Presidio Area Reliability Improvements

Prepared by AEPSC

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Executive Summary

Based on the following analysis, American Electric Power Service Corporation (AEPSC) proposes and is seeking Electric Reliability Council of Texas (ERCOT) Regional Planning Group (RPG) acceptance for the following projects:

1. Install a second 138/69kV autotransformer at the Marfa Alamito Creek Substation.
2. Install 2-2.4MW NaS battery units at the Presidio Substation.
3. Construct a new 69kV line (built for 138 KV) from Alamito Creek to Presidio with an intermediate termination point into the new Chinati substation.

Timely completion of these projects will reduce the number of outages experienced by customers in the Presidio area, which provides electric service adequacy and reliability that complies with PURA § 38.005 (d) and PUCT Subst. Rule § 25.195 (b). Additionally, these projects are necessary to maintain compliance with NERC Category A and B criteria, and they provide for backup service in the event of an outage of the radial Alamito Creek – Presidio 69kV line. These projects will also allow American Electric Power Texas North Company (AEP-TNC) to perform planned maintenance on the Alamito Creek - Presidio 69kV line without Block Load Transfers (BLTs) with Comision Federal de Electricidad (CFE), minimizing service interruption.

Background

The town of Presidio is located in far west Texas along the Rio Grande River. There is an international bridge at Presidio that connects the United States and Mexico. As shown in Figure 1, the only transmission source in the area is a radial 69kV line extending approximately 60 miles from the Alamito Creek Substation, located in Marfa, to Presidio.

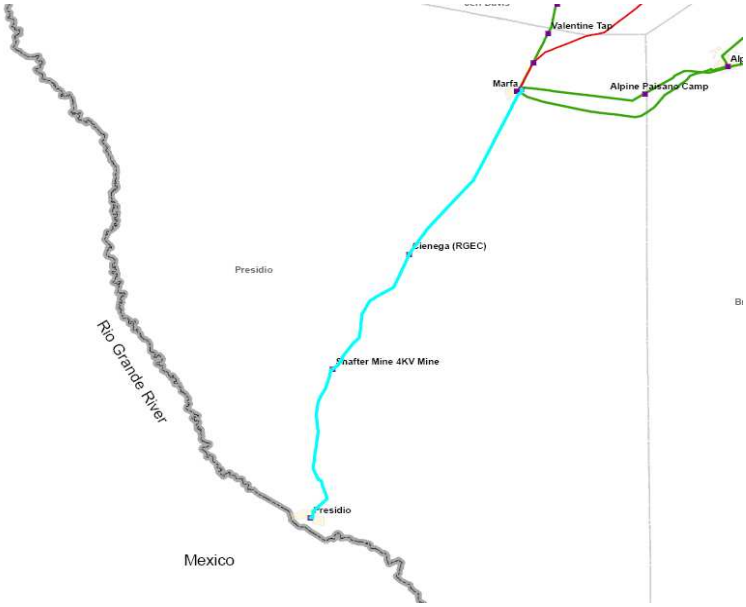

Figure 1. Presidio Area Transmission System

At an elevation of 4,688 feet, the town of Marfa lies in the high grasslands on the south side of the Davis Mountains. Ft. Davis is the only town in Texas that surpasses Marfa in elevation. The Alamito Creek – Presidio 69kV line runs parallel to State Highway 67 for most of its distance. It must cross the Chinati Mountains before descending over 2,000 feet into the Rio Grande Valley at Presidio (elevation 2,581 feet).

There are five load serving substations along this line including Bryant Ranch, Cienega, Atkinson Ranch, Shafter and Presidio and one substation called Chinati that was recently constructed to house a 3.6 MVAR capacitor bank for needed voltage support. The Cienega Substation is owned and operated by Rio Grande Electric Cooperative (RGEC). AEP-TNC owns the remaining five substations. The largest load served in the area is the town of Presidio. The Presidio Substation currently serves approximately 5MW of non-coincident summer peak demand and 5.5MW of winter peak demand. The remaining four load serving substations serve a total of 0.5MW – 1.0MW of peak load. Presidio typically peaks in the winter due to the large concentration of resistive heating. Assuming there are no fundamental econometric changes in the Presidio area, AEPSC projects that the non-coincident winter peak demand will exceed 6MW by 2012 under normal weather conditions. The AEPSC peak demand forecast for Presidio is shown in Table 1.

Year	Summer Peak (MW)	Winter Peak (MW)
2008	5.08	5.48
2009	5.19	5.74
2010	5.28	5.86
2011	5.39	5.96
2012	5.48	6.09
2013	5.60	6.19
2014	5.71	6.32
2015	5.83	6.44
2016	5.94	6.57
2017	6.08	6.70
2018	6.19	6.85

Table 1. Presidio Peak Demand Forecast

The Presidio area peak demand could be significantly greater than the current AEPSC forecast if there are any major fundamental changes to the area economy. One such change that appears to have significant momentum is the La Entrada al Pacifico Corridor.

The La Entrada al Pacifico Corridor is a project proposed to increase the efficiency of transportation of goods from Pacific Coast ports in Mexico to the Midland-Odessa area. The La Entrada al Pacifico Corridor is defined by House Bill 2115, 1997 Texas Legislature, and was signed into law by then Governor George W. Bush. This

project would utilize the border crossing at Presidio to divert traffic from the crossing at El Paso. Based on the feasibility study results, the truck traffic at Presidio may be increased from 96 to 2000 trucks per day once the critical infrastructure is in place. If this project is completed, the Presidio area peak demand could be increased dramatically.

Another change that could potentially impact the demand in the Presidio area is expansion of the Border Patrol. To the extent the Office of Homeland Security imposes additional security along the border, there may be further economic activity in the Presidio area that would also have a positive impact on area demand. Given the lead times required for new transmission system infrastructure, these developments must be followed closely and plans must be in place to ensure that AEP-TNC can reliably serve future demand in the Presidio area.

Design and Operational History

The design, physical condition (due to age) and location of the Alamito Creek – Presidio 69kV line makes it susceptible to frequent outages and long restoration times. It was originally built in 1948 as a 33 kV line and has all wood construction with #2 ACSR conductor. The phase conductors contain a steel core surrounded by seven aluminum strands. This conductor is used today for distribution service to a single home. As shown in Figure 2, the Alamito Creek – Presidio 69kV line is a single pole design with no shielding from lighting strikes and the majority of the poles feature a pole top insulator and phase conductor.

Figure 2. Alamito Creek – Presidio Line Design

The predominant cross-arm utilized is an eight foot round arm and the insulators are designed to operate at 33kV. In contrast to modern design standards that utilize clamps to secure the phase conductor to the insulator, tie wires were used to strap the conductor to the insulator on more than 85% of the poles. Figures 3 and 4 show the cross-arms, insulators and tie wires.

Figure 3. Cross-Arms

Figure 4. 33kV Insulators and Tie Wires

As shown in Figures 5 and 6, the current physical condition of the Alamito Creek – Presidio 69kV line is very poor and is in need of replacement. Based on the most recent inspection data, there is a minimum of 96 poles, cross-arms, braces or other related line components that need to be replaced. The poles, cross-arms and braces are showing signs of deterioration and are failing at an unacceptable rate. Continued refurbishment of the line will not relieve these problems, because the inherent limitations of its design cannot be corrected.

