345.   | SWEET W3 345.    |                   | 2  |
| 13,468           | GENTLMN3 345.   | CHERRY3 345.     |                   | 1  |
| 13,468           | HOSKINS3 345.   | NELIGH.EAST3345. |                   | 1  |
| 13,468           | KEYSTON3 345.   | SIDNEY 3 345.    |                   | 1  |
| 13,468           | MCCOOL 3 345.   | MOORE 3 345.     |                   | 1  |
| 13,468           | MCCOOL 3 345.   | GR ISLD3 345.    |                   | 1  |
| 13,468           | MOORE 3 345.    | PAULINE3 345.    |                   | 1  |
| 13,468           | SWEET W3 345.   | GR ISLD3 345.    |                   | 1  |
| 13,468           | HOLT.CO3 345.   | GR ISLD3 345.    |                   | 1  |
| 13,468           | S3454 3 345.    | WAGENER 3 345.   |                   | 1  |
| 13,468           | S3458 3 345.    | S3740 3 345.     |                   | 1  |
| 13,468           | S3458 3 345.    | 103&ROKEBY3 345. |                   | 1  |
| 13,468           | BELFELD3 345.   | CHAR.CK3 345.    |                   | 1  |
| 13,468           | LARAMIE3 345.   | STEGALL3 345.    |                   | 1  |
| 13,468           | 4CLEVLND 138.   | CLEVLND7 345.    | CLEVLND1 13.8     | 1  |
| 13,468           | CHAMSPR5 161.   | CHAMSPR7 345.    | CHAMSPR1 13.8     | 1  |
| 13,468           | TONITN5 161.    | TONITN7 345.     | TONITN1 13.8      | 1  |
| 13,468           | SHIPERD5 161.   | SHIPERD7 345.    | SHIPERD1 13.8     | 1  |
| 13,468           | KINGRIV5 161.   | KINGRIV7 345.    | KINGRIV1 13.8     | 1  |
| 13,468           | CHISHOLM7 345.  | CHISHOLM6 230.   | CHISHOLM1 13.2    | 1  |
| 13,468           | FTSMITH7 345.   | FTSMITH8 500.    | FTSMTH11 13.8     | 1  |
| 13,468           | RENFROW4 138.   | RENFROW7 345.    | RENFRO11 13.8     | 1  |
| 13,468           | POTTER_CO 7345. | POTTER_CO 6230.  | POTTER_TR 113.2   | 1  |
| 13,468           | SETAB 3 115.    | SETAB 7 345.     | SETAB 1 13.8      | 1  |
| 13,468           | WALKTAP3 115.   | WALKTAP7 345.    | WALKETP-T 13.8    | 1  |
| 13,468           | RENO 7 345.     | RENO 3 115.      | RENO 1X1 14.4     | 1  |
| 13,468           | RENO 7 345.     | RENO 3 115.      | RENO 2X1 14.4     | 1  |
| 13,468           | SUMMIT 7 345.   | SUMMIT 6 230.    | SUMMIT 1 14.4     | 1  |
| 13,468           | CLARK_TP 115.   | CLARKCOUNTY7345. | CLARK_TER 13.8    | 1  |
| 13,468           | ELMCREEK7 345.  | ELMCREK6 230.    | ELMCREEK1 13.8    | 1  |
| 13,468           | W.GRDNR7 345.   | WGARDNR5 161.    | WGAR T11 13.8     | 11 |
| 13,468           | NASHUA 7 345.   | NASHUA-5 161.    | NASH T11 13.8     | 11 |
| 13,468           | LANCER 115.     | SPERVIL7 345.    | SPRVL-T 13.8      | 1  |
| 13,468           | AXTELL 7 115.   | AXTELL 3 345.    | AXTELL 9 13.8     | 1  |
| 13,468           | HOSKINS7 115.   | HOSKINS3 345.    | HOSKNS19 13.8     | 1  |
| 13,468           | MCCOOL 7 115.   | MCCOOL 3 345.    | MCCOOL19 13.8     | 1  |
| 13,468           | SHELDON7 115.   | MOORE 3 345.     | MOORE 9 13.8      | 1  |
| 13,468           | REDWILO7 115.   | REDWILO3 345.    | REDWILO9 13.8     | 1  |
| 13,468           | THEDFRD7 115.   | CHERRY3 345.     | THEDFORD9 13.8    | 1  |
| 13,468           | STEGALL3 345.   | STGXFMR4 230.    | STEGALLM9 13.8    | 1  |

| Wind<br>Dispatch<br>MW | Bus 1            | Bus 2         | Transformer Bus<br>3 | ID |
|------------------------|------------------|---------------|----------------------|----|
| 13,468                 | WICHITA7 345.    | GILL TP7 345. |                      | 1  |
| 13,468                 | PLTMOUTH TAP345. | S3458 3 345.  |                      | 1  |
| 13,568                 | Pre Contingency  |               |                      |    |

*Table 19.5: Future 2 Voltage Collapse Transfers*

## **19.2: Final Reliability Assessment**

All projects in the 2015 ITP10 Consolidated Portfolio were incorporated into the ITP10 models and a steady state N-1 contingency analysis was performed to identify any new 100 kV and above reliability issues. From that analysis no new potential thermal overloads or potential voltage violations were identified.

## Section 20:Economic Needs

| Constraint                                                      | From Area | To Area | Avg Shadow Price At Max | Avg Shadow Price At Min | Hours at Max | Hours at Min | Congestion Score |
|-----------------------------------------------------------------|-----------|---------|-------------------------|-------------------------|--------------|--------------|------------------|
| 542985NEAST 5 543133CHARLOT5 1 FLO STRANGR7 - IATAN 7 1 34      | KCPL      | KCPL    | -136.71                 |                         | 2124         |              | 290,382          |
| 652421WILISTN7 659625JUDSON MW71 FLO WILLISTON27 115-MONT 7 1   | BASIN     | BASIN   | -50.74                  |                         | 5703         |              | 289,344          |
| 640287N.PLATT7 640365STOCKVL7 1 FLO GENTLMN3 345-REDWIL03 34    | NPPD      | NPPD    | -223.81                 |                         | 1075         |              | 240,597          |
| 524516CANYON_ WEST3524590DAWN 31 FLO BUSHLAND 6 230-DEAFSMI     | SWPS      | SWPS    | -114.53                 |                         | 936          |              | 107,201          |
| 3008165COLLINS 505498STOCKTN5 1 FLO NEOSHO 7 345-LACYGNE7 34    | ASEC      | SWPA    | -106.73                 |                         | 978          |              | 104,381          |
| 505498STOCKTN5 3001015MORGAN 1 FLO NEOSHO 7 345-LACYGNE7 34     | SWPA      | ASEC    | -105.54                 |                         | 862          |              | 90,974           |
| 539688S-DODGE3 539699W-DODGE3 1 FLO BASE CASE                   | MKEC      | MKEC    |                         | 30.51                   |              | 1294         | 39,482           |
| 531451MINGO 7 531429MINGO 3 1 FLO MINGO 7 345-SETAB 7 34        | SUNC      | SUNC    | -87.25                  |                         | 393          |              | 34,290           |
| 526435SUNDOWN 6526460AMOCO_SS 61 FLO SUNDOWN - SUNDOWN 1 230/   | SWPS      | SWPS    | -27.33                  |                         | 756          |              | 20,659           |
| 533180TEC E 3 533192HOOKJCT3 1 FLO TEC E 3 - TECHILE3 1 11      | WRI       | WRI     | -22.56                  |                         | 684          |              | 15,428           |
| 525830TUCO_INT 6526337JONES 61 FLO TUCO_INT 6 230-CARLISL       | SWPS      | SWPS    | -23.63                  |                         | 463          |              | 10,939           |
| 526161CARLISLE 6526160CARLISLE 31 FLO ALLEN 3 115-LUBBCK_       | SWPS      | GOLDEN  | -155.55                 |                         | 56           |              | 8,711            |
| 646221S1221 5 646255S1255 5 1 FLO S3459 3 345-S1209 5 16        | OPPD      | OPPD    |                         | 333.18                  |              | 25           | 8,329            |
| 532937NEOSHO 5 547469RIV4525 1 FLO LITCH 5 161-ASB349 5 16      | WRI       | EMDE    | -25.18                  |                         | 305          |              | 7,679            |
| 524282IATAN 7 532772STRANGR7 1 FLO HAWTH 7 345-NASHUA 7 34      | KCPL      | WRI     | -14.27                  |                         | 489          |              | 6,980            |
| 541205BLSPE 5 541235DUNCAN 5 1 FLO SIBLEYPL - CKLES-16 1 16     | GMO       | GMO     |                         | 20.43                   |              | 309          | 6,311            |
| 523961POTTER_CO 7523959POTTER_CO 61 FLO HITCHLAND 7 345-HITCHLA | SWPS      | SWPS    | -27.23                  |                         | 210          |              | 5,718            |
| 652565SIOUXCY4 640386TWIN CH4 1 FLO RAUN 3 345-HOSKINS3 34      | WAPAUM    | NPPD    | -147.51                 |                         | 38           |              | 5,605            |
| 515045SEMINOL7 515044SEMINOL4 P1 FLO SEMINOL4 138-SEMINOL7 34   | OKGE      | OKGE    | -92.14                  |                         | 58           |              | 5,344            |
| 532873SUMMIT 6 533381SUMMIT 3 1 FLO SUMMIT 6 230-SUMMIT 3 11    | WRI       | WRI     | -107.39                 |                         | 45           |              | 4,832            |
| 539654CIM-PLT3 539672E-LIBER3 1 FLO HAYNE3 115-NLIBTAP-B3 11    | MKEC      | MKEC    | -0.81                   |                         | 5478         |              | 4,447            |
| 542981LACYGNE7 532793NEOSHO 7 1 FLO EMPEC 7 345-WICHITA7 345    | KCPL      | WRI     | -20.04                  |                         | 219          |              | 4,389            |
| 659134SIDNEY 4 640302OGALALA4 1 FLO KEYSTON3 345-SIDNEY 3 34    | BASIN     | NPPD    | -95.54                  |                         | 26           |              | 2,484            |
| 512638CATSAGR5 509790CATOOSA4 1 FLO CATOOSA4 138-CATSAGR5 16    | GRDA      | AEPW    | -69.40                  |                         | 35           |              | 2,429            |
| 652519OAHE 4 652521SULLYBT4 1 FLO BASE CASE                     | WAPAUM    | WAPAUM  | -93.65                  |                         | 12           |              | 1,124            |

Table 20.1: Future 1 Economic Needs

| Constraint                                                       | From Area | To Area | Avg Shadow Price At Max | Avg Shadow Price At Min | Hours at Max | Hours at Min | Congestion Score |
|------------------------------------------------------------------|-----------|---------|-------------------------|-------------------------|--------------|--------------|------------------|
| 527799EDDY_NORTH 6527793EDDY_STH 32 FLO EDDY_NORTH 6 230 - E     | SWPS      | SWPS    | -88.44                  |                         | 5019         |              | 443,884          |
| 646221S1221 5 646255S1255 5 1 FLO S3459 3 345 - S                | OPPD      | OPPD    |                         | 408.02                  |              | 177          | 72,220           |
| 533163HOYT 3 533198HOYTJS 3 1 FLO HOYT 3 115 - N                 | WRI       | WRI     | -671.70                 |                         | 70           |              | 47,019           |
| 539688S-DODGE3 539699W-DODGE3 1 FLO BASE CASE                    | MKEC      | MKEC    |                         | 33.69                   |              | 1294         | 43,601           |
| 542985NEAST 5 543133CHARLOT5 1 FLO IATAN - STRANGER CREEK        | KCPL      | KCPL    | -95.87                  |                         | 220          |              | 21,092           |
| 526161CARLISLE 6526160CARLISLE 31 FLO ALLEN - LUBBOCK SOUTH 1    | SWPS      | GOLDEN  | -246.78                 |                         | 75           |              | 18,509           |
| 515044SEMINOL4 515178PARKLN 4 1 FLO SEMINOLE - VANOS TAP 1 1     | OKGE      | OKGE    | -106.24                 |                         | 144          |              | 15,299           |
| 640287N.PLATT7 640365STOCKVL7 1 FLO GENTLEMAN - RED WILLOW 1     | NPPD      | NPPD    | -146.06                 |                         | 79           |              | 11,539           |
| 543055SEOTTWA5 543066S.OTTWA5 1 FLO CENTENL5 161 - P             | KCPL      | KCPL    |                         | 14.90                   |              | 652          | 9,715            |
| 515045SEMINOL7 515044SEMINOL4 1 FLO SEMINOLE - SEMINOLE 1 34     | OKGE      | OKGE    | -58.30                  |                         | 137          |              | 7,987            |
| 652451RICHLDND7 661056LEWIS 7 1 FLO BELFELD3 345 - C             | BASIN     | BASIN   | -30.97                  |                         | 239          |              | 7,401            |
| 514876SW134TP4 514902MCCLAIN4 1 FLO MCCLAIN4 138 - P             | OKGE      | OKGE    |                         | 24.94                   |              | 272          | 6,783            |
| 543067CENTENL5 543069PAOLA 5 1 FLO S.OTTWA5 161 - P              | KCPL      | KCPL    |                         | 40.00                   |              | 166          | 6,640            |
| 652565SIOUXCY4 640386TWIN CH4 1 FLO RAUN - HOSKINS 1 345 (M      | WAPAUM    | NPPD    | -101.45                 |                         | 58           |              | 5,884            |
| 524623DEAFSMITH 6524622DEAFSMITH 31 FLO DEAFSMITH - DEAFSMITH 2  | SWPS      | SWPS    | -20.99                  |                         | 248          |              | 5,206            |
| 503912FULTON 3 3388753PATMOS-W# 1 FLO LONGWOOD - SAREPATA 1 34   | AEPW      | AECCEES | -43.85                  |                         | 113          |              | 4,955            |
| 532937NEOSHO 5 547469RIV4525 1 FLO ASBURY - LITCHFIELD 1 16      | WRI       | EMDE    | -33.38                  |                         | 122          |              | 4,072            |
| 533008TV1MNDV4 533020NEOSHO54 1 FLO DELWARE4 138 - F             | KEPCWERE  | WRI     |                         | 109.18                  |              | 36           | 3,930            |
| 509758PRATTV-4 509815S.S.---4 1 FLO RIVERSIDE - EXPLORER GLE     | AEPW      | AEPW    |                         | 294.43                  |              | 11           | 3,239            |
| 659372LARSON 4672603BDV 4 1 FLO FORBES 2 500 - R                 | BASIN     | SPC     |                         | 3.06                    |              | 854          | 2,612            |
| 505492SPRGFLD5 549970CLAY 51 FLO HUBEN - MORGAN 1 345 (A         | SWPA      | SPCIUT  | -72.93                  |                         | 34           |              | 2,480            |
| 525830TUCO_INT 6526337JONES 61 FLO TUCO - CARLISLE 1 230 (       | SWPS      | SWPS    | -13.27                  |                         | 183          |              | 2,428            |
| 659155LOGAN 7 659307SWMINOT CP71 FLO BLAISDELL 4 230 - B         | BASIN     | BASIN   | -60.87                  |                         | 37           |              | 2,252            |
| 549984BROOKLINE 7549969BROOKLINE 51 FLO BROOKLINE - XFR 2 345/16 | SPCIUT    | SPCIUT  | -99.68                  |                         | 16           |              | 1,595            |
| 645457PLTMOUTH TAP645456S3456 3 1 FLO SUB 3740 - SUB 3455 1 34   | OPPD      | OPPD    | -9.58                   |                         | 157          |              | 1,504            |

Table 20.2: Future 2 Economic Needs



# 2015 ITPNT

## 2015 Integrated Transmission Plan Near-Term Assessment

January 27, 2015

Engineering

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## Revision History

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| Date       | Author    | Change Description                                                                   |
|------------|-----------|--------------------------------------------------------------------------------------|
| 12/22/2014 | SPP staff | Draft                                                                                |
| 12/29/2014 | SPP staff | Approved by TWG                                                                      |
| 1/12/15    | SPP staff | Removed blank rows in Table 5.3                                                      |
| 1/12/2015  | SPP staff | Added Final Reliability Assessment section                                           |
| 1/13/15    | SPP staff | Updated Table 5.4 with accurate costs per state                                      |
| 1/13/15    | SPP staff | Removed 21 mile 115 kV line from Walkemeyer – North Liberal based upon MOPC approval |
|            |           |                                                                                      |

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## Executive Summary

The Integrated Transmission Planning (ITP) process is Southwest Power Pool's iterative three-year study process that includes 20-Year, 10-Year and Near Term Assessments. The 20-Year Assessment identifies transmission projects, generally above 300 kV, needed to provide a grid flexible enough to provide benefits to the region across multiple scenarios. The 10-Year Assessment focuses on facilities 100 kV and above to meet system needs over a ten-year horizon. The Near Term Assessment is performed annually and assesses system upgrades, at all applicable voltage levels, required in the near term planning horizon to address reliability needs. Along with the Highway/Byway cost allocation methodology, the ITP process promotes transmission investment that will meet reliability, economic, and public policy needs<sup>1</sup> intended to create a cost-effective, flexible, and robust transmission network that will improve access to the region's diverse generating resources. This report documents the Near-Term Assessment that concluded in January 2015.



The 2015 ITPNT used two scenario models, Scenario 0 and Scenario 5, built across multiple years and seasons to evaluate power flows across the grid to account for various system conditions across the near-term horizon. The first scenario (S0) contains projected transmission transfers between SPP legacy BA's and generation dispatch on the system. The second scenario (S5) maximized all applicable confirmed long-term firm transmission service with its necessary generation dispatch.

Additionally, a Consolidated Balancing Authority (CBA) model scenario was built across the same years and seasons to show the needs on the SPP transmission system as a result of a Security Constrained Unit Commitment (SCUC) and Security Constrained Economic Dispatch (SCED).

| Voltage Class | New Line (miles) | Rebuild/Reconductor (miles) |
|---------------|------------------|-----------------------------|
| 345 kV        | 0                | 0                           |
| 230 kV        | 0                | 0                           |
| 161 kV        | 17               | 0                           |
| 138 kV        | 0                | 19                          |
| 115 kV        | 1                | 76                          |
| 69 kV         | 3                | 67                          |

*Table 0.1: 2015 ITPNT Project List Breakdown - Lines by Voltage Class*

<sup>1</sup> The Highway/Byway cost allocation approving order is Sw. Power Pool, Inc., 131 FERC ¶ 61,252 (2010). The approving order for ITP is Sw. Power Pool, Inc., 132 FERC ¶ 61,042 (2010).

| Voltage Class | New Transformer |
|---------------|-----------------|
| 345/138       | 0               |
| 345/115       | 2               |
| 230/115       | 1               |
| 161/69        | 2               |
| 138/69        | 1               |
| 115/69        | 2               |

*Table 0.2: 2015 ITPNT Project List Breakdown - New Transformer by Voltage Class*

The total cost of the 2015 ITPNT project plan is estimated to be \$248.2 million for upgrades that will receive an NTC, NTC-C, or NTC Modify. Of that total, \$213.1 million comes from new projects identified in the 2015 ITPNT Assessment. Upgrades recommended for an NTC Modify account for \$35.1 million of the total project plan cost.

These upgrades that will receive an NTC, NTC-C, or NTC Modify solves 208 transmission overload violations and 64 voltage violations.

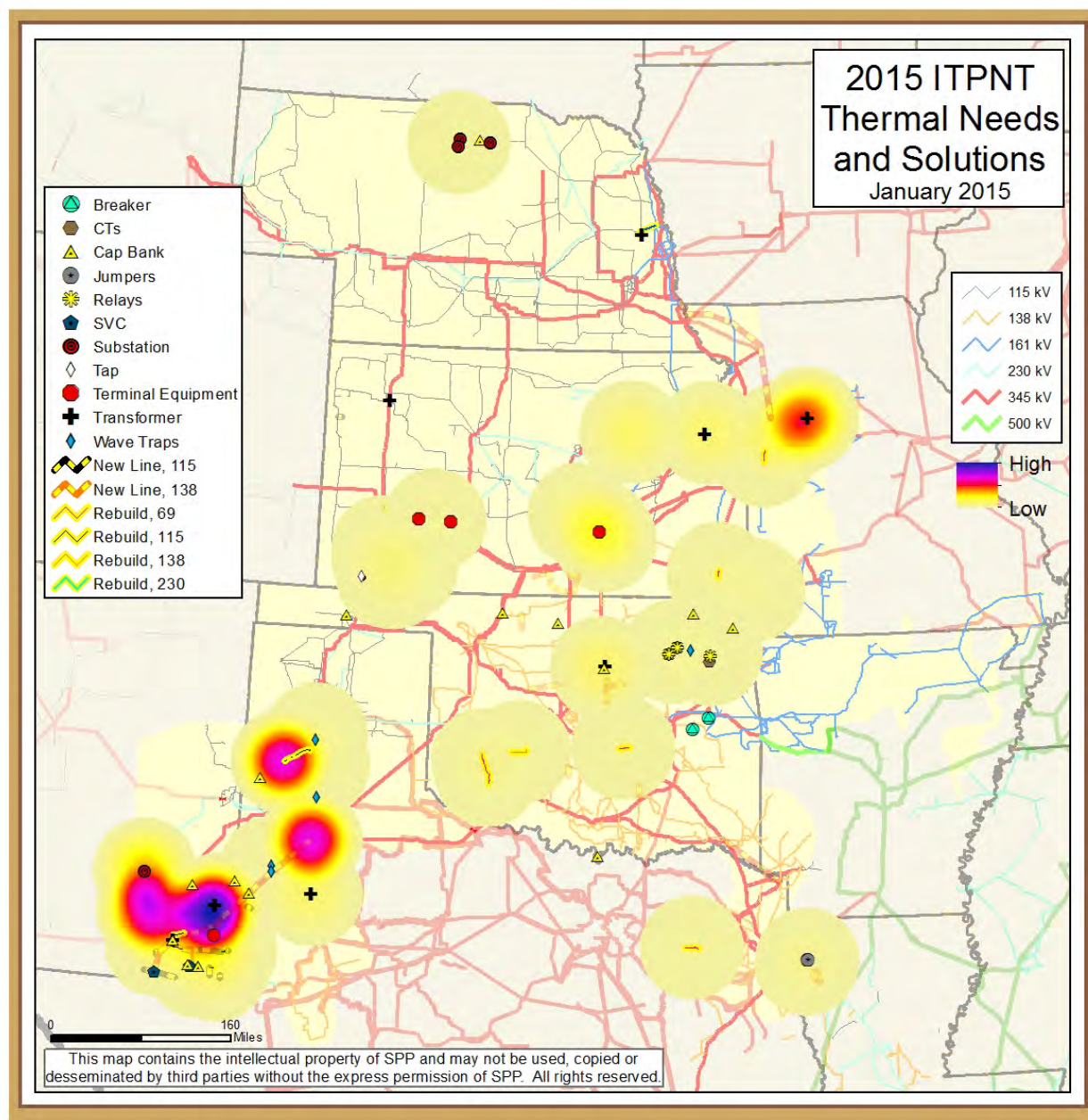


Figure 0.1: 2015 ITPNT Thermal Needs and Solutions



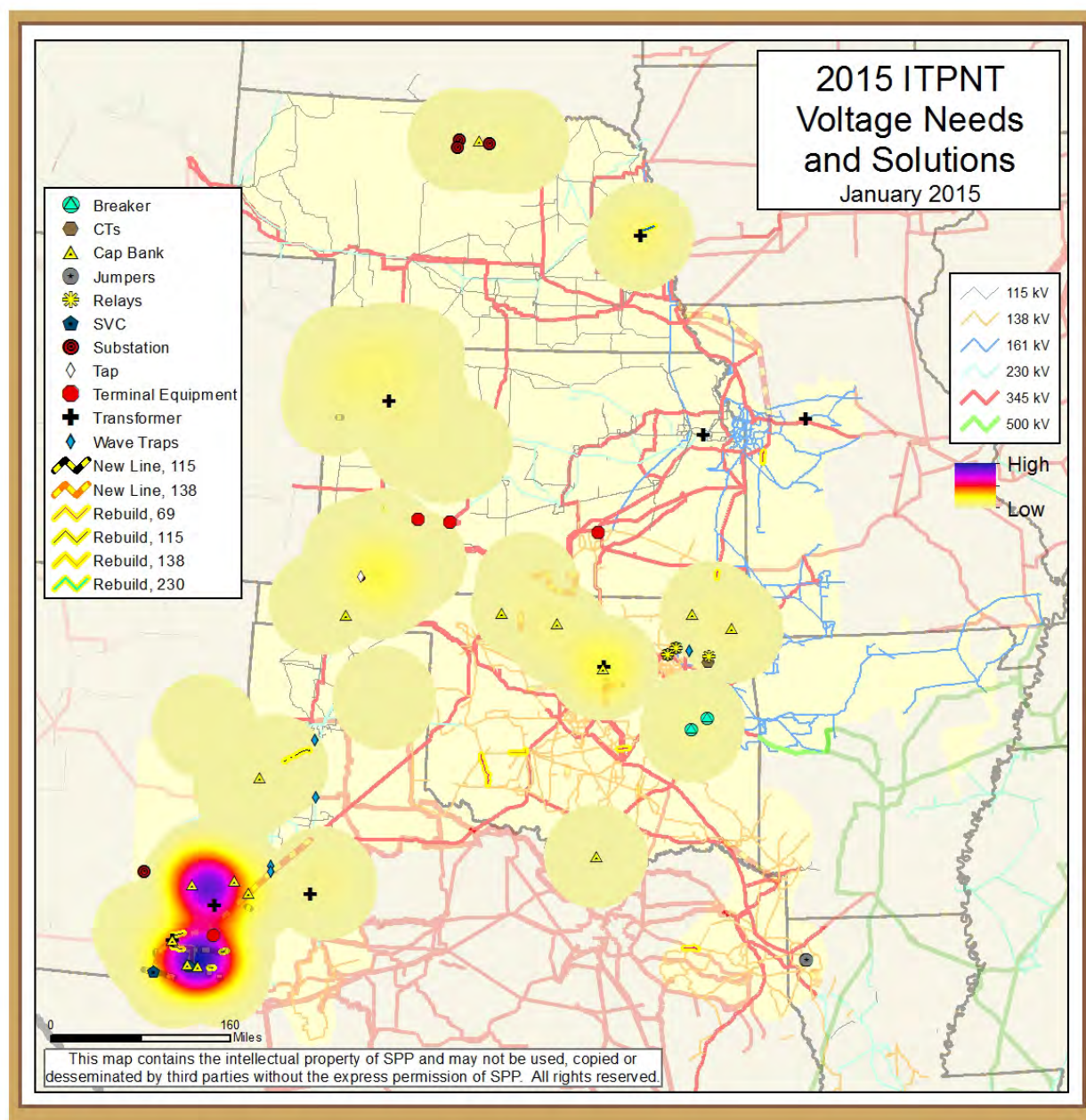


Figure 0.2: 2015 ITPNT Voltage Needs and Solutions

# PART I: STUDY PROCESS



---

## Section 1: Introduction

---

### **1.1: The ITP Near-Term**

The ITPNT is designed to evaluate the near-term reliability and robustness of the SPP transmission system, identifying needed upgrades through stakeholder collaboration. The ITPNT focuses primarily on solutions required to meet the reliability criteria defined in OATT Attachment O Section III.6. The process coordinates the ITP20, ITP10, Aggregate Studies, Attachment AQ Studies, and the Generation Interconnection transmission plans by communicating potential solutions between processes and using common solutions when appropriate. Unlike the ITP10 and ITP20, the ITPNT is not intended to focus on solutions based on a preferred voltage level, but to effectively solve all potential reliability needs in their entirety.



The 2015 ITPNT process produces a reliable near-term plan for the SPP footprint which identifies solutions to potential issues for system intact and single contingency (N-1) conditions using the following principles:

- Identifying potential reliability-based problems consisting of NERC Reliability Standards TPL-001 and TPL-002, SPP Criteria and where applicable, local SPP Member criteria
- Utilizing Transmission Operating Guides
- Developing additional mitigation plans including transmission upgrades to meet the region's needs and maintain SPP and local SPP Member reliability/planning standards

The ITPNT process is open and transparent, allowing for stakeholder input throughout the assessment. Study results are coordinated with other entities, including embedded and Tier 1.

### **Goals**

The goals of the ITPNT are to:

- Focus on local and regional needs
- Evaluate the response of the system on NERC TPL-001 and TPL-002 Standards
- Utilize a cost-effective approach to analyze six year out transmission system needs
- Identify 69 kV and above solutions stemming from needs including, but not limited to the following:
  - Resolving reliability criteria needs
  - Improving access to markets
  - Improving interconnections with SPP's neighbors
  - Meeting expected load growth demands
  - Facilitating or responding to expected facility retirements



- Synergize the ITPNT with the Generation Interconnection (GI) process, Aggregate Transmission Service Study (ATSS) process, Attachment AQ Study process (AQ), and the ITP10 and ITP20 Assessments

The 2015 ITPNT is intended to provide solutions to ensure the reliability of the transmission system during the study horizon which includes modeling of the transmission system six years out (i.e. 2020). The specific near-term requirements of Attachment O are:

- The Transmission Provider shall perform the Near Term Assessment on an annual basis.
- The Near Term Assessment will be performed on a shorter planning horizon than the 10-Year Assessment and shall focus primarily on identifying solutions required to meet the reliability criteria defined in Section III.6.
- The assessment study scope shall specify the methodology, criteria, assumptions, and data to be used to develop the list of proposed near term upgrades.
- The Transmission Provider, in consultation with the stakeholder working groups, shall finalize the assessment study scope. The study scope shall take into consideration the input requirements described in Section III.6.
- The assessment study scope shall be posted on the SPP website and will be included in the published annual SPP Transmission Expansion Plan report.
- In accordance with the assessment study scope, the Transmission Provider shall analyze potential solutions, including those upgrades approved by the SPP Board of Directors from the most recent 20-Year Assessment and 10-Year Assessment, following the process set forth in Section III.8.

## **1.2: How to Read This Report**

This report focuses on the years 2015, 2016, and 2020 and is divided into multiple sections.

- Part I addresses the concepts behind this study's approach, key procedural steps in development of the analysis, and overarching assumptions used in the study.
- Part II addresses the specific results, describes the projects that merit consideration, and contains recommendations and costs
- Part III contains detailed data and holds the report's appendix material.

### **SPP Footprint**

Within this study, any reference to the SPP footprint refers to the set of legacy Balancing Authorities (BA) and Transmission Owners (TO) whose transmission facilities are under the functional control of the SPP Regional Transmission Organization (RTO) unless otherwise noted.

### **Supporting Documents**

The development of this study was guided by the supporting documents noted below. These documents provide structure for this assessment:

- SPP 2015 ITPNT Scope
- SPP ITP Manual

All referenced reports and documents contained in this report are available on SPP.org.

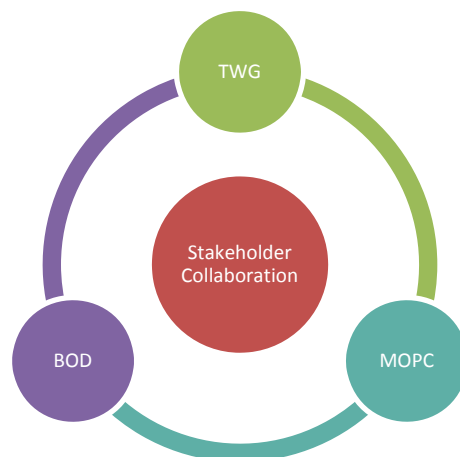
**Confidentiality and Open Access**

Proprietary information is frequently exchanged between SPP and its stakeholders in the course of any study and is extensively used during the ITP development process. This report does not contain confidential marketing data, pricing information, marketing strategies, or other data considered not acceptable for release into the public domain. This report does disclose planning and operational matters, including the outcome of certain contingencies, operating transfer capabilities, and plans for new facilities that are considered non-sensitive data.

## Section 2: Stakeholder Collaboration

Assumptions and procedures for the 2015 ITPNT analysis were developed through SPP stakeholder meetings that took place in 2013 and 2014. The assumptions were presented and discussed through a series of meetings with members, liaison-members, industry specialists, and consultants to facilitate a thorough evaluation. Groups involved in this development included the following:

- Transmission Working Group (TWG)
- Markets and Operations Policy Committee (MOPC)
- SPP Board of Directors (BOD)



SPP Staff served as facilitators for these groups and worked closely with the chairs to ensure all views were heard and that SPP's member-driven value proposition was followed.

The TWG provided technical guidance and review for inputs, assumptions, and findings. Policy level considerations were tendered to appropriate organizational groups including the MOPC. Stakeholder feedback was instrumental in the selection of the 2015 ITPNT projects.

- The TWG was responsible for technical oversight of the load forecasts, transmission topology inputs, constraint selection criteria, reliability assessments, transmission project designs, voltage studies, and the report.

### Planning Summits

In addition to the standard working group meetings, two transmission planning summits were conducted to elicit further input and provide stakeholders with a chance to interact with staff on all related planning topics.

### Project Cost Overview

Conceptual Estimates were prepared by SPP staff based on historical cost information submitted by TOs through the project tracking process. Refined cost estimates expected to be accurate within a  $\pm 30\%$  bandwidth were then prepared by a third party vendor. All cost estimates utilized in the 2015 ITPNT were developed in accordance with SPP Business Practice 7060, Notification to Construct and Project Cost Estimating Processes Effective January 1, 2012.

### Use of Transmission Operating Guides (TOG)

TOGs are tools used to mitigate issues in the daily management of the transmission grid. TOGs may be used as alternatives to planned projects and are tested annually to determine effectiveness in addressing thermal and voltage needs. The 2015 ITPNT identifies all solutions where the use of a TOG is not effective.

## Section 3: Study Drivers

### 3.1: Introduction

Drivers for the 2015 ITPNT were discussed and developed through the stakeholder process in accordance with the 2015 ITPNT Scope and involved stakeholders from several diverse groups. Stakeholder load, generation, and transmission were carefully considered in determining the need for, and design of, transmission solutions.

### 3.2: Load Outlook

#### Peak and Off-Peak Load

Future energy usage was forecasted by utilities in the SPP footprint and collected and reviewed through the efforts of the Model Development Working Group (MDWG). This assessment used both summer peak and light load scenarios to assess the performance of the grid in both peak and off-peak conditions.

#### Load Forecast

Load Serving Entities provided the load forecast used in the reliability analysis study models through the MDWG model building process.

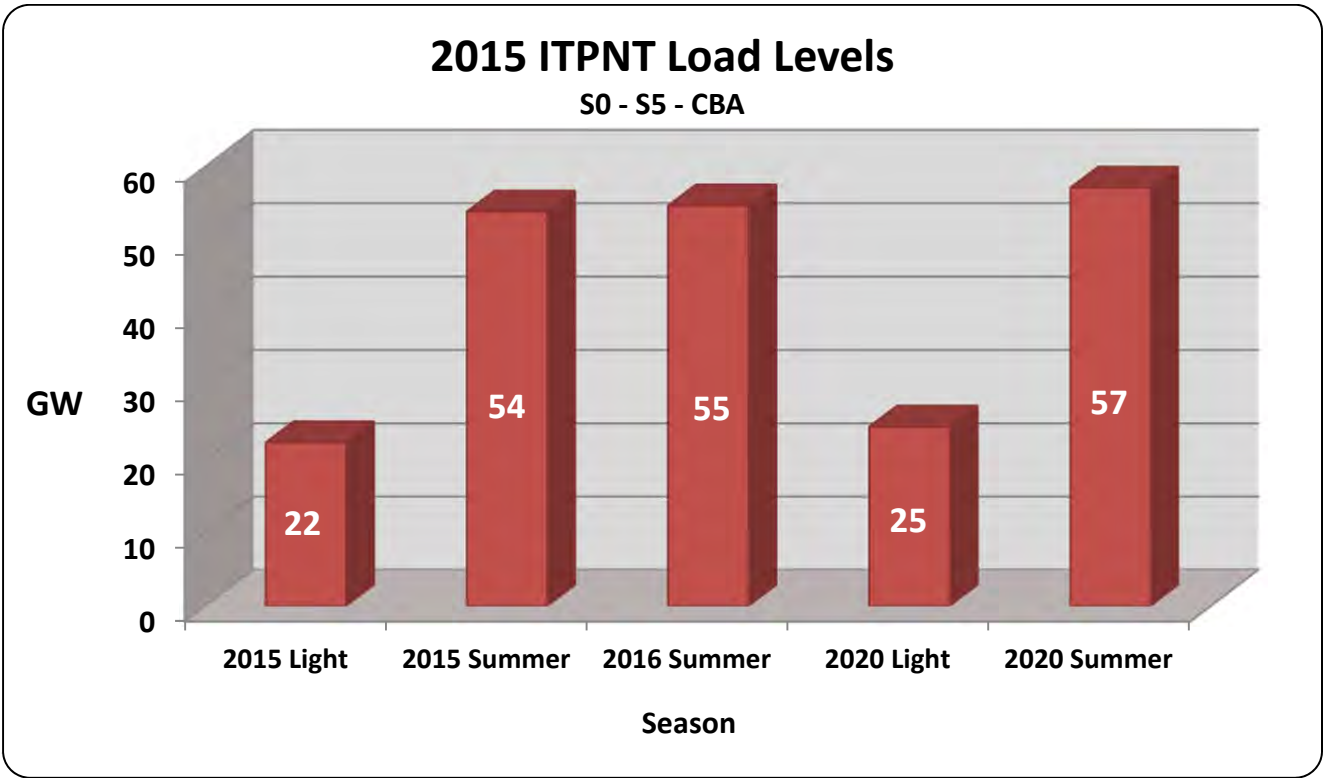


Figure 3.1: 2015 ITPNT Load Levels

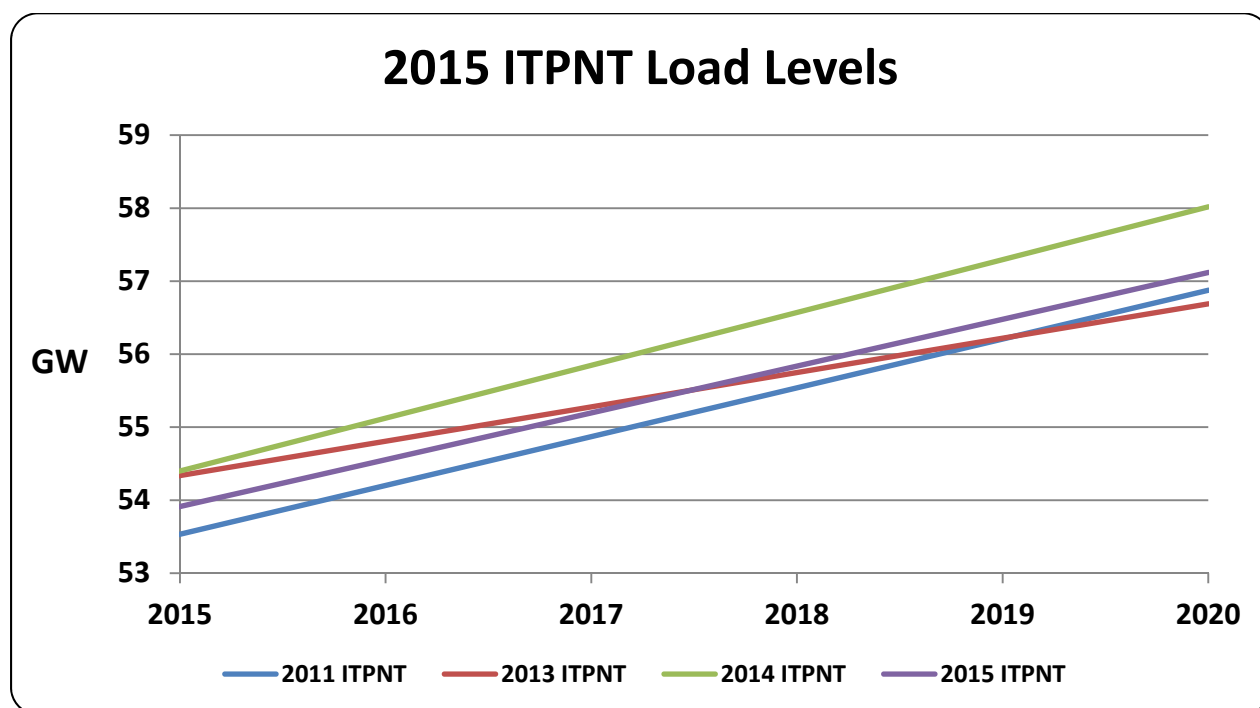


Figure 3.2: ITPNT Load Levels Comparisons

### 3.3: Generation

The three figures below show the difference between the Scenario 0, Scenario 5, and CBA Scenario models for each season. Note the significant difference in the wind output for the Scenario 5 models. The CBA Scenario dispatch methodology is discussed later in this report.

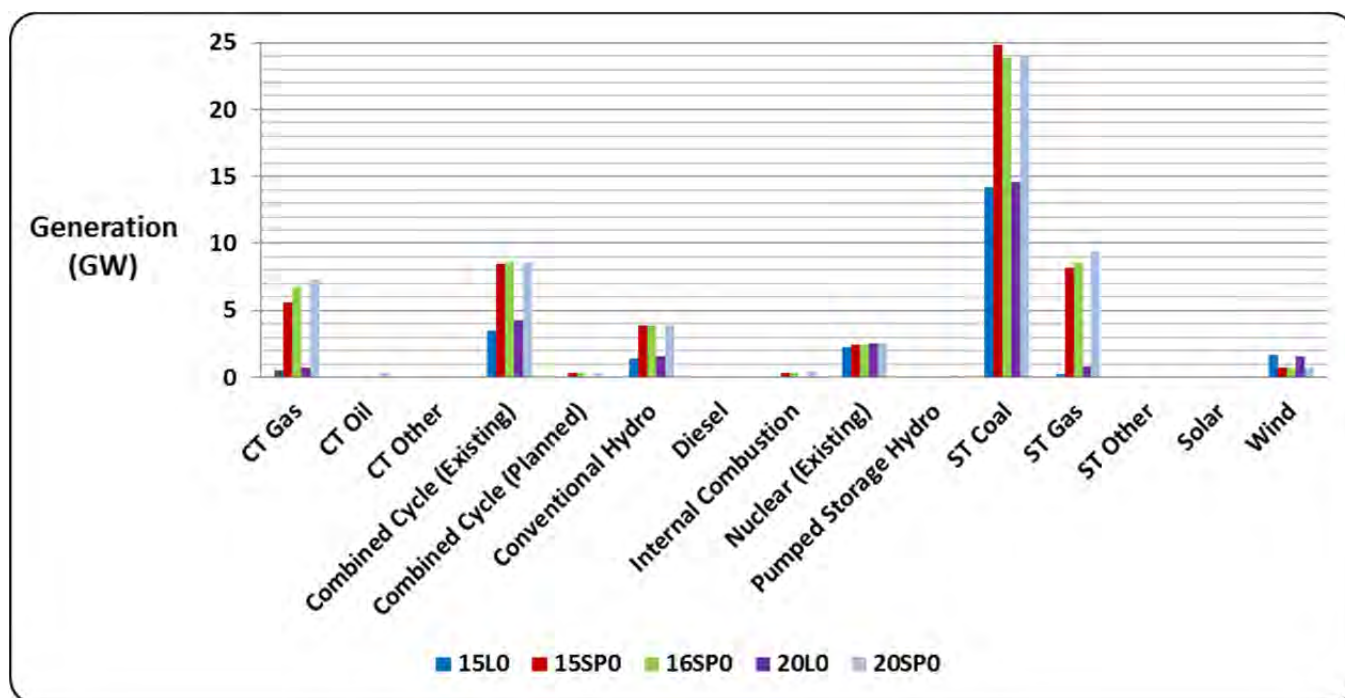


Figure 3.3: 2015 ITPNT Generation Mix Scenario 0

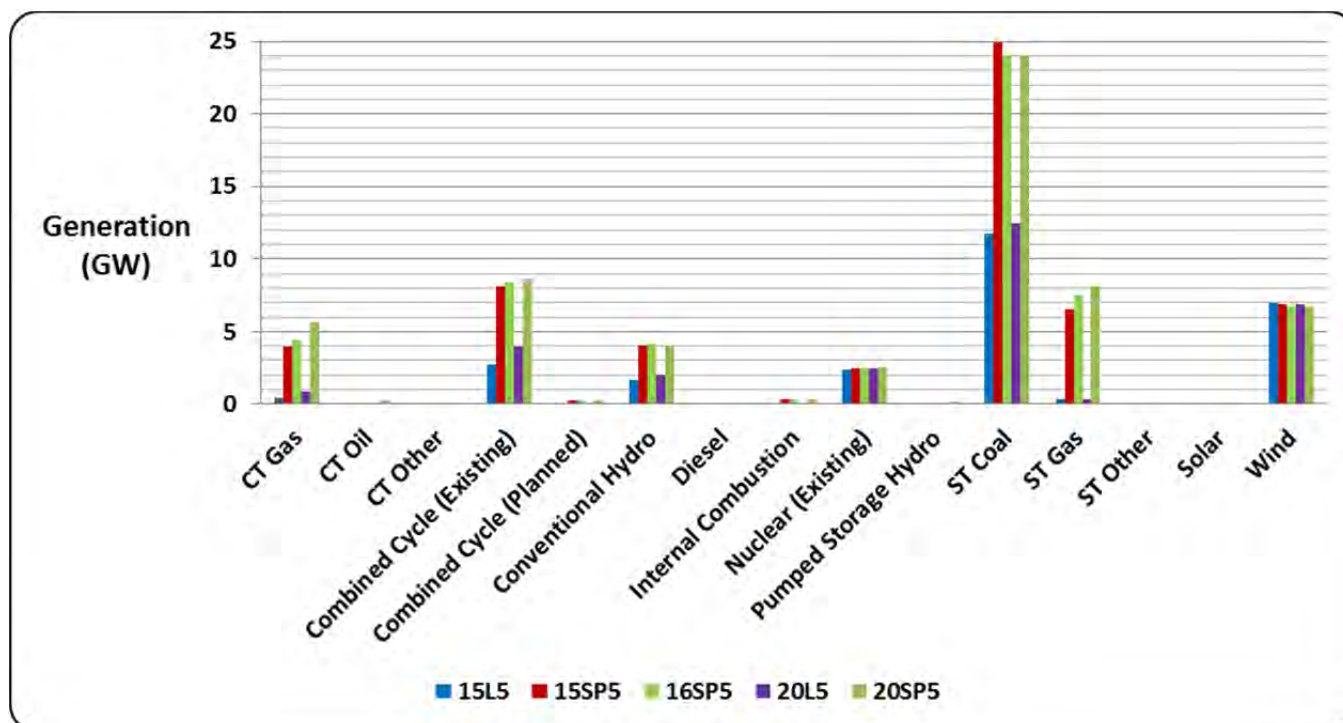


Figure 3.4: 2015 ITPNT Generation Mix Scenario 5

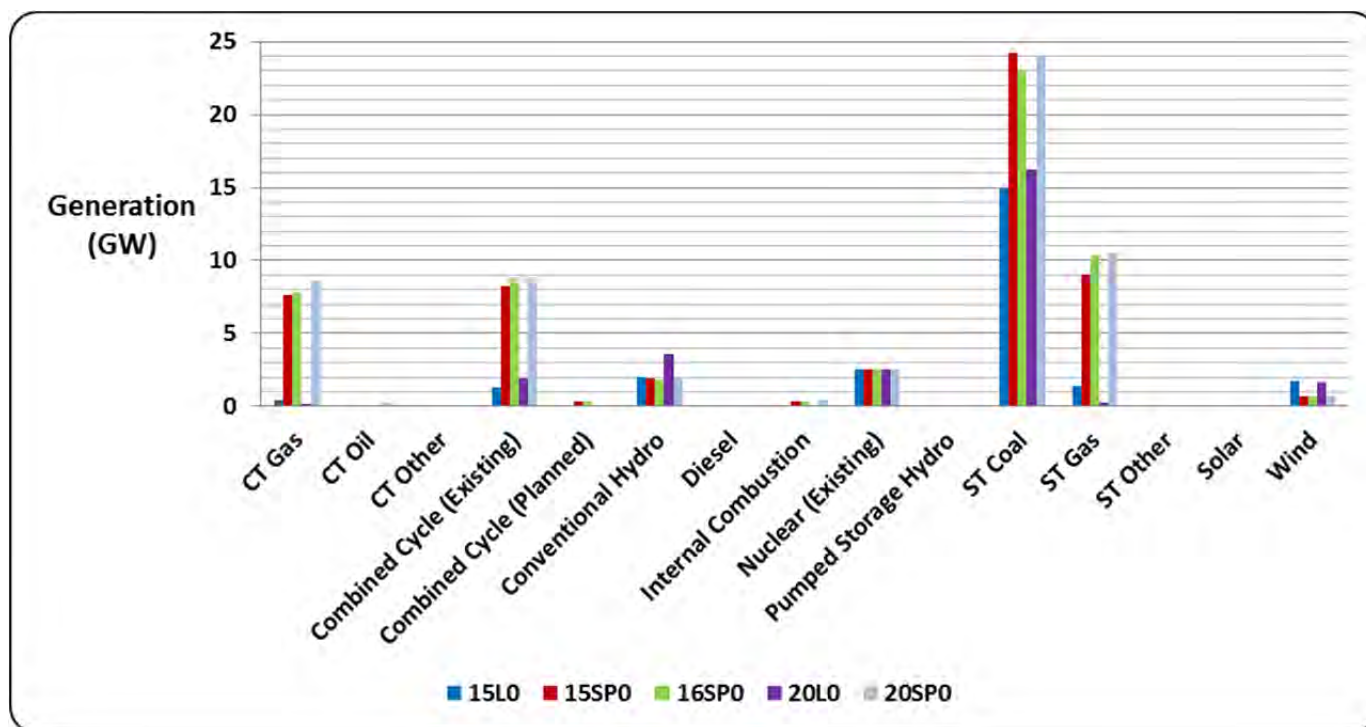


Figure 3.5: 2015 ITPNT CBA Generation Mix

### **3.4: Utilization of Different Voltage Levels**

#### **EHV Design Considerations**

When considering the design of an EHV grid, many factors must be considered, such as contingency planning, typical line lengths, line loadability, capacity requirements, voltage, reliability, cost, asset life, and operational issues.

#### **NERC N-1 Reliability Standards**

SPP designs and operates its transmission system to be capable of withstanding the next transmission outage that may occur; this is called “N-1” planning and is in accordance with NERC planning standards. Due to N-1 planning, any EHV network must be looped so that if one element of the EHV grid is lost, a parallel path will exist to move that power across the grid and avoid overloading the underlying transmission lines.

#### **Voltage Support**

A transmission line can either support voltage (produce VARs) or require voltage support from other reactive devices (consume VARs), depending on its loading level. In either case, transmission system design should account for these factors. Under light-load conditions, system voltages may rise due to VARs being produced from long EHV lines.

Shunt reactors would be necessary to help mitigate the rise in voltage. Some lines may need additional support to allow more power to flow through them. Series capacitors may be added to increase the loadability of a transmission line. However, the addition of series compensation can complicate operations and may lead to stability concerns.

#### **Construction Cost**

Cost plays a factor in EHV grid design. Lower-voltage designs cost less to construct initially. Higher voltage lines have a larger initial investment but provide significantly higher capacity and more flexibility in bulk power transport. Lower voltage lines offer more flexibility to act as a collector system for wind generation. Along with the initial cost, the lifetime of the asset needs to be considered. Transmission lines are generally assumed to have a 40-year life.

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## Section 4: Analysis Methodology

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### **4.1: Steady State Analysis**

Facilities in the SPP footprint 69 kV and above were monitored for exceeding 90% thermal loading or voltage below 0.95 per unit. Needs are generated at 100% thermal loading or voltage below 0.9 per unit for non-base case conditions and voltage below 0.95 per unit for base case conditions. All facilities in first-tier control areas were monitored at 100 kV and above. System intact (base case) and N-1 contingency analysis was performed on SPP facilities at 69 kV and above and at 100 kV and above for Tier 1 control areas in the 2015 ITPNT models.

After performing the initial reliability assessment identifying the bulk power problems, thermal and voltage needs were posted on the Trueshare site for stakeholder accessibility.

#### **Order 1000**

In order to comply with FERC's Order 1000, SPP developed the Transmission Owner Selection Process. In accordance with Attachment O, Section III.8.b, SPP shall notify stakeholders of identified transmission needs and provide a transmission planning response window of thirty (30) days during which any stakeholder may propose a detailed project proposal ("DPP"). SPP shall track each DPP and retain the information submitted pursuant to Attachment O, Section III.8.b(i). The initial 30 day window for proposals opened on June 30, 2014 for Scenario 0/5 thermal and voltage needs. Additional needs were discovered and a 30 day window opened July 12, 2014. The 30 day window for CBA thermal and voltage needs was opened October 27, 2014.<sup>2</sup>

#### **Project processing methodology**

Stakeholders submitted 493 DPPs through the new Order 1000 process and 24 FERC Order 890 projects. In addition to the DPPs and FERC Order 890 projects, 75 SPP staff solutions were considered to address the reliability needs. All together 592 projects were evaluated.

In order to efficiently evaluate the high volume of submitted and created projects that would solve all identified reliability needs within the allotted schedule; a software solution was developed by SPP. This comprehensive project testing tool tested an individual project against each reliability need identified in the Needs Assessment using PSS®E. The output of the tool indicated if the project mitigated the reliability need according to SPP Criteria for both thermal loading or per unit voltage. All automated results were then manually checked for result validation.

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<sup>2</sup> Information on the models, needs assessments, and solutions used in the 2015 ITPNT can be found on the SPP website [www.spp.org/Engineering/Order 1000/Order 1000 Documents](http://www.spp.org/Engineering/Order 1000/Order 1000 Documents)



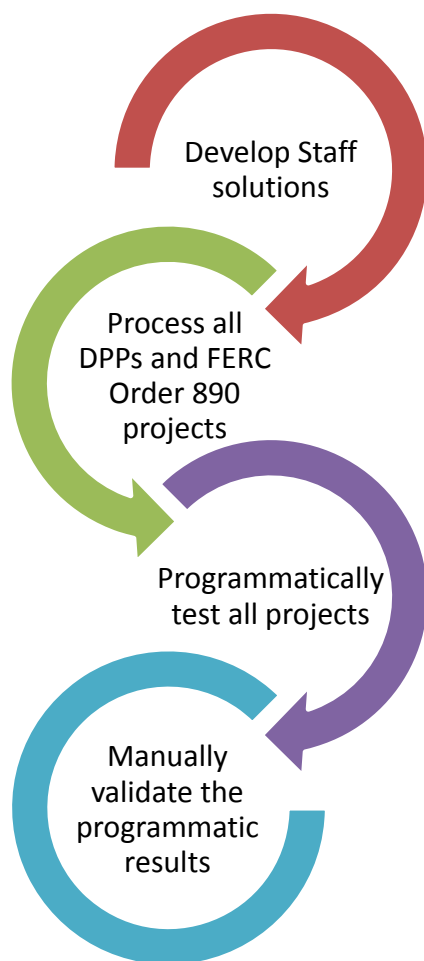


Figure 4.1: Project processing methodology overview

### Project selection methodology

SPP staff developed a standardized conceptual cost template for assigning project costs to all stakeholder submitted and SPP staff developed projects. Once all projects were assigned a cost, each project was compared against all other projects using a least cost metric. In order to perform a comparison of the extensive number of projects, a programmatic solution was developed by SPP staff. Using this project selection software, a subset of projects was generated that solved all reliability needs in the most cost effective manner. If two projects solved the same reliability needs, and one was more cost effective, then it was selected to be included in the portfolio for more analysis.

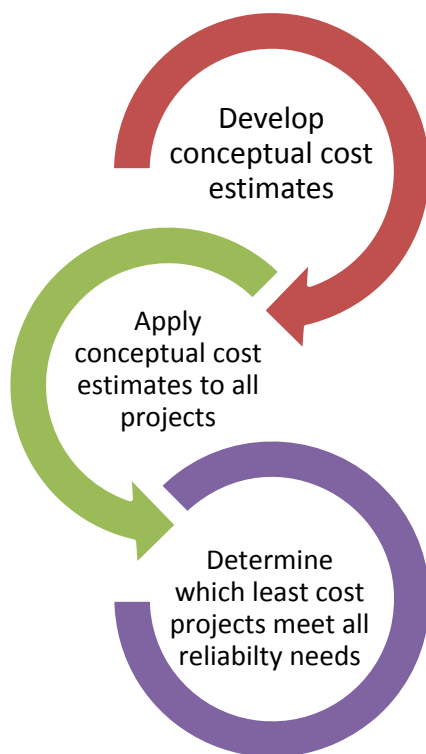


Figure 4.2: Project Selection

### Staging

Selected projects were then timed using linear interpolation based on line loading between available model years of 2015, 2016, and 2020. For example, to time a solution due to a 2020 potential overload, SPP interpolated line loadings between the 2016 and 2020 models to determine when the loading exceeded 100%. The need date was assigned based on this analysis. A similar process for timing potential voltage issues was used to check for per unit under-voltage conditions below 0.90.

SPP transmission system performance was assessed from different perspectives designed to identify transmission expansion projects necessary to accomplish the reliability objectives of the SPP Regional Transmission Organization (RTO).

- Avoid exposure to Category A and B NERC Transmission Planning (TPL) standard criteria violations during the operation of the system under high stresses
- Contribute to the voltage stability of the system
- Reduce congestion and increase opportunities for competition within the SPP Integrated Marketplace

## **4.2: CBA Model Development**

In order to account for the impacts of the Integrated Marketplace on the SPP footprint a Consolidated Balancing Authority (CBA) scenario model was developed as part of the 2015 ITPNT Assessment. The CBA scenario modeled SPP as a single BA and only modeled power transfers across the SPP seams. The CBA scenario utilized the SPP portion of the NERC Book of Flowgates updated with information from the 2014 Flowgate Assessment, 2015 ITPNT transmission topology, and 2015 ITP10 2024 Summer Base F1 Scenario economic dispatch data. The goal was to attain a SCUC and SCED for each year and season modeled in Scenario 0 and Scenario 5.

In order to simulate changes that will occur to the SPP portion of the NERC Book of Flowgates due to upgrades coming into service during the defined study period of the 2015 ITPNT Assessment, a constraint assessment was completed to determine if any system constraints should be added, removed, or modified before the SCUC/SCED was created. The constraint list was reviewed and approved by the TWG before being applied to the models.

Making use of the economic data from the 2015 ITP10 Assessment, an economic DC tool committed units, creating a dispatch to deliver the most economical power around the constraints approved by the TWG. This unit commitment and dispatch was the SCUC/SCED that was applied to the power flow model used to complete the N-1 contingency analysis described in the Steady State Analysis section. The security constrained economic dispatch in the CBA was applied to the SPP footprint only. The rest of the Eastern Interconnection remained unchanged.

## **4.3: Rate Impacts**

The SPP Open Access Transmission Tariff (OATT) requires that a “Rate Impact Analysis” be performed for each Integrated Transmission Plan (ITP) per Attachment O: Transmission Planning Process, Section III: Integrated Transmission Planning Process, Sub-Section 8):

“8) Process to Analyze Transmission Alternatives for each Assessment:

The following shall be performed, at the appropriate time in the respective planning cycle, for the 20-Year Assessment, 10-Year Assessment and Near Term Assessment studies:...

f) The analysis described above shall take into consideration the following:

vi) The analysis shall assess the net impact of the transmission plan, developed in accordance with this Attachment O, on a typical residential customer within the SPP Region and on a \$/kWh basis.”

The rate impact analysis process required to meet this 2015 ITPNT requirement was developed under the direction of the Regional State Committee in 2010-2011 by the Rate Impact Task Force (RITF). The RITF developed a methodology that allocated costs to specific rate classes in each SPP Pricing Zone (Zone).

The first step in this process is to estimate the zonal cost allocation of the Annual Transmission Revenue Requirement (ATRR). This cost allocated ATRR is calculated specifically for the ITPNT upgrades using the ATRR Forecast. The Forecast allocated 2015 ITPNT upgrade costs to the Zones using the Highway/Byway cost allocation method. This method allocates costs to the individual Zones and to the Region based on the voltage level of the upgrade. Transformer costs were allocated based on the low

side voltage. Regional ATRRs are summed and allocated to the Zones based on their individual Load Ratio Share percentages.

| Highway Byway Cost Allocation |          |       |
|-------------------------------|----------|-------|
| Voltage                       | Regional | Zonal |
| 300 kV and above              | 100%     | 0%    |
| 100 kV - 299 kV               | 33%      | 67%   |
| Below 100 kV                  | 0%       | 100%  |

*Table 4.1: Highway Byway Cost Allocation*

The following inputs and assumptions were required to generate the Forecast:

- Initial investment of each upgrade
  - New 2015 ITPNT upgrade investments modeled were \$248.2 million in 2014 dollars
- Transmission Owner's estimated individual annual carrying charge %
- Voltage level of each upgrade
- In-service year of each upgrade
- 2.5% annual straight line rate base depreciation
- 2.5% construction price inflation applied to 2014 base year estimates
- Mid-year in-service convention

# PART II: STUDY FINDINGS



## Section 5: Project Summary

### 5.1: Model Analysis and Results

The base case (N-0) and contingency (N-1) analysis that was completed provided SPP with a list of thermal and voltage needs. The table below summarizes all the observed unique thermal needs sorted by year and % loading and filtered to be unique by monitored element.

| % Overloads | 2015 | 2016 | 2020 |
|-------------|------|------|------|
| 100%-105%   | 2    | 2    | 14   |
| 105%-110%   | 4    | 3    | 4    |
| 110%-120%   | 4    | 1    | 6    |
| above 120%  | 11   | 0    | 13   |
| Subtotals   | 21   | 6    | 37   |
| Total       |      | 64   |      |

Table 5.1: Unique Thermal needs

The table below shows all the observed unique voltage needs sorted by year and the per unit voltage value observed in the base case (N-0) and under contingency (N-1) conditions and filtered to be unique by monitored element.

| Per Unit Voltage | 2015 | 2016 | 2020 |
|------------------|------|------|------|
| .90 - .95 p.u.   | 1    | 0    | 5    |
| .88 - .90 p.u.   | 4    | 22   | 26   |
| .85 - .88 p.u.   | 4    | 22   | 40   |
| below .85 p.u.   | 21   | 13   | 50   |
| Subtotals        | 30   | 57   | 121  |
| Total            |      | 208  |      |

Table 5.2: Unique Voltage needs

### 5.2: Reliability Needs and Solution Development Summary

Transmission upgrades submitted through the Order 890 and Order 1000 processes were analyzed and SPP Staff developed projects to mitigate potential reliability problems that were unable to be solved by mitigation plans or operating guides. Below is the full list of projects in the ITPNT.

| Reliability Project(s)                                                                                                                      | Project Area(s) | Monitored Element(s)*                                                                                                                                              | Miles Added/Modified | Need Date |
|---------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-----------|
| Rebuild Hobart-Snyder 69 kV line, upgrade jumpers, switches, CT ratios and relay settings at both substations and upgrade the bus at Synder | AEPW            | HOBART - ROOSEVELT TAP 69 kV<br>CKT 1<br>ROOSEVELT TAP-SNYDER 69 kV                                                                                                | 28.7                 | 6/1/2015  |
| New -50/+200 MVar SVC at China Draw 115 kV, new -50/+200 MVar SVC at Road Runner 115 kV                                                     | SPS             | DOLLARHIDE SUB 115 kV<br>AGAVE_RHILL3 115 kV<br>CHINA_DRAW 3 115 kV<br>BATTLE_AXE 3 115 kV                                                                         |                      | 4/1/2015  |
| Rebuild Grand Saline-Mineola 69 kV line, switches, CT ratios and relay settings at both substations, upgrade jumpers at Grand Saline        | AEPW            | GRAND SALINE - MINEOLA 69 kV<br>CKT 1                                                                                                                              | 13.8                 | 4/1/2020  |
| Rebuild Canyon West-Dawn-Panda-Deaf Smith 115 kV line                                                                                       | SPS             | CANYON WEST SUB - DAWN SUB<br>115 kV CKT 1<br>DAWN SUB - Panda Energy<br>Substation Hereford 115 kV CKT 1                                                          | 25.64                | 4/1/2018  |
| Replace wave traps at Amoco and Sundown 230 kV                                                                                              | SPS             | AMOCO SWITCHING STATION -<br>SUNDOWN INTERCHANGE 230 kV<br>CKT 1                                                                                                   |                      | 4/1/2020  |
| Replace wave trap at Claremore 161 kV                                                                                                       | GRDA            | PYRAMID CORNERS 69 kV                                                                                                                                              |                      | 6/1/2018  |
| Install a second 345/115 kV transformer at Mingo; Install any necessary 115 kV terminal equipment                                           | SUNC            | ONEOK 3 115 kV<br>MCDONLD3 115 kV<br>BVERVLLY 115 kV<br>ATWOOD 115 kV                                                                                              |                      | 6/1/2015  |
| Install second 115/69 kV transformer at Lovington; Install any necessary 69 kV terminal equipment                                           | SPS             | LEA COUNTY REC-SAN ANDRES<br>INTERCHANGE 115/69 kV<br>TRANSFORMER CKT 1                                                                                            |                      | 6/1/2015  |
| Upgrade wave trap at Amarillo South Interchange-Swisher County Interchange 230 kV                                                           | SPS             | AMARILLO SOUTH INTERCHANGE<br>- SWISHER COUNTY<br>INTERCHANGE 230 kV CKT 1                                                                                         |                      | 4/1/2020  |
| Rebuild Southwestern Station-Carnegie 138 kV, upgrade jumpers and CT ratios at Southwestern Station                                         | AEPW            | CARNEGIE - SOUTHWESTERN<br>STATION 138 kV CKT 1                                                                                                                    | 16.5                 | 6/1/2016  |
| Rebuild of the PCA Interchange and Quahada 115kV line                                                                                       | SPS             | PCA INTERCHANGE - QUAHADA<br>115 kV CKT 1<br>CARLSBAD INTERCHANGE -<br>PECOS INTERCHANGE 115 kV CKT<br>1<br>CENTRAL VALLEY REC-LUSK 69 kV<br>UNITED SALT SUB 69 kV | 11.08                | 6/1/2016  |
| Rebuild of the Little River and Maud 69kV line                                                                                              | OKGE            | LTRIVRT2 69 - MAUD 69 kV CKT<br>1                                                                                                                                  | 10.73                | 6/1/2015  |
| Rebuild of Harrisonville North and Ralph Green 69kV line                                                                                    | GMO             | HARRISONVILLE NORTH - RALPH<br>GREEN 69 kV CKT 1                                                                                                                   | 8.76                 | 6/1/2015  |

| Reliability Project(s)                                                                                                                                                          | Project Area(s) | Monitored Element(s)*                                                                                            | Miles Added/ Modified | Need Date |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------------------------------------------------------------------------------------------------------|-----------------------|-----------|
| Tap the Lawrence Hill-Swissvale 230kV line into Baldwin Creek substation and add a 230/115kV transformer at Baldwin Creek                                                       | WERE            | LAWRENCE HILL (LAWH TX-3) 230/115/13.8 kV TRANSFORMER CKT 1                                                      |                       | 6/1/2017  |
| Replace existing 161/69 kV transformer at South Waverly                                                                                                                         | KCPL            | SOUTH WAVERLY 161/69 kV TRANSFORMER CKT 1<br>ODESSA 161/69 kV TRANSFORMER CKT 1                                  |                       | 6/1/2015  |
| Tap Ainsworth-Stuart 115 kV line, install new 9 MVar Capacitor Bank at new Bassett substation                                                                                   | NPPD            | EMMETE.TAP<br>EMMETE.P22 7 115 kV<br>EMMETE.P22                                                                  |                       | 6/1/2016  |
| Install 138/69 kV bus tie transformer in OG&E Stillwater substation and interface OG&E Stillwater 69 kV substation with existing Stillwater Municipal 69 kV transmission system | OKGE            | STILLWATER KINZIE (KINAUTO1) 138/69/13.8 kV TRANSFORMER CKT 1                                                    |                       | 6/1/2019  |
| Rebuild Neosho SES-Labette 69 kV line                                                                                                                                           | WERE            | LABETTE SWITCHING STATION - NEOSHO 69 kV CKT 1                                                                   | 4.6                   | 6/1/2019  |
| Upgrade 115/69 kV transformer 1 at Lynn County                                                                                                                                  | SPS             | LYNN COUNTY INTERCHANGE (PENN 0154552) 115/69/13.2 kV TRANSFORMER CKT 1                                          |                       | 6/1/2019  |
| Rebuild Linwood-South Shreveport 138 kV line and upgrade jumpers at Linwood                                                                                                     | AEPW            | CEDARGROVE - LINWOOD 138 kV CKT 1<br>CEDAR GROVE – SOUTH SHREVEPORT 138 kV CKT 1                                 | 2.5                   | 6/1/2017  |
| Upgrade 138 kV terminal equipment at Benton                                                                                                                                     | WERE            | BENTON (BENT TX-2) 345/138/13.8 kV TRANSFORMER CKT 1                                                             |                       | 6/1/2015  |
| Upgrade breaker and relay at CPPX 69 kV substation                                                                                                                              | GRDA            | CPP TRANSF #2 - WILGRO 69 kV CKT 1                                                                               |                       | 6/1/2015  |
| Install second one stage 14.4 MVar Capacitor Bank at Texas County 115 kV bus                                                                                                    | SPS             | EVA REGULATOR 69 kV                                                                                              |                       | 6/1/2019  |
| Install 14.4 MVar Capacitor Bank at Cargill 115 kV bus                                                                                                                          | SPS             | FRIONA SUB 115 kV<br>DEAF SMITH REC-#20 115 kV<br>DEAF SMITH REC-#6 115 kV                                       |                       | 6/1/2019  |
| Rebuild Brooks Street-Edwards Street 69 kV line and upgrade jumpers at each end                                                                                                 | AEPW            | BROOKS STREET - EDWARDS STREET 69 kV CKT 1                                                                       | 0.8                   | 6/1/2016  |
| Install 14.4 MVar Capacitor Bank at Boomer 69 kV bus                                                                                                                            | GRDA            | STILLWATER PERKINS TAP 69 kV<br>STILLWATER CENTRAL 69 kV<br>STILLWATER HOSPITAL 69 kV<br>STILLWATER BOOMER 69 kV |                       | 6/1/2015  |
| Install 14.4 MVar Capacitor Bank at Lea County Bronco 69 kV bus                                                                                                                 | SPS             | LEA COUNTY REC-LOVINGTON INTERCHANGE 115/69 kV TRANSFORMER CKT 1                                                 |                       | 6/1/2015  |



| Reliability Project(s)                                                                                                                                                                                                                                                                                                             | Project Area(s) | Monitored Element(s)*                                                                                                                                                                                               | Miles Added/Modified | Need Date |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-----------|
|                                                                                                                                                                                                                                                                                                                                    |                 | LEA COUNTY REC-CROSSROADS 69 kV<br>LEA COUNTY REC-BRONCO TAP 69 kV<br>LEA COUNTY REC-BRONCO 69 kV                                                                                                                   |                      |           |
| Install 14.4 MVar Capacitor Bank at the Lea Rec Plains Interchange 69 kV bus                                                                                                                                                                                                                                                       | SPS             | LEA COUNTY REC-PRICE 69 kV<br>LEA COUNTY REC-LEWIS 69 kV<br>LEA COUNTY REC-NEWTEx 69 kV                                                                                                                             |                      | 6/1/2015  |
| Install 14.4 MVar Capacitor Bank at Four Corners 69 kV bus                                                                                                                                                                                                                                                                         | OKGE            | KREMLNT2 69 kV<br>KREMLIN 69 kV                                                                                                                                                                                     |                      | 6/1/2015  |
| Install new 69 kV breaker at Warner Tap to facilitate closing of the 69 kV switch at Wells substation                                                                                                                                                                                                                              | OKGE            | CHECOTA 69 kV<br>WELLS 69 kV                                                                                                                                                                                        |                      | 6/1/2015  |
| Install 12 MVar Capacitor Bank at Newport 69 kV bus                                                                                                                                                                                                                                                                                | GRDA            | NEWPORT 69 kV<br>MONKEY ISLAND 69 kV                                                                                                                                                                                |                      | 6/1/2015  |
| Install 10 MVar Capacitor Bank at Lea County Williams 69 kV bus                                                                                                                                                                                                                                                                    | SPS             | LEA COUNTY REC-DALLAS 69 kV<br>LEA COUNTY REC-WILLIAMS SUB 69 kV<br>LEA COUNTY REC-CAPROCK 69 kV                                                                                                                    |                      | 6/1/2015  |
| Install a 5 MVar Capacitor Bank at Winchester 69 kV bus                                                                                                                                                                                                                                                                            | WFEC            | WINCH_TAP 69 kV<br>WINCHESTER2 69 kV                                                                                                                                                                                |                      | 6/1/2020  |
| Install 3.6 MVar Capacitor Bank at Childers 69 kV bus                                                                                                                                                                                                                                                                              | GRDA            | PYRAMID CORNERS 69 kV                                                                                                                                                                                               |                      | 6/1/2018  |
| Install 3 MVar Capacitor Bank at Thackerville 69 kV bus                                                                                                                                                                                                                                                                            | WFEC            | THACKERVILLE 69 kV                                                                                                                                                                                                  |                      | 6/1/2019  |
| Replace CTs and relays on Collinsville and Skiatook 69 kV line                                                                                                                                                                                                                                                                     | GRDA            | COLLINSVILLE - SKIATOOK TAP 69 kV CKT 1                                                                                                                                                                             |                      | 6/1/2017  |
| Tap Hitchland-Finney 345 kV line at NewSub, new 345/115 kV transformer at NewSub, new NewSub-Walkemeyer 115 kV line                                                                                                                                                                                                                | SPS / SUNC      | CTU SUBLETTE - PIONEER TAP 115 kV CKT 1<br>BUCKNER7 345 - SPEARVILLE 345 kV CKT 1<br>CIMARRON RIVER PLANT - HAYNE3 115 kV CKT 1<br>CIMARRON RIVER PLANT 115 kV<br>HAYNE3 115 kV<br>KISMET 3 115 kV<br>CUDAHY 115 kV | 1                    | 6/1/2015  |
| Convert RIAC substation to 115 kV, new 3-way 115 kV line switch tapping Roswell Intg-Brasher 115 kV line, wreckout existing 69 kV transmission lines to RIAC substation and rebuild 69 kV line from north with new 115 kV line to RIAC, new breaker terminal at Roswell Intg, new 0.1 mile line out of Roswell Intg-Roswell 115 kV | SPS             | ROSWELL INTERCHANGE (AC *017772) 115/69/13.2 kV<br>TRANSFORMER CKT 1                                                                                                                                                | 1.5                  | 6/1/2015  |

| Reliability Project(s)                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Project Area(s) | Monitored Element(s)*                                                                                                                                                                | Miles Added/Modified | Need Date |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-----------|
| Reconductor IMC #1 Tap-Intrepid West, IMC #1-Livingston Ridge, Intrepid West-Potash Junction, Byrd-Monument, Ponderosa Tap-Whitten, National Enrichment Plant-Targa 115 kV lines, upgrade terminal equipment at Byrd 115 kV, upgrade wave trap at Whitten 115 kV, install 100 MVar Capacitor Bank at Potash 230 kV, install 28.8 MVar Capacitor Bank at Roadrunner 115 kV, install 28.8 MVar Capacitor Bank at Ochoa 115 kV, install 28.8 MVar Capacitor Bank at Agave Hill 115 kV | SPS             | National Enrichment Plant Sub - TARGA 3 115KV CKT 1<br>INTREPDW_TP3 - POTASH JUNCTION INTERCHANGE 115 kV CKT 1<br>IMC_#1_TP 3 115 kV<br>I. M. C. #1 SUB 115 kV<br>WOOD_DRAW 3 115 kV | 31.84                | 6/1/2015  |
| Upgrade terminal equipment at Buckner and Spearville 345 kV                                                                                                                                                                                                                                                                                                                                                                                                                        | SUNC            | BUCKNER7 345 - SPEARVILLE 345 kV CKT                                                                                                                                                 |                      | 6/1/2015  |
| Ainsworth - Ainsworth Wind 115 kV Ckt 1 Rebuild                                                                                                                                                                                                                                                                                                                                                                                                                                    | NPPD            | STUART 115 kV<br>AINSWORTH 115 kV<br>EMMETE.TAP<br>EMMETE.P22 7 115 kV<br>EMMETE.P22                                                                                                 | 7.13                 | 6/1/2020  |
| Accelerate NTC 200295 - Install new 161/69 kV transformer at Fremont to accommodate a new 161 kV interconnection, new 69 kV line from Fremont to new substation S6801, new 161 kV line from S1226 to new substation S1301                                                                                                                                                                                                                                                          | OPPD            | 991 TAP 69 kV<br>FREMONT SUB A 69 kV<br>FREMONT SUB B 69 kV                                                                                                                          | 20                   | 6/1/2016  |

\* Monitored Element(s) is/are not the all inclusive list of needs fixed by the project.

