

**BEFORE THE STATE CORPORATION COMMISSION
OF THE STATE OF KANSAS**

**In the Matter of the Application of Kansas
Power Pool for Certificate of Convenience
and Authority to Transact the Business
of an Electric Utility in the State of Kansas
for Transmission Rights Only to Cross
Service Territory of Southern Pioneer
Electric Company and Ninnescah Rural
Electric Cooperative.**

Docket No. 18-KPPE-343-COC

**PREFILED DIRECT TESTIMONY AND EXHIBITS
OF
ERIK SIGURD SONJU, P.E.**

**ON BEHALF OF
SOUTHERN PIONEER ELECTRIC COMPANY**

July 9, 2009

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ERIK SIGURD SONJU, P.E.**

**ON BEHALF OF
SOUTHERN PIONEER ELECTRIC COMPANY**

I. QUALIFICATIONS

Q. Please state your name and business address.

A. My name is Erik Sigurd Sonju. My business address is 1532 W. Broadway, Suite 103, Madison, Wisconsin, 53713.

Q. By whom are you employed and in what capacity?

A. I am a licensed professional engineer, employed by Power System Engineering, Inc. ("PSE"). I am the president of the company.

Q. Please describe Power System Engineering.

A. PSE is an engineering and consulting firm, established in 1974, serving electric utilities and industrial customers across the country. Our headquarters is in Madison, Wisconsin with regional offices in Topeka, Kansas; Minneapolis, Minnesota; Marietta, Ohio; Lexington, Kentucky; and Sioux Falls, South Dakota. The professionals at PSE help our clients in the areas of power supply, distributed energy resources, engineering studies, infrastructure planning, infrastructure design, industrial design, construction contracting and inspections, rate and cost of service studies, load forecasting, performance benchmarking, communication infrastructure design, utility automation, mapping/GIS and other technologies.

Q. Please describe your responsibilities with PSE.

A. My responsibilities are divided between running the day-to-day operations of PSE and helping PSE clients in the areas of my expertise. My area of expertise includes engineering

1 studies, utility infrastructure planning and design, distributed energy resources, utility
2 infrastructure operations and management.

3 **Q. What is your educational background?**

4 A. I graduated from North Dakota State University in Fargo, North Dakota in 1997 with a
5 Bachelor's of Science in Electrical Engineering, which included an emphasis in Electric
6 Power Systems. I am also a graduate of the National Rural Electric Cooperative Association
7 Management Internship Program through the University of Nebraska.

8 **Q. What is your professional background?**

9 A. From 1997 to 2001, I was employed with a consulting arm of Great River Energy, in Elk
10 River, Minnesota followed by a consulting arm of Wright Hennepin Electric Cooperative in
11 Rockford, Minnesota. My responsibilities at both places of employment primarily focused
12 on engineering studies, utility infrastructure planning and design, power quality
13 investigations, cost of service studies, and capital credit allocation studies.

14 From 2001 to 2006, I was employed with Great Lakes Energy in Boyne City, Michigan and
15 held the title of System Engineer where I managed the engineering and system technology
16 department for the cooperative. My responsibilities focused on the standardization of
17 engineering, operation and construction practices for the newly merged cooperative. Other
18 responsibilities included the development and follow through of construction work plans,
19 system reliability initiatives, distributed generation interconnection standards and day-to-day
20 operation of the distribution system.

21 I joined PSE in 2006 as Leader of System Planning. Overtime, and through multiple
22 promotions, my responsibilities grew to also include the oversight of PSE activities in the
23 areas of power line and substation design, distributed energy resources, and industrial
24 engineering. Additionally, over the last several years, I have been an instructor for

1 continuing education courses covering power line design, utility infrastructure planning,
2 system protection, power quality, and distributed energy resources.

3 On January 1, 2018, I became responsible of the day-to-day operations of PSE as the
4 company's president. Today, this role consumes approximately 50% of my time with the
5 remaining time dedicated to supporting PSE's clients in the areas of my expertise.

6 I am a licensed professional engineer registered in 20 states; including Kansas. A
7 copy of my current curriculum vitae is offered as Exhibit ESS-1.

8 **Q. Have you previously presented testimony before the Kansas Corporation Commission**
9 **("KCC" or "Commission")?**

10 A. Yes. I have presented testimony before the KCC on behalf of the Mid-Kansas Electric
11 Company, LLC in Docket No. 09-MKEE-969-RTS.

12 **Q. Do you have specific professional experience related to the testimony you are providing**
13 **to the KCC?**

14 A. Yes. Over the last twenty-one years of my profession, I have studied and designed, or
15 supervised the study and design, of the electric power infrastructure for dozens of utilities.
16 Critical aspects of this work require a solid understanding of industry best practices, industry
17 technical standards, planning and design criteria, engineering calculations, project costing,
18 and economic present worth analysis of project comparisons. Through this work, I have
19 been exposed to distribution, sub-transmission, and transmission systems that serve urban,
20 suburban, and rural areas.

21 **Q. In addition to your professional experience, what have you specifically reviewed to**
22 **formulate the testimony you are providing to the KCC?**

23 A. I have reviewed the following to formulate my testimony:

- Contingent application of Kansas Power Pool (“KPP”) for a certificate of convenience filed with the KCC in Docket No. 18-KPPE-343-COC (“18-343 Docket”) on February 9, 2018
- The direct testimony and exhibits of Larry W. Holloway in the 18-343 Docket, dated May 8, 2018.
- “Kingman Long Range Analysis” report developed by Mid-Kansas Electric Company, LLC dated Fall 2014.
- Southern Pioneer Electric Company SemCrude Substation drawings.
- Standards of Construction – Requirements for Connection of New Facilities or Changes to Existing Facilities Connected to the Sunflower or Mid-Kansas Transmission System, Appendix A, Pages 8 through 11.
- Kansas Administrative Regulations, Chapter 82, Article 12
- KSA 66-1,171

II. INTRODUCTION

Q. On whose behalf are you presenting testimony?

A. I am presenting testimony on behalf of Southern Pioneer Electric Company (“Southern Pioneer”).

Q. What is your professional connection with Southern Pioneer?

A. PSE has been providing cost of service and rate making services to Southern Pioneer for several years. I personally have not been involved with these specific services, however due to my experience in utility infrastructure planning and design, I was asked by Southern Pioneer to provide an independent third-party review of the KPP Application of Convenience and Authority for Transmission Rights Only (“KPP Application”), filed with the KCC on

February 9, 2018 and the subsequent Direct Testimony and Exhibits of Larry W. Holloway filed with the KCC on May 8, 2018.

Q. What is the purpose of your testimony in this proceeding?

A. The purpose of my testimony is threefold. First, for the record, as well as to benefit Commission and all stakeholders in this proceeding, I will make technical corrections to discrepancies in the KPP Application. Second, I will rebut certain aspects of the direct testimony and exhibits of Mr. Larry W. Holloway filed with the KCC on May 8, 2018. Finally, I will express my concerns with the KPP Application as an electric utility planning engineer.

Q. Are you sponsoring any exhibits with your testimony?

A. Yes. As supporting documentation to my testimony, I am sponsoring five exhibits. These exhibits include:

- ☐ Exhibit ESS-1: My Current Curriculum Vitae
- ☐ Exhibit ESS-2: Independent Third-Party Estimate – Kingman Direct Substation
- ☐ Exhibit ESS-3: Independent Third-Party Estimate – SemCrude Substation Upgrade
- ☐ Exhibit ESS-4: Independent Third-Party Estimate – 34.5 kV Overhead Line Alternatives
- ☐ Exhibit ESS-5: Kingman Direct Connection Substation Component Duplication

Q. Were these exhibits prepared by you or under your direct supervision?

A. All Exhibits were prepared by me or under my direct supervision.

III. CORRECTION TO KPP APPLICATION

Q. What technical correction to discrepancies are needed to the KPP Application?

A. There are two technical corrections that need to be made; both associated with the 34.5 kV overhead line that is being requested for approval by the KCC. First, the KPP Application states the following:

“The Kingman Upgrade project involves building approximately 4.5 miles of 34.5 kV line constructed according to NESC Standards.”¹

Second, Exhibit 1 to the KPP Application illustrates the below map which also indicates a project that involves constructing an approximate 4.5 mile 34.5 kV overhead line.²



¹ KPP Application, p. 4, item 8.