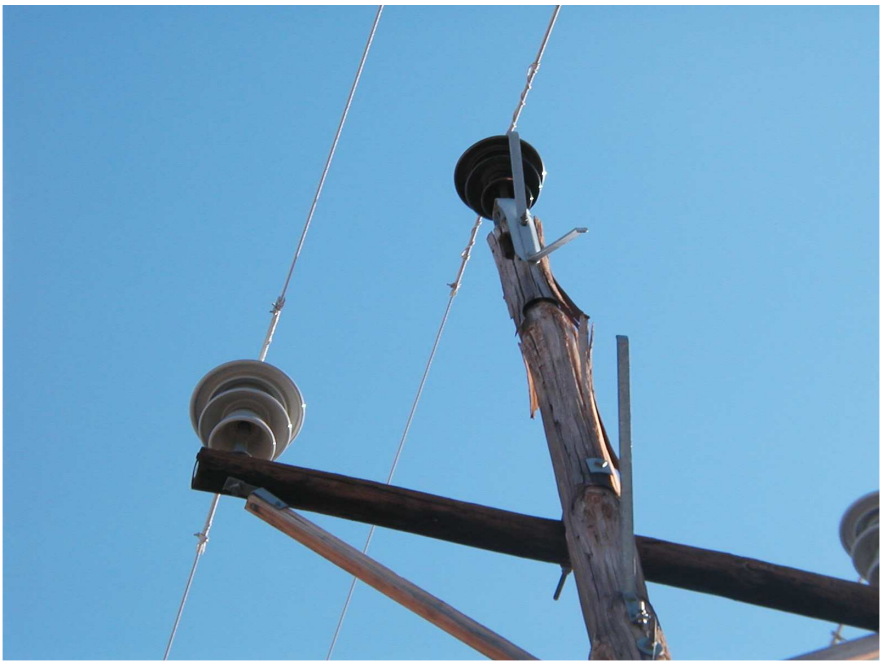

Figure 5. Pole Top Damage

Figure 6. Pole Damage

As previously mentioned, the Alamito Creek – Presidio 69kV line crosses the Chinati Mountains as it descends over 2,000 feet from Marfa into the Rio Grande Valley at Presidio. As one would expect, the area traversed by the Alamito Creek - Presidio 69kV line is extremely rough, which makes access for maintenance and repair and replacement costly. It also contributes to increase outage times when restoration action must be taken to restore service. This is shown in Figure 7.

Figure 7. Area Terrain

The rugged terrain contributes to extreme wind currents and wind shear due to temperature inversion and turbulence. This area has historically experienced very heavy thunderstorms often accompanied by high winds and lightning. This line has been especially susceptible to lightning outages due to the length of the line, pole top design, underrated insulators and lack of a shield wire. Figure 8 provides an indication of the number and location of lightning strikes over the four-year period from 2002-2006. As indicated, there have been an estimated 3,919 lightning strikes over this period within the general vicinity of this line. Despite attempts to use lightning arrestors on the line to mitigate the faults that result from lightning, interruptions have continued due to the poor grounding provided by the rocky soil.

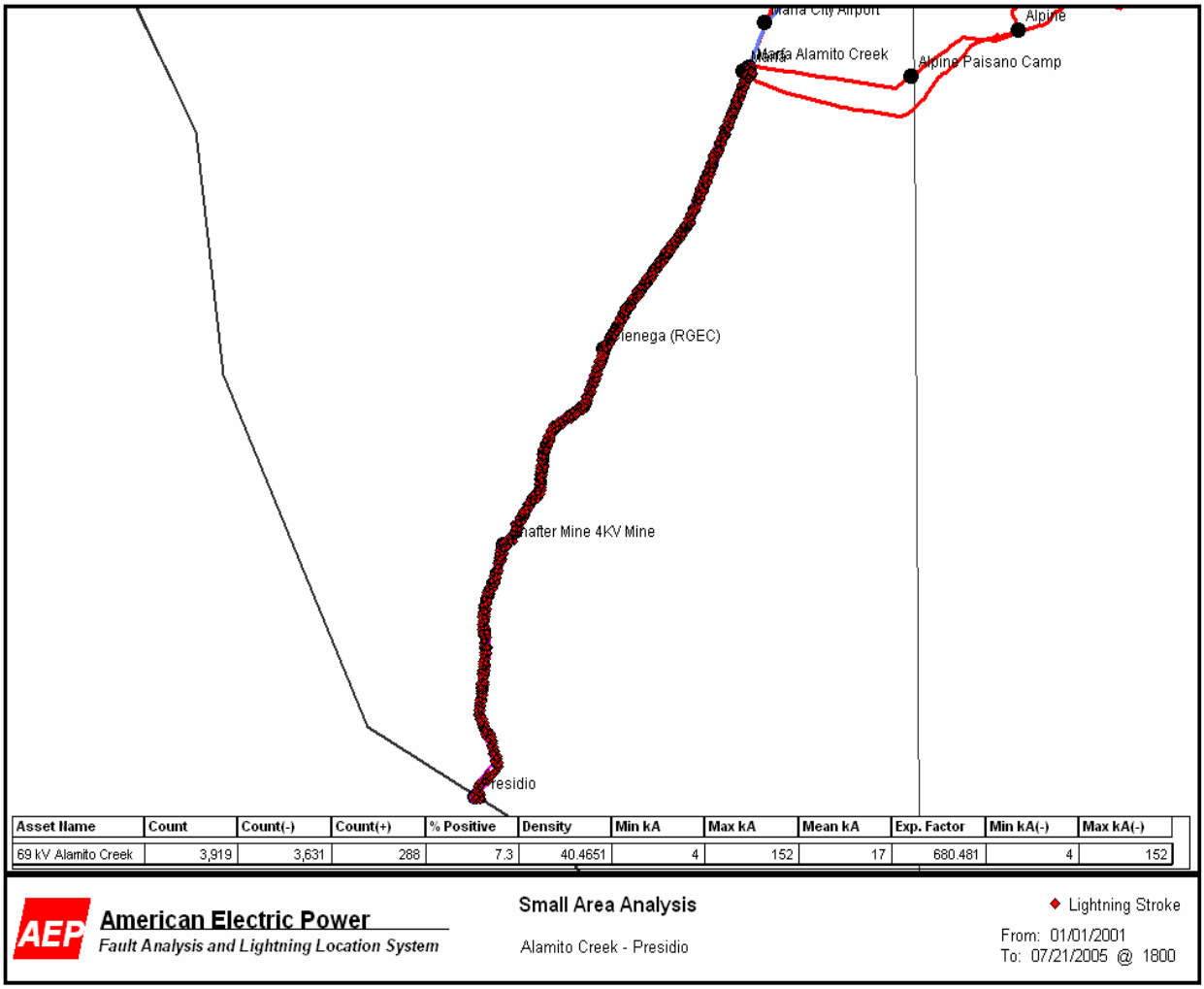

Figure 8. Lightning Activity Along Alamito Creek - Presidio 69kV line

The Alamito Creek - Presidio 69kV line has experienced 247 momentary outages primarily for weather events such as described above over the period 2001-2006. There have been nine permanent outages over this same time period with the longest outage duration being 11.2 hours and an average outage duration of 6.8 hours. The length of the line and rough terrain contribute to the long restoration times of the permanent outages. Common modes of failure along this line include, but are not limited to, the following:

- Pole, cross-arm and insulator damage due to violent lightning strikes;
- Failure of insulator tie wires allowing conductor to contact pole;
- Loosened hardware due to wind shear allowing conductor to contact pole;
- Dust collection on insulators resulting in tracking, leading to electrical arcing and fire;
- Failure of metal oxide varistor (MOV) arrestors;
- Washout created by heavy run-off; and
- Conductor fatigue due to line galloping.

These failures are indicative of a transmission line that is extremely old and in need of total redesign to better perform for the conditions experienced in its location and current application. Continued refurbishment of the line will not relieve these problems, because the inherent limitations of its design cannot be corrected. The only practical alternative is the complete replacement of the line.

Power quality has also been an issue for the Presidio area loads. Due to customer complaints, AEP-TNC placed a voltage recorder in a grocery store located in Presidio from July 8 to September 8, 2007. During that time, there were 81 recorded poor voltage service quality events with as many as eight events recorded in a single day. Of these 81 events, a store employee reported seeing 19 of them.

The poor reliability of this line has become a very important issue with the residents of Presidio and State and Local government officials as evidenced by the letters from Mayor Hernandez of Presidio and State Representative Gallego of District 74 included as Attachment 1. In addition, the management from RGEC has expressed concern about the reliability of the Alamito Creek - Presidio 69kV line and has requested that AEP-TNC take the steps necessary to improve the reliability of service. Representatives from AEP-TNC customer service, community affairs and transmission services have met with the Mayor, City Council and residents of Presidio to address the growing concerns over the poor reliability of service in the area. The major issues raised by the residents and City officials were the number of momentary outages and the length of permanent outages. There was a significant amount of discussion about damages ranging from air conditioning units to vaccine serum lost by the Health Department. AEP-TNC continues to remain in close contact with customers in the Presidio area to address their concerns and to look for solutions to improve the reliability of service in this area.

Power Flow Analysis of Existing System

In order to evaluate the integrity of the AEP-TNC transmission system in the Presidio area, AEPSC utilized the PowerWorld Simulator version 12.0. The following analysis was performed using the ERCOT 2008 summer and 2008/2009 winter peak power flow cases. The main issues and/or conditions analyzed in this analysis are as follows:

1. Pre-contingency voltage at Presidio,
2. Loss of 138kV source from Barrilla Junction,
3. Loss of Alamito Creek – Presidio 69kV line, and
4. Backup service to Presidio.