Table 5.3: 2015 ITPNT Projects

### Projects accelerated from 2015 ITP10 Assessment

The following projects were identified in the 2015 ITP10 Assessment that solved needs in the 2015 ITPNT:

- Rebuild Canyon West-Dawn-Panda 115 kV line
- Replace wave trap at Amoco and Sundown 230 kV
- Upgrade wave trap at Amarillo South Interchange-Swisher County Interchange 230 kV
- Replace wave trap at Claremore 161 kV
- Install a second 345/115 kV transformer at Mingo; Install any necessary 115 kV terminal equipment
- Install second 115/69 kV transformer at Lovington; Install any necessary 69 kV terminal equipment
- Install 14.4 MVar Capacitor Bank at the Lea Rec Plains Interchange 69 kV bus
- Tap Hitchland-Finney 345 kV line at NewSub; new 345/115 kV transformer at NewSub; new NewSub-Walkemeyer 115 kV line

### 5.3: Project Plan Breakdown

The figures below show a breakdown of the 2015 ITPNT project plan. There are 68 proposed upgrades making up 42 projects in the project plan. Of the 42 proposed projects 41 will be issued a new Notice to Construct (NTC/NTC-C). One project has been identified as needing a modified NTC (NTC Modify).

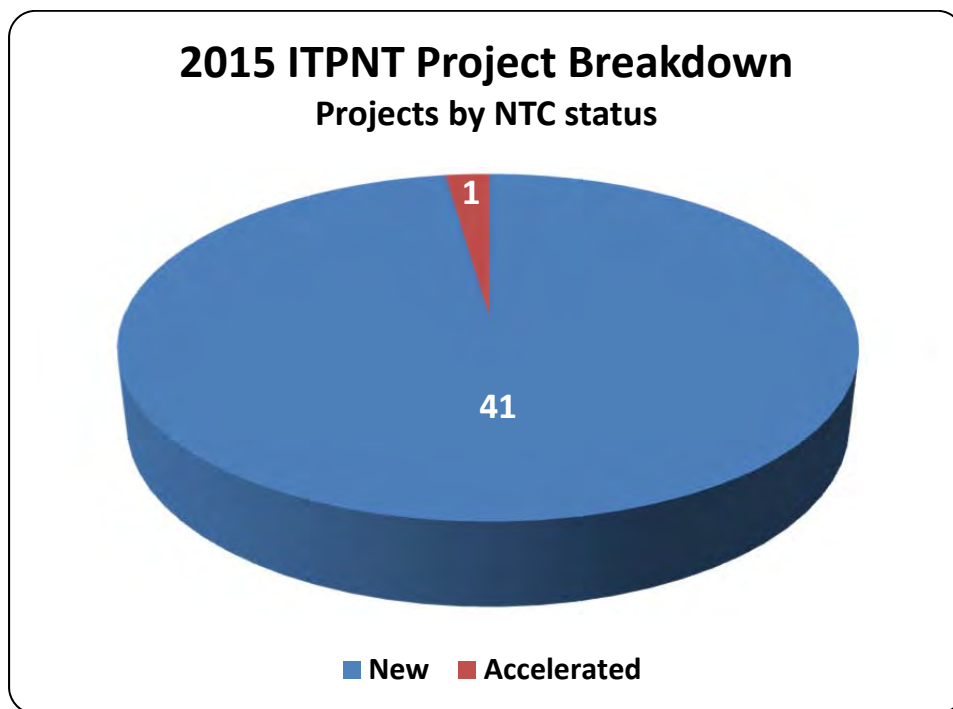


Figure 5.1: 2015 ITPNT Project Breakdown

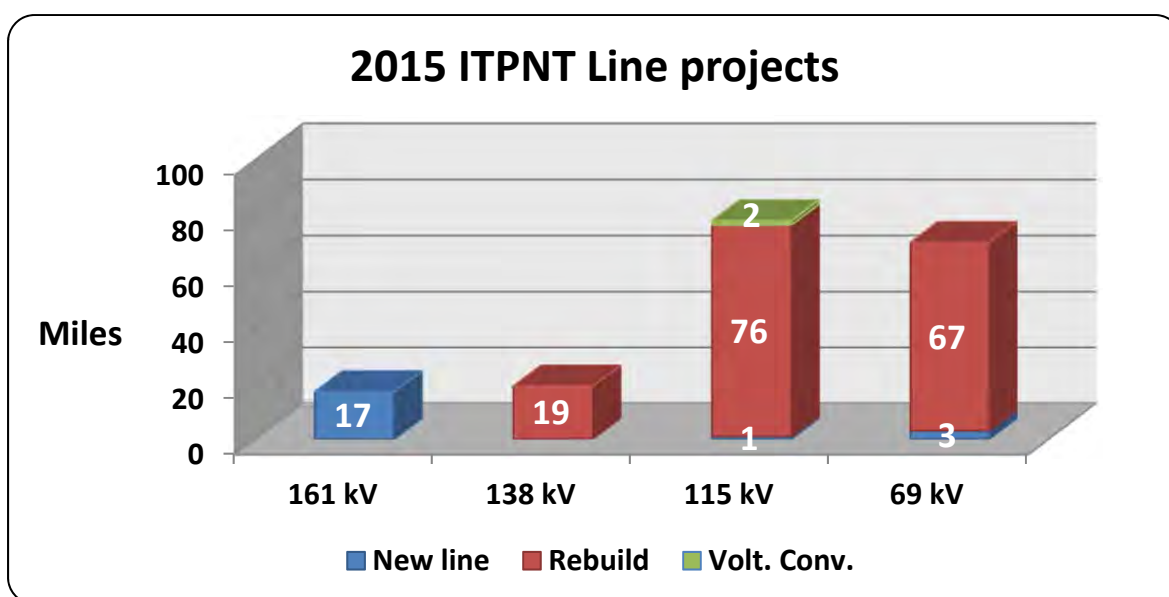


Figure 5.2: 2015 ITPNT Miles New and Rebuild by Voltage Class

The figure below shows the breakdown of new transmission by voltage class in the 2015 ITPNT project plan.

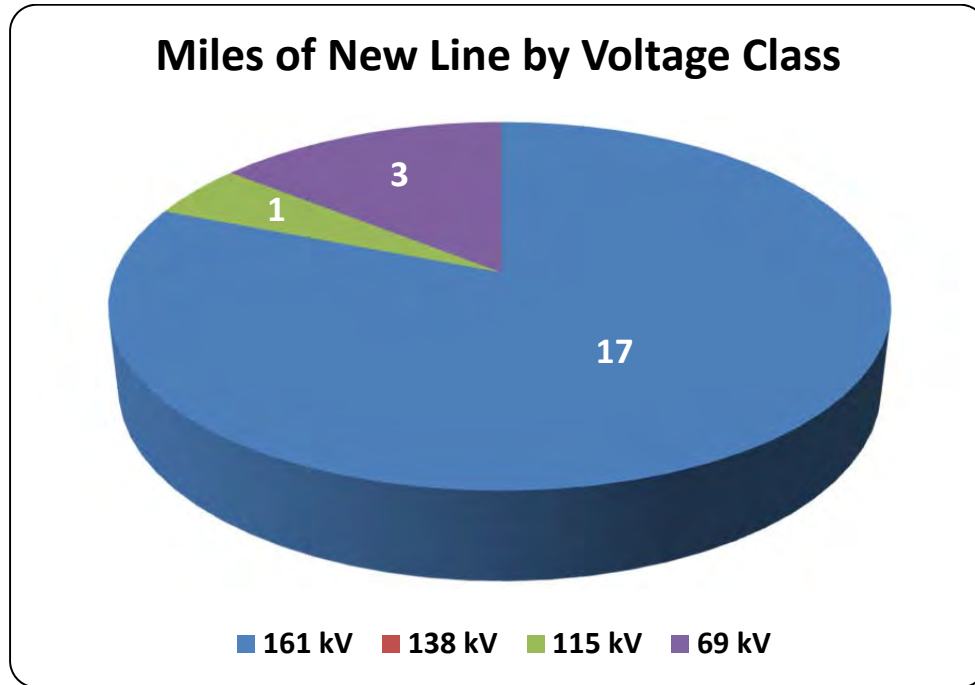


*Figure 5.3: 2015 ITPNT New Line by Voltage Class*

The figure below illustrates how many miles of existing transmission line that will require a rebuild or reconductor. There are 162 miles of rebuild/reconductor in the 2015 ITPNT project plan.

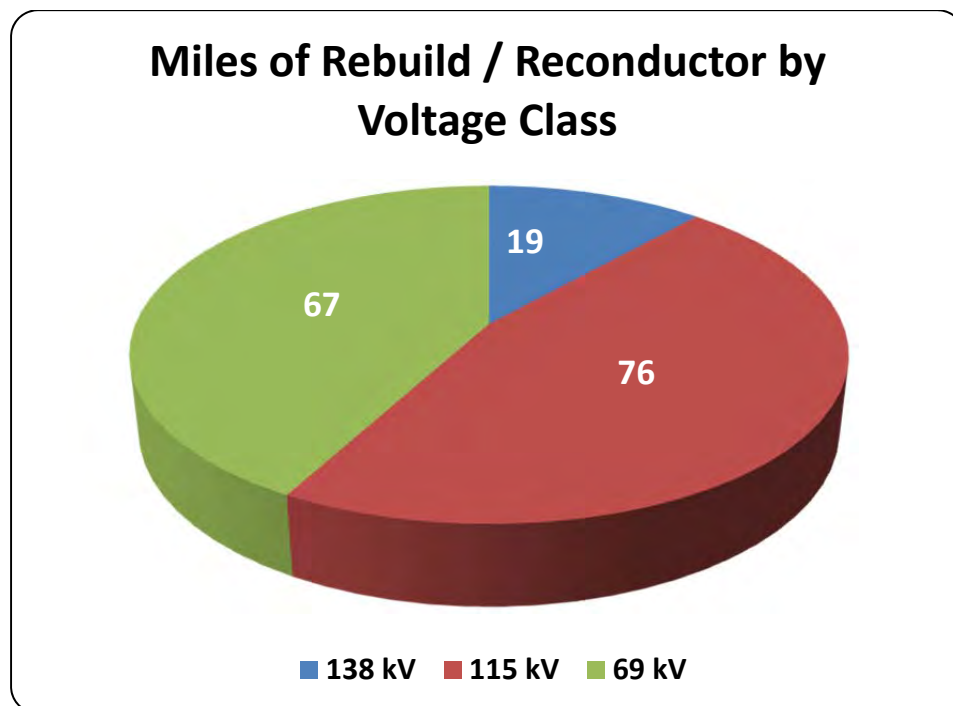


*Figure 5.4: 2015 ITPNT Miles Rebuild/Reconductor by Voltage Class*

The table below shows the dollar amount of new and modified projects of the 2015 ITPNT identified by state.

| State            | New NTC            | Modified NTC      |
|------------------|--------------------|-------------------|
| Arkansas         | 0                  | 0                 |
| Kansas           | 37,370,465         | 0                 |
| Louisiana        | 3,979,734          | 0                 |
| Missouri         | 5,770,858          | 0                 |
| Nebraska         | 11,197,764         | 35,091,946        |
| New Mexico       | 86,254,614         | 0                 |
| Oklahoma         | 38,994,767         | 0                 |
| Texas            | 29,517,730         | 0                 |
| <b>Subtotals</b> | <b>213,085,931</b> | <b>35,091,946</b> |

Table 5.4: 2015 ITPNT Projects by State

The figure below is a representation of the 2015 ITPNT portfolio of new and modified NTCs by voltage class. For each column the cost of the new or modified NTC is also displayed.

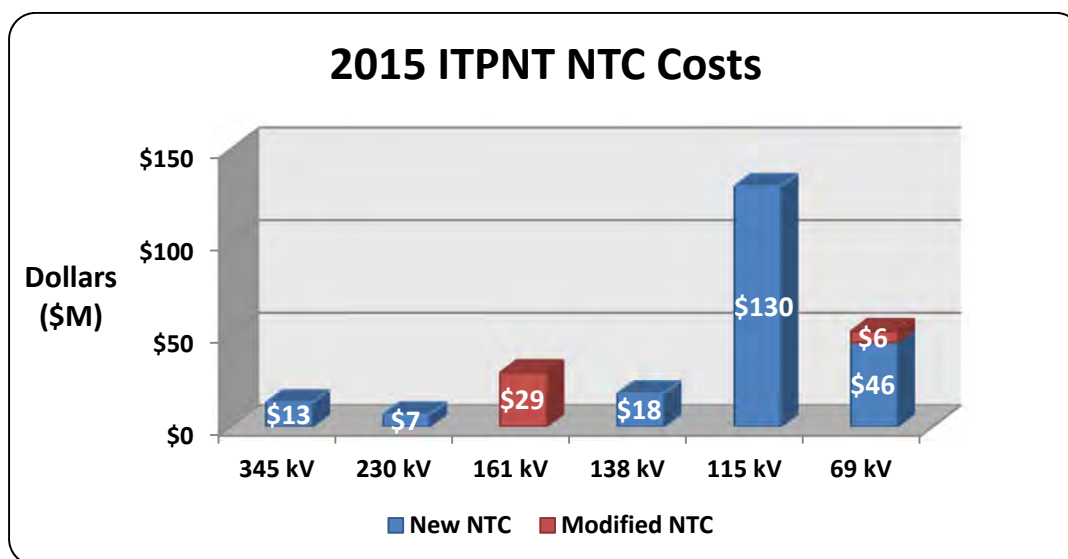


Figure 5.5: 2015 ITPNT NTC Costs by Voltage Class

The figure below shows the 2015 ITPNT projects represented two ways. The blue column represents the number of upgrades by year. The red column represents the dollars that will be invested to place the projects in service.

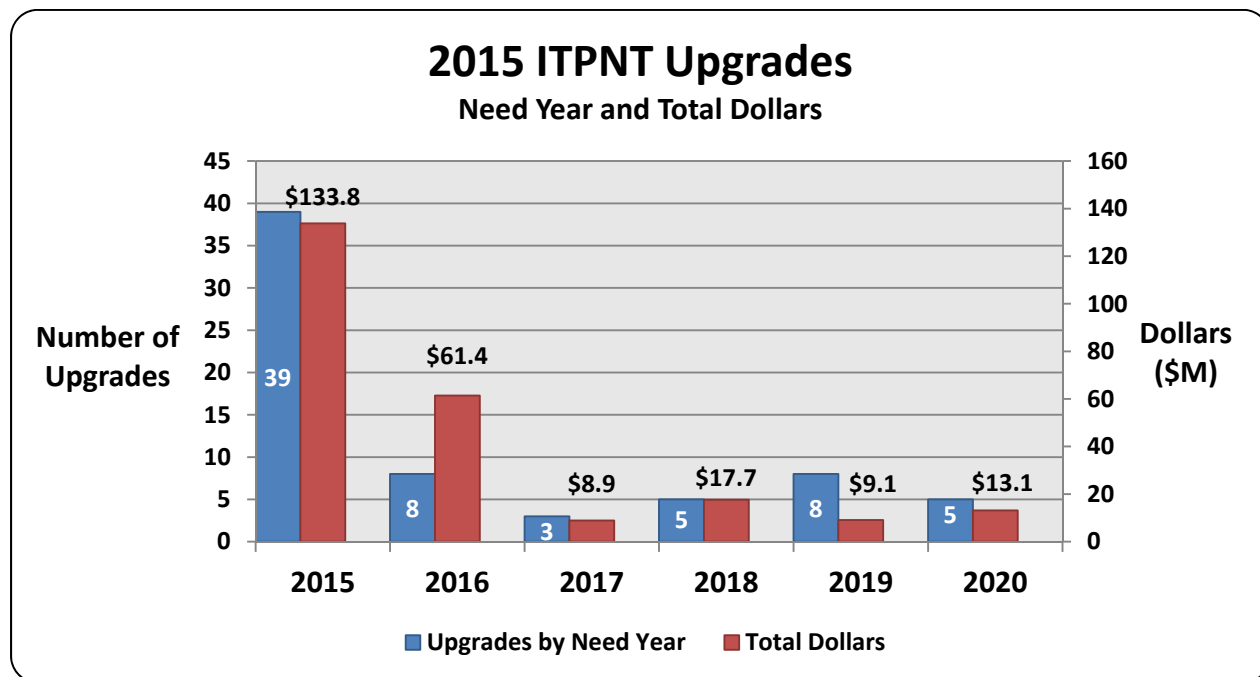


Figure 5.6: 2015 ITPNT Upgrades by Need Year and Total Dollars

The figure below shows the cost allocation of upgrades with new NTCs and modified NTCs between upgrades needed for Regional reliability and Zonal reliability.

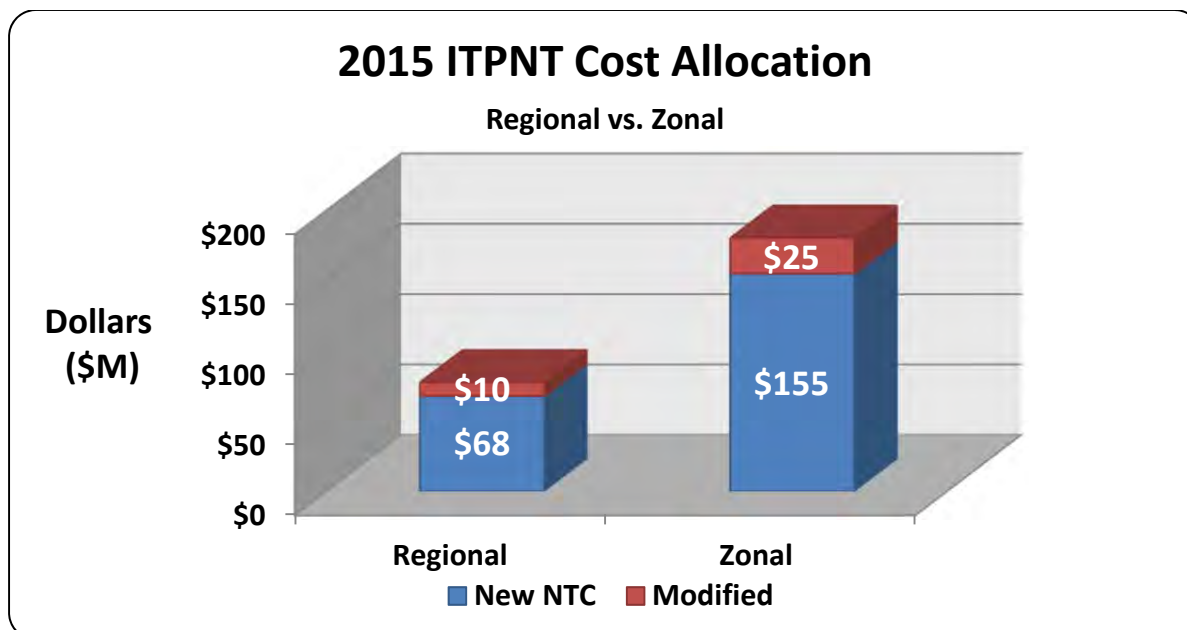


Figure 5.7: 2015 ITPNT Cost Allocation – Regional vs. Zonal



## 5.4: Project Details

This section details each of the major projects in the 2015 ITPNT project plan. Each of the projects discussed below have an SPP generated cost estimate greater than \$15 million and are needed for Regional Reliability.

### West Texas & New Mexico Area

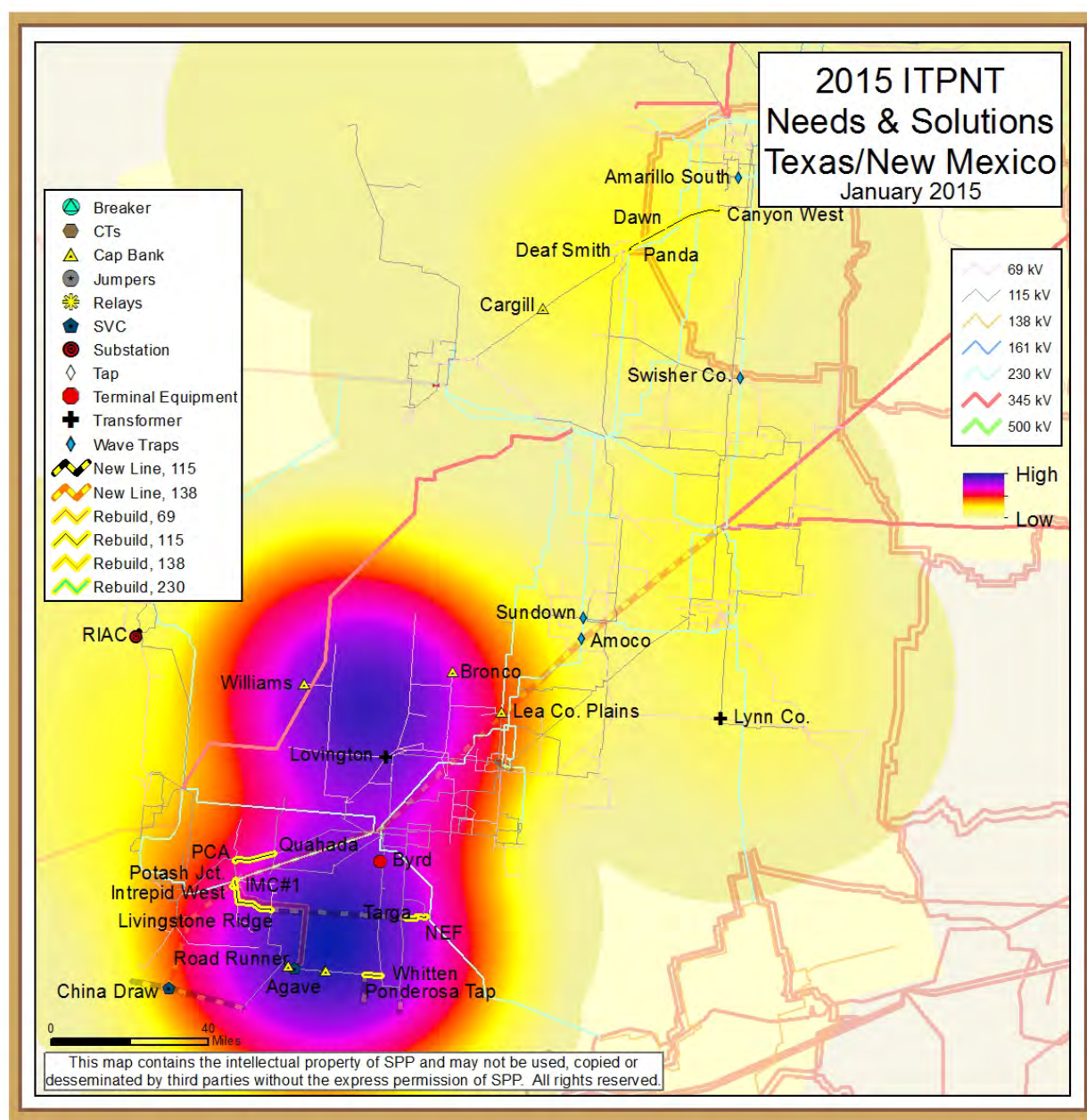


Figure 5.8: 2015 ITPNT West Texas & New Mexico Area Solutions

**Deaf Smith – Panda – Dawn – Canyon West 115 kV**

The Deaf Smith – Panda – Dawn – Canyon West 115 kV project is a rebuild of the existing 115 kV line. The ITPNT need date is identified as April of 2018. This project consists of three line segment rebuilds. The first from Deaf Smith County Interchange to Panda Energy Substation Hereford for 3.54 miles. The second from Panda Energy Substation Hereford to Dawn Substation for 8.4 miles. The third from Dawn Substation to Canyon West Substation for 13.7 miles. This project will address the overload of these three line segments for the outage of Bushland Interchange – Deaf Smith County Interchange 230 kV ckt 1.

**China Draw SVC and Road Runner SVC 115 kV**

Both China Draw and Road Runner 115 kV Static Var Compensators (SVCs) are new projects with a ITPNT need date identified as April of 2015. These SVCs provide reactive support that addresses severe voltage needs in the immediate area surrounding the China Draw and Road Runner substations and North of this area. These SVCs provide reactive support that addresses severe overloads on the National Enrichment Plant Sub – Targa 115 kV ckt 1 and National Enrichment Plant Tap – Targa 115 kV ckt 1 lines with multiple N-1 events in the Southeast New Mexico portion of SPS.

**IMC area rebuild and Capacitor additions**

This project consists of multiple upgrades. Reconductoring IMC #1 Tap-Intrepid West, IMC #1-Livingston Ridge, Intrepid West-Potash Junction, Byrd-Monument, Ponderosa Tap-Whitten, National Enrichment Plant-Targa 115 kV lines, Upgrading terminal equipment at Byrd 115 kV substation. A wave trap will be upgraded at Whitten 115 kV substation. A 100 MVar capacitor will be installed at Potash 230 kV substation. A 28.8 MVar capacitor will be installed at Roadrunner 115 kV, Ochoa 115 kV, and Agave Hill 115 kV substations. The ITPNT need date is identified as June of 2015. This project will address overloading of the National Enrichment Plant Sub - Targa 115 kV line for the outage of Kiowa – Roadrunner 345 kV line, Roadrunner 345/115/13.2 kV transformer, and Byrd – Monument Tap 115 kV line.



## West Kansas Area

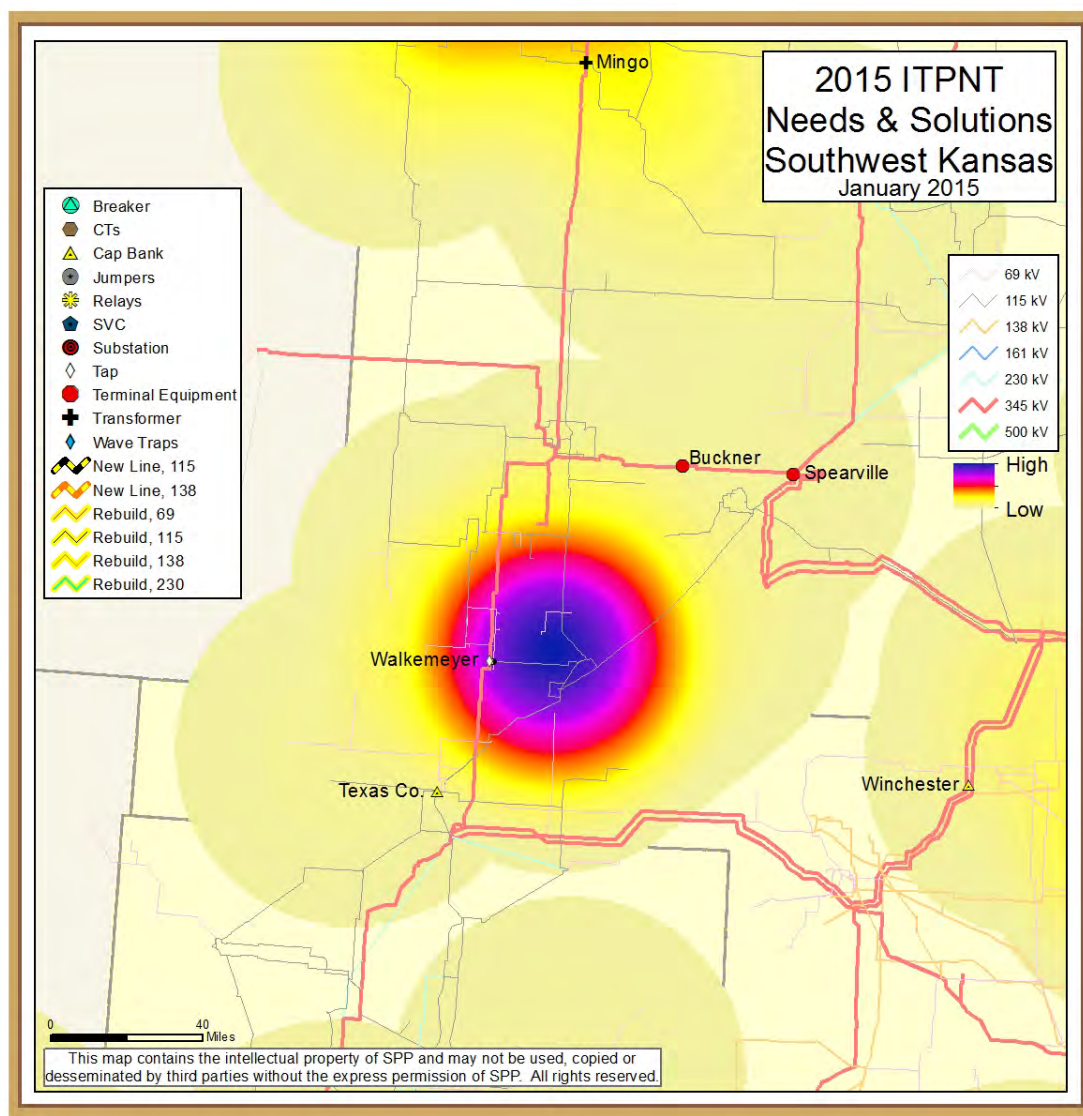


Figure 5.9: 2015 ITPNT West Kansas Solutions

### **Tap Hitchland – Finney 345 kV and NewSub – Walkemeyer 115 kV**

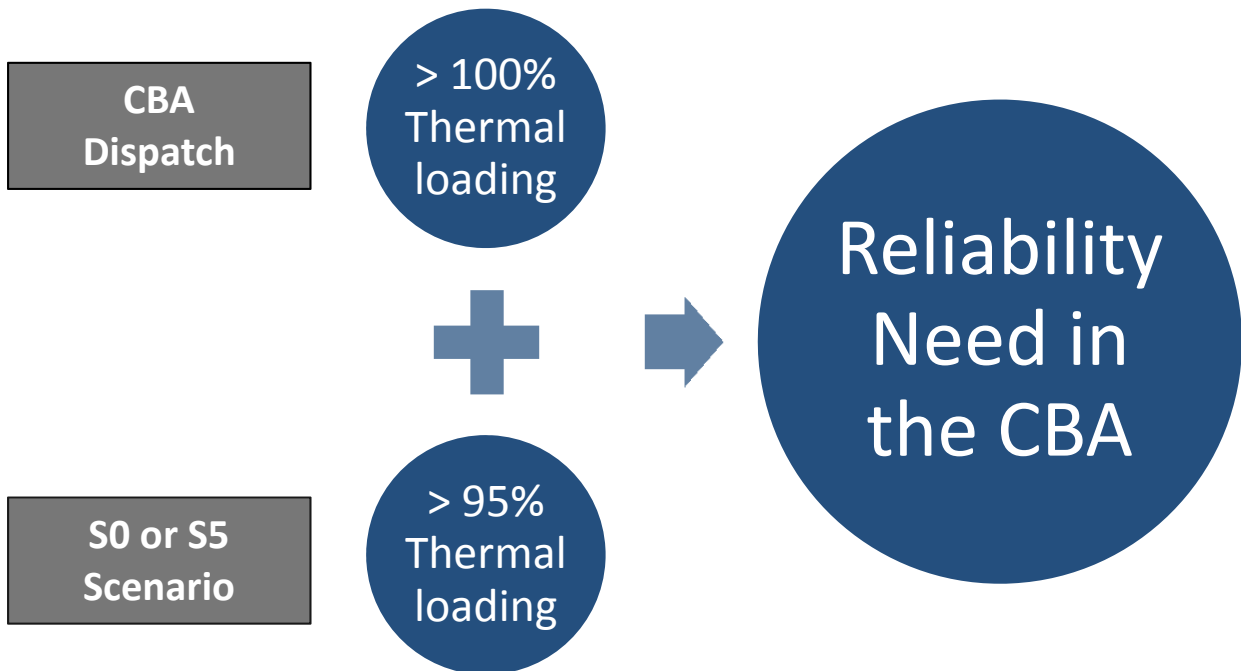
This project consists of tapping the Hitchland to Finney 345 kV line and adding a new substation with a 345/115 kV Transformer. A new 1 mile NewSub to Walkemeyer 115 kV line will be added. The need date for this project is June of 2015. This project will address the overload of the CTU Sublette – Pioneer Tap 115 kV and Cimmaron River Plant – North Cimarron 115 kV and North Cimarron – Seward 115 kV lines for the outage of Crooked Creek to Cudahay 115 kV line. Other outages of Finney Switching Station – Hitchland Interchange 345 kV line, CTU Sublette – Haskell 115 kV lines, and member-submitted outage of SPP-MKEC-01<sup>3</sup> caused overloading, which was addressed by this project.

<sup>3</sup> Cimmaron River Tap – East Liberal | Cimarron River Station - Cimmaron River Tap | Kismet - Cimmaron River Tap | Kismet – Cudahay | Cudahay – Crooked Creek 115kV lines

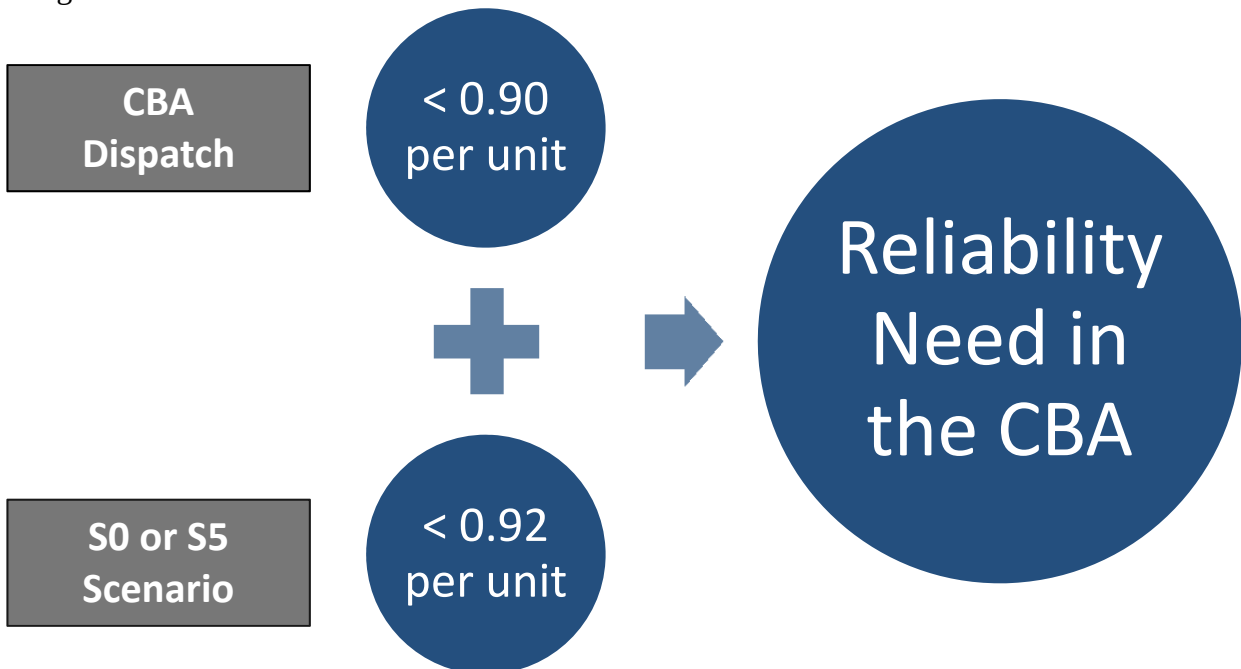
### **5.5: Reliability Upgrades from the CBA Model**

This section details potential reliability issues from the CBA N-1 contingency analysis in the 2015 ITPNT. At the May 14, 2013 Transmission Working Group meeting the TWG approved the process by which a potential additional reliability issue would be identified. The methodology for determining reliability needs in the CBA Scenario is found below.

For thermal needs:



For voltage needs:



Based on this criteria there were two projects identified and are shown in the table below.

| Season | Facility                                            | CBA %<br>Loading | Near Term<br>S0/S5 %<br>Loading |
|--------|-----------------------------------------------------|------------------|---------------------------------|
| 15SP   | BENTON (BENT TX-2) 345/138/13.8KV TRANSFORMER CKT 1 | 108.8            | 98.4                            |
| 20SP   | CARNEGIE - SOUTHWESTERN STATION 138KV CKT 1         | 104.7            | 98.2                            |

*Table 5.5: CBA Projects*

## 5.6: Rate Impacts on Transmission Customers

The 2015 ITPNT upgrades were run in the SPP Cost Allocation Forecast, the peak ATRR impact year was shown to be 2021.

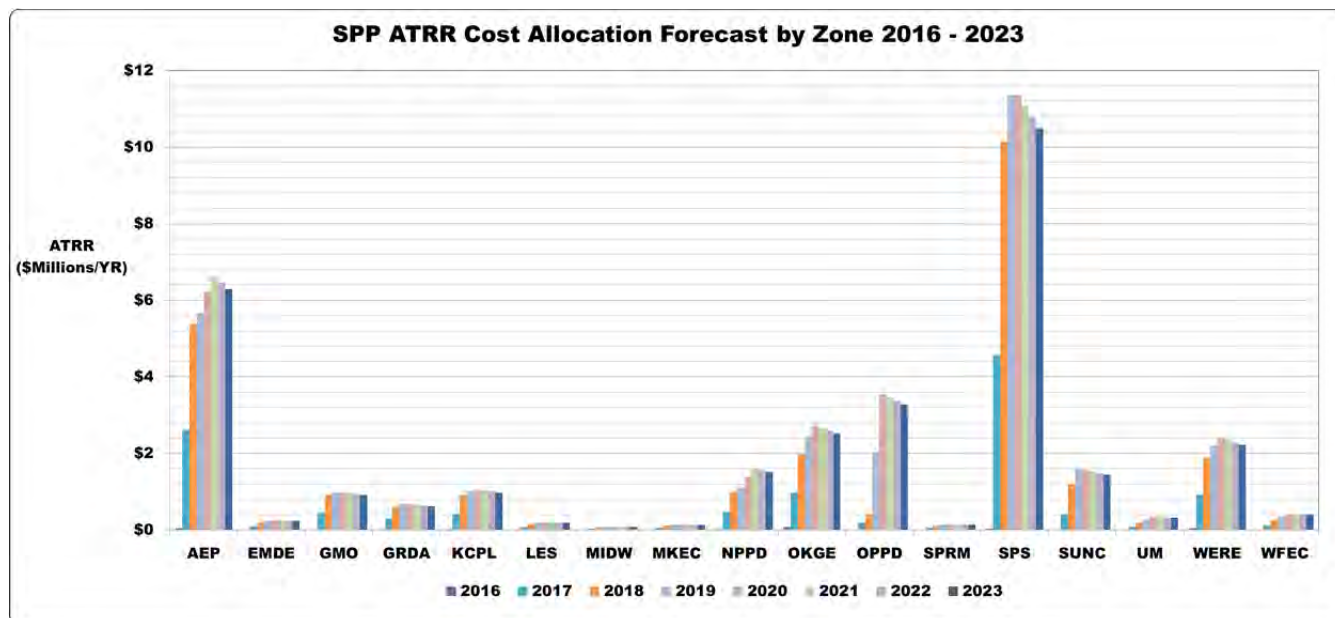


Figure 5.10: ATRR Cost Allocation Forecast by Zone of the 2015 ITPNT

As shown in the following chart, the majority of the 2015 ITPNT projects will be cost allocated to the Pricing Zone hosting the upgrade and a smaller amount will be cost allocated to the SPP region through the regional rate.

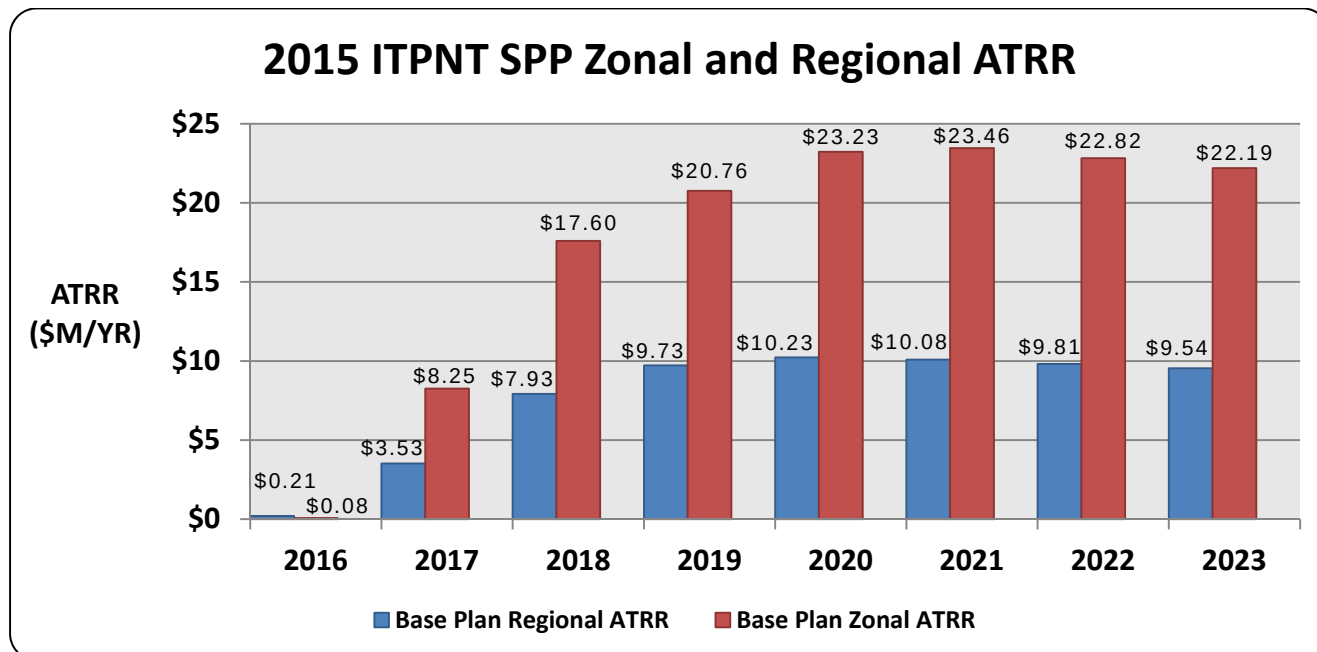


Figure 5.11: Zonal and Regional ATRR allocated in SPP

The peak year ATRR is converted into a monthly impact on a typical 1000 kWh per month Retail Residential ratepayer. This is done by dividing the ATRR zonal impact by the zonal energy usage as adjusted for typical losses.

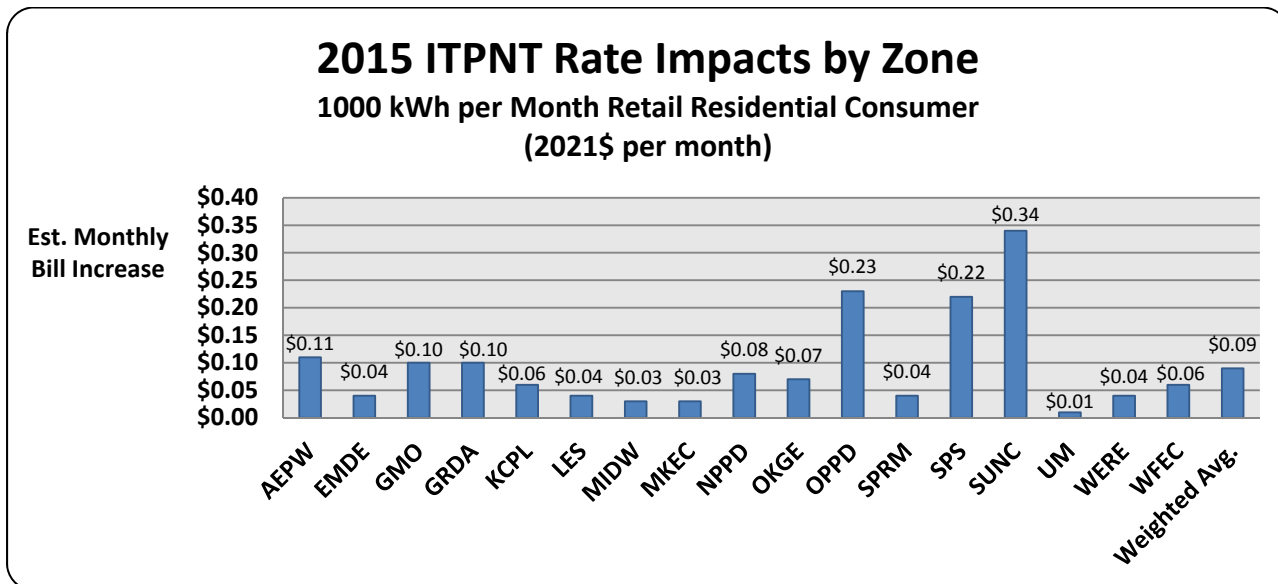


Figure 5.12: 2015 ITPNT Monthly Bill Impact 1000 kWh/Month Retail Residential

Zones providing information on more than one state were combined using a weighted average based on sales projections in each state in the peak ATRR year of 2021.

## **5.7: Stability Analysis Results**

Transient stability analysis was performed on the ITPNT 2020 Summer peak scenario 5 base case. Since no new rotating machines or 345 kV lines were added and HPILS upgrades were included in the base case, the study was performed on the base case rather than the case with the recommended portfolio. Contingencies were ranked as having a potential steady state stability violation, a loss of generation, or a critical clearing time of less than 9 cycles using PTI's PSS/E Dynamics Package and the PSSPLT Plotting Package. The Fast Fault Screening (FFS) identifies the fault bus and associated outaged branches; however, the fault sequence was determined by SPP, and was as follows:

- Category B: Apply fault at ranked bus for a time span of Critical Clearing Time (CCT) cycles and open "outaged branch"
- Category C: Open first "outaged branch" and allow steady state system adjustments. Apply fault at ranked bus for a time span of CCT cycles and open second "outaged branch"
- Category D: Apply fault at the ranked bus for a time span of CCT cycles and open all "outaged branches" at the bus

Generator rotor speed, rotor angle, real power, and reactive power output were monitored for all SPP generators during the time domain simulation. Those generators exhibiting rotor speed and angle instability were marked for further analysis. This analysis consisted of identifying and correcting the cause of instability.

Any unstable Category D event generator(s) were disconnected according to NERC Standard TPL-004 during the simulation and re-simulated to determine stability for the remaining system.

Fast Fault Screening identified severe fault locations for the ITPNT 2020 Summer case. These locations (buses) were ranked according to their Ranking Index (RI) and CCT for NERC category B, C, and D contingencies. The results are posted on SPP's Trueshare site. The outaged element(s) associated with each fault are shown and are considered only if real power is leaving the faulted bus.

The finalization of the Transient Stability analysis of most severe FFS events indicated no resulting system instability for FFS identified events. There were no identified unstable generators for the ITPNT 2020 Summer peak Scenario 5 base case.

## **5.8: Final Reliability Assessment**

All projects in the 2015 ITPNT project plan were incorporated into the powerflow models and a steady state N-1 contingency analysis was performed to identify any new reliability issues. From that analysis 6 unique potential thermal overloads and 11 unique potential voltage violations were identified. The table below lists these final reliability assessment potential issues.

| Season | Monitored Facility                                         | Potential Violation |
|--------|------------------------------------------------------------|---------------------|
| 20SP   | BYRD SUB - OIL_CENTER 3 115kV CKT 1                        | Thermal             |
| 20L    | BYRON 69kV - WAKITA 69KV CKT 1                             | Thermal             |
| 15SP   | EAGLE CREEK (WH RLP1721-2) 115/69/13.2KV TRANSFORMER CKT 1 | Thermal             |
| 16SP   | HARMONY - ST FRANCIS 115KV CKT 1                           | Thermal             |
| 16SP   | HOBART - HOBART JUNCTION 69KV CKT 1                        | Thermal             |
| 15SP   | OCHOA SUB - PNDEROSATP 3 115KV CKT 1                       | Thermal             |
| 15SP   | EAGLE CHIEF 69KV                                           | Voltage             |
| 20SP   | EUFAULA RES TAP 69KV                                       | Voltage             |
| 15SP   | FAIRVIEW 69KV                                              | Voltage             |
| 15SP   | OMPA-FAIRVIEW 69KV                                         | Voltage             |
| 20SP   | ONAPA 2 69KV                                               | Voltage             |
| 20SP   | PORUM 69KV                                                 | Voltage             |
| 15SP   | RINGWOOD JCT 69KV                                          | Voltage             |
| 20SP   | WELLS SPA 69KV                                             | Voltage             |
| 15L    | WHITEHORSE 69KV                                            | Voltage             |
| 15L    | WINCH_TAP 69KV                                             | Voltage             |
| 15L    | WINCHESTER2 69KV                                           | Voltage             |

*Table 5.6: Final Reliability Assessment Potential Issues*

# PART III: APPENDICES





## Section 6: Project Maps

### Texas & Louisiana Area

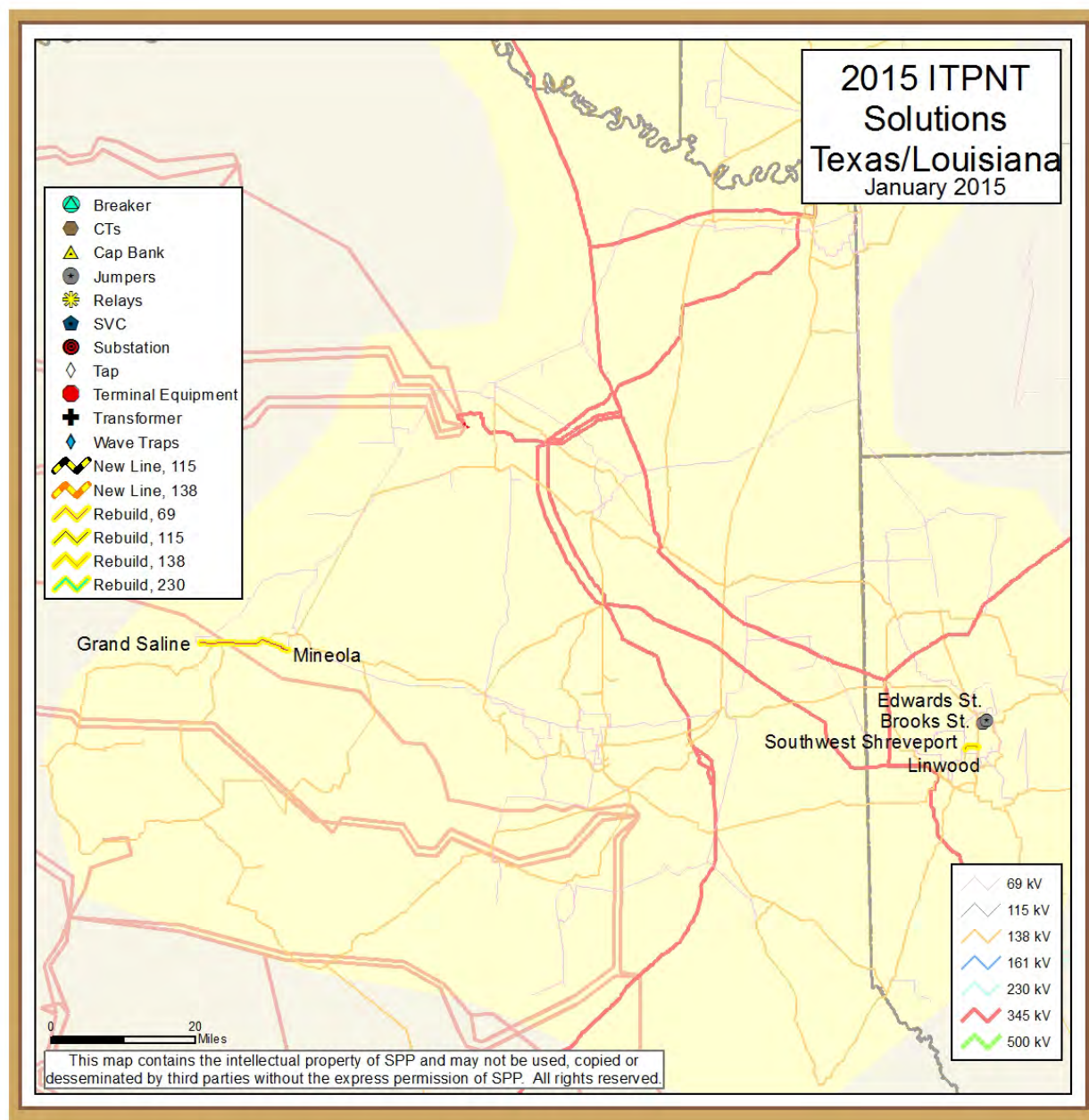


Figure 6.1: 2015 ITPNT Texas/Louisiana Solutions

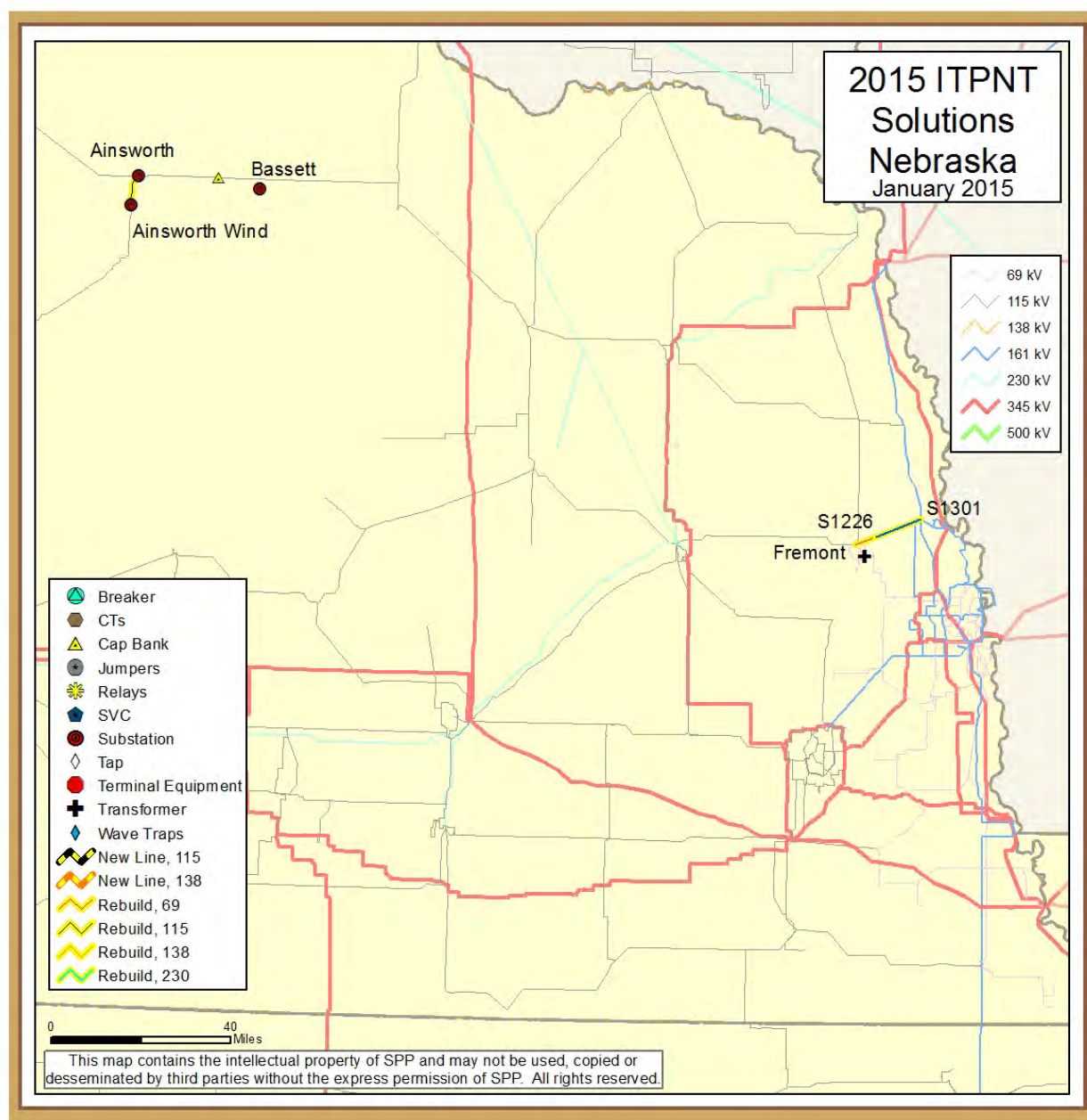
**Nebraska Area**

*Figure 6.2: 2015 ITPNT Nebraska Solutions*

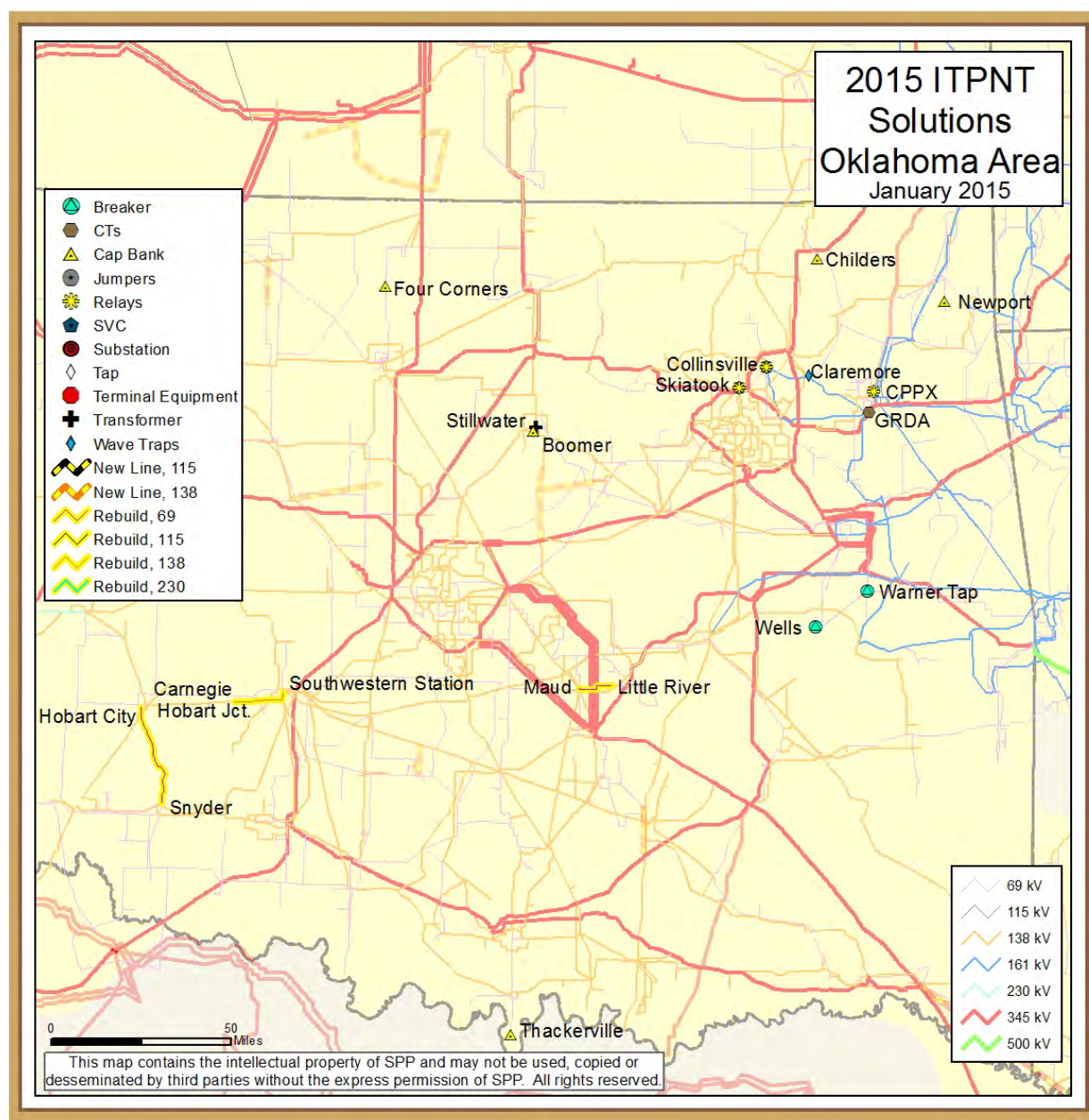
**Oklahoma Area**

*Figure 6.3: 2015 ITPNT Oklahoma Solutions*



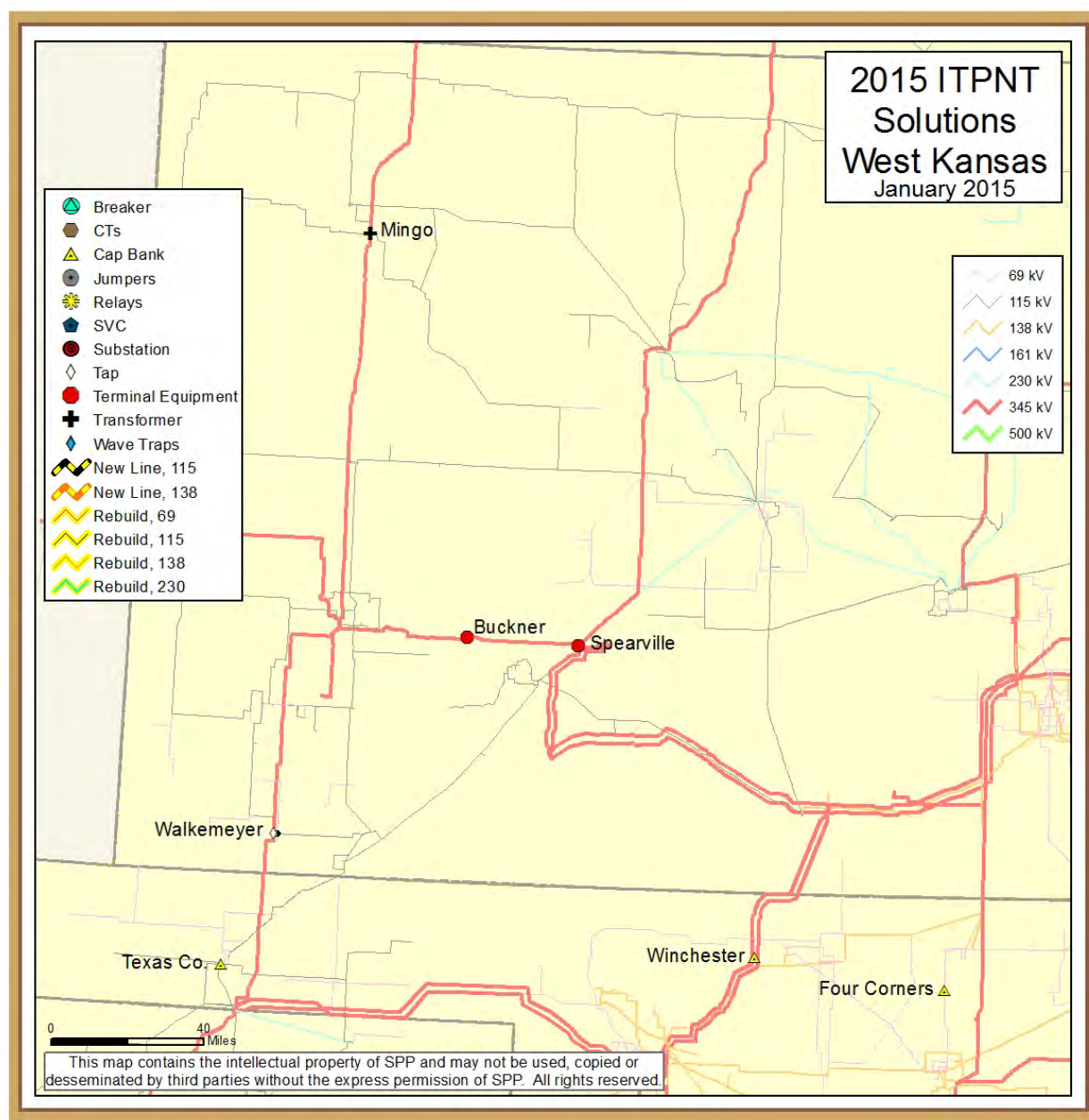
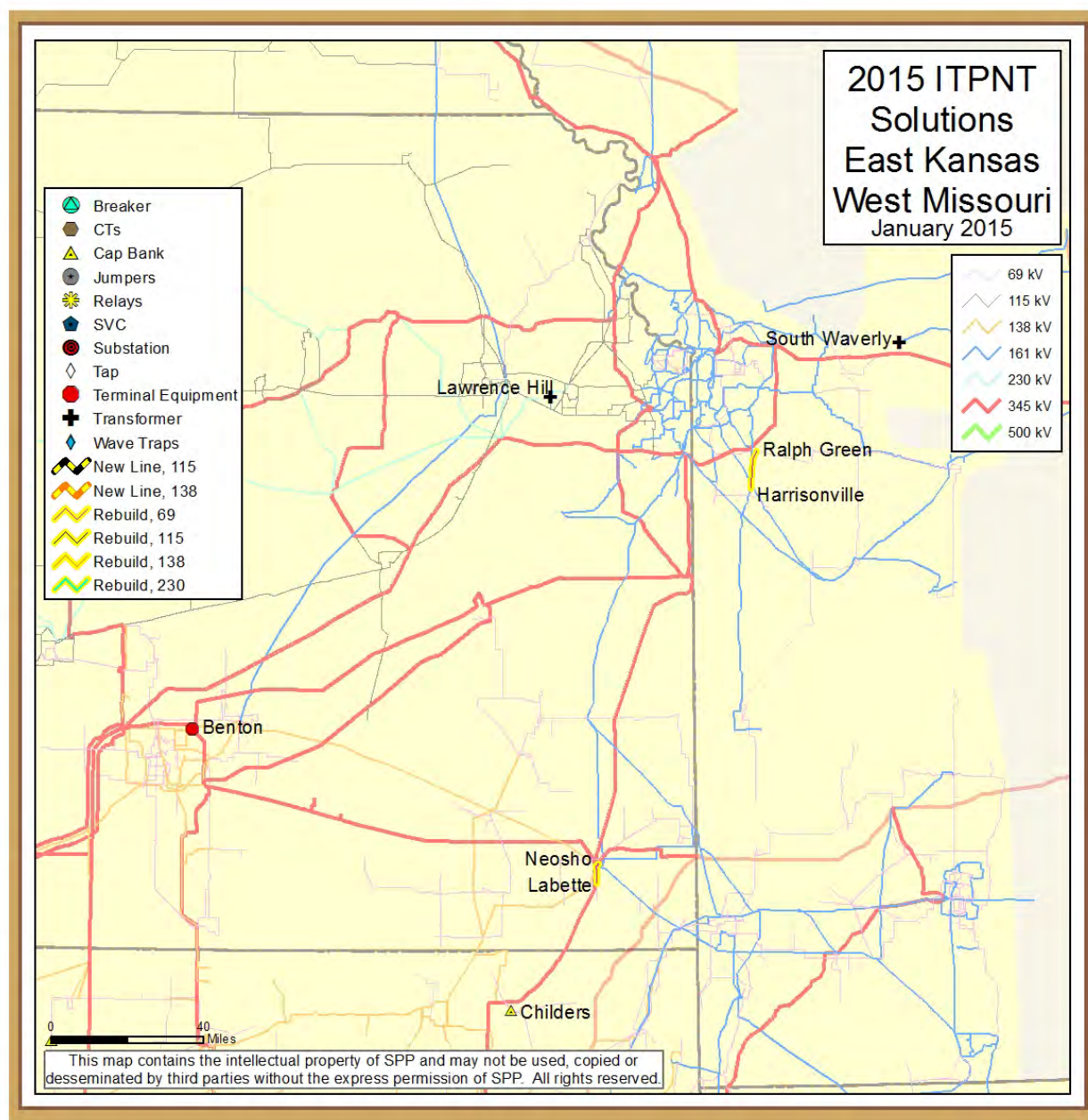
**West Kansas Area**

*Figure 6.4: 2015 ITPNT West Kansas Solutions*

**East Kansas & West Missouri Area***Figure 6.5: 2015 ITPNT East Kansas & West Missouri Solutions*

## Section 7: Glossary of Terms

The following terms are referred to throughout the report.

| Acronym      | Description                                       | Acronym      | Description                                     |
|--------------|---------------------------------------------------|--------------|-------------------------------------------------|
| <b>ATRR</b>  | Annual Transmission Revenue Requirements          | <b>MVA</b>   | Mega Volt Ampere ( $10^6$ Volt Ampere)          |
| <b>ATSS</b>  | Aggregate Transmission Service Studies            | <b>MW</b>    | Megawatt ( $10^6$ Watts)                        |
| <b>CBA</b>   | Consolidated Balancing Authority                  | <b>NERC</b>  | North American Electric Reliability Corporation |
| <b>BOD</b>   | SPP Board of Directors                            | <b>NTC</b>   | Notification to Construct                       |
| <b>EHV</b>   | Extra High Voltage                                | <b>NTC-C</b> | Notification to Construct with Conditions       |
| <b>FERC</b>  | Federal Energy Regulatory Commission              | <b>OATT</b>  | Open Access Transmission Tariff                 |
| <b>GI</b>    | Generation Interconnection                        | <b>RITF</b>  | Rate Impact Task Force                          |
| <b>GW</b>    | Gigawatt ( $10^9$ Watts)                          | <b>SPP</b>   | Southwest Power Pool, Inc.                      |
| <b>ITPNT</b> | Integrated Transmission Plan Near-Term Assessment | <b>STEP</b>  | SPP Transmission Expansion Plan                 |
| <b>ITP10</b> | Integrated Transmission Plan 10-Year Assessment   | <b>TPL</b>   | Transmission Planning NERC Standards            |
| <b>ITP20</b> | Integrated Transmission Plan 20-Year Assessment   | <b>TO</b>    | Transmission Owner                              |
| <b>MDWG</b>  | Model Development Working Group                   | <b>TOGs</b>  | Transmission Operating Guides                   |
| <b>MISO</b>  | Midcontinent Independent System Operator, Inc.    | <b>TWG</b>   | Transmission Working Group                      |
| <b>MOPC</b>  | Markets and Operations Policy Committee           |              |                                                 |

*Table 7.1: 2015 ITPNT Glossary of Terms*

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# 2015 STEP

## 2015 SPP Transmission Expansion Plan Report

January 5, 2015

Engineering



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## Revision History

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| Date       | Author    | Change Description                                 |
|------------|-----------|----------------------------------------------------|
| 01/05/2015 | SPP staff | Initial Draft                                      |
| 01/14/2015 | SPP staff | Endorsed by MOPC                                   |
| 01/20/2015 | SPP Staff | Updates to totals, maps, and graphs in Section 4.3 |
| 01/27/2015 | SPP Staff | Approved by SPP BOD                                |

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## Section 1: Executive Summary

The 2015 SPP Transmission Expansion Plan (STEP) is a comprehensive listing of all transmission projects in SPP for the 20-year planning horizon. Projects in the 2015 STEP include:

- Upgrades required to satisfy requests for Transmission Service;
- Upgrades required to satisfy requests for Generation Interconnection;
- Approved projects from the 10-Year and Near Term Assessments;
- Approved Balanced Portfolio upgrades;
- Approved High Priority upgrades; and
- Endorsed Sponsored upgrades.

The 2015 STEP consists of 568 upgrades with a total cost of \$5.7 billion. The chart below illustrates the cost distribution of the 2015 STEP based on project type. More detail on the total portfolio is listed in [Section 12](#).

### 2015 STEP Cost by Project Type

**\$5.7B**

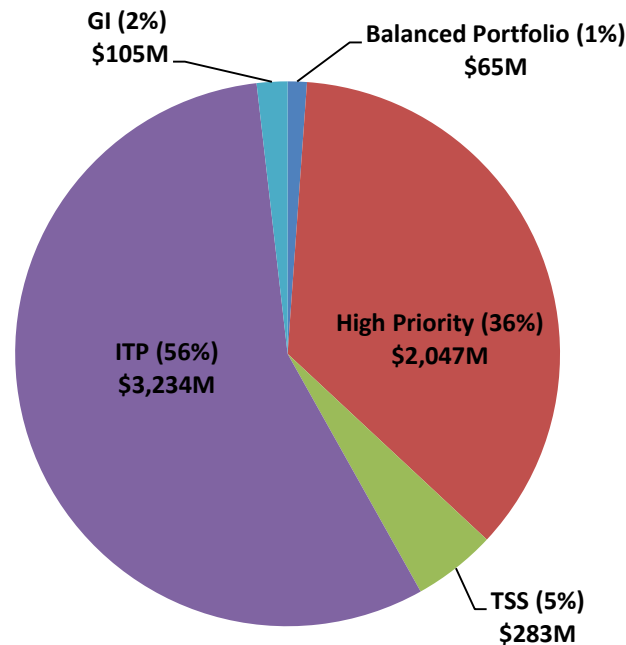


**Figure 1.1: Cost by Project Type – 2015 STEP**

After the SPP Board of Directors approves transmission expansion projects or once service agreements are filed with FERC, SPP issues Notifications to Construct (NTC) letters to appropriate Transmission Owners. A list of the NTCs issued in 2014 can be found in [Section 13](#). A breakdown of the total list of NTCs issued in 2014 is below is Figure 1.2.

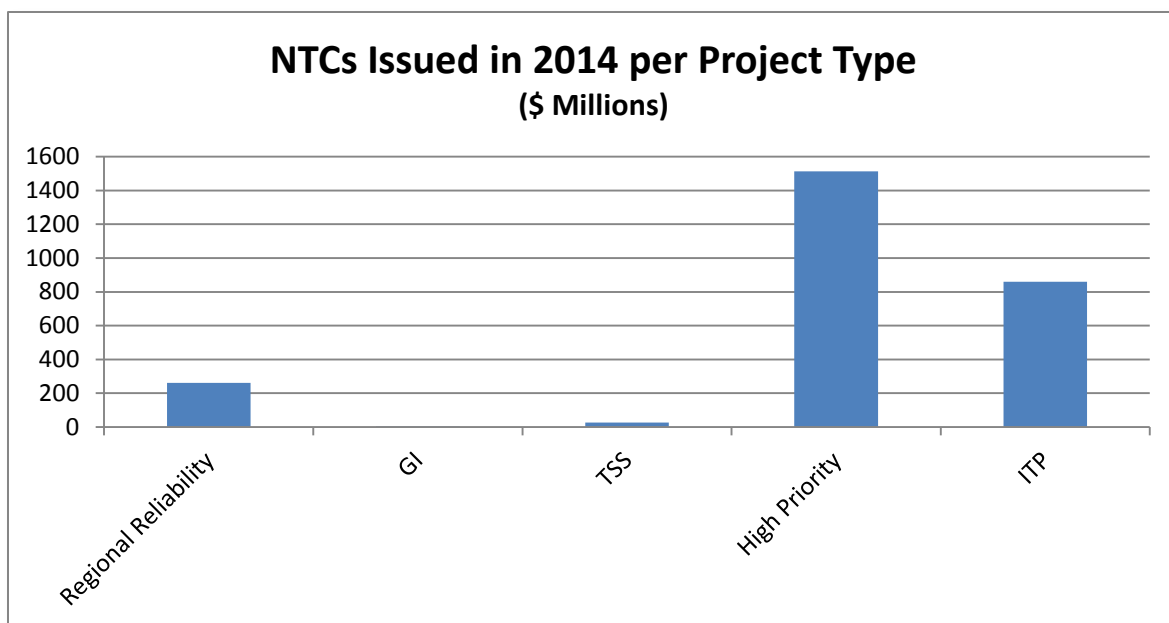


**Figure 1.2: NTCs Issued in 2014 per Project Type**

In 2014, SPP issued 38 NTC letters with estimated construction costs of \$1.48 billion for 89 projects to be constructed over the next five years through 2019. Of this \$1.48 billion, the project cost breakdown is as follows:

- \$58.3 million for Regional Reliability;
- \$3 million for Generation Interconnection;
- \$38.6 million for Transmission Service;
- \$573 million for High Priority; and
- \$806.6 million for ITP projects.