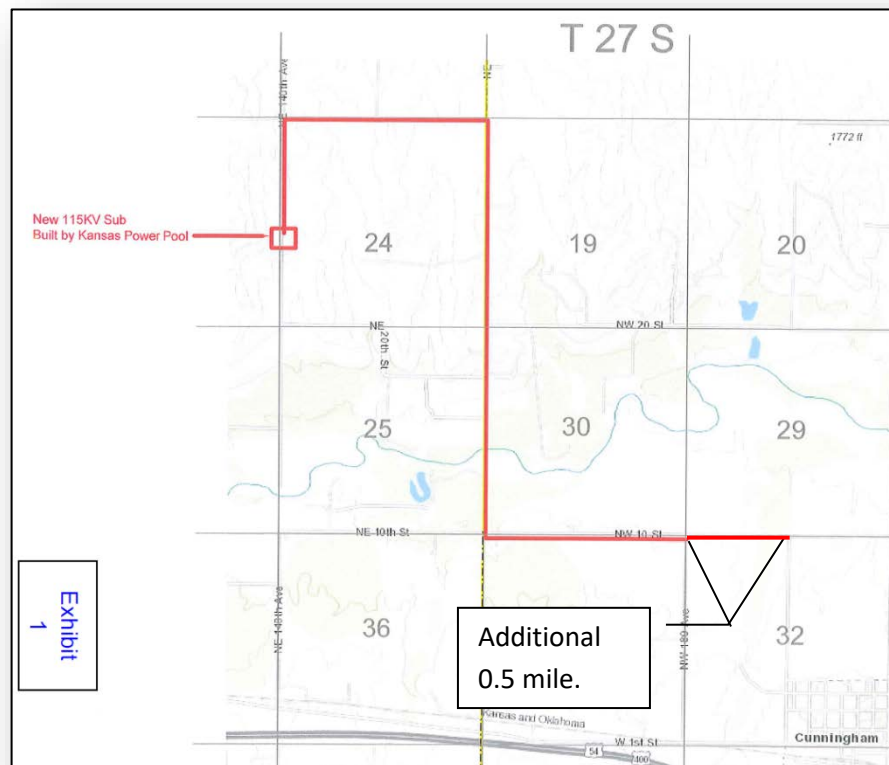
² Id.

The distance of 4.5 miles is inconsistent with the physical requirements to interconnect the proposed new 115 kV to 34.5 kV Kingman Direct Connection substation to the existing City of Kingman 34.5 kV overhead line. It is also inconsistent with statements made in the direct testimony of Mr. Holloway.³

For the record, the first sentence on page four of the KPP Application should be corrected to state the following:

“The Kingman Upgrade project involves building approximately 5.0 miles of 34.5 kV line constructed according to NESC Standards.”

Furthermore, Exhibit 1 to the KPP Application should be corrected to represent the following:



³ Holloway Direct Testimony, p. 29, lines 1-2.

1 I discussed the 4.5 mile vs. 5.0 mile discrepancy with Mr. Holloway on June 14, 2018 during
2 a technical call between me, Mid-Kansas/Sunflower technical personnel, Staff, and KPP, and
3 Mr. Holloway acknowledged the discrepancy. To avoid confusion in this proceeding, as
4 well as to not understate the overall impact of the KPP Application, it is important that this
5 correction is made and recognized by the Commission and all stakeholders having an interest
6 in this proceeding.

7 IV. RESPONSE TO KPP TESTIMONY

8 **Q. What aspects of Mr. Holloway's May 8, 2018 testimony are you responding to?**

9 **A.** I am specifically addressing the following in Mr. Holloway's testimony:

- 10 1) statement made about the design of the Southern Pioneer SemCrude substation⁴;
- 11 2) cost estimate for the proposed Kingman Direct Connection⁵;
- 12 3) orderly development of retail electric service⁶;
- 13 4) avoidance of wasteful duplication of facilities for the distribution of electricity⁷;
- 14 5) avoidance of unnecessary encumbrance of the landscape of the state⁸;
- 15 6) prevention of waste of materials and natural resources⁹;
- 16 7) facilitation of public convenience and necessity¹⁰;
- 17 8) minimization of disputes between retail electric suppliers which may result in
18 inconvenience, diminish efficiency and higher costs in servicing the consumer¹¹; and

⁴ Holloway Direct Testimony, p. 14, lines 6-8.

⁵ Holloway Direct Testimony, Exhibit LWH-3, p. 4-5.

⁶ Holloway Direct Testimony, p. 23, line 1; p. 24, lines 19-20; p. 25, lines 1-2.

⁷ Holloway Direct Testimony, p. 28, lines 16-18.

⁸ Holloway Direct Testimony, p. 28, line 23; p. 29, lines 1-2.

⁹ Holloway Direct Testimony, p. 29, lines 18-20.

¹⁰ Holloway Direct Testimony, p. 30, lines 5-7.

¹¹ Holloway Direct Testimony, p. 30, lines 12-14.

1 9) statement made about the City of Kingman being under a unique circumstance
2 because it must utilize a local transmission service by 34.5kV lines to connect to an
3 ISO/RTO¹².

4 **Q. What in Mr. Holloway’s testimony would you like to address about the design of the**
5 **Southern Pioneer SemCrude substation?**

6 A. Mr. Holloway acknowledges in his testimony that an alternative exists to the construction of
7 a new 115 kV to 34.5 kV substation and 5.0 mile 34.5 kV overhead line being requested for
8 approval in the KPP Application. This alternative is to increase the capacity of the existing
9 Southern Pioneer SemCrude substation, add a second 34.5 kV feeder exit and construct an
10 approximate 3.5 mile 34.5 kV overhead line (“SemCrude Substation Upgrade”).

11 With regards to the SemCrude Substation Upgrade alternative, Mr. Holloway makes the
12 following statement:

13 *“First, the SemCrude substation equipment was designed and installed merely*
14 *to serve the SemCrude load, and much of the equipment in the substation would*
15 *need to be replaced and rebuilt to accommodate the Kingman load and*
16 *generation.”¹³*

17 This statement is inaccurate and misleading.

18 First, it is important to understand that substation transformer replacements to
19 increase capacity is a common practice in the industry. Only when the substation’s footprint,
20 substructure, and other permanent features cannot accommodate a larger transformer is the
21 construction of a second, and adjacent, substation considered as an economical means for
22 providing additional capacity.

¹² Holloway Direct Testimony, Exhibit LWH-3, p. 1.

¹³ Holloway Direct Testimony, p. 14, lines 6-8.

1 As it relates to the Southern Pioneer SemCrude Substation, I have reviewed the
2 design drawing records and interviewed Southern Pioneer personnel regarding certain
3 engineered aspects. From my review, it is very clear the SemCrude Substation was designed
4 and constructed for the purpose and convenience of future capacity upgrades and additional
5 34.5 kV feeder exits. For example, although the existing transformer needs to be replaced
6 to increase the station's capacity, the substation's footprint, substructure and other permanent
7 features were intended to accommodate such an upgrade. The transformer foundation, oil
8 containment system, and ground grid system were all designed and constructed for a
9 transformer much larger than what exists today. More specifically, these substation elements
10 will easily accommodate a future 15/20/25 MVA transformer when additional capacity needs
11 are required.¹⁴ That said, until such need occurs, it is appropriate for the existing 6/7.5 MVA
12 unit to remain in place as to not burden ratepayers with additional revenue requirements of
13 recovering higher capital expenditures associated with surplus capacity of a larger
14 transformer.

15 In summary, the planning, engineering, and construction decisions behind the
16 SemCrude Substation follow industry best practices by developing and implementing a
17 design that economically accommodates future capacity expansions. Stating that the
18 substation was design and installed *merely* to service the SemCrude load is false.

19 **Q. What in Mr. Holloway's testimony would you like to address about the cost estimate**
20 **for the proposed Kingman Direct Connection?**

21 A. As part of my independent third-party review, I worked with PSE project engineers to
22 develop an independent estimate for a new 115 kV to 34.5 kV substation and a new 34.5 kV

¹⁴ A 15/20/25 MVA transformer will more than adequately provide capacity to serve 100% of the City of Kingman load as well as provide KPP full export capabilities of the City of Kingman generators.