Due to the length of the Alamito Creek – Presidio 69kV line and the small conductor size, the pre-contingency voltage at Presidio is a concern. As shown in Figure 9, under summer peak conditions there is an 8.3% pre-contingency voltage drop between Alamito (bus 6678) and Presidio (bus 6684) at a Presidio load level of approximately 5MW (total radial load of approximately 5.5MW).

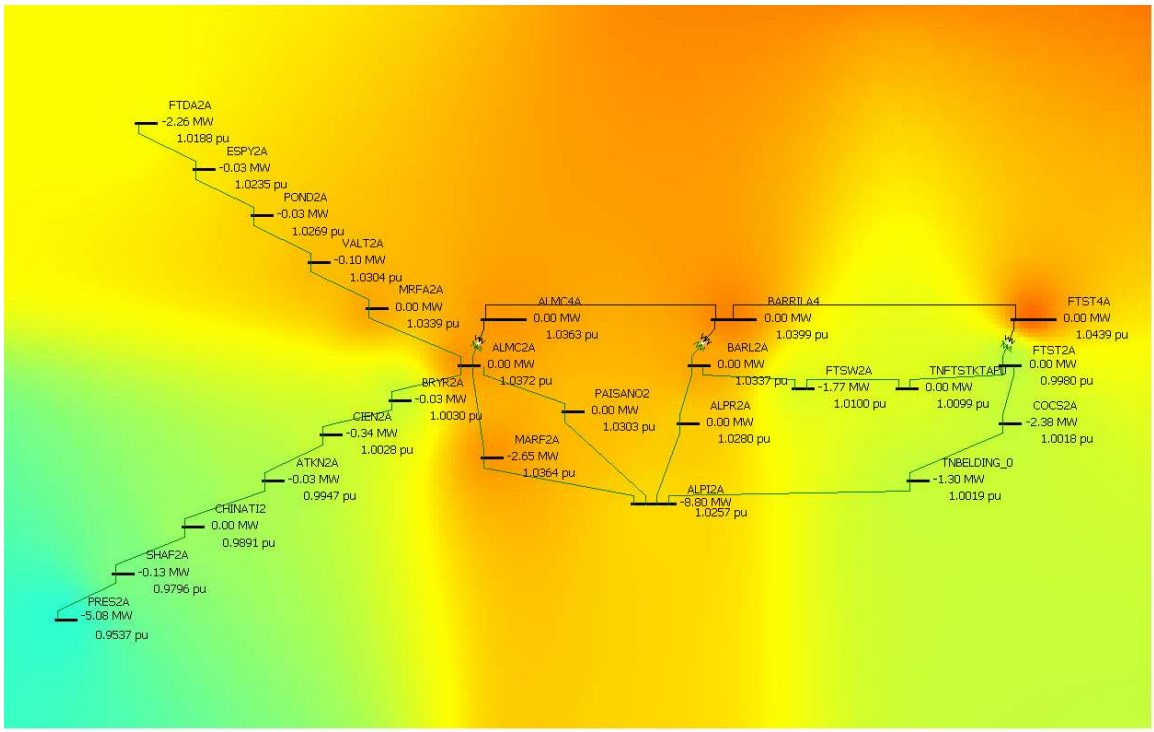

Figure 9. Existing System Pre-contingency Voltage Drop

The Presidio bus voltage under these conditions is 95.4%, assuming the source voltage at Marfa can be maintained at the indicated 103.7%. However, it is not practical to maintain a voltage at that level, since substation equipment can be damaged if voltages greater than 105% are sustained. Further, with substation metering accuracy of +/- 1%, a more conservative approach to voltage regulation at Marfa would be required. This would result in an even lower pre-contingency voltage at Presidio. AEPSC Transmission Planning Criteria requires that under normal conditions, all bus voltages should be maintained between 95% and 105%. Figure 10 shows that with a small 0.12MW increase in the Presidio summer peak load, the pre-contingency voltage will drop below 95% under normal conditions and thus violate North American Electric Reliability Council (NERC) and AEPSC Planning Criteria. AEPSC projects the Presidio load to reach this level in 2009 under normal weather conditions. If the weather is unusually hot, the Presidio load could easily exceed this level during the 2008 summer peak period. As discussed above, it is likely that a lower source voltage at Marfa would result in pre-contingency voltages below 95% at Presidio under projected 2008 peak demand levels.

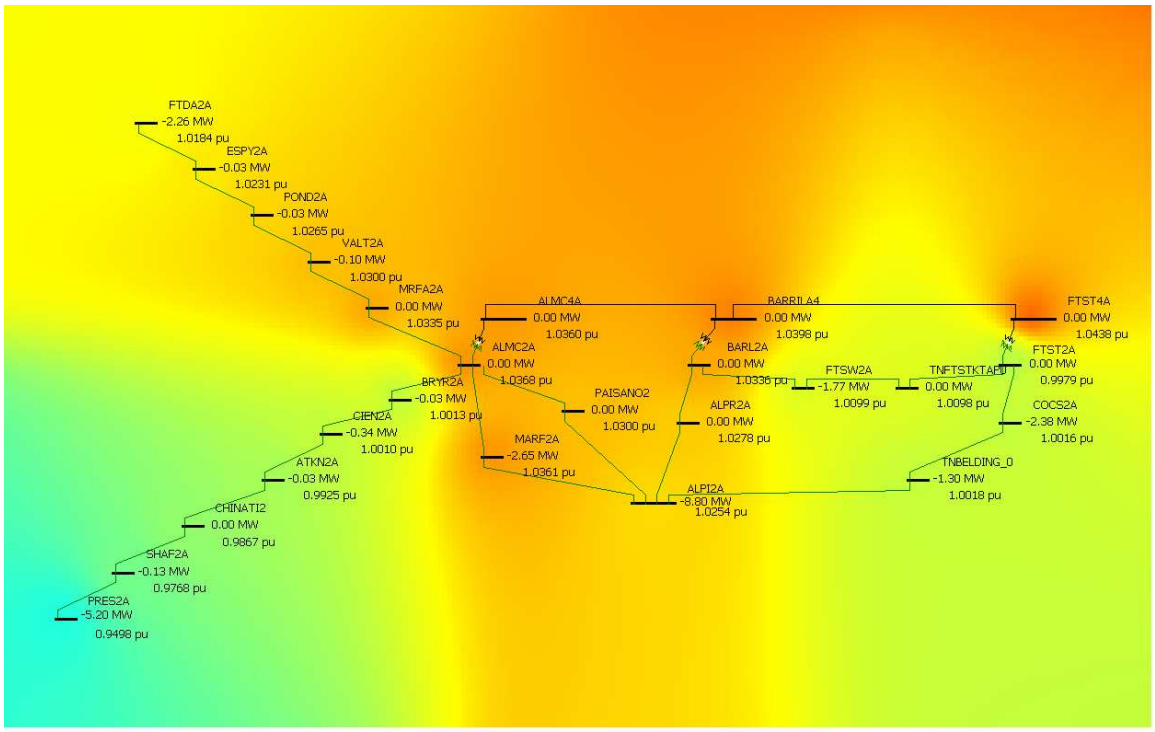

Figure 10. Presidio Pre-contingency Voltage at 5.2MW Peak Load Level

As previously discussed, Presidio typically peaks in the winter due to the high concentration of resistance heating load. Figure 11 shows the Presidio bus voltage under winter peak conditions with the forecasted 2008 winter peak demand of 5.5MW.

