Definitive Interconnection System Impact Study for Generation Interconnection Requests

Southwest Power Pool
Engineering Department
Tariff Studies – Generation Interconnection

(DISIS-2010-001 Study)
July 2010

SPP RESTRICTED

SPP Southwest Power Pool

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July 2010

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Executive Summary

Pursuant to the Southwest Power Pool (SPP) Open Access Transmission Tariff (OATT), SPP has conducted this Definitive Interconnection System Impact Study (DISIS) for certain generation interconnection requests in the SPP Generation Interconnection Queue. These interconnection requests have been clustered together for the following Impact Study. The customers will be referred to in this study as the DISIS-2010-001 Interconnection Customers. This Impact Study analyzes the interconnecting of multiple generation interconnection requests associated with new generation totaling 4,816.2 MW of new generation which would be located within the transmission systems of American Electric Power West (AEPW), Midwest Energy Inc. (MIDW), Missouri Public Service (MIPU), Mid-Kansas Electric Power LLC (MKEC), Nebraska Public Power District (NPPD), Oklahoma Gas and Electric (OKGE), Southwestern Public Service (SPS), Sunflower Electric Power Corporation (SUNC), Westar Energy (WERE). The various generation interconnection requests have differing proposed in-service dates[1]. The generation interconnection requests included in this DISIS are listed in Appendix A by their queue number, amount, area, requested interconnection point, proposed interconnection point, and the requested in-service date.

Power flow analysis has indicated that for the powerflow cases studied, 4,816.2 MW of nameplate generation may be interconnected with transmission system reinforcements within the SPP transmission system. Dynamic Stability and power factor analysis has determined the need for reactive compensation in accordance with Order No. 661-A for wind farm interconnection requests and those requirements are listed for each interconnection request within the contents of this report.

Dynamic Stability Analysis has determined that the transmission system will remain stable with the assigned Network Upgrades and necessary reactive compensation requirements.

The total estimated minimum cost for interconnecting the DISIS-2010-001 interconnection customers is $662,696,737. These costs are shown in Appendices E and F. Interconnection Service to DISIS-2010-001 interconnection customers is also contingent upon higher queued customers paying for certain required network upgrades. The in service date for the DISIS customers will be deferred until the construction of these network upgrades can be completed.

These costs do not include the Interconnection Customer Interconnection Facilities as defined by the SPP Open Access Transmission Tariff (OATT). This cost does not include additional network constraints in the SPP transmission system that were identified as shown in Appendix H.

Network Constraints listed in Appendix H are in the local area of the new generation when this generation is injected throughout the SPP footprint for the Energy Resource (ER) Interconnection Request. Additional Network constraints will have to be verified with a Transmission Service Request (TSR) and associated studies. With a defined source and sink in a TSR, this list of Network Constraints will be refined and expanded to account for all Network Upgrade requirements.

The required interconnection costs listed in Appendices E and F do not include all costs associated with the deliverability of the energy to final customers. These costs are determined by separate

[1] The generation interconnection requests in-service dates will need to be deferred based on the required lead time for the Network Upgrades necessary. The Interconnection Customer's that proceed to the Facility Study will be provided a new in-service date based on the completion of the Facility Study.

studies if the Customer submits a Transmission Service Request through SPP's Open Access Same Time Information System (OASIS) as required by Attachment Z1 of the SPP OATT.

Based on the SPP Tariff Attachment O, transmission facilities that are part of the SPP Transmission Expansion Plan (STEP) including Sponsored Economic Upgrades or the Balanced Portfolio that are approved by the SPP Board of Directors will receive notifications to construct. These projects will then be considered construction pending projects and would not be assignable to the Impact Cluster Study Generation Interconnection Requests.

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Introduction

Pursuant to the Southwest Power Pool (SPP) Open Access Transmission Tariff (OATT), SPP has conducted this Definitive Interconnection System Impact Study (DISIS) for certain generation interconnection requests in the SPP Generation Interconnection Queue. These interconnection requests have been clustered together for the following Impact Study. The customers will be referred to in this study as the DISIS-2010-001 Interconnection Customers. This Impact Study analyzes the interconnecting of multiple generation interconnection requests associated with new generation totaling 4,816.2 MW of new generation which would be located within the transmission systems of American Electric Power West (AEPW), Midwest Energy Inc. (MIDW), Missouri Public Service (MIPU), Mid-Kansas Electric Power LLC (MKEC), Nebraska Public Power District (NPPD), Oklahoma Gas and Electric (OKGE), Southwestern Public Service (SPS), Sunflower Electric Power Corporation (SUNC), Westar Energy (WERE). The various generation interconnection requests have differing proposed in-service dates[2]. The generation interconnection requests included in this Impact Cluster Study are listed in Appendix A by their queue number, amount, area, requested interconnection point, proposed interconnection point, and the requested in-service date.

The primary objective of this Definitive Interconnection System Impact Study is to identify the system constraints associated with connecting the generation to the area transmission system. The Impact and other subsequent Interconnection Studies are designed to identify attachment facilities, Network Upgrades and other Direct Assignment Facilities needed to accept power into the grid at each specific interconnection receipt point.

Model Development

Interconnection Requests Included in the DISIS-2010-001 Study

SPP has included all interconnection requests that submitted a Definitive Interconnection System Impact Study request no later than March 31, 2010 and were subsequently accepted by Southwest Power Pool under the terms of the Generation Interconnection Procedures (GIP) that became effective March 31, 2010.

Affected System Interconnection Requests - Also included in this Definitive Impact Study are four Affected System Studies, one on the Lea County Electric Cooperative system in Lea County, New Mexico (given the designation ASGI-2010-010) and three wind farm requests on the Tri County Electric Cooperative system in Texas County, Oklahoma (given the collective designation ASGI-2010-011).

The interconnection requests that are included in this study are listed in Appendix A.

[2] The generation interconnection requests in-service dates will need to be deferred based on the required lead time for the Network Upgrades necessary. The Interconnection Customer's that proceed to the Facility Study will be provided a new in-service date based on the completion of the Facility Study.

Previous Queued Projects

The previous queued projects included in this study are listed in Appendix B. In addition to the Base Case Upgrades, the previous queued projects and associated upgrades were assumed to be in-service and added to the Base Case models. These projects were dispatched as Energy Resources with equal distribution across the SPP footprint.

Development of Base Cases

Powerflow - The 2009 series Transmission Service Request (TSR) Models 2010 spring and 2014 summer and winter peak scenario 0 peak cases were used for this study. After the 2010 spring and the 2014 summer and winter peak cases were developed, each of the control areas' resources were then re-dispatched using current dispatch orders.

Stability – The 2009 series SPP Model Development Working Group (MDWG) Models 2009 winter and 2010 summer were used for this study.

Base Case Upgrades

The following facilities are part of the SPP Transmission Expansion Plan or the Balanced Portfolio or recently approved Priority Projects. These facilities have been approved or are in construction stages and were assumed to be in-service at the time of dispatch and added to the base case models. The DISIS-2010-001 Customers have not been assigned cost for the below listed projects. The DISIS-2010-001 Customers Generation Facilities in service dates may need to be delayed until the completion of the following upgrades. If for some reason, construction on these projects is discontinued, additional restudies will be needed to determine the interconnection needs of the DISIS customers.

- Woodward – Northwest 345kV line and associated projects to be built by OKGE placed in service in 2010.
- Hitchland 345/230/115kV upgrades to be built by SPS for 2010/2011 in-service[3].
  - Hitchland – Moore County 230kV line
  - Hitchland – Perryton 230kV line
  - Hitchland – Texas County 115kV line
  - Hitchland – Hansford County 115kV line
  - Hitchland – Sherman County Tap 115kV line
- Valliant – Hugo – Sunnyside 345kV – assigned to Aggregate Study AG3-2006 Customers for 2012 in-service.
- Wichita – Reno County – Summit 345kV to be built by WERE for 2010 in-service[4].
- Rose Hill – Sooner 345kV to be built by WERE/OKGE for 2013 in-service.
- Knob Hill – Steele City 115kV to be built by NPPD/WERE for 2010 in-service.
- Balanced Portfolio Projects[5]:
  - Anadarko 345/138/13.2kV Autotransformer
  - Woodward – TUCO 345kV line
  - Iatan – Nashua 345kV line
  - Muskogee – Seminole 345kV line

[3] Approved 230kV upgrades are based on SPP 2007 STEP. Upgrades may need to be re-evaluated in the system impact study.
[4] Approved based on an order of the Kansas Corporation Commission issued in Docket no. 07-WSEE-715-MIS
[5] Notice to Construct (NTC) issued June, 2009

- Knoll – Axtell 345kV line
- Spearville – Knoll 345kV line
- Tap Stillwell – Swissvale 345kV line at West Gardner

- Priority Projects[6]:
  - Hitchland - Woodward double circuit 345kV
  - Woodward – Comanche double circuit 345kV
  - Spearville – Comanche double circuit 345kV
  - Comanche – Medicine Lodge double circuit 345kV
  - Medicine Lodge – Wichita double circuit 345kV
  - Medicine Lodge 345/138kV autotransformer

Contingent Upgrades

The following facilities do not yet have approval. These facilities have been assigned to higher queued interconnection customers. These facilities have been included in the models for the DISIS-2010-001 study and are assumed to be in service. The DISIS-2010-001 Customers at this time do not have responsibility for these facilities but may later be assigned the cost of these facilities if higher queued customers terminate their GIA or withdraw from the interconnection queue. The DISIS-2010-001 Customer Generation Facilities in service dates may need to be delayed until the completion of the following upgrades.

- Finney – Holcomb 345kV Ckt #2 line assigned to GEN-2006-044 interconnection customer. This customer is currently in suspension[7].
- Central Plains – Setab 115kV transmission line assigned to GEN-2007-013 interconnection customer.
- Spearville 345/230kV autotransformer #2 assigned to 1st Cluster Interconnection Customers (100% to GEN-2006-006)
- Grassland 230/115kV autotransformer #2 assigned to 1st Cluster Interconnection Customers (100% to GEN-2008-016)
- Spearville 230/115kV autotransformer #2 assigned to DIS-2009-001-1 Interconnection Customers (100% to GEN-2008-079)
- Petersburg – Madison 115kV assigned to DIS-2009-001-1 Interconnection Customers
- Judson Large – North Judson Large – Spearville Ckt #2 assigned to DIS-2009-001-1 Interconnection Customers (100% to GEN-2008-079)
- GEN-2008-038 Tap – Barnsdall 138kV assigned to DIS-2009-001-1 Interconnection Customers (100% to GEN-2008-038)
- Belden – Bloomfield 115kV assigned to DIS-2009-001-1 Interconnection Customers

Potential Upgrades Not in the Base Case

Any potential upgrades that do not have a Notification to Construct (NTC) have not been included in the base case. These upgrades include any identified in the SPP Extra-High Voltage (EHV) overlay plan or any other SPP planning study other than the upgrades listed above in the previous sections.

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[6] Notice to Construct (NTC) issued June, 2010. NTC for double circuit lines indicated that NTC may be revised at a later time to be built at a higher voltage.

[7] Based on Facility Study Posting November 2008

Regional Groupings

The interconnection requests listed in Appendix A were grouped together in fourteen different regional groups based on geographical and electrical impacts. These groupings are shown in Appendix C.

To determine interconnection impacts, fourteen different dispatch variations of the spring base case models were developed to accommodate the regional groupings.

Powerflow - For each group, the various wind generating plants were modeled at 80% nameplate of maximum generation. The wind generating plants in the other areas were modeled at 20% nameplate of maximum generation. This process created fifteen different scenarios with each group being studied at 80% nameplate rating. These projects were dispatched as Energy Resources with equal distribution across the SPP footprint. This method allowed for the identification of network constraints that were common to the regional groupings that could then in turn have the mitigating upgrade cost allocated throughout the entire cluster. Each interconnection request was also modeled separately at 100% nameplate for certain analyses.

Peaking units were not dispatched in the 2010 spring model. To study peaking units' impacts, the 2014 summer and winter peak model was chosen and peaking units were modeled at 100% of the nameplate rating and wind generating facilities were modeled at 10% of the nameplate rating.

Stability - For each group, all interconnection requests (wind and non-wind) were modeled at 100% nameplate of maximum generation in both winter and summer seasonal models. The wind interconnection requests in the other areas were modeled at 20% nameplate of maximum generation while fossil units were modeled at 100% in the other areas. This process created twelve different scenarios with each group being studied at 100% nameplate rating. These projects were dispatched as Energy Resources with equal distribution across the SPP footprint.

Identification of Network Constraints

The initial set of network constraints were found by using PTI MUST First Contingency Incremental Transfer Capability (FCITC) analysis on the entire cluster grouping dispatched at the various levels mentioned above. These constraints were then screened to determine if any of the generation interconnection requests had at least a 20% Distribution Factor (DF) upon the constraint. Constraints that measured at least a 20% DF from at least one interconnection request were considered for mitigation.

Determination of Cost Allocated Network Upgrades

Cost Allocated Network Upgrades of wind generation interconnection requests were determined using the 2010 spring model. Cost Allocated Network Upgrades of peaking units was determined using the 2014 summer peak model. Once a determination of the required Network Upgrades was made, a powerflow model of the 2010 spring case was developed with all cost allocated Network Upgrades in-service. A MUST FCITC analysis was performed to determine the Power Transfer Distribution

Factors (PTDF), defined as a distribution factor with system impact conditions that each generation interconnection request had on each new upgrade. The impact each generation interconnection request had on each upgrade project was weighted by the size of each request. Finally the costs due by each request for a particular project were then determined by allocating the portion of each request's impact over the impact of all the required upgrades.

For example, assume that there are three Generation Interconnection requests, X, Y, and Z that are responsible for the costs of Upgrade Project '1'. Given that their respective PTDF for the project have been determined, the cost allocation for Generation Interconnection request 'X' for Upgrade Project 1 is found by the following set of steps and formulas:

- Determine an Impact Factor on a given project for all responsible GI requests:

  Request X Impact Factor on Upgrade Project 1 = PTDF(%)(X) * MW(X) = X1

  Request Y Impact Factor on Upgrade Project 1 = PTDF(%)(Y) * MW(Y) = Y1

  Request Z Impact Factor on Upgrade Project 1 = PTDF(%)(Z) * MW(Z) = Z1

- Determine each request's Allocation of Cost for that particular project:

  $$\text{Request X's Project 1 Cost Allocation (\$)} = \frac{\text{Network Upgrade Project 1 Cost(\$)} * \text{X1}}{\text{X1} + \text{Y1} + \text{Z1}}$$

- Repeat previous for each responsible GI request for each Project

The cost allocation of each needed Network Upgrade is determined by the size of each request and its impact on the given project. This allows for the most efficient and reasonable mechanism for sharing the costs of upgrades.

Credits for Amounts Advanced for Network Upgrades

Interconnection Customer shall be entitled to credits in accordance with Attachment Z1 of the SPP Tariff for any Network Upgrades including any tax gross-up or any other tax-related payments associated with the Network Upgrades, and not refunded to the Interconnection Customer.

Interconnection Facilities

The requirement to interconnect the 4,816.2 MW of generation into the existing and proposed transmission systems in the affected areas of the SPP transmission footprint consist of the necessary cost allocated shared facilities listed in Appendix F by upgrade. The interconnection requirements for the cluster total $662,696,737. Interconnection Facilities, including prior allocated facilities, specific to each generation interconnection request are listed in Appendix E.

A list of constraints with greater than or equal to a 20% OTDF that were identified and used for mitigation are listed in Appendix G. Other Network Constraints in the AEPW, MIDW, MIPU, MKEC, NPPD, OKGE, SPS, SUNC, AND WERE transmission systems that were identified are shown in

Appendix H. With a defined source and sink in a TSR, this list of Network Constraints will be refined and expanded to account for all Network Upgrade requirements.

A preliminary one-line drawing for each generation interconnection request are listed in Appendix D. Figure 1 depicts the major transmission line Network Upgrades needed to support the interconnection of the generation amounts requested in this study.

Powerflow

Powerflow Analysis Methodology

The Southwest Power Pool (SPP) Criteria states that:

"The transmission system of the SPP region shall be planned and constructed so that the contingencies as set forth in the Criteria will meet the applicable NERC Reliability Standards for transmission planning. All MDWG power flow models shall be tested to verify compliance with the System Performance Standards from NERC Table 1 – Category A."

The ACCC function of PSS/E was used to simulate single contingencies in portions or all of the modeled control areas of American Electric Power West (AEPW), Empire District Electric (EMDE), Grand River Dam Authority (GRDA), Kansas City Power & Light (KCPL), Midwest Energy (MIDW), MIPU, MKEC, Nebraska Public Power District (NPPD), OG&E Electric Services (OKGE), Omaha Public Power District (OPPD), Southwest Public Service (SPS), Sunflower Electric (SUNC), Westar Energy (WERE), Western Farmers Electric Cooperative (WFEC) and other control areas were applied and the resulting scenarios analyzed. This satisfies the "more probable" contingency testing criteria mandated by NERC and the SPP criteria.

Powerflow Analysis

A powerflow analysis was conducted for each Interconnection Customer's facility using modified versions of the 2010 spring peak and the 2014 summer and winter peak models. The output of the Interconnection Customer's facility was offset in each model by a reduction in output of existing online SPP generation. This method allows the request to be studied as an Energy Resource (ER) Interconnection Request. The available seasonal models used were through the 2014 Summer Peak.

This analysis was conducted assuming that previous queued requests in the immediate area of these interconnect requests were in-service. The analysis of each Customer's project indicates that additional criteria violations will occur on the AEPW, MIDW, OKGE, SPS, SUNC, SWPA, MKEC, WERE, AND WFEC transmission systems under steady state and contingency conditions in the peak seasons.