1 overhead line that was identified in the KPP Application (“Kingman Direct Connection”).
2 Additionally, I worked with the same PSE project engineers to develop an independent
3 estimate for the Southern Pioneer SemCrude Substation Upgrade. The purpose of this
4 independent estimate was to verify that the costs in Mr. Holloway’s testimony reflect current
5 pricing of materials, labor, and equipment as well as to establish a common basis for
6 developing comparative estimates between alternatives.

7 **Q. How did your independent estimates compare to the estimates presented in Mr.**
8 **Holloway’s testimony?**

9 A. Before answering this question, I would like to clarify that Mr. Holloway’s testimony
10 references recommendations and estimates for the Kingman Direct Connection by Olsson
11 Associates in an August 8, 2016 letter to the KPP.¹⁵ Furthermore, Mr. Holloway’s testimony
12 references dated estimates developed by Southern Pioneer for the SemCrude Substation
13 Upgrade. As a result, Mr. Holloway’s two estimates originate from two separate studies
14 developed at different times and by different entities.

15 Additionally, I would like to clarify that Table 2, titled “*Kingman Direct Connection Cost*
16 *Update*”, in Exhibit LWH-3 of Mr. Holloway’s testimony omits the costs of a 34.5 kV to
17 12.5 kV transformer replacement, at the City of Kingman’s substation, for increased capacity
18 as recommended in the Olsson Associates’ August 8, 2016 letter.¹⁶ I’m assuming this
19 upgrade and associated capital expenditure is necessary for both the Kingman Direct
20 Connection and SemCrude Substation Upgrade alternatives. Therefore, I did not place an
21 emphasis on developing an independent estimate for this capital expenditure. Rather, using
22 the same cost estimate indicated in Mr. Holloway’s testimony, I include it as a placeholder

¹⁵ Holloway Direct Testimony, Exhibit LWH-3, Appendix B.

¹⁶ Holloway Direct Testimony, Exhibit LWH-3, p. 5; Exhibit LWH-3, Appendix B, p. 2 and p. 5.

as to not be missed by the Commission and other stakeholders who have in interest in this proceeding.

Q. Knowing this, how did your independent estimates compare to the estimates presented in Mr. Holloway's testimony?

A. A summary of the estimate comparisons is provided in the following table.

Comparison of SemCrude Substation Upgrade and Kingman Direct Connection				
	KPP Stated Estimate	PSE Independent Estimate	Difference	
<u>SemCrude Substation Upgrade</u>				
Transmission Interconnection	\$ -	\$ -	\$ -	0%
Substation Upgrade	\$ 441,089	\$ 410,000	\$ 31,089	7%
Transformer Replacement	\$ 750,000	\$ 650,000	\$ 100,000	13%
Sub-Transmission Line (3.2 miles)	\$ 730,184	\$ 694,840	\$ 35,344	5%
<u>Land Purchase & ROW</u>	<u>\$ -</u>	<u>\$ -</u>	<u>\$ -</u>	<u>0%</u>
Sub-Total	\$ 1,921,273	\$ 1,754,840	\$ 166,433	9%
<u>Kingman Transformer Replacement¹</u>	<u>\$ 555,000</u>	<u>\$ 555,000</u>	<u>\$ -</u>	<u>0%</u>
Grand-Total	\$ 2,476,273	\$ 2,309,840	\$ 166,433	7%
<u>Kingman Direct Connection</u>				
Transmission Interconnection ²	\$ 500,000	\$ 500,000	\$ -	0%
Substation (New)	\$ 996,670	\$ 1,980,000	\$ (983,330)	-99%
Transformer	\$ 450,000	\$ 650,000	\$ (200,000)	-44%
Sub-Transmission (5.0 miles)	\$ 974,436	\$ 849,814	\$ 124,622	13%
<u>Land Purchase & ROW³</u>	<u>\$ 100,000</u>	<u>\$ 100,000</u>	<u>\$ -</u>	<u>0%</u>
Sub-Total	\$ 3,021,106	\$ 4,079,814	\$ (1,058,708)	-35%
<u>Kingman Transformer Replacement¹</u>	<u>\$ 555,000</u>	<u>\$ 555,000</u>	<u>\$ -</u>	<u>0%</u>
Grand-Total	\$ 3,576,106	\$ 4,634,814	\$ (1,058,708)	-30%
Difference between Alternatives	\$ 1,099,833	\$ 2,324,974	\$ 1,225,141	111%

1) Based on Olsson Associates' August 8, 2016 letter to KPP.

2) Based on 2016 discussions between MKEC and KPP.

3) Based on KPP estimate.

As shown in the above table, the results of the independent estimate indicates that the cost for the SemCrude Substation Upgrade quantified in Mr. Holloway's testimony is overstated

1 by 7%. Further review of the above table indicates that the cost estimate of the Kingman
2 Direct Connection quantified in Mr. Holloway's testimony is understated by 30%. So, while
3 Mr. Holloway's testimony indicates that the KPP requested Kingman Direct Connection
4 project is approximately \$1,100,000 more expensive than the SemCrude Substation Upgrade
5 project, my independent assessment that uses a common approach and current cost
6 information shows that the requested Kingman Direct Connection project is closer to being
7 \$2,300,000 more expensive. In other words, the difference in capital expenditures quantified
8 in Mr. Holloway's testimony is off by a factor of two. This magnitude of error has significant
9 implications when applied to a 20-year net present value analysis. Therefore, the "*Economic*
10 *Evaluation of the Kingman Transmission Service Alternatives*", as presented in Exhibit
11 LWH-3 of Mr. Holloway's testimony, should be carefully scrutinized by the Commission.

12 **Q. Why is the Kingman Direct Connection cost estimate quantified in Mr. Holloway's**
13 **testimony understated?**

14 A. Engineering details behind the KPP estimate required to reconcile discrepancies with the
15 PSE independent estimate were not made available in Mr. Holloway's testimony, nor were
16 they provided in subsequent data request responses. However, within the bounds of what
17 was provided, I will attempt to rationalize the two largest discrepancies which include the
18 substation construction costs and the substation transformer cost.

19 The first major discrepancy is found in the Kingman substation line noted in the
20 previous table. Upon closer review of the KPP estimate, as itemized in the Olsson
21 Associates' August 8, 2016 letter, I found that discrepancies are not due to any one single
22 category but rather they are across the board. That said, the KPP estimate appears to be
23 missing several items such as geotechnical soil borings, site preparation work, oil
24 containment system, station batteries, by-pass fuses, acceptance testing, and commissioning.

Additionally, foundations and steel costs are much lower than that estimated by PSE which could be caused by a discrepancy in the quantities of material (ex. lbs. of steel and number of foundations). It is also unclear if the KPP estimate incorporates protection and communications between the Kingman generation and the proposed 115 kV interconnection. The following table provides a more detail breakdown of components by general category and corresponding estimates along with comments of items that were noted during my comparison review.

Component Category	KPP Estimate ¹	PSE Estimate ²	Difference (\$)	Comments
115 Circuit Switcher, 34.5 Breaker & Switches	\$ 162,000	\$ 208,000	\$ (46,000)	By-pass fuses and hook stick switches not found in KPP estimate
Relaying, Metering, & Instrument Transformers	\$ 157,500	\$ 151,000	\$ 6,500	
Control Building	\$ 53,000	\$ 149,000	\$ (96,000)	Station batteries not found in KPP estimate. PSE estimate based on prefabricated control building with ac and dc panels, station power transfer switch, ventilation, cable racks, etc.
Steel, Bus, Insulators, arresters	\$ 115,700	\$ 420,000	\$ (304,300)	115 kV and 34.5 kV switch stands not found in KPP estimate. Steel significantly less in KPP estimate. Total lbs. of steel in KPP estimate not known.
Foundations	\$ 32,500	\$ 188,000	\$ (155,500)	Control building foundation not found in KPP estimate. Transformer pad and pier foundations for steel significantly less in KPP estimate.
Ground grid, conduit, concrete trench	\$ 21,500	\$ 149,000	\$ (127,500)	All items significantly less in KPP estimate. Total length of copper in KPP estimate not known.
Site preparation, grading, rock, fence, oil containment	\$ 74,000	\$ 202,000	\$ (128,000)	Site preparation and oil containment not found in KPP estimate. Total substation footprint in KPP estimate not known.
SCADA & Communications	\$ 13,000	\$ 55,000	\$ (42,000)	KPP estimate assumes low cost communication to SemCrude substation. Communications for generation interconnection protection in KPP estimate not known.
Engineering and project management	\$ 128,000	\$ 295,000	\$ (167,000)	Geotechnical soil boring, acceptance testing, and commissioning not found in KPP estimate. Generation interconnection protection in KPP estimate not known.
Misc. & Contingency	\$ 78,970	\$ 163,000	\$ (84,030)	5.8% of total KPP estimate. 6.6% of total cost of PSE estimate.
Underground Substation Exits	\$ 160,500	\$ -	\$ 160,500	Cost of substation underground exits are in PSE's sub-transmission line costs
Total	\$ 996,670	\$ 1,980,000	\$ (983,330)	

1) KPP estimate is based on 2016 costs.