SPP actively monitors the progress of approved projects by soliciting feedback from project owners. One hundred thirty seven (137) upgrades were completed as of December 31, 2014. The breakdown includes:

- 65 ITP - \$491.5 million
- 5 Transmission Service - \$28.2 million
- 15 Generation Interconnection - \$61.7 million
- 22 Regional Reliability - \$60.8 million
- 26 High Priority - \$865.5 million
- 4 Balanced Portfolio - \$307.9 million

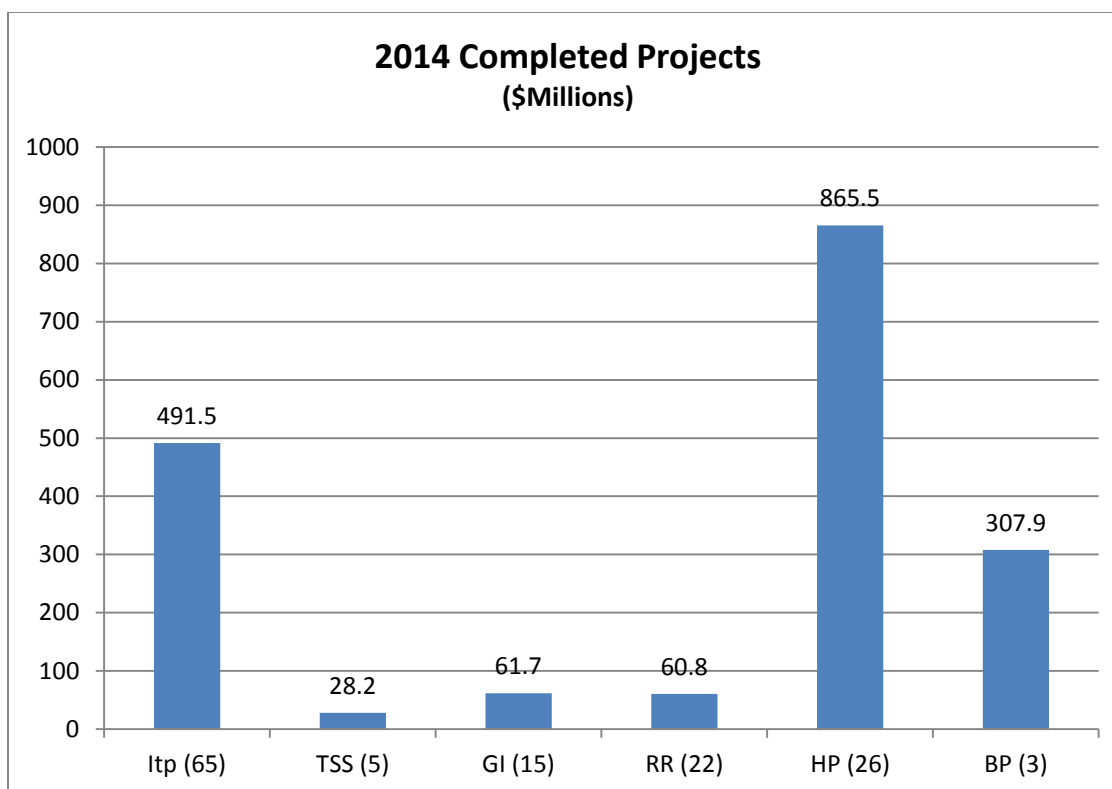


**Figure 1.3: 2014 Completed Projects**

Tables listing EHV projects completed in 2014 as well as active EHV projects carrying forward into 2015 are located in [Section 14](#). Tables listing projects completed in 2014 can be found in [Section 17](#).



## Section 2: Transmission Services

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### **2.1: Transmission Service 2014 Overview**

Studies are conducted as a result of customer-submitted long-term firm transmission service requests to determine if the SPP transmission system can accommodate transmission service above what is currently in use. In October of 2013, SPP implemented a new process for evaluating transmission service requests, designed to expedite the evaluation of requests in the queue currently (The “Backlog Clearing Process”). The Backlog Clearing Process<sup>1</sup> is intended to clear the queue of pending requests in anticipation of a new process that will permanently replace the existing process and that will be more efficient and streamlined. This successor process to the Backlog Clearing Process is nearing completion in the SPP stakeholder process

The Transmission Provider will combine all long-term point-to-point and long-term designated network resource requests received during a specified period of time into a single Aggregate Transmission Service Study. Using this Aggregate Transmission Service Study process, the Transmission Provider will combine all requests received during an open season to develop a more efficient expansion of the transmission system that provides the necessary ATC to accommodate all such requests at the minimum total cost.

During 2014, SPP Staff posted 22 Aggregate Facilities Studies, as compared to 23 in 2013, to meet 60-day study completion deadlines and FERC Order 890 requirements. Order 890 requires Transmission Providers to file notice with FERC if more than 20% of the Facilities Studies in any two (2) consecutive calendar quarters are not completed in the 60-day study window. In 2014, SPP was not required to file with FERC, as there were no two (2) consecutive quarters in which more than 20% of the studies were late. This was due in large part to the timely submission of documentation by Transmission Owners.

The tables below summarize the Aggregate Studies that were closed and produced Service Agreements during 2014. The tables show the number of requests and requested capacity (MW) for the initial study (AFS1) and the final number of requests and requested capacity (MW) for the last study iteration.



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<sup>1</sup> The SPP Tariff filing can be found at the following location: [2013-11-08 Ag Study Backlog Clearing Process Tariff Revisions ER13-2164-001](#)

|                                  | 2012-AG1-AFS-1 | 2012-AG1-AFS-7 |
|----------------------------------|----------------|----------------|
| # of requests-beginning of study | 47             |                |
| # of MW-beginning of study       | 3019           |                |
| # of requests-end of study       |                | 32             |
| #of MW-end of study              |                | 1700           |

**Table 2.1: Initial and Final Request and Capacity Amounts for 2012-AG1**

|                                  | 2012-AG2-AFS-1 | 2012-AG2-AFS-9 |
|----------------------------------|----------------|----------------|
| # of requests-beginning of study | 49             |                |
| # of MW-beginning of study       | 5733           |                |
| # of requests-end of study       |                | 6              |
| #of MW-end of study              |                | 313            |

**Table 2.2: Initial and Final Request and Capacity Amounts for 2012-AG2**

|                                  | 2012-AG3-AFS-1 | 2012-AG3-AFS-9 |
|----------------------------------|----------------|----------------|
| # of requests-beginning of study | 76             |                |
| # of MW-beginning of study       | 10,412         |                |
| # of requests-end of study       |                | 14             |
| #of MW-end of study              |                | 564            |

**Table 2.3: Initial and Final Request and Capacity Amounts for 2012-AG3**

|                                  | 2013-AG1-AFS-1 | 2013-AG1-AFS-7 |
|----------------------------------|----------------|----------------|
| # of requests-beginning of study | 50             |                |
| # of MW-beginning of study       | 4057           |                |
| # of requests-end of study       |                | 15             |
| #of MW-end of study              |                | 688            |

**Table 2.4: Initial and Final Request and Capacity Amounts for 2013-AG1**

The table below summarizes the Aggregate Studies for 2014.

| Study        | Currently Active Iteration | Due Date  | Requests Currently in Study | MW Currently in Study | Currently Posted Study | Date Posted |
|--------------|----------------------------|-----------|-----------------------------|-----------------------|------------------------|-------------|
| 2013-AG2     | AFS-8                      | 1/25/2015 | 4                           | 348                   | AFS-7                  | 11/11/2014  |
| 2013-AG3     | AFS-5                      | 1/18/2015 | 16                          | 1,855                 | AFS-4                  | 11/4/2014   |
| 2014-AG1     | AFS-4                      | 2/25/2015 | 37                          | 4958                  | AFS-3                  | 12/12/2014  |
| <b>Total</b> |                            |           | <b>57</b>                   | <b>7,161</b>          |                        |             |

**Table 2.5: Active 2014 Aggregate Studies**

The graph below shows the total estimated cost of Transmission Service projects included in the 2015 STEP as compared to previous STEP Reports. Fluctuations in the annual STEP estimates may be influenced by the number of new projects identified in completed Transmission Service Studies either having been issued NTCs or approved and awaiting the issuance of an NTC, the completion of Transmission Service related projects, and the increase

and decrease of Transmission Owner submitted projects cost estimates within the applicable STEP timeframe.

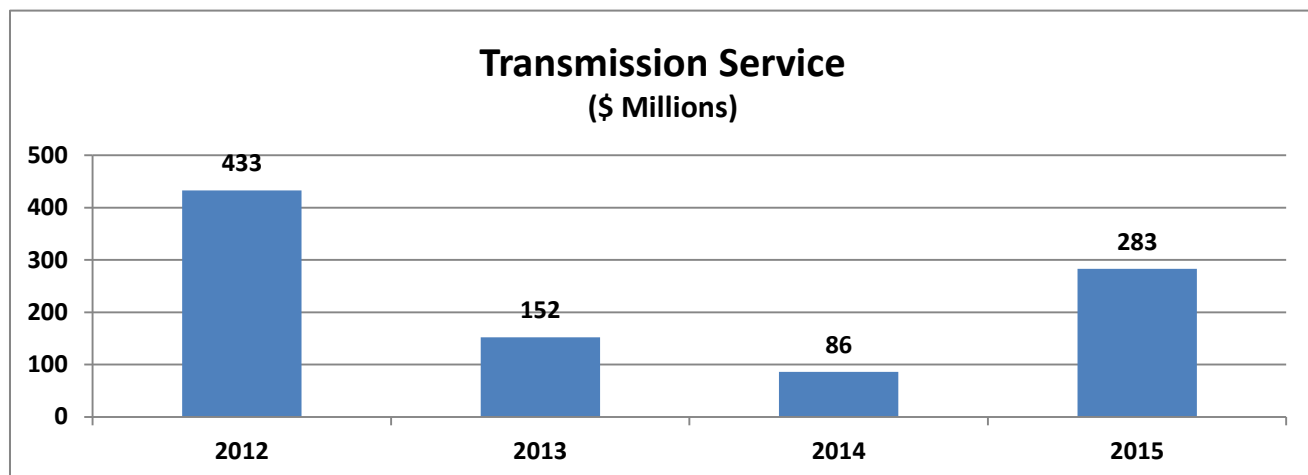
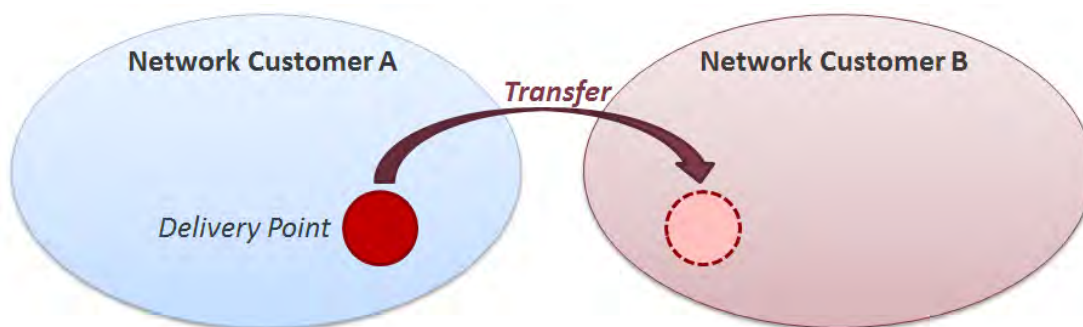


Figure 2.1: STEP Cost Estimate Comparison for Transmission Service Projects – 2012-2015

A list of Transmission Service projects completed in 2014 can be found in [Section 17](#).

## 2.2: Tariff Attachments AQ and AR



### Attachment AQ

SPP Tariff Attachments AQ defines a process through which delivery point additions, modifications, or abandonments can be studied without having to go through the Aggregate Study process. Delivery points submitted through the process are examined in an initial assessment to determine if a project is likely to have a significant effect on the transmission system. If necessary, a full study is then performed on the requested delivery points to determine any necessary upgrades. There was one (1) NTC issued in 2014 as a result of the AQ process.

The number of requests and required studies are summarized in Table 2.4 below.

| Study Year | Delivery Point Requests | Full Studies Required | Load Increase |
|------------|-------------------------|-----------------------|---------------|
| 2011       | 84                      | 9                     | 550 MW        |
| 2012       | 156                     | 51                    | 1,200 MW      |
| 2013       | 87                      | 22                    | 882 MW        |
| 2014       | 96                      | 19                    | 1,032 MW      |

Table 2.6: AQ Study Summary – 2011-2014

**Attachment AR**

Attachment AR defines a screening process used to evaluate potential Long-Term Service Request (LTSR) options or proposed Delivery Point Transfers (DPT). The LTSR option provides customers with a tool to assess possible availability of transmission service. The DPT screening study option enables customers to implement a DPT via issuance of a service agreement more expediently pending the results of the screening. Both of these screening tools allow for a more streamlined Aggregate Study process by reducing the number of requests in the studies.

During 2014, one (1) DPT study was posted. Service was granted for that DPT study. Six (6) LTSR studies were requested and posted.

## Section 3: Generation Interconnection

### 3.1: Generation Interconnection Overview

A Generation Interconnection (GI) study is conducted pursuant to Attachment V of the SPP Tariff whenever a request is made to connect new generation to the SPP transmission system. GI studies are conducted by SPP in collaboration with affected Transmission Owners to determine the required modifications to the transmission system, including cost and scheduled completion date required to provide the service.



As of October 30, 2014, SPP received 81 SPP and 16 affected system GI requests, similar to the 35 SPP and 7 affected system study requests received through the same period in 2013. As of that date, there were 79 active queue requests for 11,752 MW under study and 51 requests were removed from the queue either from being withdrawn by the requesting Transmission Owner or from the execution of a Generation Interconnection Agreement (GIA). The 16 affected system study requests were made by neighboring systems requesting SPP's evaluation of the impact of the requests on SPP's transmission system.

The approval of Priority Projects has facilitated the increase of Generation Interconnection requests. About 6,500 MW of additional Generation Interconnection Agreements were approved based on the existence of Priority Projects and Balanced Portfolio.

The graph below shows the total estimated cost of Generation Interconnection projects included in the 2015 STEP as compared to previous STEP Reports. Fluctuations in the annual STEP estimates may be influenced by the number of new projects identified in completed Generation Interconnection Studies that have either been issued NTCs or are approved and are awaiting the issuance of an NTC, the completion of Generation Interconnection related projects, and the increase and decrease of Transmission Owner submitted projects cost estimates within the applicable STEP timeframe.

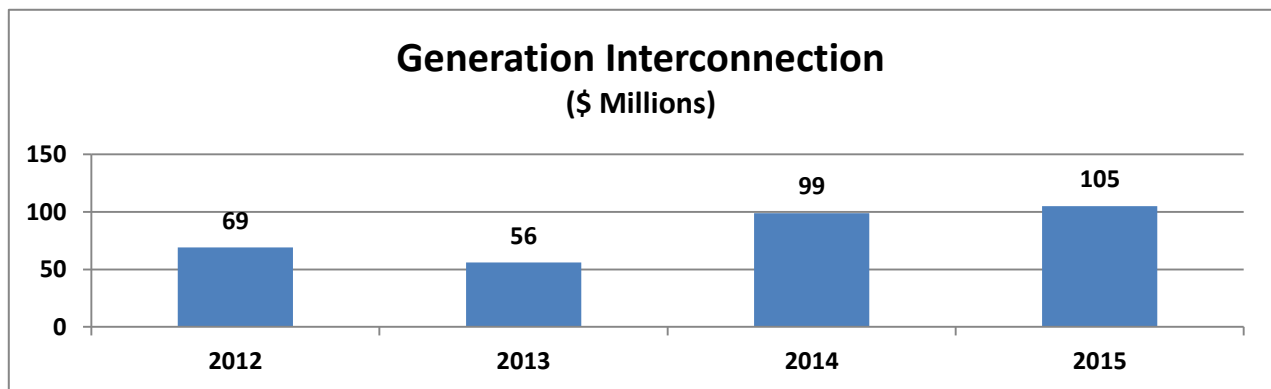


Figure 3.1: STEP Cost Estimate Comparison for Generation Interconnection Projects – 2012-2015

A list of Generation Interconnection projects completed in 2014 can be found in [Section 17](#).

### 3.2: Generator Interconnection Improvements

SPP-proposed changes to the Definitive Interconnection System Impact Study (DISIS) process were conditionally approved by FERC on June 13, 2014. Existing Generator Interconnection Requests had until August 12, 2014 to transition to the new process. The first DISIS study performed under the new process started on October 1, 2014 and is scheduled to be completed January 31, 2015.

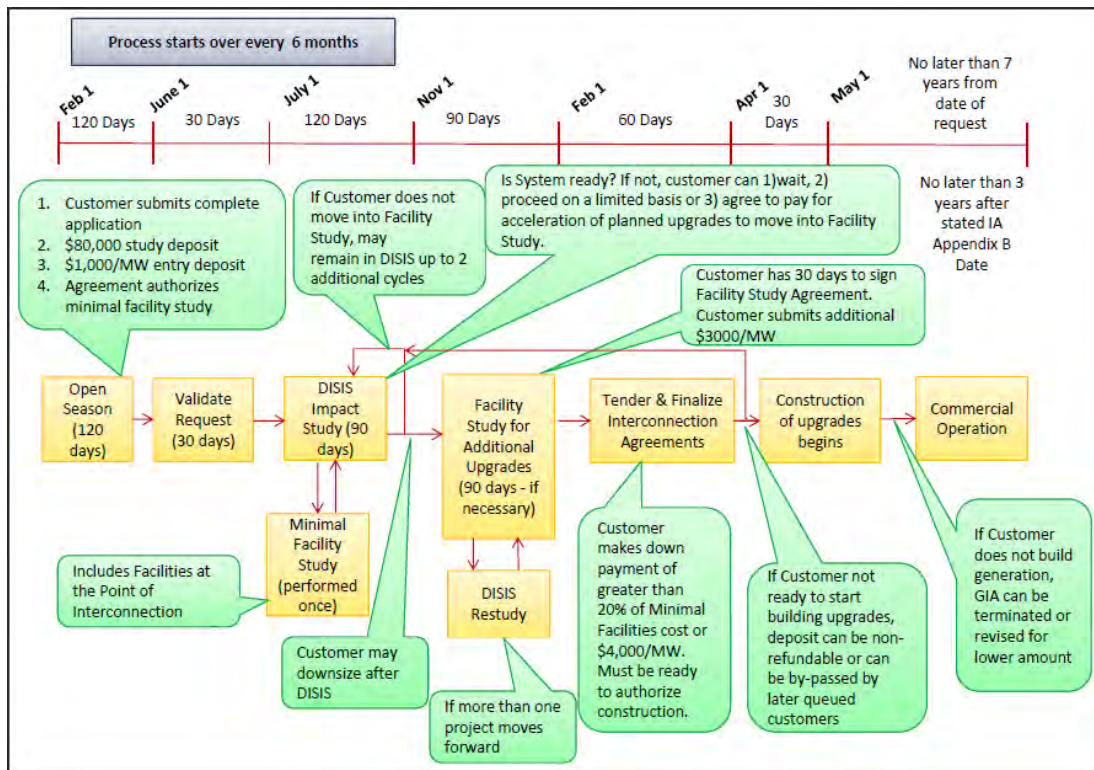


Figure 3.2: Generator Improvement Process Flowchart



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## Section 4: Integrated Transmission Planning

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The Integrated Transmission Planning (ITP) process is Southwest Power Pool's iterative three-year study process that includes 20-Year, 10-Year, and Near Term Assessments.



The 20-Year Assessment (ITP20), performed once every three (3) years, identifies transmission projects, generally above 300 kV, needed to develop a grid flexible enough to provide benefits to the region across multiple scenarios.

The 10-Year Assessment (ITP10), performed once every three (3) years, focuses on facilities 100 kV and above to meet system needs over a 10-year horizon.

The Near Term Assessment (ITPNT), performed annually, assesses system upgrades, at all applicable voltage levels, required in the near-term planning horizon to address reliability needs.

Along with the Highway/Byway cost allocation methodology, the ITP process promotes transmission investment that will meet reliability, economic, and public policy needs intended to create a cost-effective, flexible, and robust transmission network which will improve access to the region's diverse generating resources and facilitate efficient market processes. A list of ITP projects completed in 2014 can be found in [Section 17](#).

### **4.1: ITP20**

The first phase of the ITP process was completed with the Board of Directors' acceptance of the ITP20 Report on July 30, 2013. For more information on the 2013 ITP 20-Year Assessment, see the [full report](#) available on SPP's website (SPP.org > Engineering > Transmission Planning). A list of 2013 ITP20 projects can be found in [Section 18](#).

During its July 29, 2014 meeting, the SPP BOD discussed the necessity of beginning the 2016 ITP20 in January 2015 as scheduled. The Board decided to defer work on the 20-Year Assessment for further consideration at the October 2014 MOPC meeting. The BOD also recommended the submission of a deferral to the Federal Energy Regulatory Committee (FERC) seeking authorization to delay the performance of the ITP20 as prescribed by SPP's OATT. In its place, the BOD recommended performing a consecutive ITP 10-Year Assessment starting in 2015.

The Strategic Planning Committee (SPC), during its September 9, 2014 meeting, unanimously supported a proposal from SPP to delay the start of the Board-directed 2016 ITP10 by at least six (6) months while the Clean Power Plan (CPP) rule is finalized (or until a time shortly following the Rule's finalization).

The MOPC unanimously approved a recommendation from the Economic Studies Working Group (ESWG) per the SPC to delay the start of the 2016 ITP10 by at least six (6) months at its October 2014 meeting.

### **4.2: 2015 ITP10**

The second phase of the ITP study process includes the ITP 10-Year Assessment performed under the requirements of Attachment O, Section III of the SPP OATT. The

approved portfolio includes projects ranging from comprehensive regional solutions to local reliability upgrades to address the expected reliability, economic, and policy needs of the studied 10-year planning horizon.

The Federal Energy Regulatory Commission (FERC) issued Order 1000 on June 17, 2010. Order 1000 requires the removal of federal right of first refusal (ROFR) for certain transmission projects under the SPP Tariff. To comply with this requirement, SPP developed the Transmission Owner Selection Process (TOSP) to competitively solicit proposals for projects that no longer have ROFR<sup>2</sup>. The TOSP is outlined in Attachment Y of the SPP Tariff. During the Integrated Transmission Planning (ITP) process, once the applicable ITP study scope has been approved and the needs assessment performed, SPP shall notify stakeholders of the identified transmission needs and provide a transmission-planning response window of 30 calendar days. During this time, any stakeholder may submit a Detailed Project Proposal (DPP) pursuant to Section III.8.b. of Attachment O of the SPP Tariff. All DPPs will be kept confidential<sup>3</sup>.

In addition, SPP Business Practice 7650 outlines the specific DPP processes associated with Order 1000.

For the 2015 ITP10, needs were not directly addressed with projects proposed by stakeholders, as in the past. This change was due to FERC Order 1000. Under Order 1000, a 30-day window allowed potential projects to be submitted through the DPP process and was not limited to incumbent transmission owners. Potential projects submitted outside this 30-day window were considered as Non Competitive Solutions (NCS). Since DPP submittals are held in confidence and are competitively confidential, SPP Staff did not present potential projects until Phase III of the DPP process.

The 2015 ITP10 study was conducted based on a pair of futures. These futures consider evolving changes in technology, public policy and climate changes that may influence the transmission system and energy industry as a whole. By accounting for multiple future scenarios, SPP staff can assess what transmission needs arise for various uncertainties. In all futures, EPA environmental regulations, as known or anticipated at the time of the study, are incorporated.

### **Future 1: Business as Usual**

This future includes all statutory/regulatory renewable mandates and goals as well as other energy or capacity as identified in the Policy Survey resulting in 11.5 GW of renewable resources modeled in SPP, load growth projected by load serving entities including the High Priority Incremental Loads, and SPP member-identified generator retirement projections. This future assumes no major changes to policies that are currently in place.

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<sup>2</sup> SPP.org > Engineering > Order 1000

<sup>3</sup> SPP.org > Engineering > Order 1000 > Detailed Project Proposal



## **Future 2: Decreased Base Load Capacity**

This future considers factors that could drive a reduction in existing generation. It will include all assumptions from the Business as Usual future with a decrease in existing base load generation capacity. This future will retire coal units less than 200 MW, reduce hydro capacity by 20% across the board, and utilize the Palmer Drought Severity Index for an average of August 1934 and August 2012 to simulate a reduction in existing capacity affected by drought conditions: 10% under moderate, 15% under severe, and 20% under extreme conditions. These target reductions were adjusted, as appropriate, based on locational and operational characteristics provided by the unit owners within each zone.

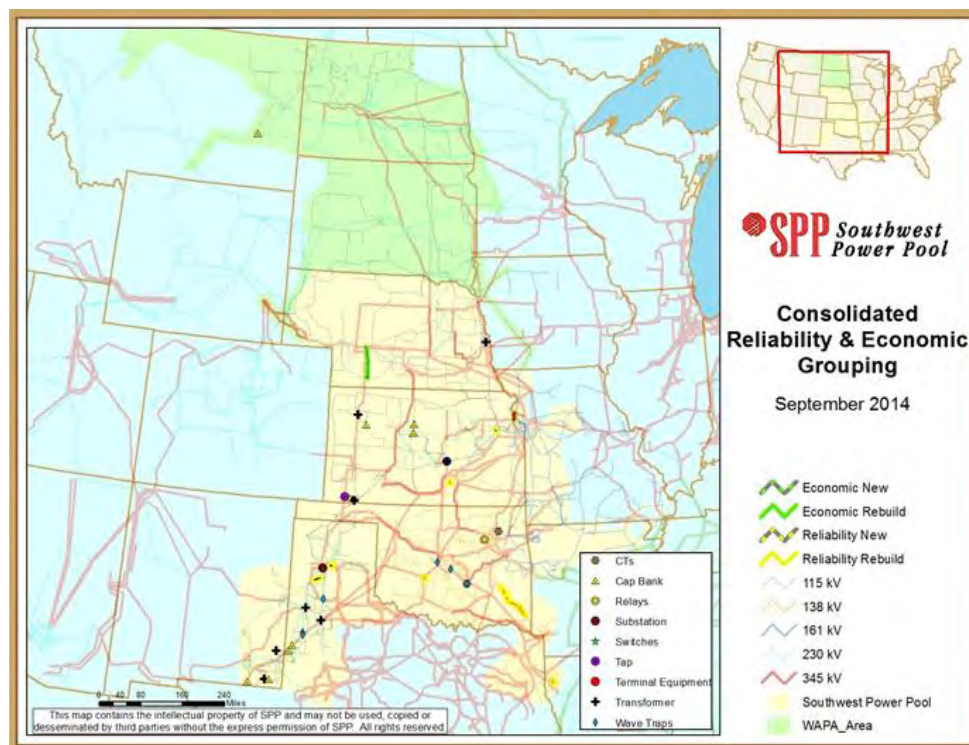


**Figure 4.1: 2015 ITP10 Consolidated Reliability and Economic Grouping Map**

The table below details the statistics of the final portfolio:

|                | Consolidated Portfolio <sup>#</sup> |          |          |
|----------------|-------------------------------------|----------|----------|
|                | Reliability                         | Economic | Total    |
| Total Cost     | \$209.6M                            | \$69.7M  | \$273.1M |
| Total Projects | 31                                  | 3        | 32       |
| Total Miles    | 166                                 | 94       | 260      |
| 1-Year Cost    |                                     | \$11.9M  | 14       |
| APC Benefit    |                                     | \$37.8M  |          |
| B/C Ratio      |                                     | 3.2*     |          |

<sup>#</sup>2 projects are included in both the economic and reliability portfolios

\*B/C includes only APC benefit of economic projects

**Table 4.1: 2015 ITP10 Final Portfolio Statistics**

The complete list of recommended 2015 ITP10 projects can be found in [Section 15](#) of this report.

### **4.3: 2015 ITP Near-Term (ITPNT)**

The 2015 ITPNT analyzed the SPP region's immediate transmission needs over the near-term planning horizon. The ITPNT assessed: (a) regional upgrades required to maintain reliability in accordance with the NERC TPL Reliability Standards and SPP Criteria in the near-term horizon; (b) zonal upgrades required to maintain reliability in accordance with more stringent individual Transmission Owner planning criteria in the near-term horizon; and (c) coordinated projects with neighboring Transmission Providers. ITPNT projects are reviewed by SPP's Transmission Working Group (TWG), Markets and Operations Policy Committee (MOPC), and approved by the Board of Directors. Following Board of Directors' approval, staff will issue Notification to Construct (NTC) letters for upgrades that require a financial commitment within the next four-year timeframe.

SPP developed models for the 2015 ITPNT analysis based on the SPP Model Development Working Group (MDWG) models, for which Transmission Owners and Balancing Authorities provided generation dispatch and load information. The study scope<sup>4</sup> – approved by the TWG on January 3, 2014 – contains:

- The years and seasons to be modeled;
- Treatment of upgrades in the models;
- Scenario cases to be evaluated;
- Description of the contingency analysis and monitored facilities; and
- Any new special conditions that are modeled or evaluated for the study including the development of the model for SPP's Consolidated Balancing Authority (CBA) dispatch.

SPP performed analyses identifying potential bulk power system reliability needs. These findings were presented to Transmission Owners and the Transmission Working Group (TWG) to solicit transmission solutions to the potential issues identified. Also considered were transmission solutions from other SPP studies, such as the Aggregate Transmission Service Study and Generation Interconnection processes. From the resulting list of potential solutions, staff identified the cost effective regional solutions for potential reliability needs. Staff presented these solutions for member and stakeholder review at SPP's December 2014 planning summit. Through this process, SPP developed a draft list of 69 kV and above solutions necessary to provide reliable service in the SPP region in the near-term planning horizon.

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<sup>4</sup> [2015 ITPNT Scope](#)

The maps in Figures 4.1 and 4.2 show the draft ITPNT thermal and voltage solutions in correlation to the areas identified with reliability criteria violations. The complete list of 2015 ITPNT projects is located in [Section 16](#) of this report.

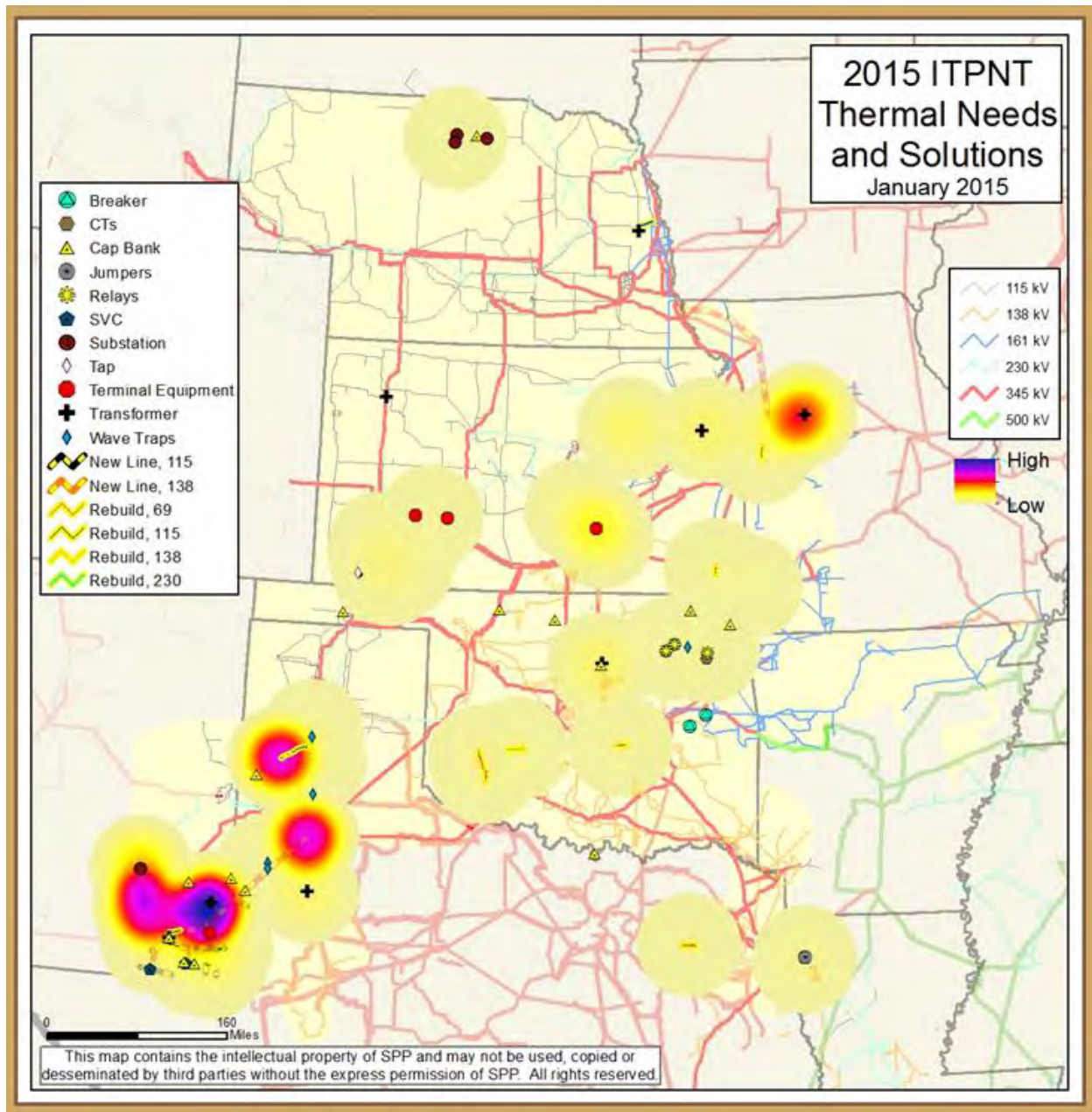


**Figure 4.2: 2015 ITPNT Thermal Needs and Solutions**



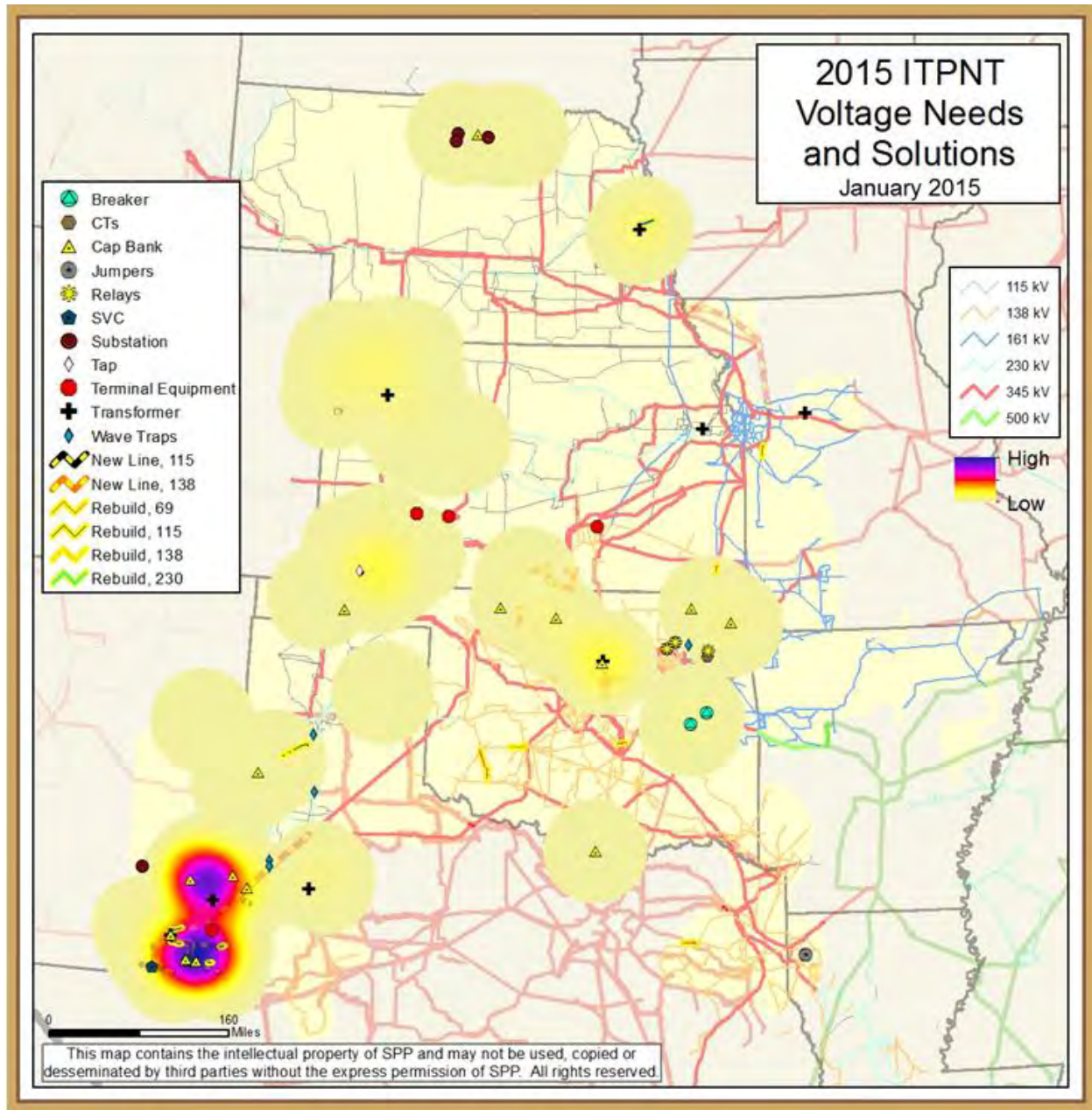


**Figure 4.3: 2015 ITPNT Voltage Needs and Solutions**

The 2015 ITPNT Project Plan consists of the following:

- 208 thermal and 64 voltage violations resolved in the 2015 ITPNT.
- 42 proposed projects consisting of 70 proposed upgrades at a total estimated cost of \$248.2 million for upgrades that will receive an NTC, NTC-C, or NTC Modify.
  - 41 will be issued a new Notice to Construct (NTC/NTC-C) at an estimated cost of \$213.1 million.
  - One (1) upgrade has been identified as needing a modified NTC (NTC Modify) at an estimated cost of \$35.1 million.

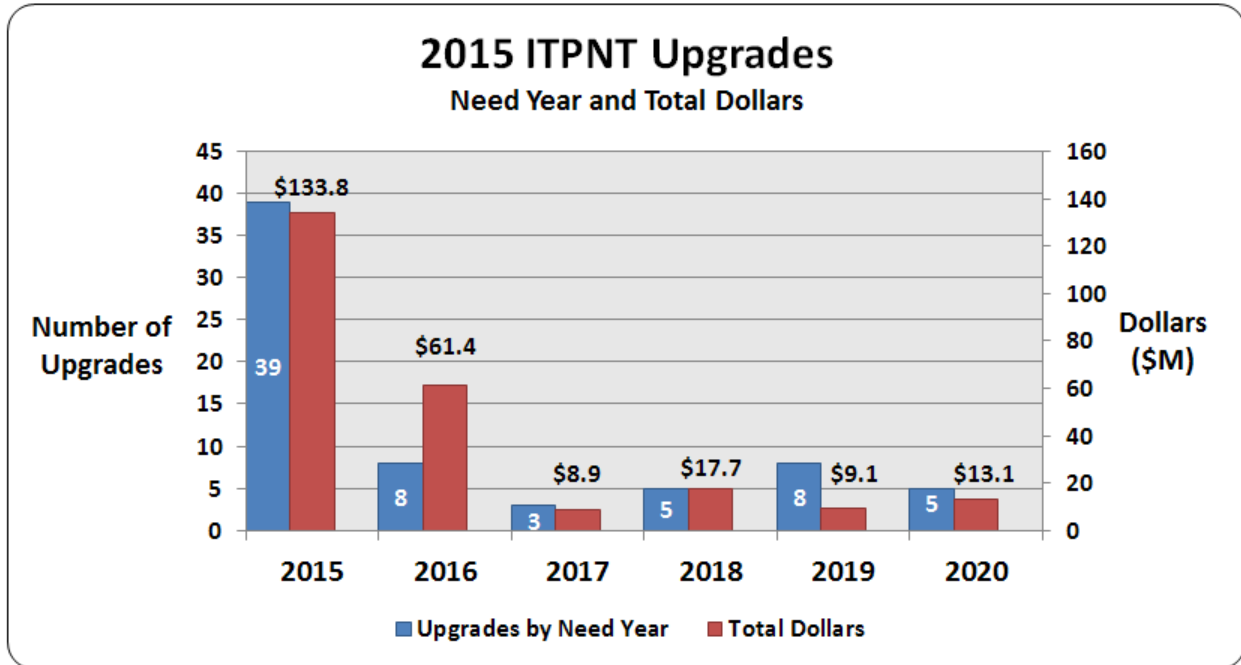


Figure 4.4: 2015 ITPNT Upgrades by Need Year and Total Dollars

- Project Plan mileage consists of:
  - 21 miles of new transmission line.
  - 162 miles of rebuild/reconductor.
  - 2 miles of voltage conversion.

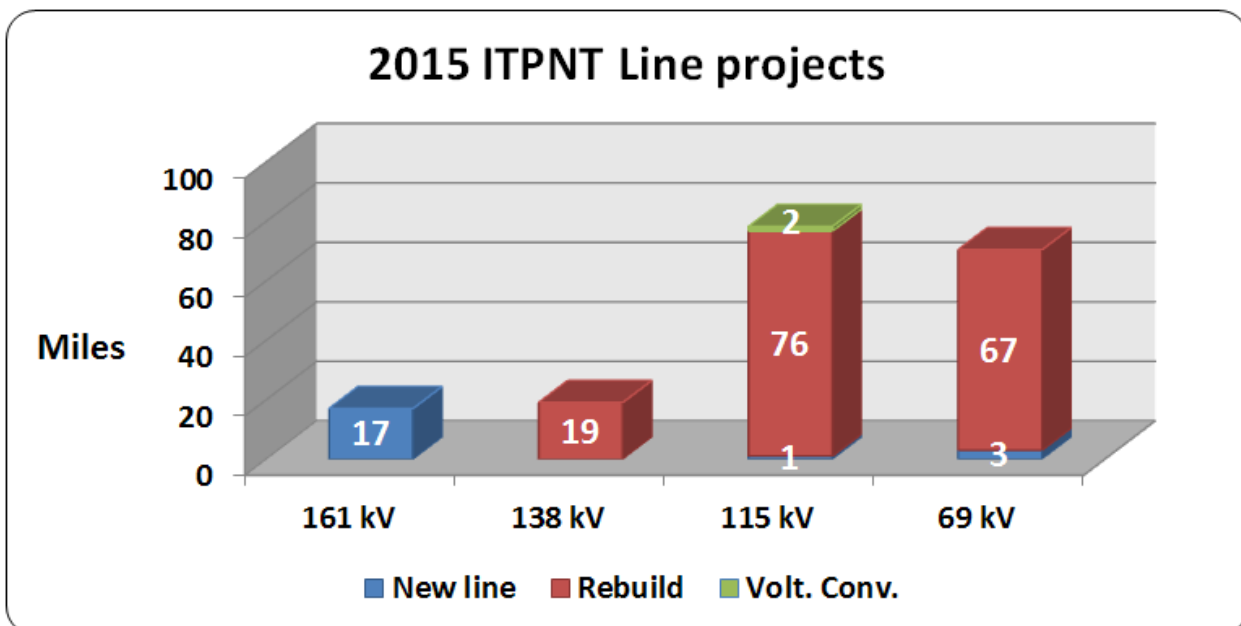


Figure 4.5: 2015 ITPNT Project Plan Mileages by Voltage Class

## Section 5: Balanced Portfolio

The SPP Board of Directors approved the Balanced Portfolio projects in April 2009 and directed staff to finalize the Balanced Portfolio Report in accordance with the SPP Tariff and then issue Notifications to Construct (NTC). The NTCs were issued in June 2009.

The Balanced Portfolio was an initiative to develop a group of economic transmission upgrades benefitting the entire SPP region and to allocate those project costs regionally. The benefits of this group of 345 kV transmission upgrades have been demonstrated by model analysis to outweigh the costs, and the regional cost sharing creates balance across the SPP region. For more information on the Balanced Portfolio, see the [full report](#) (SPP.org > Engineering > Transmission Planning).

Figure 5.1 below is a graph of the total estimated costs attributed to Balanced Portfolio projects for the 2015 STEP and previous years. The estimated project costs are affected by the completion of projects, as seen in Table 5.1, and adjustments in project cost estimates by Project Owners.

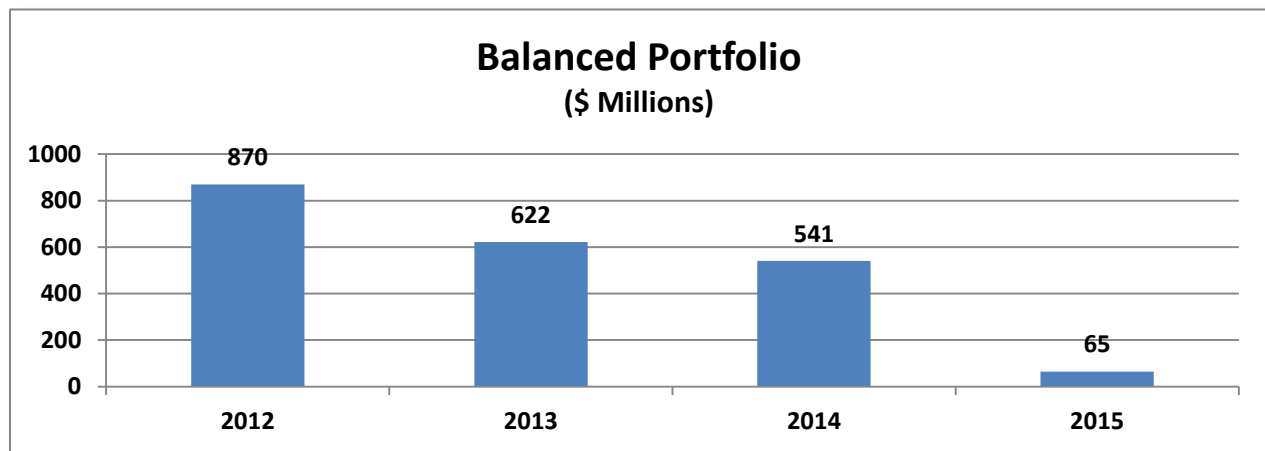


Figure 5.1: STEP Cost Estimate Comparison for Balanced Portfolio Projects – 2012-2015

| NTC ID | Project ID | Project Owner | Project Name                                      | Current Cost Estimate |
|--------|------------|---------------|---------------------------------------------------|-----------------------|
| 20041  | 701        | OGE           | Stateline - Woodward EHV 345 kV                   | \$115,000,000         |
| 20041  | 701        | OGE           | WOODWARD DISTRICT EHV 345/138KV TRANSFORMER CKT 2 | \$0                   |
| 20043  | 704        | SPS           | Tuco Interchange - Stateline 345 kV               | \$192,875,814         |
| 20043  | 701        | OGE           | Stateline 345 kV                                  | \$0                   |

Table 5.1: Balanced Portfolio Projects Completed in 2014



Figure 5.2: Approved Balanced Portfolio

## Section 6: High Priority Studies

Attachment O, Section IV.2, of SPP's OATT describes the process for which high priority studies may be requested by stakeholders and performed by SPP as the Transmission Provider. Stakeholders may request high priority studies, including a request for the Transmission Provider to study potential upgrades or other investments necessary to integrate any combination of resources, whether demand resources, transmission, or generation, identified by the stakeholders. For each high priority study the Transmission Provider shall publish a report, including but not limited to, the study input assumptions, the estimated cost of the upgrades, any third party impacts, the expected economic benefits of the upgrades, and identify reliability impacts, if any, of the upgrades. The Transmission Provider may recommend, based on the results of a high priority study, a high priority upgrade for inclusion in the SPP Transmission Expansion Plan in accordance with the approval process set forth in Section V of SPP's OATT.

Figure 6.1 below is a comparison of the cost estimates for projects coming out of high priority studies performed in 2010 and 2013-14. Study details follow in sections 6.1 and 6.2

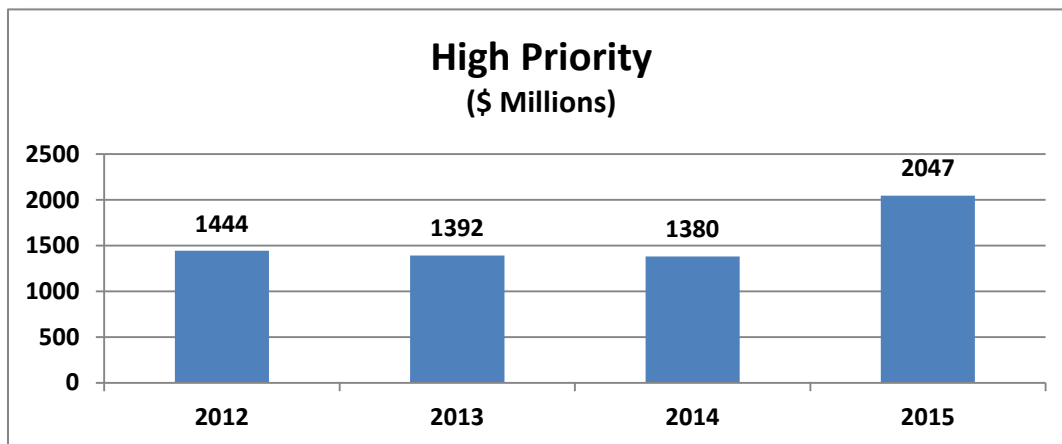


Figure 6.1: STEP Cost Estimate Comparison for High Priority Projects – 2012-2015

### 6.1: SPP Priority Projects

In 2010, the SPP Board of Directors and Members Committee approved for construction a group of "priority" high voltage electric transmission projects estimated to bring benefits of at least \$3.7 billion to the SPP region over 40 years. The projects will improve the regional electric grid by reducing congestion, better integrating SPP's east and west regions, improving SPP members' ability to deliver power to customers, and facilitating the addition of new renewable and non-renewable generation to the electric grid. For information on Priority Projects, see the [full report](#) (SPP.org > Engineering > Transmission Planning).

Twenty (20) SPP Priority Projects were completed in 2014. A list of SPP Priority Projects completed in 2014 can be found in [Section 17](#).



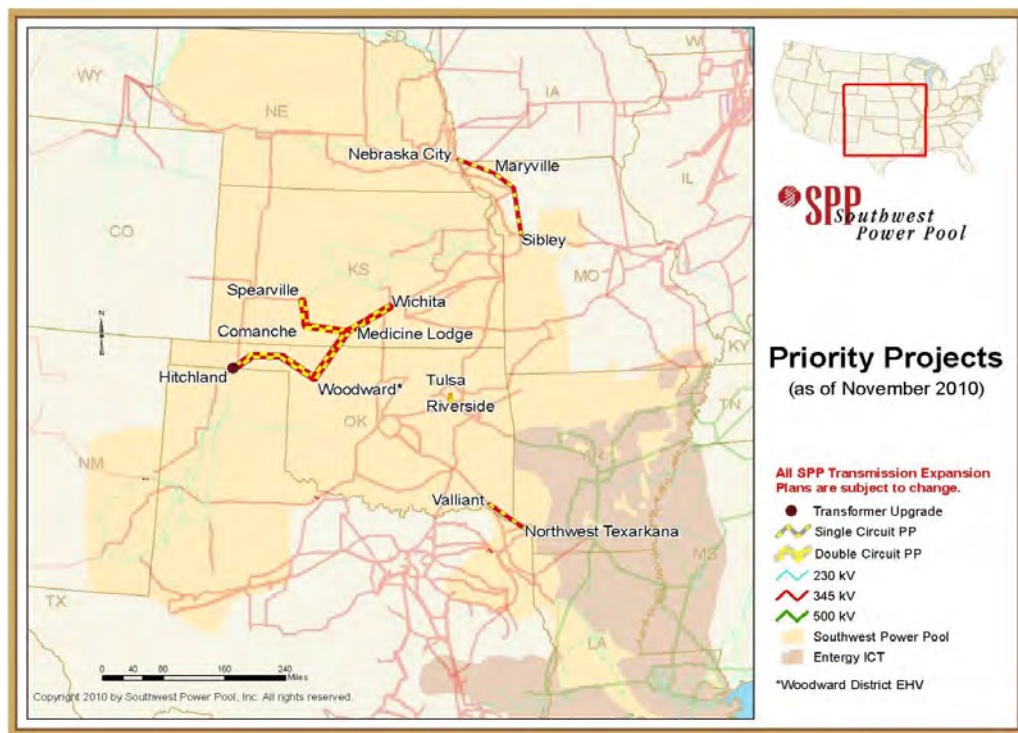


Figure 6.2: SPP Priority Projects

## 6.2: High Priority Incremental Load Study (HPILS)

Southwest Power Pool's High Priority Incremental Load Study (HPILS) evaluated transmission needs resulting from significant incremental load growth expectations in certain parts of SPP. At its April 2013 meeting, SPP Board of Directors Chairman Jim Eckelberger directed the performance of a high priority study to evaluate transmission needs resulting from expected incremental loads that had not previously been studied. SPP Staff began the High Priority Incremental Load Study (HPILS) after its scope was approved, with no opposition, by the Markets and Operations Policy Committee (MOPC) at their July 16-17, 2013 meeting. Stakeholder oversight of the study was provided primarily by a task force (HPILSTF) established by the Transmission Working Group (TWG).

HPILS was completed and a draft report issued in March of 2014. The HPILS report included an explanation of study processes and assumptions, an identification of projects needed over the 10-year study horizon to reliably meet load growth expectations, and a list of projects recommended for construction. Over a series of meetings in late March and early April of 2014, various SPP stakeholder groups reviewed the HPILS report. The report was unanimously approved by the HPILSTF. The TWG approved that the report indicated completion of the technical requirements of the HPILS scope. The MOPC reviewed the report at their April 15-16 meeting but, after a failed motion to "approve the HPILS report and Appendix C as submitted", did not forward a recommendation to the BOD regarding the HPILS report and recommended projects.

Because HPILS was performed pursuant to Chairman Jim Eckelberger's direction, Staff presented the HPILS report to the BOD and Members Committee for consideration at their April 29, 2014 meeting. Staff recommended that the BOD direct construction of those projects that meet near-term needs and as shown in Attachment C of the report.

Additional recommendations were also made to address concerns raised by stakeholders during the MOPC discussion. After considerable discussion with input from stakeholders in attendance, the BOD approved the recommendations, following a Members Committee vote that reflected eleven members supporting, two opposing, and one abstaining.

The BOD approval of the HPILS projects recommended for construction is supported by the bases shown below:

1. The projects were identified by a study performed in accordance with a stakeholder approved scope.
2. The projects were identified as cost effective solutions that met identified reliability needs associated with expected incremental load.
3. The projects approved for construction address the more urgent, near-term reliability needs such that risks associated with realization of incremental load in lower than expected amounts are minimized.
4. Concerns raised during MOPC discussion were sufficiently addressed with approval of the recommendations presented to the BOD.

HPILS was conducted in accordance with the high priority study provisions outlined in the SPP Open Access Transmission Tariff (OATT). In accordance with the HPILS scope, a cost-effective transmission plan was developed to address reliability needs over a 10-year period under updated load growth and corresponding generation expansion assumptions. The HPILS also reevaluated three projects previously approved in the 2012 Integrated Transmission Plan 10-Year Assessment (ITP10) for which Notifications to Construct with Conditions (NTC-Cs) had been suspended by the Board in April 2013, pending further evaluation. The study included an evaluation of project costs and economic benefits under selected scenarios and sensitivities. HPILS included the economic analysis of the total portfolio as well as the incremental benefit of the suspended NTC-C for the Tuco-Amoco-Hobbs or equivalent solutions.

The total cost<sup>5</sup> of the projects for which new NTCs were recommended was estimated to be \$573 M (million). Regarding the three NTC-Cs that were re-evaluated as part of the study, it was determined that the Tuco – New Deal 345 kV and Grassland – Wolfforth 230 kV projects were no longer needed. As a result, the associated NTC-Cs should be withdrawn, which would remove \$114 M from the SPP Transmission Expansion Plan (STEP).

HPILS identified the Tuco-Yoakum-Hobbs 345 kV project as a better performing and lower cost alternative to the Tuco-Amoco-Hobbs 345 kV project. It was recommended that the

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<sup>5</sup> Unless otherwise specified, all costs are Engineering and Construction costs in 2014 dollars.

Tuco-Amoco-Hobbs NTC-C be modified to reflect the Tuco-Yoakum-Hobbs project with a 2020 in-service date at a cost savings of at least \$20 M.

The HPILS Portfolio's impact on the STEP is shown in Table 6.1 below.

| Project Category                                        | Cost Estimate    |
|---------------------------------------------------------|------------------|
| New NTC Projects                                        | <b>\$573 M</b>   |
| Withdrawal of Suspended NTC-C for Tuco - New Deal       | <b>(\$57 M)</b>  |
| Withdrawal of Suspended NTC-C for Grassland - Wolfforth | <b>(\$57 M)</b>  |
| Modification of Suspended NTC-C for Tuco-Amoco-Hobbs    | <b>(\$258 M)</b> |
| Reinstate NTC-C for Tuco-Yoakum-Hobbs                   | <b>\$238 M</b>   |
| <b>HPILS Impact on the STEP</b>                         | <b>\$439 M</b>   |

**Table 6.1: HPILS Portfolio Impact on the STEP**

| State(s)  | Upgrade Name                                                  | Issue NTC | 50/50 Need Year | 90/10 Need Year | Cost Estimate |
|-----------|---------------------------------------------------------------|-----------|-----------------|-----------------|---------------|
| <b>KS</b> | Clark Co. 345/115 kV Ckt 1 Transformer                        | Yes       | 2015            | 2015            | \$10,516,124  |
| <b>NE</b> | Thedford 345/115 kV Transformer                               | Yes       | 2016            | 2016            | \$9,306,000   |
| <b>NE</b> | Thedford 345 kV Terminal Upgrades                             | Yes       | 2016            | 2016            | \$930,800     |
| <b>NM</b> | Potash Junction 230/115 kV Ckt 1                              | Yes       | 2015            | 2015            | \$3,320,942   |
| <b>NM</b> | Andrews 230/115 kV Ckt 1 Transformer                          | Yes       | 2015            | 2015            | \$9,503,243   |
| <b>NM</b> | Kiowa 345 kV Substation                                       | Yes       | 2018            | 2018            | \$10,142,928  |
| <b>NM</b> | Road Runner 345/115 kV Ckt 1 Transformer                      | Yes       | 2018            | 2018            | \$4,577,343   |
| <b>NM</b> | Road Runner 345 kV Substation Conversion                      | Yes       | 2018            | 2018            | \$3,930,065   |
| <b>NM</b> | Kiowa 345/230 kV Ckt 1 Transformer                            | Yes       | 2018            | 2018            | \$5,955,675   |
| <b>NM</b> | Potash Junction - Road Runner 345 kV Ckt 1 Voltage Conversion | Yes       | 2018            | 2018            | \$7,097,576   |
| <b>NM</b> | Hobbs - Kiowa 345 kV Ckt 1                                    | Yes       | 2018            | 2018            | \$55,846,663  |
| <b>NM</b> | China Draw - North Loving 345 kV Ckt 1                        | Yes       | 2018            | 2018            | \$18,290,178  |
| <b>NM</b> | Kiowa - North Loving 345 kV Ckt 1                             | Yes       | 2018            | 2018            | \$23,457,538  |
| <b>NM</b> | China Draw 345/115 kV Ckt 1 Transformer                       | Yes       | 2018            | 2018            | \$4,390,007   |
| <b>NM</b> | China Draw 345 kV Ckt 1 Terminal Upgrades #1                  | Yes       | 2018            | 2018            | \$4,318,803   |
| <b>NM</b> | North Loving 345/115 kV Ckt 1 Transformer                     | Yes       | 2018            | 2018            | \$5,583,339   |
| <b>NM</b> | North Loving 345 kV Substation                                | Yes       | 2018            | 2018            | \$6,579,825   |
| <b>LA</b> | Benteler - McDade 345 kV Ckt 1                                | No        | 2023            | 2018            | \$13,083,537  |

| State(s) | Upgrade Name                                                               | Issue NTC    | 50/50 Need Year | 90/10 Need Year | Cost Estimate |
|----------|----------------------------------------------------------------------------|--------------|-----------------|-----------------|---------------|
| LA       | McDade 345/138 kV Ckt 1 Transformer                                        | No           | 2023            | 2018            | \$10,516,124  |
| LA       | Messick 500/345 kV Ckt 1 Transformer                                       | No           | 2023            | 2018            | \$19,718,950  |
| LA       | McDade - Messick 345 kV Ckt 1                                              | No           | 2023            | 2018            | \$45,792,379  |
| LA       | Benteler 345/138 kV Ckt 1 Transformer                                      | No           | 2023            | 2018            | \$10,516,124  |
| NM       | Potash Junction 345/115 kV Ckt 1 Transformer                               | No           | 2019            | 2019            | \$10,516,124  |
| NM       | Andrews 345/115 kV Ckt 1 Transformer                                       | No           | 2022            | 2022            | \$10,516,124  |
| NM       | Andrews - Hobbs 345 kV Ckt 1 Voltage Conversion                            | No           | 2022            | 2022            | \$30,530,000  |
| NM       | Oasis - Roosevelt County Interchange Switch 115 kV Ckt 1 Terminal Upgrades | No           | 2023            | 2023            |               |
| OK       | Mooreland - Woodward District EHV 345 kV Ckt 1                             | No           | 2018            | 2018            | \$13,083,537  |
| OK       | Border - Chisholm 345 kV Ckt 1                                             | No           | 2021            | 2021            | \$654,177     |
| OK       | Chisholm - Woodward District EHV 345 kV Ckt 1                              | No           | 2021            | 2021            | \$654,177     |
| OK       | Chisholm 345/230 kV Ckt 2 Transformer                                      | No           | 2021            | 2021            | \$10,516,124  |
| TX       | Hitchland 230/115 kV Ckt 2 Transformer                                     | No           | 2023            | 2023            | \$6,020,434   |
| TX       | Carlisle 230/115kV Ckt 1 Transformer                                       | No           | 2023            | 2023            | \$6,020,434   |
| TX       | Sundown - Wolfforth 230 kV Ckt 1 Reconductor                               | No           | 2023            | 2023            | \$22,580,725  |
| TX       | Sundown 230/115 kV Ckt 2 Transformer                                       | No           | 2023            | 2023            | \$6,020,434   |
| TX       | Lubbock South - Wolfforth 230 kV Ckt 1 Terminal Upgrades                   | No           | 2023            | 2023            |               |
| TX       | Plant X 230/115 kV Ckt 2 Transformer                                       | No           | 2023            | 2023            | \$6,020,434   |
| TX       | Seminole 230/115 kV Ckt 1 Transformer                                      | No           | 2023            | 2023            | \$6,020,434   |
| TX       | Seminole 230/115 kV Ckt 2 Transformer                                      | No           | 2023            | 2023            | \$6,020,434   |
| TX       | Wolfforth 230/115 kV Ckt 1 Transformer                                     | No           | 2023            | 2023            | \$6,020,434   |
| TX       | Yoakum 345/230 kV Ckt 1 Transformer                                        | NTC-C Modify | 2020            | 2020            | \$4,929,607   |
| TX       | Yoakum 345 kV Ckt 1 Terminal Upgrades                                      | NTC-C Modify | 2020            | 2020            | \$1,714,283   |
| TX       | Tuco - Yoakum 345 kV Ckt 1                                                 | NTC-C Modify | 2020            | 2020            | \$160,991,967 |
| TX/NM    | Hobbs - Yoakum 345 kV Ckt 1                                                | NTC-C Modify | 2020            | 2020            | \$69,907,711  |
| NM       | Potash Junction - Road Runner 230 kV Ckt 1                                 | NTC-C Modify | 2015            | 2015            | \$3,491,968   |
| NM       | Road Runner 230/115 kV                                                     | NTC-C        | 2015            | 2015            | \$2,107,123   |

| State(s) | Upgrade Name                       | Issue NTC    | 50/50 Need Year | 90/10 Need Year | Cost Estimate |
|----------|------------------------------------|--------------|-----------------|-----------------|---------------|
|          | Substation                         | Modify       |                 |                 |               |
| NM       | Hobbs 345/230 kV Transformer Ckt 1 | NTC-C Modify | 2018            | 2018            | \$10,262,813  |

**Table 6.2: Final Reliability Projects 230 kV and above for TYH option in the HPILS Portfolio**

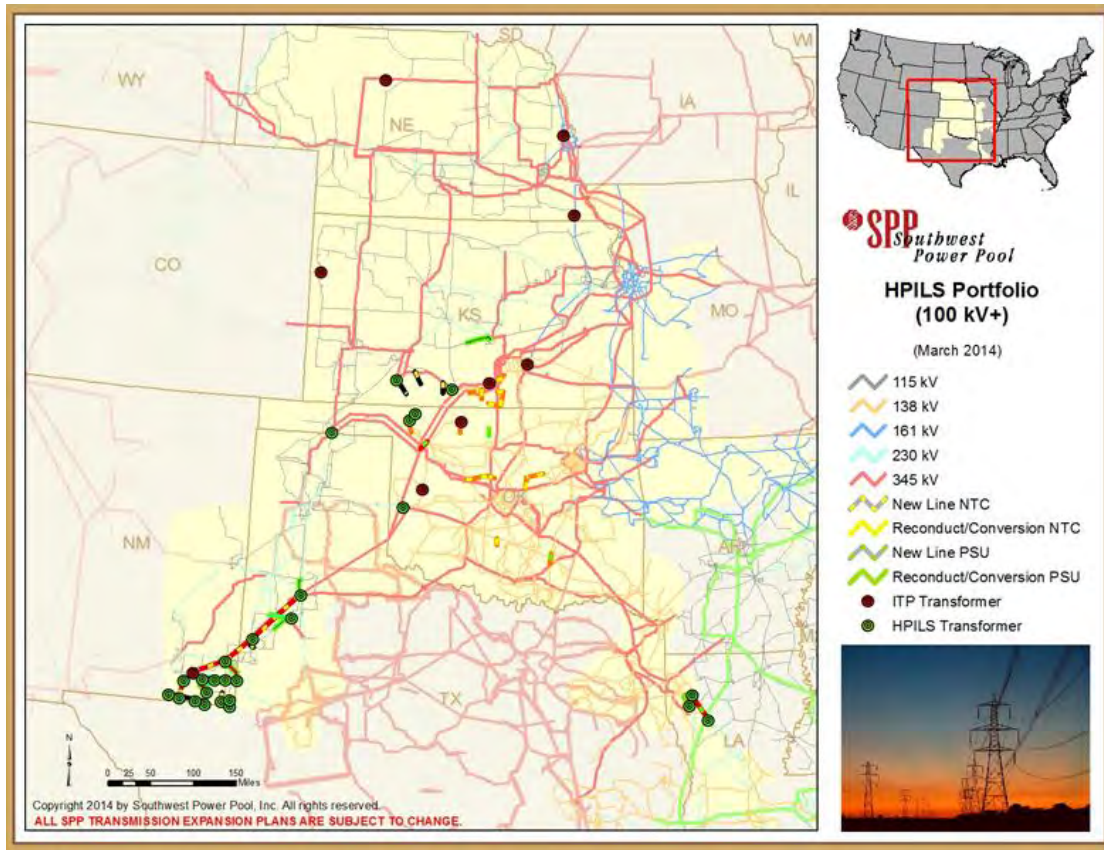


**Figure 6.3: Finalized HPILS Portfolio (100 kV and above)**

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## **Section 7: Sponsored Upgrades**

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Sponsored upgrades are Network Upgrades requested by a Transmission Customer or other entity which do not meet the definition of any other category of Network Upgrades. Any entity may request a Sponsored Upgrade. SPP will evaluate the impact of any Sponsored upgrade on transmission system reliability and identify any necessary mitigation of these impacts. The proposed Sponsored upgrades will be submitted to the MOPC and BOD for endorsement.

The Project Sponsor must be willing to assume the cost of the Sponsored upgrade, study costs, and any cost associated with necessary mitigation.

No Sponsored upgrades were completed in 2014.

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## Section 8: Regional Cost Allocation Review (RCAR)

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Upon conclusion of the Regional Cost Allocation Review (RCAR) Report in October 2013, SPP Staff and the RARTF recommended that a second RCAR process (RCAR II) be commenced and work in parallel with the 2015 ITP10 Assessment, and that it be completed shortly after the completion of the 2015 ITP10.

The RCAR II is an analysis to measure the cost allocation impacts of SPP's Highway/Byway methodology to zones. The costs and benefits of transmission projects with Notifications to Construct (NTC) are assessed for each zone. Any zone with benefits that are not roughly commensurate with their costs (defined as B/C ratio less than 0.8) will be analyzed for potential remedies. Potential remedies, in order of most to least preferable, may include but are not limited to:

1. Acceleration of planned upgrades;
2. Issuance of NTCs for selected new upgrades;
3. Apply Highway funding to one or more Byway projects;
4. Apply Highway funding to one or more Seams projects,
5. Zonal Transfers (similar to Balanced Portfolio Transfers) to offset costs or a lack of benefits to a zone;
6. Exemptions from cost associated with the next set of projects; and
7. Change cost allocation percentages.

In 2014, Staff has worked with stakeholders through the TWG, ESWG, and MOPC to further refine the benefit metric techniques that will be used in the RCAR II. These techniques were approved by the BOD in July 2014.

A preliminary RCAR II model development and analysis (referred to as the "ITP10 Cumulative Assessment") is currently being performed and is scheduled to conclude in January 2015. The results of the ITP10 Cumulative Assessment will be included in the 2015 ITP10 report. After approval of the 2015 ITP10 in January 2015, RCAR II models will be updated in order to develop final RCAR II models and perform a final analysis. Staff will work with the TWG and ESWG to finalize the RCAR II models. The RCAR II analysis and report are scheduled to be completed in April 2015.



## Section 9: Interregional Coordination

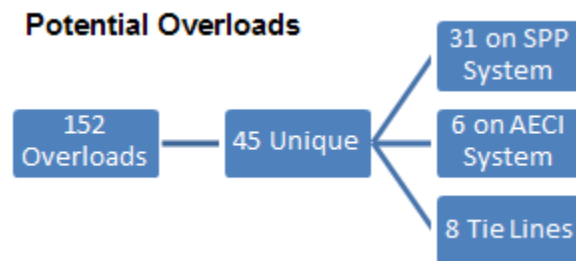
### 9.1: Interregional Planning

In 2014, SPP participated in two different joint planning processes. SPP's respective Joint Operating Agreements (JOA) with AECI and MISO outline the requirements for joint and coordinated planning procedures and the resulting product of a Coordinated System Plan (CSP).

The SPP-AECI JOA requires a reliability-focused study be performed every other year. The scope of the 2014 SPP-AECI CSP was to evaluate the reliability and robustness of the combined SPP and AECI transmission systems in the near-term and long-term planning horizons, collaborate on the development of mutually beneficial transmission improvements, and identify potential transmission projects for approval and construction. The study consisted of an ACCC steady state powerflow analysis, a low hydro scenario, and transfer analysis to determine incremental Available Transfer Capability (ATC) as a result of any seams projects.

These three components of the study were included in the scope after significant SPP and AECI stakeholder input. The study was overseen by the SPP-AECI Interregional Planning Stakeholder Advisory Committee (IPSAC) and consists of stakeholders from both SPP and AECI. SPP and AECI staff met with the IPSAC on four different occasions throughout the year to obtain the stakeholder input vital to completing the study. On multiple occasions, study updates were provided to various other SPP working groups, committees, and stakeholder summits.

The base case (N-0) and contingency (N-1) analysis that was completed in the steady state powerflow portion of the study provided a list of potential thermal and voltage limit violations. This list was provided to stakeholders along with a request for stakeholders to propose solutions to address the potential violations. Potential overloads and potential low voltage issues are represented below. The map in Figure 9.1 is an overview of all the issues identified in all the model years included in the study.



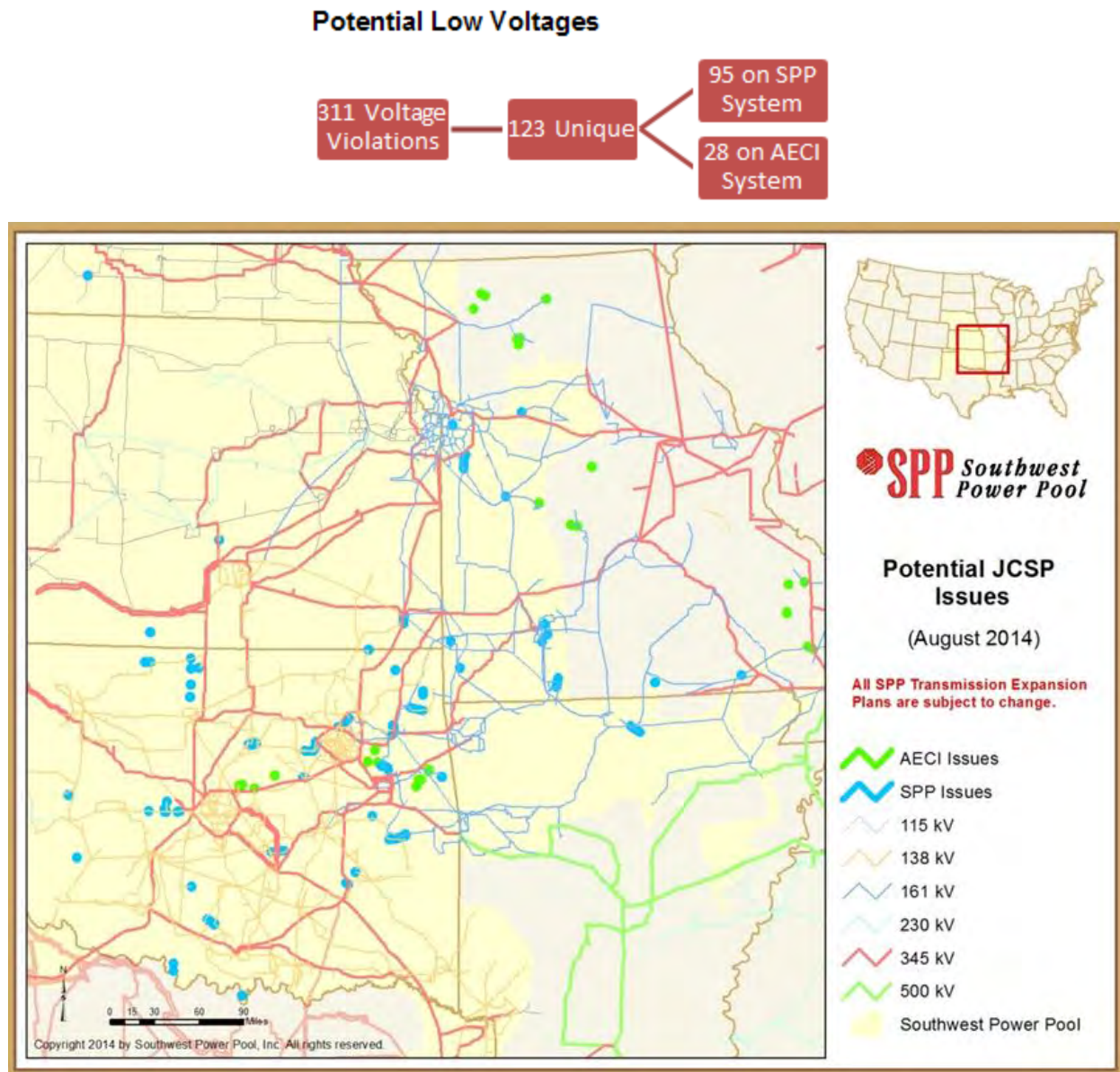
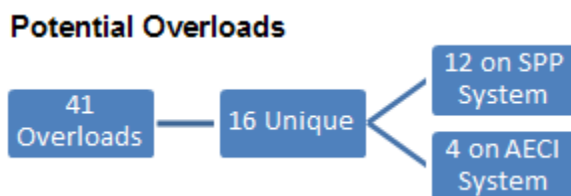
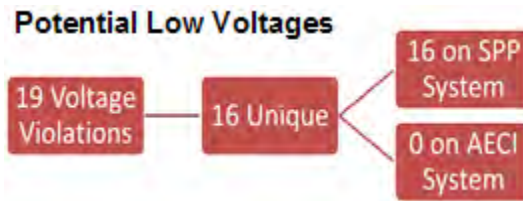


**Figure 9.1: Potential JCSP Issues**

The low hydro scenario (N-0) and contingency (N-1) powerflow analysis that was completed provided a list of potential thermal and voltage limit violations. This list was provided to stakeholders along with a request for stakeholders to submit solutions to address the potential violations. Potential overloads and potential low voltage issues are represented below.