Cluster Group 1 (Woodward Area)

The Woodward area contained approximately 292 MW of new interconnection requests in addition to the 3,053 MW of prior queued interconnection requests. Constraints were observed on the Northwest – Tatonga 345kV line and the Fargo Junction – Woodward 69kV line. To mitigate the Northwest –

Tatonga 345kV constraint, a 345kV circuit from Wheeler – Anadarko that was identified for Group 2 was found to mitigate the Group 1 constraint. To mitigate the Fargo Junction – Woodward 69kV constraint the line will need to be rebuilt.

Cluster Group 2 (Hitchland Area)

The Hitchland area contained 1,392 MW of interconnection request in addition to the 2,482 MW of previous queued generation interconnection requests. An outage of the Finney-Stevens County 345kV line or an outage of the double circuit 345kV line from Hitchland-Woodward was found to cause possible voltage collapse. To mitigate the constraint, a double 345kV circuit from Hitchland – Wheeler was added and an additional 345kV line from Wheeler - Anadarko was also needed. A change in the point of interconnection for GEN-2008-047 was also warranted. GEN-2008-047 had been studied previously assuming the Hitchland-Woodward circuit would be built at 345kV. Newly issued Notices to Construct (NTC) for this line have indicated that the voltage is proposed at 345kV presently but could be changed at a later date. Because this voltage is unknown at this time, the interconnection point for GEN-2008-047 has been moved to Hitchland 345kV.

Cluster Group 3 (Spearville Area)

The Spearville area contained 781 MW of interconnection requests and 2,333 MW of previous queued interconnection requests. There were constraints identified on the lower 230 and 115kV systems out of Spearville including the 115kV system near interconnection request GEN-2009-059 and the Circle – Mullergren 230kV line. To mitigate these issues, additional 345/230kV and 230/115kV autotransformers are necessary at Spearville as well as additional 115kV line capacity from Spearville toward the wind farms interconnecting on the Cudahy – Judson Large 115kV. To mitigate the Circle – Mullergren 230kV constraint, a 230kV transmission line from Mullergren to Rice County will need to be constructed and a 230/115kV autotransformer will be installed at Rice County.

Cluster Group 4 (Mingo/NW Kansas Group)

The Mingo/NW Kansas group had 0 MW in addition to the 924 MW of previously queued generation in the area. No new constraints were found in this area.

Cluster Group 5 (Amarillo Area)

The Amarillo group had 51 MW of interconnection requests in addition to the 2,168 MW of previously queued interconnection requests in this area. The major constraint for the GEN-2008-088 request was on the Switch 2749 substation – Wildorado 69kV line. To mitigate the constraint, the line will need to be rebuilt. In addition, the GEN-2008-088 request was found to contribute to the possible voltage collapse for the outage of the Hitchland-Woodward 345kV double circuit.

Cluster Group 6 (South Panhandle/New Mexico)

This group had 567 MW of interconnection requests in addition to the 1,390 MW of previously queued interconnection requests. The major constraints in the New Mexico area were on the Plant X Station – Tolk Station 230kV lines. To mitigate the constraints, the following actions were taken: Both Plant X Station – Tolk Station 230kV lines were rebuilt, and replacement terminal equipment on the Potter – Plant X 230kV line was modeled. The wind farm projects in Group 6 were also found to contribute to the possible voltage collapse on the Hitchland-Woodward 345kV double circuit.

Cluster Group 7 (Southwestern Oklahoma)

This group had 286 MW of interconnection requests in addition to the 1,838 MW of previous queued generation in the area. There were several constraints noticed in the Southwestern Oklahoma area, however, the major constraints were in the Clinton Junction and Weatherford areas due to GEN-2009-030 and constraints on the existing lines out of Washita substation due to all requests in the area To mitigate the constraints in the area, the following upgrades were assigned to the study projects: a second Washita – Anadarko 138kV line was added, a 138kV line from Weatherford – Washita was added, replacement terminal equipment on the Blue Canyon – Washita 138kV line was modeled, and replacement terminal equipment on the GEN-2008-037 – Washita 138kV line was modeled.

Cluster Group 8 (South Central Kansas/North Oklahoma)

This group had 629 MW of interconnection requests in addition to the 3,217 MW of previous queued generation in the area. No new constraints were found in this area. Stability issues in the area of Wolf Creek were identified and are discussed in the stability section.

Cluster Group 9 (Northeast Nebraska)

This group had 201 MW of interconnection requests in addition to the 598 MW of previous queued generation in the area. The major constraints were overloads on the Columbus – Madison County – Ft. Randle 230kV line and the Madison – Norfolk 115kV line. To mitigate the constraints, a 115kV line from Madison County – Norfolk was added, and the Petersburg – Madison 115kV line was tapped and tied to the Madison County 230kV bus.

Cluster Group 10 (North Nebraska)

This group had 0 MW of interconnection requests in addition to the 284 MW of previous queued generation in the area.

Cluster Group 11 (North Kansas)

This group had 322 MW of interconnection requests in addition to the 976 MW of previous queued generation in the area. The major constraints for the North Kansas area are the South Hays – Hays Plant – Vine Street 115kV line, and the Smoky Hills – Summit 230kV line. To mitigate the constraints, the following actions were taken: the South Hays – Hays Plant – Vine Street 115kV line was rebuilt. Also, a second Knoll 345/230kV transformer was added to mitigate the Smoky Hills – Summit 230kV line. Constraints around the interconnection point of GEN-2009-040 were also found but relieved when the Knob Hill – Steele City 115kV STEP upgrade, slated for a 2010 in-service, was added to the base case.

Cluster Group 12 (Northwest Arkansas)

This group had 0 MW of interconnection requests in addition to the 0 MW of previous queued generation in the area.

Cluster Group 13 (Northwest Missouri)

This group had 0 MW of interconnection requests in addition to the 2,481 MW of previous queued generation in the area.

Cluster Group 14 (South Central Oklahoma)
This group had 206 MW of interconnection requests in addition to the 0 MW of previous queued generation in the area. No new constraints were found in this area.

Cluster Group 15 (Southwest Nebraska)
This group had 90 MW of interconnection requests in addition to the 0 MW of previous queued generation in the area. The major constraint was noticed on the Guide Rock – Superior 115kV line. To mitigate the constraint, the line will need to be rebuilt.

Stability Analysis

A stability analysis was conducted for each Interconnection Customer's facility using modified versions of the 2010 winter peak and the 2010 summer peak models. The stability analysis was conducted with all upgrades in service that were identified in the powerflow analysis. For each group, the interconnection requests were studied at 100% nameplate output while the other groups were dispatched at 20% output for wind requests and 100% output for fossil requests. The exception to this practice was that Groups 9 and 10 were combined at the request of Transmission Owner. This exception was analyzed due despite the large geographic area of the two groupings, there are limited transmission paths that the two groups share. The output of the Interconnection Customer's facility was offset in each model by a reduction in output of existing online SPP generation. The following synopsis is included for each group. The entire stability study for each group can be found in the Appendices.

Cluster Group 1 (Woodward Area)
The Group 1 stability study was conducted by Siemens PTI. The analysis for Group 1 showed that a reactive power deficiency was apparent with addition of the interconnection request near Tatonga. The GEN-2008-044 and GEN-2010-011 interconnection requests will need to provide 95% lagging power factor at the point of interconnection (Tatonga). These requests combined will need to be able to provide over 71Mvar at the point of interconnection. This will require additional capacitor banks. With the power factor requirements and all network upgrades in service, all interconnection request in Group 1 will meet FERC Order #661A low voltage ride through (LVRT) requirements.

Power Factor Requirements

Request	Size (MW)	Generator Model	Point of Interconnection	Final PF Requirement at POI		Estimated Capacitor Requirement (Mvar)
				Lagging (supplying)	Leading (absorbing)	
GEN-2008-044	197.8	Siemens SWT 2.3 MW	Tatonga 345kV	0.95 (62 Mvar)	0.95 (-62Mvar)	yes
GEN-2010-008	64.4	Siemens SWT 2.3 MW	Fargo Jct 69kV	1.0	1.0	no
GEN-2010-011	29.7	Siemens SWT 2.3MW	Tatonga 345kV	0.95 (9 Mvar)	0.95 (-9Mvar)	yes

Cluster Group 2 (Hitchland Area)

The Group 2 stability study was conducted by Siemens PTI. The analysis for Group 2 showed that a reactive power deficiency was apparent with addition of the interconnection request near Hitchland. The GEN-2008-044 and GEN-2010-011 interconnection requests will need to provide 95% lagging power factor at the point of interconnection (Hitchland). These requests combined will need to be able to provide over 400Mvar at the point of interconnection. This will require additional capacitor banks. With the power factor requirements and all network upgrades in service, all interconnection request in Group 2 will meet FERC Order #661A low voltage ride through (LVRT) requirements and the transmission system will remain stable.

Power Factor Requirements

Request	Size (MW)	Generator Model	Point of Interconnection	Final PF Requirement at POI		Estimated Capacitor Requirement (Mvar)
				Lagging (supplying)	Leading (absorbing)	
GEN-2008-028	360	GE 1.5MW	Hitchland 345kV	0.95 (114Mvar)	0.95 (-114 Mvar)	Yes (unless GE 90% PF option)
GEN-2008-047	300	G.E. 1.5MW	Hitchland 345kV	0.95 (95Mvar)	0.95 (-95 Mvar)	Yes (unless GE 90% PF option)
GEN-2008-110	300	G.E. 1.5MW	Hitchland 345kV	0.95 (95Mvar)	0.95 (-95 Mvar)	Yes (unless GE 90% PF option)
GEN-2010-007	73.8	Vestes V100 1.8MW	Riverside – Pringle 115kV	0.95 (23 Mvar)	0.95 (-23 Mvar)	Yes
GEN-2010-014	358.8	Siemens 2.3MW	Hitchland 345kV	0.95 (114Mvar)	0.95 (-114 Mvar)	Yes

Cluster Group 3 (Spearville Area)

The Group 3 stability study was conducted by Excel Engineering (Excel). With the power factor requirements and all network upgrades in service, all interconnection request in Group 3 will meet FERC Order #661A low voltage ride through (LVRT) requirements and the transmission system will remain stable.

Power Factor Requirements

Request	Size (MW)	Generator Model	Point of Interconnection	Final PF Requirement at POI		Estimated Capacitor Requirement (Mvar)
				Lagging (supplying)	Leading (absorbing)	
GEN-2009-059	100.5	GE 1.5MW	Tap G08-79T – Cudahay 115kV (573029-539659)	1.000	0.956	0
GEN-2010-009	165.6	Siemens SWT 2.3MW	Gray County 345kV (531000)(G07-040-POI)	0.974	0.974	9
GEN-2010-015	200.1	Siemens SWT 2.3MW	Spearville 345kV (531469)	0.950	1.000	35

GEN-2010-016	199.8	Vestas V90 1.8MW	Tap Spearville (531469) – Knoll (560004) 345kV	0.950	0.992	99

Cluster Group 4 (Mingo Area)

There was no stability analysis conducted in the Mingo area due to no requests in the area.

Cluster Group 5 (Amarillo Area)

The Group 5 stability study was conducted by ABB Consulting Inc. (ABB). The Amarillo area stability analysis revealed no new stability issues due to the addition of the study projects. With the power factor requirements and all network upgrades in service, all interconnection request in Group 5 will meet FERC Order #661A low voltage ride through (LVRT) requirements and the transmission system will remain stable.

Power Factor Requirements

Request	Size (MW)	Generator Model	Point of Interconnection	Final PF Requirement at POI		Estimated Capacitor Requirement (Mvar)
				Lagging (supplying)	Leading (absorbing)	
GEN-2008-088	50.6	Siemens SWT 2.3MW	Vega 69kV	1.0	0.976	0

Cluster Group 6 (South Panhandle Area)

The Group 6 stability analysis was conducted by S&C Engineering (S&C). With the power factor requirements and all network upgrades in service, all interconnection request in Group 6 will meet FERC Order #661A low voltage ride through (LVRT) requirements and the transmission system will remain stable

Power Factor Requirements

Request	Size (MW)	Generator Model	Point of Interconnection	Final PF Requirement at POI		Estimated Capacitor Requirement (Mvar)
				Lagging (supplying)	Leading (absorbing)	
GEN-2008-022	300	G.E. 1.5MW	Eddy – Tolk 345kV			
GEN-2009-067S	20	Solar	Seven Rivers 69kV	0.95	0.95	
GEN-2010-006	205	GENROU	Jones 230kV	0.95	0.95	0
ASGI-2010-010	48	GENROU	Lovington 115kV	0.95	0.95	0

Cluster Group 7 (Southwest Oklahoma)

The Group 7 stability analysis was conducted by Excel Engineering (Excel). With the power factor requirements and all network upgrades in service, all interconnection request in Group 7 will meet FERC Order #661A low voltage ride through (LVRT) requirements and the transmission system will remain stable

Power Factor Requirements

Request	Size (MW)	Generator Model	Point of Interconnection	Final PF Requirement at POI		Estimated Capacitor Requirement (Mvar)
				Lagging (supplying)	Leading (absorbing)	
GEN-2008-037	100.8	Vestas V90 1.8MW	Washita (521089)	1.000	0.974	55
GEN-2009-030	100.8	GE 1.6MW	Weatherford 138kV (521092)	0.962	0.971	0
GEN-2009-060	85.5	GE 1.5MW	Gotebo 69kV (520925)	1.000	0.960	0

Cluster Group 8 (South Central Kansas)

The Group 8 stability analysis was conducted by Pterra Consulting (Pterra). The South Central Kansas stability analysis revealed possible oscillatory issues with GEN-2008-098 and GEN-2010-003 in relation to the Wolf Creek nuclear plant. To relieve these oscillation issues, these requests will need to install a +/-15Mvar Static Var Compensator at the wind farm. With the power factor requirements, the SVCs, and all network upgrades in service, all interconnection request in Group 8 will meet FERC Order #661A low voltage ride through (LVRT) requirements and the transmission system will remain stable.

Power Factor Requirements

Request	Size (MW)	Generator Model	Point of Interconnection	Final PF Requirement at POI		Estimated Capacitor Requirement (Mvar)
				Lagging (supplying)	Leading (absorbing)	
GEN-2008-071	76.8	GE 1.6MW	Newkirk 138kV	0.99	0.99	12
GEN-2008-098	100.8	Vestas V90 1.8MW	Wolf Creek – LaCygne 345kV	1.0	0.98	10 Mvar SVC
GEN-2010-003	100.8	Vestas V90 1.8MW	GEN-2008-098	1.0	0.98	8
GEN-2010-005	300	Clipper C95 2.5MW	Wichita – Woodring 345kV	0.97	1.0	60
GEN-2010-013	50.4	Vestas V90 1.8MW	Latham – Neosho 345kV	0.95	0.95	24

Cluster Group 9 (Northeast Nebraska)

The Group 9 stability analysis was conducted by Excel Engineering (Excel). With the power factor requirements and all network upgrades in service, all interconnection request in Group 9 will meet FERC Order #661A low voltage ride through (LVRT) requirements and the transmission system will remain stable. The study identified a possible underfrequency trip by the GE turbines for GEN-2008-06N2 for faults at the point of interconnection. At this time, this is thought to be a numerical modeling issue for three phase faults. This issue will be further analyzed in the Facility.

Power Factor Requirements

Request	Size (MW)	Generator Model	Point of Interconnection	Final PF Requirement at POI		Estimated Capacitor Requirement (Mvar)
				Lagging (supplying)	Leading (absorbing)	
GEN-2006-044N02	100.5	GE 1.5MW	Madison County 230kV	1.0	0.982	0
GEN-2010-010	100.5	GE 1.5MW	Madison County 115kV	0.976	0.987	0

Cluster Group 10 (North Nebraska)

There was no stability analysis conducted in the North Nebraska area due to no requests in the area.

Cluster Group 11 (North Kansas)

The Group 11 stability analysis was conducted by Pterra Consulting (Pterra). The North Kansas stability analysis revealed that GEN-2009-020 will require a +/-15 Mvar Static Var Compensator. With the power factor requirements, and all network upgrades in service, all interconnection request in Group 11 will meet FERC Order #661A low voltage ride through (LVRT) requirements and the transmission system will remain stable.

Power Factor Requirements

Request	Size (MW)	Generator Model	Point of Interconnection	Final PF Requirement at POI		Estimated Capacitor Requirement (Mvar)
				Lagging (supplying)	Leading (absorbing)	
GEN-2009-008	199.5	GE 1.5MW	South Hays 230kV	0.99	0.982	0
GEN-2009-020	48.6	Vestes V90 1.8MW	Balzine – Nekoma 69kV	1.0	0.98	15* (SVC required)
GEN-2009-040	73.8	Vestes V90 1.8MW	Smittyville-Knob Hill 115kV	1.0	0.95	15

Cluster Group 12 (Northwest Arkansas)

There was no stability analysis conducted in the Northwest Arkansas area due to no requests in the area.

Cluster Group 13 (Northwest Missouri)

There was no stability analysis conducted in the Northwest Missouri area due to no requests in the area.

Cluster Group 14 (South Central Oklahoma)

The Group 14 stability analysis was conducted by Black & Veatch. The South Central Oklahoma stability analysis revealed no stability issues with the study requests.