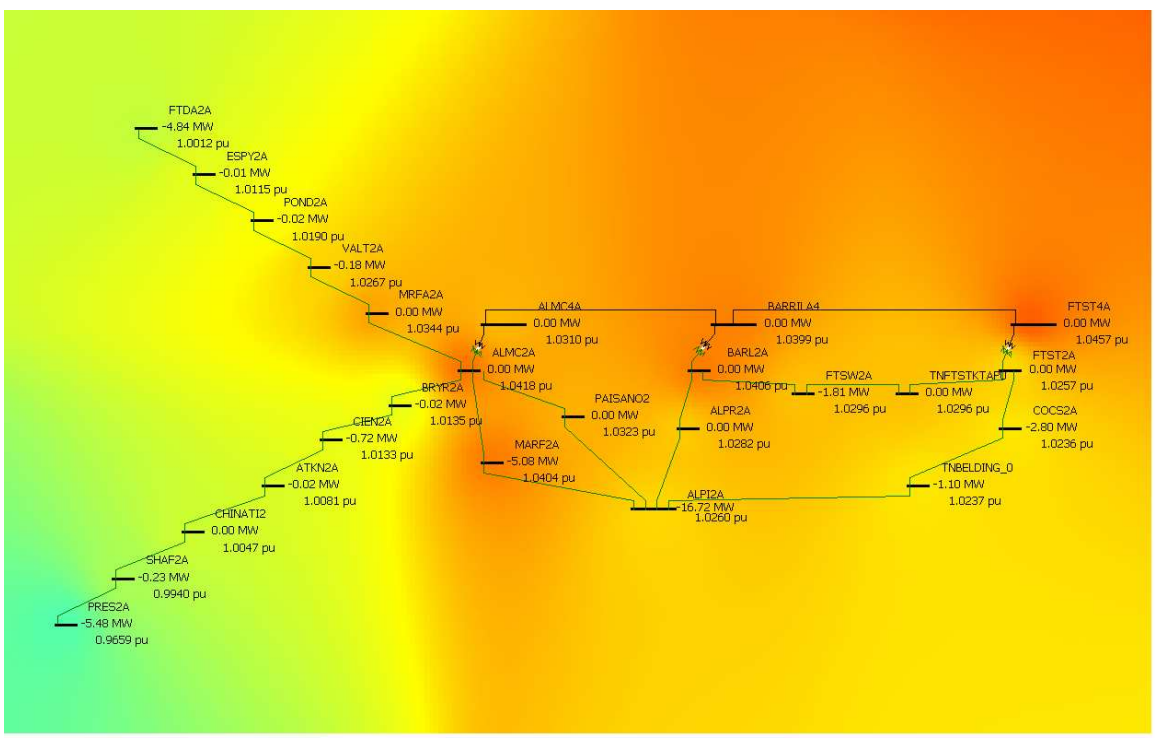

Figure 11. Presidio Pre-contingency Voltage Under Winter Peak Conditions

The Presidio voltage under these conditions is 96.6%. With an increase in the Presidio winter peak load from 5.5MW to 6.0MW, the Presidio voltage will drop below 95% under normal conditions. This scenario is shown in Figure 12.

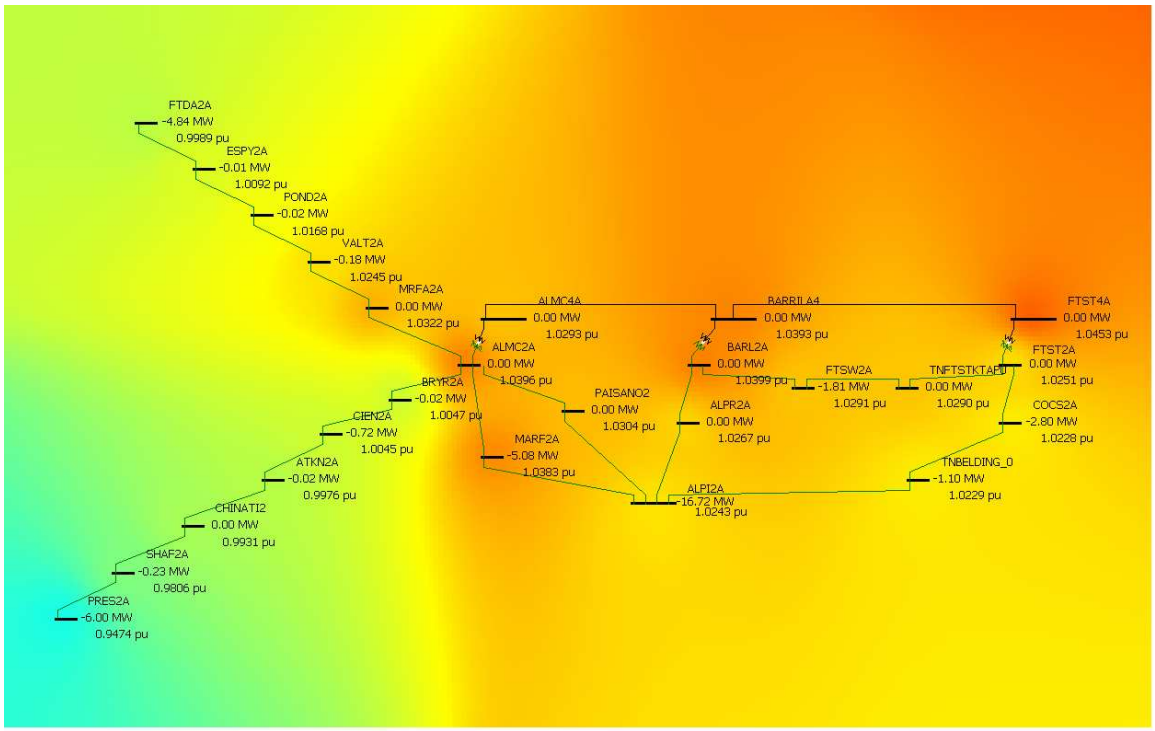

Figure 12. Presidio Pre-contingency Voltage with Winter Peak of 6MW

AEPSC forecasts the Presidio winter peak load to exceed this level by 2012 under normal weather conditions. A colder than normal winter in the Presidio area could easily push peak loads higher than forecast. In fact, the Presidio load actually peaked at 5.99MW in the winter of 2006.

In addition to the pre-contingency voltage problems at Presidio, there are two single contingency outages that result in an inability of the AEP-TNC transmission system to reliably serve the Presidio area load. These two outages are 1) loss of the 138kV source from Barrilla Junction to Marfa, and 2) loss of the Alamito Creek – Presidio 69kV line. The 138kV source from Barrilla Junction is dependent on the 138kV transmission line that terminates at the Marfa Substation as well as the 138/69kV autotransformer at Marfa. If either of these two transmission elements is out of service for any reason, voltages along the Alamito Creek – Presidio 69kV line will drop to approximately 90% with a Presidio summer load at or above 6.2MW (total radial load of 6.7MW). This scenario is shown in Figure 13.

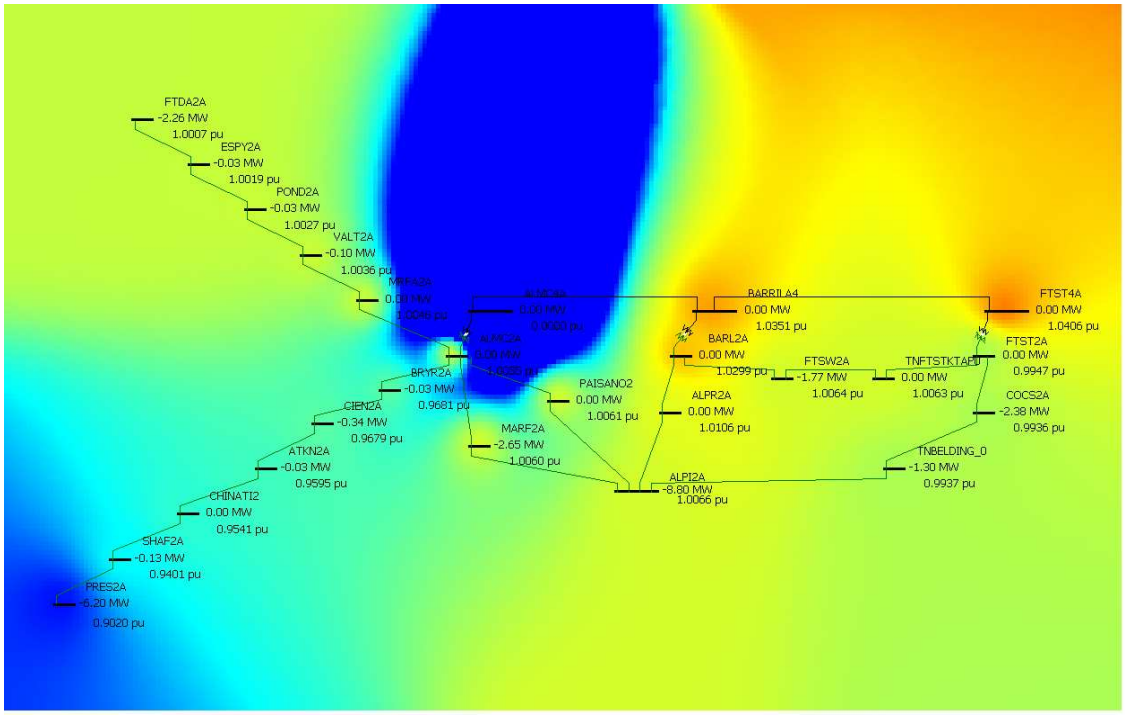

Figure 13. Loss of Barrilla Junction – Alamito Creek 138kV (6.2MW Presidio Summer Load)

A similar result is experienced under winter peak conditions with a Presidio load of 6.0MW (total radial load of 7.0MW). The winter case is shown in Figure 14.