SPP and AECI staff took the approach of focusing on developing potential joint projects that were mutually beneficial to both entities. After an extensive amount of coordination was done to ensure study results were accurate, SPP and AECI staff developed a list of the top mutually beneficial projects. These potential solutions were compared for cost-effectiveness and feasibility versus SPP's and AECI's regional solutions to those same issues. Once the cost comparisons and stakeholder input were taken into account, no joint transmission solutions were identified that would provide a more cost effective solution than SPP or AECI's regional solutions. All potential voltage and thermal issues on the SPP system identified in the joint study are being addressed by the 2015 ITPNT. The next SPP-AECI CSP will take place in 2016; however AECI and SPP will continue to coordinate in the interim on potential seams transmission upgrade opportunities that may materialize from each party's respective regional planning processes.

Also in 2014, SPP began a Coordinated System Plan study with MISO pursuant to the joint planning procedures contained in the SPP-MISO JOA. The study began in April of 2014 and is scheduled to conclude in June 2015 when both parties will have the opportunity to begin a regional review process for any Interregional Projects that may be recommended from the CSP study. The purpose of the CSP study is to jointly evaluate seams transmission issues and identify transmission solutions that efficiently address the identified issues to the benefit of SPP and MISO. This study will incorporate an economic evaluation of seams transmission issues and an assessment of potential reliability violations. A high-level overview of the scope of the CSP study is shown in the table below:

| <b>MISO-SPP CSP Tasks</b>                            |                                                                                         |
|------------------------------------------------------|-----------------------------------------------------------------------------------------|
| <b>Scope Development</b>                             |                                                                                         |
| 1. Develop and finalize scope document for CSP study |                                                                                         |
| 2. Develop detailed schedule for CSP study           |                                                                                         |
| 3. Economic Evaluation and Reliability Assessment    |                                                                                         |
| <b>Economic Evaluation</b>                           | <b>Reliability Assessment</b>                                                           |
| • Future and Model Development                       | • Perform steady-state reliability assessment using jointly developed power flow models |
| • Historical and Projected Congestion Analysis       | • Test system stability using scenario(s) appropriate for studying dynamics.            |

| MISO-SPP CSP Tasks                                     |                                                                                     |
|--------------------------------------------------------|-------------------------------------------------------------------------------------|
| • Solution Development                                 | • Determine if there are interregional alternatives to proposed regional solutions  |
| • Solution Evaluation and Robustness Testing           | • Evaluate potential transmission solutions, as needed, based on identified issues. |
| • Reliability Analysis                                 |                                                                                     |
| • Determine interregional cost allocation              |                                                                                     |
| 4. Draft Coordinated System Plan study report          |                                                                                     |
| 5. Regional Evaluation and Cost Allocation (if needed) |                                                                                     |

## **9.2: Interregional Requirements of Order 1000**

SPP is currently waiting on a response from FERC on its July 2013 filing to satisfy the interregional requirements of Order 1000. SPP and MISO entered into a CSP in 2014 based on the SPP-MISO JOA and current pending filings. SPP will comply with interregional requirements of Order 1000 with Southeastern Regional Transmission Planning Region SERTP beginning in 2015.

## **9.3: ITP Seams Coordination Enhancements**

SPP continues to enhance and refine coordination with SPP's neighbors during SPP's regional planning studies, including the ITP10. The goal of the enhanced coordination is to better ensure that the planning along the SPP seams is as robust as the transmission planning in the middle of the SPP footprint. To accomplish this, SPP's seams coordination objective was to coordinate with SPP's neighbors at every milestone of the planning process and on the same schedule as SPP staff coordinates with SPP stakeholders. As described in section 9.1, there were two ongoing seams planning studies during the course of the 2015 ITP10 which provided additional coordination opportunities as these seams studies were leveraged in the 2015 ITP10 assessment.

### **Coordination Activities**

Seams coordination in the ITP10 focused on SPP's Tier 1 neighbors. Throughout the previous sections of this report, coordination with SPP's Tier 1 neighbors is discussed as it pertains to each specific section. The subsections below provide additional information regarding that coordination.

### **Model Development & Resource Plan**

In addition to using the Multi-regional Modeling Working Group (MMWG) models as a starting point for SPP's model development, SPP also provided SPP's Tier 1 neighbors with an opportunity to review and provide edits to the ITP10 model. AECI and MISO each provided specific feedback on the modeling for their respective footprints. This review was similar to reviews performed by SPP stakeholders as the Tier 1 neighbors had the

opportunity to review load, generation, topology, and other modeling inputs. Additionally, SPP's neighbors provided feedback on the resource plan that SPP used to model the retirements and generation expansion for 2024 in the ITP10. Since SPP and MISO have a process in place to share their regional planning models, SPP was able to utilize the resource expansion plan MISO used in the MISO Transmission Expansion Plan (MTEP) 2013. The MISO expansion plan was supplemented by incorporating additional resources, as needed, for Entergy and Cleco as these areas were not included in the MTEP 2013.

### **Congestion Assessment**

While in the ITP10, SPP did not report on transmission needs outside of the SPP footprint. Each of SPP's Tier 1 neighbors were provided with the results of SPP's identified transmission needs to begin discussion of whether or not there was an opportunity to coordinate on a joint transmission solution based on SPP's identified needs. Specifically with AECI, SPP met on several occasions discussing the transmission needs SPP identified that are close to the seam with AECI. The list of transmission needs was also shared with MISO. These needs along the seam closely aligned with the transmission needs identified in the SPP-MISO Coordinated System Plan Study discussed below.

### **Coordination with Ongoing Seams Assessments**

During the 2015 ITP10, there were also two seams studies which were ongoing. The first is the SPP-AECI Joint Coordinated System Plan Study. The AECI Study focused on identifying and addressing potential reliability needs along the SPP-AECI seam. These needs could be in either the SPP or the AECI system. The needs identified in the AECI Study closely aligned with those identified in the ITP10 and the ITPNT. For this reason SPP staff was able to coordinate the two studies. All of the solutions proposed in the AECI Study were evaluated in the ITP10, and likewise the ITP10 proposed projects were evaluated in the AECI Study.

The second seams assessment is the SPP-MISO Coordinated System Plan Study (MISO Study). The MISO Study began in early 2014 and will conclude in June 2015. The MISO Study is currently in the solution development phase with the transmission needs having been published in October. The data that was used for model development in the MISO Study was used, where applicable, to enhance and improve the modeling in the ITP10. This provided SPP with the most recent and updated modeling of the large seam between SPP and MISO. The transmission needs on the SPP system identified in the MISO Study are consistent with the analysis performed in the ITP10.

While both of these seams assessments were separate studies from the 2015 ITP10, their performance during the ITP10 encouraged a more focused analysis on the seams region in the ITP10 by providing additional and more updated modeling information, better coordination and exchange of assumptions and data, and an expanded list of proposed transmission solutions focused on identifying transmission along the SPP seams.

### **Solution Evaluation**

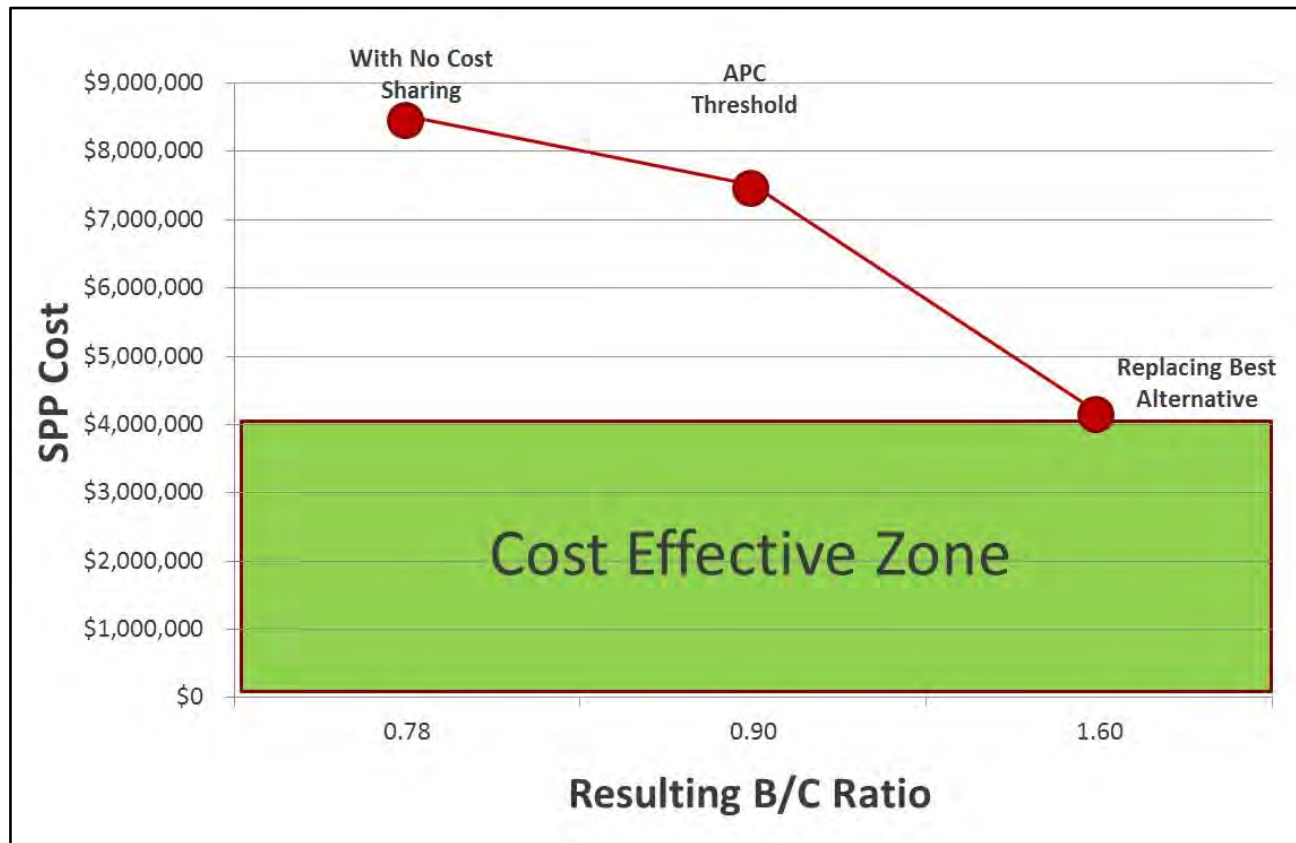
Evaluating seams transmission solutions includes an additional variable that is not present when evaluating an SPP regional transmission solution, namely, seams cost sharing. This unknown variable was seen as being a hurdle for moving forward in the planning process for seams projects in previous ITP assessments because a seams project would provide



benefits to regions outside SPP, but the SPP ITP solution development and evaluation process would assume all of the cost is being paid for by stakeholders in the SPP region. This issue was addressed in the 2015 ITP10 by a more focused evaluation of potential seams projects earlier in the planning process and by identifying the level of cost sharing a seams project would need in order to be the most cost-effective solution for SPP.

During project screening SPP staff identified projects that could potentially benefit one or more of SPP's neighbors. The projects which appeared to provide significant benefit to SPP and potentially benefit a seams neighbor were then evaluated to determine if there was a level of cost sharing which would cause the seams project to be more cost-effective than SPP's other regional solutions. After compiling this information SPP approached the applicable seams neighbor and began working with that neighbor to further evaluate the project to determine the neighbor's level of interest in the project.

The chart below shows a generic example of this evaluation.



The chart above illustrates a generic project that, if SPP approved without a seams partner, would result in an APC B/C ratio of .78 which is below the .9 B/C ratio threshold used in the ITP10. In order for that project to meet the .9 threshold the SPP portion of the costs would have to be reduced by approximately \$1,000,000. This means a seams partner would need to agree to cost share the project and pay, at a minimum, about 12% of the project. In this generic example with the 12% cost sharing, while the project would meet the 2015 ITP10 APC threshold, it would not be the preferred solution as there is a regional project which provides SPP a B/C ratio just under 1.6. In order for this generic example project to be the preferred solution it must be more cost effective than the

regional solution. For this particular scenario, the SPP portion of the cost could only be \$4,000,000 for the B/C ratio to surpass the SPP regional solution. The seams partner would need to agree to pay, at a minimum, about 53% of the total project cost. If there is a cost sharing agreement where the seams partner agrees to pay 53% of the project then that project would be considered the preferred solution in the 2015 ITP10.

This analysis described above was performed on all projects which appeared to provide significant benefit to SPP and also to an SPP neighbor. This was no less than 17 projects. Of those projects evaluated AECl expressed interest in several of them. Those projects were evaluated further with AECl to identify the specific value provided to AECl, the project feasibility, and total cost-effectiveness. After evaluation of all potential seams projects, there were not any seams projects which were both viable and more cost-effective than a regional alternative.

Projects which were shown to potentially benefit MISO will be evaluated in the MISO Study.

#### **9.4: Eastern Interconnection Planning Collaborative**

SPP is a participating Planning Authority (“PA”) in the Eastern Interconnection Planning Collaborative (EIPC). The activities of the EIPC can be found on the EIPC website at [www.eipconline.com](http://www.eipconline.com).

A significant amount of time and effort has been expended by the EIPC to facilitate an improved understanding regarding the interdependencies between the bulk power electric system and the natural gas supply and delivery network. In 2014, EIPC also created two scenarios: an updated base case for 2023, as well as a drought for 2023 to inform interregional planning efforts.



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## Section 10: Sub-Regional Planning

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Based on FERC Order 890 and Section III.2.b of Attachment O of the OATT, sub-regional areas were defined and local area planning meetings were held during 2014 in conjunction with the SPP planning summits.

The purpose of local area planning meetings is to identify unresolved local issues and transmission solutions at a more granular level than are accomplished at general regional planning meetings. Local area planning meetings provide stakeholders with local needs the opportunity to give advice and recommendations to the Transmission Provider and Transmission Owners. Local area planning meetings are open, coordinated, and transparent, providing a forum to review local area planning criteria as specified in Section II of the OATT, Attachment O. Feedback offered at each sub-regional meeting is taken into consideration by SPP staff when developing the regional reliability plan.

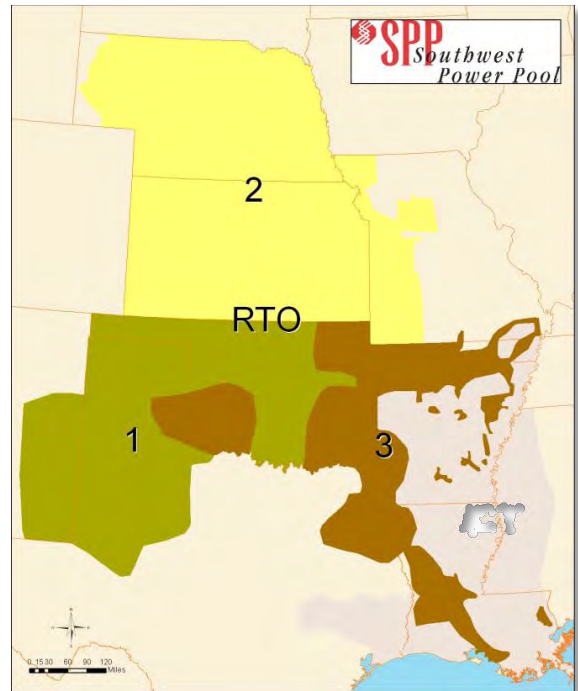


*Figure 10.1: SPP Sub-Regional Map*

### **10.1: Stakeholder Process and Forums**

Notices for the sub-regional planning meetings are posted on SPP.org and distributed to the appropriate email distribution lists. Sub-regional planning meetings are open to all entities. Any regulatory agency is invited and encouraged to participate. The map above represents the three SPP local areas.

#### **2014 Sub-Regional Meetings**

SPP held sub-regional planning meetings via net teleconferences following the October planning summit held in Little Rock at SPP's corporate headquarters. Teleconferences with each sub-regional as well as the Integrated System were held on October 10, 2014. Subject matter experts from SPP staff were present at all of the meetings to receive suggestions, answer questions, and discuss any concerns that stakeholders had about the transmission needs in their respective region. Minutes for each sub-regional net teleconference can be found on SPP's website (SPP.org>Engineering>Transmission Planning>2014 October Summit).

## Section 11: Project Tracking

### 11.1: Business Practice 7060

Applicable to projects issued an NTC on or after January 1, 2012, the MOPC approved Business Practice 7060 on March 27, 2012. The Business Practice commenced a cost estimation process defined by a tiered approach for project cost estimates based upon the level of project definition that is known. It also introduced the Notification to Construct with Conditions (NTC-C) issued to applicable projects, projects with an estimated cost of \$20 million or greater and a nominal operating voltage greater than 100 kV. The table below lists the cost estimate stage definitions.

| Estimate Name                       | Stage                              |                                 |                      | End Usage                                                 | Precision Bandwidth |
|-------------------------------------|------------------------------------|---------------------------------|----------------------|-----------------------------------------------------------|---------------------|
|                                     | Non-Competitive Projects           |                                 | Competitive Projects |                                                           |                     |
|                                     | Projects > 100 kV & > \$20 Million | All other BOD Approved Projects |                      |                                                           |                     |
| <b>Conceptual</b><br>(SPP Prepared) | 1                                  | 1                               | 1                    | Concept screening for ITP20/ITP10                         | -50% to + 100%      |
| <b>Study</b>                        | 2                                  | 2                               | 2                    | Study of feasibility and plan development for ITP10/ITPNT | -30% to +30%        |
|                                     | <b>NTC-C Issued</b>                | <b>NTC Issued</b>               | <b>RFP Issued</b>    |                                                           |                     |
| <b>NTC-C Project (CPE)</b>          | 3                                  | N/A                             | N/A                  | Established baseline (NTC-C)*                             | -20% to +20%        |
|                                     | <b>New NTC Issued</b>              |                                 |                      |                                                           |                     |
| <b>NTC Project (NPE)</b>            | N/A                                | 3                               | N/A                  | Established baseline (NTC)*                               | -20% to +20%        |
| <b>RFP Response (RRE)</b>           | N/A                                | N/A                             | 3                    | Established baseline (RFP Response)*                      | -20% to +20%        |
|                                     |                                    |                                 | <b>NTC Issued</b>    |                                                           |                     |
| <b>Design &amp; Construction</b>    | 4                                  | 4                               | 4                    | Design after NTC issued to build the project              | -20% to +20%**      |

\*BOD approval required to reset the baseline.

\*\*Actual cost is expected to be within +/-20% of final baseline estimate.

**Table 11.1: BP 7060 Cost Estimate Stage Definitions**

The precision bandwidths defined in Business Practice 7060 are used as guidelines for NTC review triggers. For a project that is issued a NTC-C, an automatic review of the project is initiated if the  $\pm 20\%$  precision bandwidth of the cost estimate that is received after NTC-C issuance, called the NTC-C Project Estimate (CPE), exceeds the  $\pm 30\%$

bandwidth of the cost estimate previously submitted during the study phase of the project, titled the Study Estimate.

In October 2014, the MOPC approved changes to Business Practice 7060 to accommodate the Transmission Owner Selection Process (TOSP) developed to comply with FERC Order 1000 for Competitive Projects.

### **11.2: Project Cost Working Group**

Business Practice 7060 also defined the role of the Project Cost Working Group (PCWG) for reviewing projects that have experienced a cost variance that exceeds  $\pm 20\%$  of the established baseline estimate. The PCWG will initially be responsible for only applicable projects. If the PCWG recommends a restudy and/or changes or revocation of a NTC, the recommendation to the MOPC would follow SPP's existing processes for approval to the BOD. The BOD will make the final determination on whether to restudy and/or change or revoke the NTC.

The PCWG is also responsible for maintaining the Standardized Cost Estimate Reporting Template (SCERT) developed to provide consistency of cost estimates and facilitate the Project Tracking process. The SCERT is to be utilized by Transmission Owners for all project cost estimates and applicable monthly/quarterly updates.

### **11.3: NTC Letters Issued in 2014**

After the SPP Board of Directors approves transmission expansion projects or once service agreements are filed with FERC, SPP issues Notifications to Construct (NTC) letters to appropriate Transmission Owners.

In 2014, SPP issued 39 NTC letters with estimated construction costs of \$1.48 billion for 108 projects to be constructed over the next five years through 2019. Of this \$1.48 billion, the project cost breakdown is as follows:

- \$58.3 million for Regional Reliability;
- \$3 million for Generation Interconnection;
- \$38.6 million for Transmission Service;
- \$573 million for High Priority; and
- \$806.6 million for ITP projects.

A list of the NTCs issued in 2014 can be found in [Section 13](#).

### **11.4: Projects Completed in 2014**

After the SPP Board of Directors approves transmission expansion projects or once Interconnection or Network Integrated Transmission Services Agreements are filed with FERC, SPP issues Notifications to Construct (NTC) letters to appropriate Transmission Owners. SPP actively monitors the progress of approved projects by soliciting feedback from project owners. One hundred thirty seven (137) upgrades were completed as of December 31, 2014. The breakdown includes:

- 65 ITP - \$491.5 million

- 5 Transmission Service - \$28.2 million
- 15 Generation Interconnection - \$61.7 million
- 22 Regional Reliability - \$60.8 million
- 26 High Priority - \$865.5 million
- 4 Balanced Portfolio - \$307.9 million

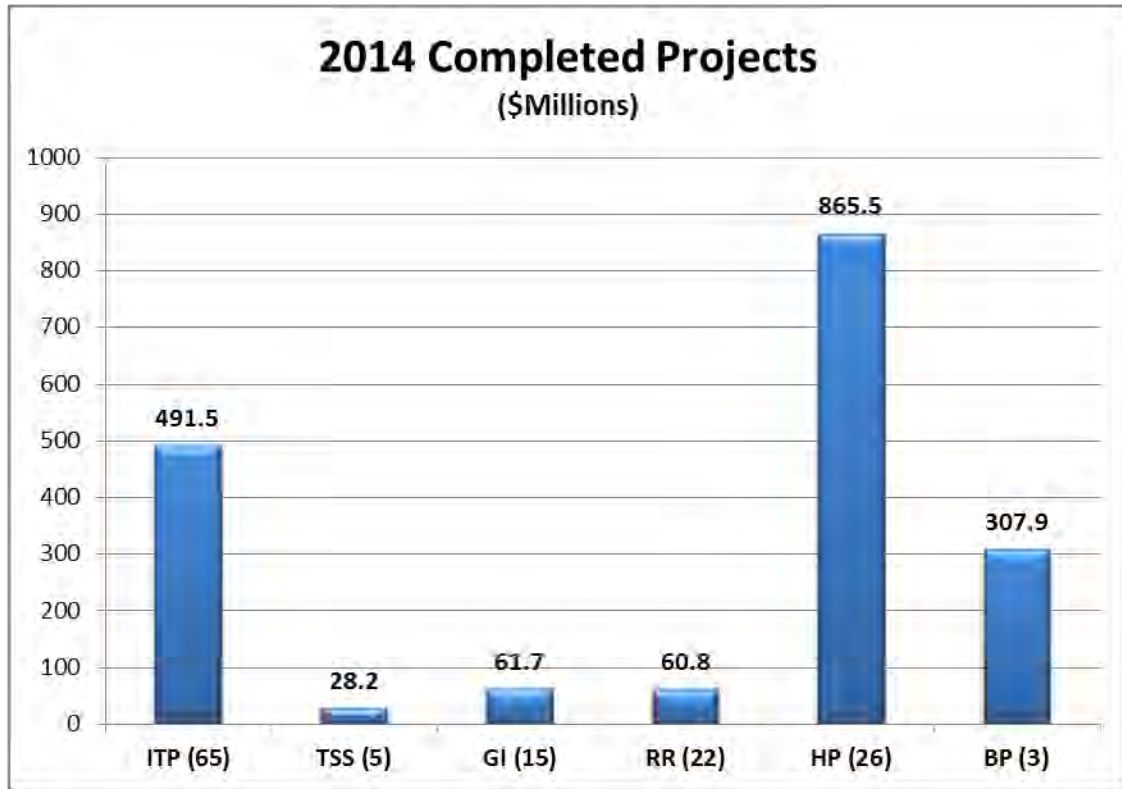


Figure 11.1: Projects Completed in 2014

Tables listing projects completed in 2014 can be found in [Section 17](#).

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## Section 12: STEP List

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The 2015 STEP List includes a comprehensive listing of transmission projects identified by the SPP RTO. Not all projects in the List have been approved by the BOD, but all BOD-approved projects are included in the list. The List also includes Tariff study projects, economic projects, and zonal projects.

Projects in the STEP List are categorized in the column labeled “Project Type” by the following designations:

- Balanced Portfolio – Projects identified through the Balanced Portfolio process
- Generation Interconnection – Projects associated with a FERC-filed Generation Interconnection Agreement
- High Priority – Projects identified in the high priority process
- ITP – Projects needed to meet regional reliability, economic, or policy needs in the ITP study processes
- Transmission Service – Projects associated with a FERC-filed Service Agreement
- Zonal Reliability – Projects identified to meet more stringent local Transmission Owner criteria
- Regional Reliability – Projects identified in the Aggregate Study and Delivery Point Study processes to meet SPP Criteria

The complete Network Upgrade list includes two dates.

1. In-service: Date Transmission Owner has identified as the date the upgrade is planned to be in-service.
2. SPP Need Date: Date upgrade was identified as needed by the RTO.

A copy of the 2015 STEP project list can be found at the following location:

SPP.org>Transmission Planning>2015 SPP Transmission Expansion Plan Project List

**Facility owner abbreviations used in the STEP List:**

| Abbreviation and Identification |                                               |
|---------------------------------|-----------------------------------------------|
| AECC                            | Arkansas Electric Cooperatives                |
| AECI                            | Associated Electric Cooperative, Incorporated |
| AEP                             | American Electric Power                       |
| CUS                             | City Utilities, Springfield Missouri          |
| DETEC                           | Deep East Texas Electric Cooperative          |
| EDE                             | Empire District Electric Company              |
| GMO                             | KCP&L Greater Missouri Operations Company     |
| GRDA                            | Grand River Dam Authority                     |
| GRIS                            | Grand Island Electric Department (GRIS)       |
| INDN                            | City Power & Light, Independence, Missouri    |
| ITCGP                           | ITC Great Plains                              |
| KCPL                            | Kansas City Power and Light Company           |
| LEA                             | Lea County Cooperative                        |
| LES                             | Lincoln Electric System                       |
| MIDW                            | Midwest Energy, Incorporated                  |
| MKEC                            | Mid-Kansas Electric Company                   |
| NPPD                            | Nebraska Public Power District                |
| OGE                             | Oklahoma Gas and Electric Company             |
| OMPA                            | Oklahoma Municipal Power Authority            |
| OPPD                            | Omaha Public Power District                   |
| PW                              | Prairie Wind Transmission                     |
| RCEC                            | Rayburn Electric Cooperative                  |
| SEPC                            | Sunflower Electric Power Corporation          |
| SPS                             | Southwestern Public Service Company           |
| SWPA                            | Southwestern Power Administration             |
| WFEC                            | Western Farmers Electric Cooperative          |
| WR                              | Westar Energy                                 |

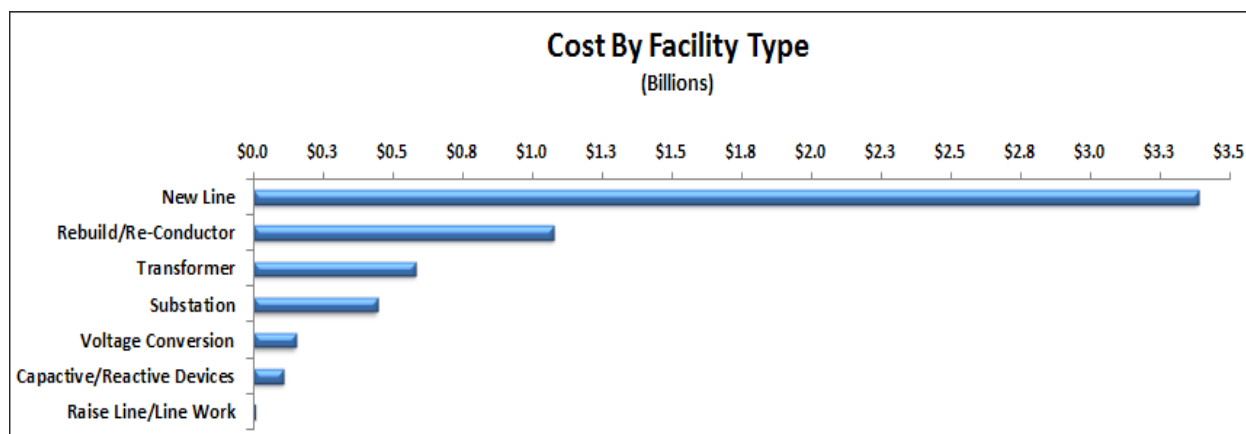


Figure 12.1: Total Cost by Facility Type (Dollars)

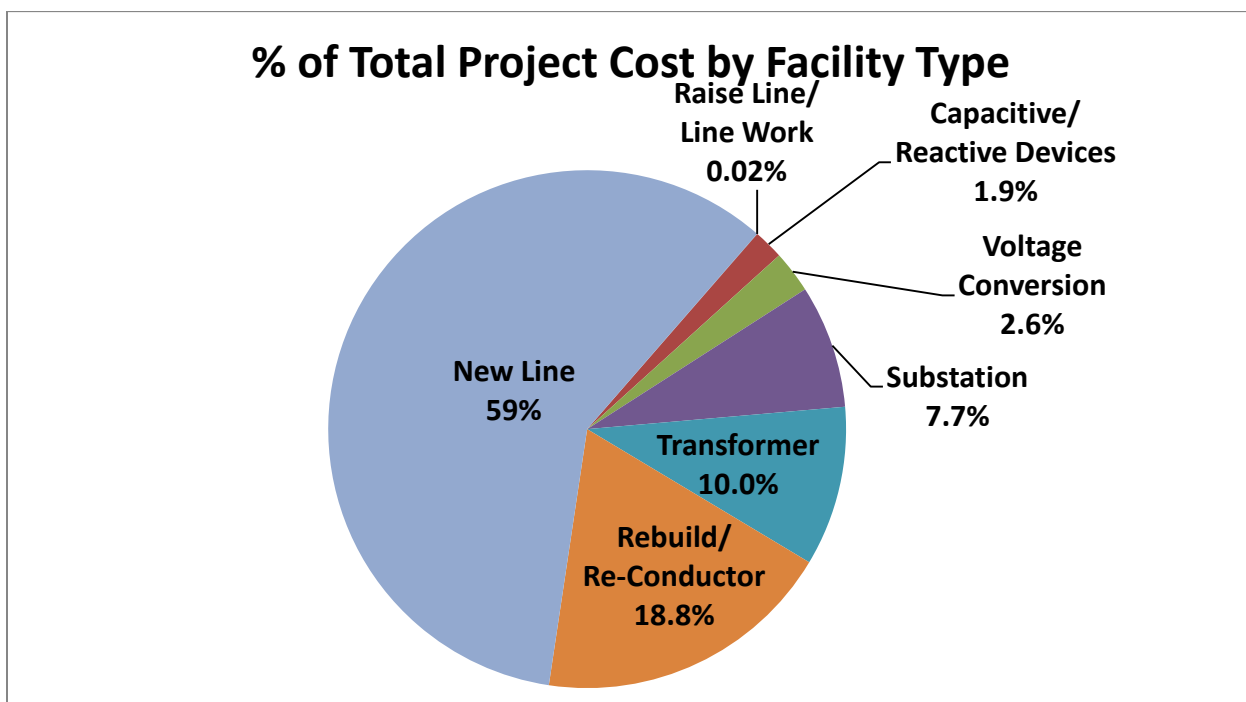


Figure 12.2: Percentage of Total Cost of Facility Type



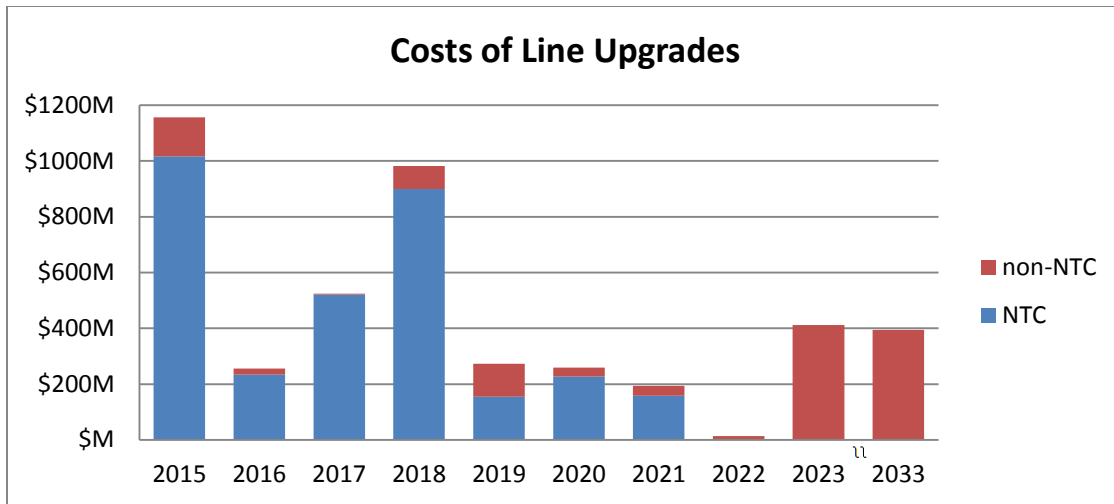


Figure 12.3: Total Cost of Line Upgrades

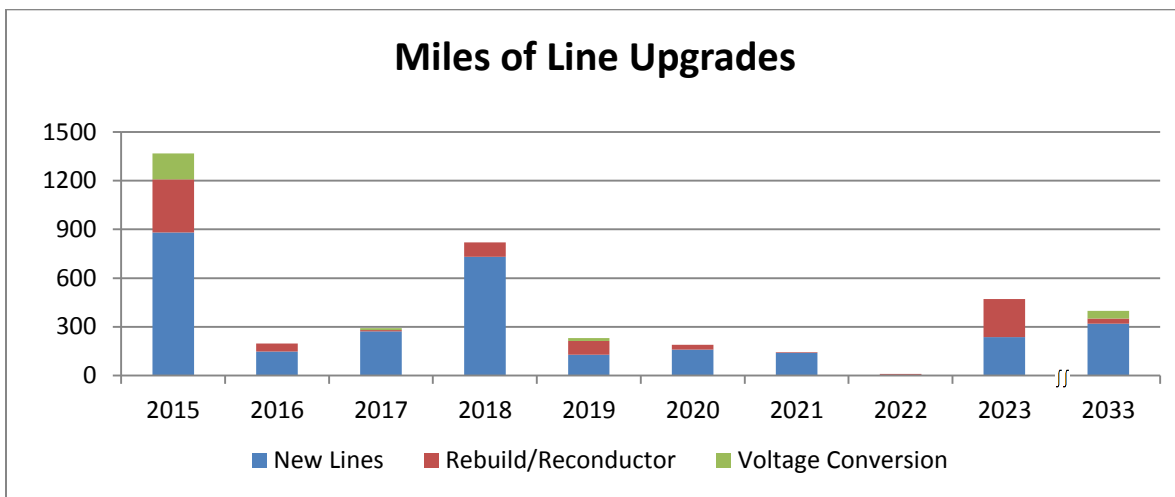


Figure 12.4: Total Miles of Line Upgrades by Project Type

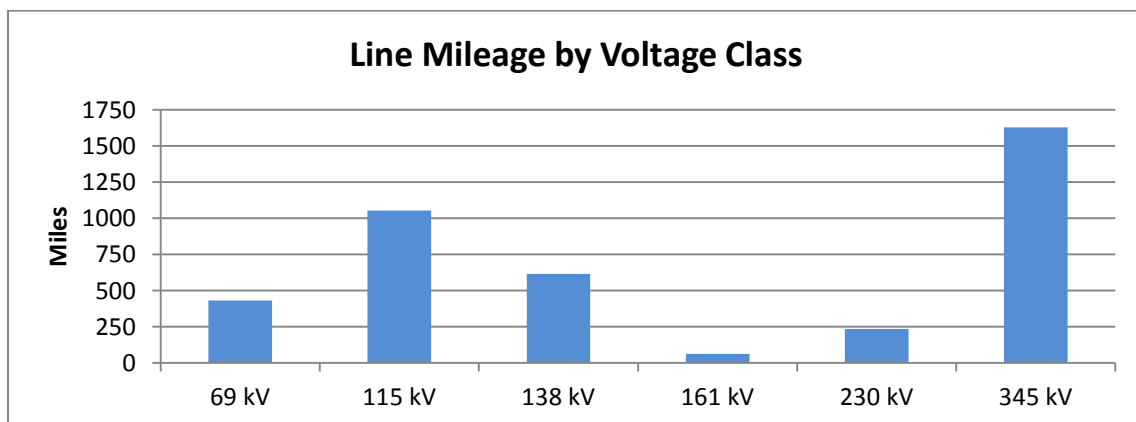


Figure 12.5: Total Line Mileage by Voltage Class

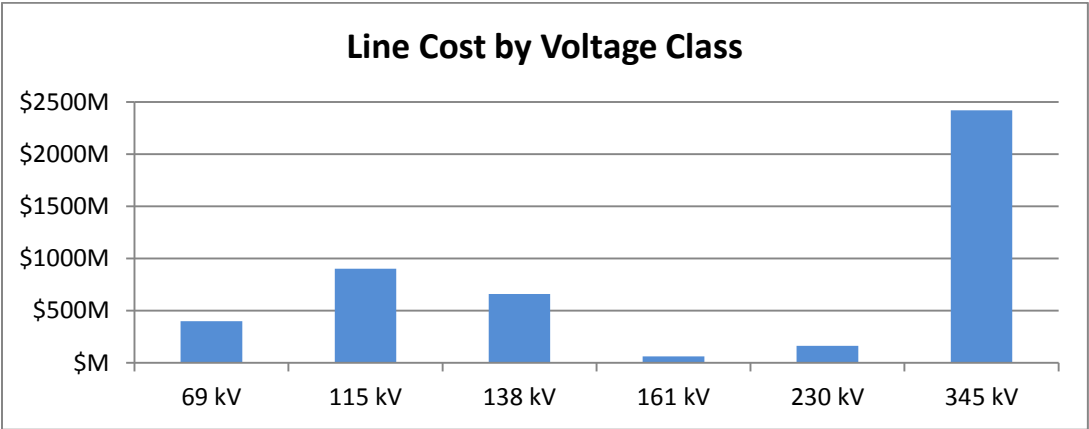


Figure 12.6: Total Line Cost by Voltage Class

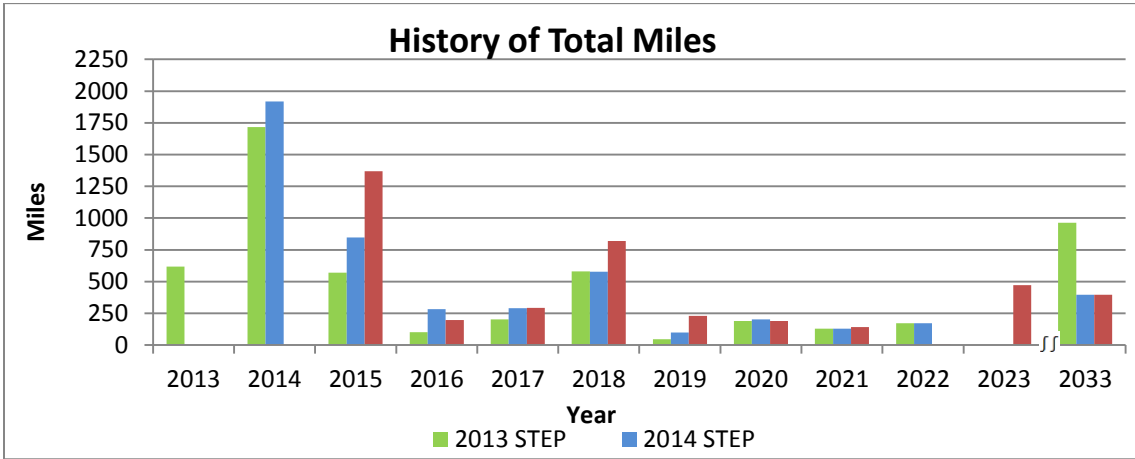


Figure 12.7: History of Total Miles 2013-2033

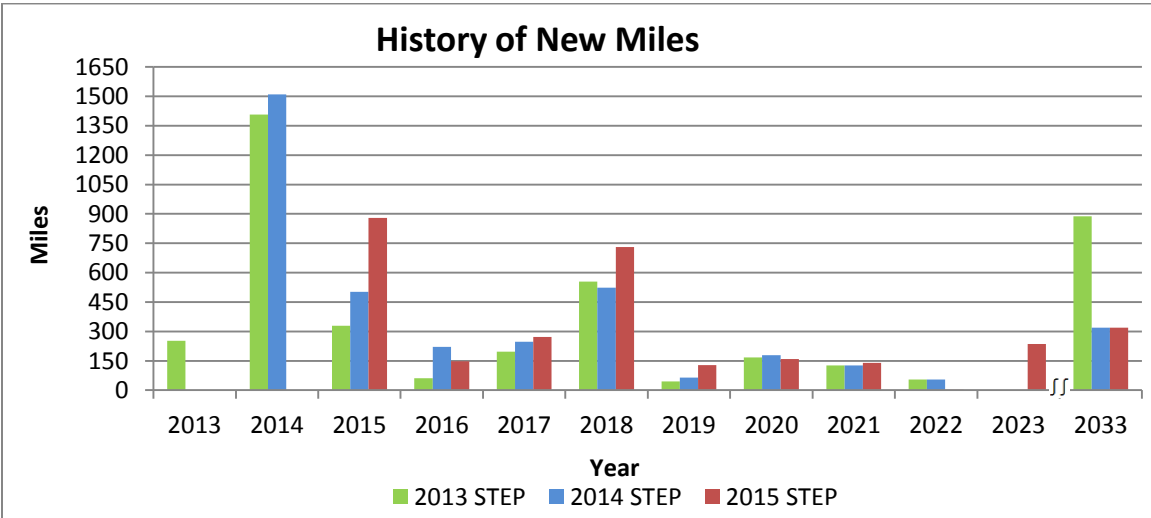


Figure 12.8: History of New Line Miles 2013-2033

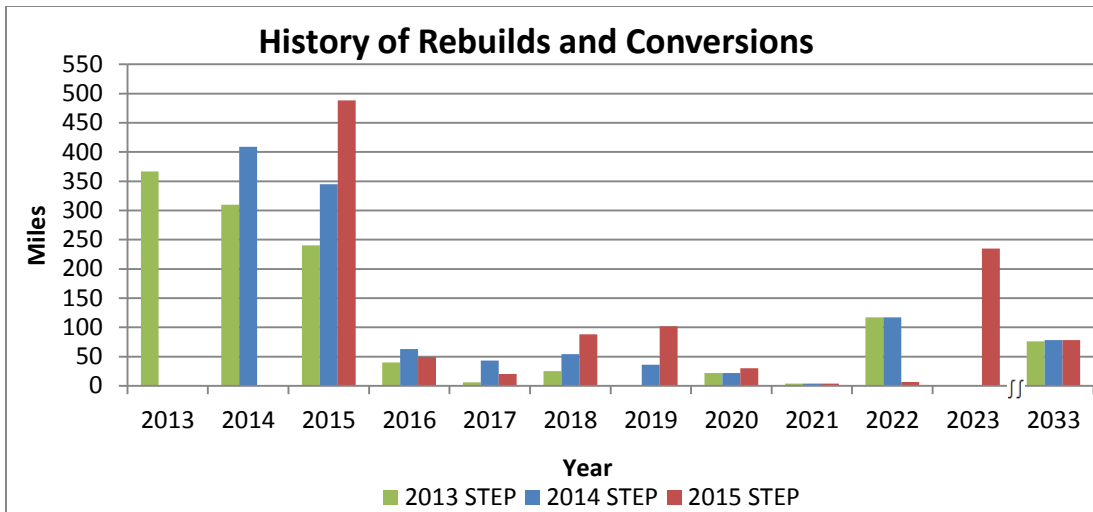


Figure 12.9: History of Line Rebuilds and Conversions 2013-2033

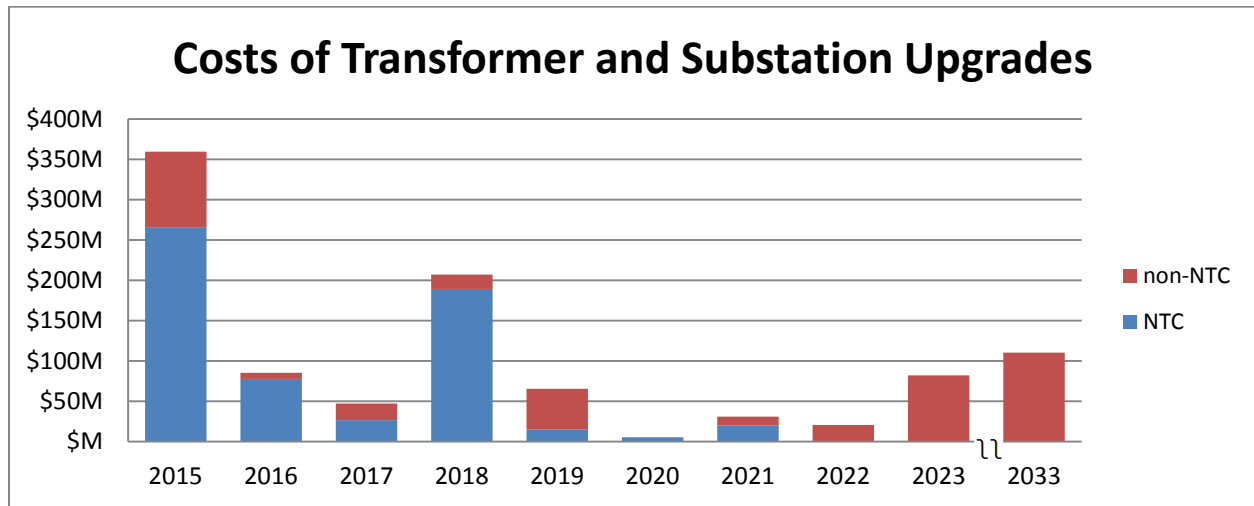


Figure 12.10: Costs of Transformer and Substation Upgrades

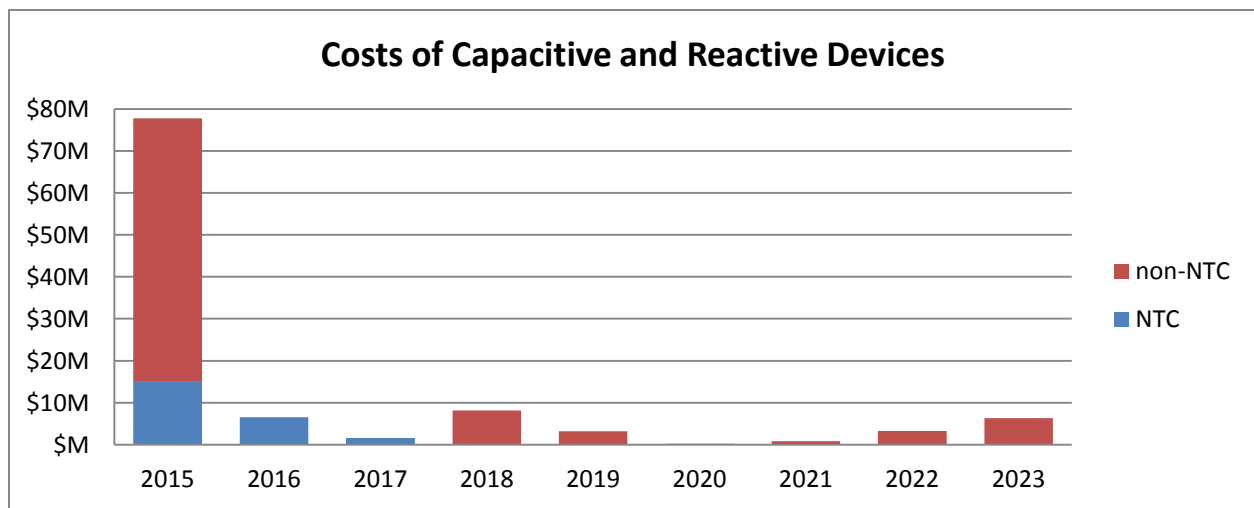


Figure 12.11: Costs of Capacitive and Reactive Devices

## Section 13: NTCs Issued in 2014

| NTC ID | Project ID | Facility Owner | Project Name                                                              | Current Cost Estimate |
|--------|------------|----------------|---------------------------------------------------------------------------|-----------------------|
| 200239 | 945        | ITCGP          | Multi - Spearville - Ironwood - Clark Co. - Thistle 345 kV Double Circuit | \$50,565,144          |
|        | 945        | ITCGP          | Multi - Spearville - Ironwood - Clark Co. - Thistle 345 kV Double Circuit | \$50,565,144          |
|        | 945        | ITCGP          | Multi - Spearville - Ironwood - Clark Co. - Thistle 345 kV Double Circuit | \$1,850,000           |
|        | 945        | ITCGP          | Multi - Spearville - Ironwood - Clark Co. - Thistle 345 kV Double Circuit | \$9,191,986           |
|        | 945        | ITCGP          | Multi - Spearville - Ironwood - Clark Co. - Thistle 345 kV Double Circuit | \$200,000             |
| 200241 | 30438      | GRDA           | Line - Kerr - 412 Sub 161 kV Ckt 1                                        | \$161,100             |
|        | 30440      | GRDA           | Line - 412 Sub - Kansas Tap 161 kV Ckt 1                                  | \$161,100             |
| 200242 | 30097      | WR             | Device - Vaughn Cap 115 kV                                                | \$1,184,617           |
|        | 30437      | WR             | Multi - Geary County 345/115 kV and Geary - Chapman 115 kV                | \$27,938,225          |
|        | 30437      | WR             | Multi - Geary County 345/115 kV and Geary - Chapman 115 kV                | \$20,530,196          |
|        | 30437      | WR             | Multi - Geary County 345/115 kV and Geary - Chapman 115 kV                | \$16,190,561          |
|        | 30553      | WR             | Line - Butler - Weaver 138 kV Ckt 1                                       | \$221,294             |
|        | 30556      | WR             | Sub - McDowell Creek Switching Station 115 kV Terminal Upgrades           | \$258,795             |
|        | 30558      | WR             | XFR - Neosho 345/138 kV Ckt 1                                             | \$7,790,221           |
|        | 30568      | WR             | Device - Clay Center Switching Station 115 kV                             | \$1,390,166           |
|        | 30579      | WR             | Line - Wellington - Creswell 69 kV                                        | \$7,405,817           |
|        | 30579      | WR             | Line - Wellington - Creswell 69 kV                                        | \$8,131,536           |
|        | 30580      | WR             | Line - Crestview - Kenmar 69 kV                                           | \$8,968,153           |
|        | 30580      | WR             | Line - Crestview - Kenmar 69 kV                                           | \$5,590,592           |
|        | 30584      | WR             | Line - Montgomery - Sedan 69 kV Ckt 1                                     | \$10,537,806          |
|        | 30584      | WR             | Line - Montgomery - Sedan 69 kV Ckt 1                                     | \$32,548,502          |
| 200243 | 30656      | OGE            | GEN-2012-040 POI                                                          | \$3,033,890           |
| 200244 | 30390      | WR             | Line - East Manhattan - JEC 230 kV                                        | \$58,317,000          |
|        | 30560      | WR             | Line - Sumner County - Viola 138 kV Ckt 1                                 | \$51,513,963          |
| 200245 | 844        | WFEC           | Line - Mustang - Sunshine Canyon 69 kV Ckt 1                              | \$4,725,000           |
|        | 30562      | WFEC           | Line - Elk City - Red Hills 138 kV Ckt 1                                  | \$3,675,000           |
|        | 30563      | WFEC           | Device - Sandy Corner 138 kV                                              | \$504,000             |
| 200246 | 512        | AEP            | Line - Ellerbe Road - Forbing Tap 69 kV Ckt 1                             | \$8,174,689           |
|        | 30559      | AEP            | Line - Chapel Hill REC - Welsh Reserve 138 kV Ckt 1                       | \$6,651,694           |
|        | 30573      | AEP            | Line - Broadmoor - Fort Humbug 69 kV Ckt 1                                | \$6,695,986           |
|        | 30574      | AEP            | Line - Daingerfield - Jenkins Rec 69 kV Ckt 1 Rebuild                     | \$2,819,806           |
|        | 30575      | AEP            | Line - Hallsville - Longview Heights 69 kV Ckt 1                          | \$8,851,677           |
|        | 30576      | AEP            | Line - Hallsville - Marshall 69 kV Ckt 1                                  | \$15,248,925          |
|        | 30598      | AEP            | Line - Letourneau Tertiary #1 - Letourneau Tap 69 kV Ckt 1                | \$2,358,802           |
| 200247 | 30582      | OGE            | Device - County Line 69 kV #2                                             | \$740,254             |
| 200248 | 30565      | SEPC           | Device - Mingo 115 kV                                                     | \$4,812,363           |
|        | 30589      | SEPC           | Device - Ruleton 115 kV                                                   | \$2,791,167           |
| 200250 | 30583      | GMO            | XFR - Harrisonville 161/69 kV Ckt 2                                       | \$2,773,480           |
|        | 30583      | GMO            | XFR - Harrisonville 161/69 kV Ckt 2                                       | \$1,005,220           |

| NTC ID | Project ID | Facility Owner | Project Name                                                                                     | Current Cost Estimate |
|--------|------------|----------------|--------------------------------------------------------------------------------------------------|-----------------------|
| 200251 | 1083       | AEP            | Line - Welsh Reserve - Wilkes 138 kV Ckt 1                                                       | \$24,880,495          |
| 200252 | 30581      | OGE            | Line - Park Lane - Ahloso - Harden City - Frisco - Lula 69/138 kV Ckt 1                          | \$5,693,264           |
|        | 30581      | OGE            | Line - Park Lane - Ahloso - Harden City - Frisco - Lula 69/138 kV Ckt 1                          | \$6,929,179           |
|        | 30581      | OGE            | Line - Park Lane - Ahloso - Harden City - Frisco - Lula 69/138 kV Ckt 1                          | \$2,121,320           |
|        | 30581      | OGE            | Line - Park Lane - Ahloso - Harden City - Frisco - Lula 69/138 kV Ckt 1                          | \$6,749,202           |
| 200253 | 30374      | NPPD           | Multi - Hoskins - Neligh 345 kV                                                                  | \$68,774,278          |
|        | 30374      | NPPD           | Multi - Hoskins - Neligh 345 kV                                                                  | \$12,118,564          |
|        | 30374      | NPPD           | Multi - Hoskins - Neligh 345 kV                                                                  | \$17,804,878          |
|        | 30496      | NPPD           | Multi - Stegall 345/115 kV and Stegall - Scottsbluff 115 kV                                      | \$6,616,429           |
|        | 30496      | NPPD           | Multi - Stegall 345/115 kV and Stegall - Scottsbluff 115 kV                                      | \$26,894,676          |
|        | 30496      | NPPD           | Multi - Stegall 345/115 kV and Stegall - Scottsbluff 115 kV                                      | \$5,975,996           |
|        | 30566      | NPPD           | Line - Maxwell - North Platt 115 kV Ckt 1                                                        | \$25,767              |
| 200254 | 30596      | NPPD           | Multi - Broken Bow Wind - Ord 115 kV Ckt 1                                                       | \$411,258             |
|        | 30596      | NPPD           | Multi - Broken Bow Wind - Ord 115 kV Ckt 1                                                       | \$34,182,113          |
| 200255 | 30361      | AEP            | Multi - Chisholm - Gracemont 345 kV                                                              | \$5,326,722           |
|        | 30361      | AEP            | Multi - Chisholm - Gracemont 345 kV                                                              | \$93,361,588          |
|        | 30361      | AEP            | Multi - Chisholm - Gracemont 345 kV                                                              | \$20,410,547          |
| 200256 | 766        | SPS            | XFR - Newhart 230/115 kV Ckt 2                                                                   | \$6,886,931           |
|        | 856        | SPS            | Multi - Centre St. - Hereford NE 115 kV Ckt 1 and Centre St. and Hereford 115 kV Load Conversion | \$9,247,136           |
|        | 856        | SPS            | Multi - Centre St. - Hereford NE 115 kV Ckt 1 and Centre St. and Hereford 115 kV Load Conversion | \$435,146             |
|        | 1004       | SPS            | XFR - Swisher 230/115 kV Ckt 1                                                                   | \$3,183,028           |
|        | 1139       | SPS            | Line - Allen Sub - Lubbock South Interchange 115 kV Ckt 1                                        | \$10,946,449          |
|        | 30552      | SPS            | Line - Oxy Permian Sub - West Bender Sub 115 kV Ckt 1                                            | \$971,535             |
|        | 30555      | SPS            | Quahada Switching Station 115 kV                                                                 | \$8,023,016           |
|        | 30577      | SPS            | Line - Chavis - Price - CV Pines - Capitan 115 kV Ckt 1                                          | \$5,961,279           |
|        | 30577      | SPS            | Line - Chavis - Price - CV Pines - Capitan 115 kV Ckt 1                                          | \$3,793,668           |
|        | 30577      | SPS            | Line - Chavis - Price - CV Pines - Capitan 115 kV Ckt 1                                          | \$3,793,053           |
|        | 30616      | SPS            | Sub - Curry County 115 kV                                                                        | \$813,381             |
| 200257 | 30569      | SPS            | Multi - Potash Junction - Road Runner 230/115 kV Ckt 1                                           | \$10,576,672          |
|        | 30569      | SPS            | Multi - Potash Junction - Road Runner 230/115 kV Ckt 1                                           | \$43,096,827          |
|        | 30578      | SPS            | Multi - Bailey Co. - Lamb Co. 115/69 kV                                                          | \$5,367,770           |
|        | 30578      | SPS            | Multi - Bailey Co. - Lamb Co. 115/69 kV                                                          | \$5,074,202           |
|        | 30578      | SPS            | Multi - Bailey Co. - Lamb Co. 115/69 kV                                                          | \$8,038,605           |
|        | 30578      | SPS            | Multi - Bailey Co. - Lamb Co. 115/69 kV                                                          | \$8,208,578           |
|        | 30578      | SPS            | Multi - Bailey Co. - Lamb Co. 115/69 kV                                                          | \$3,028,707           |
|        | 30578      | SPS            | Multi - Bailey Co. - Lamb Co. 115/69 kV                                                          | \$16,737,611          |
|        | 30578      | SPS            | Multi - Bailey Co. - Lamb Co. 115/69 kV                                                          | \$3,187,532           |
|        | 30578      | SPS            | Multi - Bailey Co. - Lamb Co. 115/69 kV                                                          | \$3,187,532           |
| 200258 | 30561      | OPPD           | XFR - S1366 161/69 kV Ckt 1                                                                      | \$4,426,730           |
|        | 30561      | OPPD           | XFR - S1366 161/69 kV Ckt 1                                                                      | \$422,270             |
|        | 30590      | OPPD           | Multi - S906 - S912 69 kV                                                                        | \$1,360,327           |
|        | 30590      | OPPD           | Multi - S906 - S912 69 kV                                                                        | \$69,679              |
|        | 30609      | OPPD           | Line - S907 - S919 69 kV Ckt 1                                                                   | \$3,141,600           |

Southwest Power Pool, Inc.

| NTC ID | Project ID | Facility Owner | Project Name                                                             | Current Cost Estimate |
|--------|------------|----------------|--------------------------------------------------------------------------|-----------------------|
| 200259 | 30588      | OPPD           | Multi - Fremont - S6801 161/69 kV Ckt 1                                  | \$3,606,519           |
|        | 30588      | OPPD           | Multi - Fremont - S6801 161/69 kV Ckt 1                                  | \$29,069,150          |
|        | 30588      | OPPD           | Multi - Fremont - S6801 161/69 kV Ckt 1                                  | \$2,416,277           |
| 200262 | 1142       | SPS            | Line - Canyon East - Randall 115 kV Ckt 1 Rebuild                        | \$12,806,065          |
|        | 1144       | SPS            | XFR - Hitchland 230/115 kV Ckt 2                                         | \$4,087,144           |
|        | 30420      | SPS            | Line - Bushland Interchange - Deaf Smith County Interchange 230 kV Ckt 1 | \$285,176             |
|        | 30509      | SPS            | Line - Canyon East Sub - Canyon West Sub 115 kV Ckt 1                    | \$2,694,811           |
|        | 30510      | SPS            | Line - Mustang - Shell CO2 115 kV Ckt 1                                  | \$15,473,119          |
|        | 30766      | SPS            | XFR - Yoakum County Interchange 230/115 kV Ckts 1 and 2                  | \$3,632,101           |
|        | 30766      | SPS            | XFR - Yoakum County Interchange 230/115 kV Ckts 1 and 2                  | \$3,432,506           |
| 200263 | 30507      | MIDW           | Line - Hays Plant - Vine Street 115 kV Ckt 1                             | \$15,720              |
| 200264 | 30508      | OGE            | Line - Division Ave - Lakeside 138 kV Ckt 1                              | \$1,720,000           |
| 200265 | 30523      | MKEC           | Line - Cudahy - Kismet 115 kV Ckt 1                                      | \$12,869,230          |
|        | 30524      | MKEC           | Line - Cimarron River Tap - Kismet 115 kV Ckt 1                          | \$5,747,750           |
| 200267 | 30610      | WR             | BUTLER - WEAVER 138KV CKT 1 #2                                           | \$18,396,464          |
| 200269 | 30612      | OGE            | HEFNER - TULSA 138KV CKT 1                                               | \$1,131,409           |
| 200270 | 30597      | OGE            | Multi - Knobhill - Lane - Noel 138 kV Ckt 1                              | \$4,009,000           |
| 200271 | 30597      | WFEC           | Multi - Knobhill - Lane - Noel 138 kV Ckt 1                              | \$450,000             |
| 200272 | 30746      | AEP            | Line - Darlington - Red Rock 138 kV Ckt 1                                | \$15,277,233          |
|        | 30747      | AEP            | Line - Grady - Round Creek 138 kV Ckt 1                                  | \$12,132,497          |
|        | 30748      | AEP            | Line - Grady - Phillips Gas 138 kV Ckt 1 and 2                           | \$8,318,584           |
|        | 30750      | AEP            | Line - Stonewall - Wapanucka 138 kV Ckt 1                                | \$8,934,149           |
|        | 30769      | AEP            | Line - Benteler - Port Robson 138 kV Ckt 1 and 2                         | \$2,248,743           |
|        | 30769      | AEP            | Line - Benteler - Port Robson 138 kV Ckt 1 and 2                         | \$2,548,575           |
|        | 30770      | AEP            | Sub - Ellis 138 kV                                                       | \$4,100,000           |
| 200273 | 30619      | AEP            | Line - Darlington - Roman Nose 138 kV Ckt 1                              | \$11,652,107          |
| 200275 | 30644      | MKEC           | Line - Anthony - Harper 138 kV Ckt 1                                     | \$13,253,238          |
|        | 30732      | MKEC           | Line - Anthony - Bluff City - Caldwell - Mayfield - Milan 138 kV Ckt 1   | \$6,325,795           |
|        | 30732      | MKEC           | Line - Anthony - Bluff City - Caldwell - Mayfield - Milan 138 kV Ckt 1   | \$12,662,775          |
|        | 30732      | MKEC           | Line - Anthony - Bluff City - Caldwell - Mayfield - Milan 138 kV Ckt 1   | \$9,093,172           |
|        | 30732      | MKEC           | Line - Anthony - Bluff City - Caldwell - Mayfield - Milan 138 kV Ckt 1   | \$12,195,327          |
| 200276 | 30640      | MKEC           | Line - Kansas Avenue - Dobson - Gano 115 kV Ckt 1                        | \$134,366             |
|        | 30642      | MKEC           | Line - Garden City - Kansas Avenue 115 kV Ckt 1                          | \$112,722             |
|        | 30645      | MKEC           | Line - Harper - Rago 138 kV Ckt 1                                        | \$12,790,167          |
| 200277 | 30567      | NPPD           | Device - Spalding 115 kV Cap Bank                                        | \$538,071             |
|        | 30678      | NPPD           | XFR - Thedford 345/115 kV                                                | \$9,306,000           |
|        | 30678      | NPPD           | XFR - Thedford 345/115 kV                                                | \$930,800             |
| 200278 | 30622      | OGE            | Multi - Knipe - SW Station - Linwood & Warwick Tap 138 kV Ckt 1          | \$12,767,120          |
|        | 30622      | OGE            | Multi - Knipe - SW Station - Linwood & Warwick Tap 138 kV Ckt 1          | \$9,899,440           |
|        | 30622      | OGE            | Multi - Knipe - SW Station - Linwood & Warwick Tap 138 kV Ckt 1          | \$8,218,020           |
| 200279 | 30624      | OGE            | Sub - Alva OGE 69 kV                                                     | \$150,000             |
|        | 30625      | OGE            | Line - Jenson - Jenson Tap 138 kV Ckt 1                                  | \$0                   |

| NTC ID | Project ID | Facility Owner | Project Name                                                                                 | Current Cost Estimate |
|--------|------------|----------------|----------------------------------------------------------------------------------------------|-----------------------|
| 200280 | 30772      | OPPD           | Sub - S1260 161 kV                                                                           | \$4,636,045           |
|        | 30789      | OPPD           | Sub - S1398 161 kV                                                                           | \$2,824,664           |
| 200281 | 30774      | WR             | Sub - Tallgrass 138 kV                                                                       | \$4,100,000           |
| 200282 | 30331      | SPS            | Device - Eagle Creek 115 kV                                                                  | \$1,470,325           |
|        | 30649      | SPS            | Multi - Andrews 230/115 kV Transformer and Andrews - NEF 115 kV Ckt 1                        | \$10,671,660          |
|        | 30649      | SPS            | Multi - Andrews 230/115 kV Transformer and Andrews - NEF 115 kV Ckt 1                        | \$3,523,472           |
|        | 30672      | SPS            | Multi - Dollarhide - Toboso Flats 115 kV                                                     | \$822,700             |
|        | 30672      | SPS            | Multi - Dollarhide - Toboso Flats 115 kV                                                     | \$5,062,341           |
|        | 30675      | SPS            | Multi - China Draw - Yeso Hills 115 kV                                                       | \$1,046,485           |
|        | 30675      | SPS            | Multi - China Draw - Yeso Hills 115 kV                                                       | \$14,583,586          |
|        | 30694      | SPS            | Multi - Ponderosa - Ponderosa Tap 115 kV                                                     | \$5,404,344           |
|        | 30694      | SPS            | Multi - Ponderosa - Ponderosa Tap 115 kV                                                     | \$996,485             |
|        | 30694      | SPS            | Multi - Ponderosa - Ponderosa Tap 115 kV                                                     | \$4,174,446           |
|        | 30756      | SPS            | Multi - Battle Axe - Road Runner 115 kV                                                      | \$2,964,499           |
|        | 30756      | SPS            | Multi - Battle Axe - Road Runner 115 kV                                                      | \$13,816,310          |
|        | 30777      | SPS            | Sub - Oxy South Hobbs 115 kV                                                                 | \$327,861             |
|        | 30824      | SPS            | XFR - Potash Junction 230/115 kV Ckt 1                                                       | \$3,508,346           |
|        | 30825      | SPS            | Line - China Draw - Wood Draw 115 kV Ckt 1                                                   | \$13,704,501          |
| 200283 | 1140       | SPS            | Multi - Tucu - Stanton 345 kV                                                                | \$6,158,183           |
|        | 1140       | SPS            | Multi - Tucu - Stanton 345 kV                                                                | \$27,602,755          |
|        | 1140       | SPS            | Multi - Tucu - Stanton 345 kV                                                                | \$23,362,589          |
|        | 30376      | SPS            | Multi - Tucu - Yoakum - Hobbs 345/230 kV Ckt 1                                               | \$129,945,941         |
|        | 30376      | SPS            | Multi - Tucu - Yoakum - Hobbs 345/230 kV Ckt 1                                               | \$5,047,343           |
|        | 30376      | SPS            | Multi - Tucu - Yoakum - Hobbs 345/230 kV Ckt 1                                               | \$16,204,449          |
|        | 30376      | SPS            | Multi - Tucu - Yoakum - Hobbs 345/230 kV Ckt 1                                               | \$90,628,750          |
|        | 30569      | SPS            | Multi - Potash Junction - Road Runner 230/115 kV Ckt 1                                       | \$43,096,827          |
|        | 30569      | SPS            | Multi - Potash Junction - Road Runner 230/115 kV Ckt 1                                       | \$10,576,672          |
|        | 30637      | SPS            | Multi - Hobbs - Kiowa 345 kV Ckt 1                                                           | \$11,249,526          |
|        | 30637      | SPS            | Multi - Hobbs - Kiowa 345 kV Ckt 1                                                           | \$59,808,956          |
|        | 30638      | SPS            | Multi - Kiowa - North Loving - China Draw 345/115 kV Ckt 1                                   | \$5,950,217           |
|        | 30638      | SPS            | Multi - Kiowa - North Loving - China Draw 345/115 kV Ckt 1                                   | \$7,873,653           |
|        | 30638      | SPS            | Multi - Kiowa - North Loving - China Draw 345/115 kV Ckt 1                                   | \$19,255,234          |
|        | 30638      | SPS            | Multi - Kiowa - North Loving - China Draw 345/115 kV Ckt 1                                   | \$25,716,516          |
|        | 30638      | SPS            | Multi - Kiowa - North Loving - China Draw 345/115 kV Ckt 1                                   | \$4,649,045           |
|        | 30638      | SPS            | Multi - Kiowa - North Loving - China Draw 345/115 kV Ckt 1                                   | \$4,172,734           |
|        | 30639      | SPS            | Multi - Potash Junction - Road Runner 345 kV Conv. and Transformers at Kiowa and Road Runner | \$2,176,451           |
|        | 30639      | SPS            | Multi - Potash Junction - Road Runner 345 kV Conv. and Transformers at Kiowa and Road Runner | \$11,569,711          |
|        | 30639      | SPS            | Multi - Potash Junction - Road Runner 345 kV Conv. and Transformers at Kiowa and Road Runner | \$5,443,140           |
|        | 30639      | SPS            | Multi - Potash Junction - Road Runner 345 kV Conv. and Transformers at Kiowa and Road Runner | \$3,989,689           |
|        | 30695      | SPS            | Multi - Livingston Ridge - Sage Brush - Lagarto - Cardinal 115 kV                            | \$4,950,983           |



Southwest Power Pool, Inc.

