BEFORE THE KANSAS CORPORATION COMMISSION
OF THE STATE OF KANSAS

In the Matter of the Application of Kansas Power Pool for a Certificate of Convenience and Authority to Transact the Business of an Electric Public Utility in the State of Kansas for Transmission Rights Only in Cross Service Territory of Southern Pioneer Electric Company and Ninnescah Rural Electric Company.	))))))	Docket No. 18-KPPE-343-COC

PREFILED DIRECT TESTIMONY OF

DR. ALA TAMIMI
VICE PRESIDENT, TRANSMISSION PLANNING AND POLICY

ON BEHALF OF

MID-KANSAS ELECTRIC COMPANY, INC.

July 9, 2018

Q. Please state your name.

A. My name is Ala Tamimi.

Q. By whom are you employed?

A. I am employed by Sunflower Electric Power Corporation ("Sunflower").

Q. What is your position with Sunflower?

A. I am Vice President of Transmission Planning and Policy for both Sunflower and Mid-Kansas Electric Company, Inc. ("Mid-Kansas"). To be clear, Mid-Kansas has no employees. Mid-Kansas contracts with Sunflower to provide all services provided by Mid-Kansas.

Q. Please describe your educational background and professional experience.

A. I joined Sunflower in 2001 and was promoted to Vice President of Transmission Planning and Policy in 2015. My responsibilities include planning and designing transmission and distribution facilities to meet the needs of Mid-Kansas, Sunflower and our Members' transmission and distribution systems. This includes planning for service to third-party users. I also focus on transmission and market policy issues that impact our system resources.

I hold a master's degree in electrical engineering from Wichita State University and a doctor of philosophy (Ph.D.) degree in electrical engineering from Kansas State University.

I am widely published in industry publications including the world's largest technical professional society, The Institute of Electrical and Electronics Engineers ("IEEE"). I am also a senior member of IEEE. I became a licensed professional engineer in June of 2005. I also serve on several Southwest Power Pool ("SPP") working groups

and committees, including the Economic Studies Working Group ("ESWG"), Markets and Operations Policy Committee ("MOPC"), Synchrophasor Task Force, Chair for the Generation Interconnection Improvement Task Force ("GIITF"), a voting member on the Holistic Integrated Tariff Team ("HITT"), and Chair for the High Priority Incremental Load Study ("HPILs") Task Force.

For Sunflower and Mid-Kansas, I provide executive leadership on activities of the Transmission Planning and Distribution Engineering departments. In my current job, I establish strategic and tactical plans to meet transmission and distribution planning requirements for Sunflower, Mid-Kansas and the Members, and to support transmission resource planning. Also, I develop and implement strategies on transmission policy, regulatory affairs, and compliance issues, including facilitating representation of Sunflower and Mid-Kansas before regional transmission organizations and various governmental and regulatory agencies.

Q. Have you previously testified before the Commission?

A. Yes. I have provided testimony in Dockets 11-GIME-597-GIE ("11-597 Docket"), 16-MKEE-023-TAR ("16-023 Docket"), and 17-KPPE-092-COM ("17-092 Docket").

Q. What is the purpose of your testimony.

A. The purpose of my testimony is to address the public interest standards applicable to the Commission's determination in this case on the application of Kansas Power Pool ("KPP") for a certificate of convenience for transmission rights only for the construction and operation of a direct interconnection to the Ninnescah 115 kV line which KPP describes in their application as the "Kingman Direct Connection". I will testify on the following matters:

1. Explanation of the SPP and local planning process.
2. Purpose of the local planning process.
3. Role of Transmission Providers in the local planning process.
4. Factors considered in the planning process for the determination of need and the least cost solution if a solution is needed to provide sufficient and efficient service to a third party.
5. Evaluation process followed in the planning process to address KPP's request for upgraded service for the City of Kingman.

I. Explanation of the SPP and Local Planning Process.

Q. You described your role at Sunflower in performing transmission and sub-transmission planning both at the SPP level and local planning level. Would you briefly discuss how the SPP and local planning differ, if at all, and how they are integrated for purposes of the over-all transmission and non-transmission planning process?

A. The SPP planning process covers planning (reliability and economic) for only the transmission facilities greater than or equal to 60 kV under the SPP tariff. Facilities owned and operated by Transmission Owners (TOs) that do not fall under SPP tariff are planned by the local TO using the TO's local planning criteria. According to the SPP tariff "Attachment O", SPP planning must consider the local TO's local planning criteria in their planning process and SPP will incorporate local planning criteria and solutions into the SPP planning process. Therefore, SPP and local planning are integrated into the overall SPP planning process. Based on FERC Order 890 and Attachment O, local area planning meetings are to be held quarterly in conjunction with Transmission Working

Group meetings. The purpose of the meetings is to have an open, coordinated and transparent planning process to ensure that stakeholders with local needs have the opportunity to provide advice and recommendations to the Transmission Provider and Transmission Owners.

The SPP planning process consists of several components with one of the major components being the Integrated Transmission Planning ("ITP"). In the ITP, SPP stakeholders develop planning data for their systems which reflects a 10-year load and generation forecast. SPP compiles that information to develop the SPP ITP planning models. SPP staff uses the SPP Planning Criteria to analyze system reliability under the stakeholder's assumptions of load and generation to determine if there are any criteria violations (voltage, thermal and stability). If SPP finds a violation, then SPP will send a request called a need list to all SPP members soliciting feedback on the need list. Once the feedback is incorporated, a final need list is issued to SPP members to solicit feedback on possible solutions. SPP compiles and verifies that the submitted solutions provide a viable solution to mitigate the criteria violations identified on the need list. SPP staff will then select the most effective and efficient solution for each need. SPP has a broad, big-picture view of the entire system and all the system violations that need to be mitigated. By analyzing the system as a whole and identifying individual solutions that solve multiple problems, least-cost planning is achieved for the entire SPP footprint. This is more effective and efficient than individual entities fixing their problems on their own.

Sunflower and Mid-Kansas' local planning process is similar to SPP's ITP planning process where third-party transmission customers provide Sunflower staff with their 10-year load projections to be included in the local planning models. Sunflower staff inputs

the load forecasts provided by the third-party customers and Sunflower and Mid-Kansas Members into the models. Sunflower and Mid-Kansas conduct annual reliability studies for those facilities and coordinate a local planning meeting with the Members and wholesale customers. In each annual local planning meeting, Sunflower staff provides our Members and third-party customers with a written report listing our study assumptions and results. Feedback from third-party customers is incorporated in the final report. Wholesale customers can review load projections for our own Member loads which are shared in the annual study report. Changes in load forecasts may result in corrections and a re-run of the study to accommodate new information or corrected load values. Local planning applies to facilities owned by Sunflower and Mid-Kansas or its Members that are greater than or equal to 34.5 kV that are not under SPP's functional control. Sunflower and Mid-Kansas have Local Planning Criteria for those facilities which is published on the SPP OASIS.[1] The Local Planning Criteria was developed in coordination with our Members and third-party customers. Similar to the SPP planning process, Sunflower/Mid-Kansas have a big picture view of the local system which facilitates the lowest cost planning solutions as a whole.

II. Purpose of Local Planning

Q. Please explain what you mean when you refer to the Local Planning Criteria?

A. Essentially, it is the criteria for the facilities that the local planning applies to and planned to meet during the annual planning cycle, in coordination with SPP planning cycle, and if

[1] Local Planning Criteria Effective April 1, 2018, http://www.oasis.oati.com/SWPP/index.html > Planning > Local Area Planning Criteria > "180401_Sunflower_Mid-Kansas_Local_Planning_Criteria".

not met, then a mitigation plan is developed and analyzed to meet the planning need. Factors considered are system voltage levels and thermal line limitations, power quality threshold and a threshold for providing redundant feed for load on radial lines, all as set forth in the Local Planning Criteria.

Q. Would you briefly describe what you and your engineering department do to prepare the annual report?

A. Each year, Sunflower's engineering department reviews the prior year loads for each electric circuit and compares the current loads with the projected loads for the next 10 years. We look at the load forecasts for both the Members and wholesale customers. If an increase or decrease in a load is identified, an analysis is performed on the potential impacts to service. Our engineers look for constraints and any reliability concerns that may be surfacing which require addressing due to an anticipated change in loads. Reliability concerns primarily focus on thermal and voltage problems based on our Local Planning Criteria. If a criteria violation is identified within the 10-year planning horizon, we begin the process with the customer or Member to identify the least cost solution to resolve the problem. This briefly describes what is a very intricate and time-consuming process performed each year as to each circuit. In addition, a Member or wholesale customer can contact our planning department at any time during the year to discuss the possibility of additional loads or loss of loads that could affect the sub-transmission system.

Q. How many circuits are analyzed in the local planning process?

A. On average there are about 80 circuits in each annual report. As I stated, this is a very intricate and time-consuming task which is performed annually.

Q. Who is responsible for facilitating the local planning process?

A. Sunflower staff are responsible for facilitating the local planning for facilities in our planning area which consists of what SPP has designated as our transmission zone which is essentially western Kansas. This would include the facilities which are the subject of this docket. As the TO of the backbone system in the zone, Sunflower and Mid-Kansas keep the most accurate load, generation and topology data for the system. One of the major tasks in the local planning process is building the simulation models that represent the most up-to-date system topology data which is used to determine system reliability over the 10-year planning horizon. Obviously, as the host TO, we have the most current data of the system, and are best positioned to build the models, conduct the study, and report on reliability solutions in coordination with third-party customers. This process does not preclude a customer or local city or utility from requesting certain changes to address their specific service needs. Those requests are studied as well. Not only are Sunflower and Mid-Kansas the logical choice to perform the local planning, SPP reviews and incorporates Sunflower/Mid-Kansas' local studies in the SPP planning process. Also, as part of the settlement in the 11-597 Docket, we agreed to do local planning for the 34.5 kV system. The settlement requires Mid-Kansas to develop and conduct annual local planning studies. The 34.5 kV local planning process, incorporated as Attachment O of the Sunflower and Mid-Kansas OATTs, was approved by the Commission.

Q. Why is local planning important?

A. Sunflower/Mid-Kansas local planning is designed to (a) encourage the orderly development of wholesale and retail electric service; (b) avoid wasteful duplication of facilities for the distribution of electricity; (c) avoid unnecessary encumbrance of the landscape of the state; (d) prevent waste of materials and natural resources; (e) facilitate

the public convenience and necessity; and (f) engage stakeholders to minimize disputes which may result in inconvenience, diminished efficiency and higher costs in serving the consumer. Also, Sunflower/Mid-Kansas' local planning establishes a planning criteria around which facilities will be built and maintained. In local planning, criteria violation will require a mitigation plan. The mitigation plan takes a holistic view of all area needs and possible solutions to achieve at the least cost for customers.

While the local planning process is integrated into the SPP planning process, SPP does not perform the planning process for local facilities such as the Members' 34.5 kV systems, or localized systems designed to serve cities or wholesale customers like KEPCo, KMEA and KPP. The local planning process is important as it ensures an orderly and well-coordinated development of a local system. Without a centralized local planning process, the system would develop in a disjointed manner, resulting in duplication of facilities and unnecessary facilities. A centralized planning process ensures an efficient delivery system that sufficiently meets the needs of the public at large. It is as important to have a centralized planning process at the local level as it is to have a regional planning process at SPP. Otherwise, the build out of facilities would be chaotic, wasteful, and a disservice to the public that expects and requires sufficient and efficient service at the least cost. Local planning allows for a holistic planning process to provide sufficient service to the public while maintaining system reliability. This can only be accomplished in an open, coordinated, transparent, and centralized planning process. Local planning depends upon a set of planning criteria to determine when a reliability problem is a credible problem and then it uses the least cost concept to determine the most efficient way to address that problem and maintain sufficient service. By applying the planning criteria consistently

through a planning process, all customers (our Members and third-party customers) receive comparable, non-discriminatory service. The centralized planning promotes the development of a sufficient and efficient, reliable transmission system and ensures all customers receive reliable service at the least cost. It also alleviates overbuilding the system wide facilities and prevents unnecessary upgrades or duplication of facilities. By cooperative and coordinated planning, we can avoid piecemeal solutions and address the needs of multiple parties through the most efficient solution for all concerned. Of course, this only works effectively, if all stakeholders participate and are forthcoming in the planning process.

III. Role of Sunflower and Mid-Kansas in the Planning Process.

Q. Please describe how Sunflower and Mid-Kansas perform the local planning responsibility as the Transmission Provider?

A. Sunflower/Mid-Kansas' local planning process is an open, transparent, coordinated process. Sunflower/Mid-Kansas Members and third-party customers provide their load projection data in an open process which results in an annual published report provided to all customers that shows load data for every customer over the 10-year planning horizon. Sunflower staff analyze the data to make sure the system local planning criteria has been met and any violations to the criteria are mitigated in a transparent and coordinated process. All our local planning solutions are presented at the annual local planning meeting where Sunflower staff presents solutions and alternatives to the Members and wholesale customers. Members and customers have the opportunity to comment or suggest different

solutions which Sunflower staff will then evaluate for sufficiency of solving reliability problems and verify if the recommended solution is the least cost option for all customers.

In addition to our own annual local planning meeting, Sunflower staff participates in the quarterly planning summits that SPP facilitates on a quarterly basis. Sunflower staff provides their local planning criteria and local planning study to entities within Sunflower/Mid-Kansas' footprint and also to neighboring entities who are interested in our local planning process who may be impacted by our solutions.

Our local planning criteria is posted on the SPP OASIS public website and anyone can obtain a copy from that website. SPP is in charge of reviewing local planning criteria, which is done in April of each year. Once the review is completed, SPP posts the local planning criteria to the SPP OASIS website. As I mentioned before, SPP staff uses our local planning criteria in all their planning processes. If the local planning criteria is more stringent than the SPP criteria, then SPP planning must accommodate the local planning criteria. For example, if an entity in our footprint applied to connect a new load on our system, SPP will study the request by applying SPP criteria to determine if there is a reliability need for a transmission upgrade to enable load service, and then SPP will apply the local planning criteria to determine if there is a need for an upgrade to meet the local criteria.

Q. Who participates in the local planning process?

A. All stakeholders who use the system or who are interested in taking service from us and neighboring entities can participate in the process and usually do. Typically, our members, KPP, KMEA and KEPCo are invited and participate in the process.

IV. Factors Considered in the Planning Process for the Determination of Need and the Least Cost Solution if a Solution is Needed to Provide Sufficient and Efficient Service to a Third Party.

Q. Are the participants in the local planning process able to request projects that address a specific need of the participant or the system as a whole?

A. As I mentioned before, during our annual meeting, or any time, any participant can ask for us to investigate a new project that serves them or serves others. When requested, Sunflower staff will review the need based on current system models to determine if there is a violation of the local planning criteria. If a violation is determined, then Sunflower staff will incorporate that need in our annual study and will recommend a solution after evaluating multiple alternatives. If the effected customer or any stakeholder has a suggested solution, our staff will evaluate the suggested solution and compare the various alternatives for solving the same problem. This vetting process is very thorough and transparent. All stakeholders are able to review the analysis and comment.

It is worth noting that in developing the options, the planning engineer selects solutions based on a holistic approach to identify robust and efficient solutions on a regional basis rather than on a narrow, individualized approach. In our analysis, we consider both transmission and distribution solutions, whichever results in the most efficient and effective project to provide sufficient service. This holistic process may identify other existing or evolving problems on the system, all of which can be solved by a more involved solution. It is conceivable that instead of an upgrade to a subtransmission system, an upgrade to a transmission line is the better solution as it cures several problems and not just the specific problem one customer may have. That is the additional value of

having a centralized local planning process that is integrated in the SPP regional planning process.

Q. Is there a process used by planners to determine the best solution to address a criteria violation?

A. To select the best option among several alternatives, the engineer obtains total project cost for each alternative and then calculates the savings from building the projects for each alternative. Savings that the engineer considers are savings from offsetting rebuilds on transmission and distribution to serve loads and system loss savings. All costs (E&C costs) and savings are then calculated based on a 30-year Net Present Value (NPV) to produce an engineering economic ranking. The alternative solution that has the lowest NPV cost in the engineering economic ranking will be recommended for solving the violation. This is generally known as the least cost approach.

Local planning uses general assumptions on capital cost and loss parameters to calculate economics for the purpose of ranking alternatives to determine the least cost option. Once the option is selected as least cost in the local planning process, additional analysis will be required to firm up assumptions and costs before implementation. Note that all inputs into the NPV engineering economic ranking calculations are developed and listed in our annual local planning report and we seek input from stakeholders on this data on a yearly basis to see if an adjustment is needed.

Q. Is the least cost solution determined on an economic or engineering basis, or both?

A. In addition to what was mentioned in answering the previous question, our goal is to make sure that we plan the system to provide sufficient service and in the most efficient manner to the public. When we discover a reliability need in our planning process, we start looking

at a set of valid engineering solutions. The engineering economic ranking analysis is then used to distinguish among the alternatives as to which alternative meets the required reliability needs at the least cost.

It is important to realize that when evaluating the economics of a project, we make sure that the economic evaluation is based on cost and savings for all customers served on the system as a whole and not just for the economic benefits to a single customer. The decision is based on the project that addresses the violations at the lowest cost for all system customers and the general public.

Q. Since Sunflower staff performs the planning process, does it matter who makes the request?

A. No. Engineers run the models to analyze system reliability based on engineering principals, not based on who is being served; Sunflower staff dord not favor its Members in the planning process. To do so would undermine the integrity of the planning process. Sunflower staff takes its duty to provide comparable and non-discriminatory treatment of all customers very seriously.

Q. To your knowledge have the participants in the planning process been satisfied with the process followed by Sunflower?

A. Yes. I have received positive feedback from the Members and wholesale customers and have not received any substantive complaints. Mr. Holloway has even expressed his appreciation for our process which he believes is better than the planning process of most other utilities.[2]

[2] Docket No. 15-SPEE-161-RTS, Holloway Direct Testimony, p. 30.

V. KPP's Application for Approval of the Kingman Direct Connection.

Q. Are you familiar with the application of KPP in this docket seeking a transmission right only certificate to construct a direct interconnection on the Ninnescah 115 kV Transmission Line, bypassing Southern Pioneer's 34.5 kV substation?

A. Yes. As one of my responsibilities as Vice President of Transmission Planning and Policy, I meet periodically with KPP and other wholesale customers taking local access service on the 34.5 kV sub-transmission systems owned by the Sunflower and Mid-Kansas Members. Also, if a wholesale customer requests service on a Member's system, my department will assess the request to ascertain what additional upgrades on the local system may be required. In this particular instance, I worked with KPP and the City of Kingman to address service limitations to the City of Kingman, so I am very familiar with the two projects being discussed as part of this docket.