Power Factor Requirements

Request	Size (MW)	Generator Model	Point of Interconnection	Final PF Requirement at POI		Estimated Capacitor Requirement (Mvar)
				Lagging (supplying)	Leading (absorbing)	
GEN-2008-046	200MW	Vestes V90 1.8MW	Sunnyside 345kV	1.0	0.95	16
GEN-2009-032S	6.4	GENROU	Foster 138kV	0.95	0.95	0

Cluster Group 15 (Southwest Nebraska)

The Group 15 stability analysis was conducted by AMEC Environmental (AMEC). The Group 15 stability analysis revealed no stability issues with the study request. With the power factor requirements and network upgrades in service, the interconnection requests will met FERC LVRT requirements and the transmission system will remain stable.

Power Factor Requirements

Request	Size (MW)	Generator Model	Point of Interconnection	Final PF Requirement		Estimated Capacitor Requirement (Mvar)
				Lagging (supplying)	Leading (absorbing)	
GEN-2008-123N	89.7Mw	Siemens SWT 2.3 MW	Pauline – Guide Rock 115kV	1.0	0.95	0

Conclusion

The minimum cost of interconnecting all of the interconnection requests included in this Impact Cluster Study is estimated at $662,696,737 for the Allocated Network Upgrades and Transmission Owner Interconnection Facilities are listed in Appendix E, F, and G These costs do not include the cost of upgrades of other transmission facilities listed in Appendix H which are Network Constraints.

These interconnection costs do not include any cost of Network Upgrades determined to be required by short circuit analysis. These studies are being performed as part of the Interconnection System Facility Study that each customer has already executed.

The required interconnection costs listed in Appendices E, and F, and G and other upgrades associated with Network Constraints do not include all costs associated with the deliverability of the energy to final customers. These costs are determined by separate studies if the Customer submits a Transmission Service Request (TSR) through SPP's Open Access Same Time Information System (OASIS) as required by Attachment Z1 of the SPP Open Access Transmission Tariff (OATT).

Appendix

A: Generation Interconnection Requests Considered for Impact Study

Request	Amount	Area	Requested Point of Interconnection	Proposed Point of Interconnection	Requested In-Service Date
GEN-2006-044N02	100.5	NPPD	GEN-2008-086N02 230kV	GEN-2008-086N02 230kV	
GEN-2008-022	300	SPS	TAP EDDY – GEN-2007-034 345kV	TAP EDDY – GEN-2007-034 345kV	09/01/2011
GEN-2008-028	360	SPS	HITCHLAND 345kV	HITCHLAND 345kV	12/31/2012
GEN-2008-037	100.8	WFEC	TAP WASHITA - BLUE CANYON 138kV	TAP WASHITA - BLUE CANYON 138kV	1/1/2010
GEN-2008-044	197.8	OKGE	TATONGA 345kV	TATONGA 345kV	12/1/2011
GEN-2008-046	200	OKGE	SUNNYSIDE 345kV	SUNNYSIDE 345kV	12/1/2010
GEN-2008-047	300	SPS	TAP HITCHLAND - WOODWARD 345kV	HITCHLAND 345kV	12/31/2012
GEN-2008-071	76.8	OKGE	NEWKIRK 138kV	NEWKIRK 138kV	11/1/2010
GEN-2008-088	50.6	SPS	VEGA 69kV	VEGA 69kV	12/1/2011
GEN-2008-098	100.8	WERE	TAP WOLF CREEK - LACYGNE 345kV	TAP WOLF CREEK - LACYGNE 345kV	12/31/2011
GEN-2008-110	299.2	SPS	HITCHLAND 345kV	HITCHLAND 345kV	7/31/2011
GEN-2008-123N	89.7	NPPD	TAP GUIDE - PAULINE 115kV	TAP GUIDE - PAULINE 115kV	
GEN-2009-008	200	SUNC	SOUTH HAYS 230kV	SOUTH HAYS 230kV	9/1/2011
GEN-2009-020	48.6	MIDW	TAP BAZINE - NEKOMA 69kV	TAP BAZINE - NEKOMA 69kV	12/31/2011
GEN-2009-030	100.8	WFEC	WEATHERFORD 138kV	WEATHERFORD 138kV	7/1/2012
GEN-2009-032S	6.4	OKGE	FOSTER 138kV	FOSTER 138kV	8/1/2010
GEN-2009-040	73.8	WERE	TAP SMITTYVILLE - KNOB HILL 115kV	TAP SMITTYVILLE - KNOB HILL 115kV	12/31/2012
GEN-2009-059	100.5	SUNC	TAP GEN-2008-079 - CUDAHY 115kV	TAP GEN-2008-079 - CUDAHY 115kV	12/31/2011
GEN-2009-060	84	WFEC	GOTEBO 69kV	GOTEBO 69kV	12/31/2011
GEN-2009-062	115	SUNC	HUGOTON 115kV	HUGOTON 115kV	9/30/2012
GEN-2009-067S	20	SPS	7 RIVERS 69kV	7 RIVERS 69kV	12/1/2010
GEN-2010-003	100.8	WERE	GEN-2008-098 345kV	GEN-2008-098 345kV	12/31/2011
GEN-2010-005	300	MKEC	GEN-2007-025 345kV	GEN-2007-025 345kV	12/1/2012
GEN-2010-006	205	SPS	JONES 230kV	JONES 230kV	6/1/2012
GEN-2010-007	73.8	SPS	TAP PRINGLE - RIVERVIEW 115kV	TAP PRINGLE - RIVERVIEW 115kV	12/1/2011
GEN-2010-008	64.4	WFEC	FARGO 69kV	FARGO 69kV	12/22/2011
GEN-2010-009	165.6	SUNC	GRAY COUNTY 345kV	GRAY COUNTY 345kV	12/1/2011
GEN-2010-010	100.5	NPPD	TAP GEN-2008-086N02 - COLUMBUS 230kV	TAP GEN-2008-086N02 - COLUMBUS 230kV	12/1/2012
GEN-2010-011	29.7	OKGE	GEN-2008-044 345kV	GEN-2008-044 345kV	12/31/2011
GEN-2010-013	50.4	WERE	GEN-2005-013 345kV	GEN-2005-013 345kV	12/31/2011
GEN-2010-014	358.8	SPS	HITCHLAND 345kV	HITCHLAND 345kV	12/13/2013
GEN-2010-015	200.1	SUNC	SPEARVILLE 345kV	SPEARVILLE 345kV	1/1/2013
GEN-2010-016	199.8	MIDW	TAP SPEARVILLE - KNOLL 345kV	TAP SPEARVILLE - KNOLL 345kV	12/31/2015
ASGI-2010-010	42	SPS	LOVINGTON 115kV	LOVINGTON 115kV	
ASGI-2010-011	48	SPS	TEXAS COUNTY 69kV	TEXAS COUNTY 69kV	
GROUPED TOTAL	**4,864.2**				

***** Planned Facility

^ Proposed Facility

******* Electrically Remote Interconnection Requests

B: Prior Queued Interconnection Requests

Request	Amount	Area	Requested/Proposed Point of Interconnection	Status or In-Service Date
GEN-2001-014	96	WFEC	Fort Supply 138kV	On-Line
GEN-2001-026	74	WFEC	Washita 138kV	On-Line
GEN-2001-033	180	SPS	San Juan Mesa Tap 230kV	On-Line
GEN-2001-036	80	SPS	Caprock Tap 115kV	On-Line
GEN-2001-037	100	OKGE	Windfarm Switching 138kV	On-Line
GEN-2001-039A	105	WPEK	Tap Greensburg - Judson-Large 115kV	On Schedule for 2011
GEN-2001-039M	100	SUNC	Central Plains Tap 115kV	On-Line
GEN-2002-004	200	WERE	Latham 345kV	On-Line
GEN-2002-005	120	WFEC	Red Hills Tap 138kV	On-Line
GEN-2002-006	150	SPS	Texas County 115kV	IA Executed/On Schedule 12/31/2010
GEN-2002-008	240	SPS	*****Hitchland 345kV	On-Line at 120MW
GEN-2002-009	80	SPS	Hansford County 115kV	On-Line
GEN-2002-022	240	SPS	Bushland 230kV	On-Line at 160MW
GEN-2002-025A	150	WPEK	Spearville 230kV	On-Line at 100MW
GEN-2003-005	100	WFEC	Tap Anadarko - Paradise 138kV	On Line
GEN-2003-006A-E	100	EMDE	Elm Creek 230kV	On-Line
GEN-2003-006A-W	100	WERE	Elm Creek 230kV	On-Line
GEN-2003-013**	198	SPS	Tap *****Hitchland - Finney 345kV	On Schedule for 2012
GEN-2003-019	250	MIDW	Smoky Hills Tap 230kV	On-Line
GEN-2003-020	160	SPS	Martin 115kV	On-Line at 80MW
GEN-2003-021N	75	NPPD	Ainsworth Wind Tap 115kV	On-Line at 60MW
GEN-2003-022	120	AEPW	Washita 138kV	On-Line
GEN-2004-005N	30	NPPD	St. Francis 115kV	IA Pending
GEN-2004-010	300	WERE	Latham 345kV	On-Line
GEN-2004-014	155	MIDW	Spearville 230kV	On Schedule for 2010
GEN-2004-020	27	AEPW	Washita 138kV	On-Line
GEN-2005-005	18	OKGE	Windfarm Switching 138kV	IA Pending
GEN-2005-008	120	OKGE	Woodward 138kV	On-Line
GEN-2005-010	160	SPS	Tap Roosevelt County - Tolk West 230kV (Single Ckt Tap)	On Suspension
GEN-2005-012	250	WPEK	Spearville 345kV	On Suspension
GEN-2005-013	201	WERE	Tap Latham - Neosho	On Schedule for 2012
GEN-2005-015	150	SPS	Tap Tuco - Oklaunion 345kV	On Suspension
GEN-2005-016	150	WERE	Tap Latham - Neosho	On Schedule for 2012
GEN-2005-017	340	SPS	Tap *****Hitchland - Potter County 345kV	On Suspension
GEN-2005-021	86	SPS	Kirby 115kV	On Suspension
GEN-2006-002	150	AEPW	Tap Grapevine - Elk City 230kV	On Suspension
GEN-2006-006	206	MKEC	Spearville 230kV	Under Study (ICS-2008-001)
GEN-2006-014	300	MIPU	Tap Maryville – Clarinda and tie Midway (WFARMS) 161kV	On Suspension
GEN-2006-017	300	MIPU	Tap Maryville – Clarinda and tie Midway (WFARMS) 161kV	On Suspension
GEN-2006-018	170	SPS	Tuco 230kV	On Schedule for 2010

Request	Amount	Area	Requested/Proposed Point of Interconnection	Status or In-Service Date
GEN-2006-020S	18.9	SPS	*DWS Frisco Tap	IA Executed/On Schedule 12/31/2010
GEN-2006-020N	42	NPPD	Bloomfield 115kV	1/1/2009
GEN-2006-021	101	WPEK	Flat Ridge Tap 138kV	On-Line (100MW)
GEN-2006-022	150	WPEK	Ninnescah Tap 115kV	On Suspension
GEN-2006-024S	20	WFEC	South Buffalo Tap 69kV	On-Line
GEN-2006-031	75	MIDW	Knoll 115kV	On-Line
GEN-2006-032	200	MIDW	South Hays 230kV	On Suspension
GEN-2006-034	81	SUNC	Tap Kanarado - Sharon Springs 115kV	On Suspension
GEN-2006-035	225	AEPW	Tap Grapevine - Elk City 230kV	On Schedule for 2010
GEN-2006-037N1	75	NPPD	Broken Bow 115kV	Under Study (DISIS-2009-001)
GEN-2006-038N005	80	NPPD	Broken Bow 115kV	IA Pending
GEN-2006-038N019	80	NPPD	Petersburg 115kV	5/1/2011
GEN-2006-038	750	WFEC	Hugo 345kV	On Suspension
GEN-2006-039	400	SPS	Tap and Tie both Potter County - Plant X 230kV and Bushland - Deaf Smith 230kV	On Suspension
GEN-2006-040	108	SUNC	Mingo 115kV	On Schedule for 2010
GEN-2006-043	99	AEPW	Tap Grapevine - Elk City 230kV	On schedule for 2009
GEN-2006-044	370	SPS	*Hitchland 345kV	On Suspension
GEN-2006-044N	40.5	NPPD	Tap Neligh – Petersburg 115kV	Under Study (DISIS-2009-001)
GEN-2006-045	240	SPS	Tap and Tie both Potter County - Plant X 230kV and Bushland - Deaf Smith 230kV	On Suspension
GEN-2006-046	131	OKGE	Dewey 138kV	On Schedule for 2010
GEN-2006-047	240	SPS	Tap and Tie both Potter County - Plant X 230kV and Bushland - Deaf Smith 230kV	On Schedule for 2013
GEN-2006-049	400	SPS	Tap *Hitchland - Finney 345kV	IA Pending
GEN-2007-002	160	SPS	Grapevine 115kV	On Suspension
GEN-2007-005	200	SPS	Pringle 115kV	Under Study (ICS-2008-001)
GEN-2007-006	160	OKGE	Roman Nose 138kV	On Suspension
GEN-2007-011	135	SUNC	Syracuse 115kV	On Schedule for 2010
GEN-2007-011N06	75	NPPD	Tap Neligh - Petersburg 115kV	Under Study (DISIS-2009-001)
GEN-2007-011N08	81	NPPD	Bloomfield 115kV	On-Line
GEN-2007-011N09	75	NPPD	Bloomfield 115kV	Under Study (DISIS-2009-001)
GEN-2007-013	99	SUNC	Selkirk 115kV	On Schedule
GEN-2007-015	135	WERE	Tap Humboldt – Kelly 161kV	On Schedule for 2011
GEN-2007-017	101	MIPU	Tap Maryville – Clarinda and tie to Midway (WFARMS)161kV	On Schedule for 2012
GEN-2007-021	201	OKGE	*Tatonga 345kV	Under Study (ICS-2008-001)
GEN-2007-025	300	WERE	Tap Woodring – Wichita 345kV	Under Study (ICS-2008-001)

Request	Amount	Area	Requested/Proposed Point of Interconnection	Status or In-Service Date
GEN-2007-032	150	WFEC	Tap Clinton Junction – Clinton 138kV	Under Study (ICS-2008-001)
GEN-2007-034	150	SPS	Tap Eddy – Tolk 345kV	Under Study (ICS-2008-001)
GEN-2007-038	200	SUNC	Spearville 345kV	Under Study (ICS-2008-001)
GEN-2007-040	200	SUNC	Tap Holcomb – Spearville 345kV	Under Study (DISIS-2009-001)
GEN-2007-043	300	AEPW	Tap Lawton Eastside – Cimarron 345kV	Under Study (ICS-2008-001)
GEN-2007-044	300	OKGE	*Tatonga 345kV	Under Study (ICS-2008-001)
GEN-2007-046	200	SPS	Tap & Tie Texas County – Hitchland & DWS Frisco Tap – Hitchland 115kV	Under Study (ICS-2008-001)
GEN-2007-048	400	SPS	Tap Amarillo South – Swisher 230kV	Under Study (ICS-2008-001)
GEN-2007-050	170	OKGE	*Woodward 138kV	Under Study (ICS-2008-001)
GEN-2007-051	200	WFEC	Mooreland 138kV	Under Study (ICS-2008-001)
GEN-2007-052	150	WFEC	Anadarko 138kV	Under Study (ICS-2008-001)
GEN-2007-053	110	MIPU	Tap Maryville – Clarinda and tie to Midway (WFARMS)161kV	Under Study (ICS-2008-001)
GEN-2007-057	35	SPS	Moore County East 115kV	Under Study (ICS-2008-001)
GEN-2007-062**	765	OKGE	*Woodward 345kV	Under Study (ICS-2008-001)
GEN-2008-003	101	OKGE	*Woodward EHV 138kV	Under Study (ICS-2008-001)
GEN-2008-008	60	SPS	Graham 115kV	Under Study (ICS-2008-001)
GEN-2008-009	60	SPS	San Juan Mesa Tap 230kV	Under Study (ICS-2008-001)
GEN-2008-013	300	OKGE	Tap Woodring – Wichita 345kV	Under Study (ICS-2008-001)
GEN-2008-014	150	SPS	Tap Tuco – Oklaunion 345kV	Under Study (ICS-2008-001)
GEN-2008-016	248	SPS	Grassland 230kV	Under Study (ICS-2008-001)
GEN-2008-017	300	SUNC	Setab 345kV	Under Study (ICS-2008-001)
GEN-2008-018	405	SUNC	Finney 345kV	Under Study (ICS-2008-001)
GEN-2008-019**	300	OKGE	*Tatonga 345kV	Under Study (ICS-2008-001)
GEN-2008-021	42	WERE	Wolf Creek 345kV	Under Study (DISIS-2009-001)
GEN-2008-023	150	AEPW	Hobart Junction 138kV	Under Study (DISIS-2009-001)
GEN-2008-025	101.2	SUNC	Ruleton 115kV	Under Study (DISIS-2009-001)
GEN-2008-029	250.5	OKGE	Woodward EHV 138kV	Under Study (DISIS-2009-001)
GEN-2008-038	144	AEPW	Tap Shidler – West Pawhuska 138kV	Under Study (DISIS-2009-001)
GEN-2008-051	322	SPS	Potter 345kV	Under Study (DISIS-2009-001)
GEN-2008-079	100.5	MKEC	Tap Judson Large – Cudahy 115kV	Under Study (DISIS-2009-001)
GEN-2008-086N02	200	NPPD	Tap Ft. Randall – Columbus 230kV	Under Study (DISIS-2009-001)