2) PSE estimate is based on 2018 costs.

The second major discrepancy is associated with the Kingman substation's 115 kV to 34.5 kV 15/20/25 MVA transformer. Mr. Holloway's testimony uses a cost of \$450,000 while

1 recent manufacturer quotations received by PSE indicate that the cost for such a transformer
2 is closer to \$650,000.

3 Finally, I will point out that the source of the estimate provided in Mr. Holloway's
4 testimony is based on costs assembled in 2016. To correct for this, Mr. Holloway applies a
5 1.00 escalation factor, derived from the Producer Price Index (PPI) between April 2014 and
6 March 2018, to adjust the estimates to current dollars.¹⁷ Using the PPI for deriving an
7 historical escalation factor for utility infrastructure costs is not appropriate. The PPI is too
8 broad and traditionally does not follow actual escalations experienced in a single sector, such
9 as the electric utility industry. Rather, a more appropriate index for establishing historical
10 escalation factors in the electric utility industry can be derived from the Handy-Whitman
11 Index (HWI). Applying the HWI for the same timeframe results in an escalation factor of
12 1.06 vs. 1.00. Omitting this escalator further exacerbates the discrepancies.

13 **Q. Is it possible that PSE's independent estimate is overstated?**

14 A. Not likely. PSE's estimates for both the Kingman Direct Connection and the SemCrude
15 Substation Upgrade were done completely independent of previous estimates developed by
16 others. In fact, the previous estimates were not seen by the project engineers until the
17 independent estimates were complete. The cost estimates developed by PSE are based on
18 actual costs of recently constructed substation projects. Also, the estimate PSE developed
19 for the SemCrude Substation Upgrade came in very similar to that developed by Southern
20 Pioneer's engineer (Peak Power) which provides an element of support for the estimating
21 methods and assumptions used by PSE for component costs and regional factors. For the

¹⁷ Holloway Direct Testimony, Exhibit LWH-3, p. 4.

benefit of others, a detailed breakdown of the independent estimates established by PSE are attached as Exhibits ESS-2, ESS-3, and ESS-4.

Q. What in Mr. Holloway's testimony would you like to address about the orderly development of retail electric service?

A. Mr. Holloway states that approving the KPP Application encourages the orderly development of retail electric service.¹⁸ I respectfully disagree.

Although the KPP Application is for wholesale service facilities, it is just as important to encourage the orderly development of the transmission and sub-transmission system in that context as it is for retail service. Mr. Holloway's testimony does not address nor recognize industry best practices of applying a coordinated 'single-system' planning approach, at a local level, that evaluates the total aggregated cost of all capital expenditures independently of how revenue requirements are allocated amongst ratepayers. The results of approving the KPP Application may be the cheapest option for KPP and the City of Kingman when taking other outside factors into account, however, it is not the overall lowest cost solution identified in the local planning efforts lead by Mid-Kansas Electric Company, Inc. ("Mid-Kansas"). The Mid-Kansas local planning efforts has identified the SemCrude Substation Upgrade as the most economical solution for all ratepayers as an aggregate.

In other words, the approval of the KPP Application will result in the spending of an additional \$2,300,000 in capital to achieve the same electrical results as the SemCrude Upgrade. This additional capital expenditures of \$2.3 million, and associated incremental on-going operation and maintenance expenses, aligning with the KPP Application, must be

¹⁸ Holloway Direct Testimony, p. 23, line 15.

1 recognized by the KCC as a need for additional revenue requirements that will ultimately
2 and unnecessarily be passed down to ratepayers.

3 Furthermore, based on the net present value analysis and statements in Mr.
4 Holloway's testimony, I'm assuming the Southern Pioneer 34.5 kV local access delivery
5 service ("LADS") charge is the real issue for KPP. Additionally, on the surface, the benefit
6 of the KPP Application appears to be more driven from a generator's perspective vs. from a
7 ratepayer's perspective. That said, attempting to avoid a regulated LADS rate that was
8 designed to recover the cost of local sub-transmission facilities by building more sub-
9 transmission/transmission facilities is both imprudent and an inefficient use of the overall
10 electric infrastructure.

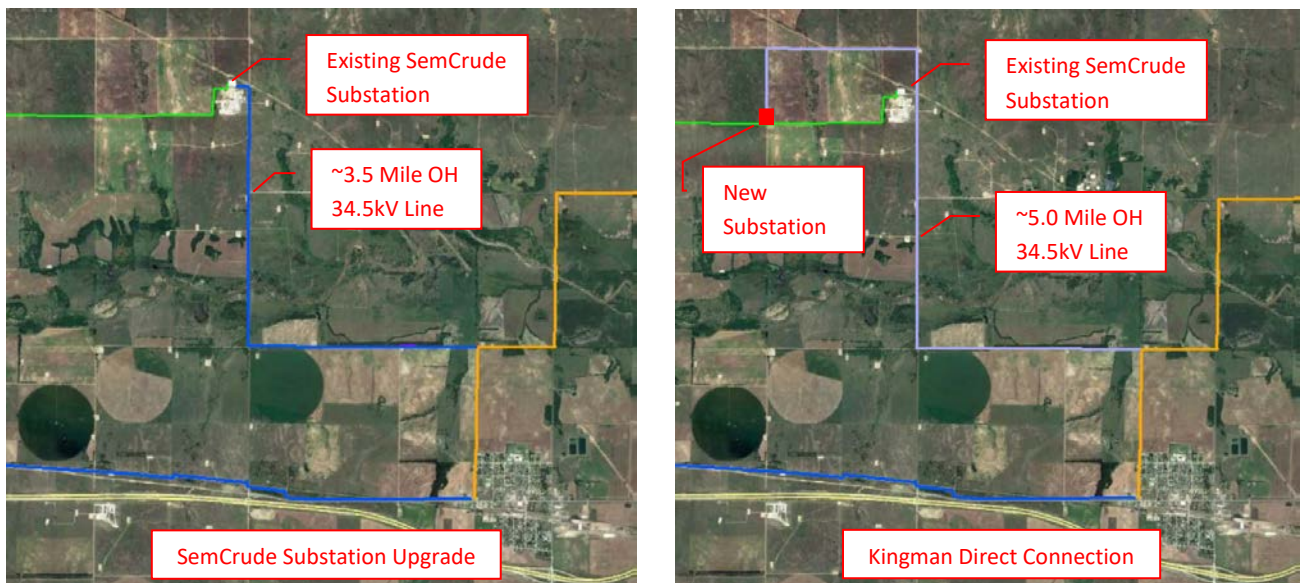
11 Regardless how one slices the pie, approving the KPP Application would not result
12 in the orderly development of retail electric service. In fact, it would do just the opposite
13 and create a precedent for others to circumnavigate industry best practices of system planning
14 methods by building their own sub-transmission facilities, regardless of the impact to others,
15 creating unnecessary duplication of facilities and incremental capital expenditures which will
16 ultimately be recovered by ratepayers.

17 **Q. What in Mr. Holloway's testimony would you like to address about the avoidance of**
18 **wasteful duplication of facilities for the distribution of electricity?**

19 A. Mr. Holloway states that granting the certificate of transmission rights only would not cause
20 wasteful duplication of facilities for the distribution of electricity.¹⁹ I respectfully disagree.
21 As it relates to the KPP Application, it is important for the Commission to acknowledge that
22 another option exists. This option consists of increasing the capacity of the existing

¹⁹ Holloway Direct Testimony, p. 25, line 5.