Q. Before we address the specific request by KPP, would you briefly describe the 34.5 kV system owned by the Members of Mid-Kansas and Sunflower that provides local delivery service?

A. The Member 34.5 kV system is a network of sub-transmission facilities integrated into the bulk electric and distribution systems. The lines provide first mile local access to the bulk electric transmission system and provide last mile service off the bulk electric system. As a simple explanation, the 34.5 kV system acts like the two-lane roads leading to and from the interstate system. The interstate system is the bulk electric transmission system and the 34.5 kV lines are the two-lane roads leading to and from the interstate transmission system. The 34.5 kV lines may serve a dual function at times. It can serve retail load for the Members, wholesale load for third party customers like KPP, or both. The Members' 34.5

kV systems consist of approximately 1,189 line miles in total. Of the total miles, approximately 407 miles, or 37.4%, are radial lines serving only retail load. Approximately 445 miles, or 40.9%, serve both retail and wholesale load. The remaining 237 miles, or 21.8%, are radial lines serving solely wholesale load. As you can see, the bulk of the lines, about 63%, serve either just wholesale or both wholesale and retail load, but a significant portion, about 22%, serve just wholesale load. Generally, 34.5 kV lines exceed the needs of the Members to serve the typical distribution cooperative's retail load. In certain instances, a higher voltage, like the 34.5 kV lines, is required to serve a larger industrial load. But as a general proposition, the Members would not have built or maintained 34.5 kV lines but for the need to serve a wholesale customer - like a city for example. It is not appropriate for Sunflower staff to limit planning just to service of the Members' retail customers. There is a too significant use of the system by wholesale customers to limit planning just to retail service.

Q. Who currently takes wholesale service on the 34.5 kV system?

A. To my knowledge, KEPCo, KMEA, Westar and KPP take service on the Members' 34.5 kV system. Also, the cities of Isabel, Cimarron, Montezuma, Glen Elder and Cawker City are served by Mid-Kansas through the 34.5 kV system. Midwest Energy has emergency exchange points on the Members 34.5 kV system as well.

Q. Based upon your knowledge of the system from former Aquila employees and your general knowledge of the system, who was the system built to serve?

A. Based upon discussions with former Aquila employees (who are now employees of Sunflower) about the system and just the basic layout of the system from a planner's perspective, it is evident the system was originally built to provide service to the retail

customers of Aquila and wholesale service to various cities that were either served by Aquila or others that depended upon the system to provide a local delivery service. As I stated earlier, generally a distribution cooperative providing retail service would not build a 34.5 kV line as it exceeds its need. It is very evident from an engineer's perspective that these lines were built primarily to serve a dual purpose and specifically for wholesale customers in certain instances.

Q. In the 17-092 Docket, it was suggested the system, particularly the Southern Pioneer 115/34.5 kV SemCrude Substation, was not built to serve Kingman.[3] Do you agree with that assessment?

A. No, I don't agree. The SemCrude Substation was primarily built to serve a retail customer of Southern Pioneer, but that would be an unfair characterization of the purpose for which it was built. It was built to serve the general public. From a planning perspective, it is not relevant whether the facility was built to serve Kingman or not. The question from the planning perspective is "does the facility promote or provide sufficient and efficient service to the public for the purposes it was intended"? Frankly, from a planning perspective, the question of who the system was built for is not relevant to the question before the Commission either in this proceeding or in the 17-092 Docket. The question is "can it be used to provide sufficient service to KPP and Kingman at the least cost to the public"?

Q. Turning specifically to the request for service by KPP to serve the City of Kingman, are you aware of the request and the reason for the request by KPP?

[3] Docket No. 17-KPPE-092-COM, Staff R&R, p. 4. See also, Docket No. 17-KPPE-092-COM, Larry W. Holloway Direct Testimony, page 15.

A. Yes. According to Mr. Holloway's testimony, KPP has been in search of a project that would improve the electric service to Kingman and optimize the utilization of Kingman's generation.

Q. What is your response to KPP's assertion that currently Kingman has inadequate electric service.

A. Currently, Kingman's service is adequate to provide the service it chose to receive as adequate service. Kingman does not have "third world" transmission access, as Mr. Holloway asserts. In fact, Mid-Kansas had invested in transmission to improve service to Kingman. Sunflower/Mid-Kansas made numerous improvements to the Pratt-Cunningham line, the transmission line to St. John, and many other area improvements to enhance overall service. KPP/Kingman simply chose the service after other options were offered but deemed not cost effective to Kingman at the time. But if you accept Mr. Holloway's assertion, then you must accept that the reason it is inadequate is because of Kingman's decisions, not because of decisions made by Aquila, Mid-Kansas or SPEC. Kingman has the service it has because it chose to have such service. So, I cannot say the service is inadequate. Mr. Magnison discusses the planning efforts and solutions in greater detail in his Direct Testimony.

Q. Let's begin with the import limitation. Is KPP limited on its import capability?

A. Mr. Linville will address KPP/Kingman's current capabilities from a market perspective. I will address if from an engineering perspective. KPP is technically limited to 6 MW of import capability although most of the time it can import more depending on the load at a specific time during the day. It is also important to note that 95% of Kingman's energy needs on an annual basis can be met with the current import limitation. But it is a fair

statement that there is a physical limitation on importing energy from the market to Kingman due to the connection at the Cunningham substation and at the Kingman facilities. The Olsson Associates letter attached to Mr. Holloway's testimony as Exhibit LWH-3 Appendix B, seems to indicate Kingman's own system restricts full import as well. The Olsson letter indicates the City of Kingman has not determined if or when the upgrade will occur. Until the upgrade is made, Kingman will still experience the same limitation tomorrow as it does today, which is a limitation of approximately 10 MVA but more practically a limitation of approximately 8 to 10 MW as Kingman's power factor changes from low peak to high peak loading conditions. The limitation on importing more than the 6 MW that exists today is two-fold. First, the 34.5 kV line out of the Pratt substation to the Cunningham substation restricts the import capability due to thermal limits of equipment. Second, the Kingman 34.5 kV line owned by Kingman also restricts Kingman's import capability as well. Specifically, the step-down transformer in Kingman's substation has a 7/10 MVA limitation that restricts power flow to and from Kingman. Removing only the restriction on the Pratt-Cunningham 34.5 kV line would not provide Kingman the full import capability it says it is seeking. To solve the import restriction, it requires both obstructions on the Pratt-Cunningham line and the Kingman 34.5 kV facilities to be removed to provide full service. So, it is not a fair statement that Southern Pioneer alone is restricting or has restricted Kingman's import capability, nor that Southern Pioneer is the reason for Kingman's alleged inadequate service. Kingman itself chose to limit service by selecting the line facilities and configuration under which it currently operates.

Q. Will the Kingman Direct Connection remove the import limitation?

A. Yes, provided of course the Kingman 34.5 kV facilities are upgraded as well, if needed.

Q. Will the Southern Pioneer SemCrude Upgrade project remove the import limitation?

A. Yes, the Southern Pioneer SemCrude Upgrade will remove the limitation and provide service equivalent to the Kingman Direct Connection but for less cost. The electric service of the two options are equivalent other than the cost. However, either option also may require upgrades to the Kingman-owned facilities.

Q. Do you agree that Kingman's export capabilities are limited?

A. Kingman's ability to export energy into the market or sell capacity are not limited by the current connection to the Cunningham substation. The 34.5 kV restriction on the facilities owned by Kingman limits the amount of energy that can flow out of Kingman, but because of how energy flows in the system, the current Southern Pioneer facilities used by KPP are not restricting the export of excess energy that can flow out of Kingman from its generation. Even if there was some restriction, the Kingman Direct Connection will not improve Kingman's export capability beyond what the Southern Pioneer SemCrude Substation Upgrade will. The same is true as to optimizing the utilization of excess capacity, if Kingman or KPP has any. Mr. Rooney and Mr. Linville address this more explicitly from a marketing and economic perspective. But from a physical perspective, KPP and Kingman do not have a limitation except for the limitations caused by facilities owned by Kingman.

Q. When and how did you first become aware of the limitation on service for Kingman?

A. In 2008, after Mid-Kansas acquired Aquila, KPP asked what it would take to remove the 6 MW limitation on the Pratt-Cunningham substation delivery point. KPP contacted Noman Williams, a former employee of Sunflower, and Noman asked me to study what would be required. At that time the only option I analyzed was to rebuild and reconductor approximately 19 miles of the existing Southern Pioneer Pratt-Cunningham 34.5 kV line.

In 2009, Mid-Kansas had not yet acquired the Ninnescah line, so that was not considered as an option.

VI. Evaluation Process Followed in the Planning Process to Address KPP's Request for Upgraded Service for the City of Kingman.

Q. In response to KPP's request, did Sunflower staff evaluate KPP's request consistent with the planning process described earlier in your testimony?

A. Yes. After 2009, we performed a number of studies to address KPP/Kingman's service request.

Q. Would you describe the steps you took to evaluate the service request?

A. Similar to what we follow in our current local planning process, we collected load data and made assumptions, with KPP's agreement, to model the load at different delivery points and then we ran N-0 and N-1 analyses to see if there were any voltage criteria violations or thermal overloads for serving Kingman's desired load service. In the analyses, we evaluated the impact of this load service on the SPP transmission facilities and the Southern Pioneer 34.5 kV local facilities.

Q. Through the planning process, did you determine KPP had a need that required you to move to the next step of determining the least cost option?

A. In March of 2009, I conducted a study to determine if it was feasible to deliver 14 MW of power to Kingman, 20 MW to KEPCo and 6 MW to the newly anticipated SemCrude load from the Ninnescah 115 kV Transmission Line. The title of that study was "System Reinforcements to Supply Additional Power to the City of Kingman". The conclusion of that study was that it was feasible to provide reliable service to both the Kingman and KEPCo load from the Ninnescah 115 kV Transmission Line with some additional 115 kV

capacitor banks needed for N-1 conditions. Note that in the study the following statement appeared on page 1, "This study does not attempt to determine which entity should construct or own any of the proposed facilities nor should the results of this study be considered as a commitment to construct any facilities recommended without additional discussion and the necessary company approvals." (See **Exhibit AT-1**.) This study didn't consider cost estimates for serving Kingman and other loads from this line as the purpose of the study was to determine if it was feasible for the Ninnescah line to physically to serve that much load.

In 2014, Sunflower engineers conducted a long-range study to determine the impact of the load growth on the Mid-Kansas' member 34.5 kV system and to determine feasible transmission (100 kV+) and sub-transmission (34.5 kV) upgrades needed to serve the load in Pratt County, Harper County, and Kingman's new load forecast. Kingman load was modeled at 14 MW for this study. The study investigated 9 alternatives and cost estimates were provided for each option. These cost estimates were what we call planning cost estimates with the purpose of comparing the alternatives. All cost estimates were documented in the study and were presented to KPP/Kingman and other entities who attended our local planning meeting in 2014. The lowest cost alternative was Option 6 where the Kingman 14 MW load and the SemCrude load would be fed from the SemCrude 115/34.5 kV substation on the existing Ninnescah 115 kV transmission line.

Q. Did you consider more than one solution to address the service limitation.

A. Yes. We considered 9 alternatives.

Q. Would you briefly describe the possible solutions?

A. It would be easiest to simply attach the study with the alternatives. (See **Exhibit AT- 2**.)

Q. Did you reach a conclusion on the least cost option?

A. Yes. The least cost option was to connect the Kingman load and serve it from the Ninnescah Transmission Line specifically through the SemCrude Substation delivery point.

Q. What factors convinced you the least cost solution was the upgrade to the SemCrude Substation?

A. Clearly cost was a factor. The SemCrude Substation upgrade is the least cost option of all the solutions considered to provide Kingman with sufficient service in the most efficient manner. None of the earlier studies conducted for Kingman considered the option of connecting Kingman or KPP directly to the Ninnescah 115 kV Transmission Line and bypassing the SemCrude Substation connection point. The Kingman Direct Connection option would have been more expensive as it required the construction of a totally new 115/34.5 kV substation at a new green field site. It simply was not considered as it didn't make sense to have two different substations serving two loads. Plus, an upgraded SemCrude Substation would provide the equivalent electric service at less cost and without duplicating the SemCrude Substation. Consolidating the SemCrude and Kingman load from one delivery point is more efficient and less wasteful. It was not necessary to construct a new substation or even consider it as an option.

Q. In your earlier planning process did you study and consider the Kingman Direct Connection solution preferred by KPP?

A. As stated, I did not at the time study a direct connection to the Ninnescah 115 kV Transmission Line. Initially, KPP was not proposing a new interconnection on the Ninnescah 115 kV Transmission Line. The primary solution was upgrading facilities on the Pratt-Cunningham 34.5 kV line currently providing service to Kingman, but this was

rejected by KPP as being too costly and it didn't provide for future load growth. In fact, all of the other potential solutions were rejected by KPP as too costly for the service required, which indirectly validates that the SemCrude Substation Upgrade was the least cost solution. The SemCrude Substation Upgrade met the needs to remove the constraints at the least cost. It was not until later that KPP decided to proceed with their current preferred option, which was not identified in any previous planning studies, by approaching SPP and filing an AQ request for their preferred option. KPP determined it would ignore the least cost option provided to them by Sunflower engineers through the previous planning studies and pursue a more expensive project. As a part of this proceeding and the 17-092 Complaint Docket, I did evaluate the Kingman Direct Connection solution proposed by KPP through the SPP AQ process in which we only evaluated the impact of this connection on the system. We didn't see the need to conduct engineering economic ranking analysis, as the SemCrude Substation connection identified in our older studies clearly was the least cost option. From an engineering planning point of view, when compared with the SemCrude Substation Upgrade option, the proposed Kingman Direct Connection does not add any reliability or service that the SemCrude Substation Upgrade connection wouldn't provide to KPP/Kingman. The two connections are basically the same when we measure voltage and thermal performances. Both options will result in similar system losses[4] and Kingman can serve their load reliably from either option.

Q. Why did you conclude the upgrade of the SemCrude Substation Upgrade was a better option than the Kingman Direct Connection?

[4] Although not prepared as part of the local planning process, a loss study comparing the status quo case, the Kingman Direct Connect and the SemCrude Substation Upgrade was prepared. See **Exhibit AT-3.**

A. The Kingman Direct Connection is more costly, does not provide for any more load serving reliability than the SemCrude Substation Upgrade option, and unnecessarily duplicates the 115/34.5 kV SemCrude Substation facilities. Plus, the Kingman Direct Connection would require a new land site which would not be required at the SemCrude location. The system or area losses differential was minimal and the decision turned on the fact the Kingman Direct Connection was a more costly project then the SemCrude Upgrade. The cost analysis is discussed in greater detail in Mr. Rooney's testimony.

Q. In your opinion, does the Kingman Direct Connection result in wasteful duplication of facilities in comparison to the SemCrude Upgrade?

A. Yes, the Kingman Direct Connection is a wasteful solution. It will duplicate the existing high and low side of the SemCrude Substation. It also causes an unnecessary encumbrance on the land as the project requires a new green field site and construction of additional 34.5 kV line. Clearly, the Kingman Direct Connection is a wasteful use of material and natural resources when you already have a convenient, existing site that can be easily upgraded at less cost.

Q. Does KPP takes issue with you that the SemCrude Substation Upgrade solution is the least costly option?

A. KPP has determined that because KPP will avoid the Southern Pioneer 34.5 kV local access delivery service ("'LADS") charge, the Kingman Direct Connection is the least cost option. KPP's analysis fails critically to assess the cost to the public as a whole. In our planning process, the SemCrude Substation Upgrade is still the least cost option despite KPP's conclusion. An appropriate planning process considers the cost to the public and not the cost to the individual customer. When you consider the fact that the public will be required

to pay for a more expensive project and that the local delivery charge is not eliminated but, rather, is shifted to others in the public, then KPP's Kingman Direct Connection is not the least cost option when considering total cost to the public. I have yet to see any open, transparent and coordinated planning process that considers the avoidance of the LADS charge by one customer as a relevant factor in deciding or recommending a solution to provide sufficient and efficient service. In my experience, including the SPP planning process, planners only focus on and incorporate the items I mentioned in my previous answer on local planning. The project cost, line losses, and offset to rebuilding of facilities are the main factors used in determining the least cost option. The LADS charges are not part of the planning process determination as they are not a cost avoided by the public. Those costs are simply shifted to others.

If the Commission views the least cost option on the basis of the benefits to a single customer, then the purposes of a robust planning process will be reduced to a question of what is in the best interest of an individual customer rather than what is in the best interest of the public as a whole. It will further lead to a chaotic build out of transmission and sub-transmission facilities at an unwarranted cost to the public because of unnecessary duplication of the transmission and sub-transmission facilities already adequately serving the public. It will lead to more disputes like this one, duplicate facilities and result in decisions which will do little to encourage the orderly development of electric service.

Q. Aside from the concerns you have expressed, would the Commission's approval of the Kingman Direct Connection raise other concerns as to the planning process?

A. Yes. Approving the Kingman Direct Connection will undermine, if not totally defeat, the purpose of the centralized, local planning process by allowing utilities to simply bypass the

planning process and build whatever project the utility deems serves their individual needs best. The organized planning process facilitates the build out of a robust, well-coordinated, efficient transmission system that sufficiently serves and facilitates the public convenience and necessity. If utilities are free to build outside the planning process or simply ignore the conclusions of a formalized process, then not only will the planning process be reduced to a meaningless exercise, but the electric system will not be planned holistically for the benefit of the general public. It will lead to a chaotically planned system with duplication of facilities of services at a far greater cost to the public. You will basically end up with two or more parallel transmission paths providing equivalent service while leading to the same place, both of which are being paid for by the public.

Q. Are you also familiar with the complaint filed by Southern Pioneer against KPP in the 17-092 Docket?

A. Yes. I reviewed the testimony and filed testimony in the docket for the Commission's consideration.

Q. Did you review the Staff Report and Recommendation filed in the 17-092 Docket?

A. Yes, I did, and it appears Staff was operating under various misconceptions and a misunderstanding of the facts at that time. For that reason, I believe it is important to clarify the facts surrounding the process and use of the 34.5 kV system.

Q. In the 17-092 docket, the Staff stated the efforts of Southern Pioneer were inadequate and Staff criticized Southern Pioneer's "progress in resolving the Kingman supply issue".[5] Do you believe Staff's statement is a fair assessment of the planning process and Southern Pioneer and Mid-Kansas' efforts to address Kingman's supply issue?

[5] Docket No. 17-KPPE-092-COM, Staff R&R, p. 9.