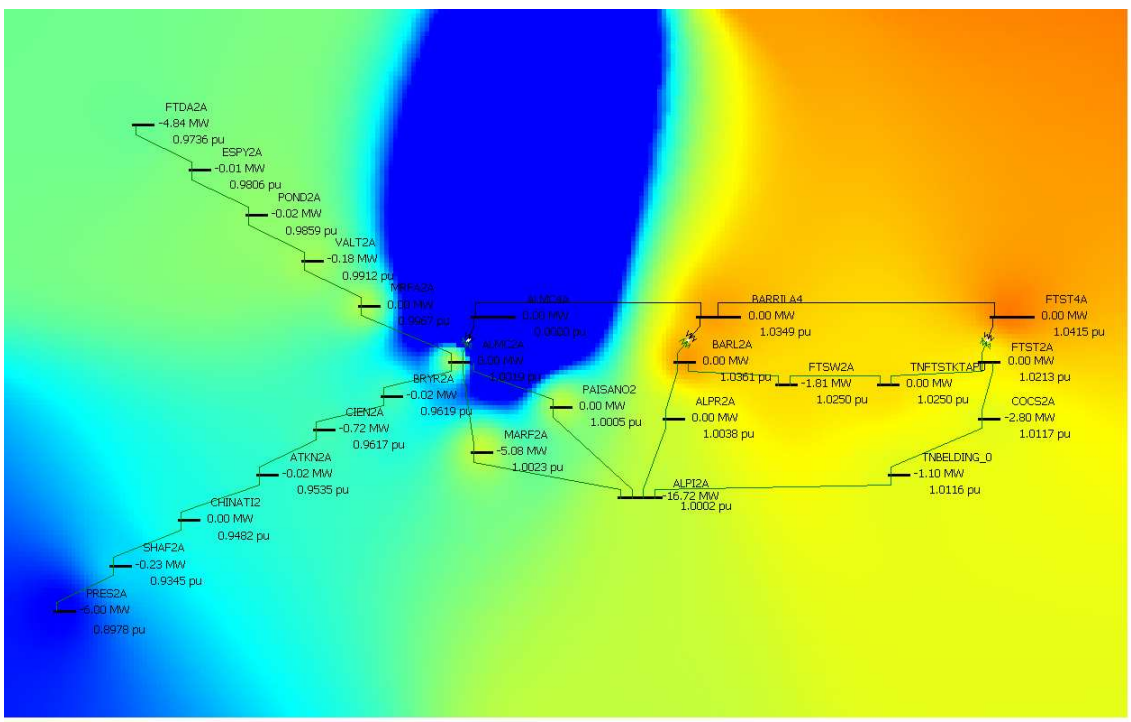

Figure 14. Loss of Barrilla Junction – Alamito Creek 138kV (6MW Presidio Winter Load)

The Presidio winter peak load is forecasted to exceed 6MW by 2012 under normal weather conditions. However, a colder than normal winter could easily push winter loads above 6MW much earlier. As previously mentioned, the Presidio winter peak load was 5.99MW in 2006.

The second single contingency outage that will prevent the AEP-TNC transmission system from serving the Presidio area load is the loss of the Alamito Creek – Presidio 69kV line. Loss of this line will result in a direct outage of the Presidio area load. The only source of backup supply in the area is a 12kV tie between the Presidio Substation and CFE. This tie is only capable of serving approximately 4MW of the Presidio peak load. In the event of an outage of the Alamito Creek - Presidio 69kV line, the Presidio load must be transferred to CFE via a BLT pursuant to ERCOT Protocols (5.8). Current operating procedures require the Presidio School load to be shed in order to accommodate the limited supply from CFE.

Options for Resolving Constraints

The preceding discussion and analysis has identified a number of issues related to the reliability of service in the Presidio area. These issues are as follows:

- Power quality and the number of momentary outages is a major problem for customers in the Presidio area;
- The Alamito Creek – Presidio 69kV is susceptible to outages due to its location and poor condition;
- The time to repair and re-energize the Alamito Creek – Presidio 69kV line can be extremely long due to rough terrain;
- There is limited backup supply available and it can only be utilized via BLT with CFE (requires an outage);
- The pre-contingency voltage at Presidio can drop below 95% resulting in a violation of NERC and AEPSC Planning Criteria;
- Loss of the Barrilla Junction – Alamito Creek 138kV can result in post-contingency voltage levels below 90% (also violating NERC and AEPSC Planning Criteria); and
- Potential economic changes and/or extreme weather conditions could easily push summer and winter peak loads well above the weather normalized load forecast.

The following discussion and analysis will attempt to address each of these important issues.

Dynamic and Steady-State Voltage

The approach often taken to resolve steady-state voltage violations is to install shunt capacitors. However, the AEP-TNC transmission system already has 3.6MVAR

capacitor banks installed at the Presidio and Chinati Substations and a 7.2MVAR capacitor bank at the Alamito Creek Substation, which is the practical limit for the application of traditional shunt capacitors. Adding more shunt capacitors is not a feasible approach to resolving the larger reliability issues in the area. Shunt capacitors do not respond quickly enough to address the power quality problems frequently experienced by area customers and can actually contribute to the power quality concerns due to voltage flicker that can occur as result from the switching of shunt capacitors. A comprehensive solution to the voltage issues in the Presidio area is needed.

Another approach to resolving dynamic and steady state voltage problems is to install a dynamic reactive compensation system (DRCS). The DRCS can monitor system voltage and instantaneously compensate for voltage disturbances by injecting reactive power. In this way, the DRSC can provide steady-state voltage regulation as well as mitigation of transient voltage fluctuations. As an extension of the DRCS, AEPSC has researched alternative technologies that can not only provide the dynamic and steady state voltage regulation, but also provide real power. One such technology that AEPSC believes may be uniquely suited for the Presidio application is Sodium-Sulfur (NaS) batteries. AEP tested a 12.5kW NaS battery for 10 months in 2001 and participated in the first U.S. demonstration project. AEP began operation of its first commercial NaS installation on June 26, 2006, in Charleston, West Virginia. This 1.2MW NaS installation allowed AEP to defer new substation construction and has been operating with great success.

NaS batteries are high capacity battery systems that have been developed for electric power applications. A NaS battery consists of liquid sulfur at the positive electrode and liquid sodium at the negative electrode as active materials. They are separated by a solid beta alumina ceramic electrolyte. During discharge, as positive Na ions flow through the electrolyte, electrons flow in the external circuit of the battery producing about 2 volts. This process is reversible as charging causes sodium polysulfides to release the positive sodium ions back through the electrolyte to recombine as elemental sodium. The hermetically sealed battery is kept at approximately 300 degrees Celsius and is operated under conditions such that the active materials at both electrodes are liquid and the electrolyte is solid. Because of the reversible charging and discharging, the NaS battery can be used continuously. The discharge cycle of the NaS battery will enable it to supply power continuously over an eight-hour period. A solid-state inverter is used to integrate the direct current (DC) battery output with the alternating current (AC) power system. The NaS batteries have an efficiency of about 89% for the charge/discharge cycle. Accounting for inverter losses, the complete system should have an efficiency of approximately 75%-80%. The expected life of the NaS batteries is about 15 years.

As mentioned previously, the Presidio area loads have experienced an excessive number of momentary outages and voltage fluctuations. In meetings with Presidio area residents, these momentary outages and voltage fluctuations are a major concern. Due to the quick response of the NaS system, it can be used in power quality applications. In this case, the NaS system will sense the voltage flicker and respond quickly enough

(within milliseconds) that machinery will not be affected and the flicker will not be noticeable to the human eye. The NaS will also be capable of providing steady-state voltage support to address the pre and post contingency voltage drop along the Alamito Creek – Presidio 69kV line. Until the NaS system output is consumed (at approximately 10.5MW in Presidio), it is capable of averting voltage collapse (instability). The NaS can also provide a number of other benefits due to its real power capability. Those benefits will be discussed later in this document.