SemCrude Substation and building a little less than 3.5 miles of overhead 34.5 kV line (the SemCrude Substation Upgrade). This is the same option identified in local planning efforts by Mid-Kansas. For comparison purposes, the below aerial imagery shows the SemCrude Substation Upgrade alternative alongside the Kingman Direct Connection alternative.



As illustrated above, approval of the KPP Application would result in the duplication of an entire new substation that would reside no more than one mile from the existing SemCrude substation. Furthermore, the above aerial imagery also illustrates that the proposed 34.5 kV overhead line, identified in the KPP Application, run within 500 feet of the existing SemCrude Substation. In addition to this imagery, I have identified a listing of substation components in Exhibit ESS-5 that would be found in the Kingman Direct Connection substation classified as full or partial duplication of existing components in the SemCrude substation. Partial duplication indicates existing SemCrude substation components that do not full represent what would be located in the Kingman Direct Connection substation. For example, the existing 6/10 MVA transformer in the SemCrude substation is a partial

1 duplication of the 15/20/25 MVA transformer that would be located in the Kingman Direct
2 Connection substation.

3 In terms of dollars, the duplication of facilities would amount to approximately \$2,000,000
4 in capital expenditures, excluding incremental on-going O&M associated with a second
5 substation. This amount further increases when including the additional 1.5 mile 34.5 kV
6 overhead line that would need to be constructed if the KPP Application is approved.

7 **Q. What in Mr. Holloway's testimony would you like to address about the avoidance of**
8 **unnecessary encumbrance of the landscape of the state?**

9 A. Mr. Holloway's testimony does not acknowledge that the SemCrude Substation Upgrade has
10 the greatest avoidance of unnecessary encumbrance to the landscape of the state when
11 compared to the facilities associated with the KPP Application.

12 It is important that the Commission recognize that the SemCrude Substation Upgrade
13 alternative will result in the *avoidance* of constructing a new 115kV motor operated switch
14 structure, an entirely new 115kV to 34.5 kV substation, and an additional 1.5 mile 34.5 kV
15 overhead line. Additionally, it is important for the Commission to understand that the
16 SemCrude Substation Upgrade option provides the same electrical capabilities as the
17 facilities presented in the KPP Application with regards to meeting KPP's generation export
18 desires and City of Kingman's load import desires.

19 **Q. What in Mr. Holloway's testimony would you like to address about the prevention of**
20 **waste of materials and natural resources?**

21 A. Mr. Holloway states that granting the certificate of transmission rights only prevents waste
22 of materials and natural resources.²⁰ I respectfully disagree.

²⁰ Holloway Direct Testimony, p. 28, lines 16-18.

1 As previously stated, approval of the KPP Application will result in the construction
2 of a new 115kV motor operated switch structure, an entirely new 115kV to 34.5 kV
3 substation, and an additional 1.5 mile 34.5 kV overhead line. These facilities all required
4 the use of materials and natural resources - including metals, mineral oil, and wood poles -
5 that are not necessary with the SemCrude Substation Upgrade option.

6 Furthermore, Mr. Holloway states that:

7 *“Current import limits on the City of Kingman result in needless and*
8 *uneconomical generation, wasting natural gas when, for example, cheaper*
9 *power supplies such as wind energy are available from the SPP Integrated*
10 *Market.*²¹”

11 Unless Mr. Holloway can demonstrate otherwise, there is no reason to believe that the
12 SemCrude Substation Upgrade will cause KPP to operate the City of Kingman generators
13 more frequently as compared to how they will be operated under KPP’s proposed option.

14 **Q. What in Mr. Holloway’s testimony would you like to address about the facilitation of**
15 **public convenience and necessity?**

16 A. Mr. Holloway states that granting the certificate of transmission rights only will facilitate
17 public convenience and necessity.²² I respectfully disagree.

18 Although the KPP Application does provide benefits to the City of Kingman, it is not
19 the best option for reasons earlier explained in my testimony, and therefore, it is not in the
20 overall public interest.

²¹ Holloway Direct Testimony, p. 29, lines 14-16

²² Holloway Direct Testimony, p 29, line 22.

1 **Q. What in Mr. Holloway's testimony would you like to address about the minimization**
2 **of disputes between retail electric suppliers which may result in inconvenience,**
3 **diminish efficiency and higher costs in servicing the consumer?**

4 A. Mr. Holloway's testimony states that the KPP Application has no impact on retail electric
5 suppliers or their territories.²³ I respectfully disagree.

6 The very nature of the KPP Application in this proceeding will cause, if it hasn't
7 already, an indirect dispute between the City of Kingman and Southern Pioneer due to
8 proposed cost shifting, as discussed in the Direct Testimony of Messrs. Davis Rooney and
9 Mr. Randall Magnison. Furthermore, for reasons earlier explained in my testimony, the KPP
10 Application diminishes efficiency by requesting the duplication of facilities as well as
11 spending an additional \$2,300,000 in capital expenditures to achieve the same electrical
12 results as the SemCrude Substation Upgrade alternative. The additional capital expenditures
13 of \$2.3 million, and associated incremental on-going O&M expenses, will ultimately and
14 unnecessarily burden ratepayers.

15 Additionally, by approving a precedent allowing municipal energy agencies
16 ("MEAs") to circumvent the local planning process and bypass existing sub-transmission
17 systems to avoid paying LADS charges by shifting such costs to retail and other wholesale
18 customers,²⁴ future disputes between MEAs and incumbent transmission/distribution
19 providers is essentially guaranteed.

20 **Q. What statement in Mr. Holloway's testimony would you like to address regarding the**
21 **City of Kingman being under a unique circumstance because it must utilize a local**
22 **transmission service by 34.5 kV lines to connect to an ISO/RTO?**

²³ Holloway Direct Testimony, p. 30, lines 12-14.

²⁴ See, Direct Testimony of Mr. Davis Rooney and Mr. Randall Magnison.

1 A. I respectfully disagree that the City of Kingman is under a unique circumstance.

2 There are many cities and communities, much larger than the City of Kingman, that
3 fall into the category of utilizing a local transmission service of 34.5 kV lines. Case in point
4 is the City of St. Charles, IL. The City of St. Charles has a population of approximately
5 35,000 and resides a little less than 50 miles from Chicago, IL. The area is relatively highly
6 urban, with much larger load center than that of the City of Kingman area described by Mr.
7 Holloway. Yet, the City of St. Charles also utilizes a local transmission service of 34.5 kV
8 lines provided by ComEd. These ComEd 34.5 kV lines fall outside the functional control of
9 the regional ISO/RTO similar to the 34.5 kV lines owned and operated by Southern Pioneer
10 that fall outside the functional control of the SPP.

11 V. SYSTEM PLANNING CONCERNS

12 **Q. As an experienced system planning engineer, what are your concerns with the KPP**
13 **Application?**

14 A. As a system planning engineer, it concerns me that the facilities identified in the KPP
15 Application do not follow industry best practices of being identified through a coordinated
16 ‘single-system’ planning effort, which includes all stakeholders, and intended to identify the
17 orderly and efficient expansion of the electric utility infrastructure, independently of how
18 revenue requirements are allocated amongst ratepayers.

19 The approval of the KPP Application will not only result in the spending of an
20 additional \$2,300,000 in capital expenditures to achieve the same electrical results that exist
21 with the SemCrude Substation Upgrade identified in Mid-Kansas local planning efforts, but
22 it will also create a precedence for others to circumnavigate industry best practices in the
23 future.

1 **Q. Does this conclude your testimony?**

2 A. Yes.

VERIFICATION OF ERIK S. SONJU

STATE OF WISCONSIN)
) ss
COUNTY OF DANE)

The undersigned, Erik S. Sonju, upon oath first duly sworn, states that he is the President of Power System Engineering, Inc., and that the foregoing testimony was prepared by him or under his supervision, that he is familiar with the contents thereof, and that the statements contained therein are true and correct to the best of his knowledge and belief.

Erik S. Sonju
Erik S. Sonju, P.E.
President | Power System Engineering, Inc.

Subscribed and sworn to before me this 6 day of July, 2018.

Christine R. Loga
Notary Public

My appointment expires: 10/2/2021



EXHIBIT ESS-1

ERIK S. SONJU, P.E.