A. No. For Staff to claim that the planning process was inadequate, it has to be based upon a lack of understanding of what planning does and what planning we performed. One need only refer to the 2014 study to see that we worked diligently to find a solution for Kingman's needs. The planning was diligent and very extensive. When comparing alternatives, planning principals are based on engineering economic ranking calculations regardless of which entity benefits more. It is focused on providing reliable and sufficient service at the least cost to the public. By allowing KPP to have their own 115 kV connection right next to or in close proximity to an already established delivery point, it will result in unnecessary duplication of facilities and services and shift costs to others without adding any more reliability to anyone on the system, including the City of Kingman itself. KPP was provided with a number of alternatives and the least cost solution. The fact that KPP rejected the results of the planning is not a basis to criticize Southern Pioneer or Mid-Kansas' efforts.

Q. Was your determination that the SemCrude Substation Upgrade was in the best interest of the public in any way influenced by the fact the least cost option would result in the continued revenue stream to Southern Pioneer which would be lost should KPP connect directly to the Ninnescah line?

A. No. We based our conclusion on a sound engineering assessment and adherence to proper planning principles which focuses on the cost of the facilities necessary to provide sufficient service.

Q. Can a local planning process, as you have described, determine the optimum transmission solutions?

A. The planning process should select the least cost solution on the basis of the cost to build the project, losses and offset of other rebuilds. KPP has stated that the least cost to KPP is to direct connect as it avoids Southern Pioneer's local access delivery service charge. Southern Pioneer contends that the Kingman Direct Connection is not the least cost to the public as it does not reduce costs but simply shifts the cost to others. If KPP's position is accepted, then I am skeptical that the planning process can be successful in determining the least cost solution in the future. And even if it can, if a wholesale customer can simply ignore the planning results, chart its own course and shift costs to others to reduce their own costs, then the State can't expect the orderly development of transmission service at the local level. That result would be contrary to an open and transparent planning process and the policy of the State to provide the public with sufficient and efficient service at just and reasonable rates.

Q. As an experienced planner and as a Ph.D in electric engineering, does the Kingman Direct Connection in your opinion meet the public convenience and necessity standard for issuance of a certificate of convenience?

A. No. The SemCrude Substation Upgrade provides sufficient electric service at the least cost to the public. The SemCrude Substation Upgrade solution is also consistent with accepted planning principles. For these reasons and the reasons set forth in my testimony, KPP's request for a certificate of convenience for a transmission rights only certificate is contrary to the public interest and should be denied.

Q. Does that conclude your testimony?

A. Yes.

VERIFICATION OF DR. ALA TAMIMI

STATE OF KANSAS)
) ss
COUNTY OF ELLIS)

The undersigned, Ala Tamimi, upon oath first duly sworn, states that he is the Vice President of Transmission Planning and Policy for both Sunflower Electric Power Corporation and Mid-Kansas Electric Company, 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.

Dr. Ala Tamimi

Subscribed and sworn to before me this 9th day of July, 2018.

NOTARY PUBLIC - State of Kansas
Renee K. Braun
My Appt. Expires 4/30/2022

Renee K. Braun
Notary Public

My appointment expires: April 30, 2022

EXHIBIT AT-1

SEPC/MKEC

March 9, 2009

System Reinforcements to Supply Additional Power to the City of Kingman

By Al Tamimi
Transmission Engineer II, P.E.
SEPC

OBJECTIVES

The objectives of this study are to evaluate the long-term voltage, service reliability, load serving capabilities of the existing and any future modification of the transmission system in the Pratt area to allow for maximum power delivery to the city of Kingman while maintaining or exceeding service capability of the existing network power system in the area. The primary concern will be maintaining proper voltages during normal and single contingency conditions (emergency conditions). Previous studies have identified voltage concerns with the 115-kV transmission system serving the area around Pratt.

This study builds on previous engineering analysis done by Aquila (September 2002), Kansas Electric Power Cooperative, Inc. (KEPCo) (June 2007) and Sunflower Electric Power Corporation (SEPC) (August 2007). Recommendations found in the Aquila study limited the City of Kingman to a maximum of 6 MW of load during summer peak. A detailed discussion of the 2007 and 2009 Southwest Power Pool (SPP) models are documented in the KEPCo January 2007 study. A copy of that study is available by contacting KEPCo engineering offices in Topeka Kansas.

This study does not attempt to determine which entity should construct or own any of the proposed facilities nor should the results of this study be considered as a commitment to construct any facilities recommended without additional discussion and the necessary company approvals.

BACKGROUND AND ASSUMPTIONS

The 2009 Summer Peak cases developed by Southwest Power Pool (SPP) of the 2008 series cases were used for this study. Adjustments had to be made to reflect correct detail model to this area since SPP cases have all loads connected to the Ninnescah's 115-kV transmission line modeled at the Pratt 115-kV bus. The Gateway Ethanol Plant and the Northern Natural Plant are currently served from the Ninnescah's 115-kV line. The maximum anticipated load at the Gateway Ethanol Plant is expected to be at 20 MW, (Refer to KEPCo's January 2007 study for detail regarding this load growth). The Gateway Ethanol Plant was modeled to have a 3.6 MVAR capacitor bank. This should

have been completely installed by the summer of 2008 per the KEPCo study. In addition to this 3.6 MVAr capacitor bank, KEPCo January 2007 study recommended the installation of 21.6 MVAr of 115-kV capacitor bank at Prichard Substation when the load at the Gateway Ethanol Plant reaches 20 MW.

The Pratt 34.5-kV bus was modeled to have a 4.8 MVAR capacitor bank, owned by MKEC (Mid Kansas Electric Company). It is assumed that the Pratt 115-kV capacitor bank (24 MVAr) will be installed and in-service by the end of September 2009 per SPP STEP recommendation (NTC). City of Kingman was modeled with a 4.8 MVAr capacitor on the 12.5-kV bus. The service area map (around Pratt) is shown in Figure 1.

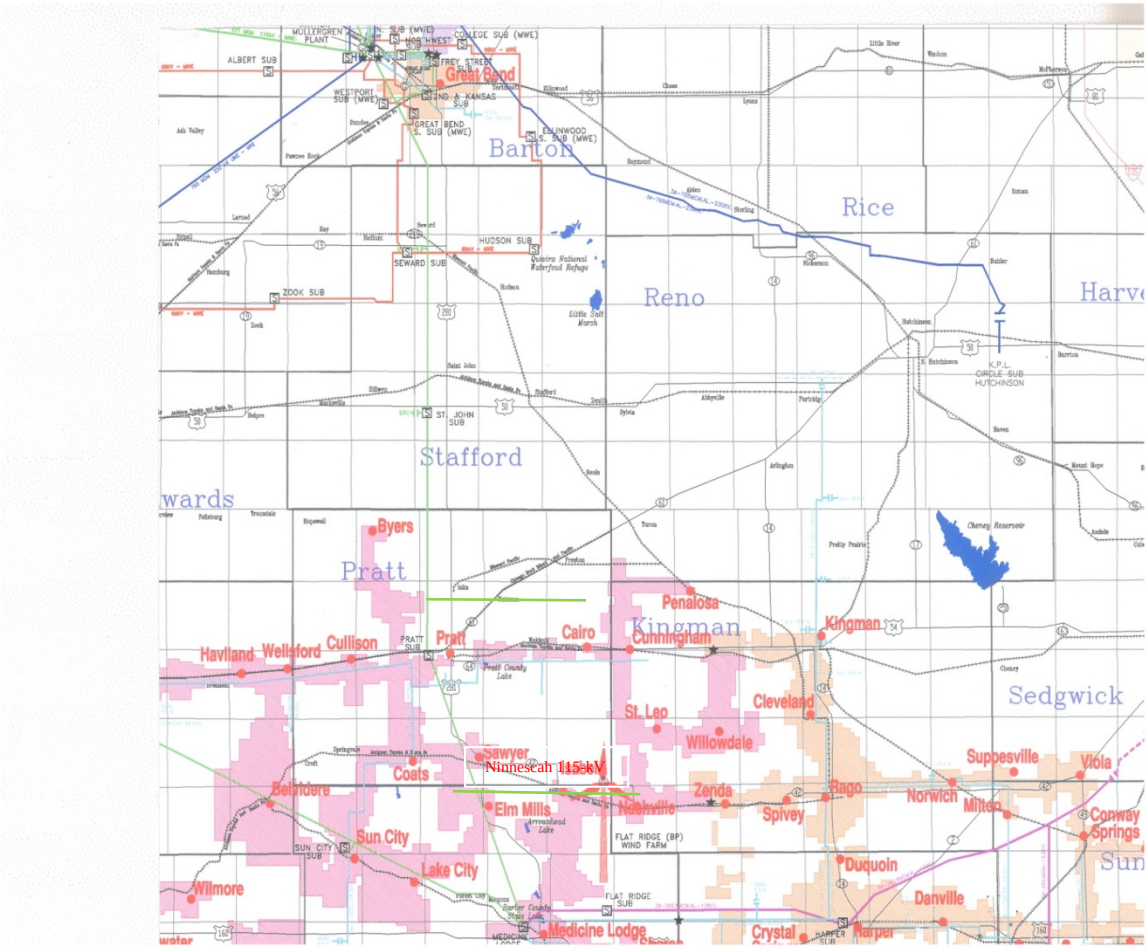


Figure 1

Single contingency (N-1) analysis was performed on the 2009 summer peak cases. Contingencies were modeled for the transmission area of MKEC, voltage and overload violations were monitored and corrected. The list of all (N-1) contingencies used in this study are listed below.

Contingency 1:

Outage of the 115-kV line from Edwards to ST John.

Contingency 2:

Outage of the 115-kV line from Huntsville to ST John.

Contingency 3:

Outage of the 115-kV bus at ST John.

Contingency 4:

Outage of the 115-kV line from Seward to ST John.

Contingency 5:

Outage of the 115-kV line from Prichard to ST John.

Contingency 6:

Outage of the 115-kV line from Prichard to Pratt.

Contingency 7:

Outage of the 115-kV line from Pratt to Medicine Lodge.

Contingency 8:

Outage of the 115-kV line from Medicine Lodge to Sun City.

Contingency 9:

Outage of the 138-kV line from Medicine Lodge to Harper.

Voltage Criteria:

Bus voltages during normal system conditions must be equal or higher than 0.95 pu. Bus voltages during N-1 contingencies must be equal or higher than 0.93 pu.

Overload Criteria:

Transformers and transmission lines loaded to a maximum of 100% of their normal rating during normal conditions. Transformers and transmission lines can be loaded to a maximum of 100% of their emergency rating during N-1 contingencies.

RECOMMENDATIONS

To allow for reliable service for the maximum anticipated load at the City of Kingman of 14 MW, it is recommended to provide service from the Ninnescah 115-kV transmission line (From the Prichard Tap Station running east to the Gateway Ethanol Plant "SemCrude Point"). Results of the analysis indicated that the Ninniscah 115-kV line can provide reliable service to the maximum anticipated load of the City of Kingman without reducing its service capability to existing and future anticipated loads served from this line.

Providing reliable service to the City of Kingman from the new SemCrude Station requires the following construction projects.

- Install a 115-kV 21.6 MVAr capacitor bank at the Prichard 115-kV Substation. (Item was recommended in the KEPCo's January 2007 study when the Gateway Ethanol Plant load increases to 20 MW).
- Install a 115-kV 24 MVAr capacitor bank at the Pratt 115-kV Substation. (Will be in service by the end of September 2009).
- Construct approximately 2.5 miles of 115-kV transmission line using 795 ACSR conductor from the Ninnescah Northern Natural 115-kV Substation to the new SemCrude Station.

The above recommendation allows the Ninnescah 115-kV line to serve all of the following loads during normal and under emergency conditions without violating voltage or overload criteria's.

- Gateway Ethanol Plant — 20 MW (Max Expected Load)
- Northern Natural Plant — 5.5 MW
- The City of Kingman Load — 14 MW (Max Expected Load)
- Southern Pioneer Electric Company Load — 6 MW (Cunningham & Future SemCrude Loads)

The 115-kV service option provided enough capacity to serve the maximum 14 MW of anticipated load at the City of Kingman. The 34.5-kV service option did not provide for reliable service to the maximum 14 MW of anticipated load at the City of Kingman. With 14 MW of load at City of Kingman, the 34.5-kV service from Pratt resulted in voltage violations during normal and emergency operating conditions. Without the Pratt 115-kV ;24 MVAr capacitor bank, the current 34.5-kV delivery service to the City of Kingman provided reliable service to only 6 MW during normal conditions but this configuration does not allow for reliable service to any load at the City of Kingman. Even with the reconductoring of 19.5 miles of 34.5-kV line from Pratt to the Cunningham regulator station with larger conductor (477 ACSR), the 34.5-kV Pratt line could not provide sufficient service capability to serve all anticipated 14 MW of load at the City of Kingman without violating voltage criteria. With the Pratt 115-kV; 24 MVAr capacitor bank in-service, the maximum Kingman load that can served from this upgraded 34.5-kV line is 11.5 MW during normal operating conditions and 4.5 MW of load at Kingman during emergency conditions (limiting contingency is Contingency 7; the 115-kV line from Pratt to Medicine Lodge out of service).

DISCUSSION

City of Kingman is anticipating their load to increase to 14 MW in near future. To investigate the maximum allowable load at the city of Kingman, this study considered three options to serve the load.

Option I: Serving the City of Kingman load from the Pratt 34.5-kV radial line.

Option II: Building 2.5 miles of 115-kV line from the Northern Natural Substation (Northern natural Plant is approximately 5 miles east of the Gateway Ethanol Plant) to the new SemCrude Station to serve the City of Kingman load from the Ninnescah 115-kV radial line.

Option III: Serving the City of Kingman load from the Harper 34.5-kV radial line. This option was discussed in the Aquila 2006 Study and allows for reliable service to only 4 MW of load at the City of Kingman.

DISCUSSION: OPTION I

Summary of Option I results are shown in Table 1.

Table 1
Maximum Load at the City of Kingman Delivery Point

Option I **Serving Kingman From the Pratt 34.5-kV line**					
System Modifications		**Maximum Kingman Load with Gateway Ethanol Plant at 20 MW**		**Maximum Kingman Load with Gateway Ethanol Plant at 10 MW**	
Adding Pratt 115-kV Capacitor Bank	**Miles of 34.5-kV Transmission Line Reconductoring With 477 ACSR**	**Normal Conditions**	**Emergency Conditions**	**Normal Conditions**	**Emergency Conditions**
N/A	N/A	6 MW	0 MW	6 MW	0 MW
24 MVAr	N/A	7.5 MW	4 MW	7.7 MW	7 MW
24 MVAr	5 miles (the 2/0 ACSR portion of the main 34.5-kV line feeding Kingman from Pratt).	9 MW	4.2 MW	10 MW	8.1 MW
24 MVAr	19.5 miles (the main 34.5-kV line feeding Kingman from Pratt).	11.5 MW	4.5 MW	12 MW	9.2 MW

In Option I, the 34.5-kV line serving the City of Kingman is capable of providing reliable service to a maximum of 6 MW under normal conditions. However, under emergency

conditions (limiting condition; the 115-kV line from Pratt to MEDICINE LODGE is out of service), this option did not provide reliable service to the city of Kingman's load due to low voltages in the area during n-1 conditions. The addition of 24 MVAr at the Pratt 115-kV substation increased service capability of this 34.5-kV line. Under normal operating conditions, with the Pratt 115-kV; 24 MVAr capacitor bank in-service, the Pratt 34.5-kV line is capable of providing reliable service to 7.5 MW of load under normal conditions and 4 MW of load at the new SemCrude Station (Cunningham regulator station) during contingencies.

With the Pratt 24 MVAr capacitor bank in service, reconductoring five miles of 2/0 ACSR conductor with 477 ACSR from Pratt to Cunningham regulator station (The 2/0 ACSR portion of the main 34.5-kV line feeding Kingman from Pratt) increased service capability of this 34.5-kV line. This five-mile of line reconductoring allows for reliable service to 9 MW of load during normal operating conditions and 4.2 MW of load during contingencies at the new SemCrude Station.

With the Pratt 24 MVAr capacitor bank in service , with Gateway Ethanol Plant load at 20 MW, reconductoring all 19.5 miles of 34.5-kV line from Pratt to Kingman delivery point with 477 ACSR increased service capability of this 34.5-kV line to serve loads off of the Kingman delivery point, at a maximum of 11.5 MW during normal operating conditions and 4.5 MW during emergency conditions.

DISCUSSION : OPTION II

A summary of Option II results is shown in Tables 2 and 3. Table I shows the maximum allowed combined load to be served from the new SemCrude Station without violating voltage or overload criteria. Table 3 shows voltage levels at that maximum combined load. Load flow cases are summarized in the Appendix at the end of this report.

Table 2

Maximum Combined Load at the New SemCrude Station

OPTION II* Serving the City of Kingman and Southern Pioneer Loads from The Ninnescah 115-kV Radial Line						
System Configuration Cases	**System Modifications**			**Gateway Ethanol Plant**	**Maximum Combined Kingman & Southern Pioneer Load at the new SemCrude Station**	
Case Number	**Additional 115-kV Capacitor Banks at PRICHARD**	**Additional 115-kV Capacitor Banks at Pratt**	**Existing Capacitor Bank at the Gateway Ethanol Plant Bus**	**MW Load**	**Normal Conditions**	**Emergency Conditions (Contingency 7)**
Case 1	N/A	N/A	3.6 MVAr	10 MW	9.5 MW	0 MW
Case 2	N/A	N/A	3.6 MVAr	20 MW	4 MW	0 MW
Case 3	N/A	24 MVAr	N/A	0 MW	26 MW	18 MW
Case 4	N/A	24 MVAr	3.6 MVAr	20 MW	16 MW	5 MW
Case 5	21.6 MVAr	24 MVAr	3.6 MVAr	20 MW	26.5 MW	17 MW

Table 3

Voltage Summary Under Maximum Combined Load at the New SemCrude Station During Normal and Emergency Conditions

(Contingency 7; Outage of the 115-kV line from Pratt to Medicine Lodge)

OPTION II*										
Serving Kingman and Southern Pioneer Loads from The Ninnescah 115-kV Radial Line										
Configuration			Voltage Levels in PU / kV During Normal and Emergency Conditions							
Cases	Combined Load at the New SemCrude Station in MW		Pratt 115-kV Bus		Prichard 115-kV Tap		ST John 115-kV Sub		New SemCrude 115-kV Station	
Case Number	Normal Conditions	Emergency Conditions	Normal Conditions	Emergency Conditions	Normal Conditions	Emergency Conditions	Normal Conditions	Emergency Conditions	Normal Conditions	Emergency Conditions
Case 1	9.5	0	0.961/ 110.5	0.904/ 104.0	0.960/ 110.1	0.907/ 104.3	0.967/ 111.2	0.935/ 107.05	0.952/ 109.5	0.900/ 103.5
Case 2	4	0	0.954/ 109.7	0.884/ 107.7	0.953/ 109.6	0.888/ 102.1	0.963/ 110.7	0.9222/ 106.1	0.950/ 109.2	0.888/ 102.1
Case 3	26	18	0.983/ 113.0	0.951/ 109.3	0.978/ 112.5	0.949/ 109.1	0.977/ 112.3	0.957/ 110.0	0.949/ 109.1	0.930/ 106.9
Case 4	16	5	0.974/ 112.0	0.939/ 108.0	0.970/ 111.5	0.938/ 107.8	0.971/ 111.7	0.949/ 109.2	0.950/ 109.2	0.932/ 107.2
Case 5	26.5	17	0.987/ 113.5	0.955/ 109.8	0.984/ 113.1	0.953/ 109.6	0.978/ 112.4	0.955/ 109.8	0.949/ 109.1	0.931/ 107.1

Five different cases where investigated under Option II. The following is a discussion of these cases.