| NTC ID | Project ID | Facility Owner | Project Name                                                            | Current Cost Estimate |
|--------|------------|----------------|-------------------------------------------------------------------------|-----------------------|
|        | 30695      | SPS            | Multi - Livingston Ridge - Sage Brush - Lagarto - Cardinal 115 kV       | \$3,822,672           |
|        | 30695      | SPS            | Multi - Livingston Ridge - Sage Brush - Lagarto - Cardinal 115 kV       | \$6,115,613           |
|        | 30695      | SPS            | Multi - Livingston Ridge - Sage Brush - Lagarto - Cardinal 115 kV       | \$6,186,323           |
|        | 30695      | SPS            | Multi - Livingston Ridge - Sage Brush - Lagarto - Cardinal 115 kV       | \$8,811,206           |
|        | 30695      | SPS            | Multi - Livingston Ridge - Sage Brush - Lagarto - Cardinal 115 kV       | \$1,200,057           |
|        | 30695      | SPS            | Multi - Livingston Ridge - Sage Brush - Lagarto - Cardinal 115 kV       | \$9,244,612           |
|        | 30717      | SPS            | Line - Hopi Sub - North Loving - China Draw 115 kV Ckt 1                | \$9,980,879           |
|        | 30717      | SPS            | Line - Hopi Sub - North Loving - China Draw 115 kV Ckt 1                | \$13,283,227          |
| 200284 | 30628      | WFEC           | Device - Freedom 69 kV                                                  | \$237,000             |
|        | 30629      | WFEC           | Line - Carmen - Eagle Chief 69 kV Ckt 1                                 | \$0                   |
|        | 30635      | WFEC           | Device - Eagle Chief 69 kV                                              | \$190,000             |
| 200286 | 30771      | MIDW           | Multi - Midwest Pump - Midwest Pump Tap 115 kV Ckt 1                    | \$4,477,251           |
|        | 30771      | MIDW           | Multi - Midwest Pump - Midwest Pump Tap 115 kV Ckt 1                    | \$2,443,469           |
| 200287 | 30661      | WFEC           | Multi - Carmen - Cherokee Junction 138 kV                               | \$3,945,000           |
|        | 30661      | WFEC           | Multi - Carmen - Cherokee Junction 138 kV                               | \$2,068,000           |
|        | 30661      | WFEC           | Multi - Carmen - Cherokee Junction 138 kV                               | \$2,475,000           |
|        | 30661      | WFEC           | Multi - Carmen - Cherokee Junction 138 kV                               | \$2,680,000           |
|        | 30661      | WFEC           | Multi - Carmen - Cherokee Junction 138 kV                               | \$6,300,000           |
| 200290 | 30619      | OGE            | Line - Darlington - Roman Nose 138 kV Ckt 1                             | \$12,701,091          |
| 200291 | 319        | WR             | Multi - Cowskin - Westlink - Tyler - Hoover 69 kV                       | \$4,151,903           |
|        | 319        | WR             | Multi - Cowskin - Westlink - Tyler - Hoover 69 kV                       | \$5,834,124           |
|        | 319        | WR             | Multi - Cowskin - Westlink - Tyler - Hoover 69 kV                       | \$4,737,867           |
| 200292 | 30556      | WR             | Sub - McDowell Creek Switching Station 115 kV Terminal Upgrades         | \$258,795             |
| 200294 | 30596      | NPPD           | Multi - Broken Bow Wind - Ord 115 kV Ckt 1                              | \$34,182,113          |
|        | 30596      | NPPD           | Multi - Broken Bow Wind - Ord 115 kV Ckt 1                              | \$411,258             |
| 200295 | 30588      | OPPD           | Multi - Fremont - S6801 161/69 kV Ckt 1                                 | \$2,416,277           |
|        | 30588      | OPPD           | Multi - Fremont - S6801 161/69 kV Ckt 1                                 | \$29,069,150          |
|        | 30588      | OPPD           | Multi - Fremont - S6801 161/69 kV Ckt 1                                 | \$3,606,519           |
| 200296 | 30390      | WR             | Line - East Manhattan - Jeffrey Energy Center 230 kV Ckt 1              | \$58,317,000          |
|        | 30560      | WR             | Line - Sumner County - Viola 138 kV Ckt 1                               | \$51,513,963          |
| 200298 | 30761      | AEP            | Multi - Linwood - Cedar Grove - South Shreveport 138 kV                 | \$6,566,218           |
| 200299 | 30581      | OGE            | Line - Park Lane - Ahloso - Harden City - Frisco - Lula 69/138 kV Ckt 1 | \$5,693,264           |
|        | 30581      | OGE            | Line - Park Lane - Ahloso - Harden City - Frisco - Lula 69/138 kV Ckt 1 | \$2,121,320           |
|        | 30581      | OGE            | Line - Park Lane - Ahloso - Harden City - Frisco - Lula 69/138 kV Ckt 1 | \$6,929,179           |
|        | 30581      | OGE            | Line - Park Lane - Ahloso - Harden City - Frisco - Lula 69/138 kV Ckt 1 | \$6,749,202           |
| 200305 | 1083       | AEP            | Line - Welsh Reserve - Wilkes 138 kV Ckt 1                              | \$24,880,495          |
| 200306 | 30731      | AEP            | Line - Mt. Pleasant - West Mt. Pleasant 69 kV Ckt 1                     | \$4,715,419           |
| 200308 | 30640      | MKEC           | Line - Kansas Avenue - Dobson - Gano 115 kV Ckt 1                       | \$134,366             |

| NTC ID | Project ID | Facility Owner | Project Name                                                                                 | Current Cost Estimate |
|--------|------------|----------------|----------------------------------------------------------------------------------------------|-----------------------|
| 200309 | 30376      | SPS            | Multi - Tuco - Yoakum - Hobbs 345/230 kV Ckt 1                                               | \$90,628,750          |
|        | 30376      | SPS            | Multi - Tuco - Yoakum - Hobbs 345/230 kV Ckt 1                                               | \$16,204,449          |
|        | 30376      | SPS            | Multi - Tuco - Yoakum - Hobbs 345/230 kV Ckt 1                                               | \$5,047,343           |
|        | 30376      | SPS            | Multi - Tuco - Yoakum - Hobbs 345/230 kV Ckt 1                                               | \$129,945,941         |
|        | 30569      | SPS            | Multi - Potash Junction - Road Runner 230/115 kV Ckt 1                                       | \$43,096,827          |
|        | 30569      | SPS            | Multi - Potash Junction - Road Runner 230/115 kV Ckt 1                                       | \$10,576,672          |
|        | 30637      | SPS            | Multi - Hobbs - Kiowa 345 kV Ckt 1                                                           | \$11,249,526          |
|        | 30637      | SPS            | Multi - Hobbs - Kiowa 345 kV Ckt 1                                                           | \$59,808,956          |
|        | 30638      | SPS            | Multi - Kiowa - North Loving - China Draw 345/115 kV Ckt 1                                   | \$25,716,516          |
|        | 30638      | SPS            | Multi - Kiowa - North Loving - China Draw 345/115 kV Ckt 1                                   | \$19,255,234          |
|        | 30638      | SPS            | Multi - Kiowa - North Loving - China Draw 345/115 kV Ckt 1                                   | \$4,649,045           |
|        | 30638      | SPS            | Multi - Kiowa - North Loving - China Draw 345/115 kV Ckt 1                                   | \$4,172,734           |
|        | 30638      | SPS            | Multi - Kiowa - North Loving - China Draw 345/115 kV Ckt 1                                   | \$7,873,653           |
|        | 30638      | SPS            | Multi - Kiowa - North Loving - China Draw 345/115 kV Ckt 1                                   | \$5,950,217           |
|        | 30639      | SPS            | Multi - Potash Junction - Road Runner 345 kV Conv. and Transformers at Kiowa and Road Runner | \$3,989,689           |
|        | 30639      | SPS            | Multi - Potash Junction - Road Runner 345 kV Conv. and Transformers at Kiowa and Road Runner | \$5,443,140           |
|        | 30639      | SPS            | Multi - Potash Junction - Road Runner 345 kV Conv. and Transformers at Kiowa and Road Runner | \$11,569,711          |
|        | 30639      | SPS            | Multi - Potash Junction - Road Runner 345 kV Conv. and Transformers at Kiowa and Road Runner | \$2,176,451           |
|        | 30695      | SPS            | Multi - Livingston Ridge - Sage Brush - Lagarto - Cardinal 115 kV                            | \$9,244,612           |
|        | 30695      | SPS            | Multi - Livingston Ridge - Sage Brush - Lagarto - Cardinal 115 kV                            | \$1,200,057           |
|        | 30695      | SPS            | Multi - Livingston Ridge - Sage Brush - Lagarto - Cardinal 115 kV                            | \$8,811,206           |
|        | 30695      | SPS            | Multi - Livingston Ridge - Sage Brush - Lagarto - Cardinal 115 kV                            | \$6,186,323           |
|        | 30695      | SPS            | Multi - Livingston Ridge - Sage Brush - Lagarto - Cardinal 115 kV                            | \$6,115,613           |
|        | 30695      | SPS            | Multi - Livingston Ridge - Sage Brush - Lagarto - Cardinal 115 kV                            | \$3,822,672           |
|        | 30695      | SPS            | Multi - Livingston Ridge - Sage Brush - Lagarto - Cardinal 115 kV                            | \$4,950,983           |
|        | 30717      | SPS            | Line - Hopi Sub - North Loving - China Draw 115 kV Ckt 1                                     | \$9,980,879           |
|        | 30717      | SPS            | Line - Hopi Sub - North Loving - China Draw 115 kV Ckt 1                                     | \$13,283,227          |
| 200310 | 30619      | AEP            | Line - Darlington - Roman Nose 138 kV Ckt 1                                                  | \$11,652,107          |
| 200311 | 30619      | OGE            | Line - Darlington - Roman Nose 138 kV Ckt 1                                                  | \$12,701,091          |
|        | 30622      | OGE            | Multi - Knipe - SW Station - Linwood & Warwick Tap 138 kV Ckt 1                              | \$12,767,120          |
|        | 30622      | OGE            | Multi - Knipe - SW Station - Linwood & Warwick Tap 138 kV Ckt 1                              | \$8,218,020           |
|        | 30622      | OGE            | Multi - Knipe - SW Station - Linwood & Warwick Tap 138 kV Ckt 1                              | \$9,899,440           |

## Section 14: 345 kV Projects

### 14.1 345 kV Projects Completed in 2014

| Facility Owner | Upgrade Name                                         | Network Upgrade Type       |
|----------------|------------------------------------------------------|----------------------------|
| AEP            | Kings River 345/161KV TRANSFORMER CKT 1              | Regional Reliability       |
| AEP            | E Rogers - Shipe Road 345 kV                         | Regional Reliability       |
| AEP            | East Rogers - Kings River 345 kV Ckt 1               | Regional Reliability       |
| AEP            | NORTHWEST TEXARKANA - VALLIANT 345KV CKT 1           | High Priority              |
| AEP            | Chisholm - Gracemont 345kV Ckt 1 (AEP)               | ITP10                      |
| AEP            | Chisholm 345/230 kV Substation                       | ITP10                      |
| AEP            | Chisholm 230 kV                                      | ITP10                      |
| ITCGP          | Elm Creek - Summit 345 kV Ckt 1 (ITCGP)              | ITP10                      |
| ITCGP          | Elm Creek 345/230 kV Transformer                     | ITP10                      |
| ITCGP          | Elm Creek 345 kV Terminal Upgrades                   | ITP10                      |
| KCPL           | Iatan - Stranger 345 kV Voltage Conversion Ckt 1     | ITP10                      |
| MKEC           | Spearville 345/115 kV Transformer CKT 1              | Generation Interconnection |
| NPPD           | Hoskins - Neligh 345 kV Ckt 1                        | Regional Reliability       |
| NPPD           | Neligh 345/115 kV Substation                         | Regional Reliability       |
| NPPD           | Cherry Co. - Gentleman 345 kV Ckt 1                  | ITP10                      |
| NPPD           | Cherry Co. Substation 345 kV                         | ITP10                      |
| NPPD           | Cherry Co. - Holt Co. 345 kV Ckt 1                   | ITP10                      |
| NPPD           | Holt Co. Substation 345 kV                           | ITP10                      |
| NPPD           | Stegall 345/115 kV Transformer Ckt 1                 | Regional Reliability       |
| NPPD           | Stegall 345 kV Terminal Upgrades                     | Regional Reliability       |
| NPPD           | Thedford 345/115 kV Transformer                      | High Priority              |
| NPPD           | Thedford 345 kV Terminal Upgrades                    | High Priority              |
| OGE            | ARCADIA - REDBUD 345KV CKT 3                         | Transmission Service       |
| OGE            | NORTHWEST 345/138KV TRANSFORMER CKT 3                | Transmission Service       |
| OGE            | Chisholm - Gracemont 345 kV Ckt 1 (OGE)              | ITP10                      |
| OGE            | Tatonga - Woodward District EHV 345 kV Ckt 2         | ITP10                      |
| OGE            | Matthewson - Tatonga 345 kV Ckt 2                    | ITP10                      |
| OGE            | Cimarron - Matthewson 345 kV Ckt 2                   | ITP10                      |
| OGE            | Matthewson 345 kV                                    | ITP10                      |
| OGE            | Northwest 345/138 kV Transformer Ckt 3 accelerated   | Transmission Service       |
| OGE            | Woodward District EHV 345kV Substation               | Generation Interconnection |
| OGE            | Beaver County 345kV Substation GEN-2010-001 Addition | Generation Interconnection |
| OGE            | Mathewson 345kV Substation GEN-2011-007 Addition     | Generation Interconnection |
| OPPD           | Nebraska City - Mullin Creek 345 kV (OPPD)           | High Priority              |
| OPPD           | S3459 345/161 kV Transformer                         | ITP10                      |
| OPPD           | S3459 345 kV Terminal Upgrades                       | ITP10                      |
| SEPC           | Mingo 345/115 kV Ckt 2 Transformer                   | Regional Reliability       |
| SEPC           | Mingo 345 kV Terminal Upgrades                       | Regional Reliability       |

| Facility Owner | Upgrade Name                                           | Network Upgrade Type       |
|----------------|--------------------------------------------------------|----------------------------|
| SEPC           | Buckner - Spearville 345 kV Ckt 1 Terminal Upgrades    | Regional Reliability       |
| SEPC           | GEN-2008-017 Interconnection Facilities at Setab 345kV | Generation Interconnection |
| SEPC           | GEN-2008-017 Network Upgrades at Setab 345kV           | Generation Interconnection |
| SPS            | Tuco - Yoakum 345 kV Ckt 1                             | High Priority              |
| SPS            | Yoakum 345/230 kV Ckt 1 Transformer                    | High Priority              |
| SPS            | Hobbs 345/230 kV Ckt 1 Transformer                     | High Priority              |
| SPS            | Hobbs - Yoakum 345 kV Ckt 1                            | High Priority              |
| SPS            | China Draw - North Loving 345 kV Ckt 1                 | High Priority              |
| SPS            | Kiowa - North Loving 345 kV Ckt 1                      | High Priority              |
| SPS            | China Draw 345/115 kV Ckt 1 Transformer                | High Priority              |
| SPS            | China Draw 345 kV Ckt 1 Terminal Upgrades              | High Priority              |
| SPS            | Kiowa 345 kV Substation                                | High Priority              |
| SPS            | North Loving 345/115 kV Ckt 1 Transformer              | High Priority              |
| SPS            | North Loving 345 kV Terminal Upgrades                  | High Priority              |
| SPS            | Road Runner 345/115 kV Ckt 1 Transformer               | High Priority              |
| SPS            | Road Runner 345 kV Substation Conversion               | High Priority              |
| SPS            | Kiowa 345/115 kV Ckt 1 Transformer                     | High Priority              |
| SPS            | Kiowa - Potash Junction 345/115 kV Ckt 1               | High Priority              |
| SPS            | Hobbs - Kiowa 345 kV Ckt 1                             | High Priority              |
| SPS            | Walkemeyer Tap 345 kV Substation                       | Regional Reliability       |
| SPS            | Walkemeyer Tap 345/115 kV Transformer                  | Regional Reliability       |
| SPS            | Eddy County - Tolk 345kV Ckt 1                         | Generation Interconnection |
| TBD            | Cass Co. - S.W. Omaha (aka S3454) 345 kV Ckt1          | ITP20                      |
| TBD            | S3459 345/161 kV Transformer Ckt 2                     | ITP20                      |
| TBD            | South Fayetteville 345/161 kV Transformer Ckt1         | ITP20                      |
| TBD            | Chamber Springs - South Fayetteville 345 kV Ckt1       | ITP20                      |
| TBD            | Maryville 345/161 kV Transformer Ckt1                  | ITP20                      |
| TBD            | Nashua 345/161 kV Transformer Upgrade Ckt11            | ITP20                      |
| TBD            | Keystone - Red Willow 345 kV Ckt1                      | ITP20                      |
| TBD            | Tolk - Tuco 345 kV Ckt1                                | ITP20                      |
| TBD            | Holcomb 345/115 kV Transformer Ckt2                    | ITP20                      |
| TBD            | Neosho - Wolf Creek 345 kV Ckt1                        | ITP20                      |
| TBD            | Auburn 345/115 kV Transformer Ckt2                     | ITP20                      |
| TBD            | Auburn - Swissvale 345 kV Ckt1 Voltage Conversion      | ITP20                      |
| TBD            | Auburn - Jeffrey EC 345 kV Ckt1 Voltage Conversion     | ITP20                      |
| TBD            | Benteler - McDade 345 kV Ckt 1                         | Regional Reliability       |
| TBD            | McDade 345/138 kV Ckt 1 Transformer                    | Regional Reliability       |
| TBD            | McDade - Messick 345 kV Ckt 1                          | Regional Reliability       |
| TBD            | Benteler 345/138 kV Ckt 1 Transformer                  | Regional Reliability       |
| TBD            | Mooreland - Woodward District EHV 345 kV Ckt 1         | Regional Reliability       |
| TBD            | Center - Dolet Hiles 345 kV Ckt 1                      | Regional Reliability       |
| TBD            | Center 345/138 kV Ckt 1 Transformer                    | Regional Reliability       |
| TBD            | Border - Chisholm 345 kV Ckt 1                         | Regional Reliability       |

**14.2 345 kV Projects with NTCs in the 2015 STEP**

| Facility Owner | Upgrade Name                                           | Network Upgrade Type       |
|----------------|--------------------------------------------------------|----------------------------|
| AEP            | Kings River 345/161KV TRANSFORMER CKT 1                | Regional Reliability       |
| AEP            | E Rogers - Shipe Road 345 kV                           | Regional Reliability       |
| AEP            | East Rogers - Kings River 345 kV Ckt 1                 | Regional Reliability       |
| AEP            | NORTHWEST TEXARKANA - VALLIANT 345KV CKT 1             | High Priority              |
| AEP            | Chisholm - Gracemont 345kV Ckt 1 (AEP)                 | ITP10                      |
| AEP            | Chisholm 345/230 kV Substation                         | ITP10                      |
| AEP            | Chisholm 230 kV                                        | ITP10                      |
| ITCGP          | Elm Creek - Summit 345 kV Ckt 1 (ITCGP)                | ITP10                      |
| ITCGP          | Elm Creek 345/230 kV Transformer                       | ITP10                      |
| ITCGP          | Elm Creek 345 kV Terminal Upgrades                     | ITP10                      |
| KCPL           | Iatan - Stranger 345 kV Voltage Conversion Ckt 1       | ITP10                      |
| MKEC           | Spearville 345/115 kV Transformer CKT 1                | Generation Interconnection |
| NPPD           | Hoskins - Neligh 345 kV Ckt 1                          | Regional Reliability       |
| NPPD           | Neligh 345/115 kV Substation                           | Regional Reliability       |
| NPPD           | Cherry Co. - Gentleman 345 kV Ckt 1                    | ITP10                      |
| NPPD           | Cherry Co. Substation 345 kV                           | ITP10                      |
| NPPD           | Cherry Co. - Holt Co. 345 kV Ckt 1                     | ITP10                      |
| NPPD           | Holt Co. Substation 345 kV                             | ITP10                      |
| NPPD           | Stegall 345/115 kV Transformer Ckt 1                   | Regional Reliability       |
| NPPD           | Stegall 345 kV Terminal Upgrades                       | Regional Reliability       |
| NPPD           | Thedford 345/115 kV Transformer                        | High Priority              |
| NPPD           | Thedford 345 kV Terminal Upgrades                      | High Priority              |
| OGE            | ARCADIA - REDBUD 345KV CKT 3                           | Transmission Service       |
| OGE            | NORTHWEST 345/138KV TRANSFORMER CKT 3                  | Transmission Service       |
| OGE            | Chisholm - Gracemont 345 kV Ckt 1 (OGE)                | ITP10                      |
| OGE            | Tatonga - Woodward District EHV 345 kV Ckt 2           | ITP10                      |
| OGE            | Matthewson - Tatonga 345 kV Ckt 2                      | ITP10                      |
| OGE            | Cimarron - Matthewson 345 kV Ckt 2                     | ITP10                      |
| OGE            | Matthewson 345 kV                                      | ITP10                      |
| OGE            | Northwest 345/138 kV Transformer Ckt 3 accelerated     | Transmission Service       |
| OGE            | Woodward District EHV 345kV Substation                 | Generation Interconnection |
| OGE            | Beaver County 345kV Substation GEN-2010-001 Addition   | Generation Interconnection |
| OGE            | Mathewson 345kV Substation GEN-2011-007 Addition       | Generation Interconnection |
| OPPD           | Nebraska City - Mullin Creek 345 kV (OPPD)             | High Priority              |
| OPPD           | S3459 345/161 kV Transformer                           | ITP10                      |
| OPPD           | S3459 345 kV Terminal Upgrades                         | ITP10                      |
| SEPC           | Mingo 345/115 kV Ckt 2 Transformer                     | Regional Reliability       |
| SEPC           | Mingo 345 kV Terminal Upgrades                         | Regional Reliability       |
| SEPC           | Buckner - Spearville 345 kV Ckt 1 Terminal Upgrades    | Regional Reliability       |
| SEPC           | GEN-2008-017 Interconnection Facilities at Setab 345kV | Generation Interconnection |

| Facility Owner | Upgrade Name                                       | Network Upgrade Type       |
|----------------|----------------------------------------------------|----------------------------|
| SEPC           | GEN-2008-017 Network Upgrades at Setab 345kV       | Generation Interconnection |
| SPS            | Tuco - Yoakum 345 kV Ckt 1                         | High Priority              |
| SPS            | Yoakum 345/230 kV Ckt 1 Transformer                | High Priority              |
| SPS            | Hobbs 345/230 kV Ckt 1 Transformer                 | High Priority              |
| SPS            | Hobbs - Yoakum 345 kV Ckt 1                        | High Priority              |
| SPS            | China Draw - North Loving 345 kV Ckt 1             | High Priority              |
| SPS            | Kiowa - North Loving 345 kV Ckt 1                  | High Priority              |
| SPS            | China Draw 345/115 kV Ckt 1 Transformer            | High Priority              |
| SPS            | China Draw 345 kV Ckt 1 Terminal Upgrades          | High Priority              |
| SPS            | Kiowa 345 kV Substation                            | High Priority              |
| SPS            | North Loving 345/115 kV Ckt 1 Transformer          | High Priority              |
| SPS            | North Loving 345 kV Terminal Upgrades              | High Priority              |
| SPS            | Road Runner 345/115 kV Ckt 1 Transformer           | High Priority              |
| SPS            | Road Runner 345 kV Substation Conversion           | High Priority              |
| SPS            | Kiowa 345/115 kV Ckt 1 Transformer                 | High Priority              |
| SPS            | Kiowa - Potash Junction 345/115 kV Ckt 1           | High Priority              |
| SPS            | Hobbs - Kiowa 345 kV Ckt 1                         | High Priority              |
| SPS            | Walkemeyer Tap 345 kV Substation                   | Regional Reliability       |
| SPS            | Walkemeyer Tap 345/115 kV Transformer              | Regional Reliability       |
| SPS            | Eddy County - Tolk 345kV Ckt 1                     | Generation Interconnection |
| TBD            | Cass Co. - S.W. Omaha (aka S3454) 345 kV Ckt1      | ITP20                      |
| TBD            | S3459 345/161 kV Transformer Ckt 2                 | ITP20                      |
| TBD            | South Fayetteville 345/161 kV Transformer Ckt1     | ITP20                      |
| TBD            | Chamber Springs - South Fayetteville 345 kV Ckt1   | ITP20                      |
| TBD            | Maryville 345/161 kV Transformer Ckt1              | ITP20                      |
| TBD            | Nashua 345/161 kV Transformer Upgrade Ckt11        | ITP20                      |
| TBD            | Keystone - Red Willow 345 kV Ckt1                  | ITP20                      |
| TBD            | Tolk - Tuco 345 kV Ckt1                            | ITP20                      |
| TBD            | Holcomb 345/115 kV Transformer Ckt2                | ITP20                      |
| TBD            | Neosho - Wolf Creek 345 kV Ckt1                    | ITP20                      |
| TBD            | Auburn 345/115 kV Transformer Ckt2                 | ITP20                      |
| TBD            | Auburn - Swissvale 345 kV Ckt1 Voltage Conversion  | ITP20                      |
| TBD            | Auburn - Jeffrey EC 345 kV Ckt1 Voltage Conversion | ITP20                      |
| TBD            | Benteler - McDade 345 kV Ckt 1                     | Regional Reliability       |
| TBD            | McDade 345/138 kV Ckt 1 Transformer                | Regional Reliability       |
| TBD            | McDade - Messick 345 kV Ckt 1                      | Regional Reliability       |
| TBD            | Benteler 345/138 kV Ckt 1 Transformer              | Regional Reliability       |
| TBD            | Mooreland - Woodward District EHV 345 kV Ckt 1     | Regional Reliability       |
| TBD            | Center - Dolet Hiles 345 kV Ckt 1                  | Regional Reliability       |
| TBD            | Center 345/138 kV Ckt 1 Transformer                | Regional Reliability       |
| TBD            | Border - Chisholm 345 kV Ckt 1                     | Regional Reliability       |
| TBD            | Chisholm - Woodward District EHV 345 kV Ckt 1      | Regional Reliability       |

| Facility Owner | Upgrade Name                                                  | Network Upgrade Type       |
|----------------|---------------------------------------------------------------|----------------------------|
| TBD            | Battle Axe 345 kV Ckt 1 Terminal Upgrades                     | Regional Reliability       |
| TBD            | China Draw 345 kV Ckt 1 Terminal Upgrades #2 (Battle Axe)     | Regional Reliability       |
| TBD            | Battle Axe - Road Runner 345 kV Ckt 1                         | Regional Reliability       |
| TBD            | Battle Axe 345/115 kV Ckt 1 Transformer                       | Regional Reliability       |
| TBD            | Andrews 345/115 kV Ckt 1 Transformer                          | Regional Reliability       |
| TBD            | Potash Junction 345/115 kV Ckt 1 Transformer                  | Regional Reliability       |
| TBD            | Andrews - Hobbs 345 kV Ckt 1 Voltage Conversion               | Regional Reliability       |
| TBD            | Potash Junction 345/115 kV Ckt 2 Transformer                  | Regional Reliability       |
| TBD            | Chisholm 345/230 kV Ckt 2 Transformer                         | Regional Reliability       |
| TSMO           | Iatan - Nashua 345 kV Ckt 1 (KCPL)                            | Balanced Portfolio         |
| TSMO           | NASHUA 345/161KV TRANSFORMER CKT 1                            | Balanced Portfolio         |
| TSMO           | Sibley - Mullin Creek 345 kV                                  | High Priority              |
| TSMO           | Nebraska City - Mullin Creek 345 kV (GMO)                     | High Priority              |
| TSMO           | Iatan - Nashua 345 kV Ckt 1 (GMO)                             | Balanced Portfolio         |
| WR             | Elm Creek - Summit 345 kV Ckt 1 (WR)                          | ITP10                      |
| WR             | Geary County 345/115 kV Substation                            | Regional Reliability       |
| WR             | Viola 345/138 kV Transformer Ckt 1                            | Regional Reliability       |
| WR             | Geary County 345 kV                                           | Regional Reliability       |
| WR             | Viola 345 kV Terminal Equipment                               | Regional Reliability       |
| WR             | Neosho 138/69 kV Ckt 1 Transformer                            | Regional Reliability       |
| WR             | Moundridge 345 kV Terminal Upgrades                           | Regional Reliability       |
| WR             | Moundridge 345/138 kV Ckt 1 Transformer                       | Regional Reliability       |
| WR             | Tap on Wolf Creek - LaCygne 345kV Ckt 1                       | Generation Interconnection |
| WR             | Tap on Wolf Creek - LaCygne 345kV Ckt 1 GEN-2010-003 Addition | Generation Interconnection |



## Section 15: 2015 ITP10 Project List

| Name                                                  | Type                          | Size | Focus               |
|-------------------------------------------------------|-------------------------------|------|---------------------|
| Road Runner 345/115 kv Transformer                    | Regional Reliability          | 115  | Transformer         |
| Road Runner 345 kV Terminal Upgrades                  | Regional Reliability          | 345  | Substation          |
| S3459 345/161 kV Transformer                          | Regional Reliability          | 161  | Transformer         |
| S3459 345 kV Terminal Upgrades                        | Regional Reliability          | 345  | Substation          |
| Russell 115 kV Cap Bank                               | Regional Reliability          | 115  | Device              |
| Waldo 115 kV Cap Bank                                 | Regional Reliability          | 115  | Substation          |
| Anadarko - Gracemont 138 kV Ckt 1 Reconductor         | Regional Reliability          | 138  | Rebuild/Reconductor |
| Pantex North - Pantex South 115 kV Ckt 1 Reconductor  | Regional Reliability          | 115  | Rebuild/Reconductor |
| Highland Park - Pantex South 115 kV Ckt 1 Reconductor | Regional Reliability          | 115  | Rebuild/Reconductor |
| Martin - Pantex North 115 kV Ckt 1 Reconductor        | Regional Reliability          | 115  | Rebuild/Reconductor |
| Cimarron - Draper 345 kV Terminal Upgrades            | Regional Reliability          | 345  | Substation          |
| Amoco - Sundown 230 kV Terminal Upgrades              | Economic/Regional Reliability | 230  | Substation          |
| South Shreveport - Wallace Lake 138 kV Ckt 1 Rebuild  | Regional Reliability          | 138  | Rebuild/Reconductor |
| Claremore 161 kV Terminal Upgrades                    | Regional Reliability          | 161  | Substation          |
| North Platt - Stockville 115 kV Ckt 1 Rebuild         | Economic                      | 115  | Rebuild/Reconductor |
| Red Willow - Stockville 115 kV Ckt 1 Rebuild          | Economic                      | 115  | Rebuild/Reconductor |
| Mingo 345/115 kV Ckt 2 Transformer                    | Economic                      | 115  | Transformer         |
| Mingo 345 kV Terminal Upgrades                        | Regional Reliability          | 345  | Substation          |
| Iatan - Stranger 345 kV Voltage Conversion Ckt 1      | Economic                      | 345  | Voltage Conversion  |
| Lovington 115/69 kV Ckt 2 Transformer                 | Regional Reliability          | 69   | Transformer         |
| Lovington 115 kV Terminal Upgrades                    | Regional Reliability          | 115  | Substation          |
| Moundridge 345 kV Terminal Upgrades                   | Regional Reliability          | 345  | Substation          |
| Moundridge 345/138 kV Ckt 1 Transformer               | Regional Reliability          | 138  | Transformer         |
| Plains Interchange 115 kV Cap Bank                    | Regional Reliability          | 115  | Device              |
| Ochoa 115 kV Cap Banks                                | Regional Reliability          | 115  | Device              |
| Miles City 115 kV Cap Bank                            | Regional Reliability          | 115  | Device              |
| Walkemeyer Tap 345 kV Substation                      | Regional Reliability          | 345  | Substation          |
| Walkemeyer Tap 345/115 kV Transformer                 | Regional Reliability          | 115  | Transformer         |
| Walkemeyer - Walkemeyer Tap 115 kV Ckt 1 (SPS)        | Regional Reliability          | 115  | New Line            |
| Walkemeyer - Walkemeyer Tap 115 kV Ckt 1 (SEPC)       | Regional Reliability          | 115  | New Line            |
| Walkemeyer 115 kV Terminal Upgrades                   | Regional Reliability          | 115  | Substation          |
| North Liberal - Walkemeyer 115 kV Ckt 1               | Regional Reliability          | 115  | New Line            |
| North Liberal 115 kV Terminal Upgrades                | Regional Reliability          | 115  | Substation          |

| Name                                                             | Type                 | Size | Focus               |
|------------------------------------------------------------------|----------------------|------|---------------------|
| Canyon West - Dawn 115 kV Ckt 1 Rebuild                          | Regional Reliability | 115  | Rebuild/Reconductor |
| Dawn - Panda 115 kV Ckt 1 Rebuild                                | Regional Reliability | 115  | Rebuild/Reconductor |
| Plant-X 230/115 kV Ckt 2 Transformer                             | Regional Reliability | 115  | Transformer         |
| Forbes - Underpass North 115 kV Ckt 1 Rebuild                    | Regional Reliability | 115  | Rebuild/Reconductor |
| Murray Gill East Energy Center - Interstate 138 kV Ckt 1 Rebuild | Regional Reliability | 138  | Rebuild/Reconductor |
| Bush Tap - Hastings 115 kV Ckt 1                                 | Regional Reliability | 115  | New Line            |
| Allred 115 kV Cap Bank                                           | Regional Reliability | 115  | Device              |
| China Draw 115 kV Cap Banks                                      | Regional Reliability | 115  | Device              |
| North Loving 115 kV Cap Banks                                    | Regional Reliability | 115  | Device              |
| Grinnell 115 kV Cap Bank                                         | Regional Reliability | 115  | Device              |
| Sand Springs 138 kV Terminal Upgrades                            | Regional Reliability | 138  | Substation          |
| Park Lane 115 kV Terminal Upgrades                               | Regional Reliability | 138  | Substation          |
| Amarillo South 230 kV Terminal Upgrades                          | Regional Reliability | 230  | Substation          |
| Tuco 230/115kV Ckt 1 Transformer                                 | Regional Reliability | 115  | Transformer         |
| Enogex Wilburton Tap - Lone Oak 138 kV Ckt 1 Rebuild             | Regional Reliability | 138  | Rebuild/Reconductor |
| Enogex Wilburton Tap - Sardis 138 kV Ckt 1 Rebuild               | Regional Reliability | 138  | Rebuild/Reconductor |
| Clayton - Sardis 138 kV Ckt 1 Rebuild                            | Regional Reliability | 138  | Rebuild/Reconductor |
| Clayton - Neshoba 138 kV Ckt 1 Rebuild                           | Regional Reliability | 138  | Rebuild/Reconductor |
| Bethel - Neshoba 138 kV Ckt 1 Rebuild                            | Regional Reliability | 138  | Rebuild/Reconductor |
| Bethel - Broken Bow 138 kV Ckt 1 Rebuild                         | Regional Reliability | 138  | Rebuild/Reconductor |

## Section 16: 2015 ITPNT Project List

| Reliability Project(s)                                                                                                                      | Project Area(s) | Monitored Element(s)*                                                                                                                     | Miles Added/ Modified | Need Date |
|---------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------|
| Rebuild Hobart-Snyder 69 kV line, upgrade jumpers, switches, CT ratios and relay settings at both substations and upgrade the bus at Synder | AEPW            | HOBART - ROOSEVELT TAP 69 kV<br>CKT 1<br>ROOSEVELT TAP-SNYDER 69 kV                                                                       | 28.7                  | 6/1/2015  |
| New -50/+200 MVar SVC at China Draw 115 kV, new -50/+200 MVar SVC at Road Runner 115 kV                                                     | SPS             | DOLLARHIDE SUB 115 kV<br>AGAVE_RHILL3 115 kV<br>CHINA_DRAW 3 115 kV<br>BATTLE_AXE 3 115 kV                                                |                       | 4/1/2015  |
| Rebuild Grand Saline-Mineola 69 kV line, switches, CT ratios and relay settings at both substations, upgrade jumpers at Grand Saline        | AEPW            | GRAND SALINE - MINEOLA 69 kV<br>CKT 1                                                                                                     | 13.8                  | 6/1/2020  |
| Rebuild Canyon West-Dawn-Panda-Deaf Smith 115 kV line                                                                                       | SPS             | CANYON WEST SUB - DAWN SUB<br>115 kV CKT 1<br>DAWN SUB - Panda Energy<br>Substation Hereford 115 kV CKT 1                                 | 25.64                 | 4/1/2018  |
| Replace wave traps at Amoco and Sundown 230 kV                                                                                              | SPS             | AMOCO SWITCHING STATION -<br>SUNDOWN INTERCHANGE 230 kV<br>CKT 1                                                                          |                       | 4/1/2020  |
| Replace wave trap at Claremore 161 kV                                                                                                       | GRDA            | PYRAMID CORNERS 69 kV                                                                                                                     |                       | 6/1/2018  |
| Install a second 345/115 kV transformer at Mingo; Install any necessary 115 kV terminal equipment                                           | SUNC            | ONEOK 3 115 kV<br>MCDONLD3 115 kV<br>BVERVLLY 115 kV<br>ATWOOD 115 kV                                                                     |                       | 6/1/2015  |
| Install second 115/69 kV transformer at Lovington; Install any necessary 69 kV terminal equipment                                           | SPS             | LEA COUNTY REC-SAN ANDRES<br>INTERCHANGE 115/69 kV<br>TRANSFORMER CKT 1                                                                   |                       | 6/1/2015  |
| Upgrade wave trap at Amarillo South Interchange-Swisher County Interchange 230 kV                                                           | SPS             | AMARILLO SOUTH INTERCHANGE<br>- SWISHER COUNTY<br>INTERCHANGE 230 kV CKT 1                                                                |                       | 4/1/2020  |
| Rebuild Southwestern Station-Carnegie 138 kV, upgrade jumpers and CT ratios at Southwestern Station                                         | AEPW            | CARNEGIE - SOUTHWESTERN<br>STATION 138 kV CKT 1                                                                                           | 16.5                  | 6/1/2016  |
| Rebuild of the PCA Interchange and Quahada 115kV line                                                                                       | SPS             | PCA INTERCHANGE - QUAHADA<br>115 kV CKT 1<br>CARLSBAD INTERCHANGE -<br>PECOS INTERCHANGE 115 kV CKT<br>1<br>CENTRAL VALLEY REC-LUSK 69 kV | 11.08                 | 6/1/2016  |

| Reliability Project(s)                                                                                                                                                          | Project Area(s) | Monitored Element(s)*                                                                    | Miles Added/ Modified | Need Date |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------------------------------------------------------------------------------|-----------------------|-----------|
|                                                                                                                                                                                 |                 | UNITED SALT SUB 69 kV                                                                    |                       |           |
| Rebuild of the Little River and Maud 69kV line                                                                                                                                  | OKGE            | LTRIVRT2 69 - MAUD 69 kV CKT 1                                                           | 10.73                 | 6/1/2015  |
| Rebuild of Harrisonville North and Ralph Green 69kV line                                                                                                                        | GMO             | HARRISONVILLE NORTH - RALPH GREEN 69 kV CKT 1                                            | 8.76                  | 6/1/2015  |
| Tap the Lawrence Hill-Swissvale 230kV line into Baldwin Creek substation and add a 230/115kV transformer at Baldwin Creek                                                       | WERE            | LAWRENCE HILL (LAWH TX-3) 230/115/13.8 kV TRANSFORMER CKT 1                              |                       | 6/1/2017  |
| Replace existing 161/69 kV transformer at South Waverly                                                                                                                         | KCPL            | SOUTH WAVERLY 161/69 kV TRANSFORMER CKT 1<br>ODESSA 161/69 kV TRANSFORMER CKT 1          |                       | 6/1/2015  |
| Tap Ainsworth-Stuart 115 kV line, install new 9 MVar Capacitor Bank at new Bassett substation                                                                                   | NPPD            | EMMETE.TAP<br>EMMETE.P22 7 115 kV<br>EMMETE.P22                                          |                       | 6/1/2016  |
| Install 138/69 kV bus tie transformer in OG&E Stillwater substation and interface OG&E Stillwater 69 kV substation with existing Stillwater Municipal 69 kV transmission system | OKGE            | STILLWATER KINZIE (KINAUTO1) 138/69/13.8 kV TRANSFORMER CKT 1                            |                       | 6/1/2019  |
| Rebuild Neosho SES-Labette 69 kV line                                                                                                                                           | WERE            | LABETTE SWITCHING STATION - NEOSHO 69 kV CKT 1                                           | 4.6                   | 6/1/2019  |
| Upgrade 115/69 kV transformer 1 at Lynn County                                                                                                                                  | SPS             | LYNN COUNTY INTERCHANGE (PENN 0154552) 115/69/13.2 kV TRANSFORMER CKT 1                  |                       | 6/1/2019  |
| Rebuild Linwood-South Shreveport 138 kV line and upgrade jumpers at Linwood                                                                                                     | AEPW            | CEDARGROVE - LINWOOD 138 kV CKT 1<br>CEDAR GROVE – SOUTH SHREVEPORT 138 kV CKT 1         | 2.5                   | 6/1/2017  |
| Upgrade 138 kV terminal equipment at Benton                                                                                                                                     | WERE            | BENTON (BENT TX-2) 345/138/13.8 kV TRANSFORMER CKT 1                                     |                       | 6/1/2017  |
| Upgrade breaker and relay at CPPX 69 kV substation                                                                                                                              | GRDA            | CPP TRANSF #2 - WILGRO 69 kV CKT 1                                                       |                       | 6/1/2016  |
| Install second one stage 14.4 MVar Capacitor Bank at Texas County 115 kV bus                                                                                                    | SPS             | HASKELL - SEWARD-3 115 kV CKT 1<br>CIMARRON RIVER PLANT 115 kV<br>N-CIMRN3 115.00 115 kV |                       | 6/1/2015  |
| Install 14.4 MVar Capacitor Bank at Cargill 115 kV bus                                                                                                                          | SPS             | FRIONA SUB 115 kV<br>DEAF SMITH REC-#20 115 kV<br>DEAF SMITH REC-#6 115 kV               |                       | 6/1/2015  |
| Rebuild Brooks Street-Edwards Street 69 kV line and upgrade jumpers at each end                                                                                                 | AEPW            | BROOKS STREET - EDWARDS STREET 69 kV CKT 1                                               | 0.8                   | 6/1/2016  |
| Install 14.4 MVar Capacitor Bank at                                                                                                                                             |                 | STILLWATER PERKINS TAP 69 kV                                                             |                       | 6/1/2019  |

| Reliability Project(s)                                                                                              | Project Area(s) | Monitored Element(s)*                                                                                                                                                                                               | Miles Added/ Modified | Need Date |
|---------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------|
| Boomer 69 kV bus                                                                                                    | GRDA            | STILLWATER CENTRAL 69 kV<br>STILLWATER HOSPITAL 69 kV<br>STILLWATER BOOMER 69 kV                                                                                                                                    |                       |           |
| Install 14.4 MVar Capacitor Bank at Lea County Bronco 69 kV bus                                                     | SPS             | LEA COUNTY REC-LOVINGTON INTERCHANGE 115/69 kV<br>TRANSFORMER CKT 1<br>LEA COUNTY REC-CROSSROADS 69 kV<br>LEA COUNTY REC-BRONCO TAP 69 kV<br>LEA COUNTY REC-BRONCO 69 kV                                            |                       | 6/1/2016  |
| Install 14.4 MVar Capacitor Bank at the Lea Rec Plains Interchange 69 kV bus                                        | SPS             | LEA COUNTY REC-PRICE 69 kV<br>LEA COUNTY REC-LEWIS 69 kV<br>LEA COUNTY REC-NEWTEx 69 kV                                                                                                                             |                       | 6/1/2015  |
| Install 14.4 MVar Capacitor Bank at Four Corners 69 kV bus                                                          | OKGE            | KREMLINT2 69 kV<br>KREMLIN 69 kV                                                                                                                                                                                    |                       | 6/1/2015  |
| Install new 69 kV breaker at Warner Tap to facilitate closing of the 69 kV switch at Wells substation               | OKGE            | CHECOTA 69 kV<br>WELLS 69 kV                                                                                                                                                                                        |                       | 6/1/2015  |
| Install 12 MVar Capacitor Bank at Newport 69 kV bus                                                                 | GRDA            | NEWPORT 69 kV<br>MONKEY ISLAND 69 kV                                                                                                                                                                                |                       | 6/1/2015  |
| Install 10 MVar Capacitor Bank at Lea County Williams 69 kV bus                                                     | SPS             | LEA COUNTY REC-DALLAS 69 kV<br>LEA COUNTY REC-WILLIAMS SUB 69 kV<br>LEA COUNTY REC-CAPROCK 69 kV                                                                                                                    |                       | 6/1/2015  |
| Install a 5 MVar Capacitor Bank at Winchester 69 kV bus                                                             | WFEC            | WINCH_TAP 69 kV<br>WINCHESTER2 69 kV                                                                                                                                                                                |                       | 6/1/2020  |
| Install 3.6 MVar Capacitor Bank at Childers 69 kV bus                                                               | GRDA            | PYRAMID CORNERS 69 kV                                                                                                                                                                                               |                       | 6/1/2018  |
| Install 3 MVar Capacitor Bank at Thackerville 69 kV bus                                                             | WFEC            | THACKERVILLE 69 kV                                                                                                                                                                                                  |                       | 6/1/2019  |
| Replace CTs and relays on Collinsville and Skiatook 69 kV line                                                      | GRDA            | COLLINSVILLE - SKIATOOK TAP 69 kV CKT 1                                                                                                                                                                             |                       | 6/1/2017  |
| Tap Hitchland-Finney 345 kV line at NewSub, new 345/115 kV transformer at NewSub, new NewSub-Walkemeyer 115 kV line | SPS / SUNC      | CTU SUBLETTE - PIONEER TAP 115 kV CKT 1<br>BUCKNER7 345 - SPEARVILLE 345 kV CKT 1<br>CIMARRON RIVER PLANT - HAYNE3 115 kV CKT 1<br>CIMARRON RIVER PLANT 115 kV<br>HAYNE3 115 kV<br>KISMET 3 115 kV<br>CUDAHY 115 kV | 1                     | 6/1/2015  |
| Convert RIAC substation to 115 kV, new 3-way 115 kV line switch tapping Roswell Intg-Brasher 115 kV line, wreckout  | SPS             | ROSWELL INTERCHANGE (AC *017772) 115/69/13.2 kV<br>TRANSFORMER CKT 1                                                                                                                                                | 1.5                   | 6/1/2015  |

| Reliability Project(s)                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Project Area(s) | Monitored Element(s)*                                                                                                                                                                | Miles Added/ Modified | Need Date |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------|
| existing 69 kV transmission lines to RIAC substation and rebuild 69 kV line from north with new 115 kV line to RIAC, new breaker terminal at Roswell Intg, new 0.1 mile line out of Roswell Intg-Roswell 115 kV                                                                                                                                                                                                                                                                    |                 |                                                                                                                                                                                      |                       |           |
| Reconductor IMC #1 Tap-Intrepid West, IMC #1-Livingston Ridge, Intrepid West-Potash Junction, Byrd-Monument, Ponderosa Tap-Whitten, National Enrichment Plant-Targa 115 kV lines, upgrade terminal equipment at Byrd 115 kV, upgrade wave trap at Whitten 115 kV, install 100 MVar Capacitor Bank at Potash 230 kV, install 28.8 MVar Capacitor Bank at Roadrunner 115 kV, install 28.8 MVar Capacitor Bank at Ochoa 115 kV, install 28.8 MVar Capacitor Bank at Agave Hill 115 kV | SPS             | National Enrichment Plant Sub - TARGA 3 115KV CKT 1<br>INTREPDW_TP3 - POTASH JUNCTION INTERCHANGE 115 kV CKT 1<br>IMC_#1_TP 3 115 kV<br>I. M. C. #1 SUB 115 kV<br>WOOD_DRAW 3 115 kV | 31.84                 | 6/1/2015  |
| Upgrade terminal equipment at Buckner and Spearville 345 kV                                                                                                                                                                                                                                                                                                                                                                                                                        | SUNC            | BUCKNER7 345 - SPEARVILLE 345 kV CKT                                                                                                                                                 |                       | 6/1/2015  |
| Ainsworth - Ainsworth Wind 115 kV Ckt 1 Rebuild                                                                                                                                                                                                                                                                                                                                                                                                                                    | NPPD            | STUART 115 kV<br>AINSWORTH 115 kV<br>EMMETE.TAP<br>EMMETE.P22 7 115 kV<br>EMMETE.P22                                                                                                 | 7.13                  | 6/1/2020  |
| Accelerate NTC 200295 - Install new 161/69 kV transformer at Fremont to accommodate a new 161 kV interconnection, new 69 kV line from Fremont to new substation S6801, new 161 kV line from S1226 to new substation S1301                                                                                                                                                                                                                                                          | OPPD            | 991 TAP 69 kV<br>FREMONT SUB A 69 kV<br>FREMONT SUB B 69 kV                                                                                                                          | 20                    | 6/1/2016  |

## Section 17: Projects Completed in 2014

### 17.1 ITP Projects Completed in 2014

| NTC ID | PID | Facility Owner | Project Name                                                | Cost Estimate |
|--------|-----|----------------|-------------------------------------------------------------|---------------|
| 19985  | 140 | WFEC           | ACME - WEST NORMAN 69KV CKT 1                               | \$912,000     |
| 200166 | 151 | SPS            | Tuco Interchange 115/69 kV Transformer Ckt 3                | \$3,212,132   |
| 20081  | 235 | OGE            | COLONY - FT SMITH 161KV CKT 1 #2                            | \$2,120,000   |
| 20003  | 311 | WFEC           | ACME - FRANKLIN SW 138KV CKT 1                              | \$2,065,000   |
| 20003  | 311 | WFEC           | ACME - WEST NORMAN 138KV CKT 1                              | \$1,601,000   |
| 20003  | 311 | WFEC           | OU SW - WEST NORMAN 138KV CKT 1                             | \$1,577,000   |
| 20000  | 450 | AEP            | 161KV CKT 1                                                 | \$11,962,000  |
| 20000  | 450 | AEP            | Shipe Road 345/161 kV transformer Ckt 1                     | \$13,104,000  |
| 20000  | 450 | AEP            | Flint Creek - Shipe Road 345 kV Ckt 1                       | \$34,085,000  |
| 200216 | 502 | AEP            | Northwest Henderson - Poynter 69 kV Ckt 1                   | \$7,815,833   |
| 200167 | 503 | AEP            | Diana - Perdue 138 kV Ckt 1                                 | \$1,004,187   |
| 200168 | 549 | GRDA           | Maid - Pryor Foundry South 69 kV Ckt 1                      | \$1,993,805   |
| 200168 | 550 | GRDA           | Maid - Redden 69 kV Ckt 1                                   | \$2,104,778   |
| 20029  | 615 | OGE            | COTTONWOOD CREEK - CRESENT 138KV CKT 1                      | \$8,100,000   |
| 20031  | 696 | SPS            | CHAVES COUNTY INTERCHANGE - ROSWELL INTERCHANGE 115KV CKT 1 | \$8,610,000   |
| 20034  | 646 | GMO            | Clinton 161/69 kV transformer                               | \$1,968,315   |
| 20027  | 649 | AEP            | LOCUST GROVE - LONE STAR 115KV CKT 1                        | \$2,150,000   |
| 20079  | 653 | MKEC           | PRATT - ST JOHN 115KV CKT 1                                 | \$15,079,303  |
| 200204 | 669 | OGE            | Five Tribes - Pecan Creek 161 kV Ckt 1                      | \$3,022,363   |
| 20087  | 715 | GMO            | GLENARE - LIBERTY 69KV CKT 1 #2                             | \$1,950,000   |
| 20084  | 774 | SPS            | CHERRY1 - POTTER COUNTY INTERCHANGE 230KV CKT 1             | \$3,792,408   |
| 20084  | 774 | SPS            | CHERRY1 230/115KV TRANSFORMER CKT 1                         | \$9,736,187   |
| 20084  | 774 | SPS            | Hastings Sub 115 kV                                         | \$1,048,295   |
| 20084  | 791 | SPS            | NEWHART 230 230/115KV TRANSFORMER CKT 1                     | \$12,864,507  |
| 20084  | 791 | SPS            | NEWHART 230 - SWISHER COUNTY INTERCHANGE 230KV CKT 1        | \$19,959,385  |
| 20084  | 791 | SPS            | KRESS INTERCHANGE - NEWHART 115KV CKT 1                     | \$16,108,465  |
| 20084  | 791 | SPS            | CASTRO COUNTY INTERCHANGE - NEWHART 115KV CKT 1             | \$15,491,109  |
| 20084  | 791 | SPS            | HART INDUSTRIAL - NEWHART 115KV CKT 1                       | \$2,568,905   |
| 20084  | 791 | SPS            | HART INDUSTRIAL - LAMTON INTERCHANGE 115KV CKT 1            | \$17,384,254  |
| 20084  | 795 | SPS            | PLEASANT HILL 230/115KV TRANSFORMER CKT 1                   | \$16,422,903  |
| 20084  | 795 | SPS            | OASIS INTERCHANGE - PLEASANT HILL 230KV CKT 1               | \$18,647,234  |
| 20084  | 795 | SPS            | PLEASANT HILL - ROOSEVELT COUNTY INTERCHANGE 230KV CKT 1    | \$18,805,425  |
| 200170 | 816 | NPPD           | Albion - Genoa 115 kV Ckt 1                                 | \$1,049,361   |
| 20084  | 704 | SPS            | TUCO INTERCHANGE 345/230KV TRANSFORMER CKT 2                | \$12,550,762  |
| 200214 | 839 | SPS            | Cox Interchange - Kiser 115 kV Ckt 1 #2                     | \$6,400,000   |
| 200214 | 841 | SPS            | Graham Interchange 115/69 kV Transformer Ckt 1              | \$1,981,510   |
| 20132  | 846 | WFEC           | Anadarko - Blanchard 138 kV Ckt 1                           | \$14,737,500  |



| NTC ID | PID   | Facility Owner | Project Name                                                       | Cost Estimate |
|--------|-------|----------------|--------------------------------------------------------------------|---------------|
| 200167 | 882   | AEP            | Carthage - Rock Hill 69 kV Ckt 1 #2                                | \$11,830,128  |
| 200214 | 940   | SPS            | Hitchland Interchange 345/230 kV Transformer Ckt 2                 | \$4,723,219   |
| 200216 | 1012  | AEP            | Diana - Perdue 138 kV Ckt 1 #2                                     | \$18,805,489  |
| 200204 | 1017  | OGE            | Classen - Southwest 5 Tap 138 kV Ckt 1                             | \$109,481     |
| 20130  | 1029  | SPS            | Lynn County Interchange 115 kV                                     | \$5,342,685   |
| 200166 | 1034  | SPS            | Hereford Interchange - Northeast Hereford Interchange 115 kV Ckt 1 | \$4,139,406   |
| 20130  | 774   | SPS            | CHERRY SUB - HASTINGS SUB 115KV CKT 1                              | \$5,540,583   |
| 20131  | 1073  | WR             | Franklin - Mulberry 69 kV Ckt 1                                    | \$6,949,300   |
| 20131  | 1073  | WR             | Franklin - Sheffield 69KV CKT 1                                    | \$1,320,792   |
| 20131  | 1073  | WR             | Franklin 161 kV                                                    | \$8,063,989   |
| 20132  | 1084  | WFEC           | ALVA - FREEDOM 69KV CKT 1                                          | \$6,243,750   |
| 20131  | 1073  | WR             | Franklin 161/69KV TRANSFORMER CKT 1                                | \$5,348,455   |
| 200214 | 1143  | SPS            | Lubbock South 230/115/13.2 kV Transformer Ckt 2                    | \$4,063,897   |
| 20030  | 30039 | WFEC           | ESQUANDALE 69KV                                                    | \$243,000     |
| 200218 | 30207 | NPPD           | Cozad 115 kV Capacitor                                             | \$518,350     |
| 200211 | 30349 | WR             | Auburn Road 230/115/13.8 kV Ckt 1 Auto Upgrade                     | \$32,936,593  |
| 200166 | 30351 | SPS            | Crosby 115 kV #2                                                   | \$985,519     |
| 200166 | 30353 | SPS            | Move lines from Lea County to Hobbs 230/115 kV                     | \$11,282,344  |
| 200167 | 30354 | AEP            | Coweta 69 kV                                                       | \$1,428,440   |
| 200167 | 30346 | AEP            | Cornville 138 kV                                                   | \$21,664,838  |
| 200214 | 839   | SPS            | Kiser Substation 115/69 kV Ckt 1                                   | \$6,400,000   |
| 200210 | 30426 | MIDW           | Pheasant Run - Seguin 115 kV Ckt 1                                 | \$7,811,905   |
| 200214 | 30430 | SPS            | Floyd 115 kV Capacitor                                             | \$1,731,323   |
| 200212 | 30431 | WR             | El Paso - Farber 138 kV Ckt 1                                      | \$3,917,751   |
| 200214 | 30467 | SPS            | Potash Junction 115/69 kV Transformer Ckt 2                        | \$2,289,368   |
| 200253 | 30566 | NPPD           | Maxwell - North Platt 115 kV Terminal Upgrades                     | \$25,767      |
| 200250 | 30583 | GMO            | Harrisonville 161/69 kV Ckt 2 Transformer                          | \$2,773,480   |
| 200250 | 30583 | GMO            | Harrisonville 161 kV Ckt 2 Terminal Upgrades                       | \$1,005,220   |

## **17.2 Transmission Service Projects Completed in 2014**

| NTC ID | PID   | Facility Owner | Project Name                                                                  | Cost Estimate |
|--------|-------|----------------|-------------------------------------------------------------------------------|---------------|
| 20067  | 904   | MKEC           | FLATRDG3 - MEDICINE LODGE 138KV CKT 1                                         | \$4,631,255   |
| 20067  | 906   | MKEC           | MEDICINE LODGE - PRATT 115KV CKT 1                                            | \$13,645,827  |
| 200193 | 1000  | SPS            | Jones Station Bus#2 - Lubbock South Interchange 230 kV CKT 2 terminal upgrade | \$190,000     |
| 20091  | 30224 | WR             | BURLINGTON JUNCTION - COFFEY COUNTY NO. 3 WESTPHALIA 69KV CKT 1               | \$3,027,106   |
| 20091  | 30224 | WR             | COFFEY COUNTY NO. 3 WESTPHALIA - GREEN 69KV CKT 1                             | \$6,726,750   |

### **17.3 Generation Interconnection Projects Completed in 2014**

| NTC ID | Project ID | Project Owner | Upgrade Name                                                                              | Current Cost Estimate |
|--------|------------|---------------|-------------------------------------------------------------------------------------------|-----------------------|
|        | 30379      | GRDA          | Pawnee 138 kV                                                                             | \$2,500,000           |
|        | 30380      | GRDA          | FAIRFAX - PAWNEE 138KV CKT 1                                                              | \$11,900,000          |
|        | 30381      | AEP           | Shidler 138 kV                                                                            | \$399,000             |
|        | 30381      | OGE           | Osage - Shidler 138kV                                                                     | \$399,300             |
|        | 30593      | ITCGP         | Spearville 345kV Substation GEN-2010-015 Addition                                         | \$4,264,906           |
|        | 30751      | OGE           | Tatonga 345kV Substation GEN-2007-021 Addition                                            | \$1,973,375           |
|        | 30752      | OGE           | Tatonga 345kV Substation GEN-2007-044 Addition                                            | \$1,973,375           |
|        | 30753      | SPS           | Hitchland 115kV Interchange GEN-2007-046 Addition                                         | \$513,231             |
|        | 30754      | WR            | GEN-2009-040 POI TOIFs                                                                    | \$540,103             |
|        | 30754      | WR            | GEN-2009-040 POI NUs                                                                      | \$5,272,127           |
|        | 30754      | WR            | Knob Hill - South Seneca 115kV Tap for GEN-2009-040 POI                                   | \$1,056,200           |
|        | 30764      | OGE           | Woodward District EHV 138 kV Substation GEN-2008-029 Addition                             | \$4,200,000           |
|        | 30765      | OGE           | Beaver County 345kV Substation                                                            | \$15,744,936          |
|        | 30781      | NPPD          | Rosemont 115kV Substation                                                                 | \$5,950,000           |
|        | 30788      | OGE           | Advanced Construction of Mathewson 345kV Substation for Limited Operation of GEN-2011-007 | \$5,000,000           |

### **17.4 Balanced Portfolio Projects Completed in 2014**

| NTC ID | Project ID | Project Owner | Project Name                                      | Current Cost Estimate |
|--------|------------|---------------|---------------------------------------------------|-----------------------|
| 20041  | 701        | OGE           | Stateline - Woodward EHV 345 kV                   | \$115,000,000         |
| 20041  | 701        | OGE           | WOODWARD DISTRICT EHV 345/138KV TRANSFORMER CKT 2 |                       |
| 20043  | 704        | SPS           | Tuco Interchange - Stateline 345 kV               | \$192,875,814         |
| 20043  | 701        | OGE           | Stateline 345 kV                                  |                       |

### **17.5 Priority Projects Completed in 2014**

| NTC ID | PID | Facility Owner | UPGRADE_NAME                                                     | Current Cost Estimate |
|--------|-----|----------------|------------------------------------------------------------------|-----------------------|
| 20099  | 940 | SPS            | Hitchland Interchange - Woodward District EHV 345 kV CKT 1 (SPS) |                       |
| 20099  | 940 | SPS            | Hitchland Interchange - Woodward District EHV 345 kV CKT 2 (SPS) | \$56,479,846          |
| 20100  | 941 | OGE            | Hitchland Interchange - WOODWARD DISTRICT EHV 345KV CKT 1 (OGE)  | \$168,000,000         |
| 20100  | 941 | OGE            | Hitchland Interchange - WOODWARD DISTRICT EHV 345KV CKT 2 (OGE)  |                       |
| 20121  | 942 | OGE            | Thistle - Woodward EHV 345 kV ckt 1 (OGE)                        | \$142,040,000         |
| 20121  | 942 | OGE            | Thistle - Woodward EHV 345 kV ckt 2 (OGE)                        |                       |
| 200163 | 943 | PW             | Thistle - Woodward EHV 345 kV ckt 1 (PW)                         | \$22,610,000          |
| 200163 | 943 | PW             | Thistle - Woodward EHV 345 kV ckt 2 (PW)                         | \$22,610,000          |
| 200239 | 945 | ITCGP          | Ironwood - Clark Co. 345 kV Ckt 1                                | \$50,565,144          |
| 200239 | 945 | ITCGP          | Ironwood - Clark Co. 345 kV Ckt 2                                | \$50,565,144          |
| 200162 | 945 | ITCGP          | Clark Co 345 kV - Thistle 345 kV ckt 1                           | \$91,618,023          |
| 200162 | 945 | ITCGP          | Clark Co 345 kV - Thistle 345 kV ckt 2                           | \$91,618,023          |
| 200163 | 946 | PW             | Thistle - Wichita 345 kV ckt 1 (PW)                              | \$58,140,000          |
| 200163 | 946 | PW             | Thistle - Wichita 345 kV ckt 2 (PW)                              | \$58,140,000          |
| 200162 | 945 | ITCGP          | Thistle 345/138 kV transformer                                   | \$6,284,694           |
| 20103  | 946 | WR             | Wichita 345 kV Terminal Upgrades                                 | \$10,746,938          |
| 200162 | 945 | ITCGP          | Flat Ridge - Thistle 138 kV                                      | \$7,106,987           |
| 200239 | 945 | ITCGP          | Ironwood 345 kV Substation                                       | \$1,850,000           |

| NTC ID | PID | Facility Owner | UPGRADE_NAME                       | Current Cost Estimate |
|--------|-----|----------------|------------------------------------|-----------------------|
| 200239 | 945 | ITCGP          | Ironwood - Spearville 345 kV Ckt 2 | \$9,191,986           |
| 200239 | 945 | ITCGP          | Ironwood - Spearville 345 kV Ckt 1 | \$200,000             |

## **17.6 Sponsored Projects Completed in 2014**

| NTC ID | Project ID | Project Owner | Project Name | Current Cost Estimate |
|--------|------------|---------------|--------------|-----------------------|
| NA     |            |               |              |                       |

## Section 18: 2013 ITP20 Project List

| Name                             | Type                                   | Size               | Focus       |
|----------------------------------|----------------------------------------|--------------------|-------------|
| Keystone – Red Willow            | New Branch                             | 345 kV             | Reliability |
| Tolk – Tuco                      | New Branch                             | 345 kV             | Reliability |
| S3459                            | 2nd Transformer                        | 345/161 kV         | Economic    |
| Holcomb                          | 2nd Transformer                        | 345/115 kV         | Reliability |
| Maryville                        | New Transformer                        | 345/161 kV         | Reliability |
| Pecan Creek – Muskogee           | Upgrade 2 circuits                     | 345 kV             | Reliability |
| Nashua                           | Upgrade Transformer                    | 345/161 kV         | Reliability |
| JEC – Auburn Hills – Swissvale   | Rebuild (New Auburn Hills transformer) | 345 kV, 345/115 kV | Reliability |
| Clinton – Truman – N Warsaw      | Upgrade Branch                         | 161 kV             | Reliability |
| S3740 - S3454                    | New Branch                             | 345 kV             | Reliability |
| Chamber Springs – S Fayetteville | New Branch & Transformer               | 345 KV, 345/161 kV | Economic    |
| Wolf Creek - Neosho              | New Branch                             | 345 kV             | Economic    |

| NTC ID | PID   | UID   | Facility Owner | 2015 Project Type    | Cost Estimate | Estimated Cost Source | Upgrade Description                                                                                                                                                                                                                                                      | TO Projected In-Service Date | SPP Determined Need Date | Upgrade Lead Time (Mo) | From Bus Number | From Bus Name                   | To Bus Number |
|--------|-------|-------|----------------|----------------------|---------------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|--------------------------|------------------------|-----------------|---------------------------------|---------------|
|        | 74    | 10092 | TBD            | High Priority        | \$2,496,948   | SPP                   | Upgrade 1st 115/69 kV transformer at Artesia to 84 MVA.                                                                                                                                                                                                                  |                              | 6/1/2018                 | 24 months              | 527699          |                                 | 527701        |
|        | 74    | 10093 | TBD            | High Priority        | \$2,496,948   | SPP                   | Upgrade 2nd 115/69 kV transformer at Artesia to 84 MVA.                                                                                                                                                                                                                  |                              | 6/1/2018                 | 24 months              | 527700          |                                 | 527707        |
| 20003  | 136   | 10174 | WFEC           | ITP                  | \$6,674,000   | SPP                   | Build new 10 mile Meeker - Hammett 138 kV and install terminal equipment.                                                                                                                                                                                                | 6/1/2015                     | 6/1/2008                 | 10 months              | 520994          | MEEKER                          | 520951        |
| 20003  | 138   | 10176 | WFEC           | ITP                  | \$1,050,000   | SPP                   | Upgrade WFEC Woodward sub to 1200 A and reconductor from 336.4 ACSR to 795 ACSR; new rating 91/110 MVA.                                                                                                                                                                  | 9/25/2015                    | 4/1/2009                 | 12 months              | 514782          | WOODWARD 69                     | 521096        |
| 20003  | 241   | 10307 | WFEC           | ITP                  | \$2,000,000   | WFEC                  | Rebuild 2 mile Anadarko - Georgia 138 kV line from 556 to 1113 ACSR.                                                                                                                                                                                                     | 6/26/2015                    | 6/1/2009                 | 12 months              | 520814          | ANADARKO                        | 520923        |
| 20003  | 242   | 10308 | WFEC           | ITP                  | \$3,240,000   | WFEC                  | Elmore - Paoli Rebuild 3/0 to 336 ACSR - 10.8 miles.                                                                                                                                                                                                                     | 12/2/2015                    | 6/1/2009                 | 12 months              | 520898          | ELMORE                          | 521022        |
| 200291 | 319   | 10413 | WR             | Regional Reliability | \$4,151,903   | WR                    | Rebuild 2.1-mile 69 kV line from Cowskin to Westlink.                                                                                                                                                                                                                    | 12/1/2015                    | 6/1/2014                 |                        | 533788          | COWSKIN 69 KV                   | 533854        |
| 200291 | 319   | 10414 | WR             | Regional Reliability | \$5,834,124   | WR                    | Rebuild 2.65-mile 69 kV line from Westlink to Tyler. Install terminal equipment at Tyler.                                                                                                                                                                                | 6/1/2015                     | 6/1/2014                 |                        | 533854          | WESTLINK 69 KV                  | 533847        |
| 200212 | 30369 | 10425 | WR             | ITP                  | \$19,020,066  | WR                    | Install second 138/115 kV transformer at Moundridge.                                                                                                                                                                                                                     | 6/1/2015                     | 6/1/2013                 | 24 months              | 533013          | MOUNDRIDGE 138 KV               | 533429        |
| 20003  | 361   | 10471 | WFEC           | ITP                  | \$2,000,000   | WFEC                  | Upgrade 7 miles to 795 ACSR from Fletcher SW to Marlow Junction 69 kV.                                                                                                                                                                                                   | 1/26/2015                    | 6/1/2011                 | 16 months              | 520911          | FLETCHER                        | 520990        |
| 20003  | 399   | 10519 | WFEC           | ITP                  | \$1,347,000   | WFEC                  | Upgrade line from 1/0 to 336.4, 4.85 miles                                                                                                                                                                                                                               | 6/1/2015                     | 6/1/2012                 | 12 months              | 520979          | LINDSAY SW                      | 521087        |
| 20003  | 402   | 10522 | WFEC           | ITP                  | \$1,125,000   | SPP                   | Convert 3 miles of 69 kV to 138 kV from Indiahoma to Grandfield.                                                                                                                                                                                                         | 3/31/2015                    | 6/1/2012                 | 12 months              | 521106          | Grandfield                      | 520954        |
| 20003  | 402   | 10523 | WFEC           | ITP                  | \$7,306,000   | WFEC                  | Tap Cache to Paradise 138 kV and install 13.7 miles of 138 kV from Cache to Indiahoma.                                                                                                                                                                                   | 3/31/2015                    | 6/1/2012                 | 24 months              | 520954          | INDIAHOMA                       | 521105        |
| 20003  | 402   | 10524 | WFEC           | ITP                  | \$5,000,000   | WFEC                  | Install new 138/69 kV transformer at Grandfield                                                                                                                                                                                                                          | 3/31/2015                    | 6/1/2012                 | 24 months              | 521106          | Grandfield                      | 520926        |
|        | 409   | 10533 | TBD            | High Priority        | \$2,496,948   | SPP                   | Upgrade 1st 115/69 kV transformer at Hereford to 84 MVA.                                                                                                                                                                                                                 |                              | 6/1/2018                 | 24 months              | 524606          | Hereford Interchange 115 kV     | 524602        |
|        | 409   | 10534 | TBD            | High Priority        | \$2,496,948   | SPP                   | Upgrade 2nd 115/69 kV transformer at Hereford to 84 MVA.                                                                                                                                                                                                                 |                              | 6/1/2018                 | 24 months              | 524606          | Hereford Interchange 115 kV     | 524603        |
| 200212 | 412   | 10538 | WR             | ITP                  | \$4,104,097   | WR                    | Rebuild 2.65-mile 69 kV line from Eastborough to 64th.                                                                                                                                                                                                                   | 6/1/2015                     | 6/1/2013                 | 18 months              | 533792          | EASTBOROUGH 69 KV               | 533842        |
|        | 445   | 10577 | TBD            | High Priority        | \$3,856,701   | SPP                   | Rebuild 5.5-mile 69 kV line from Big Sandy to Perdue with 1233.6 ACSR/TW conductor to achieve a new line rating of 123/143 MVA.                                                                                                                                          |                              | 6/1/2019                 | 24 months              | 508335          | BIG SANDY                       | 508350        |
| 200216 | 451   | 10583 | AEP            | ITP                  | \$12,705,537  | AEP                   | Rebuild and reconductor 11.1-mile 161 kV line from Chamber Springs to Farmington REC with 2-959.6 ACSR/TW. Upgrade wavetraps, CT ratios, and relay settings at Chamber Springs.                                                                                          | 6/1/2016                     | 6/1/2013                 | 36 months              | 506944          | CHAMBER SPRINGS 161KV           | 504020        |
| 200166 | 461   | 10597 | SPS            | ITP                  | \$36,112,744  | SPS                   | Build 40 miles of 115 kV transmission line between Bailey County and Curry County.                                                                                                                                                                                       | 9/30/2016                    | 6/1/2012                 | 30 months              | 524822          | Curry County Interchange 115 kV | 525028        |
| 200296 | 30390 | 10600 | WR             | ITP                  | \$58,317,000  | WR                    | Rebuild 27-mile 230 kV line from East Manhattan to Jeffrey Energy Center to 345 kV standards but operate as 230 kV using bundled 1590 ACSR conductor. Upgrade terminal equipment at East Manhattan and Jeffrey Energy Center to a minimum emergency rating of 2000 Amps. | 6/1/2017                     | 6/1/2017                 |                        | 532861          | EAST MANHATTAN 230 KV           | 532852        |

|        |     |       |      |                      |              |      |                                                                                                                              |            |          |           |        |                                  |        |
|--------|-----|-------|------|----------------------|--------------|------|------------------------------------------------------------------------------------------------------------------------------|------------|----------|-----------|--------|----------------------------------|--------|
| 200216 | 478 | 10615 | AEP  | ITP                  | \$1,221,505  | AEP  | Rebuild 2.3-mile 69 kV line from Forbing to South Shreveport with 1233.6 ACSR/TW.                                            | 6/1/2015   | 6/1/2013 | 18 months | 507728 | FORBING TAP                      | 507754 |
| 20122  | 479 | 10616 | AEP  | ITP                  | \$14,500,000 | AEP  | Rebuild 12.63 miles of the Georgia Pacific - Keatchie 138 kV line from 795 ACSR to 1272 ACSR                                 | 6/1/2016   | 6/1/2016 | 24 months | 509064 | GEORGIA-PACIFIC                  | 509050 |
| 200214 | 486 | 10629 | SPS  | ITP                  | \$2,917,118  | SPS  | Upgrade Chaves 230/115 kV transformer Ckt 2 to 250 MVA.                                                                      | 2/27/2015  | 6/1/2013 | 24 months | 527483 | Chaves County Interchange 230 kV | 527482 |
| 200216 | 501 | 10646 | AEP  | ITP                  | \$11,980,465 | AEP  | Rebuild 6.4-mile 69 kV line from Evenside to Northwest Henderson with 1233.6 ACSR/TW. Replace breaker at Evenside.           | 6/1/2018   | 6/1/2018 | 24 months | 509061 | EVENSIDE                         | 509075 |
| 200216 | 504 | 10649 | AEP  | ITP                  | \$12,424,849 | AEP  | Rebuild 4.7-mile 69 kV line from Brownlee to North Market with 1233.6 ACSR/TW.                                               | 6/1/2015   | 6/1/2013 | 24 months | 507718 | BROWNLEE                         | 507745 |
| 20000  | 511 | 10656 | AEP  | ITP                  | \$11,000,000 | AEP  | Install new 345/161 kV transformer at Kings River (Previous name Osage Creek)                                                |            | 6/1/2016 | 60 months | 506987 | Kings River 161 kV               | 506988 |
| 200246 | 512 | 10657 | AEP  | ITP                  | \$8,174,689  | AEP  | Rebuild 2.0-mile 69 kV line from Ellerbe Road to Forbing T with 1233.6 ACSR/TW conductor.                                    | 6/1/2018   | 6/1/2014 | 24 months | 507723 | ELLERBE ROAD 69 kV               | 507728 |
| 20000  | 511 | 10659 | AEP  | ITP                  | \$24,500,000 | AEP  | Install 9 miles of 345 kV line from Shipe Road to East Rogers                                                                |            | 6/1/2016 | 60 months | 506979 | Shipe Road 345                   | 506982 |
| 20000  | 511 | 10660 | AEP  | ITP                  | \$65,500,000 | AEP  | Install 32 miles of 345 kV line from East Rogers to Kings River (previous Osage Creek)                                       |            | 6/1/2016 | 60 months | 506982 | East Rogers 345                  | 506987 |
| 20031  | 633 | 10828 | SPS  | ITP                  | \$2,700,000  | SPS  | Build new 3 mile 69 kV line from Artesia Town - Artesia South Rural 69 kV.                                                   | 3/31/2015  | 6/1/2009 | 36 months | 527747 | Artesia Town Sub 69 kV           | 527775 |
| 200216 | 681 | 10898 | AEP  | ITP                  | \$4,923,124  | AEP  | Rebuild 1-mile portion of the 69 kV line from Broadmoor to Fern Street with 1233.6 ACSR/TW. Replace switches at Fern Street. | 6/1/2015   | 6/1/2013 | 24 months | 507716 | BROADMOOR                        | 507724 |
|        | 682 | 10899 | TBD  | High Priority        | \$6,404,500  | SPP  | Reconductor 10.7-mile 69 kV line from Little River to Maud Tap to achieve a new line rating of 52.6/65.7 MVA.                |            | 6/1/2015 | 24 months | 515503 |                                  | 515054 |
| 200188 | 703 | 10935 | TSMO | Balanced Portfolio   | \$7,464,022  | KCPL | Add 345 kV line terminal at Iatan. Add ring bus at Iatan to accommodate line terminals.                                      | 6/1/2015   | 6/1/2015 |           | 542982 | IATAN 345 KV                     | 542980 |
| 20042  | 703 | 10945 | TSMO | Balanced Portfolio   | \$2,654,799  | KCPL | Install new 345/161 kV transformer at Nashua                                                                                 | 6/1/2015   | 6/1/2015 |           | 542980 | PAOLA 345KV                      | 543028 |
| 20130  | 764 | 11007 | SPS  | ITP                  | \$1,518,414  | SPS  | Upgrade Happy County 115/69 kV Transformer #1 to 84/96 MVA                                                                   | 5/31/2015  | 6/1/2012 | 28 months | 525154 | Happy Interchange 115 kV         | 525153 |
| 20130  | 764 | 11009 | SPS  | ITP                  | \$1,565,056  | SPS  | Upgrade Happy County 115/69 kV Transformer #2 to 84/96 MVA                                                                   | 11/30/2015 | 6/1/2012 | 28 months | 525154 | Happy Interchange 115 kV         | 525153 |
| 200256 | 766 | 11010 | SPS  | ITP                  | \$6,886,931  | SPS  | Add second 230/115 kV 250 MVA transformer at Newhart substation.                                                             | 6/1/2015   | 6/1/2015 |           | 525461 | Newhart Interchange 230 kV       | 525460 |
| 200229 | 772 | 11017 | SPS  | ITP                  | \$32,429,240 | SPS  | Build new 16.8-mile 230 kV line from Carlisle to Wolfforth South and install necessary terminal equipment.                   | 6/1/2017   | 6/1/2017 | 36 months | 526525 | Wolfforth Interchange 230 kV     | 526161 |
| 20084  | 774 | 11023 | SPS  | ITP                  | \$4,396,370  | SPS  | Build new 3.7 mile Hastings - East Plant 115kV line.                                                                         | 6/30/2015  | 6/1/2010 | 4 months  | 524136 | Hastings Sub 115 kV              | 524162 |
| 200214 | 802 | 11064 | SPS  | ITP                  | \$4,255,145  | SPS  | Upgrade Eddy County 230/115 kV transformer Ckt 1 to 250 MVA.                                                                 | 6/1/2015   | 6/1/2016 | 24 months | 527800 | Eddy County Interchange 230 kV   | 527798 |
| 200190 | 805 | 11067 | SPS  | Regional Reliability | \$3,100,001  | SPS  | Install second 115/69 kV transformer at Bowers.                                                                              | 3/1/2015   | 6/1/2013 | 24 months | 523748 | Bowers Interchange 115 kV        | 523747 |
| 20086  | 819 | 11082 | WR   | ITP                  | \$6,384,142  | WR   | Rebuild 5.56 mile Gill Energy Center East - MacArthur 60 kV line. Replace substation bus and jumpers at MacArthur 69 kV.     | 6/1/2015   | 6/1/2013 | 18 months | 533795 | GILL ENERGY CENTER EAST 69 KV    | 533813 |
| 20084  | 834 | 11101 | SPS  | ITP                  | \$6,500,000  | SPS  | Convert existing 3 mile Portales Interchange - Zodiac 69 kV line to operate at 115 kV.                                       | 3/30/2015  | 6/1/2013 | 18 months | 524924 | Portales Interchange 115 kV      | 524935 |