PRESIDENT

SUMMARY OF EXPERIENCE AND EXPERTISE

- Consultant in the electric utility sector helping clients analyze and develop strategic decisions around industry best practices, policies, standards, and contracts.
- Principal engineer for electric power studies and design projects.
- Instructor for professional development courses.
- Expert witness in regulatory hearings and civil trials.
- Licensed Professional Engineer in 20 states.

PROFESSIONAL EXPERIENCE

Power System Engineering, Inc. – Madison, WI (2006-present)

President (2018-present)

Active consultant to PSE clients in areas of expertise. Responsible for the day-to-day operations of PSE.

Executive Vice President (2017-2018)

Executive for PSE business operations and active consultant to PSE clients.

Vice President – Power Delivery Planning and Design (2010 - 2017)

Responsible for PSE's efforts in electric transmission and distribution studies and planning, substation design, transmission line design and distribution line design. Other responsibilities include overseeing system protection and coordination studies, system operations and maintenance support, distributed energy resource studies and design, and specialty studies of electric power systems.

Leader of System Planning and Line Design (2008 – 2010)

Senior engineer and leader of system planning and line design. Emphasis included short range and long range system planning studies, distributed generation system impact studies, system protection studies, and expert testimony in regulatory proceedings associated with engineering analysis used for State Commission and FERC filed tariffs. Other responsibilities included distribution and transmission line design.

Leader of System Planning (2006 – 2008)

Senior engineer and leader of distribution system planning projects.

Great Lakes Energy – Boyne City, MI (2001-2006)

System Engineer and Manager of Engineering

Heartland Engineering Services – Rockford, MN (1999-2001)

System Engineer

United Services Group – Elk River, MN (1997-1999)

Planning Engineer

EDUCATION

North Dakota State University, Fargo, ND

Bachelor of Science in Electrical Engineering with Emphasis in Power Systems, 1997

University of Nebraska, Lincoln, NE

NRECA Management Internship Program, 2006

Numerous technical and business continuing education courses focusing on issues and topics within the power industry.

TRAINING SEMINARS AND CONFERENCE PRESENTATIONS

- Instructor for professional development courses in the areas of:
 - o Distribution System Planning
 - o Distribution System Protection and Sectionalizing
 - o Power Quality
 - o Electric Power Line Design
 - o Post Construction Inspections
- Industry conference presentations on:
 - o Distribution Independent System Operators
 - o Distributed Energy Resource Interconnection and Integration
 - o Aging Electric Utility Infrastructure
 - o Economic Conductor Analysis
 - o Mechanical Loading of Overhead Electrical Equipment on Wood Poles
 - o Application of Series Capacitors on Distribution Systems
 - o Application of Shunt Reactors on Distribution Systems
 - o Impact of Electric Motors, Drives, and Phase Converters on Distribution Systems
 - o Substation Protection Considerations
 - o National Electric Safety Code Rules and Requirements Pertaining to Communication Attachments on Power Supply Structures.

STATES LICENSED AS PROFESSIONAL ENGINEER

Arizona	Indiana	Montana	South Dakota
Arkansas	Iowa	Nebraska	Texas
Colorado	Kansas	New Hampshire	Virginia
Florida	Michigan	New Mexico	Wisconsin
Illinois	Minnesota	Ohio	Wyoming

EXPERT WITNESS AND TESTIMONY

<u>Utility / Entity</u>	<u>Jurisdiction Body</u>	<u>Case No.</u>	<u>Description</u>	<u>Year</u>
Chevron Pipe Line Company	United States District Court of Utah, Central Division	2:12-cv-00287	Industry expert on behalf of plaintiff in the matter of electrical damage to an oil pipeline. Included expert report and deposition.	2016-17
Lorain-Medina Rural Electric Cooperative	State of Ohio Median County Common Pleas Court	15CIV0749	Industry expert on behalf of defendant in the matter of the application of an electric rate schedule dispute. Included expert report and deposition.	2014-16
Toronto Hydro-Electric System Limited	Ontario Energy Board	EB-2015-0173	Industry expert on behalf of Toronto Hydro. Developed filed report regarding the variance of forecasted vs. actual expenditures associated with an OEB approved 2012-14 Incremental Capital Module request.	2015-16
Toronto Hydro-Electric System Limited	Ontario Energy Board	EB-2014-0116	Industry expert on behalf of Toronto Hydro. Developed filed report regarding independent review of the cost to serve developed environments including core downtown areas. Followed by oral testimony.	2014-15
Crow Wing Power	State of Minnesota District Court - Cass County	Court File No: 11-CV-12-1670	Testimony on behalf of defendant in the matter of a stray voltage lawsuit. Specific evidence related to conditions of underground distribution cable running adjacent to a dairy farm.	2013-14
MidAmerican Energy Company	State of Iowa District Court - Polk County	Law No. CL 114962	Industry expert on behalf of defendant providing engineering analysis showing the probable cause of failure of a 161kV transmission structure while under construction. Included affidavit of the analysis results and deposition.	2013
Toronto Hydro-Electric System Limited (THESL)	Ontario Energy Board	EB-2012-0064	Written and oral testimony regarding the replacement of aging electric infrastructure in the matter of THESL's application for 2012, 2013, and 2014 IRM Rate Adjustments and ICM Rate Adders	2012

<u>Utility / Entity</u>	<u>Jurisdiction Body</u>	<u>Case No.</u>	<u>Description</u>	<u>Year</u>
Governor Dannel P. Malloy's Two Storm Panel	State of Connecticut	N/A	Expert witness presentation to Governor Malloy's Two Storm Panel regarding distribution system reliability in the aftermath of Tropical Storm Irene and 2011 Halloween nor'easter snow storm.	2011
Mid-Kansas Electric Company	Kansas Corporation Commission	09-MKEE- 969-RTS	Written expert rebuttal testimony on certain aspects of transmission and sub-transmission losses applied in proposed open access transmission tariffs and local access charges.	2009

EXHIBIT ESS-2
(Page 1 of 2)

Kingman Direct Connection - PSE Independent Estimate
New 115 kV to 34.5 kV Substation with One 35 kV Feeder
Latest Revision: 6-22-2018

Item	Material and Construction Unit Costs	Quantity	Extended Cost	Total or Contract Costs
-----	-----	-----	-----	-----
Property		0 Acre	\$0	\$0
Transformer with LTC - 115/2.4/34.5 kV 15/20/25 MVA Wye/Delta/Wye	\$650,000	1 Ea.	\$650,000	\$650,000
115 or 138 kV circuit switcher	\$55,000	1 Ea.	\$55,000	\$55,000
35 kV breakers	\$38,000	1 Ea.	\$38,000	\$38,000
Relay panels	\$20,000	3 Ea.	\$60,000	\$60,000
Substation material package				\$341,000
Primary dead-end(s)	\$2.00	25000 Lbs.	\$50,000	
Primary switch stand(s)	\$2.00	5000 Lbs.	\$10,000	
Primary bus support(s)	\$2.00	12750 Lbs.	\$25,500	
Primary VT support(s)	\$2.00	0 Lbs.	\$0	
Secondary metering stand(s)	\$2.00	2400 Lbs.	\$4,800	
Secondary switch stand(s) for transformer	\$2.00	2400 Lbs.	\$4,800	
Distribution structure(s)	\$2.00	12000 Lbs.	\$24,000	
Secondary switch stand(s) for circuit	\$2.00	2400 Lbs.	\$4,800	
Secondary switch and riser stand(s)	\$2.00	3000 Lbs.	\$6,000	
Lightning Mast	\$2.00	20000 Lbs.	\$40,000	
115/138 kV Switch	\$10,000	2 Ea.	\$20,000	
Motor Operators	\$5,000	0 Ea.	\$0	
Bus tube, bar, angle, large conductor	\$12.00	1250 Ft	\$15,000	
115 kV VT's	\$10,000	0 Ea.	\$0	
115 or 138 kV insulators	\$300	23 Ea.	\$6,900	
115 kV Arresters	\$1,000	3 Ea.	\$3,000	
35 kV CT/VT	\$3,500	9 Ea.	\$31,500	
35 kV 3 phase switch(es)	\$7,000	3 Ea.	\$21,000	
35 kV hook stick bypass switches	\$3,000	3 Ea.	\$9,000	
35 kV fusing for PT's	\$2,500	6 Ea.	\$15,000	
35 kV Insulators	\$100	27 Ea.	\$2,700	
Secondary arresters	\$150	6 Ea.	\$900	
Bus connectors	\$50	240 Ea.	\$12,000	
Grounding connectors	\$20	150 Ea.	\$3,000	
Other packager expenses		1 Lot	\$30,990	