Case 1:

Under normal operating conditions, with the Gateway Ethanol Plant load at 10 MW, the Ninnescah 115-kV is capable of providing reliable service to only 9.5 MW of load at the new SemCrude Station. At this load level, no bus voltages violate the voltage criteria. All bus voltages are within the 0.95 pu to1.05 pu limits. All line loadings are less than 100% of their nominal applicable normal rating. The voltage observed at the Pratt 115-kV bus was 0.961 pu (110.5-kV).

Under emergency operating conditions, with the Gateway Ethanol Plant load at 10 MW, the Ninnescah 115-kV is not capable of providing reliable service to any load at the new SemCrude Station. Even without the addition of load to the Ninnescah 115-kV line, the loss of the Pratt to Medicine Lodge 115-kV line causes several bus voltages to violate the voltage criteria. Bus voltages below 0.93 pu are observed at Pratt, Prichard, Gateway Ethanol Plant, Northern Natural Plant buses and at the new SemCrude Station. The voltage observed at the Pratt 115-kV bus was 0.904 pu (104.0-kV). All line loadings are less than 100% of their nominal applicable emergency rating. Under emergency conditions, any load higher than Zero MW at the new SemCrude Station will result in voltage criteria violation.

Case 2:

Under normal operating conditions, with the Gateway Ethanol Plant load at 20 MW, the Ninnescah 115-kV is capable of providing reliable service to only 4 MW of load at the new SemCrude Station. At this load level, no bus voltages violate the Voltage Limits Criteria. All bus voltages are within the 0.95 pu to1.05 pu limits. All line loadings are less than 100% of their nominal applicable normal rating. The voltage observed at the Pratt 115-kV bus was 0.954 pu (109.7-kV), this is marginally acceptable voltage level during normal operating conditions.

Under emergency operating conditions, with the Gateway Ethanol Plant load at 10 MW, the Ninnescah 115-kV is not capable of providing reliable service to any amount of load at the new SemCrude Station. Even without the addition of load to the Ninnescah 115-kV line, the loss of the Pratt to Medicine Lodge 115-kV line causes several bus voltages to violate the voltage criteria. Bus voltages below 0.93 pu are observed at Pratt, Prichard, Gateway Ethanol Plant, Northern Natural Plant buses and at the new SemCrude Station. The voltage observed at the Pratt 115-kV bus was 0.884 pu (101.7-kV). All line loadings are less than 100% of their nominal applicable emergency rating. Under emergency conditions, any load

higher than Zero MW at the new SemCrude Station will result in voltage criteria violation.

Case 3:

Under normal operating conditions, with the Gateway Ethanol Plant load at Zero MW (currently, the Gateway Ethanol Plant not in-service) and the Pratt 115-kV, 24 MVAr capacitor bank in-service; the Ninnescah 115-kV is capable of providing reliable service to all 20 MW of load at the new SemCrude Station. At this load level, no bus voltages violate the voltage criteria. All bus voltages are within the 0.95 pu to1.05 pu limits. All line loadings are less than 100% of their nominal applicable normal rating. The voltage observed at the Pratt 115-kV bus was 0.983 pu (113.0-kV).

Under emergency operating conditions, with the Gateway Ethanol Plant load at Zero MW and the Pratt 115-kV, 24 MVAr capacitor bank in-service; the Ninnescah 115-kV is capable of providing reliable service to 18 MW of load at the new SemCrude Station. Under emergency conditions and at this load level, all bus voltages are within the 0.93 pu to1.05 pu limits. All line loadings are less than 100% of their nominal applicable emergency rating. The loss of the Pratt to Medicine Lodge 115-kV line resulted in a 0.951 pu (109.3-kV) voltage at the Pratt 115-kV bus. Under emergency conditions, any load higher than 18 MW at the new SemCrude Station will result in voltage criteria violation.

Case 4:

Under normal operating conditions, with the Gateway Ethanol Plant load at 20 MW, with Pratt 115-kV, 24 MVAr capacitor bank in-service; the Ninnescah 115-kV is capable of providing reliable service to 16 MW of load at the New SemCrude Station. At this load level, no bus voltages violate the Voltage Limits Criteria. All bus voltages are within the 0.95 pu to1.05 pu limits. All line loadings are less than 100% of their normal rating. The voltage observed at the Pratt 115-kV bus was 0.974 pu (112.0-kV).

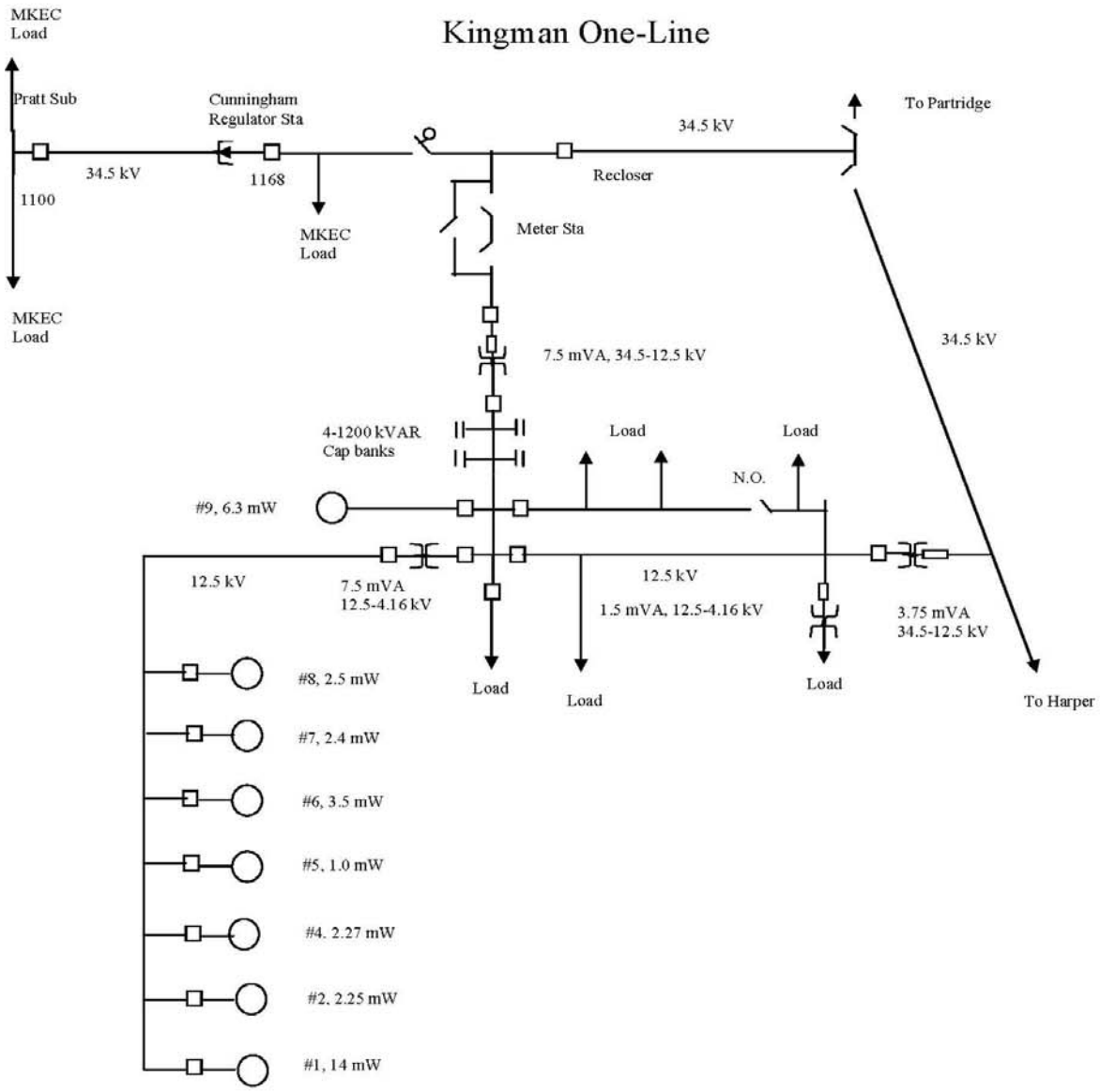
Under emergency operating conditions, with the Gateway Ethanol Plant load at Zero MW , with Pratt 115-kV, 24 MVAr capacitor bank in-service; the Ninnescah 115-kV is capable of providing reliable service to 5 MW of load at the new SemCrude Station. Under emergency conditions and at this load level, all bus voltages are within the 0.93 pu to1.05 pu limits. All line loadings are less than 100% of their nominal applicable emergency rating. The loss of the Pratt to Medicine Lodge 115-kV line resulted in a 0.939 pu (108.0-kV) voltage at the Pratt 115-kV bus. Under emergency conditions, any load higher than 5 MW at the new SemCrude Station will result in voltage criteria violation.

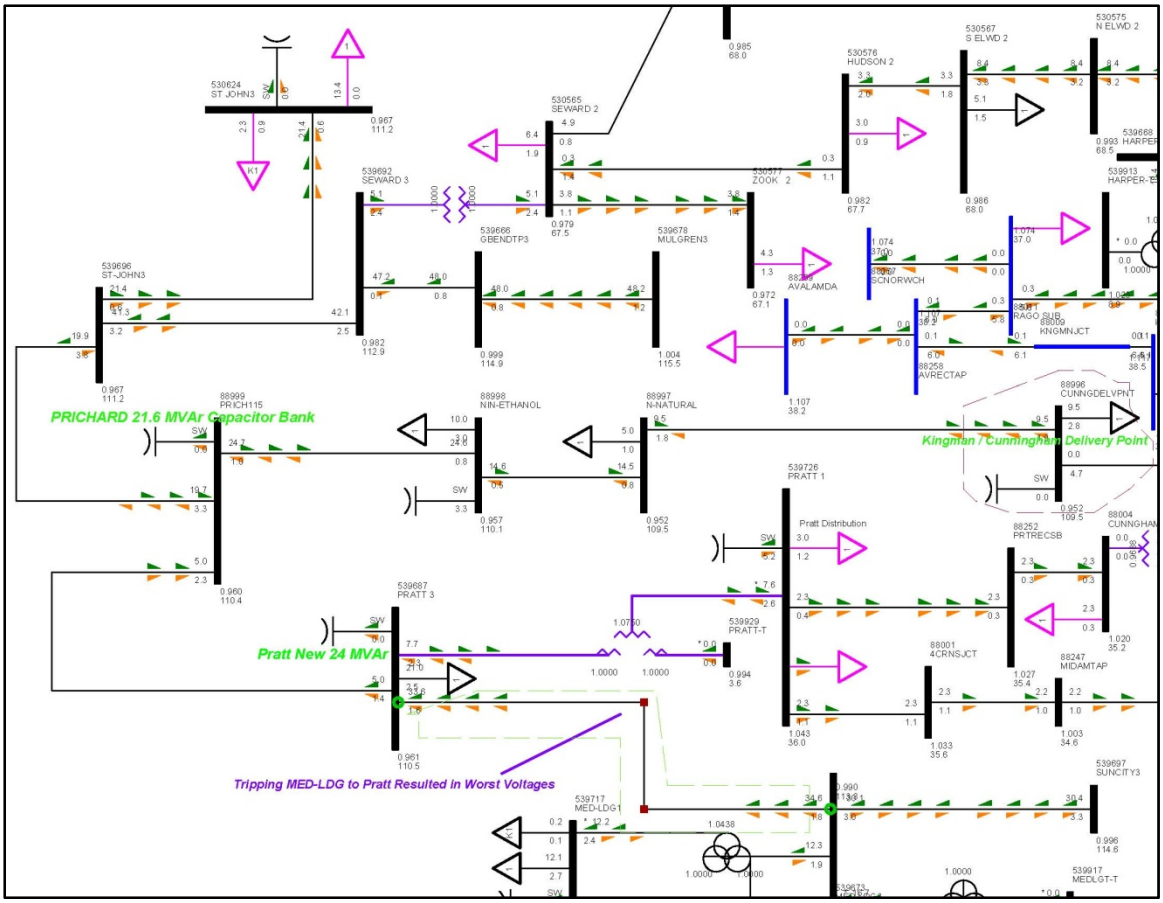
Case 5:

Under normal operating conditions, with the Gateway Ethanol Plant load at 20 MW, with Pratt 115-kV, 24 MVAr capacitor bank and Prichard 115-kV; 21.6 MVAr capacitor banks are in-service, the Ninnescah 115-kV is capable of providing reliable service to 26.5 MW of load at the New SemCrude Station. At this load level, no bus voltages violate the Voltage Limits Criteria. All bus voltages are within the 0.95 pu to1.05 pu limits. All line loadings are less than 100% of their nominal applicable normal rating. The voltage observed at the Pratt 115-kV bus was 0.987 pu (113.5-kV).

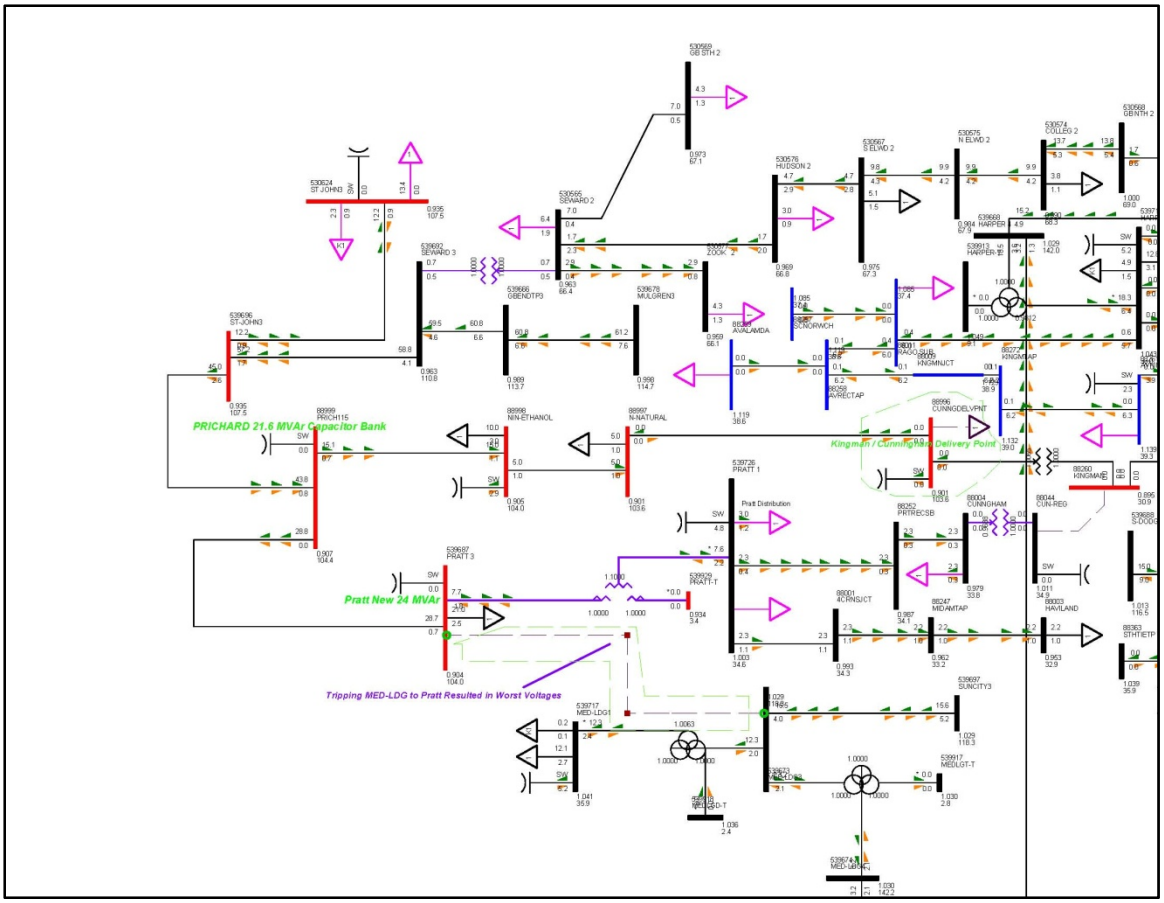
Under emergency operating conditions, with the Gateway Ethanol Plant load at Zero MW, with the Pratt 115-kV, 24 MVAr capacitor bank and the Prichard 115-kV, 21.6 MVAr in-service; the Ninnescah 115-kV is capable of providing reliable service to 17 MW of load at the new SemCrude Station. Under emergency conditions and at this load level, all bus voltages are within the 0.93 pu to1.05 pu limits. All line loadings are less than 100% of their nominal applicable emergency rating. The loss of the Pratt to Medicine Lodge 115-kV line resulted in a 0.955 pu (109.8-kV) voltage at the Pratt 115-kV bus. Under emergency conditions, any load higher than 17 MW at the new SemCrude Station will result in voltage criteria violation.