Request	Amount	Area	Requested/Proposed Point of Interconnection	Status or In-Service Date
GEN-2008-092	201	MIDW	Knoll 115kV	Under Study (DISIS-2009-001)
GEN-2008-119O	60	OPPD	Tap Humboldt – Kelly (North of GEN-2007-015) 161kV	Under Study (DISIS-2009-001)
GEN-2008-124	200.1	MKEC	Spearville 230kV	Under Study (DISIS-2009-001)
GEN-2008-127	200.1	WERE	Tap Sooner – Rose Hill 345kV	Under Study (DISIS-2009-001)
GEN-2008-129	46S/80W	MIPU	Pleasant Hill 161kV	Under Study (DISIS-2009-001)
GEN-2009-011	50	MKEC	Tap Plainville – Phillipsburg 115kV	Under Study (DISIS-2009-001)
GEN-2009-016	140.3	AEPW	Falcon Road 138kV	Under Study (DISIS-2009-001)
GEN-2009-017**	60	SPS	Tap Pembrook – Stiles 138kV	Under Study (DISIS-2009-001)
GEN-2009-025	60	OKGE	Tap Deer Creek – Sinclair 69kV	Under Study (DISIS-2009-001)
Broken Bow	8.3	NPPD	Genoa 115kV	On-Line
Ord	13.9	NPPD	Bloomfield 115kV	On-Line
Stuart	2.1	NPPD	Petersburg 115kV	On-Line
Genoa	4	NPPD	Genoa 115kV	On-Line
ASGI-2010-001	400	AECI	Tap Cooper – Fairport 345kV	AECI queue Affected Study
ASGI-2010-002	201	AECI	Lathrop 161kV	AECI queue Affected Study
ASGI-2010-003	300	AECI	Maryville 161kV	AECI queue Affected Study
ASGI-2010-004	50	AECI	Tap Queen City – Lancaster 69kV	AECI queue Affected Study
ASGI-2010-005	99	AECI	Lathrop 161kV	AECI queue Affected Study
ASGI-2010-006	150	AECI	Tap Fairfax – Fairfax Tap 138kV	AECI queue Affected Study
ASGI-2010-007	150	AECI	Tap Fairfax – Fairfax Tap 138kV	AECI queue Affected Study
ASGI-2010-008	100	AECI	Maryville 161kV	AECI queue Affected Study
ASGI-2010-009	201	AECI	Osborn 161kV	AECI queue Affected Study
Llanoest	80	SPS	Llano Wind Farm Tap 115kV	On-Line
			DUMAS_19ST 115kV	On-Line
			Etter 115kV	On-Line
			Sherman 115kV	On-Line
			Spearman 115kV	On-Line
SPSDISTR	90	SPS	Texas County 115kV	On-Line
			Washita 138kV (GEN-2003-004)	On-Line
			Washita 138kV (GEN-2004-023)	On-Line
BLUCAN2	153	WFEC	Washita 138kV (GEN-2005-003)	On-Line
Monte	110	MKEC	Haggard 115kV	On-Line
GROUPED TOTAL	**21,507.4**			

** Interconnection on Caprock Electric tested for impacts on SPP

***** Planned Facility

^ Proposed Facility

C: Study Groupings

Cluster	Request	Amount	Area	Proposed Point of Interconnection
Prior Queued	GEN-2001-014	96	WFEC	Fort Supply 138kV
	GEN-2001-037	100	OKGE	Windfarm Switching 138kV
	GEN-2002-005	120	WFEC	Tap Morewood - Elk City 138kV
	GEN-2005-005	18	OKGE	Windfarm Tap 138kV
	GEN-2005-008	120	OKGE	Woodward 138kV
	GEN-2006-024S	20	WFEC	South Buffalo Tap 69kV
	GEN-2006-046	131	OKGE	Dewey 138kV
	GEN-2007-006	160	OKGE	Roman Nose 138kV
	GEN-2007-021	201	OKGE	*Tatonga 345kV
	GEN-2007-044	300	OKGE	*Tatonga 345kV
	GEN-2007-050	170	OKGE	*Woodward 345kV
	GEN-2007-051	200	WFEC	Mooreland 138kV
	GEN-2007-062	765	OKGE	*Woodward 345kV
	GEN-2008-003	101	OKGE	*Woodward EHV 138kV
	GEN-2008-019	300	OKGE	*Tatonga 345kV
	GEN-2008-029	250.5	OKGE	WOODWARD EHV 138kV
	PRIOR QUEUED SUBTOTAL	**3,052.5**		
Cluster	**Request**	**Amount**	**Area**	**Proposed Point of Interconnection**
Woodward	GEN-2008-044	197.8	OKGE	Tatonga 345kV
	GEN-2010-008	64.4	WFEC	Fargo 69kV
	GEN-2010-011	29.7	OKGE	GEN-2008-044 345kV
	WOODWARD SUBTOTAL	**291.9**		
	AREA SUBTOTAL	**3,344.4**		

Cluster	Request	Amount	Area	Proposed Point of Interconnection
Prior Queued	SPS Distribution	90	SPS	Various
	GEN-2002-006	150	SPS	Texas County 115kV
	GEN-2002-008	240	SPS	*Hitchland 345kV
	GEN-2002-009	80	SPS	Hansford County 115kV
	GEN-2003-013	198	SPS	*Tap Hitchland - Finney 345kV
	GEN-2003-020	160	SPS	Martin 115kV
	GEN-2005-017	340	SPS	*Tap Hitchland - Potter County 345kV
	GEN-2006-020S	18.9	SPS	DWS Frisco Tap
	GEN-2006-044	370	SPS	*Hitchland 345kV
	GEN-2006-049	400	SPS	*Tap Hitchland - Finney 345kV
	GEN-2007-005	200	SPS	Pringle 115kV
	GEN-2007-046	200	SPS	Tap & Tie Texas County – Hitchland & DWS Frisco Tap – Hitchland 115kV
	GEN-2007-057	35	SPS	Moore County East 115kV
	PRIOR QUEUED SUBTOTAL	**2,481.9**		
Cluster	**Request**	**Amount**	**Area**	**Proposed Point of Interconnection**
Hitchland	GEN-2008-028	360	SPS	Tap Washita – Blue Canyon 138kV
	GEN-2008-047	300	SPS	Hitchland 345kV
	GEN-2008-110	299.2	SPS	Hitchland 345kV
	GEN-2010-007	73.8	SPS	Tap Pringle – Riverview 115kV
	GEN-2010-014	358.8	SPS	Hitchland 345kV
	ASGI-2010-011	48	SPS	Texas County 69kV
	HITCHLAND SUBTOTAL	**1,391.8**		
	AREA SUBTOTAL	**3,873.7**		

Cluster	Request	Amount	Area	Proposed Point of Interconnection
Prior Queued	Montezuma	110	MKEC	Haggard 115kV
	GEN-2001-039A	105	WPEK	Tap Greensburg - Judson-Large 115kV
	GEN-2002-025A	150	WPEK	Spearville 230kV
	GEN-2004-014	155	MIDW	Spearville 230kV
	GEN-2005-012	250	WPEK	Spearville 345kV
	GEN-2006-006	206	MKEC	Spearville 230kV
	GEN-2006-021	101	WPEK	Flat Ridge Tap 138kV
	GEN-2006-022	150	WPEK	Ninnescah Tap 115kV
	GEN-2007-038	200	SUNC	Spearville 345kV
	GEN-2007-040	200	SUNC	Tap Holcomb – Spearville 345kV
	GEN-2008-018	405	SUNC	Finney 345kV
	GEN-2008-079	100.5	MKEC	Tap Judson Large – Cudahy 115kV
	GEN-2008-124	200.1	MKEK	Spearville 230kV
	PRIOR QUEUED SUBTOTAL	**2,332.6**		
Cluster	**Request**	**Amount**	**Area**	**Proposed Point of Interconnection**
Spearville	GEN-2009-059	100.5	SUNC	Tap GEN-2008-079 – Cudahy 115kV
	GEN-2009-062	115	SUNC	Hugoton 115kV
	GEN-2010-009	165.6	SUNC	Gray County 345kV
	GEN-2010-015	200.1	SUNC	Spearville 345kV
	GEN-2010-016	199.8	MIDW	Tap Spearville – Knoll 345kV
	SPEARVILLE SUBTOTAL	**781**		
	AREA SUBTOTAL	**3,113.6**		

Cluster	Request	Amount	Area	Proposed Point of Interconnection
Prior Queued	GEN-2001-039M	100	SUNC	Tap Leoti - City Services 115kV
	GEN-2006-034	81	SUNC	Tap Kanarado - Sharon Springs 115kV
	GEN-2006-040	108	SUNC	Mingo 115kV
	GEN-2007-011	135	SUNC	Syracuse 115kV
	GEN-2007-013	99	SUNC	Selkirk 115kV
	GEN-2008-017	300	SUNC	Setab 345kV
	GEN-2008-025	101.2	SUNC	Ruleton 115kV
	PRIOR QUEUED SUBTOTAL	**924.2**		
	MINGO/NW KANSAS SUBTOTAL	**924.2**		

Cluster	Request	Amount	Area	Proposed Point of Interconnection
Prior Queued	Llano Estacado	80	SPS	Llano Estacado Tap 115kV
	GEN-2002-022	240	SPS	Bushland 230kV
	GEN-2005-021	86	SPS	Kirby 115kV
	GEN-2006-039	400	SPS	Tap and Tie both Potter County - Plant X 230kV and Bushland - Deaf Smith 230kV
	GEN-2006-045	240	SPS	Tap and Tie both Potter County - Plant X 230kV and Bushland - Deaf Smith 230kV
	GEN-2006-047	240	SPS	Tap and Tie both Potter County - Plant X 230kV and Bushland - Deaf Smith 230kV
	GEN-2007-002	160	SPS	Grapevine 115kV
	GEN-2007-048	400	SPS	Tap Amarillo South – Swisher 230kV
	GEN-2008-051	322	SPS	Potter 345kV
PRIOR QUEUED SUBTOTAL		**2,168**		
Cluster	**Request**	**Amount**	**Area**	**Proposed Point of Interconnection**
Amarillo	GEN-2008-088	50.6	SPS	Vega 69kV
AMARILLO SUBTOTAL		**50.6**		
AREA SUBTOTAL		**2,218.6**		

Cluster	Request	Amount	Area	Proposed Point of Interconnection
Prior Queued	GEN-2001-033	180	SPS	San Juan Mesa Tap 230kV
	GEN-2001-036	80	SPS	Norton 115kV
	GEN-2005-010	160	SPS	Tap Roosevelt County - Tolk West 230kV (Single Ckt Tap)
	GEN-2005-015	150	SPS	Tap Tuco - Oklaunion 345kV
	GEN-2006-018	170	SPS	Tuco 230kV
	GEN-2007-034	150	SPS	Tap Eddy – Tolk 345kV
	GEN-2008-008	60	SPS	Graham 115kV
	GEN-2008-009	60	SPS	San Juan Mesa Tap 230kV
	GEN-2008-014	150	SPS	Tap Tuco – Oklaunion 345kV
	GEN-2008-016	248	SPS	Grassland 230kV
	GEN-2009-017	60	SPS	Tap Pembrook – Stiles 138kV
PRIOR QUEUED SUBTOTAL		**1,468**		
Cluster	**Request**	**Amount**	**Area**	**Proposed Point of Interconnection**
S Pandle	GEN-2008-022	300	SPS	Tap Eddy – GEN-2007-034 345kV
	GEN-2009-067S	20	SPS	7 Rivers 69kV
	GEN-2010-006	205	SPS	Jones 345kV
	ASGI-2010-010	42	SPS	Lovington 115kV
SOUTH PANHANDLE/NM SUBTOTAL		**615**		
AREA SUBTOTAL		**2,083**		

Cluster	Request	Amount	Area	Proposed Point of Interconnection
Prior Queued	GEN-2001-026	74	WFEC	Washita 138kV
	GEN-2003-004	101	WFEC	Washita 138kV
	GEN-2003-005	100	WFEC	Anadarko - Paradise 138kV
	GEN-2003-022	120	AEPW	Washita 138kV
	GEN-2004-020	27	AEPW	Washita 138kV
	GEN-2004-023	21	WFEC	Washita 138kV
	GEN-2005-003	31	WFEC	Washita 138kV
	GEN-2006-002	150	AEPW	Grapevine - Elk City 230kV
	GEN-2006-035	225	AEPW	Grapevine - Elk City 230kV
	GEN-2006-043	99	AEPW	Grapevine - Elk City 230kV
	GEN-2007-032	150	WFEC	Tap Clinton Junction – Clinton 138kV
	GEN-2007-043	300	AEPW	Tap Lawton Eastside – Cimarron 345kV
	GEN-2007-052	150	WFEC	Anadarko 138kV
	GEN-2008-023	150	AEPW	Hobart Junction 138kV
	GEN-2009-016	140.3	AEPW	Falcon Road 138kV
PRIOR QUEUED SUBTOTAL		**1,838.3**		
Cluster	**Request**	**Amount**	**Area**	**Proposed Point of Interconnection**
SW Oklahoma	GEN-2008-037	100.8	WFEC	Tap Washita – Blue Canyon 138kV
	GEN-2009-030	100.8	WFEC	Weatherford 138kV
	GEN-2009-060	84	WFEC	Gotebo 69kV
SW OKLAHOMA SUBTOTAL		**285.6**		
AREA SUBTOTAL		**2,123.9**		

Cluster	Request	Amount	Area	Proposed Point of Interconnection
Prior Queued	Wolf Creek	1,170	WERE	Wolf Creek 345kV
	ASGI-2010-006	150	AECI	Tap Fairfax – Fairfax Tap 138kV
	ASGI-2010-007	150	AECI	Tap Fairfax – Fairfax Tap 138kV
	GEN-2002-004	200	WERE	Latham 345kV
	GEN-2004-010	300	WERE	Latham 345kV
	GEN-2005-013	201	WERE	Tap Latham - Neosho
	GEN-2005-016	150	WERE	Tap Latham - Neosho
	GEN-2007-025	300	WERE	Tap Woodring – Wichita 345kV
	GEN-2008-013	300	OKGE	Tap Woodring – Wichita 345kV
	GEN-2008-021	42	WERE	Wolf Creek 345kV
	GEN-2008-038	144	AEPW	Tap Shidler – West Pawhuska 138kV
	GEN-2008-127	200.1	WERE	Tap Sooner – Rose Hill 345kV
	GEN-2009-025	60	OKGE	Tap Deer Creek – Sinclair 69kV
PRIOR QUEUED SUBTOTAL		**3,367.1**		
Cluster	**Request**	**Amount**	**Area**	**Proposed Point of Interconnection**
North Oklahoma	GEN-2008-071	76.8	OKGE	Newkirk 138kV
	GEN-2008-098	100.8	WERE	Tap Wolf Creek – LaCygne 345kV
	GEN-2010-003	100.8	WERE	GEN-2008-098 345kV
	GEN-2010-005	300	MKEC	GEN-2007-025 345kV
	GEN-2010-013	50.4	WERE	GEN-2005-013 345kV
NORTH OKLAHOMA SUBTOTAL		**628.8**		
AREA SUBTOTAL		**3,995.9**		

Cluster	Request	Amount	Area	Proposed Point of Interconnection
Prior Queued	Genoa	4	NPPD	Genoa 115kV
	GEN-2006-020N	42	NPPD	Bloomfield 115kV
	GEN-2006-038N019	80	NPPD	Petersburg 115kV
	GEN-2006-044N	40.5	NPPD	Tap Neligh – Petersburg 115kV
	GEN-2007-011N06	75	NPPD	Tap Neligh – Petersburg 115kV
	GEN-2007-011N08	81	NPPD	Bloomfield 115kV
	GEN-2007-011N09	75	NPPD	Bloomfield 115kV
	GEN-2008-086N02	200	NPPD	Tap Ft. Randall – Columbus 230kV
	PRIOR QUEUED SUBTOTAL	**597.5**		
Cluster	**Request**	**Amount**	**Area**	**Proposed Point of Interconnection**
NE Nebraska	GEN-2006-044N02	100.5	NPPD	GEN-2008-086N02 230kV
	GEN-2010-010	100.5	NPPD	Emerick 69kV
	NE NEBRASKA SUBTOTAL	**201**		
	AREA SUBTOTAL	**798.5**		

Cluster	Request	Amount	Area	Proposed Point of Interconnection
Prior Queued	Broken Bow	8.3	NPPD	Genoa 115kV
	Ord	13.9	NPPD	Bloomfield 115kV
	Stuart	2.1	NPPD	Petersburg 115kV
	GEN-2003-021N	75	NPPD	Ainsworth Wind Tap 115kV
	GEN-2004-005N	30	NPPD	St. Francis 115kV
	GEN-2006-037N1	75	NPPD	Broken Bow 115kV
	GEN-2006-038N005	80	NPPD	Broken Bow 115kV
	PRIOR QUEUED SUBTOTAL	**284.3**		
	NORTH NEBRASKA SUBTOTAL	**284.3**		

Cluster	Request	Amount	Area	Proposed Point of Interconnection
Prior Queued	GEN-2003-006A-E	100	EMDE	Elm Creek 230kV
	GEN-2003-006A-W	100	WERE	Elm Creek 230kV
	GEN-2003-019	250	MIDW	Smoky Hills Tap 230kV
	GEN-2006-031	75	MIDW	Knoll 115kV
	GEN-2006-032	200	MIDW	South Hays 230kV
	GEN-2008-092	201	MIDW	Knoll 115kV
	GEN-2009-011	50	MKEC	Tap Plainville – Phillipsburg 115kV
	PRIOR QUEUED SUBTOTAL	**976**		
Cluster	**Request**	**Amount**	**Area**	**Proposed Point of Interconnection**
North Kansas	GEN-2009-008	200	SUNC	South Hays 230kV
	GEN-2009-020	48.6	MIDW	Tap Balzine – Nekoma 69kV
	GEN-2009-040	73.8	WERE	Tap Smittyville – Knob Hill 115kV
	NORTH KANSAS SUBTOTAL	**322.4**		
	AREA SUBTOTAL	**1,298.4**		