Loss of 138kV Source at Marfa

As mentioned previously, the 138kV source from Barrilla Junction is dependent on both the 138kV transmission line and the 138/69kV autotransformer at Marfa. If either of these two transmission elements is out of service, voltages along the Alamito Creek – Presidio 69kV line can drop to unacceptable levels. If the 138/69kV autotransformer fails, the time to repair could be quite lengthy. AEP-TNC would be required to locate a spare autotransformer or order a new autotransformer. In addition, with only a single 138/69kV autotransformer at Marfa, it is necessary to remove the 138kV line from service in order to maintain the autotransformer. Adding a second 138/69kV autotransformer at Marfa would improve reliability of service to the Presidio area by providing redundancy and would allow for maintenance of the autotransformers without taking the 138kV line from Barrilla Junction out of service. Further, the existing 138/69kV autotransformer does not have sufficient capacity to serve the existing demand for much of the year if one of the 69kV lines serving Marfa were to trip while the remaining 69kV line is out of service for maintenance. Since current daily load patterns do not allow maintenance of the 69 kV lines terminating at Alamito Creek across the daily peak without a mitigation plan to shed load, an upgrade must be pursued to meet the NERC Category B criteria, the loss of single element. The addition of a second 138/69kV autotransformer would result in improved reliability as compared to upgrading the existing autotransformer and could be completed quickly.

Loss of Radial 69kV Line

The loss of the Alamito Creek – Presidio 69kV line will result in the direct loss of the Presidio area load. The condition of this line is very poor and its design and geographic location make it susceptible to outages. As previously mentioned, the NaS batteries have the capability of injecting real and/or reactive power. The real power capability of the NaS can provide a number of benefits to the Presidio area loads. During an outage of the Alamito Creek – Presidio 69kV line, the NaS batteries can supply real power to the Presidio load without interruption for up to eight hours. Based on the historical outage data, eight hours would be sufficient time to make most repairs and re-energize the 69kV line. In the event of an outage lasting longer than eight hours, the NaS batteries could supply power until a BLT with CFE is completed. By utilizing the NaS batteries, the BLT could be accomplished without interruption to the Presidio load. Based on current load projections and historical hourly load shapes, a 4.8MW NaS installation would be sufficient to serve the Presidio load 90.5% - 99.4% of the time in 2008 with the remainder of the radial 69kV load at 500kW to 1000kW. By 2013, these

percentages would be expected to drop to 78.4% - 90.7% of the time, under normal weather conditions. If it is necessary to BLT the Presidio load, the supply from CFE will still be limited to approximately 4MW unless further improvements are made. This issue will be discussed later in more detail. The NaS batteries can also be used to serve the Presidio load without interruption while maintenance is performed on the Alamito Creek – Presidio 69kV line. Currently, Presidio load would have to be interrupted while a BLT is completed before any maintenance can be performed on this line.

By installing a 4.8MW NaS battery, it will be possible to provide a higher level of reliability to the Presidio area loads until a more permanent solution can be implemented. As shown in Figure 15, the NaS batteries will support the Presidio area voltages with an outage of the Barrilla Junction – Alamito Creek 138kV until the Presidio load grows to approximately 10.5MW. With an outage of the radial 69kV line, the NaS will be able to support the Presidio area load a minimum of approximately 90% of the time in 2008 dropping to only 78% of the time by 2013. By that time, a permanent solution that addresses single contingency conditions will be needed.

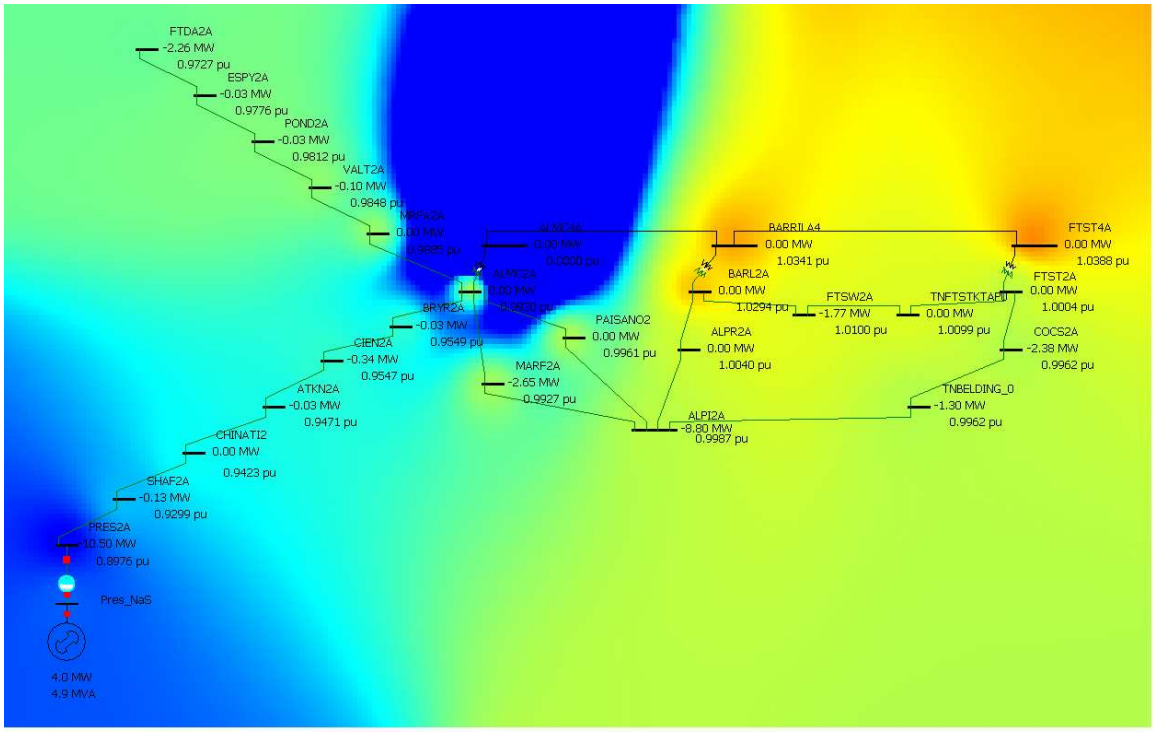

Figure 15. NaS Installed with Outage of Barrilla Junction – Alamito Creek 138kV line

One option for a permanent solution is to replace the Alamito Creek – Presidio 69kV line with a modern transmission line design. The new line would be constructed for operation at 138kV, but would initially be operated at 69kV to avoid substation equipment upgrades. As shown in Figure 16, this replacement option would improve the pre-contingency voltage drop from Alamito Creek to Presidio.

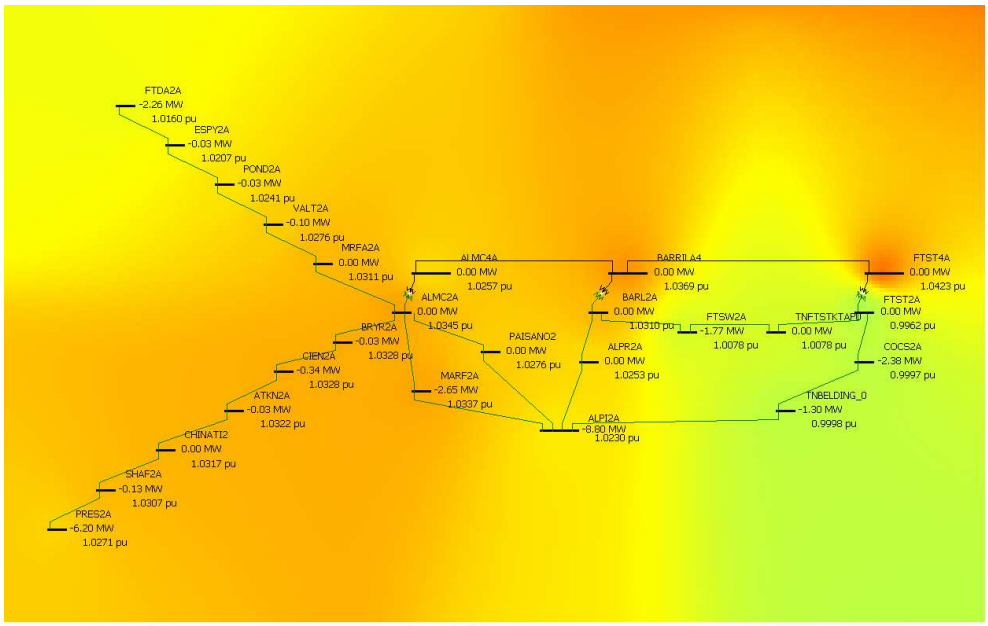

Figure 16. Pre-Contingency Voltage Drop with Line Replacement

With the new transmission line construction, the Presidio area loads would not be dependent on an aging transmission line with no shield wire – resulting in a reduction in the number of outages in the Presidio area. The new transmission line would also improve the voltage profile at Presidio during an outage of the Barrilla Junction – Alamito Creek 138kV. Figure 17 shows an outage of the Barrilla Junction – Alamito Creek 138kV with the Presidio load at approximately 6.2MW. The resulting voltage drop from Alamito Creek to Presidio is less than 1% (Presidio drops to only 97.3%) with the replacement of the Alamito Creek – Presidio 69kV line.