APPENDIX

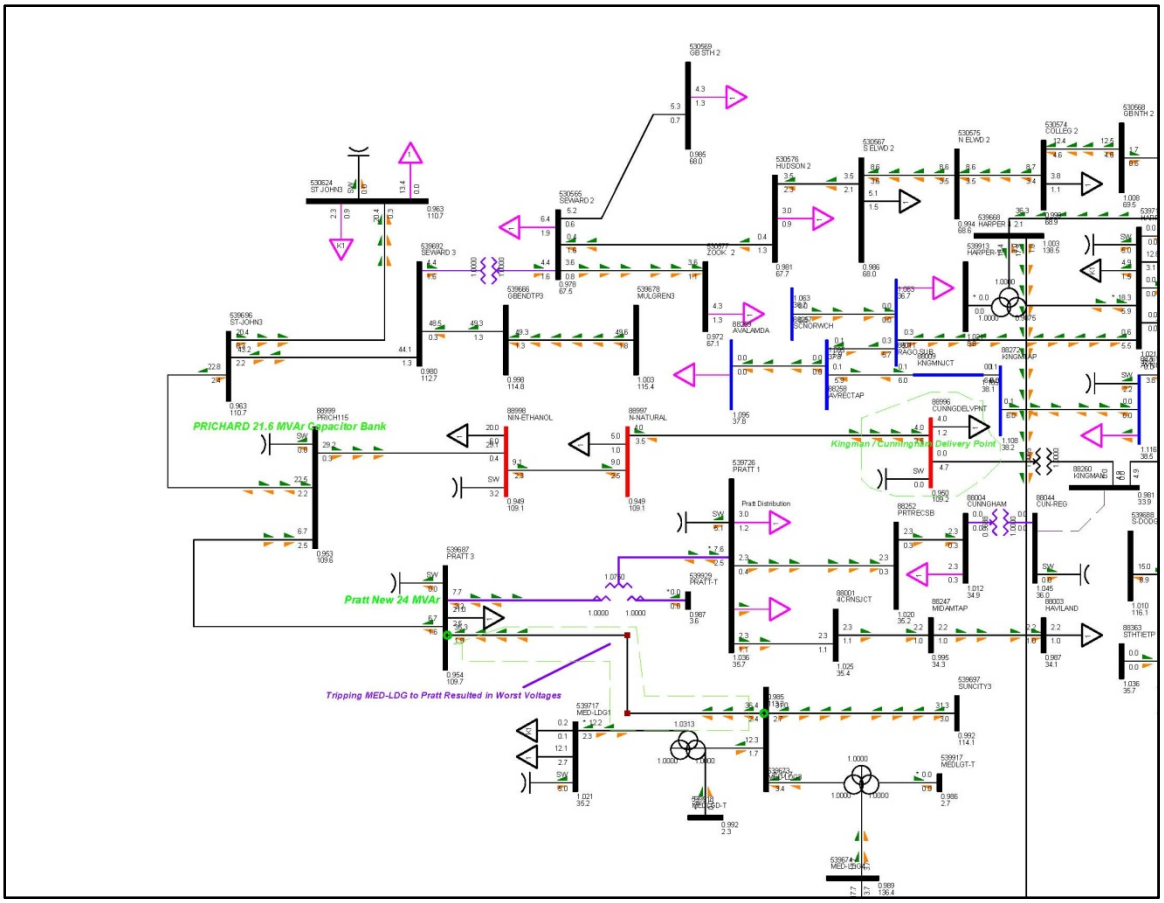

Kingman One-Line
MKEC Load
Pratt Sub
34.5 kV
1100
MKEC Load
Cunningham Regulator Sta
1168
MKEC Load
Meter Sta
Recloser
34.5 kV
To Partridge
34.5 kV
7.5 mVA, 34.5-12.5 kV
4-1200 kVAR Cap banks
Load
Load
N.O.
#9, 6.3 mW
12.5 kV
7.5 mVA 12.5-4.16 kV
12.5 kV
1.5 mVA, 12.5-4.16 kV
3.75 mVA 34.5-12.5 kV
#8, 2.5 mW
#7, 2.4 mW
#6, 3.5 mW
#5, 1.0 mW
#4, 2.27 mW
#2, 2.25 mW
#1, 14 mW
Load
Load
Load
To Harper