EXHIBIT ESS-2
(Page 2 of 2)

Substation construction				\$974,000
Preliminary site work	\$20	3067 CuYds	\$61,000	
Fencing - Chain link	\$35	820 Linear Ft	\$29,000	
Foundations		1 Lot	\$188,000	
Primary dead-end	\$7,000	4 Ea.		
Primary switch stand	\$5,000	4 Ea.		
Primary bus support	\$3,000	17 Ea.		
Primary VT support	\$3,000	0 Ea.		
Secondary metering stand	\$4,000	2 Ea.		
Secondary switch stand for xfmr	\$3,000	2 Ea.		
Distribution structure	\$4,000	4 Ea.		
Secondary switch stand for circuit(s)	\$4,000	2 Ea.		
Secondary switch and riser structure	\$4,000	2 Ea.		
Circuit switcher	\$4,000	2 Ea.		
Breaker	\$2,000	1 Ea.		
Transformer	\$15,000	1 Ea.		
Capacitor/Inductor Bank	\$0	0 Ea.		
Lightning mast / shield wire pole	\$4,000	2 Ea.		
Control Building	\$10,000	1 Ea.		
Conduit/cable trench - materials and labor	\$55,000	1 Lot	\$55,000	
Ground grid - material and labor	\$20	4550 LF	\$91,000	
Oil containment system	\$30,000	1 Ea.	\$30,000	
Crushed stone surface	\$1.00	41400 Sq. Ft	\$41,400	
Erection of substation structures	\$30,000	1 Lot	\$30,000	
Installation of bus work, switches, etc.	\$50,000	1 Lot	\$50,000	
Major equipment installation	\$50,000	1 Lot	\$50,000	
Control building	\$400	336 Sq Ft	\$134,400	
Station battery/charger	\$15,000	1 Lot	\$15,000	
Station 600 V power/control wiring, lighting	\$60,000	1 Lot	\$60,000	
Wildlife protection (35 kV system only)	\$10,000	1 Lot	\$10,000	
Final grading and restoration	\$5	8200 Lot	\$41,000	
Other contractor expenses		1 Lot	\$88,580	
Capacitor/Inductor bank - _____ MVAR		0 Lot	\$250,000	\$0
Communications	\$30,000	1 Lot	\$30,000	\$30,000
Acceptance testing	\$40,000	1 Lot	\$40,000	\$40,000
Soil Borings & Geotechnical Report	\$2,500	4 Ea.	\$10,000	\$10,000
Foundation design		1 Lot		\$25,000
Site grading, SPCC design, storm water/erosion control design		1 Lot		\$30,000
SCADA System		1 Lot		\$25,000
Contingencies - 10%		1 Lot		\$163,000
Engineering including contract management		1 Lot		\$190,000
			Total	\$2,630,000

Does not include property, real estate agent, or regulatory filings.

Does not include remote end 115 kV substations modifications

Estimate assumes no new relaying or major work at adjacent 115 kV substations is required

Estimate assumes contract labor

Estimate assumes 35 kV underground cable out of the substation is part of the distribution line work

EXHIBIT ESS-3
(Page 1 of 2)

SemCrude Upgrade - PSE Independent Estimate
Upgrade 115 kV to 34.5 kV Transformer and Add 35 kV Feeder
Latest Revision: 6-22-2018

Item	Material and Construction Unit Costs	Quantity	Extended Cost	Total or Contract Costs
-----	-----	-----	-----	-----
Property		0 Acre	\$0	\$0
Transformer with LTC - 115/2.4/34.5 kV 15/20/25 MVA Wye/Delta/Wye	\$650,000	1 Ea.	\$650,000	\$650,000
115 or 138 kV circuit switcher	\$55,000	0 Ea.	\$0	\$0
35 kV breakers	\$38,000	1 Ea.	\$38,000	\$38,000
Relay panels	\$20,000	1 Ea.	\$20,000	\$20,000
Substation material package				\$64,000
Primary dead-end(s)	\$2.00	0 Lbs.	\$0	
Primary switch stand(s)	\$2.00	0 Lbs.	\$0	
Primary bus support(s)	\$2.00	0 Lbs.	\$0	
Primary VT support(s)	\$2.00	0 Lbs.	\$0	
Secondary metering stand(s)	\$2.00	0 Lbs.	\$0	
Secondary switch stand(s) for transformer	\$2.00	0 Lbs.	\$0	
Distribution structure(s)	\$2.00	0 Lbs.	\$0	
Secondary switch stand(s) for circuit	\$2.00	2400 Lbs.	\$4,800	
Secondary switch and riser stand(s)	\$2.00	3000 Lbs.	\$6,000	
Lightning Mast	\$2.00	0 Lbs.	\$0	
115/138 kV Switch	\$10,000	0 Ea.	\$0	
Motor Operators	\$5,000	0 Ea.	\$0	
Bus tube, bar, angle, large conductor	\$12.00	150 Ft	\$1,800	
115 kV VT's	\$10,000	0 Ea.	\$0	
115 or 138 kV insulators	\$300	0 Ea.	\$0	
115 kV Arresters	\$1,000	0 Ea.	\$0	
35 kV CT/VT	\$3,500	3 Ea.	\$10,500	
35 kV 3 phase switch(es)	\$7,000	2 Ea.	\$14,000	
35 kV hook stick bypass switches	\$3,000	3 Ea.	\$9,000	
35 kV fusing for PT's	\$2,500	3 Ea.	\$7,500	
35 kV Insulators	\$100	9 Ea.	\$900	
Secondary arresters	\$150	3 Ea.	\$450	
Bus connectors	\$50	48 Ea.	\$2,400	
Grounding connectors	\$20	40 Ea.	\$800	
Other packager expenses		1 Lot	\$5,815	

EXHIBIT ESS-3
(Page 2 of 2)

Substation construction				\$149,000
Preliminary site work	\$20	0 CuYds	\$0	
Fencing - Chain link	\$35	0 Linear Ft	\$0	
Foundations		1 Lot	\$10,000	
Primary dead-end	\$7,000	0 Ea.		
Primary switch stand	\$5,000	0 Ea.		
Primary bus support	\$3,000	0 Ea.		
Primary VT support	\$3,000	0 Ea.		
Secondary metering stand	\$4,000	2 Ea.		
Secondary switch stand for xfmr	\$4,000	0 Ea.		
Distribution structure	\$4,000	0 Ea.		
Secondary switch stand for circuit(s)	\$3,000	2 Ea.		
Secondary switch and riser structure	\$4,000	2 Ea.		
Circuit switcher	\$4,000	0 Ea.		
Breaker	\$2,000	1 Ea.		
Transformer	\$15,000	0 Ea.		
Capacitor/Inductor Bank	\$0	0 Ea.		
Lightning mast / shield wire pole	\$4,000	0 Ea.		
Control Building	\$10,000	0 Ea.		
Conduit - materials and labor	\$10,000	1 Lot	\$10,000	
Ground grid - material and labor	\$20	200 LF	\$4,000	
Oil containment system	\$30,000	0 Ea.	\$0	
Crushed stone surface - Removal and addition	\$1.50	900 Sq. Ft	\$1,350	
Erection of substation structures	\$5,000	1 Lot	\$5,000	
Installation of bus work, switches, etc.	\$10,000	1 Lot	\$10,000	
Major equipment removal and installation	\$75,000	1 Lot	\$75,000	
Control building	\$400	0 Sq Ft	\$0	
Station battery/charger	\$15,000	0 Lot	\$0	
Station 600 V power/control wiring, lighting	\$15,000	1 Lot	\$15,000	
Wildlife protection (35 kV system only)	\$5,000	1 Lot	\$5,000	
Final grading and restoration	\$5	0 Lot	\$0	
Other contractor expenses		1 Lot	\$13,535	
Capacitor/Inductor bank - _____ MVAR		0 Lot	\$250,000	\$0
Acceptance testing	\$20,000	1 Lot	\$20,000	\$20,000
Soil Borings & Geotechnical Report	\$2,500	0 Ea.	\$0	\$0
Foundation design		1 Lot		\$10,000
Site grading, SPCC design, storm water/erosion control design		1 Lot		\$0
SCADA System		1 Lot		\$20,000
Contingencies - 10%		1 Lot		\$32,000
Engineering including contract management		1 Lot		\$60,000
Total				\$1,060,000

Does not include property, real estate agent, or regulatory filings.