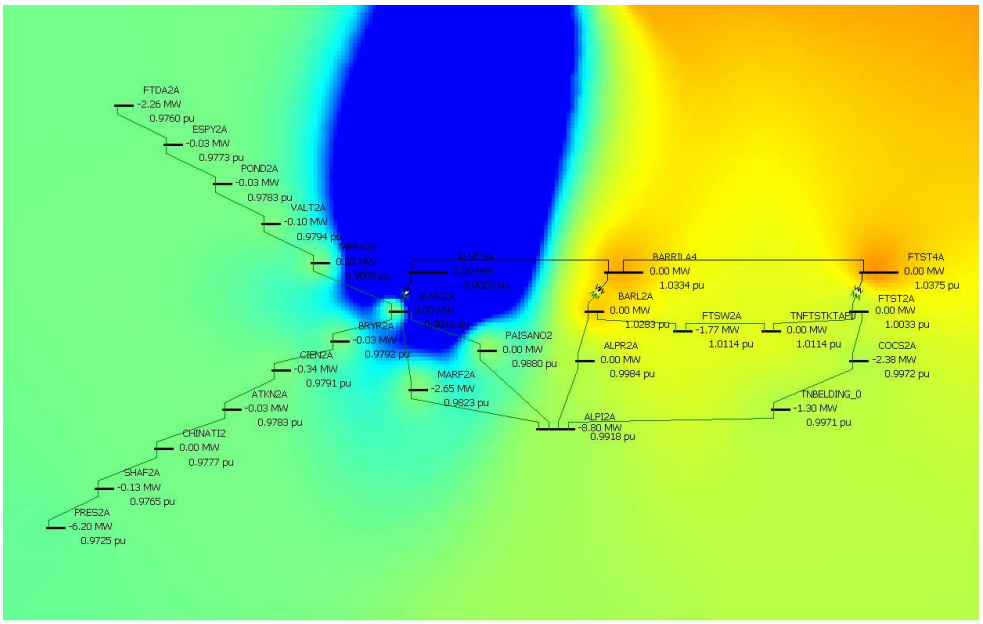

Figure 17. Barrilla Junction – Alamito Creek 138kV Outage with Line Replacement

There are two variations of this plan that should also be considered. One variation would involve connecting and operating the new line at 138kV. Under this arrangement, the new line would be constructed from the Alamito Creek 138kV Substation to Chinati and then to Presidio. A 138/69kV autotransformer would be installed at Chinati and the existing 69kV line would be left in place. A 138/12kV transformer would be installed at Presidio. The existing 69kV line would be normally open at Alamito Creek and at Presidio. Under contingency conditions, the old 69kV line could be closed in and operated for backup until the new 138kV line is returned to service. With only three termination points, this approach would provide more flexibility in line routing. This is an important advantage given the terrain in this area. This approach would also provide a 138kV source closer to the load stations and would eliminate the need to convert four load serving stations to 138/12kV service until future circumstances required such.

The second variation is similar to the one previously described except the new transmission line would continue to be operated at 69kV. This would eliminate the need for the 138/69kV autotransformer at Chinati and the 138/12kV transformation at Presidio. The new line could then be converted to 138kV at a future time. A one-line diagram of these new build options is shown in Figure 18.

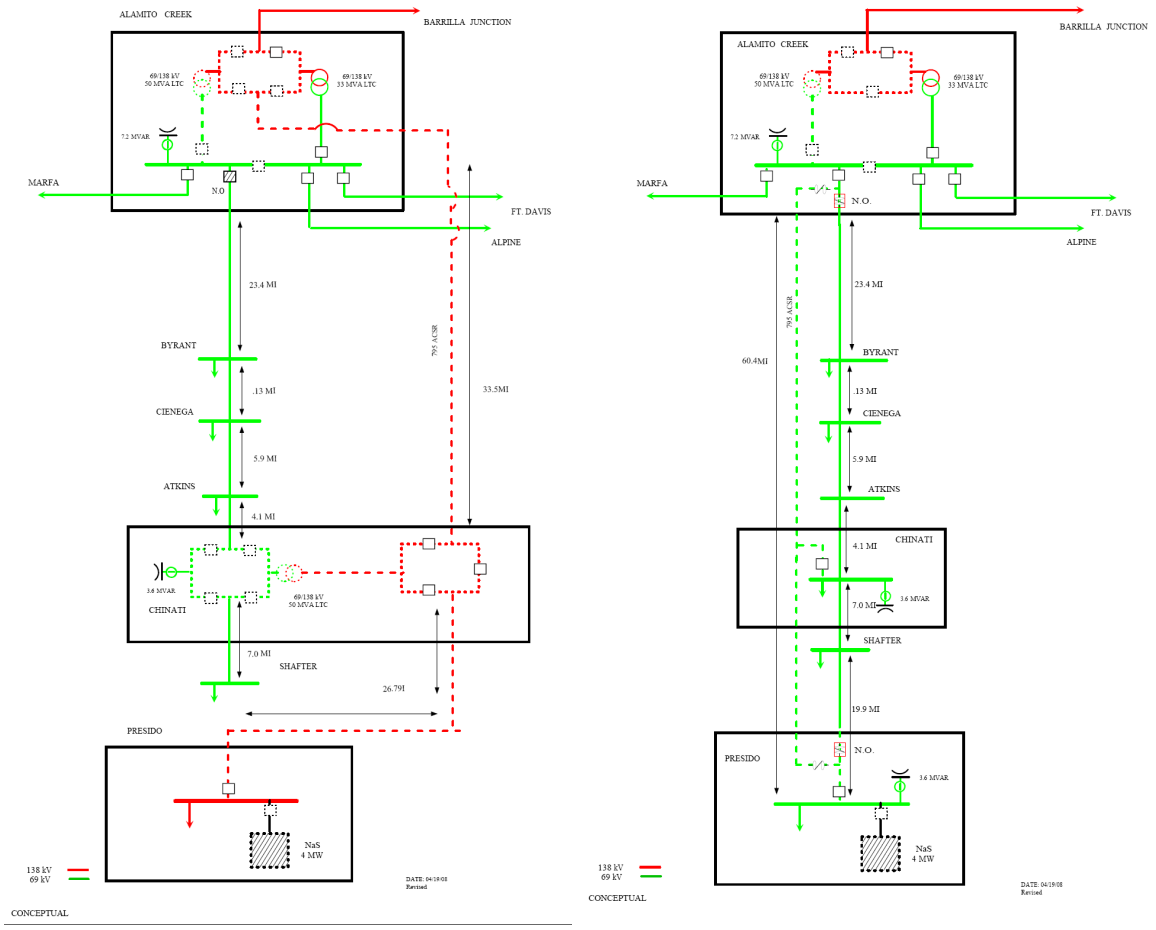

Figure 18. Line Replacement Options

Long-Term Backup Service to Presidio

Another major issue to be considered is backup service to Presidio. In the event of an outage that persists over a period of days, there is currently limited recourse. As mentioned previously, the only source for backup supply is through BLTs with CFE. However, this backup source is limited to approximately 4MW of the Presidio peak load. The CFE/ERCOT Interconnection Study dated December 19, 2003, explicitly identifies the Ojinaga/Presidio interconnection, and recognizes that it is constrained. The Introduction of the same report takes the following position, "With the technology currently available, interconnections between the close geographic regions yet isolated transmissions systems of CFE and ERCOT can uniquely and cost effectively displace inefficient units and provide economic reliability enhancements to meet local load growth needs. Given the significant and mounting operating cost of the inefficient units in today's market, a new urgency exists to develop innovative and timely alternatives such as asynchronous interconnections between CFE and ERCOT as a means to mitigate these generation costs, provide mutual emergency support and allow for economic transactions." Wind generation as a source of economic energy is of particular interest to ERCOT at this time. Given its excess in West Texas, the Ojinaga/Presidio interconnection would provide a small but effective path for the export of wind energy to Mexico. Reciprocally, the Ojinaga/Presidio interconnection would provide the access to additional natural gas energy production across peak load periods in ERCOT.