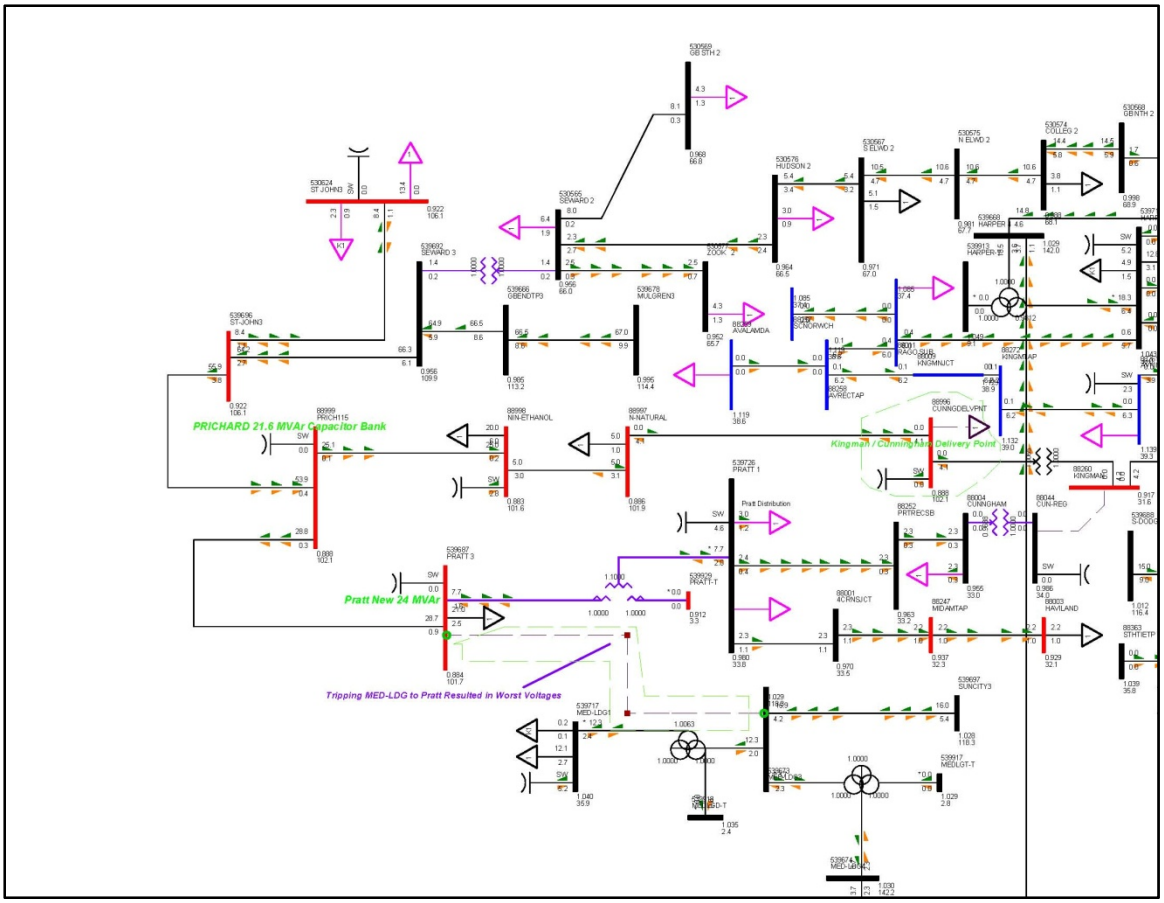
Case 1 : Normal Condition



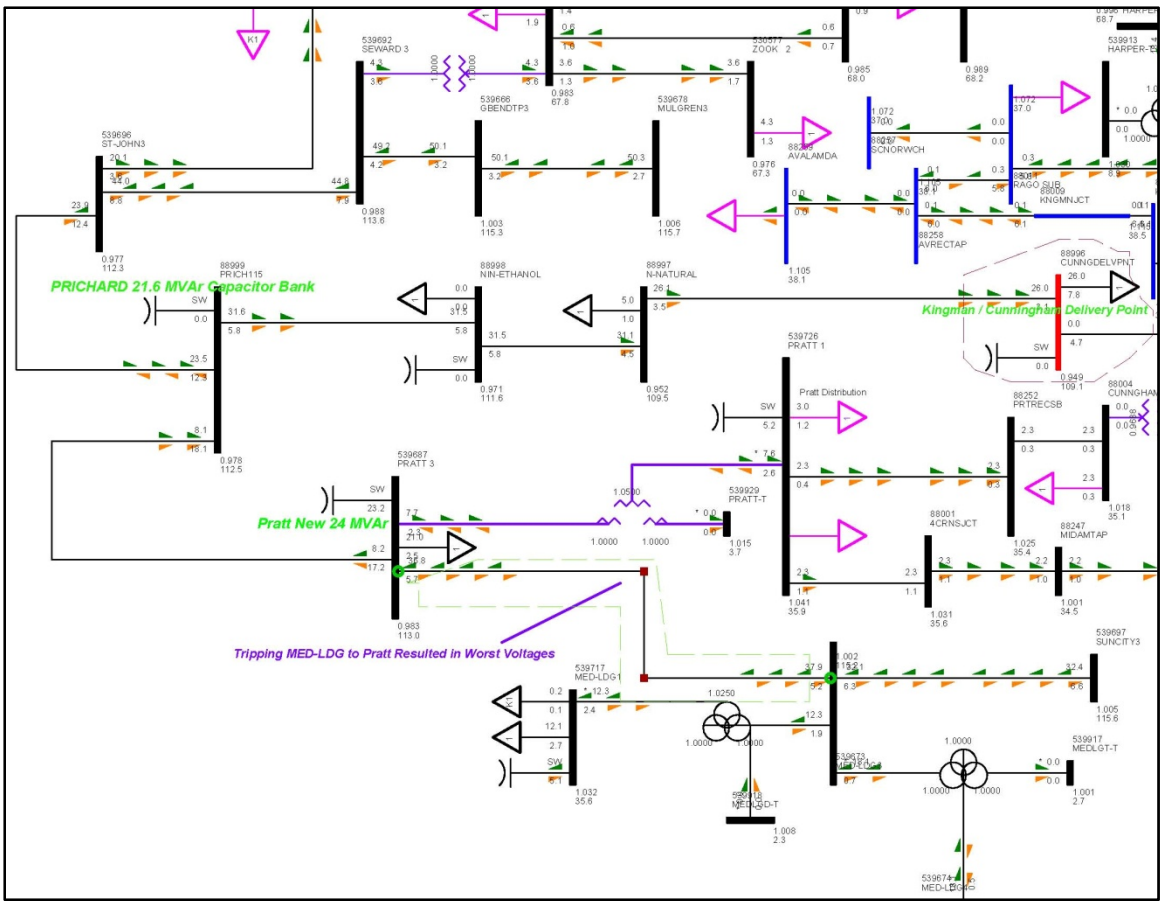
Case 1: Emergency Condition



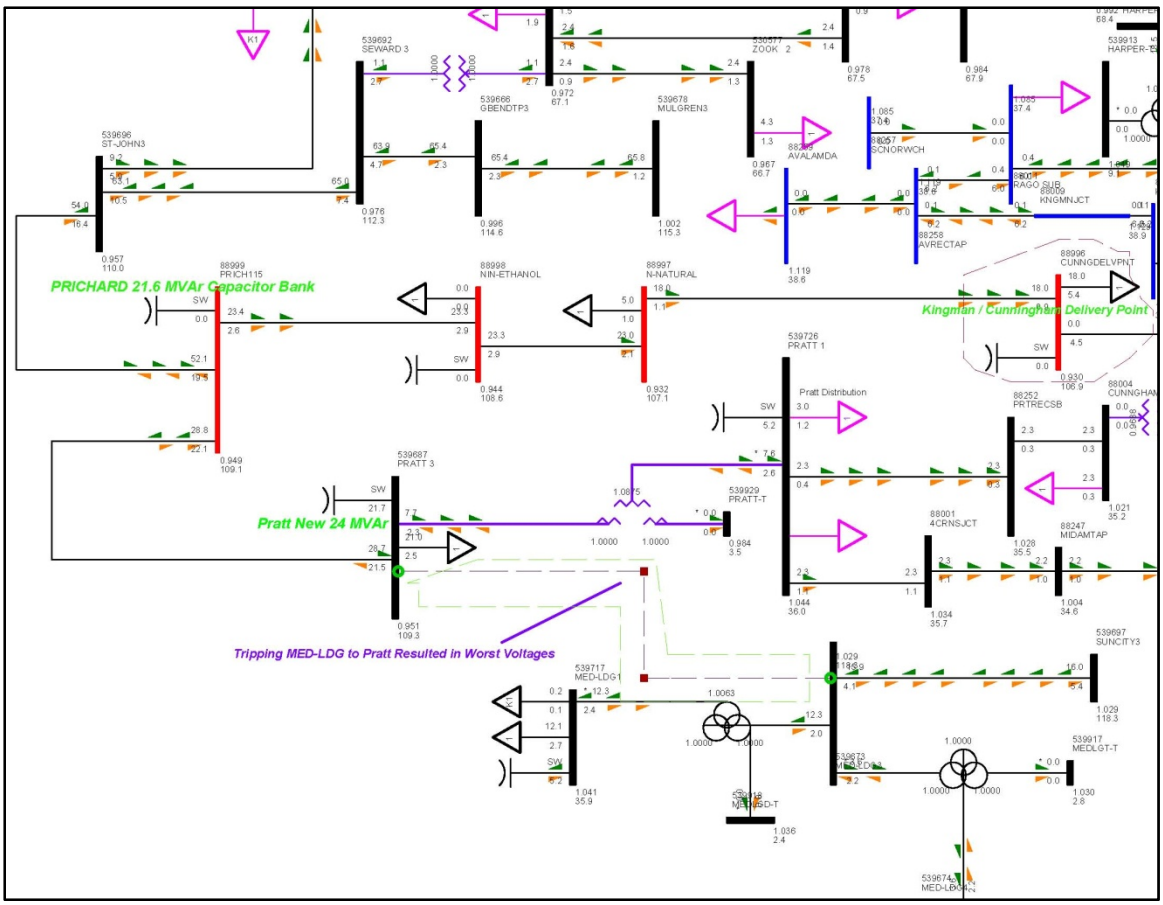
Case 2: Normal Condition



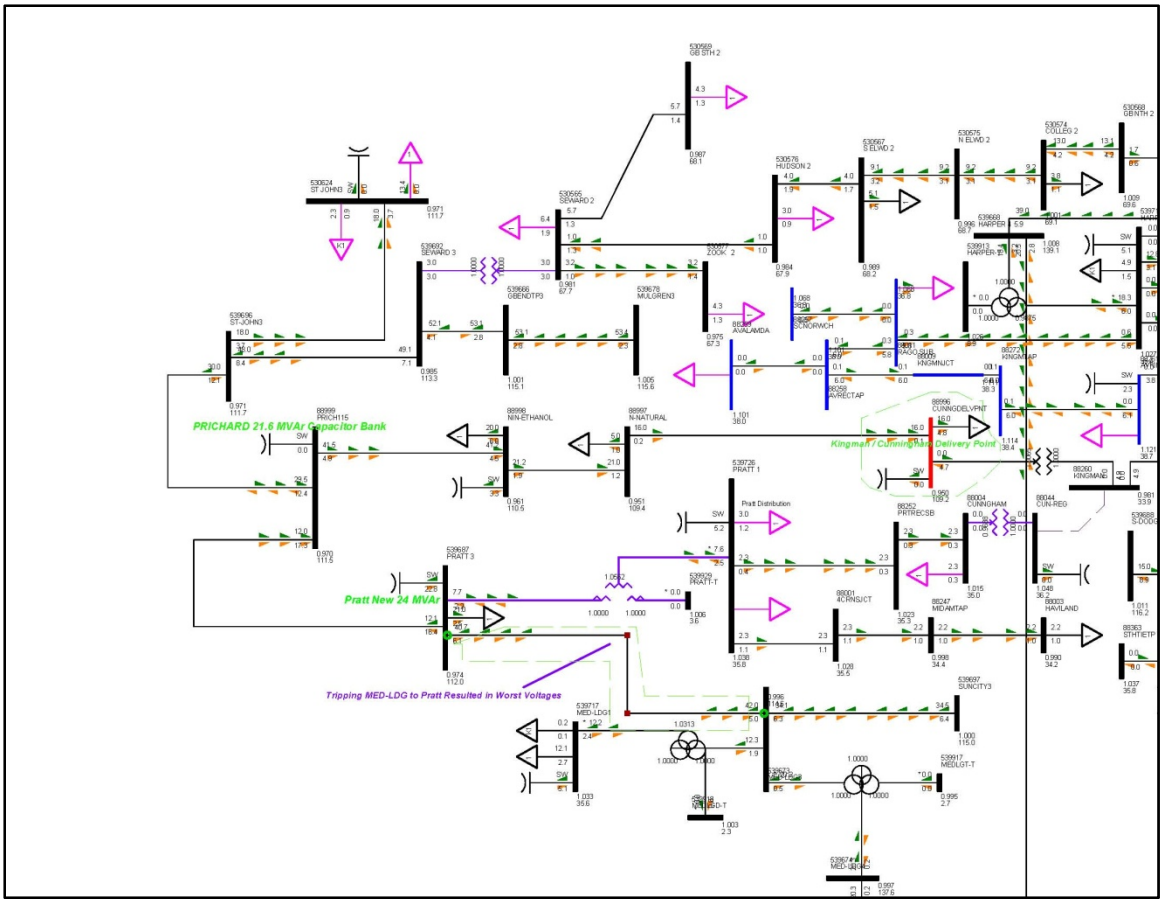
Case 2: Emergency Condition



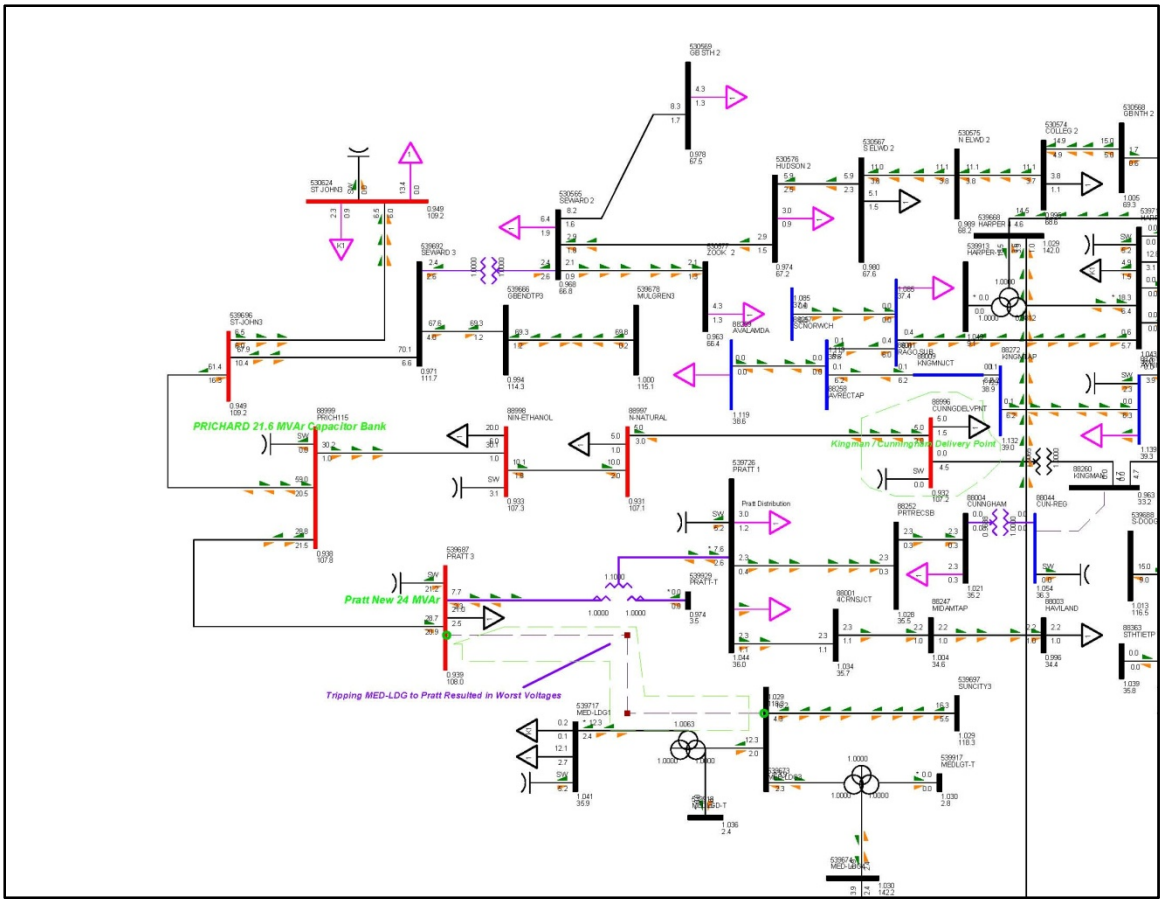
Case 3: Normal Condition



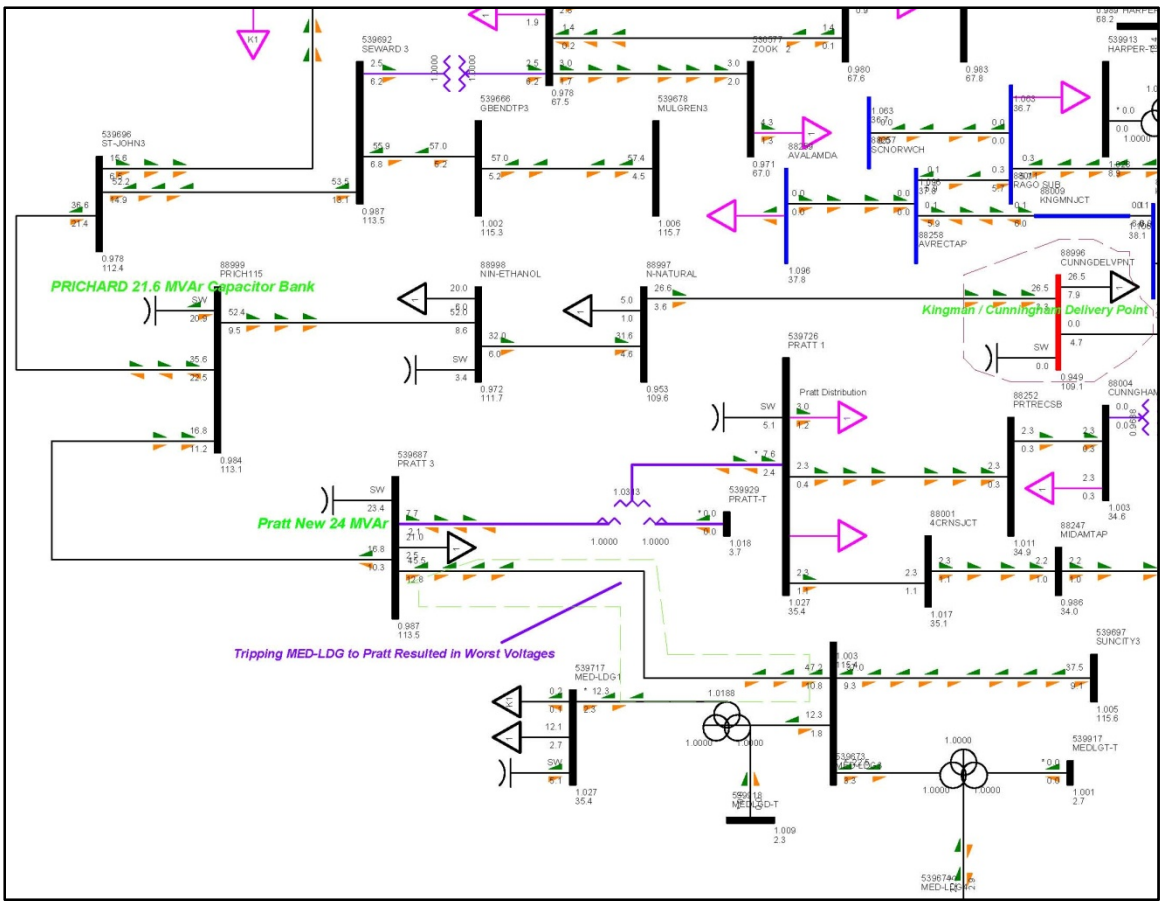
Case 3: Emergency Condition



Case 4: Normal Condition

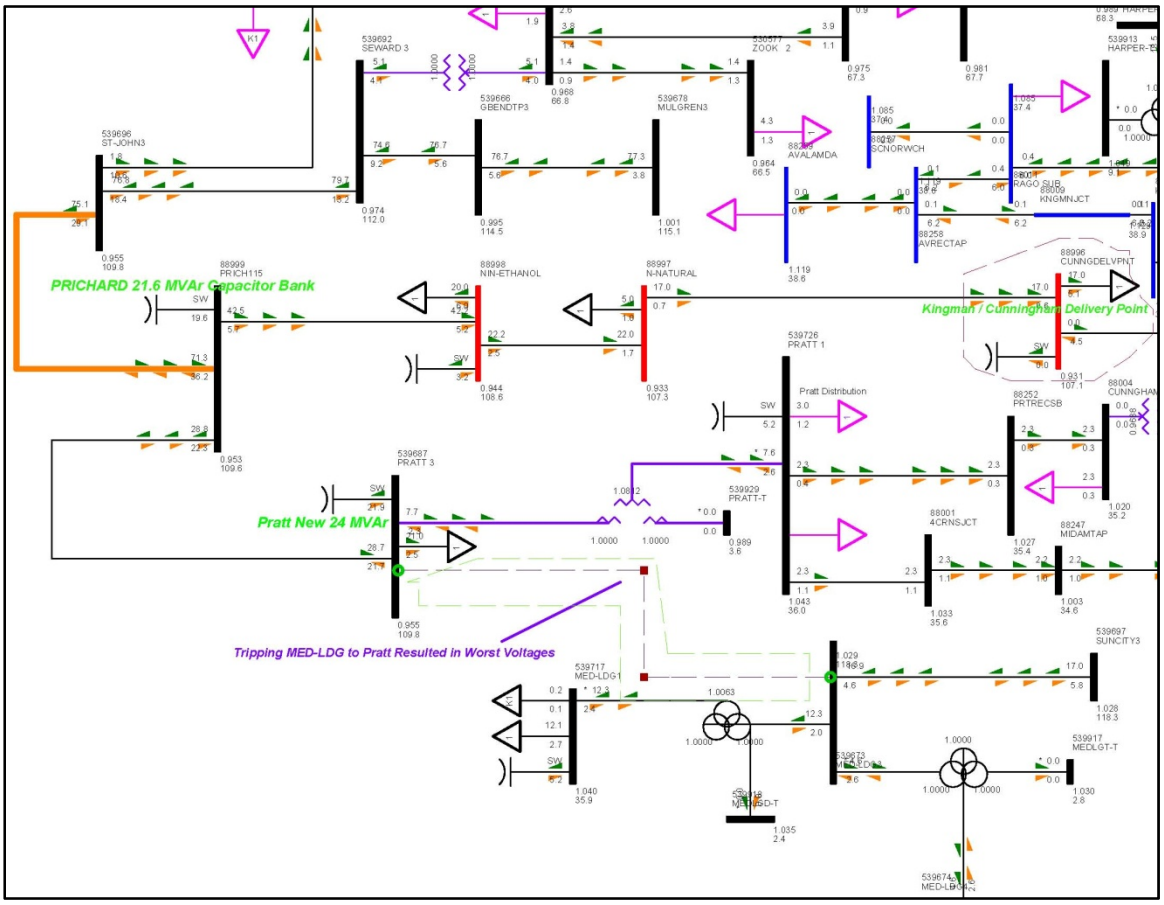


Case 4: Emergency Condition



Case 5: Normal Condition

C



Case 5: Emergency Condition

Kingman Long Range Analysis

A Long-term Assessment of Options to Serve the Expected Load in Kingman and Harper Counties

Fall 2014

Prepared by:

Ryan Yokley, I.E., C.E.M. / Al Tamimi, Ph.D., P.E.

Sunflower Planning Engineering Department, Sunflower Electric Power Corporation

2014 – Kingman Analysis

Power System Transmission & Distribution Impact

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2014 – Kingman Analysis

Power System Transmission & Distribution Impact

Report Summary

The purpose of this report is to summarize the impact of the load growth on the Mid-Kansas Electric Company, LLC (Mid-Kansas) 34.5 kV system and to determine feasible transmission (100 kV+) and sub-transmission (34.5 kV) upgrades needed to serve the load in Pratt, Kingman, and Harper Counties of Kansas. The load in the area directly impacts two Mid-Kansas electric cooperative members that serve load via a sub-transmission system in western Kansas: Wheatland Electric Cooperative, Inc. (WEC) and Southern Pioneer Electric Company (SPEC). In addition, the area impacts several wholesale customers and their members that take service in the area. These include Kansas Electric Power Cooperative, Inc. (KEPCo) and Kansas Power Pool (KPP).

Projected system loads were estimated based on the Non-Coincidental Peak (NCP) data recorded over the last few years at the 115/34.5 kV and 138/34.5 kV delivery points. The primary source of information for this study is the Mid-Kansas 34.5 kV Assessment. The load was grown at a constant percentage based on recent characteristics of the loads. The load was projected to a 20 year estimate for this analysis and a system model was created using PSS/E software. The load totals are summarized under the Area Load Projections heading on page 21.

This report analyzes the entire area for various options to determine the projects necessary to reliably serve the load for both normal and contingency operations and calculates the associated net present value (NPV) of the loss savings and project costs for the proposed upgrades. The system detailed in this report includes feeders on 4 substations (115/34.5 kV and 138/34.5 kV) and 14 loads served. Of the load served, there are 6 retail loads and 8 wholesale delivery points. In total, nearly 46 MW of system load was projected onto the 34.5 kV system for the Pratt East, SemCrude, Harper North, and Milan West feeders. This projection represents an annual increase of approximately 1.3% for retails loads and near 1.0% for KEPCo Member loads. The KPP Kingman load was increased to 14 MW for this study and remained constant.

Summary of the Analysis

The analysis indicated that the transmission system will require additional projects for to reliably serving the long-term loads for several base scenarios. Projects were added to each option as a result of violations and service concerns on the sub-transmission system and are NOT a result of reliability concerns on the transmission system.

Summary of Options Analyzed

OPTION	CASE NAME	Transmission Sources (115-138/34.5 kV)					New Transmission Lines			Project Summary	
		Harper	Pratt	Rago	SemCrude	Kingman	Harper to Rago	Rago to Kingman	SemCrude to Kingman	COST (Real)	LOSSES (kW)
1	Base Case	X	X							$4.6 MM	3,780
2	Current NTC	X	X	X			X			$12.3 MM	1,916
3	Modified NTC	X	X			X	X	X		$17.5 MM	1,174
4	138 kV Extension	X	X	X		X	X	X		$20.0 MM	967
5	NTC with SemCrude	X	X	X	X		X			$11.0 MM	2,904
6	Only SemCrude	X	X		X					$1.0 MM	3,901
7	115 kV Extension	X	X			X			X	$13.5 MM	932
8	Completed Loop	X	X	X		X	X	X	X	$36.0 MM	941
9	115 kV Extension with SemCrude	X	X		X	X			X	$14.5 MM	932

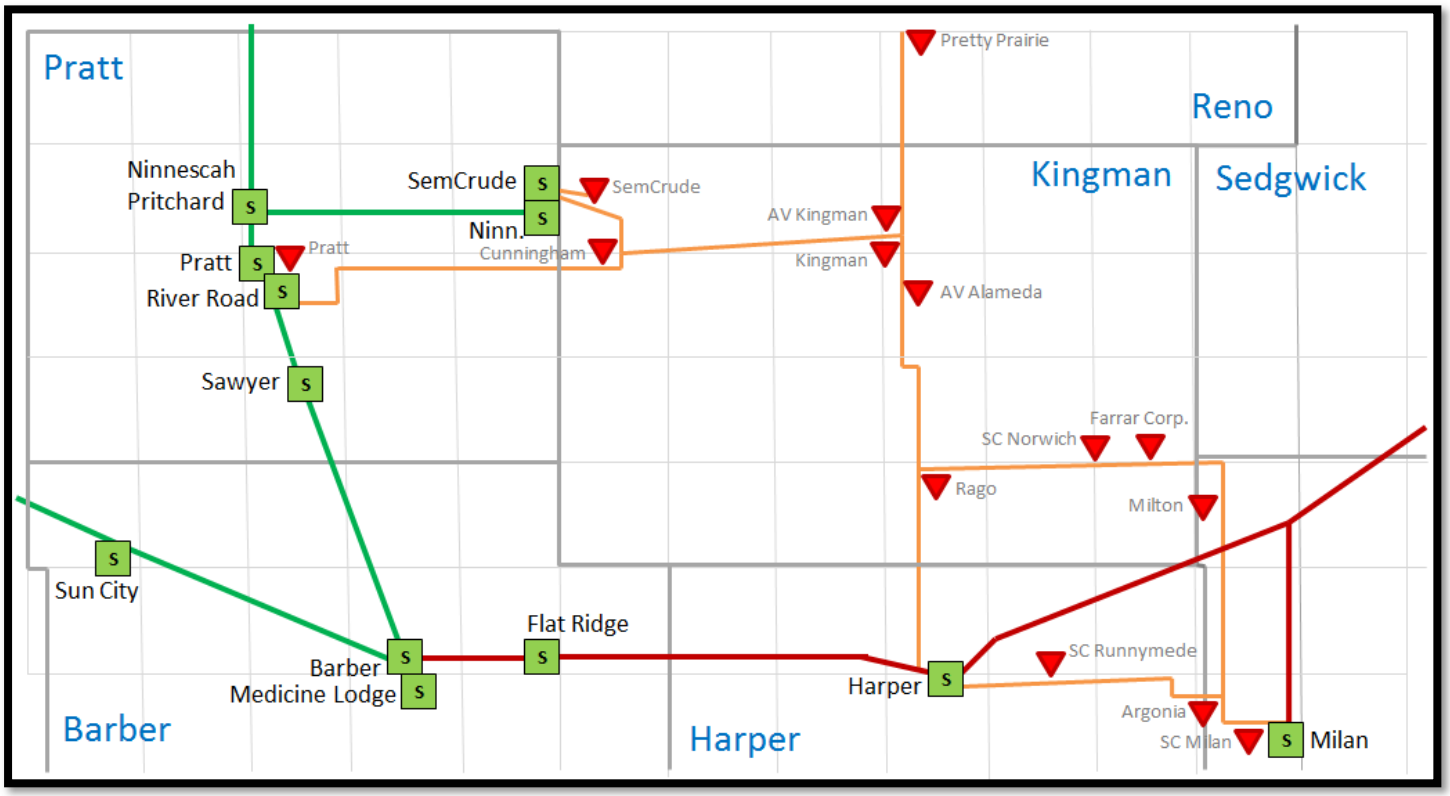
Summary of NPV

For each of the options, a 30 Year Net Present Value (NPV) was calculated for the estimated project cost as well as the total cost of the area losses.

Table 1: Summary of NPV

OPTION	Projects NPV	Losses NPV	TOTAL	Cost Factor
1	$13.6 MM	$39.1 MM	$52.7 MM	2.2
2	$36.3 MM	$19.8 MM	$56.1 MM	2.6
3	$51.6 MM	$12.1 MM	$63.7 MM	3.5
4	$58.9 MM	$10.0 MM	$68.9 MM	4.2
5	$32.4 MM	$30.0 MM	$62.5 MM	3.4
6	$3.0 MM	$40.4 MM	$43.3 MM	1.0
7	$39.8 MM	$9.6 MM	$49.4 MM	1.8
8	$106.1 MM	$9.7 MM	$115.8 MM	10.0
9	$42.7 MM	$9.6 MM	$52.4 MM	2.1

Figure 1: Area Map



Area Recommendations

It is recommended that this option be implemented.

2014 – Kingman Analysis

Power System Transmission & Distribution Impact

Mid-Kansas Criteria and Assumptions

The limitations placed on the transmission system (100 kV+) and the sub-transmission system (34.5 kV) are listed below. To determine the near-term impact of the load addition, summer peak cases were analyzed for the one and five year scenarios.

Voltage Criteria

The following tables indicate the criteria used for the purpose of this assessment.