Cluster	Request	Amount	Area	Proposed Point of Interconnection
Prior Queued	ASGI-2010-001	400	AECI	Tap Cooper – Fairport 345kV
	ASGI-2010-002	201	AECI	Lathrop 161kV
	ASGI-2010-003	300	AECI	Maryville 161kV
	ASGI-2010-004	50	AECI	Tap Queen City – Lancaster 69kV
	ASGI-2010-005	99	AECI	Lathrop 161kV
	ASGI-2010-008	100	AECI	Maryville 161kV
	ASGI-2010-009	201	AECI	Osborn 161kV
	GEN-2006-014	300	MIPU	Maryville – Clarinda 161kV & Tie to Midway 161kV
	GEN-2006-017	300	MIPU	Maryville – Clarinda 161kV & Tie to Midway 161kV
	GEN-2007-015	135	WERE	Tap Humboldt – Kelly 161kV
	GEN-2007-017	101	MIPU	Maryville – Clarinda 161kV & Tie to Midway 161kV
	GEN-2007-053	110	MIPU	Maryville – Clarinda 161kV & Tie to Midway 161kV
	GEN-2008-119O	60	OPPD	Tap Humboldt – Kelly 161kV
	GEN-2008-129	80	MIPU	Pleasant Hill 161kV
PRIOR QUEUED SUBTOTAL		**2,437**		
NORTHWEST MISSOURI SUBTOTAL		**2,437**		

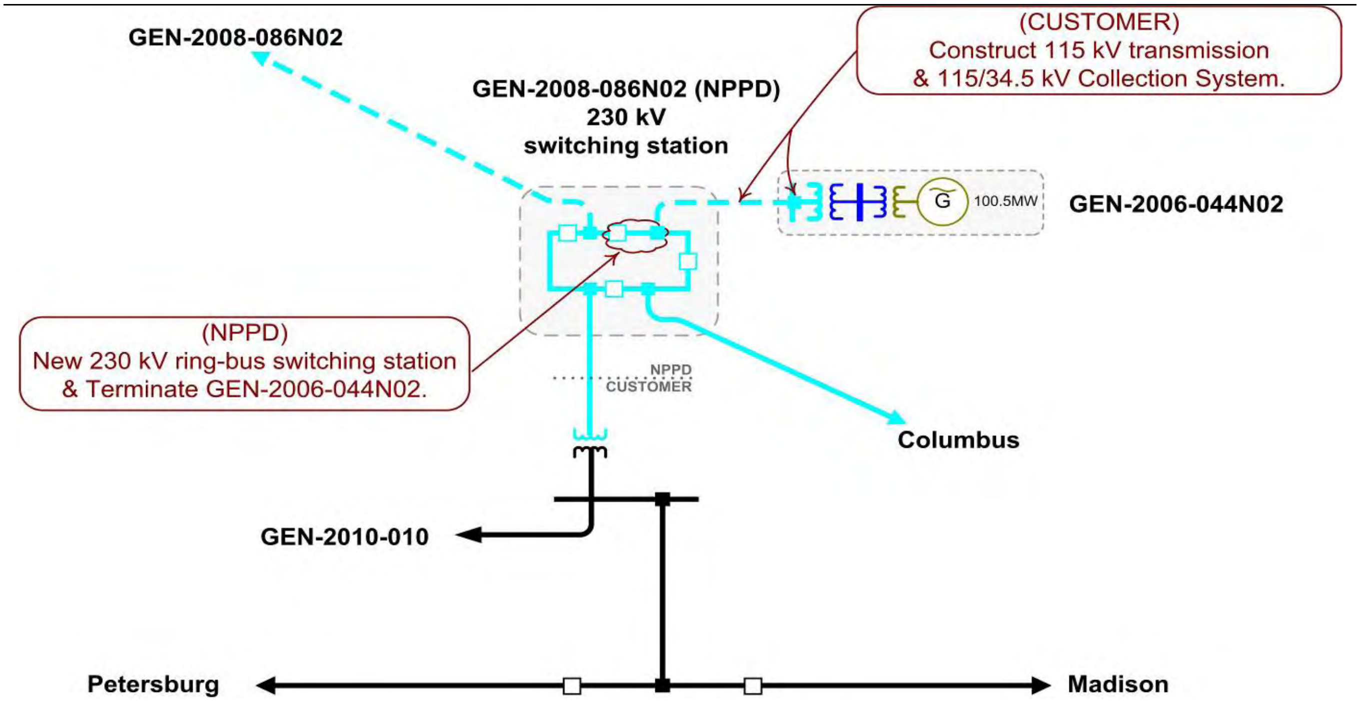
Cluster	Request	Amount	Area	Proposed Point of Interconnection
Prior Queued	GEN-2006-038	750	WFEC	Hugo 345kV
PRIOR QUEUED SUBTOTAL		**750**		
Cluster	**Request**	**Amount**	**Area**	**Proposed Point of Interconnection**
South Central Oklahoma	GEN-2008-046	200	OKGE	Sunnyside 345kV
	GEN-2009-032S	6.4	OKGE	Foster 138kV
SOUTH CENTRAL OKLAHOMA SUBTOTAL		**206.4**		
AREA SUBTOTAL		**956.4**		

Cluster	Request	Amount	Area	Proposed Point of Interconnection
Southwest Nebraska	GEN-2008-123N	89.7	NPPD	Tap Guide – Pauline 115kV
SOUTHWEST NEBRASKA SUBTOTAL		**89.7**		
AREA SUBTOTAL		**89.7**		
*****CLUSTERED TOTAL (w/o PRIOR QUEUED)**		**4,864.2**		
*****CLUSTERED TOTAL (w/PRIOR QUEUED)**		**27,541.6**		

***** Planned Facility
^ Proposed Facility
****** Alternate requests - counted as one request for study purpose
*** Electrically Remote Interconnection Requests included in total

D: Proposed Point of Interconnection One line Diagrams

GEN-2006-044N02



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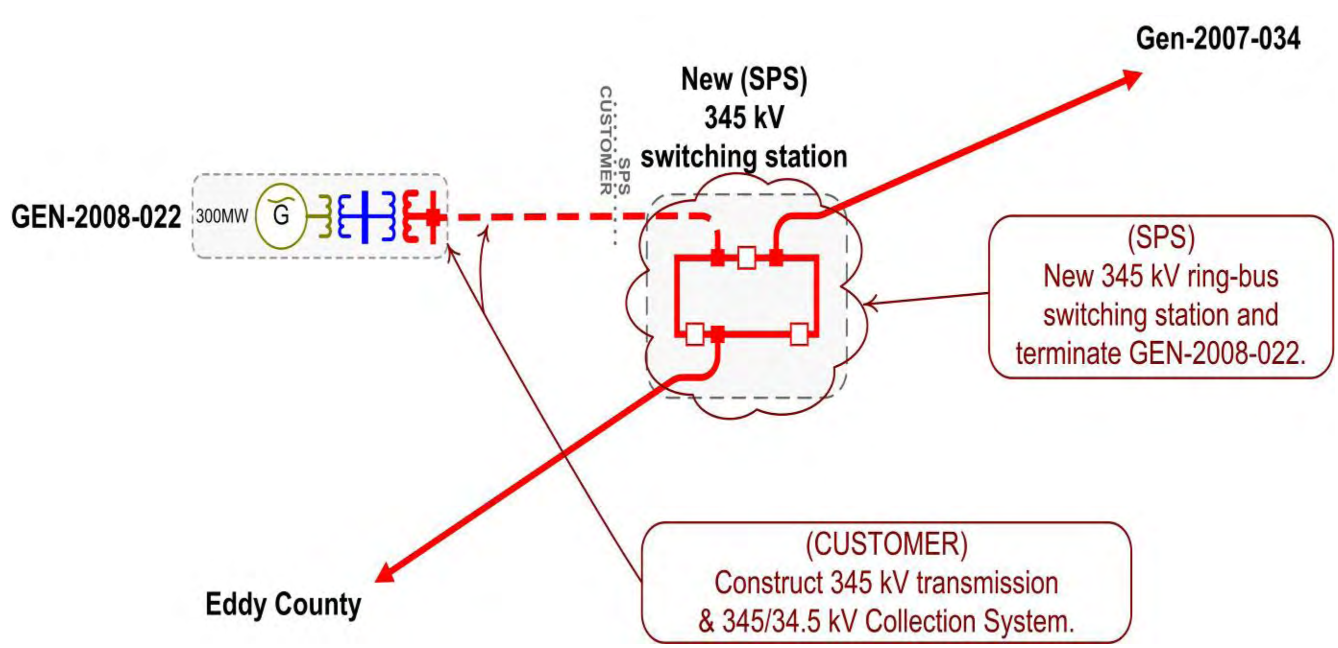

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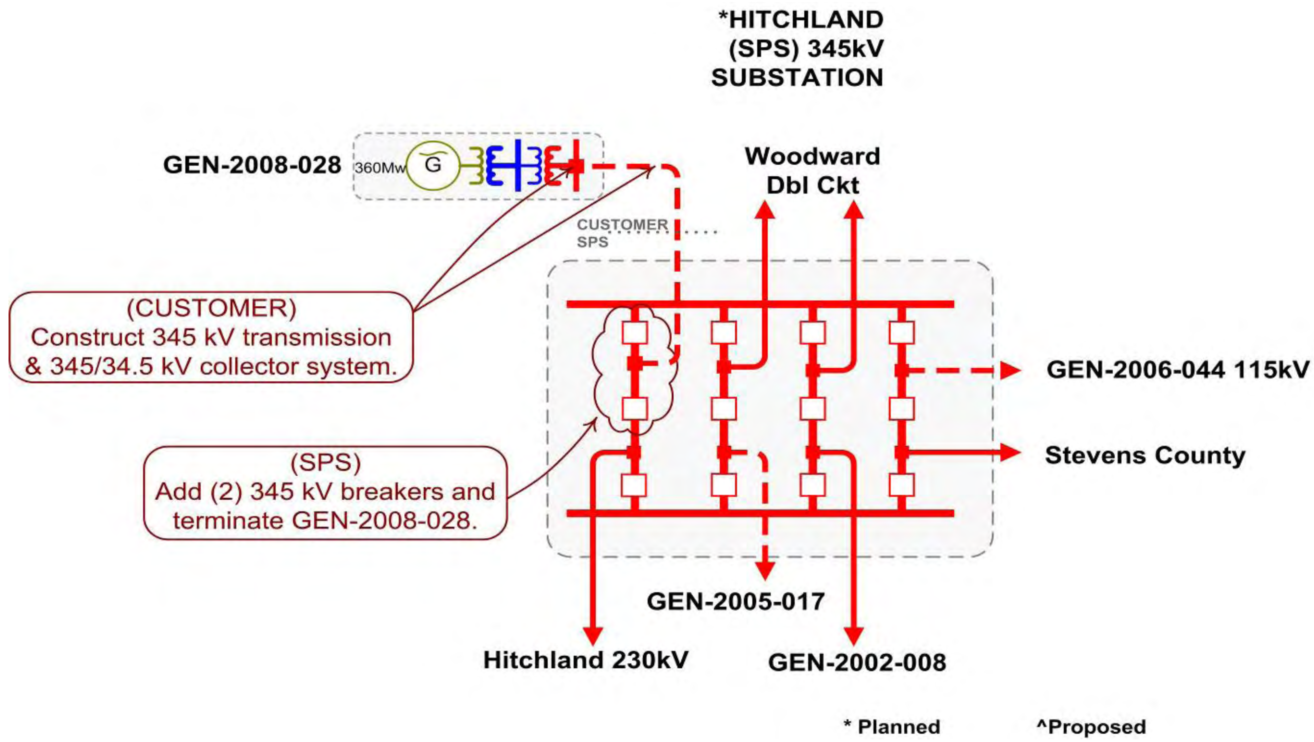

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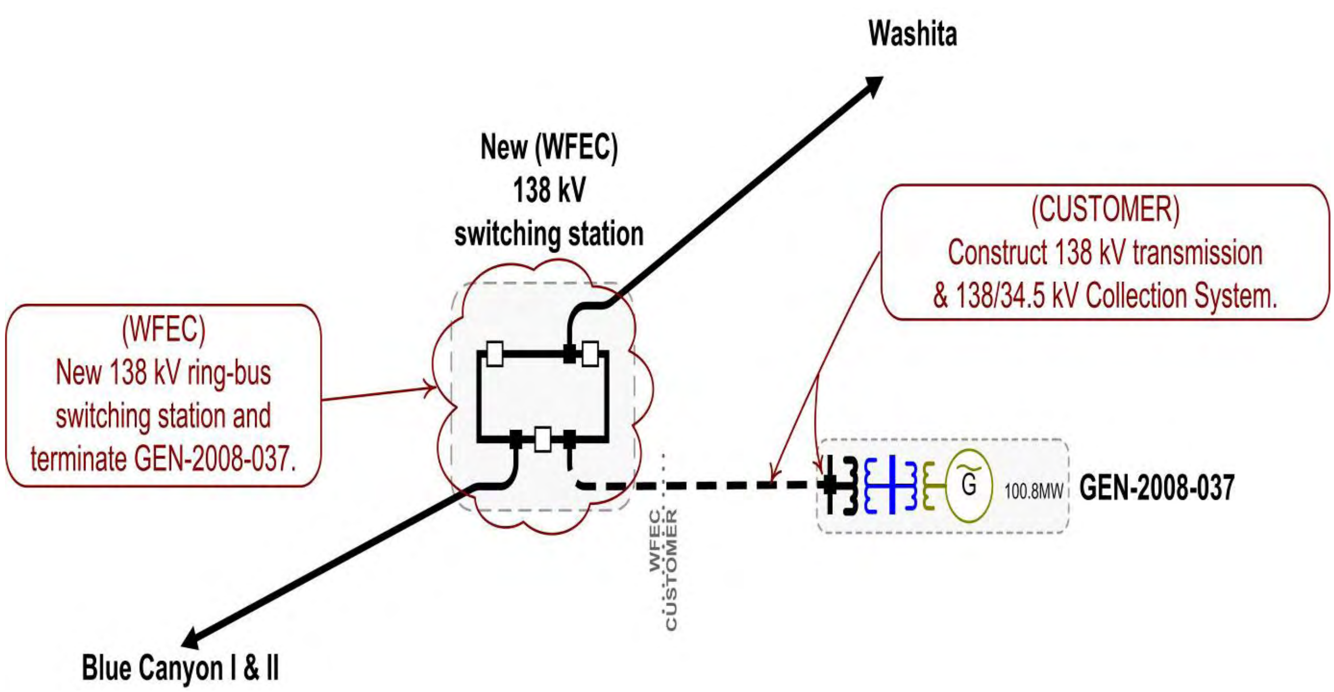

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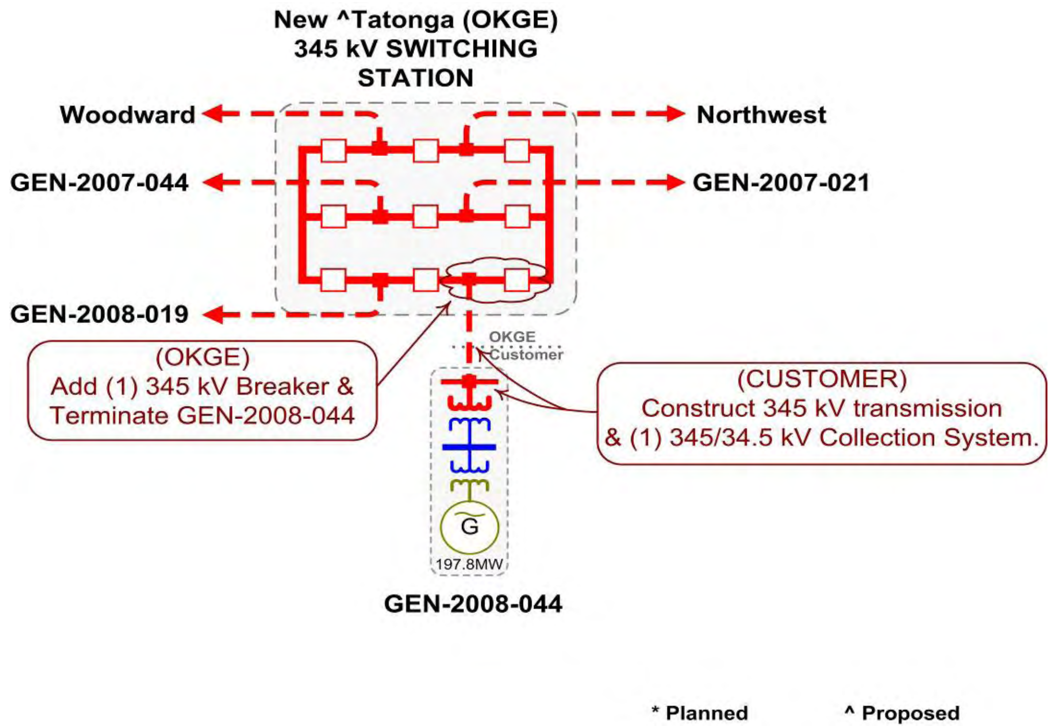