CFE is presently upgrading the radial 115kV transmission line to Ojinaga to accommodate developing irrigation load. If the ERCOT 69kV transmission line from Alamito Creek to Presidio were upgraded to 138kV in the future, it would be possible to install an asynchronous tie to CFE. With technology similar to the tie with CFE that currently exists at Laredo, both reliability and economic benefits would be achieved.

Discussion of Options

Table 2 shows several plans for addressing the Presidio area constraints based on the specific improvements discussed above.

Option	Description	In-Service	Cost
1	• Install 2nd 138/69kV autotransformer at Marfa • Replace 69kV circuit from Alamito Creek to Presidio • Total	2008 2010	$4M $45M $49M
2	• Install 2nd 138/69kV autotransformer at Marfa • Install 2-2.4MW NaS battery units at Presidio • Replace 69kV circuit from Alamito Creek to Presidio • Total	2008 2009 2012	$4M $15M $45M $64M
3	• Install 2nd 138/69kV autotransformer at Marfa, with 138 kV terminal • Install 2-2.4MW NaS battery units at Presidio • Replace existing 69kV line with new 138kV line Alamito Creek – Chinati – Presidio • Install 138/69kV autotransformer at Chinati • Install 138/12kV transformer at Presidio • Total	2008 2009 2012 2012 2012	$5M $15M $48M $3M $2M $73M
4	• Install 2nd 138/69kV autotransformer at Marfa • Install 2-2.4MW NaS battery units at Presidio • Replace existing 69kV line with new 69kV line (designed for later operation at 138kV) Alamito Creek – Chinati – Presidio • Total	2008 2009 2012	$4M $15M $48M $67M

Table 2. Plan Options

All of the options include the addition of a second 138/69kV autotransformer at Marfa in 2008. The addition of the second Marfa autotransformer is necessary to meet NERC Category B criteria under maintenance conditions, and will improve the reliability of service to Presidio by providing transformation redundancy and allow maintenance to be performed reliably on the Marfa autotransformer and the 69kV lines that terminate at Marfa. This improvement could be made quickly.

Option 1 includes the replacement of the Alamito Creek – Presidio 69kV line in 2010. Given the lead times for new transmission construction, 2010 is the earliest that such an improvement can be made. Option 1 does not include any interim improvements,

so the Presidio area loads will continue to be exposed to outages and poor power quality until the line can be replaced.

Option 2 includes installation of a 4.8MW NaS battery unit in 2009. Including the NaS battery unit will not only provide interim support and improved power quality to the Presidio area, but will also allow additional time for the existing 69kV line to be replaced. As mentioned previously, the NaS battery unit will provide sufficient real power and voltage support to serve the Presidio area load 90%-99% of the time in 2008 under normal weather conditions. However, by 2013, the NaS system will only be able to meet the Presidio area load 78%-91% of the time. At that point, the existing 69kV line must be replaced. Option 2 includes a line replacement on a route that matches the route of the existing 69kV line.

Option 3 is similar to Option 2 except the new transmission line routed to Chinati and then on to Presidio and would be operated at 138kV. This option requires a new 138kV terminal at Alamito, the installation of a 138/69kV autotransformer at Chinati and a 138/12kV transformer at Presidio. The existing 69kV line would be left in place and would be normally open at Alamito Creek and Presidio. New line construction could result in fewer structures than the existing line due to the more direct route, and would allow for improved access to the line with a corresponding improvement in restoration time.

Option 4 is identical to Option 3 except the new transmission line would be initially operated at 69kV. Option 4 would not require additional transformation at Chinati and Presidio. The new line could be converted to 138kV at a future time --- perhaps coincident with the construction of an asynchronous tie, if it were to be built by CFE to access wind energy.

Preferred Option

Option 4 is the preferred option. This option provides better reliability to the Presidio area loads than Option 1 due to the addition of the NaS battery unit. The addition of the NaS battery unit will allow the 69kV line replacement to be deferred for two years. Based on an 18% revenue requirement for Electric Transmission Texas, a two-year deferral of the 69kV line replacement would pay for the NaS battery unit. Option 4 is preferred over Options 3 because it provides similar quality of service at a lower initial cost. Option 4 is preferred over option 2 because it will also allow for future growth and reliability improvement through conversion to 138kV and a potential tie with CFE.

Conclusion

The existing reliability of service to loads in the Presidio area is very poor. Continued refurbishment of the line will not relieve these problems, because the inherent limitations of its design cannot be corrected. The only practical alternative is the complete replacement of the line. In addition, there are tremendous power quality issues due to the long radial transmission source into Presidio. The pre-contingency voltage drop along the Alamito Creek to Presidio 69kV line results in violations of AEP and NERC Transmission Planning Criteria with existing levels of demand. The practical limit of the application of traditional shunt capacitors has been reached, and adding more shunt capacitors is not a feasible approach to resolving the larger reliability issues in the area. It is necessary to both provide support to this area as soon as possible, and have systems in place to accommodate potential economic changes.

The plan that is proposed by AEPSC will provide near-term support to Presidio area loads while a permanent solution is put in place. The cost of the near term application of the NaS battery is offset by the savings of the two year deferral of the long term solution, the replacement of the 69 kV line. Together, these projects provide a comprehensive and forward-thinking solution to the Presidio area. Once complete, the AEP-TNC transmission system will be able to support existing and future demand in the area and can accommodate anticipated economic expansion into the future.

Attachments

City of Presidio

March 10, 2008

Charles Patton
President and COO
AEP Texas
539 N. Carancahua
Corpus Christi, Texas 78478

Dear President Patton:

As Mayor of the City of Presidio, I want to thank you on behalf of all of the citizens living in our town for your proposals designed to improve our electric transmission service. These include the short term measures you may take, as well as the eventual replacement of the old transmission line that supplies power to Presidio.

This single transmission line is our major source of power and is, therefore, our life line when it comes to receiving reliable electric service. As you know, over the past years, our area has experienced many outages, some quite lengthy, caused by age, weather and terrain related problems experienced by this single transmission line.

Just as with every other community in Texas, reliable electricity is vital to our very existence. From an economic development and population standpoint, Presidio is projected to grow to over 10,000 residents in the next five years. And because of our location, we are not only known as the nation's "Hot Spot," because of our extremely high summer temperatures, but because we are on the frontline in America's efforts to secure our borders.

For these reasons and many more, the town of Presidio is deeply appreciative of your various proposals to improve electric transmission service to our city, including taking steps to replace the old electric transmission "life line" as soon as possible. Please do not hesitate to contact me if there is anything I can do to help you and AEP Texas in your efforts to get these projects approved and completed.

Sincerely,

Lorenzo Hernandez
Mayor

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House of Representatives

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Del Rio, TX 78842-0663
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March 10, 2008

Mr. Charles Patton
President and COO
AEP Texas
539 N. Carancahua
Corpus Christie, Texas 78478

Dear Mr. Patton:

I'm writing to express my support and appreciation for your ongoing efforts to improve the reliability of electric service in Presidio, Texas. As I understand it, this will be done by first providing some short term solutions followed by the eventual replacement of the 60-mile transmission line between Marfa and Presidio that serves as Presidio's primary source of power.

The citizens in Presidio deserve to have reliable electric delivery seven days a week, 24 hours a day, just like Texans who live in every other part of the state. They should not be penalized simply because of their geography.

As we have discussed, the citizens in Presidio pay their fair share of transmission costs in Texas, although the transmission service they currently are receiving needs considerable improvement. The argument that Presidio does not use as much electricity as other larger metropolitan areas and should not receive needed funding for a project of this magnitude simply does not wash with me.

Again, please accept my personal note of gratitude, as well as those originating from my constituents in Presidio, for your leadership in getting some short term transmission help, which, in turn, will lead to the replacement of the aging transmission line itself. You have my unwavering support for your efforts and I urge you to contact me if there is anything that I can do to help produce a successful, and speedy, outcome.

Sincerely,

Pete P. Gallego

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