Table 2: Mid-Kansas 34.5 kV Voltage Criteria for Local Planning

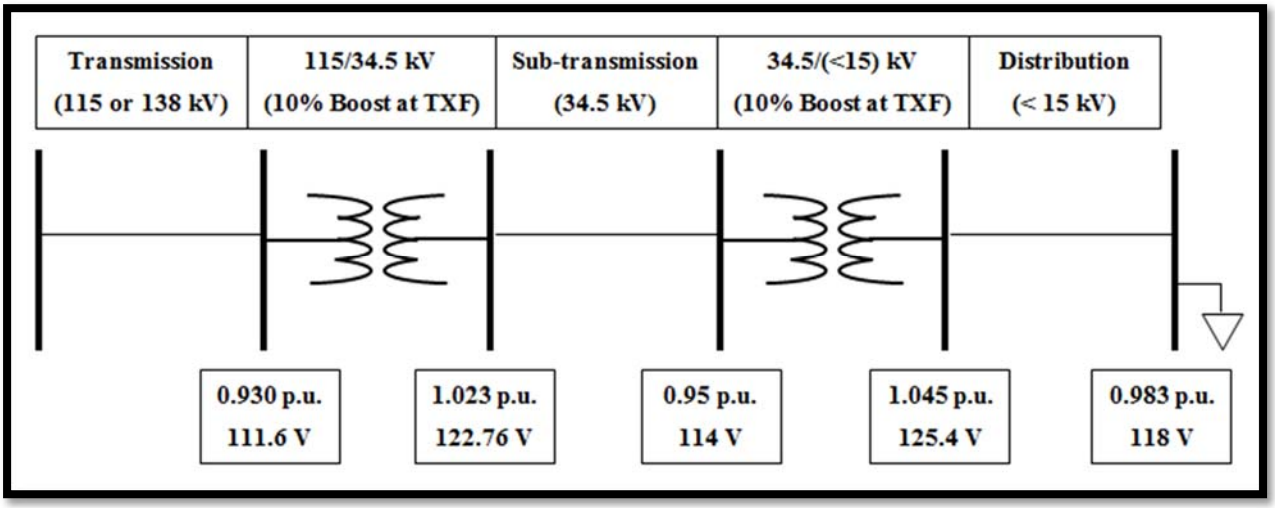
Element	Normal Operation Voltage Limits
34.5 kV Load Serving Buses	0.95 pu - 1.05 pu (114 V - 126 V) 32.78 kV - 36.23 kV
34.5 kV Non-Load Buses	0.90 pu - 1.05 pu (108 V - 126 V) 31.05 kV - 36.23 kV

Table 3: Mid-Kansas Transmission Criteria for Local Planning

Voltage Level	Normal Operations		Contingency Operations	
	Voltage	Thermal	Voltage	Thermal
100 kV+ (Criteria for Internal Analysis Planning)	0.95 pu - 1.05 pu (114 V - 126 V)	100% of Normal Rating (Rate A)	0.90 pu - 1.05 pu (108 V - 126 V)	100% of Normal Rating (Rate B)

For each 34.5 kV feeder, the voltage will be locked at the transmission substation on the low-side bus. The voltage profile shows the voltage limitations for the 34.5 kV circuits below. A voltage level of 0.93 pu will be assumed at the high-side of the transmission substation. This will be confirmed in transmission analysis portion of the report.

Figure 2: Voltage Criteria Profile



Thermal Criteria

Table 4: Mid-Kansas 34.5 kV Thermal Criteria for Local Planning

Element	Normal Operation Thermal Limits
34.5 kV Lines	100% of Maximum Rating
34.5 kV Voltage Regulators	100% of Maximum Rating (at 10% Voltage Boost)
Transmission to 34.5 kV Transformers	100% of Maximum Rating

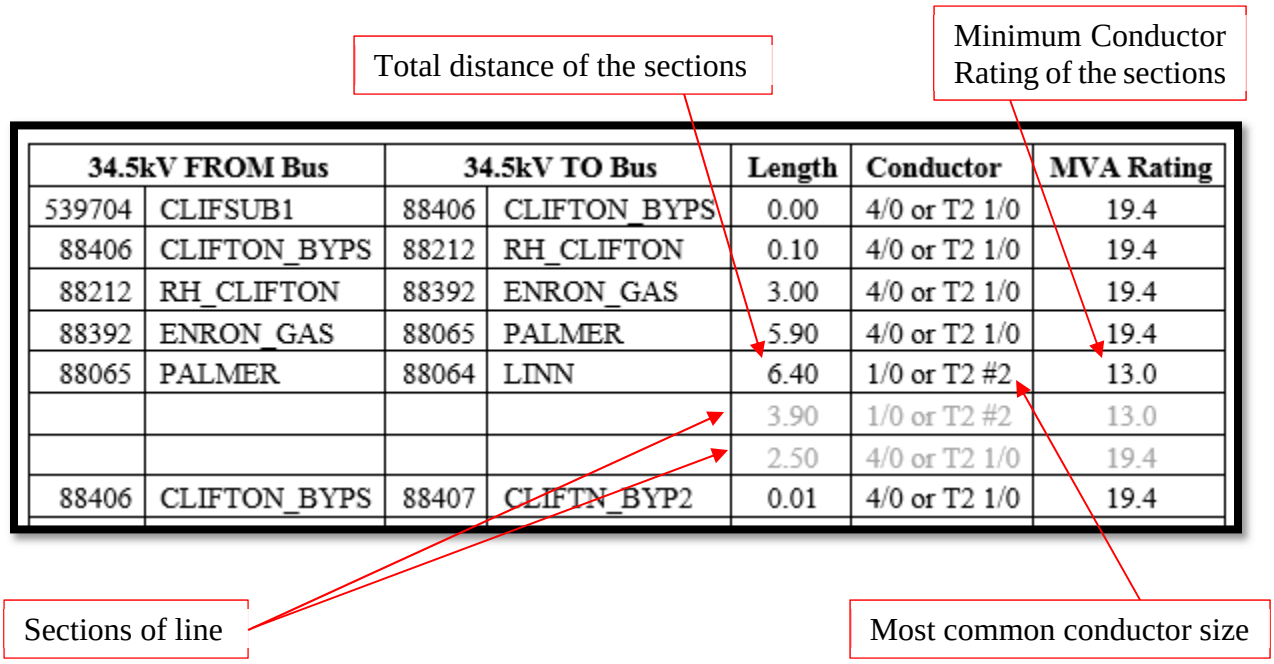
Table 5: Maximum Conductor Ratings for the 34.5 kV System

Conductor Name		*Maximum MVA Rating for a 34.5 kV Base Voltage
#4	Swan	7.5
#2	Sparrow	9.9
1/0 or T2 #2	Raven	13.0
2/0	Quail	14.9
4/0 or T2 1/0	Penguin	19.4
T2 2/0 or 266.8	Partridge	24.1
T2 4/0 or 397.5	Ibis	29.2
477	Hawk	34.5

*Maximum Conductor Ratings were recalculated to reflect the average environmental factors in Kansas. The changes include a 43°C ambient temperature and a 4 ft/sec average wind speed. The ratings are for a conductor temperature of 75°C.

Note: Any conductor listed that has multiple conductor sections will be listed with each of the line sections grayed and the total length, most common conductor size, and the minimum conductor rating will be listed. The format will be as in the table that follows.

Figure 3: EXAMPLE – Multiple Conductor Sections



34.5kV FROM Bus		34.5kV TO Bus		Length	Conductor	MVA Rating
539704	CLIFSUB1	88406	CLIFTON_BYPS	0.00	4/0 or T2 1/0	19.4
88406	CLIFTON_BYPS	88212	RH_CLIFTON	0.10	4/0 or T2 1/0	19.4
88212	RH_CLIFTON	88392	ENRON_GAS	3.00	4/0 or T2 1/0	19.4
88392	ENRON_GAS	88065	PALMER	5.90	4/0 or T2 1/0	19.4
88065	PALMER	88064	LINN	6.40	1/0 or T2 #2	13.0
				3.90	1/0 or T2 #2	13.0
				2.50	4/0 or T2 1/0	19.4
88406	CLIFTON_BYPS	88407	CLIFTN_BYP2	0.01	4/0 or T2 1/0	19.4

General Cost Estimate Assumptions

The costs provided in this section were gathered to estimate the projects suggested in this assessment. The actual cost to implement will vary by location and the specific details of the installation.

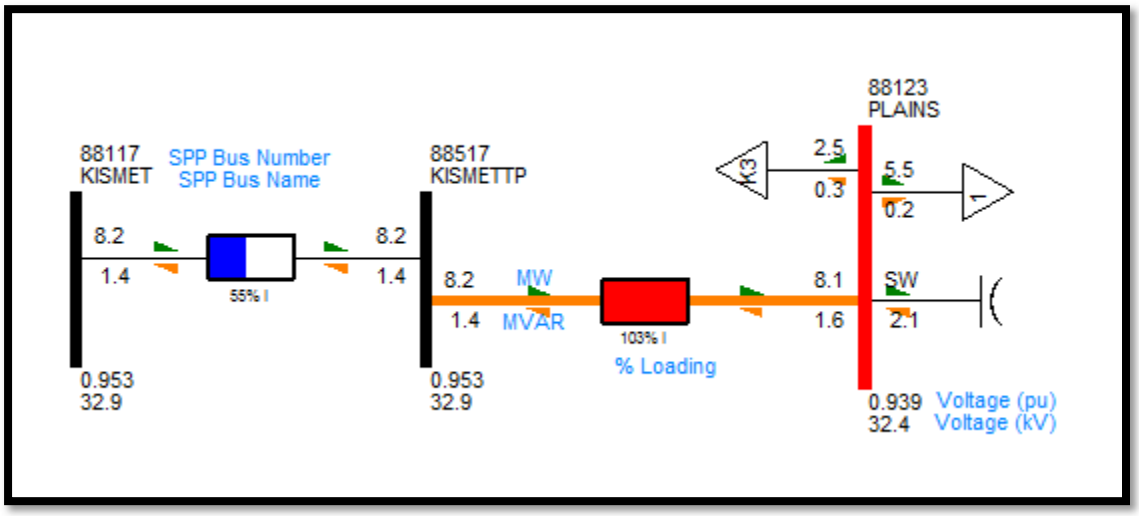
Sub-Transmission Items	Cost*
Transmission Line	$500,000 per mile
115/34.5 kV Substation – Any Size	$2,500,000
115/34.5 kV Transformer – Any Size	$800,000
34.5 kV Regulator Station – Any Size	$200,000
34.5 kV Line Rebuild – T2 4/0 ACSR	$165,000 per mile
34.5 kV Line Rebuild – 4/0 ACSR	$135,000 per mile
Capacitor Bank with Switching Controls	$30,000
34.5 kV Circuit Reconfiguration	$3,000

*In some instances, the estimated cost may vary from this list as information specific to the project is gathered and better estimates become available. These values are general cost estimate guidelines and do not represent the actual cost that will be incurred for each project.

PSS/E Diagram Key

The analysis of the sub-transmission system was completed in PSS/E and the results of each scenario were provided with screenshots similar to the figure below. The text in blue is the description of the labels on the diagram. Each wholesale delivery point and each distribution substation are modeled as spot loads and are represented as the triangles seen below.

Figure 4: PSS/E Diagram Key



Buses with high voltage (above 1.05 pu) will appear blue. Buses with low voltage (below 0.95 pu) will appear red. Overloaded branches will be highlighted in orange.

Identifiers

- Load IDs containing a "K" – Load projections provided by KEPCo
- Load IDs containing an "M" – Wholesale load: Kansas Power Pool (KPP), Kansas Municipal Energy Agency (KMEA), or a Retail Municipal
- Load IDs containing only a number – Mid-Kansas Member retail load

Abbreviations

- AV – Ark Valley Electric Cooperative
- BEC – Bluestem Electric Cooperative, Inc.
- CMS – CMS Electric Cooperative, Inc.
- DSO – DS&O Electric Cooperative, Inc.
- NI – Ninnescah Rural Electric Cooperative, Inc.
- RH – Rolling Hills Electric Cooperative, Inc.
- SC – Sumner-Cowley Electric Cooperative, Inc.

Criteria for Determining Projects

- Voltage and Thermal Constraints – Option Priorities
  - Switching and configuration changes
  - Capacitor Bank
  - Regulator Station (only for voltage support)
  - Line Rebuild
  - Transmission (new source)

- Capacitor Banks - General guidelines for the 34.5 kV system
  - Maximum of 3.0 MVAR per location – to reduce the impact of voltage flicker and inrush current
  - No more than three capacitor locations per feeder – to reduce voltage control issues
  - Avoid leading power factors on the feeder – to prevent MVAR being pushed back on the radial system and to reduce the risk of voltage collapse during transient events

- Regulator Stations - General guidelines for the 34.5 kV system
  - No cascading regulators – no more than one regulator station should be added between the regulation in the transmission substation and the distribution substation or wholesale delivery point

- Line Rebuilds - General guidelines for the 34.5 kV system
  - All rebuild projects are assumed to be 477 ACSR

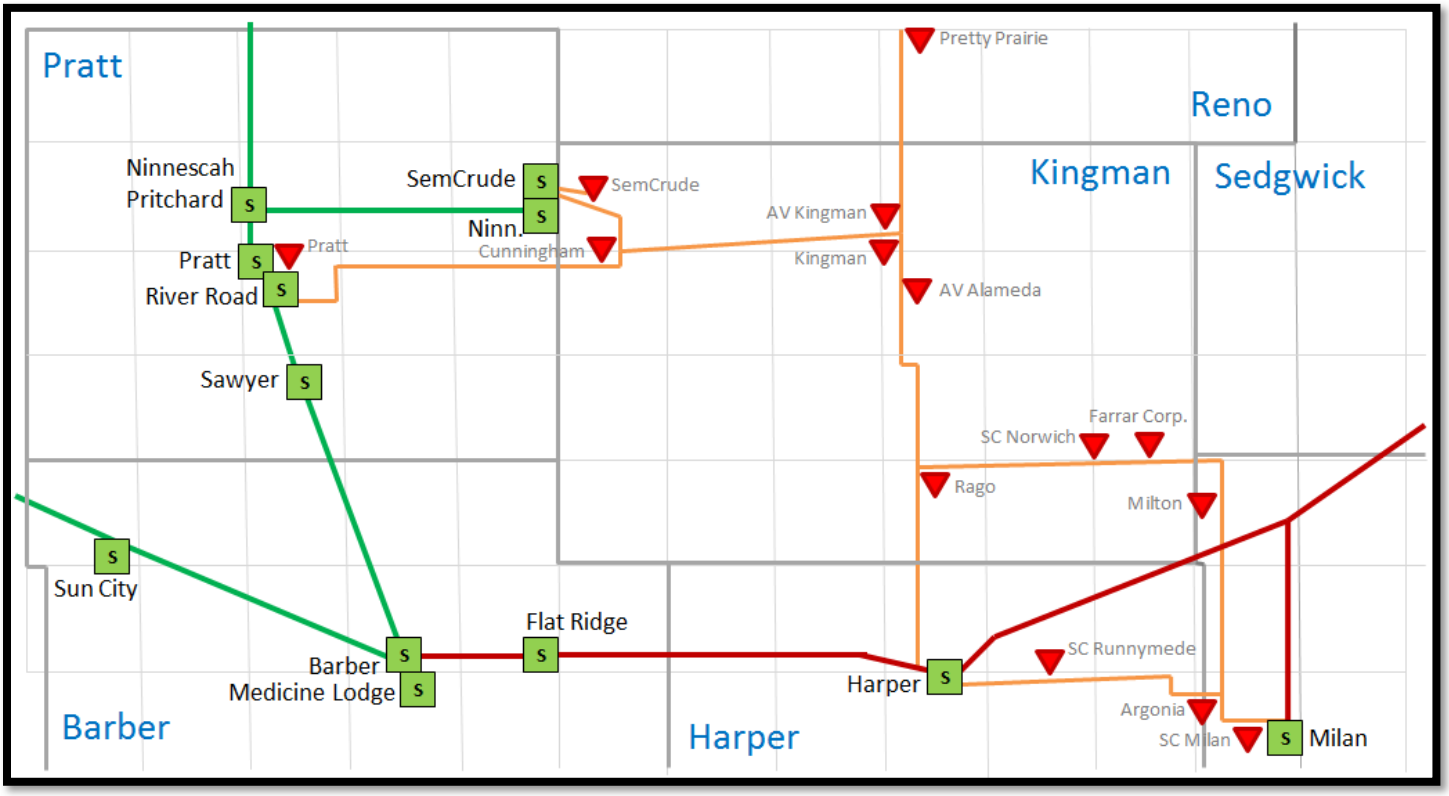
- Transmission Substations
  - All low-side 34.5 kV substation voltages will be locked at 35.29 kV (1.023 pu)
  - The transmission system will be verified to maintain 0.93 pu and a 10% boost in voltage will be assumed at each transmission to 34.5 kV substation
  - Harper is the exception. A project was implemented to control the voltage to 35.64 kV (1.033 pu)

System Modeling Data and Load Projections

The primary analysis to determine the impact on the transmission and sub-transmission power system was determined with the use of PSS/E Software.

Projected system loads were estimated based on the Non-Coincidental Peak (NCP) data recorded over the last few years at the 115/34.5 kV and 138/34.5 kV delivery points. The primary source of information for this study is the Mid-Kansas 34.5 kV Assessment. The load was grown at a constant percentage based on recent characteristics of the loads. The load was projected to a 20 year estimate for this analysis and a system model was created using PSS/E software.

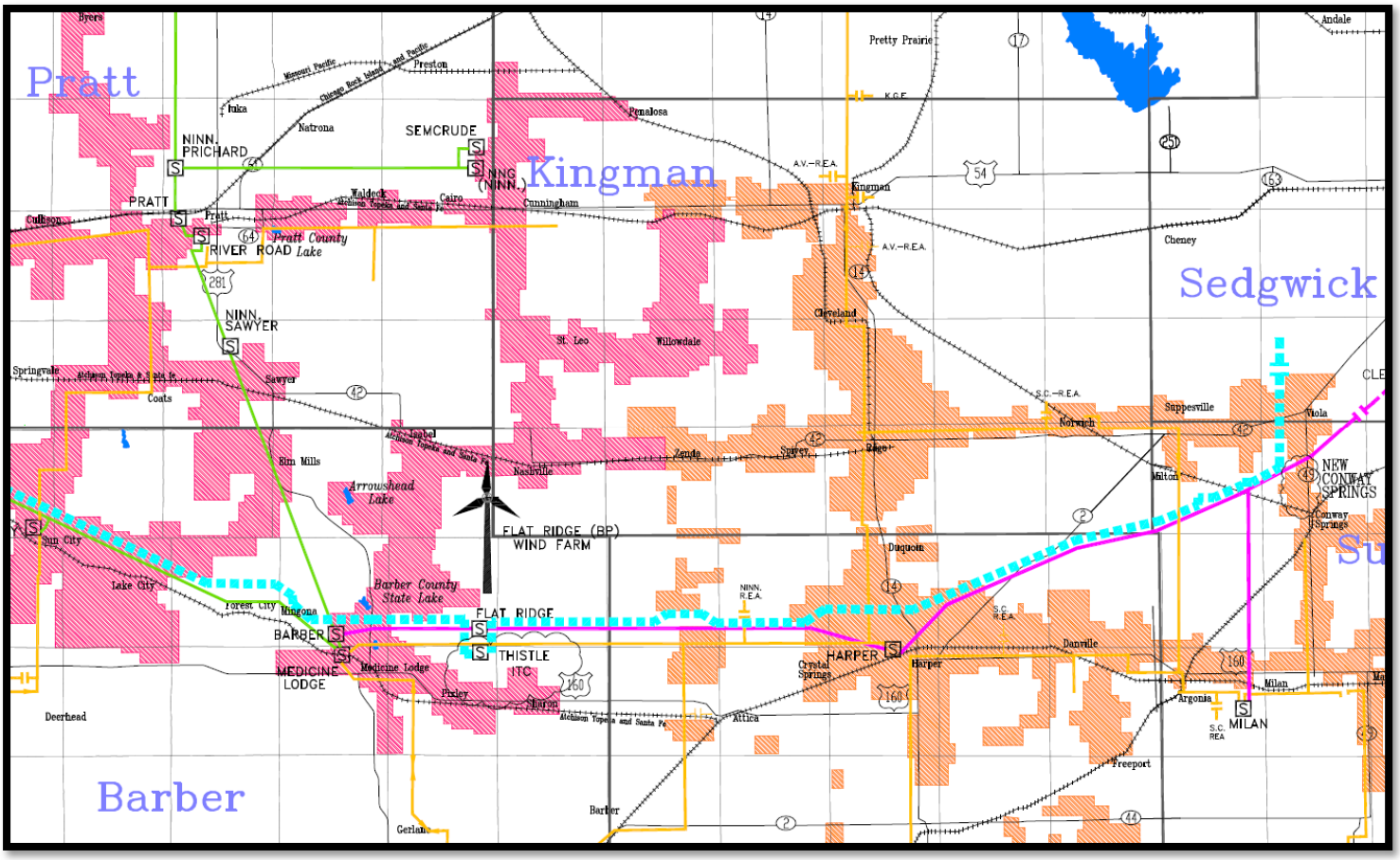
Figure 5: Area One-line Map



Kingman County Service Area

The 34.5 kV system in Kingman and Harper Counties is served from two Mid-Kansas Members, Southern and Wheatland. The members serve retail load as well as wholesale load to KEPCo and KPP.