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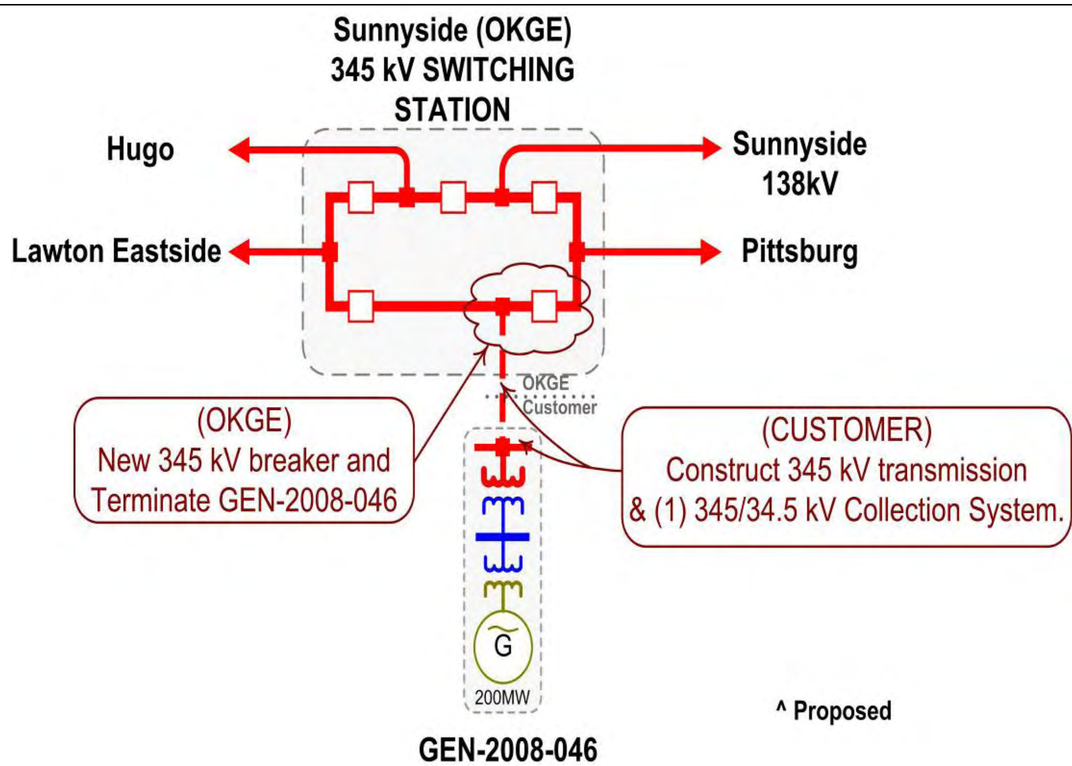

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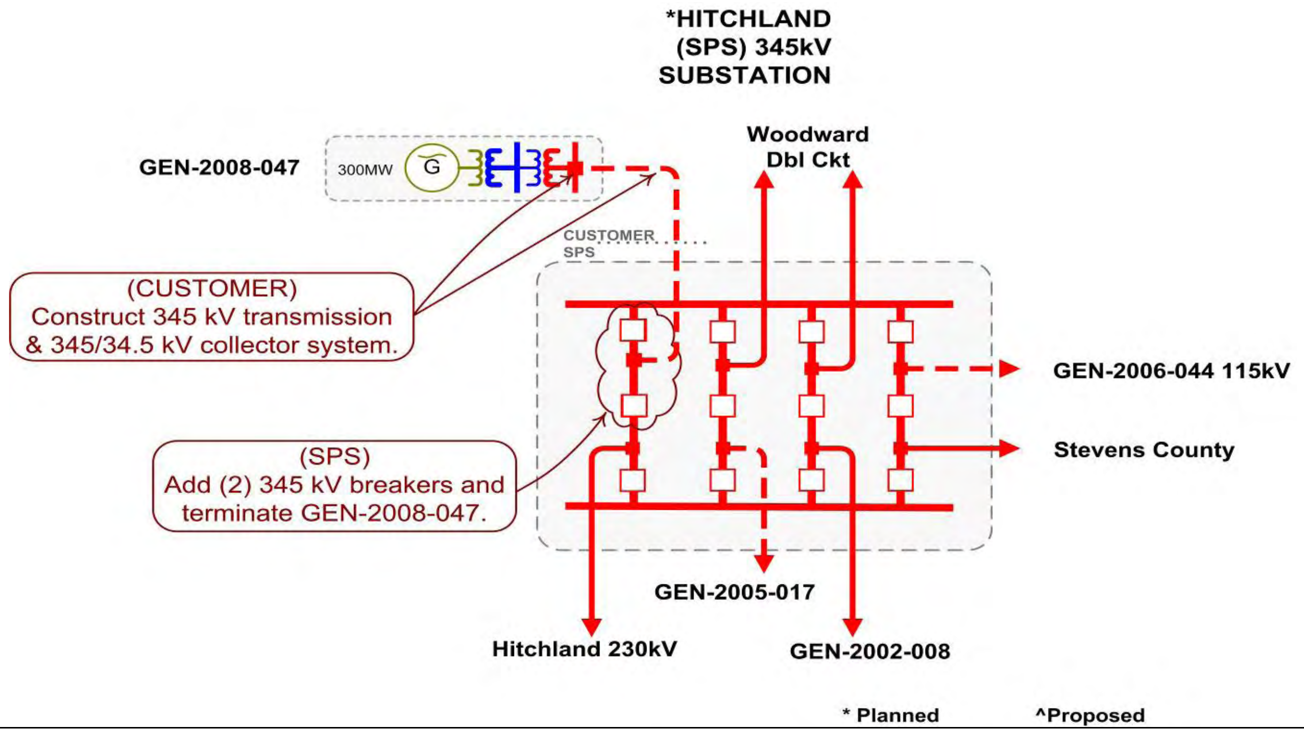

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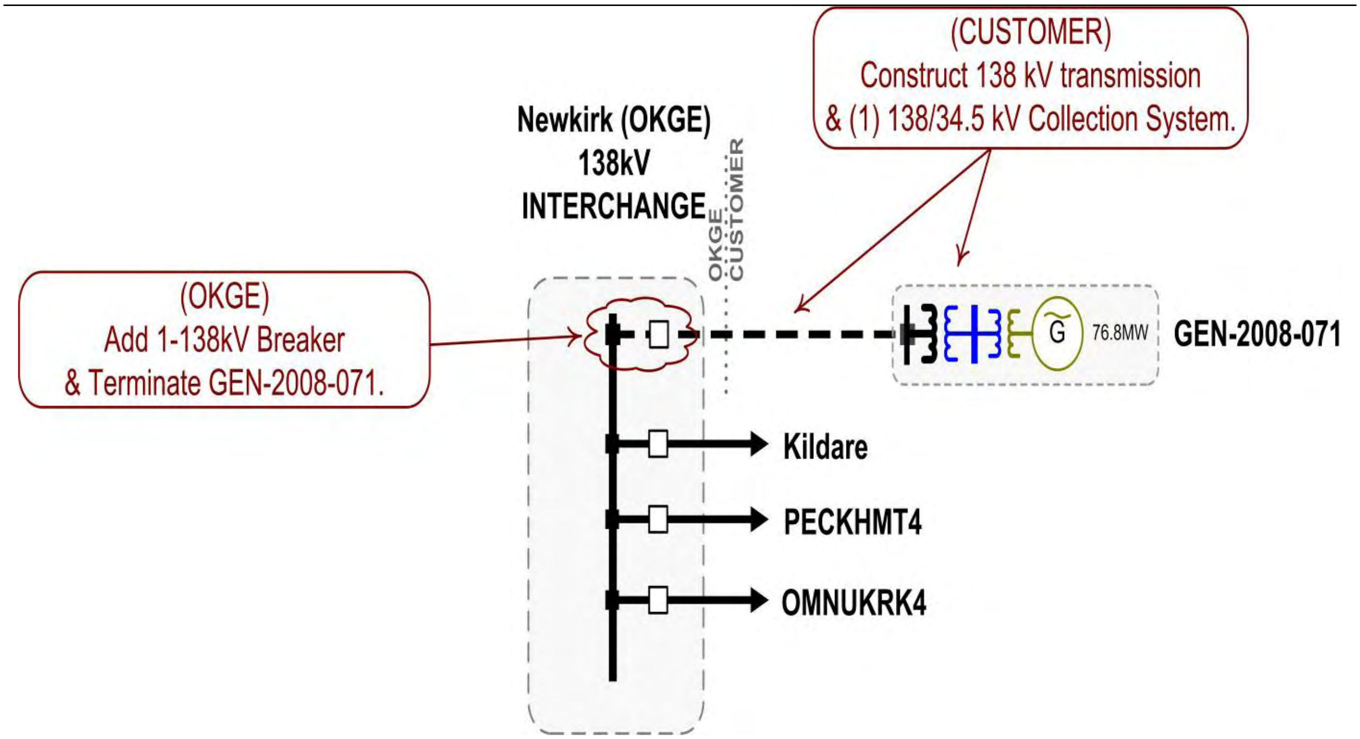

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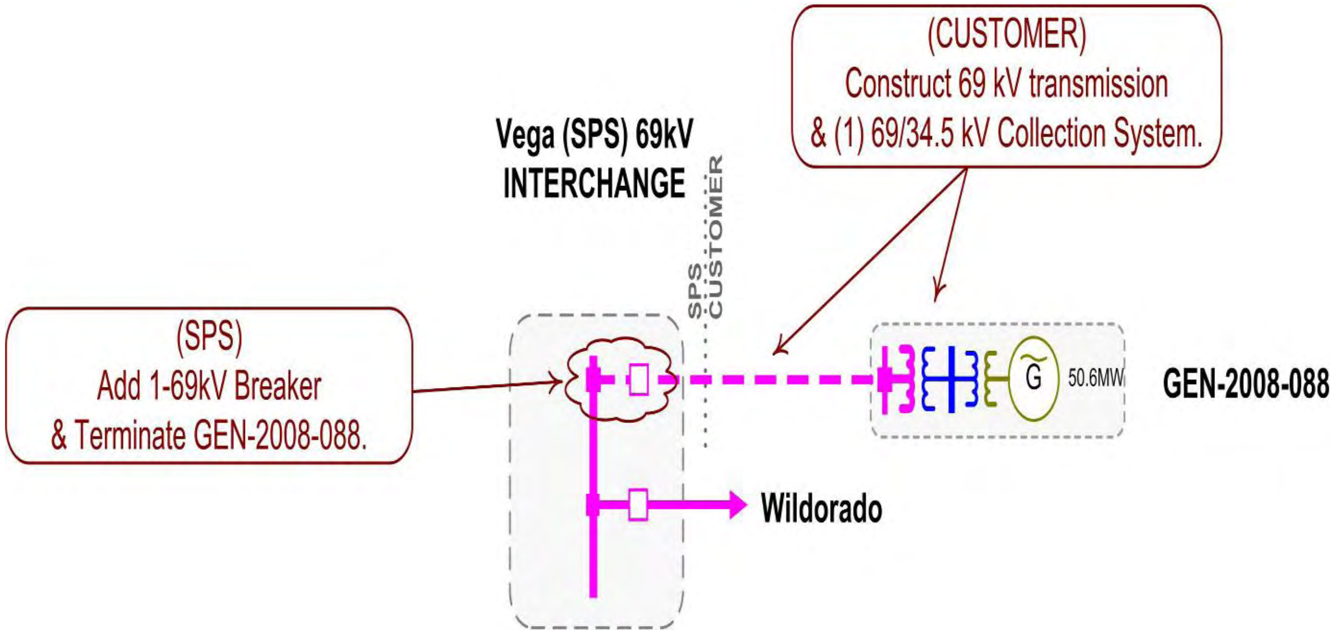

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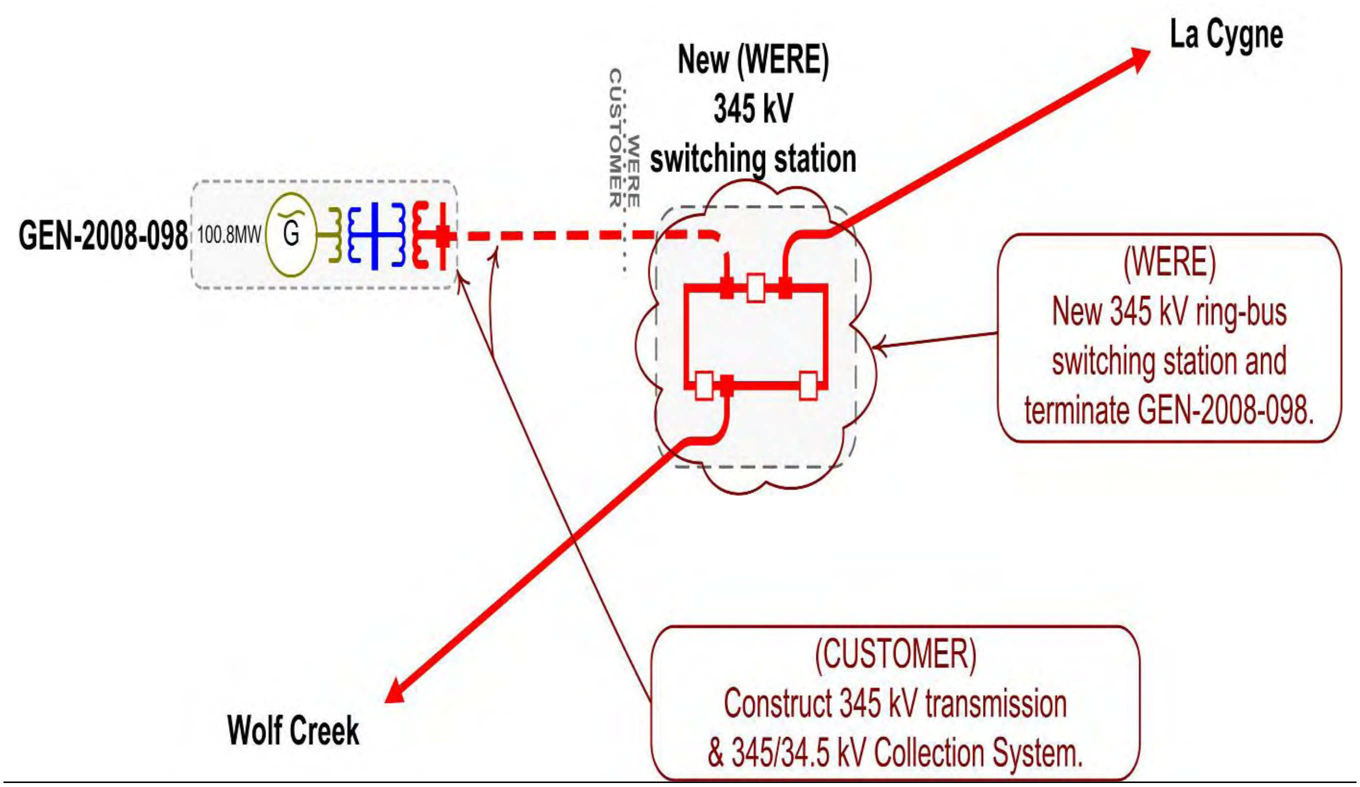

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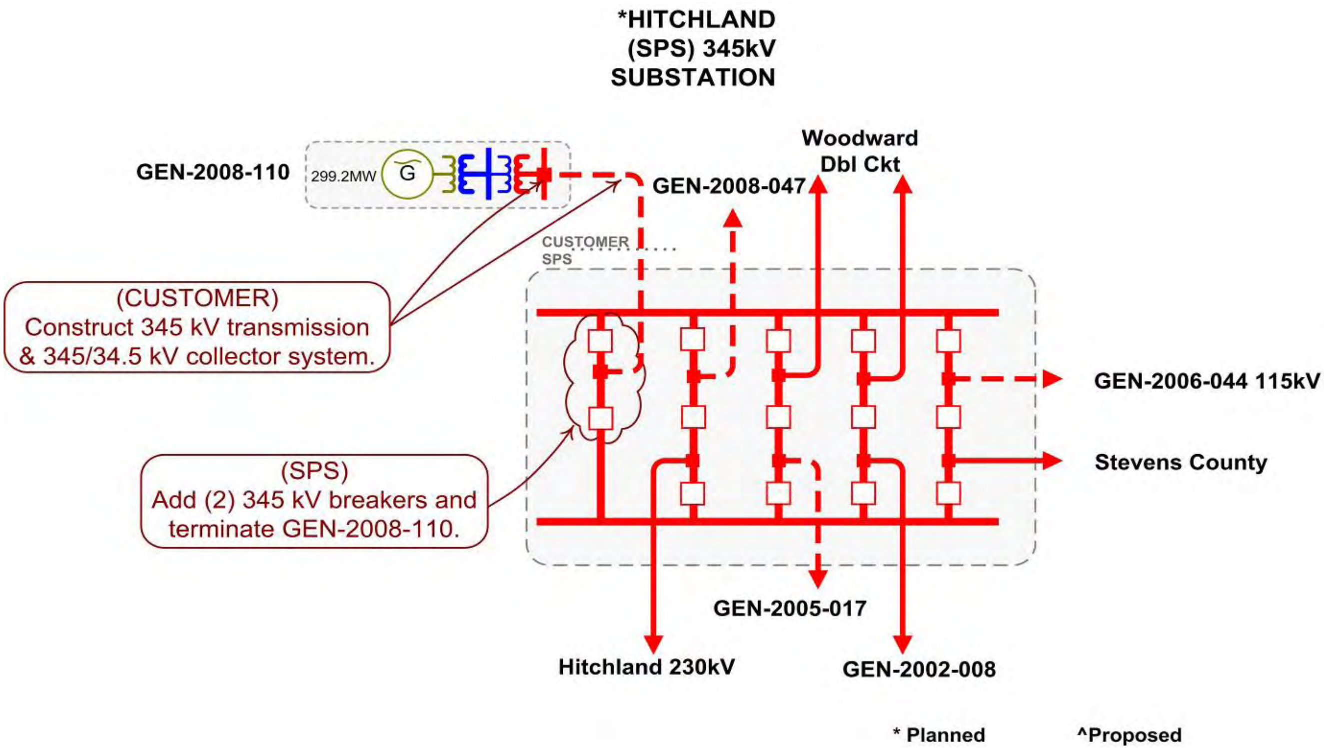