Does not include remote end 115 kV substations modifications

Estimate assumes no new relaying or major work at adjacent 115 kV substations is required

Estimate assumes contract labor

Estimate assumes 35 kV underground cable out of the substation is part of the distribution line work

EXHIBIT ESS-4

Latest Update: 06/25/2018

	Material	Labor & Equipment	Extended		
<u>SemCrude Upgrade (3.27 Miles)</u>	<u>Cost Per Unit</u>	<u>Cost Per Unit</u>	<u>Cost Per Unit</u>	<u>Quantity</u>	<u>Extended</u>
35kV 4/0 ACSR/T-2 Conductor	\$1.25	\$2.00	\$3.25	69,100	\$224,575.00
7.2kV #2 ACSR Conductor	\$0.25	\$0.75	\$1.00	8,500	\$8,500.00
3PH 34.5kV Tangent Framed Structure	\$250.00	\$400.00	\$650.00	66	\$42,900.00
3PH 34.5kV Angle Structure w/ guying	\$600.00	\$900.00	\$1,500.00	6	\$9,000.00
3PH 34.5kV Deadend Structure w/ guying	\$600.00	\$1,100.00	\$1,700.00	1	\$1,700.00
3PH 34.5kV Vertical Construction Corner w/guying	\$750.00	\$1,500.00	\$2,250.00	3	\$6,750.00
1PH Distribution Underbuild Framing	\$125.00	\$200.00	\$325.00	17	\$5,525.00
40/1 Wood Pole	\$690.00	\$500.00	\$1,190.00	2	\$2,380.00
50/2 Wood Pole	\$815.00	\$600.00	\$1,415.00	66	\$93,390.00
50/1 Wood Pole	\$935.00	\$600.00	\$1,535.00	7	\$10,745.00
60/1 Wood Pole	\$1,600.00	\$650.00	\$2,250.00	3	\$6,750.00
Relocate 35kV Redcloser and Control. Pole Mount and Power Supply			\$12,000.00	1	\$12,000.00
35kV Primary Metering Package			\$30,000.00	1	\$30,000.00
35kV Gang Operated Air Break Switch			\$12,000.00	1	\$12,000.00
Communications			\$30,000.00	1	\$30,000.00
Retirement and Transfer of Existing Distribution Facilities	\$375.00	\$4,250.00	\$4,625.00	1 LOT	\$4,625.00
ROW clearing for overhead line		\$10.00	\$10.00	5,500	\$55,000.00
Contingencies (10%)			\$55,600.00	1	\$55,600.00
PM and Engineering (15%)			\$83,400.00	1	\$83,400.00
SemCrude Upgrade Total					\$694,840.00

	Material	Labor & Equipment	Extended		
<u>Kingman Direct Connection (4.96 Miles)</u>	<u>Cost Per Unit</u>	<u>Cost Per Unit</u>	<u>Cost Per Unit</u>	<u>Quantity</u>	<u>Extended</u>
34.5kV 750 MCM URD Cable	\$8.50	\$1.75	\$10.25	900	\$9,225.00
34.5kV 4/0 ACSR/T-2 Conductor	\$1.25	\$2.00	\$3.25	104,755	\$340,453.75
7.2kV #2 ACSR Conductor	\$0.25	\$0.75	\$1.00	8,500	\$8,500.00
3PH 34.5kV Tangent Framed Structure	\$250.00	\$400.00	\$650.00	102	\$66,300.00
3PH 34.5kV Angle Structure w/ guying	\$600.00	\$900.00	\$1,500.00	10	\$15,000.00
3PH 34.5kV Deadend Structure w/ guying	\$600.00	\$1,100.00	\$1,700.00	2	\$3,400.00
3PH 34.5kV Vertical Construction Corner w/guying	\$750.00	\$1,500.00	\$2,250.00	3	\$6,750.00
1PH Distribution Underbuild Framing	\$125.00	\$200.00	\$325.00	17	\$5,525.00
40/1 Wood Pole	\$690.00	\$500.00	\$1,190.00	4	\$4,760.00
50/2 Wood Pole	\$815.00	\$600.00	\$1,415.00	102	\$144,330.00
50/1 Wood Pole	\$935.00	\$600.00	\$1,535.00	12	\$18,420.00
60/1 Wood Pole	\$1,600.00	\$650.00	\$2,250.00	3	\$6,750.00
Retirement and Transfer of Existing Distribution Facilities	\$375.00	\$4,250.00	\$4,625.00	1 LOT	\$4,625.00
ROW clearing for overhead line		\$10.00	\$10.00	5,500	\$55,000.00
Contingencies (10%)			\$68,000.00	1	\$68,000.00
PM and Engineering (15%)			\$102,000.00	1	\$102,000.00
Kingman Direct Connection Total					\$849,813.75

EXHIBIT ESS-5
(Page 1 of 2)

Kingman Direct Connection
Substation Component Duplication as Compared to SemCrude

Item

Property	Full Duplication
Transformer with LTC - 115/2.4/34.5 kV	Partial Capacity Duplication
115 or 138 kV circuit switcher	Full Duplication
35 kV breakers	
Relay panels	Partial Duplication
Substation material package	
Primary dead-end(s)	Full Duplication
Primary switch stand(s)	Full Duplication
Primary bus support(s)	Full Duplication
Primary VT support(s)	Full Duplication
Secondary metering stand(s)	Full Duplication
Secondary switch stand(s) for transformer	Full Duplication
Distribution structure(s)	Full Duplication
Secondary switch stand(s) for circuit	
Secondary switch and riser stand(s)	
Lightning Mast	Full Duplication
115/138 kV Switch	Full Duplication
Motor Operators	Full Duplication
Bus tube, bar, angle, large conductor	Partial Duplication
115 kV VT's	Full Duplication
115 or 138 kV insulators	Full Duplication
115 kV Arresters	Full Duplication
35 kV CT/VT	Partial Duplication
35 kV 3 phase switch(es)	Partial Duplication
35 kV hook stick bypass switches	Partial Duplication
35 kV fusing for PT's	Partial Duplication
35 kV Insulators	Partial Duplication
Secondary arresters	Partial Duplication
Bus connectors	Partial Duplication
Grounding connectors	Full Duplication
Other packager expenses	Partial Duplication

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Substation construction	
Preliminary site work	Full Duplication
Fencing - Chain link	Full Duplication
Foundations	
Primary dead-end	Full Duplication
Primary switch stand	Full Duplication
Primary bus support	Full Duplication
Primary VT support	Full Duplication
Secondary metering stand	Partial Duplication
Secondary switch stand for xfmr	Full Duplication
Distribution structure	Full Duplication
Secondary switch stand for circuit(s)	Partial Duplication
Secondary switch and riser structure	Partial Duplication
Circuit switcher	Full Duplication
Breaker	
Transformer	Partial Duplication
Lightning mast / shield wire pole	Full Duplication
Control Building	Full Duplication
Conduit/cable trench - materials and labor	Partial Duplication
Ground grid - material and labor	Full Duplication
Oil containment system	Full Duplication
Crushed stone surface	Full Duplication
Erection of substation structures	Partial Duplication
Installation of bus work, switches, etc.	Partial Duplication
Major equipment installation	Partial Duplication
Control building	Full Duplication
Station battery/charger	Full Duplication
Station 600 V power/control wiring, lighting	Full Duplication
Wildlife protection (35 kV system only)	Partial Duplication
Final grading and restoration	Full Duplication
Other contractor expenses	Partial Duplication
Communications	Full Duplication
Acceptance testing	Partial Duplication
Soil Borings & Geotechnical Report	Full Duplication
Foundation design	Full Duplication
Site grading, SPCC design, storm water/erosion control design	Full Duplication
SCADA System	