Figure 6: Mid-Kansas Area Service Territory



Area Load Projections

The system detailed in this report includes feeders on 3 substations (115/34.5 kV and 138/34.5 kV) and 13 loads served. Of the load served, there are 6 retail loads and 7 wholesale delivery points. In total, nearly 46 MW of system load was projected onto the 34.5 kV system for the Pratt East, Harper North, and Milan West feeders. This projection represents an annual increase of approximately 1.3% for retails loads and near 1.0% for KEPCo Member loads. The KPP Kingman load was increased to 14 MW for this study and remained constant

Table 6: Load Projections

Source	Load Name	Annual Growth (%)	Average Power Factor	*20 year Load Projection*		Bus Number	ID
				MW	MVAR		
SemCrude 115	SemCrude	1.30%	0.98	6.37	1.29	88912	1
SemCrude 115	City of Kingman	0.00%	0.98	14.00	2.84	88260	P1
Pratt 115	Pratt	1.30%	0.95	1.53	0.50	539726	1
Pratt 115	Cunningham	1.30%	0.95	5.50	1.81	88044	1
Harper 138	Rago	1.30%	0.95	3.08	1.01	88011	1
Harper 138	AV Alameda	0.80%	0.913	1.24	0.55	88259	K1
Harper 138	SC Norwich	0.20%	0.99	0.62	0.09	88257	K5
Harper 138	AV Kingman	0.90%	0.99	2.71	0.39	88261	K2
Harper 138	AV Pretty Prairie	0.90%	0.943	2.16	0.76	88148	K3
Harper 138	SC Runnymede	0.16%	0.963	0.64	0.18	88263	K6
Milan 138 (West)	SC Milan	0.10%	0.904	3.07	1.45	88266	K2
Milan 138 (West)	Argonia	1.30%	0.95	0.91	0.30	88265	1
Milan 138 (West)	Milton	1.30%	0.95	0.65	0.21	88264	1
Milan 138 (West)	Farrar Corp	1.30%	0.95	3.86	1.27	88010	1

Conductor Assumptions

These are the existing conductor sizes. The line information in this document was gathered from several pieces of data including recent data from latest members' construction work plans and feedback provided from the previous 34.5 kV assessment. From this data, a system model was created using PSS/E

Table 7: Existing 34.5 kV Conductor Sizes

Source	Voltage	From Bus		To Bus		Miles	Conductor
SemCrude	34.5	88912	SEMCRUDE	88913	CUNNGHM_TAP	3.5	T2 4/0 or 397.5
SemCrude	34.5	88913	CUNNGHM_TAP	88260	KINGMAN	16.5	4/0 or T2 1/0
SemCrude	34.5	88260	KINGMAN	88272	KINGMAN_TAP	0.2	4/0 or T2 1/0
SemCrude	34.5	88912	SEMCRUDE	88914	SEMCRUDE_DST	1.5	T2 4/0 or 397.5
Pratt	34.5	539726	PRATT 1	88252	PRT_REC_SB	0.5	2/0
Pratt	34.5	88252	PRT_REC_SB	88578	PRATT_CAP	4.0	2/0
Pratt	34.5	88578	PRATT_CAP	88004	CUNNGHM_REG	15.0	4/0 or T2 1/0
						6.0	4/0 or T2 1/0
						7.0	T2 4/0 or 397.5
						2.0	2/0
Pratt	34.5	88044	CUNNINGHAM	88913	CUNNGHM_TAP	0.0	477
Harper	34.5	539713	HARPER 1	88011	RAGO_SUB	13.6	2/0
Harper	34.5	88011	RAGO_SUB	88785	HARPER_REG_U	0.2	2/0
Harper	34.5	88786	HARPER_REG_D	88257	SC_NORWICH	9.0	4/0 or T2 1/0
Harper	34.5	88257	SC_NORWICH	88410	NORWICH	4.0	4/0 or T2 1/0
Harper	34.5	88410	NORWICH	88010	FARRAR_CORP	0.4	4/0 or T2 1/0
Harper	34.5	88786	HARPER_REG_D	88258	AV_REC_TAP	10.0	2/0
Harper	34.5	88258	AV_REC_TAP	88259	AV_ALAMEDA	1.0	#2
Harper	34.5	88258	AV_REC_TAP	88009	KINGMAN_JCT	3.0	2/0
Harper	34.5	88009	KINGMAN_JCT	88272	KINGMAN_TAP	0.9	2/0
Harper	34.5	88272	KINGMAN_TAP	88261	AV_KINGMAN	2.2	2/0
Harper	34.5	88261	AV_KINGMAN	88262	KG&E_TAP	3.0	2/0
						1.0	4/0 or T2 1/0
						2.0	2/0
Harper	34.5	88262	KG&E_TAP	88148	AV_PRETTY_PR	8.0	2/0
Milan	34.5	539718	MILAN 1	88266	SC_MILAN	0.5	1/0 or T2 #2
Milan	34.5	88266	SC_MILAN	88265	ARGONIA	5.0	1/0 or T2 #2
						0.5	2/0
						4.5	1/0 or T2 #2
Milan	34.5	88265	ARGONIA	88013	MILTON_TAP	0.1	1/0 or T2 #2
Milan	34.5	88013	MILTON_TAP	88264	MILTON_SUB	11.0	1/0 or T2 #2
						7.7	1/0 or T2 #2
						3.3	2/0
Milan	34.5	88264	MILTON_SUB	88010	FARRAR_CORP	6.7	2/0

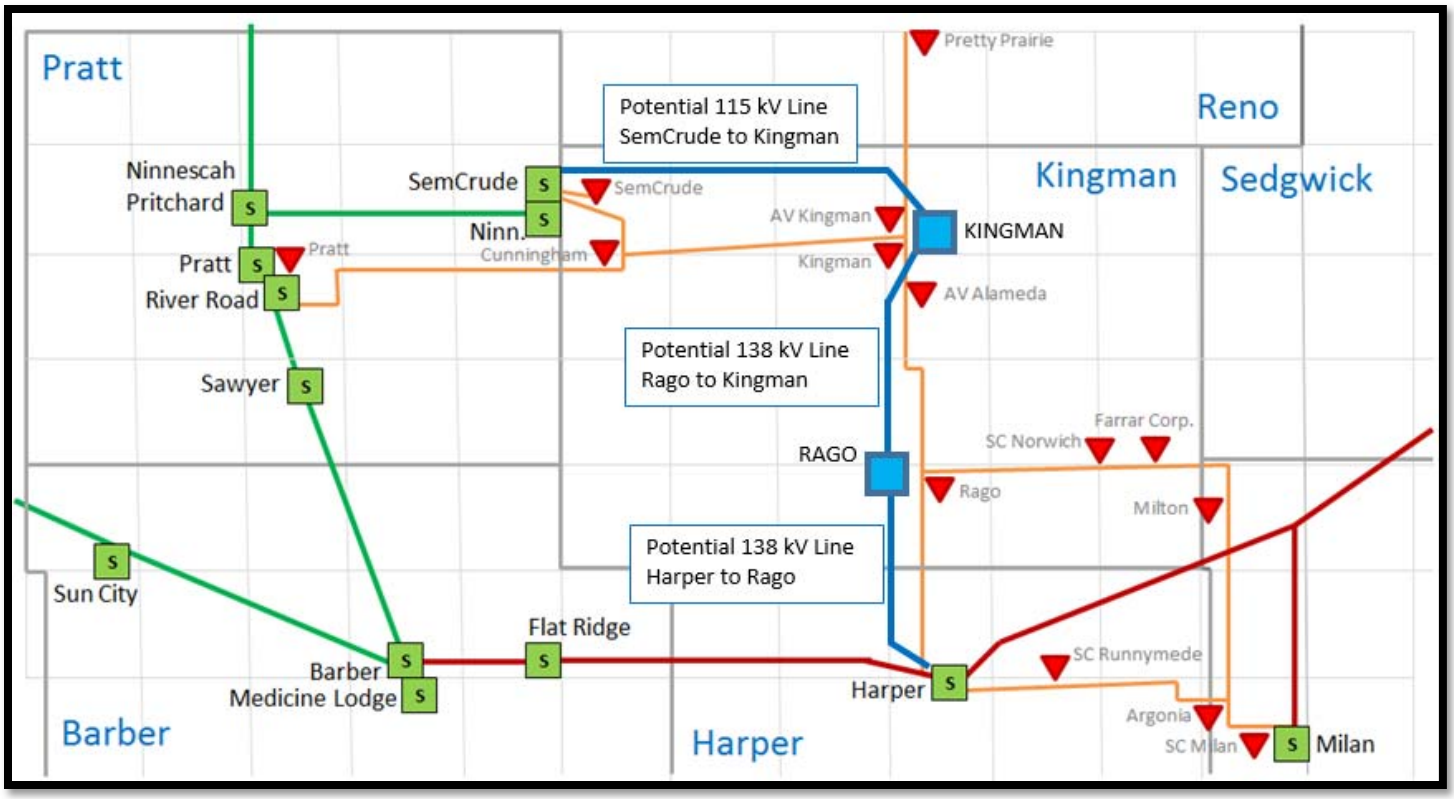
2014 – Mid-Kansas 34.5 kV Assessment

Power System Transmission & Distribution Impact

System Analysis

The analysis in this section…

Figure 7: Rough Location Estimate for New Transmission Projects



Option 1 – Base Case

Case Description – The Base Case Configuration refers to the system as it currently exists. The Pratt and Harper Substation currently serve the projected load in Kingman County. For the 20 year load projections, the Harper North Circuit will no longer be able to serve the area loads. Rebuilding 28 miles of 34.5 kV and adding a capacitor bank near Kingman will allow approximately 12.5 MW of load to be served at the Kingman Delivery point.

- Sources – Harper, Pratt
- New Transmission – None

Table 8: 20-Year Outlook – Total Projects Required for Normal Operations

Required Projects for (N-0)				
Voltage	**Miles**	**Project**	**Cost**	**Losses**
34.5	27.7	Rebuild Harper to Kingman	$4,570,500	3,780
34.5		Add a 3.0 MVAR Capacitor near Kingman	$30,000	
34.5		Reconfigure Rago downline of regulation	$3,000	
34.5		Limit Kingman load to 12.5 MW	??	
-	**27.7**	**4**	**$4,603,500**	**3,780**

Option 2 – Current NTC

Case Description – The Current NTC Configuration refers to the system as it will be for the additional line 138 kV line to Rago and a new 138/34.5 kV source. The new source will relieve Harper from the north circuit, but will still require 34.5 kV projects to serve the load.

- Sources – Harper, Pratt, Rago
- New Transmission – Harper to Rago

Table 9: 20-Year Outlook – Total Projects Required for Normal Operations

Required Projects for (N-0)				
Voltage	**Miles**	**Project**	**Cost**	**Losses**
138	15.0	Harper to Rago line	$7,500,000	1,916
138/34.5		Rago Substation	$2,500,000	
34.5	13.9	Rebuild Rago to Kingman	$2,293,500	
34.5		Add a 3.0 MVAR Capacitor near Kingman	$30,000	
-	**28.9**	**4**	**$12,323,500**	**1,916**

Option 3 – Modified NTC

Case Description – The Base Case Configuration refers to the system as it currently exists. The Pratt and Harper Substation currently serve the projected load in Kingman County.

- Sources – Harper, Pratt, Kingman
- New Transmission – Harper to Rago, Rago to Kingman

Table 10: 20-Year Outlook – Total Projects Required for Normal Operations

Required Projects for (N-0)				
Voltage	**Miles**	**Project**	**Cost**	**Losses**
138	30.0	Harper to Kingman line	$15,000,000	1,174
138/34.5		Kingman Substation	$2,500,000	
-	**30.0**	**2**	**$17,500,000**	**1,174**

Option 4 – 138 kV Extension

Case Description – The Base Case Configuration refers to the system as it currently exists. The Pratt and Harper Substation currently serve the projected load in Kingman County.

- Sources – Harper, Pratt, Rago, Kingman
- New Transmission – Harper to Rago, Rago to Kingman

Table 11: 20-Year Outlook – Total Projects Required for Normal Operations

Required Projects for (N-0)				
Voltage	**Miles**	**Project**	**Cost**	**Losses**
138	30.0	Harper to Kingman line	$15,000,000	967
138/34.5		Kingman Substation	$2,500,000	
138/34.5		Rago Substation	$2,500,000	
-	**30.0**	**3**	**$20,000,000**	**967**

Option 5 – Base Case

Case Description – The Base Case Configuration refers to the system as it currently exists. The Pratt and Harper Substation currently serve the projected load in Kingman County.

- Sources – Harper, Pratt, Rago, SemCrude
- New Transmission – Harper to Rago

Table 12: 20-Year Outlook – Total Projects Required for Normal Operations

Required Projects for (N-0)				
Voltage	**Miles**	**Project**	**Cost**	**Losses**
138	15.0	Harper to Rago line	$7,500,000	2,904
138/34.5		Rago Substation	$2,500,000	
115/34.5		SemCrude Substation	$800,000	
34.5		Kingman Regulator	$200,000	
-	**15.0**	**4**	**$11,000,000**	**2,904**

Option 6 – Base Case

Case Description – The Base Case Configuration refers to the system as it currently exists. The Pratt and Harper Substation currently serve the projected load in Kingman County.

- Sources – Harper, Pratt, SemCrude
- New Transmission – None

Table 13: 20-Year Outlook – Total Projects Required for Normal Operations

Required Projects for (N-0)				
Voltage	**Miles**	**Project**	**Cost**	**Losses**
115/34.5		SemCrude Substation	$800,000	3,901
34.5		Kingman Regulator	$200,000	
34.5		Reconfigure Rago downline of regulation	$3,000	
-	**0.0**	**3**	**$1,003,000**	**3,901**

Option 7 – Base Case

Case Description – The Base Case Configuration refers to the system as it currently exists. The Pratt and Harper Substation currently serve the projected load in Kingman County.

- Sources – Harper, Pratt, Kingman
- New Transmission – SemCrude to Kingman

Table 14: 20-Year Outlook – Total Projects Required for Normal Operations

Required Projects for (N-0)				
Voltage	**Miles**	**Project**	**Cost**	**Losses**
115	22.0	SemCrude to Kingman line	$11,000,000	932
115/34.5		Kingman Substation	$2,500,000	
-	**22.0**	**2**	**$13,500,000**	**932**

Option 8 – Base Case

Case Description – The Base Case Configuration refers to the system as it currently exists. The Pratt and Harper Substation currently serve the projected load in Kingman County.

- Sources – Harper, Pratt, Rago, Kingman
- New Transmission – Harper to Rago, Rago to Kingman, SemCrude to Kingman

Table 15: 20-Year Outlook – Total Projects Required for Normal Operations

Required Projects for (N-0)				
Voltage	**Miles**	**Project**	**Cost**	**Losses**
138	30.0	Harper to Kingman line	$15,000,000	941
138/34.5		Kingman Substation	$2,500,000	
138/34.5		Rago Substation	$2,500,000	
115	22.0	SemCrude to Kingman line	$11,000,000	
138/115		Transformer to tie 138 and 115 kV systems	$5,000,000	
-	**52.0**	**5**	**$36,000,000**	**941**

Option 9 – Base Case

Case Description – The Base Case Configuration refers to the system as it currently exists. The Pratt and Harper Substation currently serve the projected load in Kingman County.

- Sources – Harper, Pratt, Kingman
- New Transmission – SemCrude to Kingman

Table 16: 20-Year Outlook – Total Projects Required for Normal Operations

Required Projects for (N-0)				
Voltage	**Miles**	**Project**	**Cost**	**Losses**
115	22.0	SemCrude to Kingman line	$11,000,000	932
115/34.5		Kingman Substation	$2,500,000	
115/34.5		SemCrude Substation	$800,000	
34.5		Kingman Regulator	$200,000	
-	**22.0**	**4**	**$14,500,000**	**932**

Exhibit AT-3

Loss Study

	Scenario	Base	Kingman Direct Connect	SemCrude Substation Upgrade
	Source	Pratt 34.5 kV	New 115 kV Tap	SemCrude 34.5 kV
	Projects	No Projects Kingman at 6 MW	New 115 kV Tap 6 MVAR Capacitor SemCrude 5% Boost	6 MVAR Capacitor SemCrude 5% Boost
Area Losses (kW)	**2018**	1,341	1,497	1,529
	2019	1,342	1,542	1,575
	2020	1,342	1,613	1,649
	2021	1,343	1,664	1,701
	2022	1,344	1,741	1,781
	2023	1,346	1,824	1,866
	2024	1,347	1,912	2,022
	2025	1,347	1,974	2,024
	2026	1,349	2,069	2,118
	2027	1,351	2,171	2,223
	2028+	1,351	2,171	2,223
10-year Avg		1,345	1,801	1,849
Average Peak loss %		6.9%	6.6%	6.8%