|        |     |       |      |                      |               |      |                                                                                                                                                                                                                                                                                                        |            |           |           |        |                                       |        |
|--------|-----|-------|------|----------------------|---------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----------|-----------|--------|---------------------------------------|--------|
| 200166 | 836 | 11104 | SPS  | ITP                  | \$3,000,000   | SPS  | Tap Bailey County Interchange - Plant X 115 kV line and convert Muleshoe East substation to 115 kV operation.                                                                                                                                                                                          | 11/28/2015 | 6/1/2012  | 20 months | 524030 | Muleshoe E 115 kV                     |        |
| 200214 | 839 | 11107 | SPS  | ITP                  | \$15,196,472  | SPS  | Build new 22-mile 115 kV line from Kress Interchange to new Kiser substation.                                                                                                                                                                                                                          | 1/15/2015  | 6/1/2013  | 36 months | 525192 | Kress Interchange 115 kV              | 525271 |
| 200245 | 844 | 11113 | WFEC | ITP                  | \$4,725,000   | WFEC | Reconductor 9.9-mile 69 kV line from Mustang to Sunshine Canyon upgrading conductor from 4/0 to 556.                                                                                                                                                                                                   | 12/31/2015 | 6/1/2014  | 18 months | 521005 | MUSTANG                               | 521058 |
| 20132  | 846 | 11116 | WFEC | ITP                  | \$1,125,000   | WFEC | Rebuild 2-mile Blanchard - OU Switchyard 69 kV line as 138 kV.                                                                                                                                                                                                                                         | 12/1/2015  | 6/1/2012  | 12 months | 520828 | BLANCHARD                             | 521104 |
| 200256 | 856 | 11127 | SPS  | ITP                  | \$9,247,136   | SPS  | Build new 5.1-mile 115 kV line from Centre St. to Hereford NE. Convert distribution transformer high side at Centre St. from 69 kV to 115 kV. Install any necessary terminal equipment at Hereford NE.                                                                                                 | 12/31/2017 | 6/1/2014  |           | 524567 | Northeast Hereford Interchange 115 kV | 524555 |
| 200207 | 865 | 11142 | OPPD | ITP                  | \$475,340     | OPPD | Increase line clearances and upgrade terminal equipment on Sub 917 - Sub 918 69 kV line to allow the use of a higher conductor rating.                                                                                                                                                                 | 6/1/2018   | 6/1/2018  | 18 months | 647917 | Sub 917                               | 647918 |
|        | 876 | 11156 | TBD  | High Priority        | \$631,096     | SPP  | Rebuild 0.9-mile 69 kV line from Thomas Tap to Weatherford with 959.6 ACSR/TW conductor to achieve a new line rating of 68/94 MVA.                                                                                                                                                                     |            | 6/1/2021  | 24 months | 511517 | THOMAS TAP                            | 511481 |
| 200216 | 879 | 11158 | AEP  | ITP                  | \$10,241,314  | AEP  | Rebuild 9.0-mile 138 kV line from Prattville to Bluebell with 1926.9 ACSR/TW.                                                                                                                                                                                                                          | 6/1/2015   | 6/1/2014  | 24 months | 515242 | BLUEBELL 138                          | 509758 |
| 200208 | 909 | 11205 | WFEC | ITP                  | \$1,705,000   | WFEC | Rebuild and convert 4-mile Oklahoma University Switchyard - Cole Substation line to 138 kV and install necessary terminal equipment.                                                                                                                                                                   | 9/25/2015  | 6/1/2013  | 12 months | 521104 | OU SWITCH 4                           | 520861 |
| 20110  | 910 | 11207 | OGE  | Transmission Service | \$225,000     | OGE  | Replace wavetrap                                                                                                                                                                                                                                                                                       | 6/1/2019   | 6/1/2019  | 12 months | 514839 | BRYANT 138                            | 514835 |
| 20096  | 936 | 11236 | AEP  | High Priority        | \$127,995,000 | AEP  | Build a new 76 mile 345 kV line from Valliant to NW Texarkana with at least 3000 A capacity. Upgrade the Valliant and NW Texarkana substations with the necessary breakers and terminal equipment.                                                                                                     | 10/1/2015  | 10/1/2014 | 51 months | 510911 | VALLIANT 345KV                        | 508072 |
| 20097  | 938 | 11238 | TSMO | High Priority        | \$232,784,543 | GMO  | Build a new 105 mile 345 kV line with at least 3000 A capacity from Sibley to a new Mullin Creek (formerly Maryville) substation. Upgrade the Sibley substation with the necessary breakers and terminal equipment.                                                                                    | 6/1/2017   | 6/1/2017  | 72 months | 541201 | Sibley 345 KV                         | 541197 |
| 20097  | 938 | 11239 | TSMO | High Priority        | \$99,442,066  | GMO  | Build a new 345 kV substation at Mullin Creek (formerly Maryville) with a ring bus and necessary terminal equipment. Build a new 65 mile 345 kV line with at least 3000 A capacity from the new Mullin Creek substation to the Missouri/Nebraska state border towards OPPD's Nebraska City substation. | 6/1/2017   | 6/1/2017  | 72 months | 645458 | Sub 3458 (Neb Cty)                    | 541197 |
| 20098  | 939 | 11240 | OPPD | High Priority        | \$75,564,841  | OPPD | Build a new 45-mile 345 kV line with at least 3000 A capacity from the Nebraska City substation to the Missouri/Nebraska state border towards KCPL's Mullin Creek (formerly Maryville) substation. Upgrade the Nebraska City substation with the necessary breakers and terminal equipment.            | 6/1/2017   | 6/1/2017  |           | 645458 | Sub 3458 (Neb Cty)                    | 541197 |
| 20104  | 947 | 11261 | AEP  | Transmission Service | \$6,072,000   | AEPW | Rebuild 4.33 of 795 ACSR with 1590 ACSR.                                                                                                                                                                                                                                                               | 6/1/2015   | 6/1/2015  | 20 months | 509806 | ONETA 138KV                           | 509786 |



|        |      |       |      |                      |              |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |          |           |        |                                   |        |
|--------|------|-------|------|----------------------|--------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------|-----------|--------|-----------------------------------|--------|
| 20130  | 1001 | 11315 | SPS  | ITP                  | \$10,316,217 | SPS  | Construct approximately 2 miles of new 115 kV line from Randall Co. with 795 ACSR. Tie new line into V70 around (not to) Osage Substation. Add new 115 kV terminal at Randall Co. Interchange. (Re-build Randall 115 kV bus to breaker and one-half design.) Re-Conductor V70 with 795 ACSR. Remove line termination at Osage Substation. Upgrade terminal equipment and reset relays at South Georgia Interchange. Remove V04 termination from Osage and remove circuit back to Manhattan Tap (remove 3-terminal condition). Remove circuits V67 & V05 terminations from Osage and tie together around Osage Substation. Leave only V43 & T75 terminated at the Osage Substation. | 6/1/2015   | 6/1/2016 | 24 months | 524364 | Randall County Interchange 115 kV | 524322 |
| 200214 | 1003 | 11317 | SPS  | ITP                  | \$3,659,503  | SPS  | Upgrade Grassland 230/115 kV transformer Ckt 1 to 250 MVA.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 6/1/2015   | 6/1/2013 | 24 months | 526677 | Grassland Interchange 230 kV      | 526676 |
| 200256 | 1004 | 11318 | SPS  | ITP                  | \$3,183,028  | SPS  | Upgrade existing 230/115 kV transformer at Swisher to 250 MVA.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 5/29/2015  | 6/1/2014 | 24 months | 525213 | Swisher County Interchange 230 kV | 525212 |
| 20110  | 1021 | 11343 | OGE  | Transmission Service | \$18,000,000 | OGE  | Add 3rd 345kV line from Arcadia to Redbud                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 6/1/2019   | 6/1/2019 | 36 months | 514908 | ARCADIA 345                       | 514909 |
| 200214 | 1031 | 11355 | SPS  | ITP                  | \$2,378,798  | SPS  | Upgrade Crosby County 115/69 kV transformer Ckt 1 to 84 MVA.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 6/1/2015   | 6/1/2013 | 24 months | 525926 | Crosby County Interchange 115 kV  | 525925 |
| 200214 | 1031 | 11356 | SPS  | ITP                  | \$2,301,000  | SPS  | Upgrade Crosby County 115/69 kV transformer Ckt 2 to 84 MVA.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 6/1/2015   | 6/1/2013 | 24 months | 525926 | Crosby County Interchange 115 kV  | 525925 |
| 200166 | 1033 | 11358 | SPS  | ITP                  | \$6,300,000  | SPS  | Reconductor 4.1 miles of 6.1-mile 115 kV line from Randall County to South Georgia.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 6/1/2015   | 6/1/2017 | 18 months | 524364 | Randall County Interchange 115 kV | 524322 |
| 20130  | 1036 | 11372 | SPS  | ITP                  | \$3,624,336  | SPS  | Convert 1.04 miles of Z33 to 115 kV service by tapping the 115 kV line from Sunset Substation to Coulter Interchange at I-40 & Soncy Street. At Soncy Sub split the converted Z33 line off the 69 kV bus and terminate to a new 115/13.2 kV transformer to serve the Soncy distribution load. Install new 115/13.2 kV distribution transformer. Leave 69 kV underground cable to Lawrence Park to be fed by Y72 out of Coulter Interchange.                                                                                                                                                                                                                                        | 12/31/2015 | 6/1/2015 | 18 months | 524252 | Soncy Tap 115 kV                  | 524254 |
| 20130  | 1042 | 11383 | SPS  | ITP                  | \$300,000    | SPS  | Tap the Kress - Plainview City 115 kV line with North Plainview substation. Convert North Plainview substation to 115 kV.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1/15/2015  | 6/1/2015 |           | 525257 | North Plainview Sub 115 kV        |        |
| 20130  | 1043 | 11384 | SPS  | ITP                  | \$400,000    | SPS  | Tap the Kress - Plainview City 115 kV line with Kress Rural. Convert Kress Rural substation to 115 kV.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1/15/2015  | 6/1/2015 |           | 525225 | Kress Rural Sub 115 kV            |        |
| 200305 | 1083 | 11423 | AEP  | ITP                  | \$24,880,495 | AEP  | Rebuild 23.7-mile 138 kV line from Welsh Reserve to Wilkes with 1926.9 ACSR/TW conductor. Upgrade switches at Welsh Reserve and Wilkes and wave traps, jumpers, CT ratios, and relay settings at Wilkes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 6/1/2019   | 6/1/2019 |           | 508355 | Welsh Reserve 138 kV              | 508840 |
| 200208 | 909  | 11425 | WFEC | ITP                  | \$1,400,000  | WFEC | Convert 10.2-mile Cole - Criner line to 138 kV and convert the Cole substation to 138 kV.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 9/25/2015  | 6/1/2013 | 12 months | 520861 | COLE                              | 520868 |
| 20137  | 1134 | 11496 | OGE  | Transmission Service | \$12,500,000 | OGE  | Install third 345/138 kV transformer in Northwest Sub                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 6/1/2015   | 6/1/2017 | 40 months | 514880 | NORTHWEST 345                     | 514879 |
|        | 1139 | 11501 | TBD  | High Priority        | \$10,946,449 | SPS  | Rebuild 6-mile 115 kV line from Lubbock South Interchange to Allen substation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 6/1/2017   | 6/1/2019 | 24 months | 526268 | Lubbock South Interchange 115 kV  | 526213 |

|        |       |       |      |                      |              |      |                                                                                                                          |            |           |           |        |                                      |        |
|--------|-------|-------|------|----------------------|--------------|------|--------------------------------------------------------------------------------------------------------------------------|------------|-----------|-----------|--------|--------------------------------------|--------|
| 200262 | 1142  | 11506 | SPS  | Regional Reliability | \$12,806,065 | SPS  | Rebuild 13.5-mile 4/0 segment of 115 kV line from Canyon East Sub to Randall County Interchange with 795 ACSR conductor. | 3/31/2018  | 2/1/2014  |           | 524364 | Randall County Interchange 115 kV    | 524523 |
| 200262 | 1144  | 11508 | SPS  | Regional Reliability | \$4,087,144  | SPS  | Add second 230/115 kV 250 MVA transformer at Hitchland.                                                                  | 6/1/2019   | 6/1/2019  | 24 months | 523095 | Hitchland Interchange 230 kV         | 523093 |
|        | 1146  | 11509 | TBD  | High Priority        | \$3,644,914  | SPS  | Increase Carlisle 230/115 kV transformer to 250 MVA.                                                                     |            | 6/1/2023  | 24 months | 526161 | Carlisle Interchange 230 kV          | 526160 |
| 200214 | 1147  | 11512 | SPS  | ITP                  | \$2,045,196  | SPS  | Convert 26 miles of 115 kV line from Channing to Potter to 230 kV and upgrade necessary terminal equipment at Potter.    | 6/1/2015   | 6/1/2013  | 48 months | 523869 | Channing 230 kV                      | 523959 |
| 200214 | 1147  | 11514 | SPS  | ITP                  | \$4,796,000  | SPS  | Convert 35 miles of 115 kV line from Channing to new XIT substation (near Dallam) to 230 kV.                             | 6/1/2015   | 6/1/2013  | 48 months | 523869 | Channing 230 kV                      | 523229 |
| 200214 | 1147  | 11515 | SPS  | ITP                  | \$8,849,320  | SPS  | Install 230/115 kV transformer at XIT substation.                                                                        | 6/1/2015   | 6/1/2013  | 48 months | 523229 | Dallam 230 kV                        | 523228 |
| 20028  | 30071 | 50077 | GRDA | ITP                  | \$374,000    | GRDA | Add 7.2 Mvar capacitor at Sallisaw 69 kV.                                                                                |            | 6/1/2011  | 12 months | 512652 | SALLISAW 69                          |        |
| 20003  | 30079 | 50085 | WFEC | ITP                  | \$324,000    | SPP  | Install 12 Mvar capacitor at Carter Jct which makes at total of 24 Mvar.                                                 | 6/26/2015  | 6/1/2010  | 12 months | 520846 | CARTER JCT                           |        |
| 200242 | 30097 | 50103 | WR   | ITP                  | \$1,184,617  | WR   | Install 10.9-Mvar capacitor bank at 115 kV bus at Vaughn substation.                                                     | 12/1/2015  | 6/1/2014  | 18 months | 533308 | VAUGHN 115 KV                        |        |
| 20017  | 30160 | 50168 | OGE  | Transmission Service | \$14,000,000 | OGE  | Convert Ft. Smith 161KV to 1-1/2 breaker design and install 3rd 500-161KV transformer bank.                              | 6/1/2017   | 6/1/2017  | 36 months | 515305 | FT SMITH 500                         | 515300 |
| 20017  | 30164 | 50172 | OGE  | Transmission Service | \$100,000    | OGE  | Upgrade CT                                                                                                               | 6/1/2017   | 6/1/2017  | 9 months  | 515336 | VBI 69                               | 504032 |
| 20080  | 30201 | 50208 | NPPD | ITP                  | \$700,000    | NPPD | Add a 18 Mvar capacitor bank at Clarks substation 115 kV bus.                                                            |            | 11/1/2012 | 24 months | 640436 | Clarks                               |        |
| 20080  | 30202 | 50209 | NPPD | ITP                  | \$50,000     | NPPD | Expand existing 9 Mvar bank to 15 Mvar capacitor bank at Ainsworth substation 115 kV bus.                                |            | 11/1/2012 | 24 months | 640051 | Ainsworth                            |        |
| 20080  | 30203 | 50210 | NPPD | ITP                  | \$700,000    | NPPD | Add a second 18 Mvar capacitor bank at Oneill 115 kV substation for a total of 36 Mvar at this location.                 |            | 11/1/2012 | 24 months | 640305 | O'Neill                              |        |
| 20059  | 30226 | 50230 | WR   | transmission service | \$2,166,509  | WR   | Add 6 Mvar Cap bank at Altoona East                                                                                      | 12/1/2015  | 6/1/2014  | 18 months | 533673 | ALTOONA EAST 69 KV                   |        |
| 20108  | 30290 | 50328 | WR   | Transmission Service | \$700,000    | WR   | Replace disconnect switches, wavetrap and CT                                                                             | 6/1/2016   | 6/1/2019  |           | 533012 | HALSTEAD SOUTH BUS 138 KV            | 533065 |
| 20122  | 30296 | 50334 | AEP  | ITP                  | \$1,166,400  | AEP  | Install a new 28.8 MVAR capacitor bank at Winnsboro 138 kV substation.                                                   | 6/1/2016   | 6/1/2016  | 18 months | 508317 | Winnsboro 138 kV                     |        |
| 20122  | 30298 | 50336 | AEP  | ITP                  | \$1,166,400  | AEP  | Install 28.8 MVAR capacitor bank at Logansport 138 kV substation.                                                        | 6/1/2016   | 6/1/2016  | 18 months | 509071 | LOGANSPO RT 138KV                    |        |
| 20107  | 30299 | 50337 | MKEC | Transmission Service | \$145,319    | MKEC | Replace CTs and relays at Jewell substation and Smith Center substation                                                  | 6/1/2015   | 6/1/2018  |           | 539669 | Jewell 3 115                         | 539693 |
| 20136  | 30320 | 50366 | WFEC | Transmission Service | \$4,800,000  | WFEC | UPGRADE CANTON TO TALOGA TO 336.4                                                                                        | 10/15/2015 | 6/1/2011  |           | 521064 | TALOGA                               | 520843 |
| 20136  | 30321 | 50367 | WFEC | Transmission Service | \$1,000,000  | WFEC | Replace Taloga 138/69 kV auto transformer with 112 MVA.                                                                  | 6/1/2015   | 6/1/2011  |           | 521065 | TALOGA                               | 521064 |
| 20140  | 30326 | 50372 | WR   | Zonal Reliability    | \$9,308,090  | WR   | Build 6.7-mile Clay Center Switching Station to TC Riley 115 kV line with Single 1192.5 kcmil ACSR (Bunting).            | 6/1/2017   | 10/1/2012 |           | 533320 | Clay Center Switching Station 115 kV | 533319 |
| 20140  | 30328 | 50374 | WR   | Zonal Reliability    | \$963,441    | WR   | Install a 2000 Amp bus system, GOAB switches, metering and communication systems.                                        | 6/1/2017   | 10/1/2012 |           | 533319 | Riley                                |        |
| 200282 | 30331 | 50378 | SPS  | High Priority        | \$1,470,325  | SPS  | Install 14.4-Mvar capacitor bank at Eagle Creek 115 kV bus.                                                              | 10/15/2016 | 6/1/2015  | 12 months | 527711 | Eagle Creek 115 kV                   |        |
| 200166 | 30332 | 50379 | SPS  | ITP                  | \$1,143,670  | SPS  | Install 14.4 Mvar capacitor at Drinkard 115 kV.                                                                          | 6/1/2015   | 6/1/2015  | 12 months | 528589 | Drinkard Sub 115 kV                  |        |

|        |       |       |       |                            |              |       |                                                                                                                                                                                                                                                                                                                                               |            |          |           |        |                            |        |
|--------|-------|-------|-------|----------------------------|--------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------|-----------|--------|----------------------------|--------|
| 200165 | 30340 | 50387 | AEP   | Generation Interconnection | \$150,000    | AEP   | Replace transmission line relays protecting the terminal to a new WFEC 138 kV switching station being built for Windfarm66 LLC.                                                                                                                                                                                                               |            |          |           | 511485 | CLINTON JUNCTION 138KV     |        |
| 200166 | 30356 | 50406 | SPS   | ITP                        | \$5,400,001  | SPS   | Install new 115/69 kV transformer at new Diamondback Interchange near Cedar Lake.                                                                                                                                                                                                                                                             | 6/30/2015  | 6/1/2012 | 24 months | 527212 | Cedar Lake 115 kV          | 527211 |
| 200166 | 30356 | 50407 | SPS   | ITP                        | \$8,000,000  | SPS   | Build 12 miles of new 115 kV line from Sulphur Interchange to Diamondback Interchange near Cedar Lake.                                                                                                                                                                                                                                        | 6/30/2015  | 6/1/2012 | 24 months | 527262 | Sulphur Interchange 115 kV | 527212 |
| 200173 | 30358 | 50409 | MKEC  | ITP                        | \$13,151,512 | MKEC  | Build 21-mile new 115 kV line from Ellsworth to the Midwest Energy's Bushton substation.                                                                                                                                                                                                                                                      | 6/1/2015   | 6/1/2012 | 24 months | 530623 | RICE COUNTY 115 KV         | 539662 |
| 200173 | 30358 | 50410 | MKEC  | ITP                        | \$5,914,221  | MKEC  | Install 3-breaker ring bus at Ellsworth Tap 115 kV.                                                                                                                                                                                                                                                                                           | 6/1/2015   | 6/1/2012 | 12 months | 539642 | Ellsworth Tap              |        |
| 200255 | 30361 | 50413 | AEP   | ITP                        | \$93,361,588 | AEP   | Build new single circuit 345 kV line from new Chisholm substation to point of interconnection with Oklahoma Gas & Electric Co. (OGE) towards Gracemont. The approximate line length for the Chisholm - Gracemont 345 kV line is 100 miles, of which AEP will construct approximately 70 miles from Chisholm to the OGE interconnection point. | 3/1/2018   | 3/1/2018 | 60 months | 700345 | Chisholm 345 kV            | 515800 |
| 200255 | 30361 | 50414 | AEP   | ITP                        | \$20,410,547 | AEP   | Construct new 345/230 kV Chisholm substation between existing 230 kV substations, Sweetwater and Elk City. Cut-in existing Sweetwater - Elk City 230 kV Ckt 1 line into new Chisholm substation and install any necessary 230 kV terminal equipment. Install new 345/230 675 MVA transformer at new Chisholm substation.                      | 3/1/2018   | 3/1/2018 | 60 months | 700345 | Chisholm 345 kV            | 700231 |
| 200240 | 30361 | 50419 | OGE   | ITP                        | \$43,853,500 | OGE   | Build new 30-mile single circuit 345 kV line from the Gracemont substation to the interconnection point with American Electric Power, toward the new Chisholm substation. Install any necessary terminal equipment at Gracemont.                                                                                                              | 3/1/2018   | 3/1/2018 | 60 months | 700345 | Chisholm 345 kV            | 515800 |
| 200223 | 30364 | 50420 | OGE   | ITP                        | \$59,522,400 | OGE   | Build second circuit of new 49-mile 345 kV line from Woodward District EHV to Tatonga.                                                                                                                                                                                                                                                        | 3/1/2021   | 3/1/2021 | 72 months | 515375 | Woodward EHV 345kv         | 515407 |
| 200223 | 30364 | 50421 | OGE   | ITP                        | \$65,785,650 | OGE   | Build second circuit of new 61-mile 345 kV line from Tatonga to new Matthewson substation.                                                                                                                                                                                                                                                    | 3/1/2021   | 3/1/2021 | 72 months | 515407 | Tatonga 345kv              | 515497 |
| 200222 | 30367 | 50425 | ITCGP | ITP                        | \$35,045,917 | ITCGP | Build new 345 kV line from the Elm Creek substation to the Westar Energy, Inc. interception point from the Summit substation.                                                                                                                                                                                                                 | 3/1/2018   | 3/1/2018 | 48 months | 750011 | Elm Creek 345 kV           | 532773 |
| 200222 | 30367 | 50426 | ITCGP | ITP                        | \$6,049,619  | ITCGP | Install new 345/230 kV transformer at Elm Creek.                                                                                                                                                                                                                                                                                              | 12/31/2016 | 3/1/2018 | 48 months | 750011 | Elm Creek 345 kV           | 539639 |
| 200222 | 30367 | 50427 | ITCGP | ITP                        | \$9,226,245  | ITCGP | Install terminal equipment on the 345 kV side of the Elm Creek substation.                                                                                                                                                                                                                                                                    | 12/31/2016 | 3/1/2018 | 48 months | 750011 | Elm Creek 345 kV           |        |
| 200222 | 30367 | 50428 | ITCGP | ITP                        | \$2,110,930  | ITCGP | Install terminal equipment on the 230 kV side of the Elm Creek substation.                                                                                                                                                                                                                                                                    | 12/31/2016 | 3/1/2018 | 48 months | 539639 | Elm Creek Substation       |        |
| 200221 | 30367 | 50429 | WR    | ITP                        | \$66,202,442 | WR    | Build new 345 kV line from the Summit substation to the ITC Great Plains, LLC interception point from the Elm Creek substation.                                                                                                                                                                                                               | 12/31/2016 | 3/1/2018 | 60 months | 750011 | Elm Creek 345 kV           | 532773 |
| 200253 | 30374 | 50440 | NPPD  | ITP                        | \$68,774,278 | NPPD  | Build a new 41-mile 345 kV line from Hoskins to Neligh.                                                                                                                                                                                                                                                                                       | 6/1/2016   | 6/1/2016 | 39 months | 640226 | Hoskins 345 kV             | 750013 |
| 200253 | 30374 | 50441 | NPPD  | ITP                        | \$12,118,564 | NPPD  | Build new substation at Neligh. Install a new 345/115 kV transformer and all necessary 345 kV equipment at Neligh.                                                                                                                                                                                                                            | 6/1/2016   | 6/1/2016 | 39 months | 750013 | Neligh 345 kV              | 640293 |

|        |       |       |      |                      |               |      |                                                                                                                                                                                                                                                                            |           |          |           |        |                           |        |
|--------|-------|-------|------|----------------------|---------------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|----------|-----------|--------|---------------------------|--------|
| 200220 | 30375 | 50442 | NPPD | ITP                  | \$139,090,440 | NPPD | Build new 110-mile 345 kV line from Gerald Gentleman Station substation to new Cherry County substation. This upgrade is contingent upon approval from Western Area Power Administration ("WAPA") to tap the Grand Island - Fort Thompson 345 kV line.                     | 1/1/2018  | 1/1/2018 | 72 months | 640500 | Cherry County 345 kV      | 640183 |
| 200220 | 30375 | 50444 | NPPD | ITP                  | \$11,896,383  | NPPD | Build new Cherry County 345 kV substation and install necessary terminal equipment. This upgrade is contingent upon approval from WAPA to tap the Grand Island - Fort Thompson 345 kV line.                                                                                | 1/1/2018  | 1/1/2018 | 72 months | 640500 | Cherry County 345 kV      |        |
| 200220 | 30375 | 50445 | NPPD | ITP                  | \$146,065,000 | NPPD | Build new 117-mile 345 kV line from new Cherry County substation to new Holt County substation. This upgrade is contingent upon approval from WAPA to tap the Grand Island - Fort Thompson 345 kV line.                                                                    | 1/1/2018  | 1/1/2018 | 72 months | 640500 | Cherry County 345 kV      | 640503 |
| 200220 | 30375 | 50446 | NPPD | ITP                  | \$16,324,800  | NPPD | Build new Holt County 345 kV substation tap on the Grand Island - Fort Thompson 345 kV line owned by WAPA. Install necessary terminal equipment at new substation. This upgrade is contingent upon approval from WAPA to tap the Grand Island - Fort Thompson 345 kV line. | 1/1/2018  | 1/1/2018 | 72 months | 640503 | Holt County 345 kV        |        |
| 200309 | 30376 | 50447 | SPS  | High Priority        | \$129,945,941 | SPS  | Construct new 107-mile 345 kV line from Tuco to Yoakum. Install any necessary 345 kV terminal equipment at Yoakum associated with new 345/230 kV transformer.                                                                                                              | 6/1/2020  | 6/1/2020 | 72 months | 525832 | TUCO Interchange 345 kV   | 526462 |
| 200173 | 30358 | 50449 | MKEC | ITP                  | \$2,669,385   | MKEC | Expand Ellsworth Substation to include two new 115 kV breakers for the new 115 kV line to Rice.                                                                                                                                                                            | 6/1/2015  | 6/1/2012 | 24 months | 539662 | Ellsworth 115 KV          |        |
| 200309 | 30376 | 50451 | SPS  | High Priority        | \$5,047,343   | SPS  | Install new 345/230 kV 644 MVA transformer at Yoakum substation. Install any necessary 230 kV terminal equipment.                                                                                                                                                          | 6/1/2020  | 6/1/2020 | 72 months | 526462 |                           | 526460 |
| 200309 | 30376 | 50452 | SPS  | High Priority        | \$16,204,449  | SPS  | Expand existing Hobbs substation to accommodate 345 kV terminals. Install 345/230 kV 644 MVA transformer at Hobbs.                                                                                                                                                         | 6/1/2018  | 6/1/2018 | 72 months | 527896 | Hobbs Interchange 345 kV  | 527894 |
| 200190 | 805   | 50453 | SPS  | Regional Reliability | \$30,851,077  | SPS  | Build new 38-mile 115 kV line from Bowers Interchange - Howard. At Bowers, install 115 kV breaker positions to serve the new transmission line, converting to a three-breaker ring configuration.                                                                          | 1/14/2016 | 6/1/2013 | 36 months | 523748 | Bowers Interchange 115 kV | 523797 |
| 200223 | 30364 | 50456 | OGE  | ITP                  | \$32,936,400  | OGE  | Build second circuit of new 16-mile 345 kV line from the new Matthewson substation to Cimarron.                                                                                                                                                                            | 3/1/2021  | 3/1/2021 | 72 months | 515497 | MATHEWSON 345             | 514901 |
| 200309 | 30376 | 50457 | SPS  | High Priority        | \$90,628,750  | SPS  | Construct new 52-mile 345 kV line from Hobbs to Yoakum.                                                                                                                                                                                                                    | 6/1/2020  | 6/1/2020 | 72 months | 526462 |                           | 527896 |
| 200223 | 30364 | 50458 | OGE  | ITP                  | \$19,967,850  | OGE  | Build new Matthewson 345 kV substation at the intersection of the Woodring - Cimarron and Northwest - Tatonga 345 kV lines.                                                                                                                                                | 3/1/2021  | 3/1/2021 | 72 months | 515497 | MATHEWSON 345             |        |
|        | 30401 | 50492 | TBD  | ITP                  | \$33,126,800  | SPP  | Build new 28 miles 345 kV Cass Co. - S.W. Omaha (aka S3454) and associated terminal equipment                                                                                                                                                                              |           | 1/1/2033 |           | 645740 | Sub 3740                  | 645454 |
|        | 30402 | 50493 | TBD  | ITP                  | \$12,600,000  | SPP  | Install 2nd 345/161 kV 560 MVA S3459 transformer                                                                                                                                                                                                                           |           | 1/1/2033 |           | 645459 | Sub 3459                  | 646209 |
| 200189 | 703   | 50499 | TSMO | Balanced Portfolio   | \$55,223,248  | GMO  | Build 31 miles of new 345 kV line from Iatan to Nashua.                                                                                                                                                                                                                    | 6/1/2015  | 6/1/2015 |           | 542982 | IATAN 345 KV              | 542980 |
| 200190 | 30410 | 50503 | SPS  | Regional Reliability | \$36,000,000  | SPS  | Rebuild 49-mile 69 kV line between Bowers and Canadian with 795 ACSR conductor.                                                                                                                                                                                            | 1/15/2016 | 6/1/2012 | 36 months | 523747 | Bowers Interchange 69 kV  | 523579 |

|        |       |       |      |                      |              |      |                                                                                                                                                                                                                                     |            |          |           |        |                                                          |        |
|--------|-------|-------|------|----------------------|--------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------|-----------|--------|----------------------------------------------------------|--------|
| 200190 | 30412 | 50505 | SPS  | Regional Reliability | \$911,730    | SPS  | Add two banks of 7.2 Mvar capacitors at the Kingsmill Interchange 115 kV substation.                                                                                                                                                | 1/31/2015  | 6/1/2013 | 36 months | 523712 | Kingsmill Interchange 115 kV                             |        |
| 200262 | 30420 | 50513 | SPS  | Regional Reliability | \$285,176    | SPS  | Upgrade 800 Amp wave trap at both Bushland Interchange and Deaf Smith Interchange.                                                                                                                                                  | 6/1/2016   | 2/1/2014 |           | 524267 | Bushland Interchange 230 kV (POI: Wildorado Wind, 160MW) | 524623 |
| 200193 | 30422 | 50515 | SPS  | Regional Reliability | \$4,236,816  | SPS  | Upgrade Deaf Smith County Interchange 230/115 kV Ckt 1 transformer to 250 MVA.                                                                                                                                                      | 3/1/2015   | 6/1/2012 | 24 months | 524623 | Deaf Smith County Interchange 230 kV                     | 524622 |
| 200214 | 30423 | 50516 | SPS  | ITP                  | \$4,225,233  | SPS  | Upgrade Deaf Smith Interchange 230/115 kV transformer Ckt 2 to 250 MVA.                                                                                                                                                             | 3/1/2015   | 6/1/2013 | 24 months | 524623 | Deaf Smith County Interchange 230 kV                     | 524622 |
| 200214 | 30424 | 50517 | SPS  | ITP                  | \$12,470,000 | SPS  | Rebuild 16.9-mile 115 kV line from Ochiltree to Tri-County REC Cole Ckt 1.                                                                                                                                                          | 12/31/2015 | 6/1/2013 | 24 months | 523154 | Ochilltree Interchange 115 kV                            | 523120 |
| 200214 | 30429 | 50522 | SPS  | ITP                  | \$21,078,890 | SPS  | Rebuild 25.8-mile 115 kV line from Crosby to Floyd Ckt 1.                                                                                                                                                                           | 11/15/2015 | 6/1/2013 | 24 months | 525926 | Crosby County Interchange 115 kV                         | 525780 |
| 200216 | 30436 | 50531 | AEP  | ITP                  | \$1,000,000  | AEP  | Replace 138 kV breaker at Perdue.                                                                                                                                                                                                   | 6/1/2016   | 6/1/2016 | 12 months | 508560 | NEW GLADEWATER                                           | 508351 |
| 200242 | 30437 | 50532 | WR   | ITP                  | \$20,530,196 | WR   | Build new Geary County 345/115 kV substation south of Junction City where JEC - Summit 345 kV and McDowell Creek - Junction City #2 115 kV circuits separate. Install 345/115 kV 440 MVA transformer and 115 kV terminal equipment. | 6/1/2017   | 6/1/2014 | 24 months | 532767 | Geary County 345 kV                                      | 533336 |
| 200241 | 30438 | 50533 | GRDA | ITP                  | \$161,100    | GRDA | Replace 1200 Amp switch with a 2000 Amp switch at Kerr substation 161 kV bus.                                                                                                                                                       | 6/1/2017   | 6/1/2017 | 12 months | 512637 | 412SUB 161                                               | 512635 |
| 200242 | 30437 | 50534 | WR   | ITP                  | \$27,938,225 | WR   | Build new 15.1-mile 115kV line between the new Geary County substation and Chapman Tap. 10.4 miles of the line will be built as a 2nd circuit to the existing Summit - McDowell Creek 345 kV line.                                  | 6/1/2017   | 6/1/2014 | 36 months | 533336 | Geary County 115 kV                                      | 533362 |
| 200241 | 30440 | 50535 | GRDA | ITP                  | \$161,100    | GRDA | Replace 1200 Amp switch with a 2000 Amp switch at Kansas Tap substation 161 kV bus.                                                                                                                                                 | 6/1/2018   | 6/1/2018 | 12 months | 512637 | 412SUB 161                                               | 512714 |
|        | 30444 | 50539 | TBD  | High Priority        | \$1,401,906  | SPS  | Install 28.8 Mvar capacitor bank at Cochran 115 kV bus.                                                                                                                                                                             |            | 6/1/2015 | 12 months | 526361 | Cochran Interchange 115 kV                               |        |
| 200231 | 30449 | 50545 | AEP  | ITP                  | \$25,060,655 | AEP  | Rebuild 27.6-mile 138 kV line from Rock Hill to Springridge Pan-Harr REC with 1926.9 ACSR/TW conductor.                                                                                                                             | 6/1/2016   | 6/1/2014 | 24 months | 509083 | ROCK HILL 138                                            | 507757 |
| 200214 | 30451 | 50546 | SPS  | ITP                  | \$20,808,304 | SPS  | Build new 12-mile 115 kV line from Atoka to Eagle Creek and install necessary terminal equipment.                                                                                                                                   | 12/31/2016 | 6/1/2015 | 36 months | 527786 | Atoka Interchange 115 kV                                 | 527711 |
| 200172 | 30358 | 50549 | MIDW | ITP                  | \$1,459,629  | MIDW | Install terminal equipment at new Bushton 115 kV substation to accommodate the new 115 kV line from Ellsworth.                                                                                                                      | 6/1/2015   | 6/1/2012 | 29 months | 530681 | Bushton 115 kV                                           |        |
| 200214 | 30466 | 50560 | SPS  | ITP                  | \$2,194,976  | SPS  | Upgrade Potash Junction 115/69 kV transformer Ckt 1 to 84 MVA.                                                                                                                                                                      | 5/15/2015  | 6/1/2013 | 24 months | 527962 | Potash Junction Interchange 115 kV                       | 527961 |
| 200229 | 30469 | 50563 | SPS  | ITP                  | \$5,136,476  | SPS  | Build new 5.3-mile 115 kV line from the switching station east of Kilgore substation to South Portales and install necessary terminal equipment.                                                                                    | 6/1/2018   | 6/1/2018 |           | 524935 | Zodiac Sub 115 kV                                        | 524949 |
| 200229 | 30469 | 50564 | SPS  | ITP                  | \$6,498,682  | SPS  | Build new 6-mile 115 kV line from South Portales to Market St. and install necessary terminal equipment.                                                                                                                            | 6/1/2018   | 6/1/2018 | 24 months | 524949 | S Portales 115 kV                                        | 524950 |
| 200229 | 30469 | 50565 | SPS  | ITP                  | \$15,394,429 | SPS  | Build new 10.4-mile 115 kV line from Market St. to Portales and install necessary terminal equipment.                                                                                                                               | 6/1/2018   | 6/1/2018 | 24 months | 524950 | Market ST 115 kV                                         | 524924 |
| 200216 | 30471 | 50567 | AEP  | ITP                  | \$16,548,317 | AEP  | Rebuild 13.2-mile 69 kV line from Dekalb to New Boston with 1233.6 ACSR/TW. Upgrade CT ratios and relay settings at New Boston.                                                                                                     | 6/1/2015   | 6/1/2013 | 24 months | 508067 | NEW BOSTON                                               | 508289 |
| 200216 | 30472 | 50568 | AEP  | ITP                  | \$7,519,658  | AEP  | Rebuild 1.6-mile 69 kV line from Hardy Street to Waterworks with 1233.6 ACSR/TW.                                                                                                                                                    | 6/1/2015   | 6/1/2013 | 18 months | 507734 | HARDY STREET                                             | 507766 |

|        |       |       |      |                      |              |      |                                                                                                                                                                                                                                                       |            |          |           |        |                                 |        |
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| 200216 | 30473 | 50569 | AEP  | ITP                  | \$1,829,026  | AEP  | Rebuild 4.0-mile 69 kV line from Midland REC to North Huntington with 1233.6 ACSR/TW. Upgrade CT ratios, relay settings, and jumpers at North Huntington.                                                                                             | 6/1/2015   | 6/1/2013 | 24 months | 507196 | MIDLAND REC                     | 507188 |
| 200216 | 30474 | 50570 | AEP  | ITP                  | \$5,653,353  | AEP  | Rebuild 1.3-mile 69 kV line from Midland to Midland REC with 1233.6 ACSR/TW. Upgrade CT ratios, relay settings, switches, and station conductors at Midland.                                                                                          | 6/1/2015   | 6/1/2013 | 18 months | 507187 | MIDLAND                         | 507196 |
| 200216 | 30475 | 50571 | AEP  | ITP                  | \$9,145,130  | AEP  | Rebuild 7.0-mile portion of the 69 kV line from Howe Interchange to Midland with 1233.6 ACSR/TW. The portion of line to be rebuilt is from the state line to Midland. Upgrade CT ratios, relay settings, switches, and station conductors at Midland. | 6/1/2015   | 6/1/2013 | 24 months | 515259 | HOWE INT 69                     | 507187 |
| 200202 | 30476 | 50572 | GRDA | ITP                  | \$355,000    | GRDA | Increase line clearance for Chelsea - Childers 69 kV Ckt 1.                                                                                                                                                                                           | 6/1/2015   | 6/1/2015 | 24 months | 512725 | CHELSEA 69                      | 512723 |
| 200207 | 30478 | 50574 | OPPD | ITP                  | \$260,590    | OPPD | Rebuild 0.7-mile 69 kV line from 915 Tap South to Sub 915 T2.                                                                                                                                                                                         | 6/1/2015   | 6/1/2015 | 12 months | 647016 | 915 Tap in Ckt 623              | 647915 |
| 200194 | 30481 | 50577 | OGE  | Transmission Service | \$10,000     | OGE  | Replace 400 amp CT in El Reno sub with 800 amp.                                                                                                                                                                                                       | 6/1/2017   | 6/1/2017 | 14 months | 514818 | EL RENO 69                      | 514817 |
| 200208 | 909   | 50579 | WFEC | ITP                  | \$3,000,000  | WFEC | Convert 6.3 miles of 69 kV line to 138 kV from Criner to new Payne Switching Station.                                                                                                                                                                 | 9/25/2015  | 6/1/2013 | 24 months | 520868 | CRINER                          | 520888 |
| 200208 | 909   | 50580 | WFEC | ITP                  | \$250,000    | WFEC | Tap the Paoli - Cornville Tap 138 kV line and install switching station at Payne with any necessary terminal equipment. The new switching station will terminate the Payne - Criner - Cole - Oklahoma University 138 kV line.                         | 9/25/2015  | 6/1/2013 | 24 months | 520888 | Payne Switching Station 138 kV  |        |
| 200212 | 30483 | 50581 | WR   | ITP                  | \$7,122,480  | WR   | Install a third 138/69 kV transformer at Gill Energy Center.                                                                                                                                                                                          | 12/1/2015  | 6/1/2015 | 18 months | 533046 | GILL ENERGY CENTER SOUTH 138 KV | 533795 |
| 200228 | 30484 | 50582 | WR   | ITP                  | \$14,331,670 | WR   | Install new 345/138 kV transformer at Viola substation.                                                                                                                                                                                               | 6/1/2018   | 6/1/2018 | 36 months | 532798 | Viola 7                         | 533075 |
| 200228 | 30484 | 50583 | WR   | ITP                  | \$35,992,903 | WR   | Build new 21.8-mile 138 kV line from new Viola substation to Clearwater 138 kV substation.                                                                                                                                                            | 6/1/2018   | 6/1/2018 | 36 months | 533075 | Viola 138kV                     | 533036 |
| 200228 | 30484 | 50584 | WR   | ITP                  | \$22,234,744 | WR   | Build new 27.9-mile 138 kV line from new Viola substation to Gill 138 kV substation.                                                                                                                                                                  | 6/1/2017   | 6/1/2018 | 36 months | 533075 | Viola 138kV                     | 533045 |
| 200194 | 1134  | 50585 | OGE  | Transmission Service | \$2,260,299  | OGE  | Accelerate installation of third 345/138 kV bus tie in Northwest Sub (UID 11496).                                                                                                                                                                     | 6/1/2015   | 6/1/2012 | 36 months | 514880 | NORTHWEST 345                   | 514879 |
| 200212 | 30487 | 50593 | WR   | ITP                  | \$767,165    | WR   | Install 9.6 Mvar capacitor bank at Potwin 69 kV bus.                                                                                                                                                                                                  | 6/1/2017   | 6/1/2013 |           | 533601 | POTWIN 69 KV                    |        |
| 200200 | 30489 | 50598 | WFEC | Regional Reliability | \$237,000    | WFEC | Install two 4.8 Mvar capacitors at White Horse 69 kV for total of 9.6 Mvar.                                                                                                                                                                           | 2/27/2015  | 1/1/2013 |           | 520394 | Whitehorse 69kV                 |        |
| 200200 | 30491 | 50600 | WFEC | Regional Reliability | \$237,000    | WFEC | Install two 4.8 Mvar capacitors at Hazelton 69 kV for total of 9.6 Mvar.                                                                                                                                                                              | 2/1/2015   | 1/1/2013 |           | 520937 | HAZELTON                        |        |
| 200242 | 30437 | 50605 | WR   | ITP                  | \$16,190,561 | WR   | Install 345 kV ring bus at the new Geary County substation.                                                                                                                                                                                           | 6/1/2017   | 6/1/2014 | 24 months | 532767 | Geary County 345 kV             |        |
| 200210 | 30494 | 50606 | MIDW | ITP                  | \$8,832,219  | MIDW | Rebuild 3.25-mile 115 kV line from Hays Plant to South Hays.                                                                                                                                                                                          | 6/1/2016   | 6/1/2013 | 30 months | 530562 | HAYS PLANT 115 KV               | 530553 |
| 200231 | 30495 | 50607 | AEP  | ITP                  | \$30,369,537 | AEP  | Build Messick 500/230 kV substation. Connect to Carrol, Clarence, and Western Kraft 230 kV lines. Install 500/230 kV 675 MVA transformer. This upgrade is contingent upon approval from Cleco Power LLC.                                              | 12/31/2015 | 6/1/2013 | 30 months | 999113 | Messick 500 kV                  | 999114 |



|        |       |       |      |                      |              |      |                                                                                                                                                                                                                                                  |            |          |           |        |                                      |        |
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| 200253 | 30496 | 50608 | NPPD | ITP                  | \$6,616,429  | NPPD | Install new 345/115 kV 400 MVA transformer at Stegall substation and necessary terminal equipment at the 115 kV bus. This upgrade is contingent upon approval from Basin Electric to connect to the Stegall 345 kV substation that they operate. | 6/1/2017   | 6/1/2014 | 48 months | 659135 | STEGALL 345 kV                       | 640530 |
| 200253 | 30496 | 50609 | NPPD | ITP                  | \$26,894,676 | NPPD | Install new 22-mile 115 kV line from Stegall to Scottsbluff and install any necessary terminal equipment. This upgrade is contingent upon Basin Electric's approval noted in Upgrade ID 50608.                                                   | 6/1/2017   | 6/1/2014 | 48 months | 640530 | Stegall 115 kV                       | 640338 |
| 200228 | 30484 | 50612 | WR   | ITP                  | \$5,007,657  | WR   | Install 345 kV breakers at Viola substation.                                                                                                                                                                                                     | 6/1/2017   | 6/1/2018 | 36 months | 532798 | Viola 7                              |        |
| 200231 | 30495 | 50615 | AEP  | ITP                  | \$21,508,234 | AEP  | Install terminal equipment on 500 kV side of new Messick substation. Connect to Mt. Olive - Hartburg 500 kV line. This upgrade is contingent upon approval from Cleco Power LLC for Upgrade ID 50607.                                            | 12/31/2015 | 6/1/2013 | 30 months | 999113 | Messick 500 kV                       |        |
| 200253 | 30496 | 50616 | NPPD | ITP                  | \$5,975,996  | NPPD | Install any necessary terminal equipment at the 345 kV bus in Stegall substation. This upgrade is contingent upon Basin Electric's approval noted in Upgrade ID 50608.                                                                           | 6/1/2017   | 6/1/2014 | 48 months | 659135 | STEGALL 345 kV                       |        |
| 200253 | 30374 | 50621 | NPPD | ITP                  | \$17,804,878 | NPPD | Install necessary terminal equipment at the 115 kV bus in the new Neligh substation. Construct approximately 18 miles of new 115 kV transmission to tie Neligh East 345/115 kV into the existing 115 kV transmission system                      | 6/1/2016   | 6/1/2016 | 39 months | 640293 | Neligh 115 kV                        |        |
| 200226 | 30501 | 50622 | OGE  | Regional Reliability | \$3,195,056  | OGE  | Build new 4-mile 138 kV line from Renfrow to Medford Tap.                                                                                                                                                                                        | 3/1/2015   | 5/1/2013 | 22 months | 515569 | Medford Tap 138kV                    | 515544 |
| 200234 | 30501 | 50624 | WFEC | Regional Reliability | \$3,540,000  | WFEC | Build new 12-mile 138 kV line from new Pond Creek substation to Oklahoma Gas and Electric Co. interception point going towards Medford Tap.                                                                                                      | 2/27/2015  | 5/1/2013 |           | 515569 | Medford Tap 138kV                    |        |
| 200226 | 30501 | 50625 | OGE  | Regional Reliability | \$13,765,950 | OGE  | Build new 22-mile 138 kV line from Medford Tap to new Doolin substation.                                                                                                                                                                         | 12/1/2015  | 6/1/2015 | 22 months | 515569 | Medford Tap 138kV                    | 515570 |
| 200234 | 30502 | 50626 | WFEC | Regional Reliability | \$185,004    | WFEC | Install new 138 kV 4.8-Mvar capacitor at Renfrow-Sandridge substation.                                                                                                                                                                           | 6/1/2017   | 6/1/2017 |           | 520409 | Sandridge Tap 138kV                  |        |
| 200226 | 30501 | 50627 | OGE  | Regional Reliability | \$8,164,117  | OGE  | Build new 5-mile 138 kV line from Chikaskia to new Doolin substation.                                                                                                                                                                            | 12/1/2015  | 5/1/2013 | 22 months | 514757 | CHIKASKIA 138                        | 515570 |
| 200234 | 30503 | 50628 | WFEC | Regional Reliability | \$185,004    | WFEC | Install new 69 kV 4.8-Mvar capacitor at Hazelton substation.                                                                                                                                                                                     | 6/1/2017   | 6/1/2017 |           | 520937 | HAZELTON                             |        |
| 200226 | 30501 | 50629 | OGE  | Regional Reliability | \$3,041,661  | OGE  | Build new 138 kV Doolin switching station.                                                                                                                                                                                                       | 3/1/2015   | 5/1/2013 | 22 months | 515570 | Doolin 138kV                         |        |
| 200264 | 30508 | 50635 | OGE  | Regional Reliability | \$1,720,000  | OGE  | Rebuild 3.58-mile 138 kV line from Division Ave to Lakeside.                                                                                                                                                                                     | 6/1/2019   | 6/1/2019 | 24 months | 514853 | DIVISION AVE 138                     | 514849 |
| 200262 | 30509 | 50636 | SPS  | Regional Reliability | \$2,694,811  | SPS  | Rebuild 3.73-mile 115 kV line from Canyon East Sub to Canyon West Sub with 795 ACSR conductor.                                                                                                                                                   | 5/1/2017   | 2/1/2014 |           | 524523 | Canyon East Sub 115 kV               | 524516 |
| 200262 | 30510 | 50637 | SPS  | Transmission Service | \$15,473,119 | SPS  | Construct new 7.7-mile 115 kV line from Mustang to Shell CO2.                                                                                                                                                                                    | 6/1/2017   | 6/1/2015 |           | 527146 | Mustang Interchange North Bus 115 kV | 527062 |
| 200265 | 30523 | 50654 | MKEC | Regional Reliability | \$12,869,230 | MKEC | Construct new 115 kV substation adjacent to Cudahy. Tear down 23.2-mile 115 kV line from Cudahy to Kismet and rebuild with new 32-mile 115 kV line from Kismet to the new substation. Increase terminal limits as necessary at Kismet.           |            | 6/1/2014 |           | 539659 | Cudahy 115 KV                        | 539646 |



|        |       |       |      |                      |              |      |                                                                                                                                                                                                                                                                                                                                                                                      |           |          |           |        |                                      |        |
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| 200265 | 30524 | 50655 | MKEC | Regional Reliability | \$5,747,750  | MKEC | Tear down 3.4-mile 115 kV line from Cimarron River Tap to Kismet and rebuild with new 6-mile 115 kV line from Cimarron River Station to Kismet. Install any necessary terminal equipment at Cimarron River Station. Increase terminal limits as necessary at Kismet.                                                                                                                 |           | 6/1/2014 |           | 539652 | Cimarron River Tap 115 KV            | 539646 |
|        | 30526 | 50657 | TBD  | ITP                  | \$4,744,431  | SPP  | Rebuild 10-mile 69 kV line from Hobart to Roosevelt Tap to achieve a new emergency rating of 143 MVA. Upgrade jumpers, switches, CT ratios, and relay settings at Hobart.                                                                                                                                                                                                            |           | 6/1/2015 | 30 months | 511465 | HOBART                               | 511444 |
|        | 30526 | 50658 | TBD  | ITP                  | \$9,218,626  | SPP  | Rebuild 18.7-mile 69 kV line from Roosevelt Tap to Snyder 69 kV to achieve a new emergency rating of 158 MVA. Upgrade jumpers, switches, CT ratios, and relay settings at Snyder.                                                                                                                                                                                                    |           | 6/1/2015 | 30 months | 511444 | ROOSEVELT TAP                        | 511475 |
| 200256 | 30552 | 50690 | SPS  | ITP                  | \$971,535    | SPS  | Rebuild 0.5-mile 115 kV line from Oxy Permian Sub to West Bender Sub.                                                                                                                                                                                                                                                                                                                | 6/1/2018  | 6/1/2018 |           | 528575 | OXY Permian Sub 115 kV               | 528449 |
| 200242 | 30553 | 50691 | WR   | ITP                  | \$221,294    | WR   | Change CT setting from 600/5 to 1200/5 and upgrade relays at both Butler and Weaver to achieve a new emergency rating of 160 MVA on Butler - Weaver 138 kV Ckt 1.                                                                                                                                                                                                                    | 6/1/2015  | 6/1/2015 |           | 532991 | WEAVER 138 KV                        | 532989 |
| 200256 | 30555 | 50693 | SPS  | ITP                  | \$8,023,016  | SPS  | Install 4-breaker ring bus at Quahada to connect the 115 kV lines from Cunningham to PCA Interchange and Lea National to Maljamar.                                                                                                                                                                                                                                                   | 7/15/2015 | 6/1/2015 |           | 528394 | Quahada 115 kV                       |        |
| 200242 | 30558 | 50696 | WR   | ITP                  | \$7,790,221  | WR   | Replace the existing Neosho #2 A, B, and C transformers with a single transformer with a minimum emergency rating of 165 MVA. Then, re-terminate the Neosho 138/69 kV #1 transformer from 533020-532793-532824 to 533021-532793-532824. This will move the 138 kV connection of this transformer from the Neosho South 138 kV bus (533020) to the Neosho 138 kV center bus (533021). | 6/1/2016  | 6/1/2014 |           | 533021 | NEOSHO 138 KV                        | 533768 |
| 200246 | 30559 | 50697 | AEP  | ITP                  | \$6,651,694  | AEP  | Rebuild 4.4-mile 138 kV line from Chapel Hill REC to Welsh Reserve.                                                                                                                                                                                                                                                                                                                  | 6/1/2019  | 6/1/2019 |           | 508337 | CHAPEL HILL REC                      | 508355 |
| 200296 | 30560 | 50698 | WR   | ITP                  | \$51,513,963 | WR   | Build new 28-mile 138 kV line from Viola to Sumner County.                                                                                                                                                                                                                                                                                                                           | 6/1/2019  | 6/1/2019 |           | 532984 | SUMNER COUNTY 138 kV                 | 533075 |
| 200258 | 30561 | 50699 | OPPD | ITP                  | \$4,426,730  | OPPD | Install new 161/69 kV auto transformer including any necessary 69 kV terminal equipment.                                                                                                                                                                                                                                                                                             | 6/1/2016  | 6/1/2016 | 18 months | 646366 | SUB 1366 161kV                       | 647866 |
| 200245 | 30562 | 50700 | WFEC | ITP                  | \$3,675,000  | WFEC | Reconductor 9-mile 138 kV line from Red Hills to Elk City.                                                                                                                                                                                                                                                                                                                           | 6/1/2015  | 6/1/2015 | 24 months | 521116 | RED HILLS WIND FARM BUS 138 kV       | 511458 |
| 200245 | 30563 | 50702 | WFEC | ITP                  | \$504,000    | WFEC | Add 20 Mvar of capacitance at Sandy Corner 138 kV.                                                                                                                                                                                                                                                                                                                                   | 5/1/2017  | 6/1/2017 | 18 months | 520204 | Sandy Corner 138 kV                  |        |
| 200248 | 30565 | 50703 | SEPC | ITP                  | \$4,812,363  | SEPC | Install 24-Mvar capacitor bank at 115 kV bus at Mingo substation.                                                                                                                                                                                                                                                                                                                    | 5/31/2016 | 6/1/2014 | 24 months | 531429 | Mingo 115 kV                         |        |
| 200242 | 30568 | 50706 | WR   | ITP                  | \$1,390,166  | WR   | Install 10.8-Mvar capacitor bank at Clay Center Switching Station (Bus No. 533320).                                                                                                                                                                                                                                                                                                  | 6/1/2017  | 6/1/2016 |           | 533320 | Clay Center Switching Station 115 kV |        |
| 200309 | 30569 | 50708 | SPS  | High Priority        | \$43,096,827 | SPS  | Construct new 40-mile 345 kV line operated at 230 kV from Potash Junction to Road Runner.                                                                                                                                                                                                                                                                                            | 12/1/2015 | 6/1/2015 |           | 527965 |                                      | 528027 |

|        |       |       |     |               |              |     |                                                                                                                                                                                                                                                                                                                        |            |          |  |        |                                  |        |
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| 200309 | 30569 | 50709 | SPS | High Priority | \$10,576,672 | SPS | Construct new 230 kV Road Runner substation, tapping the existing 115 kV line from Red Bluff to Agave Hills. Construct substation to accommodate future 345 kV line terminal from Potash Junction. Install new 230/115 kV 288 MVA transformer at new Road Runner substation. Install any necessary terminal equipment. | 12/1/2015  | 6/1/2015 |  | 528027 | Road Runner 345 kV               | 528025 |
| 200246 | 30573 | 50718 | AEP | ITP           | \$6,695,986  | AEP | Rebuild 1.7-mile 69 kV line from Fort Humbug to Broadmoor with 1233.6 ACSR/TW conductor. Upgrade jumpers at Fort Humbug along with jumpers and bus at Broadmoor.                                                                                                                                                       | 6/1/2019   | 6/1/2019 |  | 507716 | BROADMOOR                        | 507730 |
| 200246 | 30574 | 50719 | AEP | ITP           | \$2,819,806  | AEP | Rebuild 1.3-mile 69 kV line from Daingerfield to Jenkins REC T with 959.6 ACSR/TW conductor.                                                                                                                                                                                                                           | 6/1/2019   | 6/1/2019 |  | 508288 | DAINGERFIELD                     | 508293 |
| 200246 | 30575 | 50720 | AEP | ITP           | \$8,851,677  | AEP | Rebuild 6.6-mile 69 kV line from Longview Heights to Hallsville with 1233.6 ACSR/TW conductor. Upgrade jumpers, CT ratios, and relay settings at Longview Heights.                                                                                                                                                     | 6/1/2017   | 6/1/2014 |  | 508543 | HALLSVILLE                       | 508553 |
| 200246 | 30576 | 50721 | AEP | ITP           | \$15,248,925 | AEP | Rebuild 11.2-mile 69 kV line from Hallsville to Marshall with 1233.6 ACSR/TW conductor. Upgrade jumpers, CT ratios, and relay settings at Marshall.                                                                                                                                                                    | 6/1/2017   | 6/1/2014 |  | 508556 | MARSHALL 69KV                    | 508543 |
| 200256 | 30577 | 50722 | SPS | ITP           | \$5,961,279  | SPS | Rebuild 5-mile 69 kV line from Chaves to Price converting to 115 kV. Install any necessary terminal equipment at Chaves.                                                                                                                                                                                               | 12/30/2017 | 6/1/2017 |  | 527482 | Chaves County Interchange 115 kV | 527543 |
| 200256 | 30577 | 50723 | SPS | ITP           | \$3,793,668  | SPS | Rebuild 3-mile 69 kV line from CV Pines to Price converting to 115 kV.                                                                                                                                                                                                                                                 | 12/30/2017 | 6/1/2017 |  | 527543 | PRICE 3 115 kV                   | 527542 |
| 200256 | 30577 | 50724 | SPS | ITP           | \$3,793,053  | SPS | Rebuild 5-mile 69 kV line from Capitan to CV Pines converting to 115 kV.                                                                                                                                                                                                                                               | 12/30/2017 | 6/1/2017 |  | 527542 | CV-PINES 3 115 kV                | 527541 |
| 200257 | 30578 | 50725 | SPS | ITP           | \$8,208,578  | SPS | Build new 9.4-mile 115 kV line from Bailey Co. to Bailey Co. Pump. Install any necessary terminal equipment at Bailey Co.                                                                                                                                                                                              | 9/1/2018   | 6/1/2016 |  | 525028 | Bailey County Interchange 115 kV | 525040 |
| 200242 | 30579 | 50726 | WR  | ITP           | \$7,405,817  | WR  | Rebuild 9.06-mile 69 kV line from Wellington to Sumner County No. 4 Rome with single 1192 ACSR conductor to achieve 1200 Amp minimum ampacity.                                                                                                                                                                         | 6/1/2016   | 6/1/2014 |  | 533553 | SUMNER COUNTY NO. 4 ROME 69 KV   | 533560 |
| 200242 | 30579 | 50727 | WR  | ITP           | \$8,131,536  | WR  | Rebuild 9.43-mile 69 kV line from Creswell to Sumner County No. 4 Rome with single 1192 ACSR conductor to achieve 1200 Amp.                                                                                                                                                                                            | 12/1/2015  | 6/1/2014 |  | 533543 | CRESWELL 69 KV                   | 533553 |
| 200257 | 30578 | 50729 | SPS | ITP           | \$8,038,605  | SPS | Build new 11.7-mile 115 kV line from Bailey Co. Pump to Sundan Rural and convert high side voltage of the distribution transformers at Bailey Co. Pump and Sundan Rural from 69 kV to 115 kV.                                                                                                                          | 9/1/2018   | 6/1/2016 |  | 525040 | Bailey Pump 115 KV               | 525594 |
| 200242 | 30580 | 50730 | WR  | ITP           | \$8,968,153  | WR  | Rebuild 5.64-mile 69 kV line from Crestview to Northeast.                                                                                                                                                                                                                                                              | 12/15/2015 | 6/1/2014 |  | 533822 | NORTHEAST 69 KV                  | 533789 |
| 200257 | 30578 | 50731 | SPS | ITP           | \$5,367,770  | SPS | Install new 115/69 kV 84 MVA transformer at New Amherst. Install any necessary 69 kV terminal equipment.                                                                                                                                                                                                               | 9/1/2018   | 6/1/2016 |  | 525600 | Lamb County Sandhill 115 kV      | 525599 |
| 200257 | 30578 | 50732 | SPS | ITP           | \$5,074,202  | SPS | Build new 8.6-mile 115 kV line from New Amherst to Sudan Rural.                                                                                                                                                                                                                                                        | 9/1/2018   | 6/1/2016 |  | 525594 | Sundan Rural 115 kV              | 525600 |
| 200242 | 30580 | 50733 | WR  | ITP           | \$5,590,592  | WR  | Rebuild 1.74-mile 69 kV line from Kenmar to Northeast with single 1192 ACSR to achieve 1200 Amp minimum ampacity.                                                                                                                                                                                                      | 6/1/2016   | 6/1/2014 |  | 533822 | NORTHEAST 69 KV                  | 533811 |

|        |       |       |      |     |              |      |                                                                                                                                                                                                                                                                                                                               |            |          |           |        |                             |        |
|--------|-------|-------|------|-----|--------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------|-----------|--------|-----------------------------|--------|
| 200257 | 30578 | 50734 | SPS  | ITP | \$3,028,707  | SPS  | Install 115 kV terminal equipment at New Amherst to accommodate new 115/69 kV transformer.                                                                                                                                                                                                                                    | 9/1/2018   | 6/1/2016 |           | 525600 | Lamb County Sandhill 115 kV | 525608 |
| 200257 | 30578 | 50735 | SPS  | ITP | \$16,737,611 | SPS  | Build new 13.9-mile 115 kV line from Lamb Co. to New Amherst. Convert high side voltage of the West Littlefield distribution transformer from 69 kV to 115 kV.                                                                                                                                                                | 9/1/2018   | 6/1/2016 |           | 525608 | Amherst 115 kV              | 525615 |
| 200257 | 30578 | 50736 | SPS  | ITP | \$3,187,532  | SPS  | Build new 8.6-mile 115 kV line from West Littlefield to West Littlefield Tap. Install necessary terminal equipment at West Littlefield.                                                                                                                                                                                       | 9/1/2018   | 6/1/2016 |           | 525615 | West Littlefield 115 kV     | 525636 |
| 200247 | 30582 | 50738 | OGE  | ITP | \$740,254    | OGE  | Install a 9-Mvar capacitor bank at 69 kV at Wildhorse substation.                                                                                                                                                                                                                                                             | 6/1/2017   | 6/1/2017 | 18 months | 515127 | WILDHORSE 69                |        |
| 200242 | 30584 | 50739 | WR   | ITP | \$10,537,806 | WR   | Rebuild 9.7-mile 69 kV line from Elk Junction to Montgomery to achieve new emergency rating of 72 MVA.                                                                                                                                                                                                                        | 6/1/2018   | 6/1/2018 |           | 533698 | MONTGOMERY 69 KV            | 533690 |
| 200242 | 30584 | 50740 | WR   | ITP | \$32,548,502 | WR   | Rebuild 18.8-mile 69 kV line from Elk Junction to Sedan to achieve new emergency rating of 72 MVA.                                                                                                                                                                                                                            | 6/1/2018   | 6/1/2018 |           | 533690 | ELK JUNCTION 69 KV          | 533544 |
| 200295 | 30588 | 50745 | OPPD | ITP | \$2,416,277  | OPPD | Install new 161/69 kV transformer at Fremont to accommodate a new 161 kV interconnection.                                                                                                                                                                                                                                     | 6/1/2019   | 6/1/2019 | 60 months | 646301 | S1301 161kV                 | 647801 |
| 200295 | 30588 | 50746 | OPPD | ITP | \$3,606,519  | OPPD | Build new 3-mile 69 kV line from Fremont to new substation S6801.                                                                                                                                                                                                                                                             | 6/1/2019   | 6/1/2019 | 60 months | 647422 | Fremont Sub B               | 647801 |
| 200295 | 30588 | 50747 | OPPD | ITP | \$29,069,150 | OPPD | Build new 17-mile 161 kV line from S1226 to new substation S1301.                                                                                                                                                                                                                                                             | 6/1/2019   | 6/1/2019 | 60 months | 646226 | Sub 1226                    | 646301 |
| 200258 | 30590 | 50748 | OPPD | ITP | \$1,360,327  | OPPD | Rebuild 1.34-mile 69 kV line from S906 to S924 to achieve a new emergency rating of 143 MVA.                                                                                                                                                                                                                                  | 6/1/2019   | 6/1/2019 | 24 months | 647906 | Sub 906 South Bus           | 647924 |
| 200258 | 30590 | 50749 | OPPD | ITP | \$69,679     | OPPD | Install terminal upgrades at S924 to increase emergency rating of S924 - S912 69 kV Ckt 1 to 99 MVA.                                                                                                                                                                                                                          | 6/1/2019   | 6/1/2019 | 24 months | 647912 | Sub 912                     | 647924 |
| 200248 | 30589 | 50750 | SEPC | ITP | \$2,791,167  | SEPC | Install a second 12-Mvar capacitor bank at 115 kV bus at Ruleton substation.                                                                                                                                                                                                                                                  | 5/31/2016  | 6/1/2016 | 18 months | 531357 | RULETON                     |        |
| 200256 | 856   | 50754 | SPS  | ITP | \$435,146    | SPS  | Convert distribution transformer high side at Hereford from 69 kV to 115 kV.                                                                                                                                                                                                                                                  | 12/31/2016 | 6/1/2014 |           | 524606 | Hereford Interchange 115 kV |        |
| 200294 | 30596 | 50757 | NPPD | ITP | \$34,182,113 | NPPD | Build a new 35-mile 115 kV line from Ord to Broken Bow Wind and install necessary terminal equipment.                                                                                                                                                                                                                         | 6/1/2018   | 6/1/2014 | 48 months | 640445 | Broken Bow Wind             | 640308 |
| 200270 | 30597 | 50758 | OGE  | ITP | \$4,009,000  | OGE  | Build new Lane 138 kV substation adjacent to existing Knobhill substation. Install a new 138 kV terminal at Knobhill. Tie the Knobhill and Lane substations together with one span of 138 kV line. Build new 1.5-mile 138 line from Lane to Noel. Install fiber optics on 138 kV circuit connecting Knobhill to Lane to Noel. | 6/1/2019   | 6/1/2019 | 24 months | 514795 | KNOBHILL 138                | 514794 |
| 200246 | 30598 | 50759 | AEP  | ITP | \$2,358,802  | AEP  | Build new 0.3-mile 69 kV line from Letourneau to a tap point along the existing Air Liquide Tap line with 664.8 ACSR/TW conductor. Make the existing line section from Letourneau Plant to Letourneau open normally.                                                                                                          | 6/1/2017   | 6/1/2017 |           | 508536 | LETOURNEAU STEEL            | 508594 |
| 200294 | 30596 | 50760 | NPPD | ITP | \$411,258    | NPPD | Increase line clearance on 115 kV line from North Loup to Ord to 100 degree C. Upgrade disconnect switches, CTs, and jumpers at North Loup.                                                                                                                                                                                   | 6/1/2018   | 6/1/2014 | 24 months | 640284 | North Loup                  | 640308 |
| 200258 | 30561 | 50761 | OPPD | ITP | \$422,270    | OPPD | Install 161 kV terminal equipment at S1366 for new 161/69 kV transformer.                                                                                                                                                                                                                                                     | 6/1/2016   | 6/1/2016 | 18 months | 646366 | SUB 1366 161kV              |        |

|        |       |       |      |                      |               |      |                                                                                                                                                                                     |          |          |           |        |                                 |        |
|--------|-------|-------|------|----------------------|---------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|-----------|--------|---------------------------------|--------|
| 200299 | 30581 | 50763 | OGE  | ITP                  | \$5,693,264   | OGE  | Convert existing 4.32-mile 69 kV line from Ahloso to Park Lane to 138 kV.                                                                                                           | 6/1/2017 | 6/1/2015 | 30 months | 515178 | PARK LANE 138 kV                | 515318 |
| 200299 | 30581 | 50764 | OGE  | ITP                  | \$6,929,179   | OGE  | Convert existing 10.12-mile 69 kV line from Ahloso to Harden City to 138 kV.                                                                                                        | 6/1/2015 | 6/1/2015 | 30 months | 515318 | Ahloso 138KV                    | 515362 |
| 200299 | 30581 | 50765 | OGE  | ITP                  | \$2,121,320   | OGE  | Convert existing 3.39-mile 69 kV line from Harden City to Frisco to 138 kV.                                                                                                         | 6/1/2017 | 6/1/2015 | 30 months | 515500 | Frisco 138 kV                   | 515362 |
| 200299 | 30581 | 50766 | OGE  | ITP                  | \$6,749,202   | OGE  | Convert existing 3.39-mile 69 kV line from Frisco to Lula to 138 kV.                                                                                                                | 6/1/2015 | 6/1/2015 | 30 months | 515192 | LULA 138                        | 515500 |
| 200255 | 30361 | 50768 | AEP  | ITP                  | \$5,326,722   | AEP  | Install approximately 2 miles of 230 kV transmission line for a cut-in to existing 230 kV line from Sweetwater to Elk City, creating termination points at new Chisholm substation. | 3/1/2018 | 3/1/2018 |           | 700345 | Chisholm 345 kV                 |        |
|        | 30599 | 50769 | TBD  | ITP                  | \$12,600,000  | SPP  | Install new 345/161 kV Transformer at South Fayetteville.                                                                                                                           |          | 1/1/2033 |           |        |                                 |        |
|        | 30599 | 50770 | TBD  | ITP                  | \$21,295,800  | SPP  | Build new 345 kV line from Chamber Springs to South Fayetteville and associated terminal equipment.                                                                                 |          | 1/1/2033 |           |        |                                 |        |
|        | 30600 | 50771 | TBD  | ITP                  | \$12,600,000  | SPP  | Install new 345/161 transformer at Maryville.                                                                                                                                       |          | 1/1/2033 |           | 541197 | Maryville 345 kV                | 300097 |
|        | 30601 | 50772 | TBD  | ITP                  | \$12,600,000  | SPP  | Increase rating of Nashua transformer to 650/715 MVA.                                                                                                                               |          | 1/1/2033 |           |        |                                 |        |
|        | 30602 | 50773 | TBD  | ITP                  | \$130,141,000 | SPP  | Build new 110 mile 345 kV line from Keystone to Red Willow and associated terminal equipment.                                                                                       |          | 1/1/2033 |           | 640252 | Keystone                        | 640325 |
|        | 30603 | 50774 | TBD  | ITP                  | \$75,718,400  | SPP  | Build new 64 mile 345 kV line from Tolk to Tuco and associated terminal equipment.                                                                                                  |          | 1/1/2033 |           | 525549 | Tolk Station 345 kV             | 525832 |
|        | 30604 | 50775 | TBD  | ITP                  | \$12,600,000  | SPP  | Install 2nd 345/115 kV transformer at Holcomb.                                                                                                                                      |          | 1/1/2033 |           | 531449 | HOLCOMB                         | 531448 |
|        | 30605 | 50776 | TBD  | ITP                  | \$117,126,900 | SPP  | Build new 99 mile 345 kV line from Neosho to Wolf Creek and associated terminal equipment.                                                                                          |          | 1/1/2033 |           | 532797 | WOLF CREEK 345 KV               | 532793 |
|        | 30606 | 50777 | TBD  | ITP                  | \$15,701,325  | SPP  | Rebuild 29 mile 161 kV line from Clinton to Truman.                                                                                                                                 |          | 1/1/2033 |           | 300071 | Clinton                         | 505502 |
|        | 30606 | 50778 | TBD  | ITP                  | \$1,082,850   | SPP  | Rebuild 2 miles of 161 kV line from North Warsaw to Truman.                                                                                                                         |          | 1/1/2033 |           | 505502 | Truman                          | 541314 |
|        | 30608 | 50779 | TBD  | ITP                  | \$12,600,000  | SPP  | Install new 345/115 kV transformer at Auburn.                                                                                                                                       |          | 1/1/2033 |           |        |                                 |        |
|        | 30608 | 50780 | TBD  | ITP                  | \$20,112,700  | SPP  | Convert 17 mile Auburn - Swissvale 230 kV line to a 345 kV line.                                                                                                                    |          | 1/1/2033 |           |        |                                 |        |
|        | 30608 | 50781 | TBD  | ITP                  | \$35,493,000  | SPP  | Convert the 30 mile Auburn - Jeffrey EC 230 kV to 345 kV.                                                                                                                           |          | 1/1/2033 |           |        |                                 |        |
|        | 30607 | 50782 | TBD  | ITP                  | \$34,605,675  | SPP  | Upgrade terminal equipment at Muskogee and Pecan Creek substations to increase Muskogee - Pecan Creek 345 kV Ckts 1 & 2 ratings to 1195/1195 MVA.                                   |          | 1/1/2033 |           | 515224 | MUSKOGEE 345                    | 515235 |
| 200258 | 30609 | 50783 | OPPD | ITP                  | \$3,141,600   | OPPD | Rebuild 3.3-mile 69 kV line from S907 to S919 to achieve a new emergency rating of 143 MVA.                                                                                         | 6/1/2019 | 6/1/2019 | 36 months | 647907 | Sub 907                         | 647919 |
| 200267 | 30610 | 50784 | WR   | Transmission Service | \$18,396,464  | WR   | Rebuild 16.31-mile 477 ACSR segment of 138 kV line from Butler to Weaver.                                                                                                           | 6/1/2018 | 6/1/2015 | 36 months | 532991 | WEAVER 138 KV                   | 532987 |
| 200269 | 30612 | 50786 | OGE  | Transmission Service | \$1,131,409   | OGE  | Reconductor 1.25-mile 138 kV line from Hefner to Tulsa with 1590 AS52 conductor.                                                                                                    |          | 6/1/2019 | 26 months | 514848 | HEFNER 138                      | 514847 |
| 200256 | 30616 | 50794 | SPS  | ITP                  | \$813,381     | SPS  | Install two 115 kV breakers at Curry County Interchange to convert the high side of the Curry County distribution transformer to 115 kV.                                            | 6/1/2018 | 6/1/2018 |           | 524822 | Curry County Interchange 115 kV |        |
|        | 30630 | 50795 | TBD  | High Priority        | \$237,000     | SPP  | Install new 12-Mvar capacitor bank at Brady 69 kV.                                                                                                                                  |          | 6/1/2023 | 18 months | 520830 | BRADY                           |        |
|        | 30631 | 50796 | TBD  | High Priority        | \$13,083,537  | SPP  | Construct new 10-mile 345 kV line from Benteler to McDade.                                                                                                                          |          | 6/1/2023 | 60 months | 507794 |                                 | 507793 |