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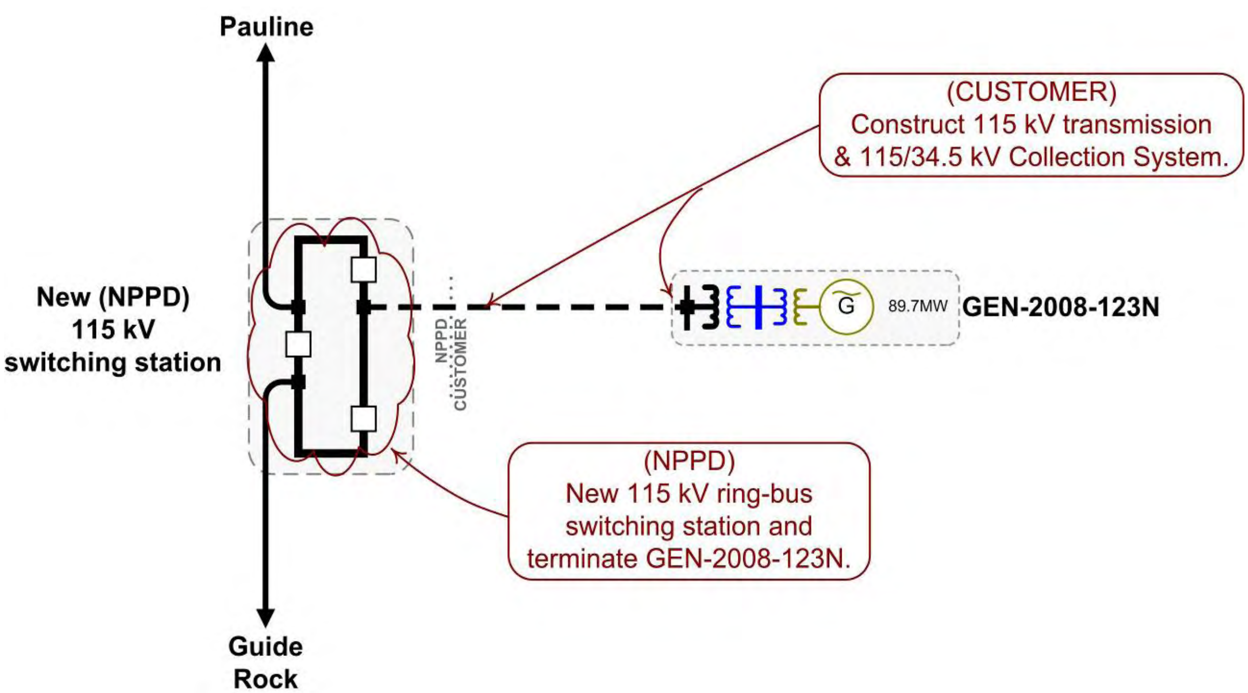

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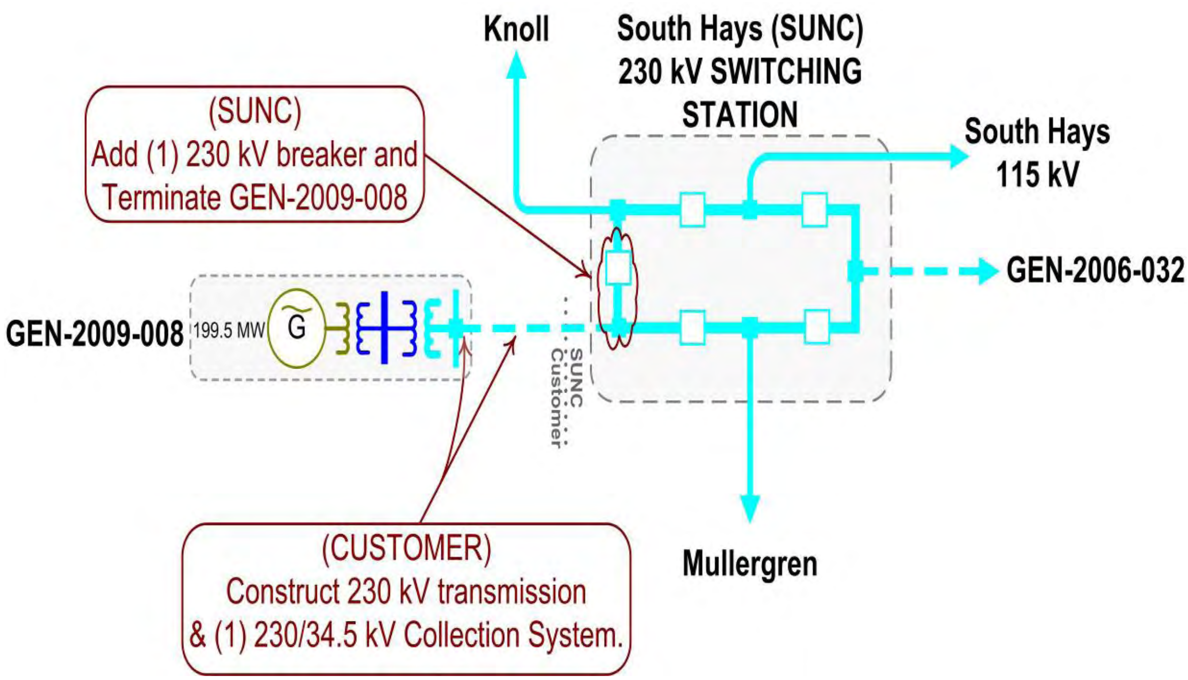

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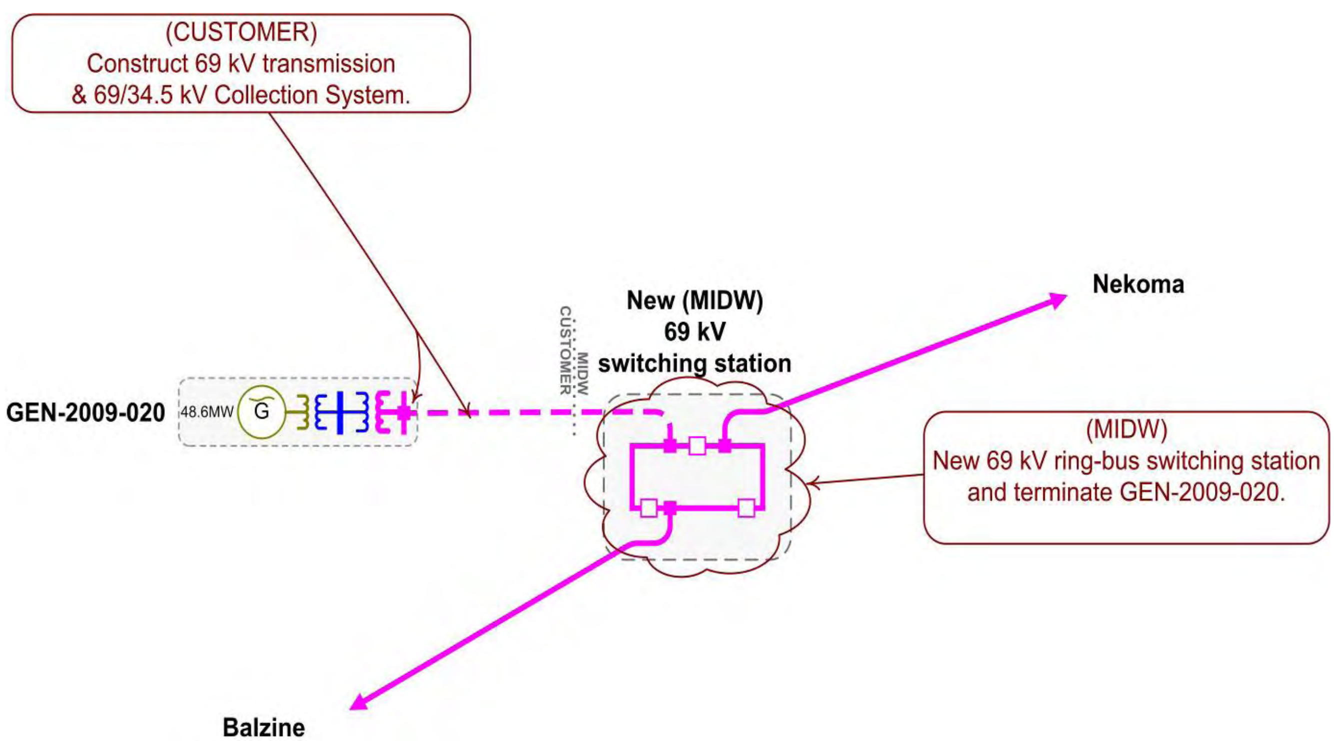

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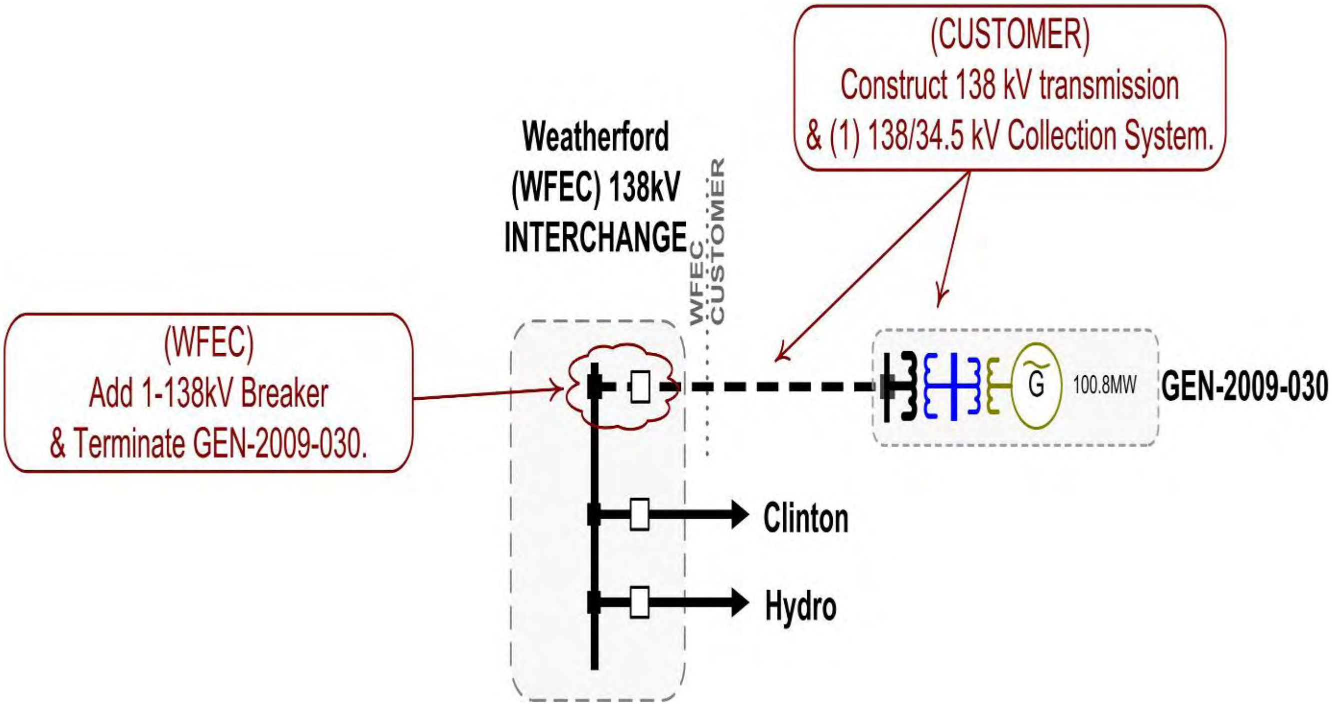

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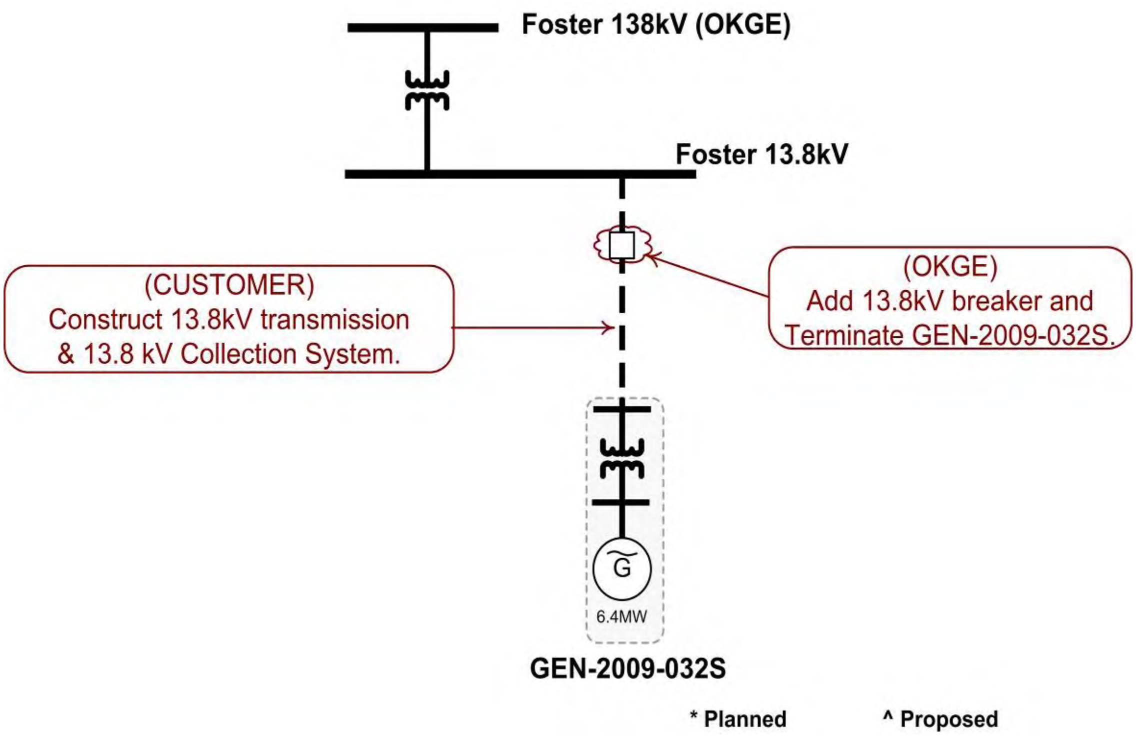

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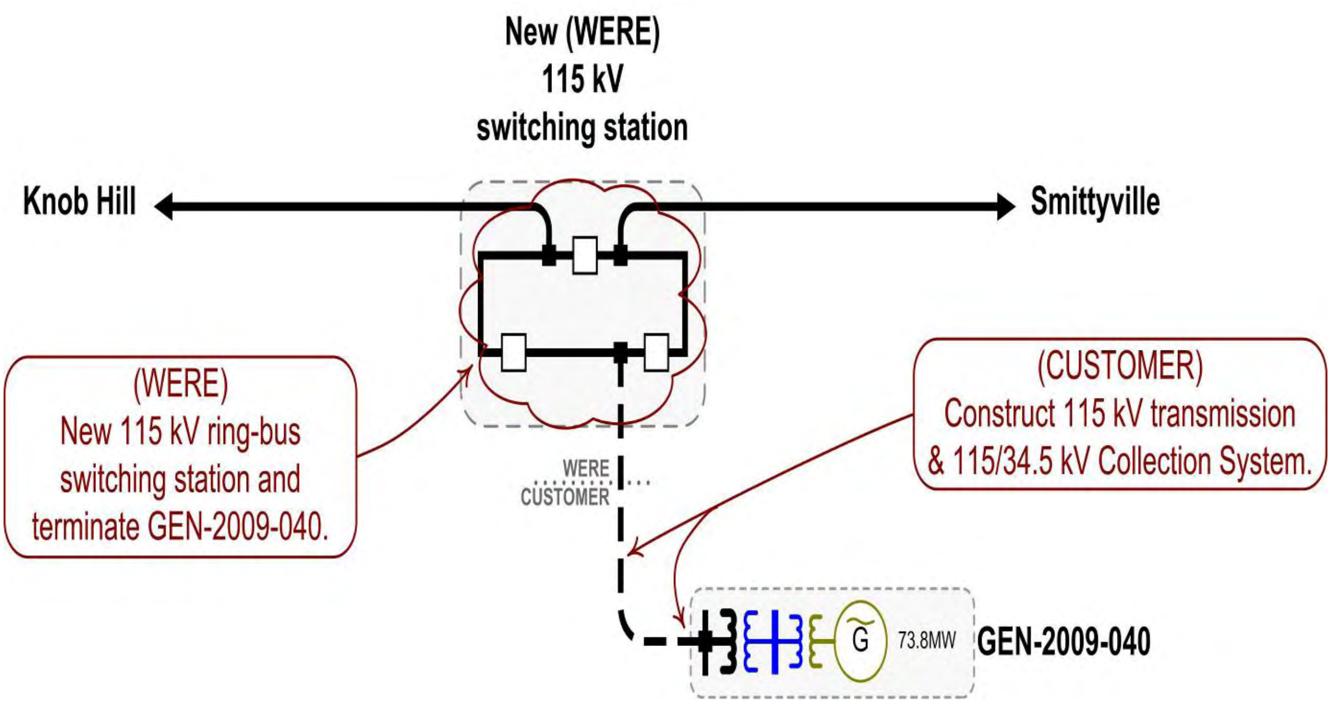