|        |       |       |      |               |              |      |                                                                                                                                            |            |          |           |        |                                    |        |
|--------|-------|-------|------|---------------|--------------|------|--------------------------------------------------------------------------------------------------------------------------------------------|------------|----------|-----------|--------|------------------------------------|--------|
|        | 30631 | 50797 | TBD  | High Priority | \$10,516,124 | SPP  | Install new 345/138 kV 675 MVA transformer at McDade substation. Install any necessary 138 kV terminal equipment.                          |            | 6/1/2023 | 60 months | 507793 |                                    | 507741 |
|        | 30631 | 50798 | TBD  | High Priority | \$19,718,950 | SPP  | Install new 500/345 kV 1500 MVA transformer at Messick.                                                                                    |            | 6/1/2023 | 60 months | 999113 | Messick 500 kV                     | 999115 |
|        | 30631 | 50799 | TBD  | High Priority | \$45,792,379 | SPP  | Construct new 35-mile 345 kV line from McDade to Messick.                                                                                  |            | 6/1/2023 | 60 months | 507793 |                                    | 999115 |
|        | 30631 | 50800 | TBD  | High Priority | \$10,516,124 | SPP  | Install new 345/138 kV 314 MVA transformer at Benteler substation. Install any necessary 138 kV terminal equipment.                        |            | 6/1/2023 | 60 months | 507794 |                                    | 507792 |
|        | 30618 | 50801 | TBD  | High Priority |              |      | Replace wave traps at Northeast Station and Nowata 138 kV to achieve a new line rating of 202/235 MVA.                                     |            | 6/1/2018 | 12 months | 510396 | NORTHEAST STATION 138KV            | 510384 |
| 200310 | 30619 | 50802 | AEP  | High Priority | \$11,652,107 | AEP  | Construct AEP's portion of new 25-mile 138 kV line from Darlington to Roman Nose (OGE).                                                    | 12/31/2016 | 6/1/2015 | 36 months | 511559 |                                    | 514823 |
|        | 30620 | 50803 | TBD  | High Priority |              |      | Upgrade CTs at Wilkes 138 kV to achieve a new rating of 423/423 MVA on the Lone Star South to Wilkes 138 kV line.                          |            | 6/1/2023 | 12 months | 508297 | LONE STAR SOUTH 138KV              | 508840 |
| 200311 | 30622 | 50805 | OGE  | High Priority | \$12,767,120 | OGE  | Construct new 138 kV SW Station switching station. Construct new 13-mile 138 kV line from new SW Station switching station to Warwick Tap. | 6/1/2016   | 6/1/2018 | 36 months | 515012 | SPRING VALLEY TAP 69               | 515047 |
| 200311 | 30622 | 50806 | OGE  | High Priority | \$9,899,440  | OGE  | Construct new 18-mile 138 kV line from Linwood to new SW Station switching station.                                                        |            | 6/1/2018 | 36 months | 515401 | Pump Station 32                    | 515012 |
| 200311 | 30622 | 50807 | OGE  | High Priority | \$8,218,020  | OGE  | Construct new 5-mile 138 kV line from Knipe to new SW Station switching station.                                                           | 6/1/2018   | 6/1/2018 | 36 months | 515514 | Knipe 138 kV                       | 515012 |
|        | 30653 | 50808 | TBD  | High Priority | \$407,419    | SPP  | Reconductor WFEC's portion of the 2.1-mile 69 kV line from Alva OGE to Alva WFEC to achieve a new line rating of 134/143 MVA.              |            | 6/1/2018 | 24 months | 514792 | ALVA 69                            | 520806 |
| 200279 | 30624 | 50809 | OGE  | High Priority | \$150,000    | OGE  | Upgrade CTs at Alva OGE substation to achieve a minimum 800 amp rating.                                                                    | 6/1/2015   | 6/1/2015 | 12 months | 514792 | ALVA 69                            |        |
|        | 30627 | 50812 | TBD  | High Priority | \$185,004    | SPP  | Install new 9-Mvar capacitor bank at Sandridge 138 kV.                                                                                     |            | 6/1/2023 | 18 months | 520409 | Sandridge Tap 138kV                |        |
| 200284 | 30628 | 50813 | WFEC | High Priority | \$237,000    | WFEC | Install new 9.6-Mvar capacitor bank at Freedom 69 kV.                                                                                      | 6/1/2015   | 6/1/2015 | 18 months | 520915 | FREEDOM                            |        |
|        | 30634 | 50816 | TBD  | High Priority | \$504,000    | SPP  | Install new 24-Mvar capacitor bank at El Reno 138 kV.                                                                                      |            | 6/1/2018 | 18 months | 520893 | EL RENO SW                         |        |
| 200284 | 30635 | 50817 | WFEC | High Priority | \$190,000    | WFEC | Install new 12-Mvar capacitor bank at Eagle Chief 69 kV.                                                                                   | 6/1/2015   | 6/1/2015 | 18 months | 520890 | EAGLE CHIEF                        |        |
|        | 30636 | 50818 | TBD  | High Priority | \$237,000    | SPP  | Install new 24-Mvar capacitor bank at Winchester Tap 69 kV.                                                                                |            | 6/1/2018 | 24 months | 520408 |                                    |        |
| 200309 | 30638 | 50819 | SPS  | High Priority | \$19,255,234 | SPS  | Construct new 18.2-mile 345 kV line from North Loving to China Draw.                                                                       | 6/1/2018   | 6/1/2018 | 48 months | 528185 |                                    | 528223 |
| 200309 | 30638 | 50820 | SPS  | High Priority | \$25,716,516 | SPS  | Construct new 20.4-mile 345 kV line from new Kiowa substation to North Loving.                                                             | 6/1/2018   | 6/1/2018 | 48 months | 528185 |                                    | 527965 |
| 200282 | 30824 | 50821 | SPS  | High Priority | \$3,508,346  | SPS  | Upgrade 230/115 kV transformer at Potash Junction to 250 MVA.                                                                              | 6/1/2015   | 6/1/2015 | 24 months | 527963 | Potash Junction Interchange 230 kV | 527962 |
| 200308 | 30640 | 50822 | MKEC | High Priority | \$134,366    | MKEC | Replace switches at Dobson to achieve a rating of 189 MVA on the 115 kV line from Kansas Avenue to Dobson to Gano.                         | 6/1/2015   | 6/1/2015 |           | 531419 | DOBSON                             | 531480 |
| 200275 | 30644 | 50827 | MKEC | High Priority | \$20,992,491 | MKEC | Construct new 21-mile 138 kV line from Anthony to Harper.                                                                                  | 12/31/2017 | 6/1/2018 |           | 539001 |                                    | 539668 |

|        |       |       |      |                            |              |      |                                                                                                                                                                                                      |            |           |           |        |                             |        |
|--------|-------|-------|------|----------------------------|--------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----------|-----------|--------|-----------------------------|--------|
| 200276 | 30645 | 50828 | MKEC | High Priority              | \$13,666,262 | MKEC | Construct new 15-mile 138 kV line from Harper to new Rago substation.                                                                                                                                | 12/31/2017 | 6/1/2015  |           | 539668 | Harper 138 KV               | 539017 |
|        | 30646 | 50829 | TBD  | High Priority              | \$2,567,594  | SPP  | Install new 12-Mvar capacitor bank at Sun South 115 kV.                                                                                                                                              |            | 6/1/2018  | 24 months | 539007 |                             |        |
|        | 30647 | 50830 | TBD  | High Priority              | \$240,204    |      | Upgrade terminal equipment at Cowskin to achieve a rating of 80 MVA on the 4.6-mile 69 kV line from Cowskin to Goddtap.                                                                              |            | 6/1/2019  | 12 months | 533788 | COWSKIN 69 KV               | 533879 |
|        | 30648 | 50831 | TBD  | High Priority              | \$1,976,980  | SPP  | Install 9.6 Mvar capacitor bank at Rock Creek 69 kV.                                                                                                                                                 |            | 6/1/2018  | 18 months | 533458 | ROCK CREEK 69 KV            |        |
|        | 30736 | 50832 | TBD  | High Priority              | \$8,475,407  | SPP  | Rebuild Westar's portion of the 11.7-mile 138 kV line from Clearwater to Milan Tap to achieve a rating of 478 MVA.                                                                                   |            | 6/1/2018  | 24 months | 533036 | CLEARWATER 138KV            | 539675 |
|        | 30650 | 50833 | TBD  | High Priority              | \$1,249,680  | SPP  | Install 9.6 Mvar capacitor bank at Caney 69 kV.                                                                                                                                                      |            | 6/1/2018  | 18 months | 533678 | CANEY 69 KV                 |        |
|        | 30636 | 50834 | TBD  | High Priority              | \$237,000    | SPP  | Install new 12-Mvar capacitor bank at Winchester 69 kV.                                                                                                                                              | 6/26/2015  | 6/1/2018  | 18 months | 520408 |                             |        |
| 200287 | 30661 | 50835 | WFEC | High Priority              | \$2,068,000  | WFEC | Install any necessary 138 kV terminal equipment at Carmen associated with new 138/69 kV transformer.                                                                                                 |            | 6/1/2016  | 24 months | 525845 |                             |        |
|        | 30636 | 50836 | TBD  | High Priority              | \$0          |      | Convert Bufbear substation to 138 kV.                                                                                                                                                                |            | 6/1/2018  | 24 months | 521120 | BUFFALO BEAR 2              |        |
|        | 30654 | 50837 | TBD  | High Priority              | \$500,000    | SPP  | Expand existing 18-Mvar capacitor bank to 27-Mvar capacitor bank at Emmet Tap 115 kV.                                                                                                                |            | 6/1/2018  | 18 months | 640465 |                             |        |
|        | 30655 | 50838 | TBD  | High Priority              | \$500,000    | SPP  | Install second 18-Mvar capacitor bank at Broken Bow 115 kV.                                                                                                                                          |            | 6/1/2015  | 18 months | 640089 | Broken Bow                  |        |
| 200243 | 30656 | 50839 | OGE  | Generation Interconnection | \$3,033,890  |      | Construct new 138 kV three (3) breaker ring bus substation to accept GEN-2012-040 as per SA 2647 dated 12/17/2013.                                                                                   | 3/31/2015  | 3/31/2015 |           |        |                             |        |
|        | 30657 | 50840 | TBD  | High Priority              | \$2,557,852  | SPP  | Rebuild 2.8-mile 138 kV line from Bartlesville Commanche to Mound Road with 1533.6 ACSR/TW conductor. Upgrade CT ratios and relay settings.                                                          |            | 6/1/2015  | 24 months | 510390 | BARTLESVILLE COMANCHE 138KV | 510395 |
|        | 30623 | 50841 | TBD  | High Priority              | \$8,175,993  |      | Remove existing 9-mile 69 kV line from Clyde to Grant County and replace with new 138 kV line.                                                                                                       |            | 6/1/2023  | 36 months | 514719 | CLYDE 69                    | 515546 |
|        | 30623 | 50842 | TBD  | High Priority              | \$5,625,708  |      | Reconductor 10.1-mile 138 kV line from Clyde to Four Corners.                                                                                                                                        |            | 6/1/2023  | 36 months | 514719 | CLYDE 69                    | 514736 |
|        | 30623 | 50845 | TBD  | High Priority              | \$19,480,437 | OGE  | Reconductor 8.1-mile 138 kV line from Four Corners to Kremlin.                                                                                                                                       |            | 6/1/2023  | 24 months | 514736 | FOUR CORNERS 69             | 515501 |
|        | 30623 | 50846 | TBD  | High Priority              | \$0          |      | Remove existing 8-mile 69 kV line from Kremlin to NE Enid and replace with new 138 kV line.                                                                                                          |            | 6/1/2023  | 36 months | 515501 |                             | 514769 |
|        | 30632 | 50847 | TBD  | High Priority              | \$6,303,279  | WFEC | Rebuild existing 6.9-mile 69 kV line 138 kV line from Byron to Medlodge with 138 kV conductor.                                                                                                       | 6/29/2018  | 6/1/2021  | 24 months | 520203 |                             | 522396 |
|        | 30632 | 50848 | TBD  | High Priority              | \$11,510,336 | WFEC | Rebuild existing 12.6-mile 69 kV line from Hazelton to Medlodge with 138 kV conductor.                                                                                                               | 6/29/2018  | 6/1/2021  | 24 months | 520937 | HAZELTON                    | 522396 |
| 200309 | 30638 | 50849 | SPS  | High Priority              | \$4,649,045  | SPS  | Install new 345/115 kV 448 MVA transformer at new China Draw substation. Install any necessary 115 kV terminal equipment and ring/breaker and a half 115 kV bus for 4 line or transformer terminals. | 6/1/2018   | 6/1/2018  | 48 months | 528223 |                             | 528222 |
| 200309 | 30638 | 50850 | SPS  | High Priority              | \$4,172,734  | SPS  | Construct 345 kV ring bus, expandable to breaker and a half for 6 line or transformer terminals at China Draw.                                                                                       | 6/1/2018   | 6/1/2018  | 48 months | 528223 |                             |        |
| 200309 | 30637 | 50851 | SPS  | High Priority              | \$11,249,526 | SPS  | Construct new Kiowa 345 kV substation adjacent to Potash Junction. 345 kV bus will be ring, expandable to minimum 6 line or transformer terminals. Install terminal equipment as needed.             | 6/1/2018   | 6/1/2018  | 48 months | 527965 |                             |        |



|        |       |       |      |               |              |      |                                                                                                                                                                                                         |           |          |           |        |                    |        |
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| 200309 | 30638 | 50852 | SPS  | High Priority | \$5,950,217  | SPS  | Install new 345/115 kV 448 MVA transformer at new North Loving substation. Install any necessary 115 kV terminal equipment.                                                                             | 6/1/2018  | 6/1/2018 | 48 months | 528185 |                    | 528186 |
|        | 30651 | 50853 | TBD  | High Priority | \$13,083,537 | SPP  | Contract WFEC's portion of new 10-mile 345 kV line from Mooreland to Woodward District EHV.                                                                                                             |           | 6/1/2018 | 60 months | 522400 |                    | 515375 |
| 200309 | 30638 | 50854 | SPS  | High Priority | \$7,873,653  | SPS  | Install 345 kV line terminals at North Loving substation for Kiowa and China Draw. Install any necessary 345 kV terminal equipment necessary to install 345/115 kV 448 MVA transformer at North Loving. | 6/1/2018  | 6/1/2018 | 48 months | 528185 |                    |        |
| 200287 | 30661 | 50855 | WFEC | High Priority | \$2,475,000  | SPP  | Install new 138/69 kV 70 MVA transformer at Carmen substation. Install any necessary 69 kV terminal equipment.                                                                                          |           | 6/1/2016 | 24 months | 525845 |                    | 520845 |
| 200287 | 30661 | 50856 | WFEC | High Priority | \$2,680,000  | SPP  | Install new 138/69 kV 70 MVA transformer at new Cherokee Junction Tap substation. Install any necessary 69 kV terminal equipment.                                                                       |           | 6/1/2016 | 24 months | 521302 |                    | 520850 |
| 200287 | 30661 | 50857 | WFEC | High Priority | \$6,300,000  | WFEC | Tear down the existing 69 kV line from Cherokee Junction to Carmen. Construct new 11.5-mile 138 kV line Cherokee Junction Tap to Carmen.                                                                |           | 6/1/2016 | 24 months | 521302 |                    | 525845 |
|        | 30636 | 50858 | TBD  | High Priority | \$2,810,198  | SPP  | Install new 138/69 kV 70 MVA transformer at Buffalo substation. Install any necessary 69 kV terminal equipment.                                                                                         |           | 6/1/2018 | 24 months | 521300 |                    | 520835 |
|        | 30636 | 50859 | TBD  | High Priority | \$13,246,021 | SPP  | Rebuild the 14.5-mile 69 kV line from Bufbear to Ft. Supply with 138 kV conductor.                                                                                                                      |           | 6/1/2018 | 24 months | 520920 | FT SUPPLY          | 521120 |
|        | 30636 | 50860 | TBD  | High Priority | \$2,968,936  | SPP  | Rebuild the 3.3-mile 69 kV line from Bufbear to Buffalo with 138 kV conductor.                                                                                                                          | 9/25/2015 | 6/1/2018 | 24 months | 521120 | BUFFALO BEAR 2     | 521300 |
|        | 30662 | 50861 | TBD  | High Priority | \$2,810,198  | SPP  | Install new 138/69 kV 68/89 MVA transformer at Elk City substation. Install any necessary 69 kV terminal equipment.                                                                                     |           | 6/1/2017 | 24 months | 511458 | ELK CITY 138       | 511459 |
| 200309 | 30639 | 50862 | SPS  | High Priority | \$3,989,689  | SPS  | Install new 345/115 kV 448 MVA transformer at new Road Runner substation. Install any necessary 115 kV terminal equipment.                                                                              | 6/1/2016  | 6/1/2018 | 48 months | 528027 | Road Runner 345 kV | 528025 |
| 200309 | 30639 | 50863 | SPS  | High Priority | \$11,569,711 | SPS  | Convert 230 kV Road Runner substation to 345 kV. Install any necessary 345 kV terminal equipment.                                                                                                       | 6/1/2016  | 6/1/2018 | 48 months | 528027 | Road Runner 345 kV |        |
|        | 30666 | 50864 | TBD  | ITP           | \$12,991,922 | SPP  | Install new -50/+200 Mvar Static VAR Capacitor (SVC) at China Draw 115 kV bus.                                                                                                                          |           | 4/1/2015 | 30 months | 528220 |                    |        |
|        | 30670 | 50865 | TBD  | High Priority |              |      | Install new -50/+200 Mvar Static VAR Capacitor (SVC) at Toboso Flats 115 kV bus.                                                                                                                        |           | 6/1/2018 | 24 months | 528566 |                    |        |
|        | 30664 | 50866 | TBD  | High Priority | \$6,928,199  | SPP  | Construct new 3.4-mile 115 kV line from North Loving to South Loving.                                                                                                                                   |           | 6/1/2015 | 36 months | 528191 |                    | 528192 |
|        | 30653 | 50867 | TBD  | High Priority | \$1,141,488  | SPP  | Reconductor OGE's portion of the 2.1-mile 69 kV line from Alva OGE to Alva WFEC to achieve a new line rating of 134/143 MVA.                                                                            |           | 6/1/2018 | 24 months | 514792 | ALVA 69            | 520806 |
| 200309 | 30639 | 50868 | SPS  | High Priority | \$5,443,140  | SPS  | Install 345/115 kV 448 MVA transformer at Kiowa substation.                                                                                                                                             | 6/1/2018  | 6/1/2018 | 48 months | 527965 |                    |        |
| 200282 | 30675 | 50869 | SPS  | High Priority | \$14,583,586 | SPS  | Construct new 18.4-mile 115 kV line from China Draw to new Yeso Hills substation.                                                                                                                       | 6/1/2018  | 6/1/2018 | 36 months | 528222 | China Draw 115 kV  | 528246 |
| 200309 | 30717 | 50870 | SPS  | High Priority | \$9,980,879  | SPS  | Construct new 9.5-mile 115 kV line from Hopi Sub to North Loving 115 kV.                                                                                                                                | 6/1/2015  | 6/1/2015 | 36 months | 528226 |                    | 528191 |



|        |       |       |      |               |              |      |                                                                                                                                                                                                                                                     |           |          |           |        |                            |        |
|--------|-------|-------|------|---------------|--------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|----------|-----------|--------|----------------------------|--------|
| 200309 | 30639 | 50871 | SPS  | High Priority | \$2,176,451  | SPS  | Construct 1-mile of double circuit structures from the new Kiowa substation to Potash Junction. Construct Circuit 1 with 345 kV conductor and Circuit 2 with 115 kV conductor.                                                                      | 6/1/2018  | 6/1/2018 | 48 months | 527965 |                            | 528027 |
| 200282 | 30672 | 50872 | SPS  | High Priority | \$822,700    | SPS  | Construct new 115 kV Toboso Flats substation. Install any necessary 115 kV terminal equipment.                                                                                                                                                      | 6/1/2018  | 6/1/2018 | 36 months | 528566 |                            |        |
| 200282 | 30756 | 50873 | SPS  | High Priority | \$13,816,310 | SPS  | Construct new 18.9-mile 115 kV line from Road Runner to Battle Axe.                                                                                                                                                                                 | 12/4/2015 | 6/1/2018 | 36 months | 528040 |                            | 528025 |
| 200282 | 30672 | 50874 | SPS  | High Priority | \$5,062,341  | SPS  | Construct new 7.4-mile 115 kV line from new Toboso Flats substation to Dollarhide.                                                                                                                                                                  | 6/1/2018  | 6/1/2018 | 36 months | 528561 | Dollarhide Sub 115 kV      | 528566 |
| 200309 | 30637 | 50875 | SPS  | High Priority | \$59,808,956 | SPS  | Construct new 47.2-mile 345 kV line from Kiowa to Hobbs.                                                                                                                                                                                            | 6/1/2018  | 6/1/2018 | 48 months | 527965 |                            | 527896 |
|        | 30669 | 50876 | TBD  | High Priority | \$9,415,457  | SPP  | Reconductor 20.5-mile 115 kV line from Tuco to Hale County with 477 ACSS conductor.                                                                                                                                                                 |           | 6/1/2018 | 24 months | 525454 | Hale Co Interchange 115 kV | 525828 |
| 200282 | 30694 | 50877 | SPS  | High Priority | \$996,485    | SPS  | Construct new 115 kV Ponderosa substation. Install any necessary 115 kV terminal equipment.                                                                                                                                                         | 6/1/2017  | 6/1/2018 | 36 months | 528240 |                            |        |
|        | 30671 | 50878 | TBD  | High Priority | \$697,688    | SPP  | Install two (2) 14.4 Mvar capacitor banks at Kiser 115 kV bus.                                                                                                                                                                                      |           | 6/1/2018 | 18 months | 525272 | Kiser Sub 69 kV            |        |
| 200282 | 30694 | 50879 | SPS  | High Priority | \$4,174,446  | SPS  | Tap the existing 115 kV line from Ochoa to Whitten to construct new 115 kV Ponderosa Tap substation. Install any necessary 115 kV terminal equipment.                                                                                               | 6/1/2017  | 6/1/2018 | 36 months | 528239 |                            |        |
| 200282 | 30649 | 50881 | SPS  | High Priority | \$10,671,660 | SPS  | Install new 230/115 kV 288 MVA transformer at Andrews substation. Install any necessary terminal equipment.                                                                                                                                         | 4/4/2016  | 6/1/2015 | 24 months | 528604 |                            | 528601 |
| 200282 | 30649 | 50882 | SPS  | High Priority | \$3,523,472  | SPS  | Construct new 2.1-mile 115 kV line from Andrews to National Enrichment Facility (NEF).                                                                                                                                                              | 4/4/2016  | 6/1/2015 | 36 months | 528602 |                            | 528603 |
| 200309 | 30717 | 50883 | SPS  | High Priority | \$13,283,227 | SPS  | Construct new 19.7-mile 115 kV line from North Loving to China Draw.                                                                                                                                                                                | 6/1/2015  | 6/1/2015 | 36 months | 528182 | North Loving 115 kV        | 528222 |
|        | 30677 | 50887 | TBD  | High Priority | \$6,966,383  | SPP  | Rebuild 3.5-mile 69 kV line from Coleman to Ripley to achieve a rating of 131/143 MVA.                                                                                                                                                              |           | 6/1/2018 | 24 months | 533787 | COLEMAN 69 KV              | 533832 |
| 200287 | 30661 | 50888 | WFEC | High Priority | \$3,945,000  | SPP  | Tap the existing 138 kV line from Noel Switch to Cherokee City to construct the new Cherokee Junction Tap substation. Install any necessary 138 kV terminal equipment.                                                                              |           | 6/1/2016 | 24 months | 521302 |                            |        |
| 200277 | 30678 | 50889 | NPPD | High Priority | \$9,306,000  | NPPD | Install new 345/115 kV 400 MVA transformer at Thedford substation. Install any necessary 115 kV terminal equipment.                                                                                                                                 | 1/1/2018  | 6/1/2016 | 48 months | 640500 | Cherry County 345 kV       | 640381 |
|        | 30680 | 50891 | TBD  | High Priority | \$58,875,915 | SPP  | Construct new 45-mile 345 kV line from Center to Dolet Hills.                                                                                                                                                                                       |           | 6/1/2023 | 60 months | 509048 |                            | 500250 |
|        | 30680 | 50892 | TBD  | High Priority | \$10,516,124 | SPP  | Install new 345/138 kV 314 MVA transformer at Center substation. Install any necessary 138 kV terminal equipment.                                                                                                                                   |           | 6/1/2023 | 60 months | 509048 |                            | 509058 |
|        | 30681 | 50893 | TBD  | High Priority | \$654,177    | SPP  | Cut in to 345 kV line from Border to Woodward District EHV and construct new 0.5-mile line to terminating at Chisholm 345 kV substation, creating a Border - Chisholm EHV 345 kV line. Install any necessary 345 kV terminal equipment at Chisholm. |           | 6/1/2021 | 36 months | 515458 | Border                     | 511553 |

|  |       |       |     |               |              |     |                                                                                                                                                                                                                                                               |  |          |           |        |                             |        |
|--|-------|-------|-----|---------------|--------------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------|-----------|--------|-----------------------------|--------|
|  | 30681 | 50894 | TBD | High Priority | \$654,177    | SPP | Cut in to 345 kV line from Border to Woodward District EHV and construct new 0.5-mile line to terminating at Chisholm 345kV substation, creating a Chisholm - Woodward District EHV 345 kV line. Install any necessary 345 kV terminal equipment at Chisholm. |  | 6/1/2021 | 36 months | 511553 | Elk City 345 kV             | 515375 |
|  | 30663 | 50897 | TBD | High Priority | \$6,163,422  |     | Construct new 345 kV terminal at the Battle Axe substation. Install any necessary 345 kV terminal equipment for 4 transformer/line terminations in ring configuration expandable to future breaker and a half.                                                |  | 6/1/2019 | 48 months | 528041 |                             |        |
|  | 30663 | 50898 | TBD | High Priority | \$1,118,826  |     | Install 345 kV terminal at China Draw to terminate the new 345 kV line from Battle Axe. Install any necessary 345 kV terminal equipment.                                                                                                                      |  | 6/1/2019 | 48 months | 528223 |                             |        |
|  | 30663 | 50899 | TBD | High Priority | \$19,437,381 | SPS | Construct new 15-mile 345 kV line from Battle Axe to Road Runner. Install 345 kV bus at Road Runner for 4 transformer or line terminations, expandable for future terminations.                                                                               |  | 6/1/2019 | 48 months | 528041 |                             | 528027 |
|  | 30663 | 50900 | TBD | High Priority | \$4,277,468  | SPP | Install new 345/115 kV 448 MVA transformer at new Battle Axe substaton. Install any necessary 115 kV terminal equipment as expandable breaker and half design.                                                                                                |  | 6/1/2019 | 48 months | 528041 |                             | 528040 |
|  | 30719 | 50901 | TBD | High Priority | \$10,516,124 | SPP | Install new 345/115 kV 448 MVA transformer at Andrews substaton and remove two 230/115 kV transformers. Install any necessary 115 kV terminal equipment.                                                                                                      |  | 6/1/2022 | 48 months | 528604 |                             | 528602 |
|  | 30757 | 50902 | TBD | High Priority | \$10,516,124 | SPP | Remove 345/230 kV transformer at Potash Junction. Replace with new 345/115 kV 448 MVA transformer. Expand 115 kV bus at Potash Junction as needed.                                                                                                            |  | 6/1/2019 | 24 months | 527965 |                             | 527962 |
|  | 30719 | 50903 | TBD | High Priority | \$30,530,000 | SPP | Convert existing 30.5-mile 230 kV line from Andrews to Hobbs to 345 kV. Re-terminate line on 345 kV bus at Hobbs. Ratings will be based on current conductors - bundled 795 ACSR.                                                                             |  | 6/1/2022 | 48 months | 528604 |                             | 527896 |
|  | 30757 | 50907 | TBD | High Priority | \$10,516,124 | SPP | Install 2nd 345/115 kV 448 MVA transformer at Potash Junction. Expand 115 kV bus as needed for termination.                                                                                                                                                   |  | 6/1/2019 | 24 months | 527965 |                             | 527962 |
|  | 30686 | 50913 | TBD | High Priority |              |     | Increase capacity of Russet CT from 600 amps to 800 amps to increase the emergency rating on 138 kV line from Glasses to Russet to 152.7 MVA.                                                                                                                 |  | 6/1/2023 | 12 months | 515147 | GLASSES 138                 | 515120 |
|  | 30687 | 50914 | TBD | High Priority | \$740,254    | SPP | Install 9-Mvar capacitor bank at Cleo 69 kV.                                                                                                                                                                                                                  |  | 6/1/2023 | 18 months | 514791 | CLEO 69                     |        |
|  | 30688 | 50915 | TBD | ITP           | \$84,327     | SPP | Upgrade Park Lane 138 kV CTs and wave trap from 1200 A to 1600 A to achieve a new emergency rating of 382.4 MVA on the 138 kV line from Park Lane to Seminole.                                                                                                |  | 6/1/2022 | 18 months | 515044 | SEMINOLE 138                | 515178 |
|  | 30688 | 50916 | TBD | High Priority |              |     | Replace wave trap on 138 kV line from Seminole to Vanoss to increase the line rating to 310/354 MVA.                                                                                                                                                          |  | 6/1/2023 | 12 months | 515044 | SEMINOLE 138                | 515174 |
|  | 30690 | 50918 | TBD | ITP           | \$3,411,800  | SPP | Add 2nd 230/115 kV 250 kV transformer at Plant X.                                                                                                                                                                                                             |  | 6/1/2022 | 24 months | 525481 | Plant X Station 230 kV      | 525480 |
|  | 30692 | 50920 | TBD | High Priority | \$6,020,434  | SPP | Increase 1st 230/115 kV transformer at Seminole to 250 MVA.                                                                                                                                                                                                   |  | 6/1/2023 | 24 months | 527276 | Seminole Interchange 230 kV | 527275 |
|  | 30692 | 50921 | TBD | High Priority | \$6,020,434  | SPP | Increase 2nd 230/115 kV transformer at Seminole to 250 MVA.                                                                                                                                                                                                   |  | 6/1/2023 | 24 months | 527276 | Seminole Interchange 230 kV | 527275 |

|        |       |       |     |               |              |     |                                                                                                                                     |          |          |           |        |                                  |        |
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|        | 30693 | 50922 | TBD | High Priority | \$6,020,434  | SPP | Increase 230/115 kV transformer Wolfforth to 250 MVA.                                                                               |          | 6/1/2023 | 24 months | 526525 | Wolfforth Interchange 230 kV     | 526524 |
| 200282 | 30694 | 50923 | SPS | High Priority | \$5,404,344  | SPS | Construct new 9.3-mile 115 kV line from new Ponderosa substation to new Ponderosa Tap substation.                                   | 6/1/2017 | 6/1/2018 | 36 months | 528239 |                                  | 528240 |
| 200309 | 30695 | 50924 | SPS | High Priority | \$4,950,983  | SPS | Convert Livingston Ridge from 69 kV to 115 kV. Install any necessary 115 kV terminal equipment.                                     | 6/1/2018 | 6/1/2018 | 36 months | 527953 |                                  |        |
| 200309 | 30695 | 50925 | SPS | High Priority | \$3,822,672  | SPS | Construct new 115 kV Sage Brush substation with 3 ring bus configuration. Install any necessary 115 kV terminal equipment.          | 6/1/2018 | 6/1/2018 |           | 527955 |                                  |        |
| 200309 | 30695 | 50926 | SPS | High Priority | \$8,811,206  | SPS | Construct new 13.9-mile 115 kV line from Livingston Ridge to new Sage Brush substation.                                             | 6/1/2018 | 6/1/2018 | 36 months | 527953 |                                  | 527955 |
| 200309 | 30695 | 50927 | SPS | High Priority | \$1,200,057  | SPS | Construct new 115 kV Lagarto substation. Install any necessary 115 kV terminal equipment.                                           | 6/1/2018 | 6/1/2018 | 36 months | 527957 |                                  |        |
| 200309 | 30695 | 50928 | SPS | High Priority | \$6,186,323  | SPS | Construct new 10.4-mile 115 kV line from new Lagarto substation to new Sage Brush substation.                                       | 6/1/2018 | 6/1/2018 | 36 months | 527957 |                                  | 527955 |
|        | 30689 | 50929 | TBD | High Priority |              |     | Replace line trap to increase the rating on the 230 kV line from Lubbock South to Wolfforth to 478/502 MVA.                         |          | 6/1/2023 | 12 months | 526269 | Lubbock South Interchange 230 kV | 526525 |
|        | 30705 | 50930 | TBD | High Priority | \$11,067,349 | SPP | Construct new 15-mile 115 kV line from Battle Axe to Wood Draw.                                                                     |          | 6/1/2023 | 36 months | 528040 |                                  | 528228 |
| 200282 | 30825 | 50931 | SPS | High Priority | \$13,704,501 | SPS | Construct new 14-mile 115 kV line from China Draw to Wood Draw.                                                                     | 6/1/2018 | 6/1/2018 |           | 528222 | China Draw 115 kV                | 528228 |
|        | 30758 | 50935 | TBD | High Priority | \$1,148,787  | SPP | Reconductor 2.3-mile 115 kV line from Carlisle to Doud Tap to achieve a new rating of 276/304.                                      |          | 6/1/2023 | 24 months | 526160 | Carlisle Interchange 115 kV      | 526162 |
|        | 30758 | 50936 | TBD | High Priority | \$781,175    | SPP | Reconductor 1.7-mile 115 kV line from Doud to Doud Tap to achieve a new rating of 276/304.                                          |          | 6/1/2023 | 24 months | 526162 |                                  | 526176 |
|        | 30758 | 50937 | TBD | High Priority | \$643,321    | SPP | Reconductor 1.4-mile 115 kV line from Doud Tap to Wolf Tap to achieve a new rating of 276/304.                                      |          | 6/1/2023 | 24 months | 526162 |                                  | 526481 |
|        | 30758 | 50938 | TBD | High Priority | \$367,612    | SPP | Reconductor 0.8-mile 115 kV line from Wolf Tap to Yuma to achieve a new rating of 276/304.                                          |          | 6/1/2023 | 24 months | 526481 |                                  | 526475 |
|        | 30696 | 50939 | TBD | High Priority | \$1,796,703  | SPP | Reconductor 3.9-mile 115 kV line from Bowers to Grapevine with 477 ACSS conductor.                                                  |          | 6/1/2019 | 24 months | 523748 | Bowers Interchange 115 kV        | 523770 |
|        | 30697 | 50940 | TBD | High Priority | \$997,147    | SPP | Reconductor second 2.2-mile 115 kV line from Deaf Smith to Hereford with 477 ACSS conductor to achieve a new rating of 276/304 MVA. |          | 6/1/2023 | 24 months | 524606 | Hereford Interchange 115 kV      | 524622 |
|        | 30698 | 50941 | TBD | High Priority | \$326,255    | SPP | Reconductor 0.7-mile 115 kV line from Puckett to Soncy Tap with 477 ACSS conductor to achieve a new rating of 276/304 MVA.          |          | 6/1/2023 | 24 months | 524256 | Puckett Sub 115 kV               | 524252 |
|        | 30698 | 50942 | TBD | High Priority | \$1,056,884  | SPP | Reconductor 2.3-mile 115 kV line from Coulter to Puckett with 477 ACSS conductor to achieve a rating of 276/304 MVA.                |          | 6/1/2023 | 24 months | 524306 | Coulter Interchange 115 kV       | 524256 |
|        | 30699 | 50943 | TBD | High Priority | \$3,832,353  | SPP | Reconductor 8.3-mile 115 kV line from Northwest to Rolling Hills with 477 ACSS conductor to achieve a rating of 276/304 MVA.        |          | 6/1/2023 | 24 months | 524007 |                                  | 524106 |
|        | 30665 | 50944 | TBD | High Priority | \$22,580,725 | SPP | Reconductor 24.6-mile 230 kV line from Sundown to Wolfforth to achieve a rating of 598/598 MVA.                                     |          | 6/1/2023 | 24 months | 526435 | Sundown Interchange 230 kV       | 526525 |
|        | 30665 | 50945 | TBD | High Priority | \$6,020,434  | SPP | Install 2nd 230/115 kV 250 MVA transformer at Sundown.                                                                              |          | 6/1/2023 | 24 months | 526435 | Sundown Interchange 230 kV       | 526434 |
|        | 30700 | 50946 | TBD | High Priority |              |     | Increase Murphy to Frankfrd 115 kV line rating to 159/160 MVA.                                                                      |          | 6/1/2023 | 12 months | 526192 | Murphy Sub 115 kV                | 526199 |

|        |       |       |     |               |              |     |                                                                                                                                                                                       |           |          |           |        |                                                       |        |
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|        | 30701 | 50947 | TBD | High Priority | \$697,688    | SPP | Install two (2) 14.4-Mvar capacitor banks at Castro 115 kV.                                                                                                                           |           | 6/1/2023 | 18 months | 524746 | Castro County Interchange 115 kV                      |        |
|        | 30702 | 50948 | TBD | High Priority | \$697,688    | SPP | Install two (2) 7.5 Mvar capacitor banks at Graham 69 kV.                                                                                                                             |           | 6/1/2023 | 18 months | 526693 | Graham Interchange 69 kV                              |        |
|        | 30703 | 50949 | TBD | High Priority | \$697,688    | SPP | Install 7.5 Mvar capacitor bank at Newtext 69 kV.                                                                                                                                     |           | 6/1/2023 | 18 months | 528718 | Lea County REC-Newtex 69 kV                           |        |
|        | 30704 | 50950 | TBD | High Priority | \$25,823,814 | SPP | Construct new 35-mile 115 kV line from Wheeler to McLean to achieve a rating of 180/199 MVA.                                                                                          |           | 6/1/2023 | 36 months | 523811 | McLean Rural Sub 115 kV                               | 523776 |
| 200309 | 30695 | 50951 | SPS | High Priority | \$6,115,613  | SPS | Construct new 115 kV Cardinal substation. Install any necessary 115 kV terminal equipment.                                                                                            | 6/1/2018  | 6/1/2018 | 36 months | 528596 | National Enrichment Plant Tap 115 kV                  |        |
|        | 30914 | 50952 | TBD | ITP           | \$6,469,386  | SPP | Reconductor 9.5-mile 115 kV line from Livingston Ridge to IMC #1 Tap.                                                                                                                 |           | 6/1/2015 | 30 months | 528035 | I. M. C. #1 Sub Tap 115 kV (International Mineral Co) | 527953 |
|        | 30707 | 50953 | TBD | High Priority | \$1,700,205  | SPP | Reconductor 3.7-mile 115 kV line from Dollarhide to South Jal Sub with 477 ACSS conductor to achieve a rating of 276/304 MVA.                                                         |           | 6/1/2023 | 24 months | 528561 | Dollarhide Sub 115 kV                                 | 528547 |
|        | 30708 | 50954 | TBD | High Priority | \$4,161,825  | SPP | Reconductor 9.1-mile 115 kV line from Ochoa to Ponderosa Tap with 477 ACSS conductor to achieve a rating of 276/304 MVA.                                                              |           | 6/1/2023 | 24 months | 528232 | Ochoa Sub 115 kV                                      | 528239 |
|        | 30914 | 50955 | TBD | ITP           | \$4,044,971  | SPP | Reconductor 5.9-mile 115 kV line from Ponderosa Tap to Whitten with 477 ACSS conductor to achieve a rating of 276/304 MVA.                                                            |           | 6/1/2015 | 30 months | 528239 |                                                       | 528540 |
|        | 30709 | 50956 | TBD | High Priority | \$2,747,898  | SPP | Reconductor Line - 5.98 miles. 115 kV - Lubbock South - Woodrow for 477 ACSS rated 276/304 MVA                                                                                        |           | 6/1/2023 | 24 months | 526268 | Lubbock South Interchange 115 kV                      | 526602 |
|        | 30914 | 50957 | TBD | ITP           | \$1,258,393  | SPP | Reconductor 1.5-mile 115 kV line from Intrepid West Tap to Potash Junction with 477 ACSS conductor to achieve a rating of 276/304 MVA.                                                |           | 6/1/2015 | 30 months | 527999 |                                                       | 527962 |
|        | 30914 | 50958 | TBD | ITP           | \$2,655,853  | SPP | Reconductor 3.9-mile 115 kV line from Intrepid West Tap to IMC #2 with 477 ACSS conductor to achieve a rating of 276/304 MVA.                                                         |           | 6/1/2015 | 30 months | 527999 |                                                       | 528035 |
|        | 30712 | 50961 | TBD | High Priority |              |     | Move loads from Bowers 2 - 69 kV to Bowers 3 - 115 kV                                                                                                                                 |           | 6/1/2023 | 24 months | 523747 | Bowers Interchange 69 kV                              | 523748 |
|        | 30715 | 50965 | TBD | High Priority | \$22,599,580 | SPP | Rebuild 28.8-mile 115 kV from HEC to Huntsville and upgrade CTs to achieve new rating of 80/88 MVA.                                                                                   |           | 6/1/2023 | 24 months | 533419 | HUTCHINSON ENERGY CENTER 115 KV                       | 530618 |
| 200309 | 30695 | 50967 | SPS | High Priority | \$9,244,612  | SPS | Construct new 17.5-mile 115 kV line from Lagarto to Cardinal.                                                                                                                         | 6/1/2018  | 6/1/2018 | 36 months | 528596 | National Enrichment Plant Tap 115 kV                  | 527957 |
| 200282 | 30756 | 50968 | SPS | High Priority | \$2,964,499  | SPS | Construct new 115 kV Battle Axe substation. Install any necessary 115 kV terminal equipment.                                                                                          | 12/4/2015 | 6/1/2018 | 36 months | 528040 |                                                       |        |
|        | 30720 | 50969 | TBD | High Priority |              |     | Upgrade Oasis to SW_4K33 230 kV line trap: Increase Oasis to SW_4K33 230 kV line rating to 478/478 MVA.                                                                               |           | 6/1/2023 | 12 months | 524875 | Oasis Interchange 230 kV                              | 524915 |
|        | 30721 | 50970 | TBD | High Priority |              |     | Move Curry Load 69 kV to 115 kV : Move loads from Curry 69 kV to 115 kV                                                                                                               |           | 6/1/2023 | 24 months | 524821 | Curry County Interchange 69 kV                        | 524822 |
|        | 30722 | 50971 | TBD | High Priority | \$740,254    | SPP | Install 9-Mvar capacitor bank at Saline 69 kV.                                                                                                                                        |           | 6/1/2023 | 18 months | 514716 | SALINE 69                                             |        |
|        | 30652 | 50972 | TBD | High Priority | \$4,500,000  |     | Reconductor 69 kV line from Atchison Junction 1 to Maur Hill to achieve a rating of 41 MVA. Rebuild 1.7-mile 69 kV line from Kerford to Maur Hill to achieve a rating of 131/157 MVA. |           | 6/1/2020 |           | 533472 | ATCHISON JCT1 69 KV                                   | 533475 |

|        |       |       |      |               |              |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |          |           |        |                              |        |
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|        | 30723 | 50977 | TBD  | High Priority | \$7,740,000  |      | Remove 69 kV line from Midwest Grain Solvents Junction 1 (STR 45 2) to Midwest Grain Solvents Junction 2 (Arnold Junction 2) to Arnold to Atchison Junction1 to Atchison Castings. Remove 69 kV line from Atchison Junction 2 to Maur Hill. Install zero impedance line between Arnold and Arnold Junction 2. Construct new 69 kV line from Atchison Junction 1 to Midwest Grain Solvents Junction 1 (STR 45 2). Construct new 69 kV line from Arnold Junction 2 to Atchison Junction 1 with a rating of 131/143 MVA. Reconductor 69 kV line from Atchison Junction 2 to Midwest Grain with a rating of 131/157 MVA. Construct new 138 kV line from Arnold Junction 2 to Atchison Junction 1 with a rating of 131/143 MVA. Construct new 138 kV line from Atchison Junction 2 to Midwest Grain Solvents Junction 1 (STR 45 2) with a rating of 108 MVA. Construct new 138 kV line from Atchison Castings to Midwest Grain Solvents Junction 1 (STR 45 2) with a rating of 42 MVA. Construct new 138 kV line from Arnold Junction 2 to Midwest Grain with a rating of 131/157 MVA. |            | 6/1/2020 |           | 533472 | ATCHISON JCT1 69 KV          | 533478 |
|        | 30727 | 50985 | TBD  | High Priority |              |      | Tap 115 kV line from Crosby to Lubbock East - 69 kV bus via - New Line - 2.45 mile, 69kV - Connect SP-ACUFF to SP-IDALOU                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            | 6/1/2023 | 24 months | 525906 | South Plains REC-Acuff 69 kV | 526116 |
|        | 30728 | 50986 | TBD  | High Priority |              |      | Move Vicksburg Load 69 kV to 115 kV: Move load from Vickers 69 kV to 115 kV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |            | 6/1/2023 | 24 months | 526123 | Vickers Sub 69 kV            | 526124 |
|        | 30691 | 50987 | TBD  | High Priority | \$14,756,465 | SPP  | Construct new 20-mile 115 kV line from new Sage Brush substation to Road Runner.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            | 6/1/2023 | 36 months | 527955 |                              | 528025 |
| 200282 | 30675 | 50988 | SPS  | High Priority | \$1,046,485  | SPS  | Construct new 115 kV Yeso Hills substation. Install any necessary 115 kV terminal equipment.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 6/1/2018   | 6/1/2018 | 36 months | 528246 |                              |        |
| 200275 | 30732 | 50991 | MKEC | High Priority | \$8,335,592  | MKEC | Construct new 7-mile 138 kV line from Anthony to Bluff City.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 12/31/2018 | 6/1/2015 |           | 539001 |                              | 539004 |
| 200275 | 30732 | 50993 | MKEC | High Priority | \$19,286,271 | MKEC | Construct new 22-mile 138 kV line from Bluff City to Caldwell.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 12/31/2018 | 6/1/2015 |           | 539004 |                              | 539005 |
| 200275 | 30732 | 50994 | MKEC | High Priority | \$14,413,382 | MKEC | Construct new 16-mile 138 kV line from Caldwell to Mayfield.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 12/31/2018 | 6/1/2015 |           | 539005 |                              | 539006 |
| 200275 | 30732 | 50995 | MKEC | High Priority | \$15,155,080 | MKEC | Construct new 8-mile 138 kV line from Mayfield to Milan.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 12/31/2018 | 6/1/2015 |           | 539006 |                              | 539676 |
|        | 30736 | 51000 | TBD  | High Priority | \$10,688,169 | SPP  | Rebuild Sunflower's portion of the 11.7-mile 138 kV line from Clearwater to Milan Tap to achieve a rating of 478 MVA.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            | 6/1/2018 | 24 months | 533036 | CLEARWATER 138KV             | 539675 |
|        | 30737 | 51001 | TBD  | High Priority | \$500,000    | SPP  | Install new 18-Mvar capacitor bank at Minneola 115 kV.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            | 6/1/2023 | 18 months | 539037 |                              |        |
| 200277 | 30678 | 51002 | NPPD | High Priority | \$930,800    | NPPD | Install any necessary 345 kV terminal equipment at Thedford associated with new 345/115 kV transformer.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1/1/2018   | 6/1/2016 | 48 months | 640500 | Cherry County 345 kV         |        |
|        | 30662 | 51004 | TBD  | High Priority |              |      | Install any necessary 138 kV terminal equipment at Elk City associated with new 138/69 kV transformer.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            | 6/1/2017 | 24 months | 511458 | ELK CITY 138                 |        |

|        |       |       |      |                      |              |      |                                                                                                                                                                                                                                                                                   |           |          |           |        |                                  |        |
|--------|-------|-------|------|----------------------|--------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|----------|-----------|--------|----------------------------------|--------|
| 200272 | 30747 | 51014 | AEP  | High Priority        | \$12,132,497 | AEP  | Construct new Round Creek box bay tap structure adjacent to the Rush Springs 138 kV substation. Construct new 6-mile 138 kV line from Grady to Round Creek. Install 3-breaker ring bus where hard tap to Round Creek intersects the Cornville to Duncan 138 kV transmission line. | 6/1/2015  | 6/1/2015 | 36 months | 511560 |                                  | 511427 |
| 200272 | 30750 | 51017 | AEP  | High Priority        | \$8,934,149  | AEP  | Construct new 6.4-mile 138 kV line from Stonewall to Wapanucka.                                                                                                                                                                                                                   |           | 6/1/2015 | 36 months | 521075 |                                  | 510949 |
| 200271 | 30597 | 51030 | WFEC | ITP                  | \$450,000    | WFEC | Install fiber optics on existing 138 kV line from Noel to Knobhill. Install a new 138 kV breaker and metering equipment at Noel to accommodate new circuit from new Lane substation.                                                                                              | 6/1/2019  | 6/1/2019 |           | 514795 | Knobhill 138                     | 520201 |
| 200298 | 30761 | 51033 | AEP  | Transmission Service | \$6,566,218  | AEP  | Rebuild 2.3 miles of 138 kV 954 ACSR conductor with 1590 ACSR conductor from Cedar Grove to South Shreveport. Replace breaker, switches, and jumpers at South Shreveport. Replace switch at Cedar Grove.                                                                          |           | 6/1/2020 |           | 507771 | CEDARGROVE                       | 507755 |
| 200262 | 30766 | 51039 | SPS  | Transmission Service | \$3,632,101  | SPS  | Upgrade Yoakum County Interchange Ckt 1 230/115 kV transformer to 250 MVA.                                                                                                                                                                                                        | 6/1/2019  | 6/1/2019 |           | 526935 | Yoakum County Interchange 230 kV | 526934 |
| 200272 | 30769 | 51045 | AEP  | High Priority        | \$2,248,743  | SPP  | Build 138 kV line from Benteler to Port Robson (circuit 1).                                                                                                                                                                                                                       | 6/1/2015  | 6/1/2015 | 36 months | 507792 |                                  | 507782 |
| 200272 | 30769 | 51046 | AEP  | High Priority        | \$2,548,575  | SPP  | Build 138 kV line from Benteler to Port Robson (circuit 2).                                                                                                                                                                                                                       | 6/1/2015  | 6/1/2015 | 36 months | 507792 |                                  | 507782 |
| 200286 | 30771 | 51048 | MIDW | High Priority        | \$4,477,251  | MIDW | Tap existing 115 kV line from Kanarado (Sunflower) to Sharon Springs to construct new Midwest Pump Tap substation.                                                                                                                                                                | 7/2/2016  | 6/1/2015 | 24 months | 530700 |                                  |        |
| 200286 | 30771 | 51049 | MIDW | High Priority        | \$2,443,469  | MIDW | Build new 5-mile 115 kV line from Midwest Pump to the new Midwest Pump Tap substation.                                                                                                                                                                                            | 7/2/2016  | 6/1/2015 | 24 months | 530700 |                                  | 530701 |
| 200262 | 30766 | 51050 | SPS  | Regional Reliability | \$3,432,506  | SPS  | Upgrade Yoakum County Interchange Ckt 2 230/115 kV transformer to 250 MVA.                                                                                                                                                                                                        | 6/1/2019  | 6/1/2019 |           | 526935 | Yoakum County Interchange 230 kV | 526934 |
| 200282 | 30777 | 51059 | SPS  | High Priority        | \$327,861    | SPS  | Tap existing 115 kV line from South Hobbs to the Switch 4J44 substation to construct new Oxy South Hobbs substation.                                                                                                                                                              | 6/30/2015 | 6/1/2018 | 24 months | 528480 |                                  |        |
|        | 30778 | 51060 | TBD  | High Priority        | \$8,853,879  |      | Construct new 12-mile 115 kV line from Andrews to Cardinal.                                                                                                                                                                                                                       |           | 6/1/2021 | 36 months | 528602 |                                  | 528596 |
|        | 30779 | 51061 | TBD  | High Priority        | \$217,378    |      | Construct new 0.3-mile 138 kV line from Barber to Medicine Lodge.                                                                                                                                                                                                                 |           | 6/1/2023 | 36 months | 539674 | Medicine Lodge 138 KV            | 539998 |
|        | 30779 | 51062 | TBD  | High Priority        | \$2,810,198  |      | Install new 138/115 kV 250 MVA transformer at Barber substation. Install any necessary 138 kV terminal equipment                                                                                                                                                                  |           | 6/1/2023 | 36 months | 539673 | Medicine Lodge 115 KV            | 539998 |
|        | 30780 | 51063 | TBD  | High Priority        |              |      | Install new 18-Mvar capacitor bank at Milan 138 kV.                                                                                                                                                                                                                               |           | 6/1/2023 |           | 539676 | MILAN 4 138                      |        |
|        | 30681 | 51073 | TBD  | High Priority        | \$10,516,124 |      | Install 2nd 345/230 kV 675 MVA transformer at Chisholm substation. Install any necessary 230 kV terminal equipment.                                                                                                                                                               |           | 6/1/2021 | 36 months | 511553 | Elk City 345 kV                  | 511490 |
|        | 30790 | 51074 | TBD  | High Priority        | \$3,365,848  |      | Rebuild 4.8 miles to 959.6 ACSR/TW. Upgrade jumpers at Hughes Springs.                                                                                                                                                                                                            |           | 6/1/2023 | 24 months | 508291 | HUGHES SPRINGS                   | 508293 |
|        | 30791 | 51075 | TBD  | High Priority        | \$4,207,310  |      | Rebuild 6-mile 69kV line from Plattsmouth to S985.                                                                                                                                                                                                                                |           | 6/1/2023 | 24 months | 640320 | Plattsmouth                      | 647985 |
|        | 30792 | 51076 | TBD  | High Priority        | \$2,503,349  |      | Rebuild 3.6-mile 69kV line from S906 to S928.                                                                                                                                                                                                                                     |           | 6/1/2023 | 24 months | 647006 | Sub 906 North Bus                | 647928 |
|        | 30793 | 51077 | TBD  | High Priority        | \$785,365    |      | Rebuild 1.1-mile 69kV line from JCT205 to S901.                                                                                                                                                                                                                                   |           | 6/1/2023 | 24 months | 647901 | Sub 901                          | 647105 |
|        | 30793 | 51078 | TBD  | High Priority        | \$2,012,497  |      | Rebuild 2.9-mile 69kV line from JCT205 to S910.                                                                                                                                                                                                                                   |           | 6/1/2023 | 24 months | 647910 | Sub 910                          | 647105 |



|  |       |       |     |               |              |     |                                                                                                                                                                                   |  |          |           |        |                       |        |
|--|-------|-------|-----|---------------|--------------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------|-----------|--------|-----------------------|--------|
|  | 30794 | 51079 | TBD | High Priority | \$2,804,873  |     | Rebuild the 4-mile 69 kV line from Gypsum to Russell to achieve a rating of 53/65 MVA.                                                                                            |  | 6/1/2023 | 24 months | 520929 | GYPSUM                | 521042 |
|  | 30794 | 51080 | TBD | High Priority | \$4,978,650  |     | Rebuild the 7.1-mile 69 kV line from El Dorado Junction to Gypsum to achieve a rating of 53/65 MVA.                                                                               |  | 6/1/2023 | 24 months | 520895 | ELDORADO JCT          | 520929 |
|  | 30795 | 51081 | TBD | High Priority | \$10,518,275 |     | Rebuild the 15-mile 69 kV line from El Dorado to Lake Pauline WTU to achieve a rating of 53/65 MVA.                                                                               |  | 6/1/2023 | 24 months | 520896 | ELDORADO              | 512111 |
|  | 30796 | 51082 | TBD | High Priority | \$500,000    |     | Install new 3-Mvar capacitor bank at Manning 115 kV.                                                                                                                              |  | 6/1/2023 | 18 months | 531362 | MANNING TAP           |        |
|  | 30797 | 51083 | TBD | High Priority | \$237,000    |     | Install new 12-Mvar capacitor bank at Sugden 69 kV.                                                                                                                               |  | 6/1/2023 | 18 months | 521057 | SUGDEN                |        |
|  | 30798 | 51084 | TBD | High Priority | \$237,000    |     | Install new 4.8-Mvar capacitor bank at Walville 69 kV.                                                                                                                            |  | 6/1/2023 | 18 months | 521087 | WALLVILLE             |        |
|  | 30799 | 51085 | TBD | High Priority |              |     | Restore the rating of the 138 kV line from Kinzie to 19th Street to 203/238 MVA.                                                                                                  |  | 6/1/2023 | 12 months | 512710 | STILLWATER KINZIE 138 | 512712 |
|  | 30800 | 51086 | TBD | High Priority | \$3,881,288  |     | Install new 161/69 kV 134 MVA transformer at Humboldt substaton. Install any necessary 69 kV terminal equipment.                                                                  |  | 6/1/2018 | 24 months | 640234 | Humboldt              | 647975 |
|  | 30801 | 51087 | TBD | High Priority | \$500,000    |     | Add 14.4 Mvar capacitor bank to Glencoe 138 kV.                                                                                                                                   |  | 6/1/2023 | 18 months | 301425 |                       |        |
|  | 30802 | 51088 | TBD | High Priority | \$3,856,701  |     | Rebuild 5.5-mile 69 kV line from Big Sandy to Hawkins with 1233.6 ACSR/TW conductor to achieve a new line rating of 123/143 MVA.                                                  |  | 6/1/2023 | 24 months | 508335 | BIG SANDY             | 508344 |
|  | 30803 | 51089 | TBD | ITP           | \$7,248,352  | SPP | Rebuild Grand Saline - Mineola 69 kV line, and upgrade jumpers,switches,CT ratios and relay settings at both substations                                                          |  | 4/1/2020 | 24 months | 508342 | GRAND SALINE          | 508347 |
|  | 30804 | 51090 | TBD | High Priority | \$6,030,478  |     | Rebuild 8.6-mile 69 kV line from North Mineola to Quitman with 959.6 ACSR/TW and upgrade bus, jumpers, CT ratios and relay settings at Quitman. New ratings 64/94 MVA.            |  | 6/1/2023 | 24 months | 508348 | NORTH MINEOLA 69KV    | 508353 |
|  | 30805 | 51091 | TBD | High Priority | \$981,706    |     | Adora T - Adora - Winfield: Rebuild 6.5 miles to 959.6 ACSR/TW. Upgrade CT ratios at Winfield. New ratings 137/137.                                                               |  | 6/1/2023 | 24 months | 508284 | ADORA REC             | 508285 |
|  | 30805 | 51092 | TBD | High Priority | \$3,576,213  |     | Adora T - Adora - Winfield: Rebuild 6.5 miles to 959.6 ACSR/TW. Upgrade CT ratios at Winfield. New ratings 137/137.                                                               |  | 6/1/2023 | 24 months | 508284 | ADORA REC             | 508315 |
|  | 30806 | 51093 | TBD | High Priority | \$271,612    |     | Reconductor 0.7-mile 69 kV line from Blocker to Blocker Tap.                                                                                                                      |  | 6/1/2023 | 24 months | 509053 | BLOCKER               | 509055 |
|  | 30807 | 51094 | TBD | High Priority | \$29,512,930 |     | Construct new 40-mile 115 kV line from Stuart to the new SW Holt substation.                                                                                                      |  | 6/1/2023 | 36 months | 640367 | Stuart                | 640701 |
|  | 30808 | 51095 | TBD | High Priority | \$11,067,349 |     | Construct new 15-mile 115 kV line from Fullerton to the PS24 substation.                                                                                                          |  | 6/1/2023 | 36 months | 640176 | Fullerton             | 640434 |
|  | 30526 | 50657 | AEP | ITP           | \$4,744,431  | SPP | Rebuild 10-mile 69 kV line from Hobart to Roosevelt Tap to achieve a new emergency rating of 143 MVA. Upgrade jumpers, switches, CT ratios, and relay settings at Hobart.         |  | 6/1/2015 | 30 months | 511465 | HOBART                | 511444 |
|  | 30526 | 50658 | AEP | ITP           | \$9,218,626  | SPP | Rebuild 18.7-mile 69 kV line from Roosevelt Tap to Snyder 69 kV to achieve a new emergency rating of 158 MVA. Upgrade jumpers, switches, CT ratios, and relay settings at Snyder. |  | 6/1/2015 | 30 months | 511444 | ROOSEVELT TAP         | 511475 |
|  | 30666 | 50864 | SPS | ITP           | \$17,142,313 | SPP | Install new -50/+200 Mvar Static VAR Cacpacitor (SVC) at China Draw 115 kV bus.                                                                                                   |  | 4/1/2015 | 30 months | 528220 |                       |        |



|  |       |       |      |     |              |     |                                                                                                                                                                                               |  |          |           |        |                                                       |        |
|--|-------|-------|------|-----|--------------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------|-----------|--------|-------------------------------------------------------|--------|
|  | 30688 | 50915 | OGE  | ITP | \$84,327     | SPP | Upgrade Park Lane 138 kV CTs and wave trap from 1200 A to 1600 A to achieve a new emergency rating of 382.4 MVA on the 138 kV line from Park Lane to Seminole.                                |  | 6/1/2022 | 18 months | 515044 | SEMINOLE 138                                          | 515178 |
|  | 30690 | 50918 | SPS  | ITP | \$3,411,800  | SPP | Add 2nd 230/115 kV 250 kV transformer at Plant X.                                                                                                                                             |  | 6/1/2022 | 24 months | 525481 | Plant X Station 230 kV                                | 525480 |
|  | 30914 | 50952 | SPS  | ITP | \$6,469,386  | SPP | Reconductor 9.5-mile 115 kV line from Livingston Ridge to IMC #1 Tap.                                                                                                                         |  | 6/1/2015 | 30 months | 528035 | I. M. C. #1 Sub Tap 115 kV (International Mineral Co) | 527953 |
|  | 30914 | 50955 | SPS  | ITP | \$4,044,971  | SPP | Reconductor 5.9-mile 115 kV line from Ponderosa Tap to Whitten with 477 ACSS conductor to achieve a rating of 276/304 MVA.                                                                    |  | 6/1/2015 | 30 months | 528239 |                                                       | 528540 |
|  | 30914 | 50957 | SPS  | ITP | \$1,258,393  | SPP | Reconductor 1.5-mile 115 kV line from Intrepid West Tap to Potash Junction with 477 ACSS conductor to achieve a rating of 276/304 MVA.                                                        |  | 6/1/2015 | 30 months | 527999 |                                                       | 527962 |
|  | 30914 | 50958 | SPS  | ITP | \$2,655,853  | SPP | Reconductor 3.9-mile 115 kV line from Intrepid West Tap to IMC #2 with 477 ACSS conductor to achieve a rating of 276/304 MVA.                                                                 |  | 6/1/2015 | 30 months | 527999 |                                                       | 528035 |
|  | 30803 | 51089 | AEP  | ITP | \$7,248,352  | SPP | Rebuild Grand Saline - Mineola 69 kV line, and upgrade jumpers,switches,CT ratios and relay settings at both substations                                                                      |  | 4/1/2020 | 24 months | 508342 | GRAND SALINE                                          | 508347 |
|  | 30817 | 51109 | SPS  | ITP | \$8,110,872  | SPP | Rebuild 13.7-mile 115 kV line from Canyon West to Dawn to achieve a new emergency rating of 273 MVA.                                                                                          |  | 4/1/2018 | 30 months | 524516 | Canyon West Sub 115 kV                                | 524590 |
|  | 30817 | 51110 | SPS  | ITP | \$5,737,375  | SPP | Rebuild 8.4-mile 115 kV line from Dawn to Panda achieve a new emergency rating of 273 MVA.                                                                                                    |  | 4/1/2018 | 30 months | 524590 | Dawn Sub 115 kV                                       | 524597 |
|  | 30817 | 51111 | SPS  | ITP | \$3,550,001  | SPP | Rebuild 2.4-mile 4/0 segment of 115 kV line from Deaf Smith to Panda HFD with 795 ACSR conductor.                                                                                             |  | 4/1/2018 | 30 months | 524622 | Deaf Smith County Interchange 115 kV                  | 524597 |
|  | 30914 | 51131 | SPS  | ITP | \$2,655,853  | SPP | Rebuild 3.8-mile 115 kV line from Monument Tap to Byrd.                                                                                                                                       |  | 6/1/2015 | 30 months | 528582 | Byrd Sub 115 kV                                       | 528568 |
|  | 30666 | 51132 | SPS  | ITP | \$17,142,313 | SPP | Install new -50/+200 MVAR Static VAR Capacitor (SVC) at the Road Runner 115 kV bus.                                                                                                           |  | 4/1/2015 | 30 months | 528025 | Road Runner 115 kV                                    |        |
|  | 30838 | 51133 | OPPD | ITP | \$5,793,456  | SPP | Install a new 345/161 kV transformer at S3459. Install any necessary 161 kV terminal equipment.                                                                                               |  | 6/1/2019 | 24 months | 645459 | Sub 3459                                              | 646209 |
|  | 30838 | 51136 | OPPD | ITP | \$2,183,363  | SPP | Install any 345 kV terminal equipment required for new 345/161 kV transformer at S3459.                                                                                                       |  | 6/1/2019 | 24 months | 645459 | Sub 3459                                              |        |
|  | 30841 | 51137 | OGE  | ITP | \$4,537,130  | SPP | Reconductor 5.3-mile 138 kV line from Anadarko to Gracemont to achieve a new emergency rating of 286 MVA.                                                                                     |  | 4/1/2019 | 24 months | 515802 | Gracemont 138 kV                                      | 520814 |
|  | 30842 | 51138 | SPS  | ITP | \$1,780,240  | SPP | Reconductor 3.4-mile 115 kV line from Pantex North to Pantex South to achieve a new rating of 240 MVA.                                                                                        |  | 4/1/2019 | 24 months | 523938 | Pantex North Sub 115 kV                               | 523945 |
|  | 30843 | 51139 | OGE  | ITP | \$113,988    | SPP | Upgrade CT and wavetrap at both Cimarron and Draper 345 kV substations to 2000 A to achieve a new rating of 1195 MVA on the Cimarron - Draper 345 kV line.                                    |  | 4/1/2019 | 18 months | 514901 | CIMARRON 345                                          | 514934 |
|  | 30844 | 51140 | SPS  | ITP | \$54,284     | SPP | Upgrade wave traps at Sundown and Amoco to 1200 A to achieve a new emergency rating of 437 MVA on the 230 kV line from Amoco to Sundown.                                                      |  | 1/1/2019 | 18 months | 526435 | Sundown Interchange 230 kV                            | 526460 |
|  | 30842 | 51141 | SPS  | ITP | \$3,560,480  | SPP | Reconductor 6.8-mile 115 kV line from Highland Park Tap to Pantex South to achieve a new emergency rating of 240 MVA. Replace wave trap at Pantex South. Replace switch at Highland Park Tap. |  | 4/1/2019 | 24 months | 523931 | Highland Park Tap 115 kV                              | 523945 |

|  |       |       |      |     |              |     |                                                                                                                                                                                                                                                                                     |  |          |           |        |                                            |        |
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|  | 30842 | 51142 | SPS  | ITP | \$3,514,318  | SPP | Reconductor 5.1-mile 115 kV line from Martin to Pantex North to achieve a new rating emergency rating of 240 MVA. Replace wave trap at Pantex North.                                                                                                                                |  | 4/1/2019 | 24 months | 523928 | Martin Sub 115 kV                          | 523938 |
|  | 30847 | 51144 | AEP  | ITP | \$10,018,471 | SPP | Rebuild 11.2-mile 138 kV line from South Shreveport to Wallace Lake to achieve a new emergency rating of 246 MVA. Upgrade wavetrap and conductor within South Shreveport substation to 1200 A.                                                                                      |  | 6/1/2019 | 24 months | 507755 | SOUTH SHREVEPORT 138KV                     | 507765 |
|  | 30848 | 51146 | GRDA | ITP | \$86,400     | SPP | Replace CT at Claremore to achieve a new emergency rating of 261 MVA on the 161 kV line from Claremore to GRDA 1.                                                                                                                                                                   |  | 6/1/2018 | 18 months | 512651 | CLAREMORE 161                              | 512656 |
|  | 30849 | 51148 | NPPD | ITP | \$29,610,781 | SPP | Rebuild 39.4-mile 115 kV from North Platt to Stockville to achieve a new emergency rating of 240 MVA.                                                                                                                                                                               |  | 1/1/2019 | 30 months | 640287 | North Platte 115 kV                        | 640365 |
|  | 30849 | 51149 | NPPD | ITP | \$16,665,000 | SPP | Rebuild 21-mile 115 kV from Red Willow to Stockville to achieve a new emergency rating of 240 MVA.                                                                                                                                                                                  |  | 1/1/2019 | 30 months | 640365 | Stockville 115 kV                          | 640326 |
|  | 30849 | 51150 | SEPC | ITP | \$3,996,563  | SPP | Install a second 345/115 kV transformer at Mingo. Install any necessary 115 kV terminal equipment.                                                                                                                                                                                  |  | 6/1/2015 | 24 months | 531451 | Mingo 345 kV                               | 531429 |
|  | 30850 | 51151 | KCPL | ITP | \$15,726,289 | SPP | Convert existing 18.2-mile 161 kV line from Iatan to Stranger Creek to 345 kV.                                                                                                                                                                                                      |  | 1/1/2019 | 36 months | 542982 | IATAN 345 KV                               | 532772 |
|  | 30852 | 51153 | SPS  | ITP | \$1,495,913  | SPP | Install a second 115/69 kV transformer at Lovington. Install any necessary 69 kV terminal equipment.                                                                                                                                                                                |  | 6/1/2015 | 24 months | 528618 | Lea County REC-Lovington Interchange 69 kV | 528334 |
|  | 30854 | 51156 | WR   | ITP | \$7,686,209  | SPP | Rebuild 3.1-mile 115 kV line from Forbes to Underpass North using single 1192.5 ACSR conductor to achieve a new emergency rating of 262 MVA. Rebuild Underpass 115 kV substation with ring bus breaker configuration and new 2000 A terminal equipment.                             |  | 6/1/2021 | 24 months | 533157 | FORBES FIELD 115 KV                        | 533189 |
|  | 30855 | 51157 | WR   | ITP | \$6,033,488  | SPP | Rebuild 6.3-mile 138 kV line from Murray Gill East Energy Center to Interstate to achieve new emergency rating of 286 MVA. Replace jumpers at Interstate and Murray Gill East Energy Center.                                                                                        |  | 6/1/2022 | 24 months | 533044 | GILL ENERGY CENTER EAST 138 KV             | 533051 |
|  | 30856 | 51158 | SPS  | ITP | \$7,789,804  | SPP | Tap the existing Northwest to Bush 115kV line approximately 2 miles from Northwest substation to create new Bush Tap substation. Build new 3-mile 115 kV line from Bush Tap to Hastings with 795 ACSS conductor.                                                                    |  | 6/1/2022 | 30 months | 524122 | Bush Tap 115 kV                            | 524136 |
|  | 30857 | 51159 | WR   | ITP | \$9,974,068  | SPP | Add four (4) new 345 kV terminals to the Moundridge substation, configured in a ring bus breaker scheme. Tap the existing 345 kV line from Reno County to Wichita and terminate both ends into new 345 kV terminals at Moundridge. Install any necessary 345 kV terminal equipment. |  | 6/1/2019 | 24 months | 532779 | Moundridge 345 kV                          | 532796 |
|  | 30857 | 51161 | WR   | ITP | \$4,389,083  | SPP | Install a new 345/138 kV transformer at Moundridge. Install any necessary 115 kV terminal equipment.                                                                                                                                                                                |  | 6/1/2019 | 24 months | 532779 | Moundridge 345 kV                          | 533013 |
|  | 30858 | 51162 | SPS  | ITP | \$809,640    | SPP | Install one (1) 14.4 MVAR capacitor bank at Allred 115 kV.                                                                                                                                                                                                                          |  | 6/1/2021 | 24 months | 527024 | Allred & Cortez Subs 115 kV                |        |

|  |       |       |      |     |              |     |                                                                                                                                                |  |          |           |        |                                             |        |
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|  | 30859 | 51163 | SPS  | ITP | \$809,640    | SPP | Install one (1) 14.4 MVAR capacitor bank at Plains Interchange 115 kV.                                                                         |  | 6/1/2015 | 24 months | 526928 | Lea County REC-Plains Interchange115 kV     |        |
|  | 30860 | 51164 | SPS  | ITP | \$1,619,280  | SPP | Install two (2) stages of 14.4 MVAR capacitor banks at China Draw 115 kV.                                                                      |  | 6/1/2022 | 24 months | 528222 | China Draw 115 kV                           |        |
|  | 30860 | 51165 | SPS  | ITP | \$1,619,280  | SPP | Install two (2) stages of 14.4 MVAR capacitor banks at North Loving 115 kV.                                                                    |  | 6/1/2022 | 24 months | 528182 | North Loving 115 kV                         |        |
|  | 30914 | 51166 | SPS  | ITP | \$1,619,280  | SPP | Install two (2) stages of 14.4 MVAR capacitor banks at Ochoa 115 kV.                                                                           |  | 6/1/2015 | 30 months | 528232 | Ochoa Sub 115 kV                            |        |
|  | 30862 | 51167 | SEPC | ITP | \$337,350    | SPP | Install one (1) 6 MVAR capacitor bank at Grinnell 115 kV.                                                                                      |  | 6/1/2023 | 24 months | 531412 | Grinnell 115 kV                             |        |
|  | 30863 | 51168 | WAPA | ITP | \$337,350    | SPP | Install one (1) 6 MVAR capacitor bank at Miles City 115 kV.                                                                                    |  | 6/1/2019 | 24 months | 652412 | Miles City East 115 kV                      |        |
|  | 30866 | 51170 | SPS  | ITP | \$27,142     | SPP | Replace wave trap at Amarillo South to achieve a new emergency rating of 520 MVA on the 230 kV line from Amarillo South to Swisher County.     |  | 4/1/2020 | 18 months | 524415 | Amarillo South Interchange 230 kV           | 525213 |
|  | 30867 | 51171 | SPS  | ITP | \$3,051,300  | SPP | Upgrade existing 230/115 kV transformer at Tuco to achieve a new emergency rating of 288 MVA.                                                  |  | 6/1/2022 | 24 months | 525830 | TUCO Interchange 230 kV                     | 525828 |
|  | 30868 | 51172 | AEP  | ITP | \$251,887    | SPP | Rebuild 0.32-mile 138 kV from Enogex Wilburton Tap to Lone Oak to achieve a new emergency rating of 286 MVA.                                   |  | 4/1/2023 | 30 months | 510897 | Lone Oak 138 kV                             | 510944 |
|  | 30868 | 51173 | AEP  | ITP | \$16,726,892 | SPP | Rebuild 22.5-mile 138 kV from Enogex Wilburton Tap to Sardis to achieve a new emergency rating of 286 MVA.                                     |  | 4/1/2023 | 30 months | 510944 | Enogex Wilburton Tap 138 kV                 | 510926 |
|  | 30868 | 51174 | AEP  | ITP | \$3,353,250  | SPP | Rebuild 3.6-mile 138 kV from Clayton to Sardis to achieve a new emergency rating of 286 MVA.                                                   |  | 4/1/2023 | 30 months | 510926 | Sardis 138 kV                               | 510919 |
|  | 30868 | 51175 | AEP  | ITP | \$8,152,603  | SPP | Rebuild 11.6-mile 138 kV from Clayton to Nashoba to achieve a new emergency rating of 286 MVA.                                                 |  | 4/1/2023 | 30 months | 510919 | Clayton 138 kV                              | 510927 |
|  | 30868 | 51176 | AEP  | ITP | \$17,844,360 | SPP | Rebuild 22.4-mile 138 kV from Bethel to Nashoba to achieve a new emergency rating of 286 MVA.                                                  |  | 4/1/2023 | 30 months | 510927 | Nashoba 138 kV                              | 510928 |
|  | 30868 | 51177 | AEP  | ITP | \$12,992,400 | SPP | Rebuild 16.3-mile 138 kV from Bethel to Broken Bow to achieve a new emergency rating of 286 MVA.                                               |  | 4/1/2023 | 30 months | 510928 | Bethel 138 kV                               | 505614 |
|  | 30864 | 51178 | AEP  | ITP | \$171,990    | SPP | Upgrade relays and relays settings at Sand Springs to achieve a new emergency rating of 309 MVA on the Prattville - Sand Springs 138 kV line . |  | 6/1/2023 | 18 months | 509815 | Sand Springs 138 kV                         | 509758 |
|  | 30849 | 51180 | SEPC | ITP | \$1,983,363  | SPP | Install any 345 kV terminal equipment required for second 345/115 kV transformer at Mingo.                                                     |  | 6/1/2015 | 24 months | 531451 | Mingo 345 kV                                |        |
|  | 30852 | 51181 | SPS  | ITP | \$689,063    | SPP | Install any 115 kV terminal equipment required for second 115/69 kV transformer at Lovington.                                                  |  | 6/1/2015 | 24 months | 528334 | Lea County REC-Lovington Interchange 115 kV |        |
|  | 30873 | 51187 | AEP  | ITP | \$13,404,139 | SPP | Rebuild 16.5 miles at Southwestern Station-Carnegie 138 kV                                                                                     |  | 6/1/2016 | 30 months | 511477 | SOUTHWESTERN STATION 138KV                  | 511445 |
|  | 30875 | 51189 | SPS  | ITP | \$6,736,917  | SPP | Rebuild of the PCA Interchange and Quahada 115kV line.                                                                                         |  | 6/1/2016 | 30 months | 527930 | PCA Interchange 115 kV                      | 528394 |
|  | 30876 | 51190 | OGE  | ITP | \$5,060,286  | SPP | Rebuild of the Little River and Maud 69kV line.                                                                                                |  | 6/1/2015 | 24 months | 515054 | MAUD 69                                     | 515503 |
|  | 30877 | 51191 | GMO  | ITP | \$4,329,248  | SPP | Rebuild of Harrisonville North and Ralph Green 69kV line.                                                                                      |  | 6/1/2015 | 24 months | 541279 | Ralph Green 69 KV                           | 541297 |
|  | 30878 | 51192 | WFEC | ITP | \$1,854,448  | SPP | Install new 138/69 kV transformer at Byron.                                                                                                    |  | 6/1/2016 | 24 months | 520203 |                                             | 520207 |
|  | 30879 | 51193 | WR   | ITP | \$5,379,150  | SPP | Add a second 230/115kV transformer at Lawrence Hill.                                                                                           |  | 6/1/2017 | 24 months | 532853 | LAWRENCE HILL 230 KV                        | 533250 |
|  | 30914 | 51194 | SPS  | ITP | \$6,465,875  | SPP | Install 100MVAR capacitor at Potash 230kV Substation.                                                                                          |  | 6/1/2015 | 30 months | 527963 | Potash Junction Interchange 230 kV          |        |

|  |       |       |      |     |             |     |                                                                                                                                                                                 |  |          |           |        |                                   |        |
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|  | 30914 | 51195 | SPS  | ITP | \$1,619,280 | SPP | Install 28.8MVAR capacitors at Road Runner 115kv substation                                                                                                                     |  | 6/1/2015 | 30 months | 528025 | Road Runner 115 kV                |        |
|  | 30881 | 51197 | KCPL | ITP | \$1,355,978 | SPP | Replace Existing 161/69 kV transformer at South Waverly to increase ratings from 22 MVA to 50 MVA.                                                                              |  | 6/1/2015 | 24 months | 543063 | SOUTH WAVERLY 161 KV              | 543094 |
|  | 30883 | 51200 | NPPD | ITP | \$5,118,750 | SPP | Tap Ainsworth and Stuart 115kV line for the new Bassett substation. Install 9-MVAR capacitor bank at Bassett.                                                                   |  | 6/1/2016 | 24 months | 640580 |                                   |        |
|  | 30884 | 51202 | OGE  | ITP | \$2,786,625 | SPP | Install 138/69 kV bus tie transformer in OG&E Stillwater substation and interface OG&E Stillwater 69 kV substation with existing Stillwater Municipal 69 kV transmission system |  | 6/1/2019 | 24 months | 515011 | STILLWATER 138                    | 999919 |
|  | 30885 | 51203 | WR   | ITP | \$2,054,345 | SPP | Rebuild 69 kV line between Neosho SES and Labette.                                                                                                                              |  | 6/1/2019 | 24 months | 533696 | LABETTE SWITCHING STATION 69 KV   | 533768 |
|  | 30888 | 51206 | SPS  | ITP | \$1,830,575 | SPP | Upgrade Lynn County 115/69 kV transformer.                                                                                                                                      |  | 6/1/2019 | 24 months | 526656 | Lynn County Interchange 115 kV    | 526655 |
|  | 30889 | 51207 | AEP  | ITP | \$3,409,682 | SPP | Rebuild the 138kV line between Linwood, Cedar Grove, and South Shreveport upgrade the jumpers at Linwood to 276/376 MVA.                                                        |  | 6/1/2017 | 24 months | 507738 | LINWOOD                           | 507771 |
|  | 30916 | 51209 | SEPC | ITP | \$1,480,238 | SPP | Upgrade terminal equipment at the Buckner and Spearville 345kV line.                                                                                                            |  | 6/1/2015 | 18 months | 531469 | SPEARVILLE                        | 531501 |
|  | 30890 | 51210 | EDE  | ITP | \$916,722   | SPP | Rebuild 1.33 miles of the 69kV line between the Joplin 26th st sub 59 and the Joplin 10th St sub 64 substations.                                                                |  | 6/1/2016 | 24 months | 547526 | SUB 64 - JOPLIN 10TH ST.          | 547525 |
|  | 30891 | 51211 | WR   | ITP | \$480,900   | SPP | Upgrade terminal equipment at Benton 138kV substation to increase transformer ratings.                                                                                          |  | 6/1/2015 | 18 months | 532986 | BENTON 138 KV                     | 532791 |
|  | 30892 | 51212 | GRDA | ITP | \$134,800   | SPP | Upgrade breaker and relay at CPPX 69kV substation.                                                                                                                              |  | 6/1/2015 | 18 months | 512661 | CPP TRANSF #2 69                  |        |
|  | 30893 | 51213 | SPS  | ITP | \$822,140   | SPP | Install second one stage 14.4 MVAR capacitor bank at Texas County 115kV bus.                                                                                                    |  | 6/1/2019 | 24 months | 523090 | Texas County Interchange 115 kV   |        |
|  | 30894 | 51214 | SPS  | ITP | \$822,140   | SPP | Install 14.4 MVAR capacitor bank at Cargill 115kV bus.                                                                                                                          |  | 6/1/2019 | 24 months | 524648 | Cargill Sub 115 kV                |        |
|  | 30895 | 51215 | AEP  | ITP | \$570,052   | SPP | Rebuild Brooks Street and Edwards Street 69kV line and upgrade jumpers at each end.                                                                                             |  | 6/1/2016 | 24 months | 507717 | BROOKS STREET                     | 507722 |
|  | 30896 | 51216 | GRDA | ITP | \$647,712   | SPP | Install 14.4 MVAR capacitor at Boomer 69kV bus.                                                                                                                                 |  | 6/1/2015 | 24 months | 512663 | STILLWATER BOOMER 69              |        |
|  | 30897 | 51217 | SPS  | ITP | \$647,712   | SPP | Install 14.4 MVAR Capacitor bank at Lea County Bronco 69kV Bus                                                                                                                  |  | 6/1/2015 | 24 months | 528727 | Lea County REC-Bronco 69 kV       |        |
|  | 30899 | 51219 | OGE  | ITP | \$647,712   | SPP | Install a 14.4 MVAR capacitor bank at Four Corners 69kV bus.                                                                                                                    |  | 6/1/2015 | 24 months | 514736 | FOUR CORNERS 69                   |        |
|  | 30900 | 51220 | OGE  | ITP | \$469,219   | SPP | Install new 69kv breaker at Warner Tap to facilitate closing of the 69kV switch at Wells substation.                                                                            |  | 6/1/2015 | 18 months | 515202 | WELLS 69                          |        |
|  | 30901 | 51221 | GRDA | ITP | \$539,760   | SPP | Install 12MVAR Capacitor Bank at Newport 69kV bus                                                                                                                               |  | 6/1/2015 | 24 months | 512645 | NEWPORT 69                        |        |
|  | 30902 | 51222 | SPS  | ITP | \$449,800   | SPP | Install 10MVAR capacitor bank at Lea County Williams 69kV bus.                                                                                                                  |  | 6/1/2015 | 24 months | 528659 | Lea County REC-Williams Sub 69 kV |        |
|  | 30903 | 51223 | WFEC | ITP | \$224,900   | SPP | Install a 5 MVAR capacitor bank at Winchester 69kV bus.                                                                                                                         |  | 6/1/2020 | 24 months | 520408 |                                   |        |
|  | 30904 | 51224 | GRDA | ITP | \$172,049   | SPP | Install 3.6 MVAR capacitor at Childers 69kv bus                                                                                                                                 |  | 6/1/2018 | 24 months | 512723 | CHILDERS 69                       |        |
|  | 30905 | 51225 | WFEC | ITP | \$160,241   | SPP | Install 3 MVAR capacitor bank at Thackerville 69kV bus.                                                                                                                         |  | 6/1/2019 | 24 months | 521068 | THACKERVILLE                      |        |
|  | 30909 | 51230 | GRDA | ITP | \$86,469    | SPP | Replace CTs and relays at both Collinsville and Skiatook substations to achive a new rating of 44 MVA on the Collinsville - Skiatook 69 kV line.                                |  | 6/1/2017 | 18 months | 512676 | COLLINSVILLE 69                   |        |

|  |       |       |      |     |              |     |                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |          |           |        |                                      |        |
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|  | 30912 | 51235 | SPS  | ITP | \$9,639,744  | SPP | Tap the existing 345 kV line from Finney to Hitchland to construct the new Walkemeyer Tap substation. Install any necessary 345 kV terminal equipment.                                                                                                                                                                                                                                                                                  |  | 6/1/2015 | 36 months | 531512 | Walkemeyer Tap 345 kV                |        |
|  | 30912 | 51236 | SPS  | ITP | \$3,444,000  | SPP | Install new 345/115 kV transformer at the new Walkemeyer Tap substation. Install any necessary 115 kV terminal equipment.                                                                                                                                                                                                                                                                                                               |  | 6/1/2015 | 36 months | 531512 | Walkemeyer Tap 345 kV                | 531405 |
|  | 30913 | 51237 | SPS  | ITP | \$5,102,450  | SPP | Convert RIAC substation to 115kV. Install a new 3-way 115kV line switch tapping the Roswell Intg to Brasher 115kV line. Wreckout the existing 69kV transmission lines to the RIAC substation and rebuild the 1.5-mile 69kV line from the north with a new 115 kV line to RIAC. Add a new 115 kV terminal at Roswell Interchange and build a new 0.1-mile line out of Roswell Interchange to connect to the Roswell City 115 kV circuit. |  | 6/1/2015 | 24 months | 527552 | RIAC Subs 69 kV                      |        |
|  | 30912 | 51239 | SPS  | ITP | \$423,644    | SPP | Construct SPS's portion of new 1-mile 115 kV line from Walkemeyer to the new Walkemeyer Tap substation.                                                                                                                                                                                                                                                                                                                                 |  | 6/1/2015 | 36 months | 531405 | Walkemeyer 115 kV                    |        |
|  | 30912 | 51240 | SEPC | ITP | \$423,644    | SPP | Construct SEPC's portion of new 1-mile 115 kV line from Walkemeyer to the new Walkemeyer Tap substation.                                                                                                                                                                                                                                                                                                                                |  | 6/1/2015 | 36 months | 531405 | Walkemeyer 115 kV                    |        |
|  | 30912 | 51241 | SEPC | ITP | \$3,907,813  | SPP | Install any 115 kV terminal equipment at the existing Walkemeyer substation necessary to accommodate terminations of new 115 kV lines from the new Walkemeyer Tap substation and North Liberal.                                                                                                                                                                                                                                         |  | 6/1/2015 | 36 months | 531405 | Walkemeyer 115 kV                    |        |
|  | 30912 | 51242 | SEPC | ITP | \$16,813,452 | SPP | Construct new 21-mile 115 kV line from North Liberal to Walkemeyer.                                                                                                                                                                                                                                                                                                                                                                     |  | 6/1/2015 | 36 months | 539737 | North Liberal 115 KV                 |        |
|  | 30912 | 51243 | SEPC | ITP | \$689,063    | SPP | Install any 115 kV terminal equipment at the existing North Liberal substation necessary to accommodate termination of new 115 kV line from Walkemeyer.                                                                                                                                                                                                                                                                                 |  | 6/1/2015 | 36 months | 539737 | North Liberal 115 KV                 |        |
|  | 30914 | 51245 | SPS  | ITP | \$2,049,062  | SPP | Rebuild 3-mile 115 kV line from Cardinal to Targa to achieve a new rating of 276/304 MVA.                                                                                                                                                                                                                                                                                                                                               |  | 6/1/2015 | 30 months |        |                                      |        |
|  | 30914 | 51250 | SPS  | ITP | \$2,909,669  | SPP | Wreck out and rebuild the 115kv line between National Enrich Plant and Targa to increase the ratings from 120/120 MVA to 276/304 MVA                                                                                                                                                                                                                                                                                                    |  | 6/1/2015 | 30 months | 528603 | National Enrichment Plant Sub 115 kV | 528540 |
|  | 30914 | 51254 | SPS  | ITP | \$1,619,280  | SPP | Install 28.8 MVAR capacitor bank at Agave Hill substation 115kV.                                                                                                                                                                                                                                                                                                                                                                        |  | 6/1/2015 | 30 months | 528230 |                                      |        |
|  | 30878 | 51267 | WFEC | ITP | \$380,635    | SPP | Install 138 kV terminal equipment at Byron necessary to install new 138/69 kV transformer.                                                                                                                                                                                                                                                                                                                                              |  | 6/1/2016 | 24 months |        |                                      |        |
|  | 30881 | 51268 | KCPL | ITP | \$85,632     | SPP | Install 161 kV terminal upgrades at South Waverly necessary to upgrade existing 161/69 transformer to increase the normal rating from 22 MVA to 50 MVA.                                                                                                                                                                                                                                                                                 |  | 6/1/2015 | 24 months | 543063 | SOUTH WAVERLY 161 KV                 |        |
|  | 30884 | 51269 | OGE  | ITP | \$611,398    | SPP | Install any required 138 kV terminal equipment to install new 138/69 kV transformer at Stillwater.                                                                                                                                                                                                                                                                                                                                      |  | 6/1/2019 | 24 months | 515011 | STILLWATER 138                       |        |
|  | 30888 | 51270 | SPS  | ITP | \$19,425     | SPP | Install 115 kV terminal equipment at Lynn County necessary to upgrade 115/69 kV transformer.                                                                                                                                                                                                                                                                                                                                            |  | 6/1/2019 | 24 months | 526656 | Lynn County Interchange 115 kV       |        |
|  | 30917 | 51271 | SEPC | ITP | \$809,640    | SPP | Install one (1) 14.4-MVAR capacitor bank on the 115 kV bus at Ellsworth.                                                                                                                                                                                                                                                                                                                                                                |  | 6/1/2019 | 24 months | 539662 | Ellsworth 115 KV                     |        |

|  |       |       |      |                            |              |                   |                                                                                                                                                                                                                                                                                                                                                                      |            |          |           |           |                     |        |
|--|-------|-------|------|----------------------------|--------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------|-----------|-----------|---------------------|--------|
|  | 30921 | 51276 | NPPD | ITP                        | \$5,673,047  | SPP               | Rebuild 7.1-mile 115 kV line from Ainsworth to Ainsworth Wind to achieve a new emergency rating of 140 MVA.                                                                                                                                                                                                                                                          |            | 6/1/2020 | 24 months |           |                     |        |
|  | 30416 | 50509 | MKEC | Generation Interconnection | \$7,424,833  | Original estimate | Build approximately 20 miles of 115kV to serve as second circuit between North Ft Dodge and Spearville. Reroute Ft. Dodge - Greensburg 115kV to North Ft. Dodge Substation.                                                                                                                                                                                          | 4/30/2015  |          | 36 months | \$539,671 | Judson Large 115 KV | 539771 |
|  | 30417 | 50510 | MKEC | Generation Interconnection | \$18,276,977 | MKEC              | Add 345/115 kV transformer at Spearville. Needed as Network Upgrade for GEN-2008-079 but cost shared with GEN-2006-006 & previously with GEN-2009-062 prior to that project's withdrawal.                                                                                                                                                                            | 4/30/2015  |          | 36 months | 531469    | SPEARVILLE          | 539694 |
|  | 30592 | 50752 | SPS  | Generation Interconnection | \$12,525,622 | GEN-2008-022 (\$  | 345kV ring bus substation including: three (3) 345kV circuit breakers, control house, transmission line work, right-of-way, relay upgrades, disturbance monitoring device, reactors, and associated equipment.                                                                                                                                                       | 5/1/2015   |          |           |           |                     |        |
|  | 30658 | 50843 | SEPC | Generation Interconnection | \$3,864,028  | SEPC              | Setab 345kV substation: Construct 345kV dead end tower, disconnect switch, revenue metering and miscellaneous equipment to interconnect GEN-2008-017 as per GEN-2008-017 GIA (Service Agreement 2178R1, effective 1/28/2013.                                                                                                                                         | 7/1/2017   |          | 23 months |           |                     |        |
|  | 30659 | 50844 | SEPC | Generation Interconnection | \$8,304,207  | SEPC              | Setab 345kV substation: Add next rung to the existing breaker-and-a-half scheme for one (1) 345kV line terminal. Included are two (2) 345kV circuit breakers, four (4) 345kV breaker disconnect switches, one (1) 345kV line switch, bus supports, all associated structural steel, foundations, control house modifications and associated miscellaneous equipment. | 7/1/2017   |          | 23 months |           |                     |        |
|  | 30416 | 51007 | MKEC | Generation Interconnection | \$23,071,113 | MKEC              | Reroute Ft. Dodge - Greensburg 115kV to North Ft. Dodge Substation. Build second circuit between Ft. Dodge and North Ft Dodge (these stations are very close to each other).                                                                                                                                                                                         | 4/30/2015  |          | 36 months | 539671    | Judson Large 115 KV | 539771 |
|  | 30763 | 51036 | OGE  | Generation Interconnection | \$2,707,042  | EN-2007-062 (\$   | 345kV line terminal including two (2) 345kV circuit breakers, line relaying, disconnect switches, and associated equipment                                                                                                                                                                                                                                           | 5/20/2015  |          |           | 515375    | Woodward EHV 345kv  |        |
|  | 30768 | 51044 | MIDW | Generation Interconnection | \$599,380    | MIDW              | 230kV Line terminal including one (1) 230kV circuit breaker, disconnect switches, and associated equipment.                                                                                                                                                                                                                                                          | 9/1/2015   |          |           | 530584    | POST ROCK 230 KV    |        |
|  | 30782 | 51058 | OGE  | Generation Interconnection | \$2,466,719  | OGE               | 345kV line terminal including one (1) 345kV circuit breaker, line relaying, disconnect switches, and associated equipment                                                                                                                                                                                                                                            | 6/14/2015  |          |           |           |                     |        |
|  | 30783 | 51064 | WR   | Generation Interconnection | \$13,197,769 | 8-098 & GEN-20    | 345kV Ring-bus Substation including three (3) 345kV Circuit Breakers, Switches, CCVT's, wave traps, structures, relaying, inspection, and Transmission Line Work                                                                                                                                                                                                     | 2/10/2015  |          |           |           |                     |        |
|  | 30783 | 51065 | WR   | Generation Interconnection | \$478,861    | 8-098 & GEN-20    | 345kV Ring-bus Substation relaying and inspection                                                                                                                                                                                                                                                                                                                    | 2/10/2015  |          |           |           |                     |        |
|  | 30786 | 51069 | NPPD | Generation Interconnection | \$5,750,000  | EN-2010-051 (\$   | 230kV Line Terminal including four (4) breaker substation addition                                                                                                                                                                                                                                                                                                   | 10/24/2015 |          |           |           |                     |        |



|        |       |       |      |                                   |             |                |                                                                                                                                |            |          |  |  |  |  |  |
|--------|-------|-------|------|-----------------------------------|-------------|----------------|--------------------------------------------------------------------------------------------------------------------------------|------------|----------|--|--|--|--|--|
|        | 30787 | 51070 | NPPD | Generation<br>Interconnectio<br>n | \$100,000   | EN-2010-051 (S | Increase clearances to accommodate 320MVA facility<br>rating                                                                   | 10/24/2015 |          |  |  |  |  |  |
|        | 30788 | 51072 | OGE  | Generation<br>Interconnectio<br>n | \$2,554,395 | OGE            | 345kV Line Terminal including one (1) 345kV Circuit<br>Breaker line relaying, disconnect switches, and<br>associated equipment | 3/15/2015  |          |  |  |  |  |  |
| 200306 | 30731 | 50990 | AEP  | Regional<br>Reliability           | \$4,715,419 | AEP            | Rebuild 2.75-mile 69 kV line from Mt. Pleasant to West<br>Mt. Pleasant to achieve a new emergency rating of 84<br>MVA.         |            | 6/1/2015 |  |  |  |  |  |

| To Bus Name                      | Circuit | Voltages (kV) | Miles of New Line | Miles of Rebuild/Reconductor | Miles of Voltage Conversion | Ratings |
|----------------------------------|---------|---------------|-------------------|------------------------------|-----------------------------|---------|
| Artesia Interchange 69 kV        | 1       | 115/69        |                   |                              |                             | 84/84   |
| Artesia Interchange 115 kV       | 2       | 115/69        |                   |                              |                             | 84/84   |
| HAMMETT269.0                     | 1       | 138           | 10                |                              |                             | 219/235 |
| WOODWARD                         | 1       | 69            |                   | 3.5                          |                             | 91/114  |
| GEORGIA                          | 1       | 138           |                   | 2                            |                             | 212/264 |
| PAOLI                            | 1       | 69            |                   | 10.8                         |                             | 47/61   |
| WESTLINK 69 KV                   | 1       | 69            | 2.11              |                              |                             | 131/143 |
| TYLER 69 KV                      | 1       | 69            |                   | 2.65                         |                             | 131/143 |
| MOUNDRIDGE 115 KV                | 2       | 138/115       |                   |                              |                             | 110/125 |
| MARLOW JCT                       | 1       | 69            |                   | 7                            |                             | 72/72   |
| WALLVILLE                        | 1       | 69            |                   | 4.85                         |                             | 53/65   |
| INDIAHOMA                        | 1       | 138           |                   |                              | 3                           | 183/228 |
| CACHE 4                          | 1       | 138           | 13.7              |                              |                             | 183/228 |
| GRANDFIELD                       | 1       | 138/69        |                   |                              |                             | 70/70   |
|                                  | 1       | 115/69        |                   |                              |                             | 84/84   |
|                                  | 2       | 115/69        |                   |                              |                             | 84/84   |
| SIXTY-FOURTH (64TH) 69 KV        | 1       | 69            |                   | 2                            |                             | 131/143 |
| PERDUE 69KV                      | 1       | 69            |                   | 5.5                          |                             | 123/143 |
| FARMINGTON AECC                  | 1       | 161           |                   | 11.1                         |                             | 294/360 |
| Bailey County Interchange 115 kV | 1       | 115           | 41.5              |                              |                             | 273/300 |
| JEFFREY ENERGY CENTER 230 KV     | 1       | 230           | 30                |                              |                             | 797/797 |



|                                     |   |         |      |       |   |           |
|-------------------------------------|---|---------|------|-------|---|-----------|
| SOUTH SHREVEPORT 69KV               | 1 | 69      |      | 2.3   |   | 90/121    |
| KEATCHIE REC                        | 1 | 138     |      | 12.63 |   | 287/287   |
| Chaves County Interchange<br>115 kV | 2 | 230/115 |      |       |   | 250/250   |
| NORTHWEST HENDERSON<br>69KV         | 1 | 69      | 6.4  |       |   | 71/96     |
| NORTH MARKET                        | 1 | 69      | 4.7  |       |   | 136/143   |
| Kings River 161 kV                  | 1 | 345/161 |      |       |   | 400/440   |
| FORBING TAP                         | 1 | 69      |      | 2     |   | 90/121    |
| East Rogers 345                     | 1 | 345     | 9    |       |   | 1366/1915 |
| Kings River 161 kV                  | 1 | 345     | 32   |       |   | 1366/1915 |
| Artesia South Rural Sub 69 kV       | 1 | 69      | 3    |       |   | 179/197   |
|                                     |   |         |      |       |   |           |
| FERN STREET                         | 1 | 69      | 1    |       |   | 68/94     |
|                                     |   |         |      |       |   |           |
| MAUD 69                             | 1 | 69      |      |       |   | 52.6/65.7 |
| PAOLA 345KV                         | 1 | 345     | 30   |       |   | 2546/2546 |
| NASHUA 161 KV                       | 1 | 345/161 |      |       |   | 400/440   |
| Happy Interchange 69 kV             | 1 | 115/69  |      |       |   | 84/96     |
| Happy Interchange 69 kV             | 2 | 115/69  |      |       |   | 84/96     |
| Newhart Interchange 115 kV          | 2 | 230/115 |      |       |   | 250/250   |
|                                     |   |         |      |       |   |           |
| Carlisle Interchange 230 kV         | 1 | 230     | 16.8 |       |   | 478/478   |
| East Plant Interchange 115 kV       | 1 | 115     | 3.7  |       |   | 157/173   |
| Eddy County Interchange 115<br>kV   | 1 | 230/115 |      |       |   | 250/250   |
| Bowers Interchange 69 kV            | 2 | 115/69  |      |       |   | 84/96     |
|                                     |   |         |      |       |   |           |
| MACARTHUR 69 KV                     | 1 | 69      |      | 5.56  |   | 134/147   |
| Zodiac Sub 115 kV                   | 1 | 115     |      |       | 3 | 157/173   |

|                                   |   |     |       |      |     |           |
|-----------------------------------|---|-----|-------|------|-----|-----------|
|                                   |   | 115 | 0.3   |      | 1.5 | 139/160   |
| Kiser Sub 115 kV                  | 1 | 115 | 22.2  |      |     | 157/173   |
| SUNSHINE CANYON                   | 1 | 69  |       | 10   |     | 72/89     |
| OU SWITCH 4                       | 1 | 138 |       |      | 2   | 212/264   |
| Hereford Centre Street Sub        | 1 | 115 | 7.8   |      |     | 245/275   |
| Sub 918                           | 1 | 69  |       |      |     | 89/89     |
| WEATHERFORD                       | 1 | 69  |       | 0.9  |     | 68/98     |
| PRATTVILLE                        | 1 | 138 |       | 9    |     | 272/287   |
| COLE                              | 1 | 138 |       |      |     | 144/179   |
| MEMORIAL 138                      | 1 | 138 |       |      |     | 478/478   |
| NORTHWEST TEXARKANA<br>345KV      | 1 | 345 | 76.25 |      |     | 1330/1940 |
| Maryville 345 kV                  | 1 | 345 | 105   |      |     | 2496/2496 |
| Maryville 345 kV                  | 1 | 345 | 65    |      |     | 2496/2496 |
| Maryville 345 kV                  | 1 | 345 | 45    |      |     | 2496/2496 |
| BROKEN ARROW NORTH -<br>SOUTH TAP | 1 | 138 |       | 4.33 |     | 284/316   |

|                                      |   |         |   |       |      |           |
|--------------------------------------|---|---------|---|-------|------|-----------|
|                                      |   |         |   |       |      |           |
| South Georgia Interchange<br>115 kV  | 1 | 115     | 2 |       |      | 160/160   |
| Grassland Interchange 115 kV         | 1 | 230/115 |   |       |      | 250/250   |
| Swisher County Interchange<br>115 kV | 1 | 230/115 |   |       |      | 250/250   |
| REDBUD 345                           | 3 | 345     | 5 |       |      | 1248/1426 |
| Crosby County Interchange 69<br>kV   | 1 | 115/69  |   |       |      | 84/84     |
| Crosby County Interchange 69<br>kV   | 2 | 115/69  |   |       |      | 84/84     |
| South Georgia Interchange<br>115 kV  | 1 | 115     |   | 4.1   |      | 246/270   |
|                                      |   |         |   |       |      |           |
|                                      |   |         |   |       |      |           |
| New Soncy 115 kV                     | 1 | 115     |   |       | 1.04 | 157/173   |
|                                      |   | 115     |   |       |      |           |
|                                      |   | 115     |   |       |      | 157/173   |
|                                      |   |         |   |       |      |           |
| WILKES 138KV                         | 1 | 138     |   | 23.74 |      | 395/592   |
| CRINER                               | 1 | 138     |   |       |      | 144/179   |
| NORTHWEST 138                        | 3 | 345/138 |   |       |      | 493/493   |
| Allen Sub 115 kV                     | 1 | 115     |   | 6.1   |      | 273/300   |

|                                          |   |         |      |     |    |           |
|------------------------------------------|---|---------|------|-----|----|-----------|
| Canyon East Sub 115 kV                   | 1 | 115     | 18.5 |     |    | 273/300   |
| Hitchland Interchange 115 kV             | 2 | 230/115 |      |     |    | 250/288   |
| Carlisle Interchange 115 kV              | 1 | 230/115 |      |     |    | 250/288   |
| Potter County Interchange<br>230 kV      | 1 | 230     |      |     | 52 | 492/541   |
| Dallam 230 kV                            | 1 | 230     |      |     | 70 | 492/541   |
| Dallam County Interchange<br>115 kV      | 1 | 230/115 |      |     |    | 168/168   |
|                                          |   | 69      |      |     |    | 7.2 Mvar  |
|                                          |   | 69      |      |     |    | 12 Mvar   |
|                                          |   | 115     |      |     |    | 10.9 Mvar |
| FT SMITH 161                             | 5 | 500/161 |      |     |    | 493/493   |
| VBI NORTH                                | 1 | 161     |      |     |    | 72/72     |
|                                          |   | 115     |      |     |    | 18 Mvar   |
|                                          | 1 | 115     |      |     |    | 15 Mvar   |
|                                          |   | 115     |      |     |    | 18 Mvar   |
|                                          |   | 69      |      |     |    | 6 Mvar    |
| SEDGWICK COUNTY NO. 12<br>COLWICH 138 KV | 1 | 138     |      |     |    | 160/160   |
|                                          |   | 138     |      |     |    | 28.8 Mvar |
|                                          |   | 138     |      |     |    | 28.8 Mvar |
| Smith Center 115 KV                      | 1 | 115     |      |     |    | 80/88     |
| CANTON                                   | 1 | 69      |      | 9.7 |    | 106/132   |
| TALOGA                                   | 1 | 138/69  |      |     |    | 112/112   |
| Riley                                    | 1 | 115     | 6.7  |     |    | 233/245   |
|                                          |   | 115     |      |     |    |           |
|                                          | 1 | 115     |      |     |    | 14.4 Mvar |
|                                          |   | 115     | 0.4  |     |    | 14.4 Mvar |

|                      |   |         |       |  |  |           |
|----------------------|---|---------|-------|--|--|-----------|
|                      |   | 138     |       |  |  |           |
| Adair Tap 69 kV      | 1 | 115/69  | 17.79 |  |  | 84/84     |
| Cedar Lake 115 kV    | 1 | 115     | 12.5  |  |  | 157/173   |
| Ellsworth 115 KV     | 1 | 115     | 21    |  |  | 165/199   |
|                      |   | 115     |       |  |  | 239/239   |
| Gracemont 345kv      | 1 | 345     | 72    |  |  | 1792/1792 |
| Chisholm 230 kV      | 1 | 345/230 |       |  |  | 675/675   |
| Gracemont 345kv      | 1 | 345     | 29.8  |  |  | 1792/1792 |
| Tatonga 345kv        | 2 | 345     | 49    |  |  | 1792/1792 |
| MATHEWSON 345        | 1 | 345     | 61    |  |  | 1792/1792 |
| SUMMIT 345 KV        | 1 | 345     | 29.77 |  |  | 1792/1792 |
| Elm Creek Substation | 1 | 345/230 |       |  |  | 448/448   |
|                      | 1 | 345     |       |  |  |           |
|                      |   | 230     |       |  |  |           |
| SUMMIT 345 KV        | 1 | 345     | 28.46 |  |  | 1792/1792 |
| Neligh 345 kV        | 1 | 345     | 41    |  |  | 1792/1792 |
| Neligh 115 kV        | 1 | 345/115 |       |  |  | 458/474   |

|                                                  |   |         |     |    |  |           |
|--------------------------------------------------|---|---------|-----|----|--|-----------|
|                                                  |   |         |     |    |  |           |
| Gerald Gentleman Station                         | 1 | 345     | 110 |    |  | 1792/1792 |
|                                                  |   | 345     |     |    |  |           |
|                                                  |   |         |     |    |  |           |
| Holt County 345 kV                               | 1 | 345     | 117 |    |  | 1792/1792 |
|                                                  |   | 345     |     |    |  |           |
|                                                  | 1 | 345     | 107 |    |  | 1792/1792 |
|                                                  |   | 115     |     |    |  |           |
| Amoco Switching Station 230 kV (Amoco Slaughter) | 1 | 345/230 |     |    |  | 560/644   |
| Hobbs Interchange 230 kV                         | 1 | 345/230 |     |    |  | 448/644   |
|                                                  |   |         |     |    |  |           |
| Howard 115 kV                                    | 1 | 115     | 33  |    |  | 180/199   |
| CIMARRON 345                                     | 1 | 345     | 16  |    |  | 1792/1792 |
| Hobbs Interchange 345 kV                         | 1 | 345     | 52  |    |  | 1792/1792 |
|                                                  |   | 345     |     |    |  | 1792/1792 |
| Sub 3454                                         | 1 | 345     | 28  |    |  | 1792/1792 |
| Sub 1209                                         | 1 | 345/161 |     |    |  | 558/560   |
| PAOLA 345KV                                      | 1 | 345     |     |    |  | 2546/2546 |
| Canadian Sub 69 kV                               | 1 | 69      | 39  | 10 |  | 52/69     |



|                                      |   |         |      |       |  |           |
|--------------------------------------|---|---------|------|-------|--|-----------|
|                                      | 2 | 115     |      |       |  | 7.2 Mvar  |
| Deaf Smith County Interchange 230 kV | 1 | 230     |      |       |  | 478/502   |
| Deaf Smith County Interchange 115 kV | 1 | 230/115 |      |       |  | 250/250   |
| Deaf Smith County Interchange 115 kV | 2 | 230/115 |      |       |  | 250/259   |
| Cole Interchange 115 kV              | 1 | 115     | 17   |       |  | 249/273   |
| Floyd County Interchange 115 kV      | 1 | 115     | 25.8 |       |  | 249/273   |
| PERDUE 138KV                         |   | 138     |      |       |  | 272/272   |
|                                      |   |         |      |       |  |           |
| Geary County 115 kV                  | 1 | 345/115 |      |       |  | 400/440   |
| KERR 161                             | 1 | 161     |      |       |  | 356/432   |
|                                      |   |         |      |       |  |           |
| CHAPMAN 115 KV                       | 1 | 115     | 4.67 | 10.42 |  | 218/262   |
| KANSAS TAP 161                       | 1 | 161     |      |       |  | 356/432   |
|                                      | 1 | 115     |      |       |  | 28.8 Mvar |
|                                      |   |         |      |       |  |           |
| SPRINGRIDGE PAN-HARR REC             | 1 | 138     | 27.6 |       |  | 272/376   |
| Eagle Creek 115 kV                   | 1 | 115     | 22.1 |       |  | 249/249   |
|                                      |   | 115     |      |       |  | 156/199   |
| Potash Junction Interchange 69 kV    | 1 | 115/69  |      |       |  | 84/84     |
|                                      |   |         |      |       |  |           |
| S Portales 115 kV                    | 1 | 115     | 5.3  |       |  | 159/175   |
|                                      |   |         |      |       |  |           |
| Market ST 115 kV                     | 1 | 115     | 6    |       |  | 159/175   |
| Portales Interchange 115 kV          | 1 | 115     | 10.4 |       |  | 159/175   |
|                                      |   |         |      |       |  |           |
| DEKALB                               | 1 | 69      | 13.2 |       |  | 52/69     |
| WATERWORKS                           | 1 | 69      | 1.65 |       |  | 90/121    |

|                                |   |         |      |      |  |           |
|--------------------------------|---|---------|------|------|--|-----------|
| NORTH HUNTINGTON 69KV          | 1 | 69      |      | 4    |  | 143/143   |
| MIDLAND REC                    | 1 | 69      | 4.3  |      |  | 150/217   |
| MIDLAND                        | 1 | 69      | 7    |      |  | 150/217   |
| CHILDERS 69                    | 1 | 69      |      |      |  | 50/56     |
| Sub 915 T2 Primary             | 1 | 69      |      | 0.71 |  | 65/65     |
| SERVICE PL EL RENO 69          |   | 69      |      |      |  | 72/72     |
| Payne Switching Station 138 kV | 1 | 138     |      |      |  | 144/178   |
|                                |   | 138     |      |      |  | 286/286   |
| GILL ENERGY CENTER EAST 69 KV  | 1 | 138/69  |      |      |  | 150/165   |
| Viola 138kV                    | 1 | 345/138 |      |      |  | 448/492   |
| CLEARWATER 138KV               | 1 | 138     | 21.8 |      |  | 534/586   |
| GILL ENERGY CENTER WEST 138 KV | 1 | 138     | 27.9 |      |  | 534/586   |
| NORTHWEST 138                  | 3 | 345/138 |      |      |  | 493/493   |
|                                |   | 69      |      |      |  | 9.6 Mvar  |
|                                |   | 69      |      |      |  |           |
|                                |   | 69      |      |      |  |           |
|                                |   | 345     |      |      |  | 1793/1793 |
| SOUTH HAYS 115 KV              | 1 | 115     |      | 3.25 |  | 164/199   |
|                                |   | 500/230 |      |      |  | 675/675   |



|                          |   |         |      |     |  |          |
|--------------------------|---|---------|------|-----|--|----------|
|                          |   |         |      |     |  |          |
| Stegall 115 kV           | 1 | 345/115 |      |     |  | 400/440  |
| Scottsbluff              | 1 | 115     | 23   |     |  | 400/440  |
|                          | 1 | 345     |      |     |  | 448/492  |
|                          | 1 | 500     |      |     |  |          |
|                          | 1 | 345     |      |     |  |          |
|                          | 1 | 115     | 11.4 | 7   |  |          |
| Renfrow 138kV            | 1 | 138     | 4    |     |  | 183/228  |
|                          |   | 138     | 13   |     |  | 183/228  |
| Doolin 138kV             |   | 138     | 22   |     |  | 183/228  |
|                          |   | 138     |      |     |  | 4.8 Mvar |
| Doolin 138kV             |   | 138     | 5    |     |  | 183/228  |
|                          |   | 69      |      |     |  | 4.8 Mvar |
|                          |   | 138     |      |     |  | 183/228  |
| LAKESIDE 138             | 1 | 138     |      | 3.6 |  |          |
| Canyon West Sub 115 kV   |   | 115     | 3.7  |     |  |          |
| Shell Co2 Gas Sub 115 kV | 1 | 115     | 7.71 |     |  | 276/299  |
| Kismet Substation        |   | 115     | 26   |     |  |          |

|                        |   |         |      |      |  |           |
|------------------------|---|---------|------|------|--|-----------|
|                        |   |         |      |      |  |           |
| Kismet Substation      |   | 115     |      | 4    |  |           |
| ROOSEVELT TAP          | 1 | 69      |      | 10   |  | 136/143   |
|                        |   |         |      |      |  |           |
| SNYDER 69KV            | 1 | 69      |      | 18.7 |  | 143/158   |
| West Bender Sub 115 kV | 1 | 115     |      | 0.5  |  | 276/303   |
|                        |   |         |      |      |  |           |
| Butler 138kV           | 1 | 138     |      |      |  | 143/160   |
|                        |   |         |      |      |  |           |
|                        |   | 115     | 0.68 |      |  |           |
|                        |   |         |      |      |  |           |
| NEOSHO 69 KV           | 1 | 345/138 |      | 0.5  |  | 150/165   |
| Welsh Reserve 138 kV   |   | 138     |      | 4.39 |  | 395/592   |
| Viola 138kV            | 1 | 138     | 28   |      |  | 262/314   |
|                        |   |         |      |      |  |           |
|                        |   | 161/69  |      |      |  | 200/200   |
| ELK CITY 138           | 1 | 138     |      | 9    |  | 183/228   |
|                        |   |         |      |      |  |           |
|                        |   | 138     |      |      |  | 20 Mvar   |
|                        |   |         |      |      |  |           |
|                        | 1 | 115     |      |      |  | 24 Mvar   |
|                        |   |         |      |      |  |           |
|                        |   | 115     |      |      |  | 10.8 Mvar |
|                        |   |         |      |      |  |           |
| Road Runner 345 kV     | 1 | 230     | 40.4 |      |  | 492/541   |

|                                    |   |         |      |      |   |         |
|------------------------------------|---|---------|------|------|---|---------|
|                                    |   |         |      |      |   |         |
| Road Runner 115 kV                 | 1 | 230/115 | 1    |      |   | 250/288 |
|                                    |   |         |      |      |   |         |
| FORT HUMBUG 69KV                   | 1 | 69      |      | 1.7  |   | 136/143 |
| JENKINS REC T                      |   | 69      |      | 1.3  |   | 132/178 |
|                                    |   |         |      |      |   |         |
| LONGVIEW HEIGHTS 69KV              | 1 | 69      |      | 6.6  |   | 68/89   |
|                                    |   |         |      |      |   |         |
| HALLSVILLE                         | 1 | 69      |      | 11.2 |   | 68/89   |
|                                    |   |         |      |      |   |         |
| PRICE 3 115 kV                     | 1 | 115     | 5    |      | 5 | 250/250 |
| CV-PINES 3 115 kV                  | 1 | 115     |      |      | 3 | 245/245 |
| Capitan 115 kV                     | 1 | 115     | 5    |      | 5 | 245/265 |
|                                    |   |         |      |      |   |         |
| Bailey Pump 115 KV                 | 1 | 115     | 9.4  |      |   | 276/304 |
|                                    |   |         |      |      |   |         |
| CITY OF WELLINGTON 69 KV           |   | 69      |      | 9    |   | 96/96   |
| SUMNER COUNTY NO. 4<br>ROME 69 KV  |   | 69      |      | 9.5  |   | 96/96   |
|                                    |   |         |      |      |   |         |
| Sundan Rural 115 kV                | 1 | 115     | 11.7 |      |   | 276/304 |
|                                    |   |         |      |      |   |         |
| CRESTVIEW 69 KV                    |   | 69      |      | 5.59 |   | 131/143 |
| Lamb County REC-Sandhill 115<br>kV | 1 | 115/69  | 0.2  |      |   | 84/84   |
| Lamb County Sandhill 115 kV        | 1 | 115     | 8.6  |      |   | 276/304 |
|                                    |   |         |      |      |   |         |
| KEN MAR 69 KV                      |   | 69      |      | 1.74 |   | 131/143 |

|                                |   |        |       |      |  |             |
|--------------------------------|---|--------|-------|------|--|-------------|
| Amherst 115 kV                 |   | 115    |       |      |  | 276/304     |
|                                |   |        |       |      |  |             |
| West Littlefield 115 kV        | 1 | 115    | 13.71 |      |  | 276/304     |
| Lamb County Interchange 115 kV | 1 | 115    | 8.6   |      |  | 276/304     |
|                                |   | 69     |       |      |  | 9 Mvar      |
|                                |   |        |       |      |  |             |
| ELK JUNCTION 69 KV             | 1 | 69     |       | 9.5  |  | 72/72       |
| CANEY VALLEY NO. 5 SEDAN 69 KV | 1 | 69     |       | 19   |  | 72/72       |
|                                |   |        |       |      |  |             |
| S6801 8 69kV                   |   | 161/69 |       |      |  | 134.4/134.4 |
|                                |   |        |       |      |  |             |
| S6801 8 69kV                   |   | 161/69 | 3     |      |  | 144/144     |
|                                |   |        |       |      |  |             |
| S1301 161kV                    |   | 161    | 17    |      |  | 377/377     |
|                                |   |        |       |      |  |             |
| Sub 924                        |   | 69     |       | 1.34 |  | 143/143     |
|                                |   |        |       |      |  |             |
| Sub 924                        |   | 69     |       |      |  | 99/99       |
|                                |   |        |       |      |  |             |
|                                | 1 | 115    |       |      |  | 24 Mvar     |
|                                |   |        |       |      |  |             |
|                                |   | 115    |       |      |  |             |
|                                |   |        |       |      |  |             |
| Ord                            | 1 | 115    | 42    |      |  | 160/176     |
|                                |   |        |       |      |  |             |
|                                |   |        |       |      |  |             |
| KNOBHILL 69                    |   | 138    | 0.09  |      |  |             |
|                                |   |        |       |      |  |             |
|                                |   |        |       |      |  |             |
| Letouteau W tap 69 kV          |   | 69     | 0.3   |      |  | 150/150     |
|                                |   |        |       |      |  |             |
| Ord                            | 2 | 115    |       |      |  | 137/151     |
|                                |   |        |       |      |  |             |
|                                |   | 161    |       |      |  |             |

|                         |   |         |       |       |       |           |
|-------------------------|---|---------|-------|-------|-------|-----------|
| Ahloso 138KV            | 1 | 138     |       |       | 4.39  | 268/286   |
| Harden City 138KV       | 1 | 138     |       | 10.12 | 10.12 | 268/286   |
| Harden City 138KV       | 1 | 138     |       | 3.42  | 3.42  | 268/286   |
| Frisco 138 kV           | 1 | 138     |       | 8.3   | 8.3   | 268/286   |
|                         | 1 | 345     | 2     |       |       | 1792/1792 |
|                         | 1 | 345/161 |       |       |       | 400/440   |
|                         | 1 | 345     | 18    |       |       | 1792/1792 |
| Maryville               | 1 | 345/161 |       |       |       | 400/440   |
|                         | 1 | 345/161 |       |       |       | 650/715   |
| Red Willow              | 1 | 345     | 110   |       |       | 956/956   |
| TUCO Interchange 345 kV | 1 | 345     | 64    |       |       | 1792/1792 |
| HOLCOMB                 | 2 | 345/115 |       |       |       | 435/435   |
| NEOSHO 345 KV           | 1 | 345     | 99    |       |       | 1792/1792 |
| Truman                  | 1 | 161     |       | 29    |       | 554/554   |
| North Warsaw 161        | 1 | 161     |       | 2     |       | 554/554   |
|                         | 2 | 345/115 |       |       |       | 435/435   |
|                         | 1 | 345     |       |       | 17    | 1792/1792 |
|                         | 1 | 345     |       |       | 30    | 1792/1792 |
| PECAN CREEK 345         |   |         |       |       |       | 1195/1195 |
| Sub 919                 |   | 69      |       | 3.3   |       |           |
| BUTLER 138 KV           |   | 138     | 18.76 |       |       |           |
| TULSA 138               |   | 138     |       | 1.25  |       | 404/465   |
|                         |   | 115     |       |       |       |           |
|                         | 1 | 69      |       |       |       | 12 Mvar   |
|                         | 1 | 345     | 10    |       |       |           |

|                                        |   |         |       |      |  |           |
|----------------------------------------|---|---------|-------|------|--|-----------|
| MCDADE (BREMCO)                        | 1 | 345/138 |       |      |  | 675/742.5 |
|                                        | 1 | 500/345 |       |      |  | 1500/1500 |
|                                        | 1 | 345     | 35    |      |  |           |
|                                        | 1 | 345/138 |       |      |  | 314/366   |
| WATOVA                                 | 1 | 138/138 |       |      |  | 202/235   |
| ROMAN NOSE 138                         | 1 | 138     | 14.25 |      |  | 278/316   |
| WILKES 138KV                           | 1 | 138     |       |      |  |           |
| WARWICK 138                            | 1 | 138     | 13    |      |  | 268/286   |
| SPRING VALLEY TAP 69                   | 1 | 138     | 18    |      |  | 268/286   |
| SPRING VALLEY TAP 69                   | 1 | 138     | 5     |      |  | 268/286   |
| ALVA                                   | 1 | 69      |       | 1.05 |  | 134/143   |
|                                        | 1 | 69      |       |      |  |           |
|                                        | 1 | 138     |       |      |  | 9 Mvar    |
|                                        | 1 | 69      |       |      |  | 9.6 Mvar  |
|                                        | 1 | 138     |       |      |  | 24 Mvar   |
|                                        | 1 | 69      |       |      |  | 12 Mvar   |
|                                        | 1 | 69      |       |      |  | 24 Mvar   |
|                                        | 1 | 345     | 18.2  |      |  | 1792/1792 |
|                                        | 1 | 345     | 20.4  |      |  | 1792/1792 |
| Potash Junction Interchange<br>115 kV  | 1 | 230/115 |       |      |  | 250/288   |
| KANSAS AVENUE WATER<br>TREATMENT PLANT | 1 | 138     |       |      |  | 280/189   |
| Harper 138 KV                          | 1 | 138     | 21    |      |  | 190/190   |



|                   |   |         |     |     |  |           |
|-------------------|---|---------|-----|-----|--|-----------|
|                   | 1 | 138     | 15  |     |  | 190/190   |
|                   | 1 | 115     |     |     |  | 12 Mvar   |
| GODDARD TAP       | 1 | 69      |     |     |  |           |
|                   | 1 | 69      |     |     |  | 9.6 Mvar  |
| Milan Tap 138 KV  | 1 | 138     | 6.1 |     |  | 478/478   |
|                   | 1 | 69      |     |     |  | 9.6 Mvar  |
|                   | 1 | 69      |     |     |  | 12 Mvar   |
|                   | 1 | 138     |     |     |  | 70/70     |
|                   | 1 | 138     |     |     |  |           |
|                   | 1 | 115     |     |     |  | 27 Mvar   |
|                   | 1 | 115     |     |     |  | 18 Mvar   |
|                   |   | 138     |     |     |  |           |
| MOUND ROAD        | 1 | 138     |     | 2.8 |  | 212/212   |
| Grant Co. 138kV   | 1 | 138     |     |     |  | 268/308   |
| FOUR CORNERS 69   | 1 | 138     |     |     |  | 268/308   |
|                   | 1 | 138     |     |     |  | 268/308   |
| NE ENID4 138      | 1 | 138     |     |     |  | 268/308   |
|                   | 1 | 138     |     |     |  | 183/228   |
|                   | 1 | 138     |     |     |  | 183/228   |
| China Draw 115 kV | 1 | 345/115 |     |     |  | 448/448   |
|                   | 1 | 345     |     |     |  | 1792/1792 |
|                   | 1 | 345     |     |     |  | 1792/1792 |

|                    |   |         |      |  |               |           |
|--------------------|---|---------|------|--|---------------|-----------|
|                    | 1 | 345/115 |      |  |               | 448/448   |
| Woodward EHV 345kv | 1 | 345     |      |  |               | 1004/1198 |
|                    |   | 345     |      |  |               | 1792/1792 |
| CARMEN             | 1 | 138/69  |      |  |               | 70/70     |
| CHEROKEE JCT       | 1 | 138/69  |      |  |               | 70/70     |
|                    | 1 | 138     |      |  |               | 183/228   |
| BUFFALO            | 1 | 138/69  |      |  |               | 70/70     |
| BUFFALO BEAR 2     | 1 | 138     |      |  |               | 144/179   |
|                    | 1 | 138     |      |  |               | 144/179   |
| ELK CITY 69        | 1 | 138/69  |      |  |               | 68/89     |
| Road Runner 115 kV | 1 | 345/115 |      |  |               | 448/448   |
|                    | 1 | 345     |      |  |               | 1792/1792 |
|                    | 1 | 115     |      |  | -50/+200 Mvar |           |
|                    | 1 | 115     |      |  | -50/+200 Mvar |           |
|                    | 1 | 115     | 3.4  |  |               | 276/304   |
| ALVA               | 1 | 69      |      |  |               | 134/143   |
|                    | 1 | 345/115 |      |  |               | 448/644   |
|                    | 1 | 115     | 18.4 |  |               | 276/304   |
|                    | 1 | 115     | 9.5  |  |               | 276/304   |



|                                         |   |         |       |       |  |           |
|-----------------------------------------|---|---------|-------|-------|--|-----------|
|                                         |   |         |       |       |  |           |
| Road Runner 345 kV                      | 1 | 345     | 2     |       |  | 1792/1792 |
|                                         | 1 | 115     |       |       |  | 239/304   |
| Road Runner 115 kV                      | 1 | 115     | 18.9  |       |  | 276/304   |
|                                         | 1 | 115     | 7.4   |       |  | 276/304   |
| Hobbs Interchange 345 kV                |   | 345     | 47.24 |       |  | 1792/1792 |
| TUCO Interchange 115 kV                 | 1 | 115     |       | 20.49 |  | 276/304   |
|                                         | 1 | 115     |       |       |  | 239/304   |
|                                         | 1 | 115     |       |       |  | 28.8 Mvar |
|                                         | 1 | 115     | 0.2   |       |  | 239/304   |
|                                         | 1 | 230/115 | 0.1   |       |  | 250/288   |
| National Enrichment Plant Sub<br>115 kV |   | 115     | 2.1   |       |  | 276/304   |
| China Draw 115 kV                       | 1 | 115     | 19.7  |       |  | 276/304   |
| RIPLEY 69 KV                            | 1 | 69      | 3.35  |       |  | 131/157   |
|                                         | 1 | 138     |       |       |  | 183/228   |
| Thedford                                | 1 | 345/115 |       |       |  | 400/400   |
| DOLET HILLS                             | 1 | 345     | 45    |       |  |           |
| CENTER                                  | 1 | 345/138 |       |       |  | 314/366   |
|                                         |   |         |       |       |  |           |
| Elk City 345 kV                         | 1 | 345     | 0.5   |       |  | 1475/1623 |

|                                       |   |         |    |  |  |           |
|---------------------------------------|---|---------|----|--|--|-----------|
|                                       |   |         |    |  |  |           |
| Woodward EHV 345kv                    | 1 | 345/230 |    |  |  | 1475/1623 |
|                                       | 1 | 345     |    |  |  |           |
|                                       | 1 | 345     |    |  |  |           |
| Road Runner 345 kV                    | 1 | 345     | 15 |  |  |           |
|                                       | 1 | 345/115 |    |  |  | 448/448   |
|                                       |   | 345/115 |    |  |  | 448/448   |
| Potash Junction Interchange<br>115 kV | 1 | 345/115 |    |  |  | 448/448   |
| Hobbs Interchange 345 kV              | 1 | 345     |    |  |  |           |
| Potash Junction Interchange<br>115 kV | 2 | 345/115 |    |  |  | 448/448   |
| RUSSETT 138                           | 1 | 138     |    |  |  |           |
|                                       | 1 | 69      |    |  |  | 9 Mvar    |
| PARK LANE 138 kV                      | 1 | 138     |    |  |  | 382/382   |
| VANOSS 138                            | 1 | 138     |    |  |  |           |
| Plant X Station 115 kV                | 2 | 230/115 |    |  |  | 250/288   |
| Seminole Interchange 115 kV           | 1 | 230/115 |    |  |  | 250/288   |
| Seminole Interchange 115 kV           | 2 | 230/115 |    |  |  | 250/288   |

|                                       |   |         |      |       |  |         |
|---------------------------------------|---|---------|------|-------|--|---------|
| Wolfforth Interchange 115 kV          | 1 | 230/115 |      |       |  | 250/288 |
|                                       | 1 | 115     | 9.3  |       |  | 276/304 |
|                                       | 1 | 115     |      |       |  | 239/304 |
|                                       | 1 | 115     |      |       |  | 239/304 |
|                                       | 1 | 115     | 13.9 |       |  | 276/304 |
|                                       | 1 | 115     |      |       |  | 239/304 |
|                                       | 1 | 115     | 10.4 |       |  | 276/304 |
| Wolfforth Interchange 230 kV          | 1 | 230     |      |       |  | 478/502 |
|                                       | 1 | 115     | 15   |       |  | 276/304 |
|                                       | 1 | 115     | 14   |       |  | 276/304 |
|                                       | 1 | 115     |      | 2.5   |  | 276/304 |
| Doud Sub 115 kV                       | 1 | 115     |      | 1.71  |  | 276/304 |
|                                       | 1 | 115     |      | 1.38  |  | 276/304 |
| Yuma Interchange 115 kV               | 1 | 115     |      | 0.81  |  | 276/304 |
| Grapevine Interchange 115 kV          | 1 | 115     |      | 3.91  |  | 276/304 |
| Deaf Smith County Interchange 115 kV  | 2 | 115     |      | 2.17  |  | 276/304 |
| Soncy Tap 115 kV                      | 1 | 115     |      | 0.71  |  | 276/304 |
| Puckett Sub 115 kV                    | 1 | 115     |      | 2.3   |  | 276/304 |
| Northwest Interchange 115 kV          | 1 | 115     |      | 8.34  |  | 276/304 |
| Wolfforth Interchange 230 kV          | 1 | 230     |      | 24.62 |  | 598/598 |
| Sundown Interchange 115 kV            |   | 230/115 |      |       |  | 250/288 |
| South Plains REC-Frankford Sub 115 kV | 1 | 115     |      |       |  | 159/160 |

|                                                          |   |     |      |       |  |           |
|----------------------------------------------------------|---|-----|------|-------|--|-----------|
|                                                          | 1 | 115 |      |       |  | 28.8 Mvar |
|                                                          | 1 | 69  |      |       |  | 15 Mvar   |
|                                                          | 1 | 69  |      |       |  | 7.5 Mvar  |
| Wheeler County Interchange<br>115 kV                     | 1 | 115 | 35   |       |  | 180/199   |
|                                                          | 1 | 115 | 0.2  |       |  | 239/304   |
|                                                          | 1 | 115 |      | 9.47  |  |           |
|                                                          |   |     |      |       |  |           |
| South Jal Sub 115 kV                                     | 1 | 115 |      | 3.7   |  | 276/304   |
|                                                          | 1 | 115 |      | 9.06  |  | 276/304   |
|                                                          |   |     |      |       |  |           |
| Whitten Sub 115 kV                                       | 1 | 115 |      | 5.913 |  | 276/304   |
| South Plains REC-Woodrow<br>Interchange 115 kV           | 1 | 115 |      | 5.98  |  | 276/304   |
|                                                          |   |     |      |       |  |           |
| Potash Junction Interchange<br>115 kV                    | 1 | 115 |      | 1.51  |  | 276/304   |
|                                                          |   |     |      |       |  |           |
| I. M. C. #1 Sub Tap 115 kV<br>(International Mineral Co) | 1 | 115 |      | 3.89  |  | 276/304   |
|                                                          |   |     |      |       |  |           |
| Bowers Interchange 115 kV                                |   | 115 |      |       |  |           |
|                                                          |   |     |      |       |  |           |
| HUNTSVILLE 115 KV                                        | 1 | 115 |      | 28.8  |  | 80/88     |
|                                                          | 1 | 115 | 17.5 |       |  | 276/304   |
|                                                          | 1 | 115 |      |       |  | 239/304   |
|                                                          |   |     |      |       |  |           |
| Roosevelt County Interchange<br>SWITCH #4K33 230 kV      | 1 | 230 |      |       |  | 478/478   |
| Curry County Interchange 115<br>kV                       |   | 115 |      |       |  |           |
|                                                          | 1 | 69  |      |       |  | 9 Mvar    |
|                                                          |   |     |      |       |  |           |
| KEREFORD JUNCTION 69 KV                                  | 1 | 69  |      |       |  | 41/41     |

|                                      |   |         |      |      |  |         |
|--------------------------------------|---|---------|------|------|--|---------|
|                                      |   |         |      |      |  |         |
| MIDWEST GRAIN SOLVENTS<br>JCT1 69 KV | 1 |         |      |      |  | 131/143 |
| South Plains REC-Idalou 69 kV        | 1 | 69      | 2.45 |      |  | 54/54   |
|                                      |   | 115     |      |      |  |         |
| Road Runner 115 kV                   | 1 | 115     | 20   |      |  | 276/304 |
|                                      | 1 | 115     |      |      |  | 239/239 |
|                                      | 1 | 138     | 7    |      |  | 190/190 |
|                                      | 1 | 138     | 22   |      |  | 190/190 |
|                                      | 1 | 138     | 16   |      |  | 190/190 |
| MILAN 4 138                          | 1 | 138     | 8    |      |  | 190/190 |
| Milan Tap 138 KV                     | 1 | 138     |      | 11.7 |  | 478/478 |
|                                      | 1 | 115     |      |      |  | 18 Mvar |
|                                      | 1 | 345     |      |      |  | 400/400 |
|                                      | 1 | 138/138 |      |      |  | 68/89   |

|                                         |   |         |      |      |  |           |
|-----------------------------------------|---|---------|------|------|--|-----------|
|                                         |   |         |      |      |  |           |
| RUSH SPRINGS NATURAL GAS                | 1 | 138     | 6    |      |  | 278/316   |
|                                         | 1 | 138     | 6.4  |      |  | 322/478   |
| Noel 138kV                              | 1 | 138     |      |      |  |           |
|                                         |   |         |      |      |  |           |
| SOUTH SHREVEPORT 138KV                  |   | 138     |      | 2.3  |  |           |
| Yoakum County Interchange<br>115 kV     | 1 | 230/115 |      |      |  | 250/250   |
| Port Robson 69kV                        | 1 | 138     | 3    |      |  | 344/478   |
| Port Robson 69kV                        | 2 | 138     | 3.4  |      |  | 344/478   |
|                                         |   |         |      |      |  |           |
|                                         |   | 115     |      |      |  | 239/239   |
|                                         | 1 | 115     | 6    |      |  | 164/199   |
| Yoakum County Interchange<br>115 kV     |   | 230/115 |      |      |  | 250/250   |
|                                         |   |         |      |      |  |           |
|                                         |   | 115     |      |      |  | 239/304   |
| National Enrichment Plant Tap<br>115 kV | 1 | 115     | 12   |      |  | 525/525   |
|                                         | 1 | 138     | 0.29 |      |  |           |
|                                         |   |         |      |      |  |           |
|                                         | 1 | 138/115 |      |      |  | 250/250   |
|                                         | 1 | 138     | 18   |      |  |           |
|                                         |   |         |      |      |  |           |
| ELK CITY 230KV                          | 2 | 345/230 |      |      |  | 675/742.5 |
| JENKINS REC T                           | 1 | 69/69   |      | 4.8  |  | 123/143   |
| Sub 985                                 | 1 | 69      |      | 6    |  | 65/65     |
| Sub 928                                 | 1 | 69      |      | 3.57 |  | 65/65     |
| Junction 205                            | 1 | 69/69   |      | 1.12 |  | 65/65     |
| Junction 205                            | 1 | 69/69   |      | 2.87 |  | 65/65     |



|                            |   |        |    |      |               |         |  |   |
|----------------------------|---|--------|----|------|---------------|---------|--|---|
| RUSSELL                    | 1 | 69/69  |    | 4.8  |               | 53/65   |  |   |
| GYPSUM                     | 1 | 69/69  |    | 7.1  |               | 53/65   |  |   |
| LAKE PAULINE 69KV          | 1 | 69/69  |    | 15   |               | 53/65   |  |   |
|                            | 1 | 115    |    |      |               |         |  |   |
|                            | 1 | 69     |    |      |               |         |  |   |
|                            | 1 | 69     |    |      |               |         |  |   |
| STILLWATER 19TH STREET 138 | 1 | 138    |    |      |               |         |  |   |
| Sub 975                    | 1 | 161/69 |    |      |               | 134/134 |  |   |
|                            | 1 | 138    |    |      |               |         |  |   |
| HAWKINS                    | 1 | 69     |    | 5.5  |               | 123/143 |  |   |
| MINEOLA                    | 1 | 69     |    | 13.8 |               | 140/143 |  |   |
| QUITMAN                    | 1 | 69     |    | 8.6  |               | 64/94   |  |   |
| ADORA T                    | 1 | 69     |    | 1.4  |               | 137/137 |  |   |
| WINFIELD                   | 1 | 69     |    | 5.1  |               | 137/137 |  |   |
| BLOCKER TAP                | 1 | 69     |    | 0.7  |               | 134/156 |  |   |
|                            |   | 115    | 40 |      |               | 240/240 |  |   |
| Central City North         |   | 115    | 15 |      |               | 160/160 |  |   |
| ROOSEVELT TAP              | 1 | 69     |    | 10   |               | 136/143 |  | X |
| SNYDER 69KV                | 1 | 69     |    | 18.7 |               | 143/158 |  | X |
|                            | 1 | 115    |    |      | -50/+200 Mvar |         |  | X |

|                                                          |   |         |  |       |               |           |   |   |
|----------------------------------------------------------|---|---------|--|-------|---------------|-----------|---|---|
|                                                          |   |         |  |       |               |           |   |   |
| PARK LANE 138 kV                                         | 1 | 138     |  |       |               | 382/382   | X |   |
| Plant X Station 115 kV                                   | 2 | 230/115 |  |       |               | 250/288   | X |   |
|                                                          | 1 | 115     |  | 9.47  |               |           |   | X |
|                                                          |   |         |  |       |               |           |   |   |
| Whitten Sub 115 kV                                       | 1 | 115     |  | 5.913 |               | 276/304   |   | X |
|                                                          |   |         |  |       |               |           |   |   |
| Potash Junction Interchange<br>115 kV                    | 1 | 115     |  | 1.51  |               | 276/304   |   | X |
|                                                          |   |         |  |       |               |           |   |   |
| I. M. C. #1 Sub Tap 115 kV<br>(International Mineral Co) | 1 | 115     |  | 3.89  |               | 276/304   |   | X |
|                                                          |   |         |  |       |               |           |   |   |
| MINEOLA                                                  | 1 | 69      |  | 13.8  |               | 140/143   |   | X |
|                                                          |   |         |  |       |               |           |   |   |
| Dawn Sub 115 kV                                          | 1 | 115     |  | 13.7  |               |           | X | X |
| Panda Energy Substation,<br>Hereford 115 kV              | 1 | 115     |  | 8.4   |               |           | X | X |
| Panda Energy Substation,<br>Hereford 115 kV              | 1 | 115     |  | 3.54  |               |           |   | X |
|                                                          |   |         |  |       |               |           |   |   |
| Monument Tap 115 kV                                      | 1 | 115     |  | 3.8   |               | 239/239   |   | X |
|                                                          |   |         |  |       |               |           |   |   |
|                                                          | 1 | 115     |  |       | -50/+200 MVAR |           |   | X |
|                                                          |   |         |  |       |               |           |   |   |
| Sub 1209                                                 | 1 | 345/161 |  |       |               | 400/440   | X |   |
|                                                          |   |         |  |       |               |           |   |   |
|                                                          | 2 | 345     |  |       |               |           | X |   |
|                                                          |   |         |  |       |               |           |   |   |
| ANADARKO                                                 | 1 | 138     |  | 5.28  |               | 286/286   | X |   |
|                                                          |   |         |  |       |               |           |   |   |
| Pantex South Sub 115 kV                                  | 1 | 115     |  |       |               | 240/240   | X |   |
|                                                          |   |         |  |       |               |           |   |   |
| DRAPER LAKE 345                                          | 1 |         |  |       |               | 1195/1195 | X |   |
|                                                          |   |         |  |       |               |           |   |   |
| Amoco Switching Station 230<br>kV (Amoco Slaughter)      | 2 | 230     |  |       |               | 437/437   | X | X |
|                                                          |   |         |  |       |               |           |   |   |
|                                                          |   |         |  |       |               |           |   |   |
| Pantex South Sub 115 kV                                  | 1 | 115     |  | 6.8   |               | 240/240   | X |   |



|                                             |   |         |      |       |       |           |   |   |
|---------------------------------------------|---|---------|------|-------|-------|-----------|---|---|
| Pantex North Sub 115 kV                     | 1 | 115     |      |       |       | 240/240   | X |   |
| WALLACE LAKE 138KV                          | 1 | 138     |      | 11.18 |       | 246/246   | X |   |
| GRDA1 161                                   | 1 |         |      |       |       | 261/261   | X | X |
| Stockville 115 kV                           | 1 | 115     | 39.4 |       |       | 240/240   | X |   |
| Red Willow                                  | 1 | 115     | 21   |       |       | 240/240   | X |   |
| Mingo 115 kV                                | 2 | 345/115 |      |       |       | 280/280   | X | X |
| STRANGER CREEK 345 KV                       | 1 | 345     |      |       | 18.17 | 1195/1195 | X |   |
| Lea County REC-Lovington Interchange 115 kV | 2 | 115/69  |      |       |       | 100/100   | X | X |
| UNDERPASS (NORTH) 115 KV                    | 1 | 115     |      | 3.1   |       | 218/262   | X |   |
| INTERSTATE 138 KV                           | 1 | 138     |      | 6.3   |       | 286/286   | X |   |
| Hastings Sub 115 kV                         | 1 | 115     | 3    |       |       | 384/422   | X |   |
| WICHITA 345 KV                              | 1 | 345     |      |       |       |           | X | X |
| MOUNDRIDGE 138 KV                           | 1 | 345/138 |      |       |       | 280/308   | X | X |
|                                             |   | 115     |      |       |       | 14.4 MVAR | X |   |

|                                      |   |         |  |       |  |           |   |   |
|--------------------------------------|---|---------|--|-------|--|-----------|---|---|
|                                      | 1 |         |  |       |  | 14.4 MVAR | X | X |
|                                      | 1 | 115     |  |       |  | 28.8 MVAR | X |   |
|                                      | 1 | 115     |  |       |  | 28.8 MVAR | X |   |
|                                      | 1 |         |  |       |  | 28.8 MVAR | X | X |
|                                      | 1 | 115     |  |       |  | 6 MVAR    | X |   |
|                                      | 1 |         |  |       |  | 6 MVAR    | X |   |
| Swisher County Interchange<br>230 kV | 1 |         |  |       |  | 478/526   | X | X |
| TUCO Interchange 115 kV              | 1 | 115/230 |  |       |  | 252/288   | X |   |
| Enogex Wilburton Tap 138 kV          | 1 | 138     |  | 0.3   |  | 286/286   | X |   |
| Sardis 138 kV                        | 1 | 138     |  | 22.4  |  | 286/286   | X |   |
| Clayton 138 kV                       | 1 | 138     |  | 3.8   |  | 286/286   | X |   |
| Nashoba 138 kV                       | 1 | 138     |  | 11.6  |  | 286/286   | X |   |
| Bethel 138 kV                        | 1 | 138     |  | 22.4  |  | 286/286   | X |   |
| Broken Bow                           | 1 | 138     |  | 16.3  |  | 286/286   | X |   |
| PRATTVILLE                           | 1 |         |  |       |  | 265/309   | X |   |
|                                      | 2 | 345     |  |       |  |           | X | X |
|                                      | 1 | 115     |  |       |  |           | X | X |
| CARNEGIE                             | 1 | 138     |  | 16.5  |  | 272/376   |   | X |
| Quahada 115 kV                       | 1 | 115     |  | 11.08 |  | 239/239   |   | X |
|                                      | 1 | 69      |  | 10.73 |  | 72/72     |   | X |
| Harrionsville North 69 KV            | 1 | 69      |  | 8.76  |  | 72/72     |   | X |
|                                      | 1 | 138/69  |  |       |  |           |   | X |
| LAWRENCE HILL 115 KV                 | 2 | 230/115 |  |       |  | 280/308   |   | X |
|                                      | 1 |         |  |       |  |           |   | X |

|                               |   |        |  |      |  |           |  |   |
|-------------------------------|---|--------|--|------|--|-----------|--|---|
|                               | 1 |        |  |      |  |           |  | X |
| SOUTH WAVERLY 69 KV           | 1 | 161/69 |  |      |  | 50/55     |  | X |
|                               | 1 |        |  |      |  |           |  | X |
|                               | 1 | 138/69 |  |      |  | 123/134   |  | X |
| NEOSHO 69 KV                  | 1 | 69     |  | 4.6  |  |           |  | X |
| Lynn County Interchange 69 kV | 1 | 115/69 |  |      |  | 84/84     |  | X |
| CEDARGROVE                    | 1 | 138    |  | 2.5  |  | 272/376   |  | X |
|                               | 1 | 345    |  |      |  | 1526/1526 |  | X |
| SUB 59 - JOPLIN 26TH ST.      | 1 | 69     |  | 1.33 |  | 113/129   |  | X |
| BENTON 345 KV                 | 1 |        |  |      |  | 400/440   |  | X |
|                               | 1 |        |  |      |  | 102/123   |  | X |
|                               |   |        |  |      |  |           |  | X |
|                               |   |        |  |      |  |           |  | X |
| EDWARDS STREET                | 1 | 69     |  | 0.8  |  | 136/143   |  | X |
|                               | 1 |        |  |      |  |           |  | X |
|                               | 1 |        |  |      |  |           |  | X |
|                               |   |        |  |      |  |           |  | X |
|                               | 1 |        |  |      |  |           |  | X |
|                               |   |        |  |      |  |           |  | X |
|                               | 1 |        |  |      |  |           |  | X |
|                               |   |        |  |      |  |           |  | X |
|                               |   |        |  |      |  |           |  | X |
|                               |   |        |  |      |  |           |  | X |
|                               | 1 |        |  |      |  | 44/44     |  | X |

|                    |   |         |     |      |  |           |   |   |
|--------------------|---|---------|-----|------|--|-----------|---|---|
|                    | 1 | 345     |     |      |  | 956/1052  | X | X |
| Walkemeyer 115 kV  | 1 | 345/115 |     |      |  | 280/280   | X | X |
|                    | 1 |         |     |      |  |           |   | X |
|                    | 1 | 115     | 0.5 |      |  | 281/304   | X | X |
|                    | 1 | 115     | 0.5 |      |  | 281/304   | X | X |
|                    | 1 | 115     |     |      |  |           | X | X |
|                    | 1 | 115     | 21  |      |  | 210/256   | X | X |
|                    | 1 | 115     |     |      |  |           | X | X |
|                    | 1 | 115     |     | 3    |  | 276/304   |   | X |
| Whitten Sub 115 kV | 1 | 115     |     | 4.26 |  | 276/304   |   | X |
|                    | 1 |         |     |      |  |           |   | X |
|                    | 1 | 138/69  |     |      |  |           |   | X |
|                    | 1 | 161     |     |      |  |           |   | X |
|                    | 1 | 138     |     |      |  |           |   | X |
|                    | 1 | 115     |     |      |  |           |   | X |
|                    | 1 | 115     |     |      |  | 14.4 MVAR | X |   |

|                               |   |         |    |  |  |  |  |   |
|-------------------------------|---|---------|----|--|--|--|--|---|
|                               |   | 115     |    |  |  |  |  | X |
| North Judson Large 115 kV Sub |   | 115     | 20 |  |  |  |  |   |
| Spearville 115 KV             | 1 | 345/115 |    |  |  |  |  |   |
|                               |   | 345     |    |  |  |  |  |   |
|                               |   | 345     |    |  |  |  |  |   |
|                               |   | 345     |    |  |  |  |  |   |
| North Judson Large 115 kV Sub |   | 115     |    |  |  |  |  |   |
|                               |   | 345     |    |  |  |  |  |   |
|                               |   | 230     |    |  |  |  |  |   |
|                               |   | 345     |    |  |  |  |  |   |
|                               |   | 345     |    |  |  |  |  |   |
|                               |   | 345     |    |  |  |  |  |   |
|                               |   | 230     |    |  |  |  |  |   |

|  |   |     |  |      |  |       |
|--|---|-----|--|------|--|-------|
|  |   | 230 |  |      |  |       |
|  |   | 345 |  |      |  |       |
|  | 1 | 69  |  | 2.72 |  | 84/84 |