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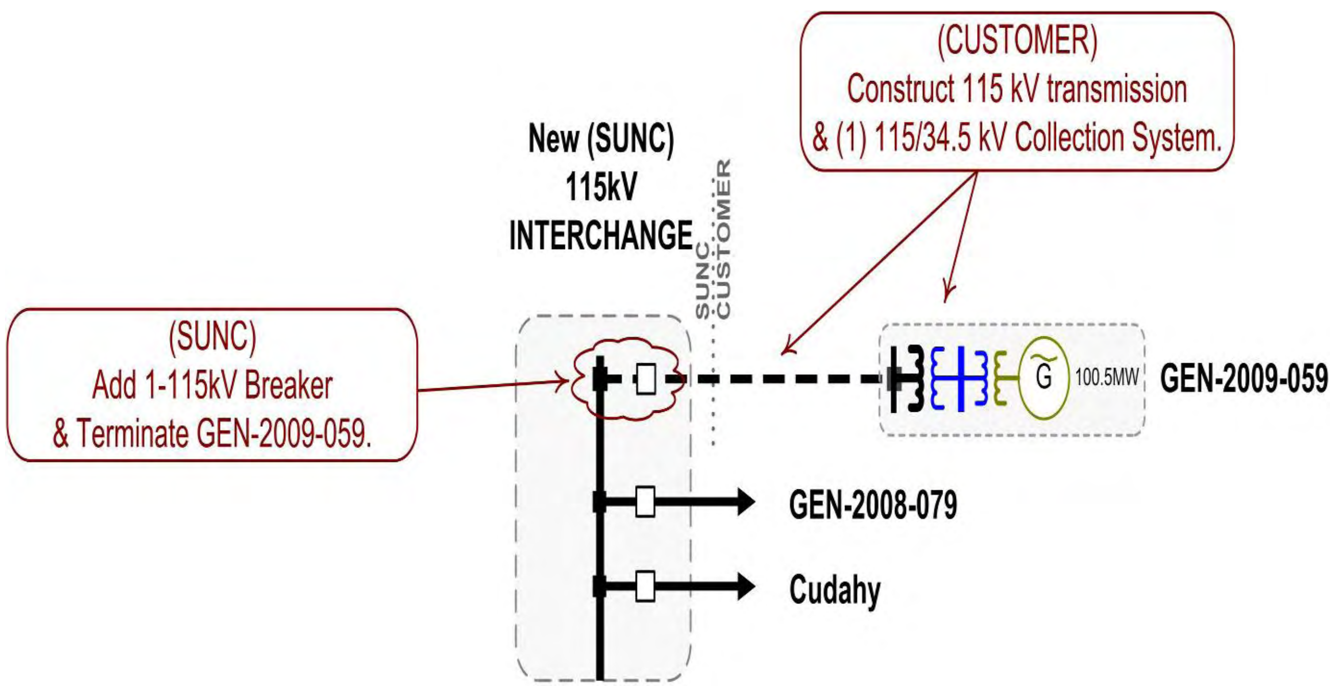

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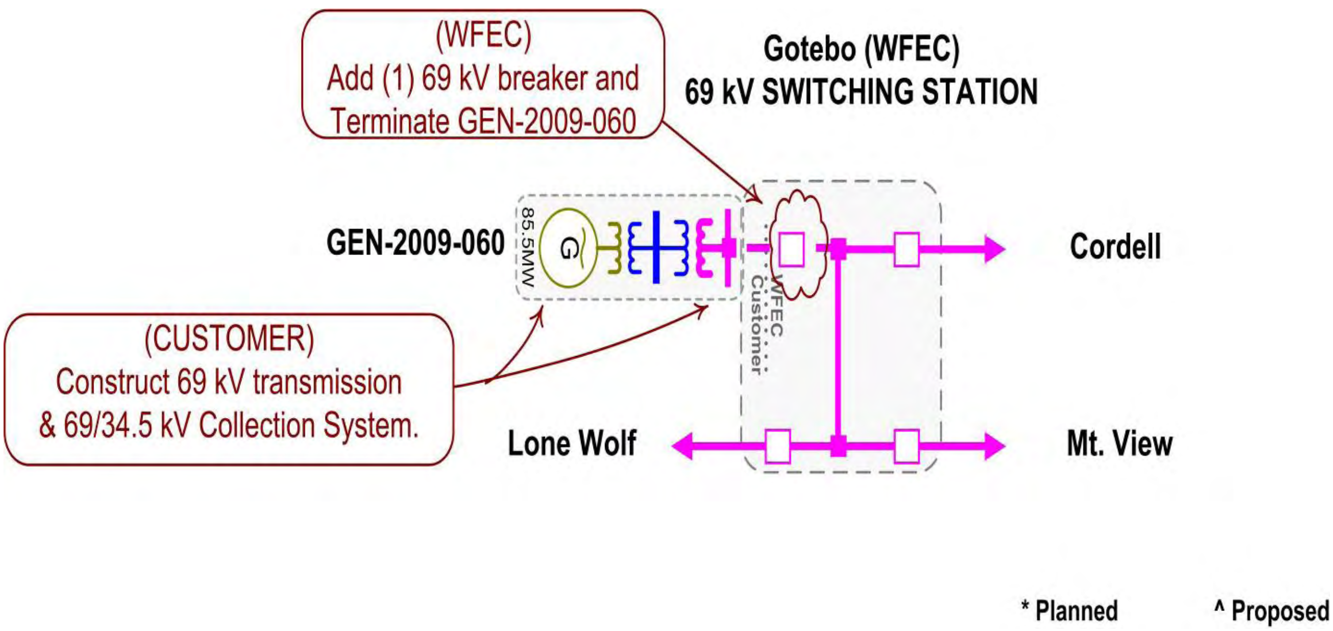

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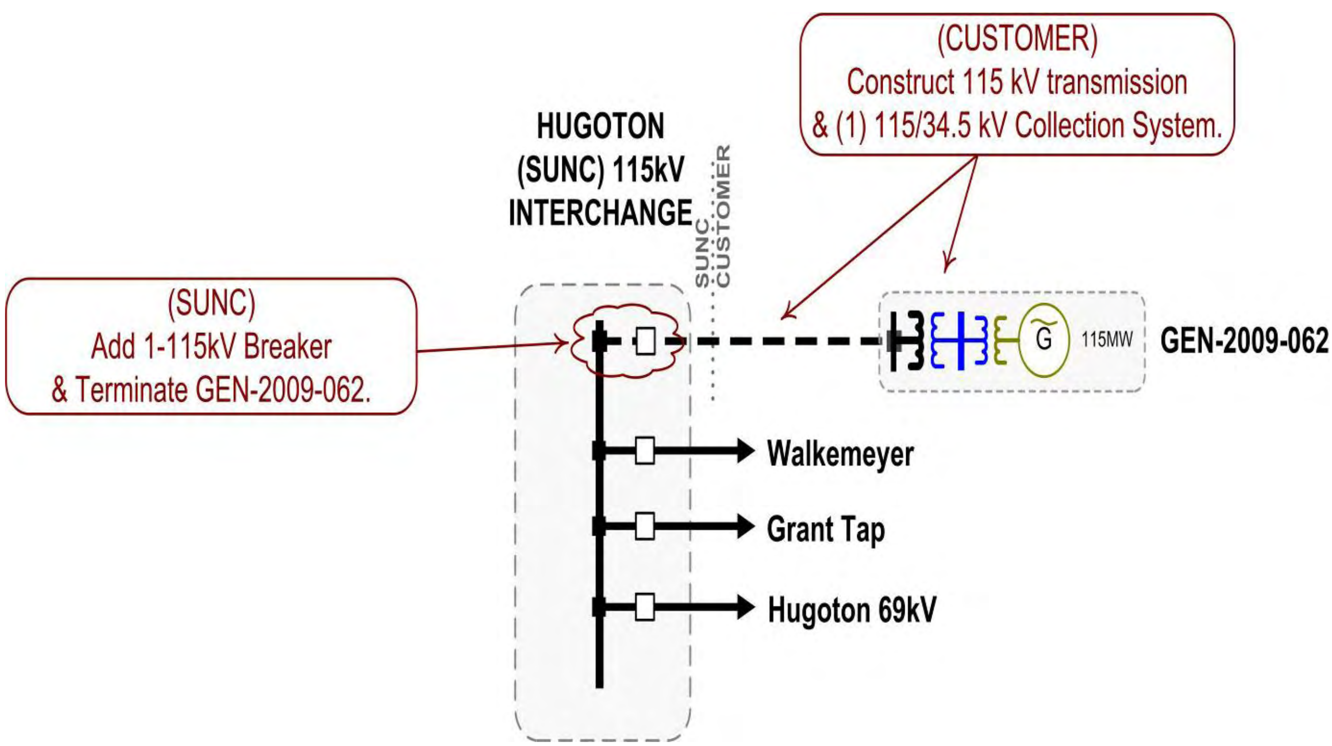

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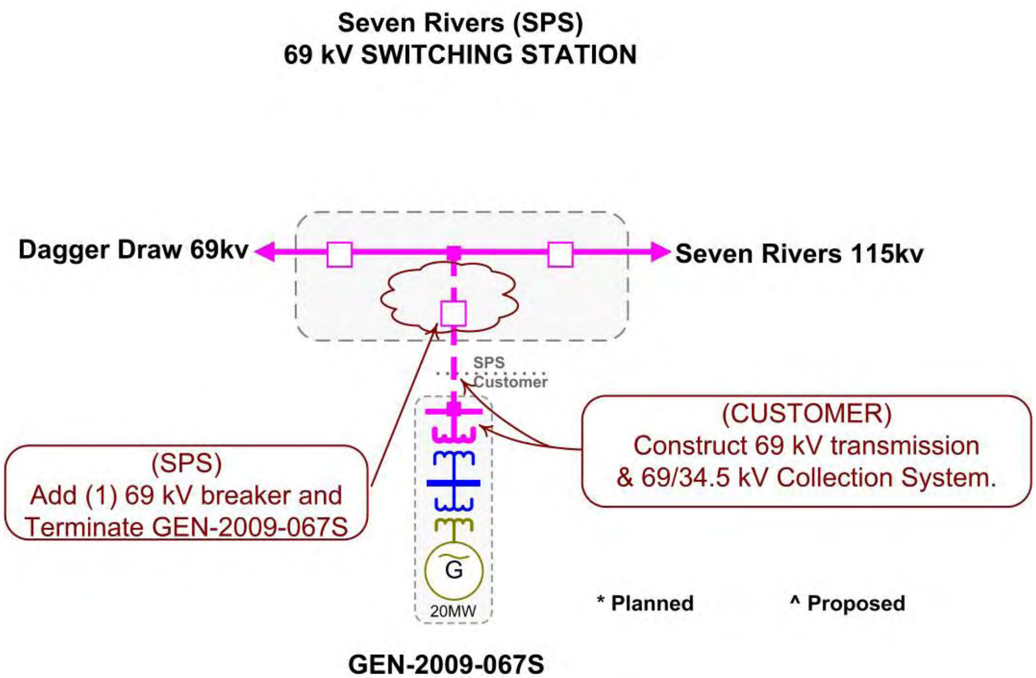

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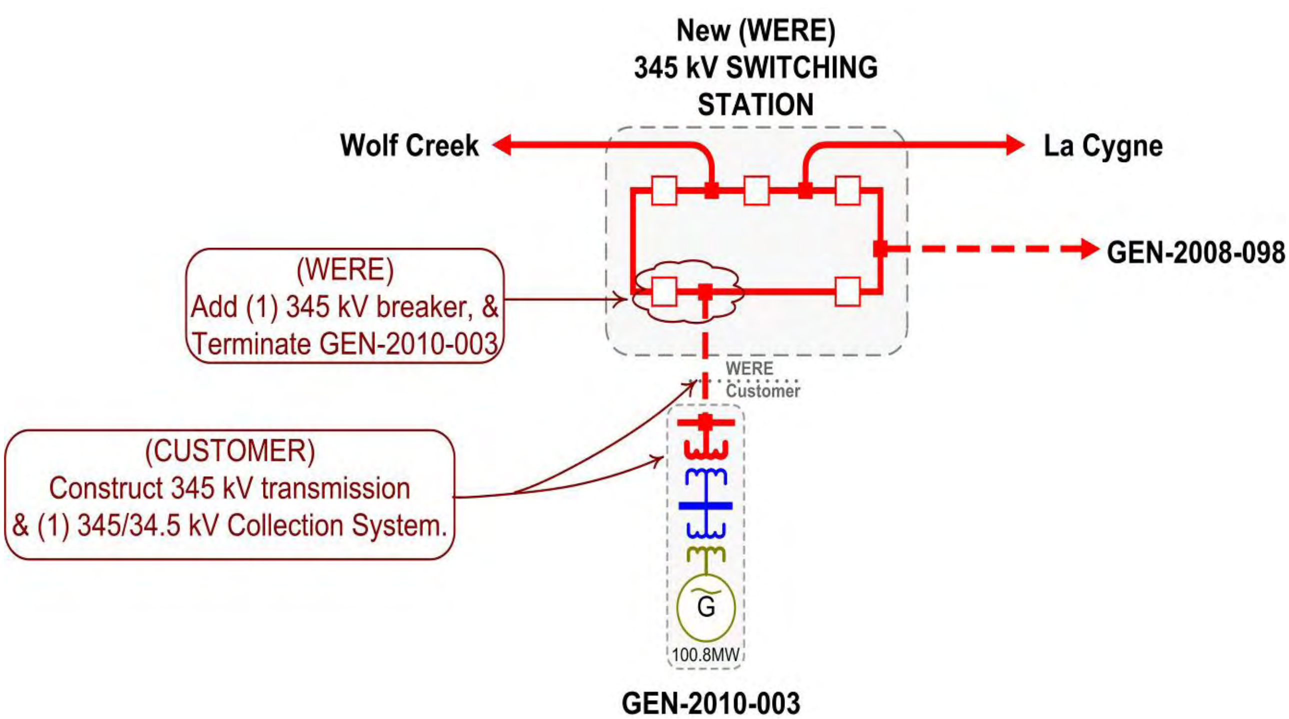

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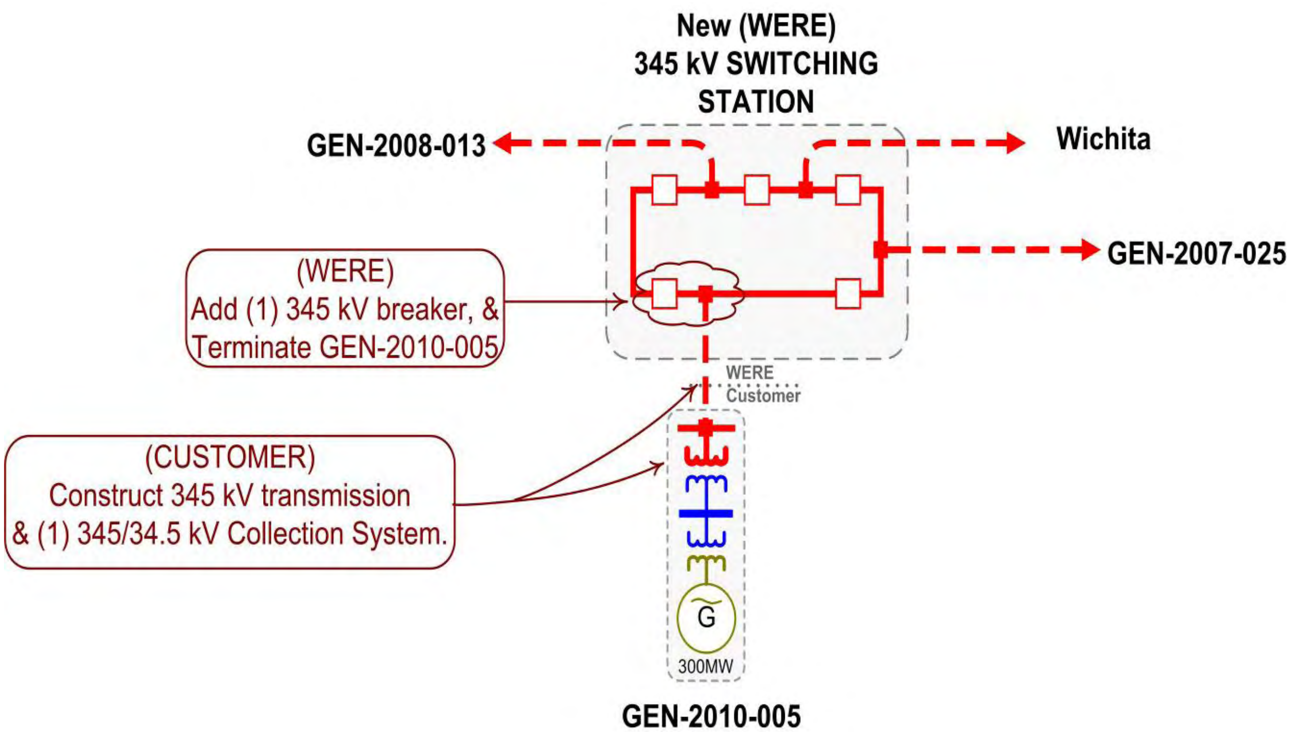

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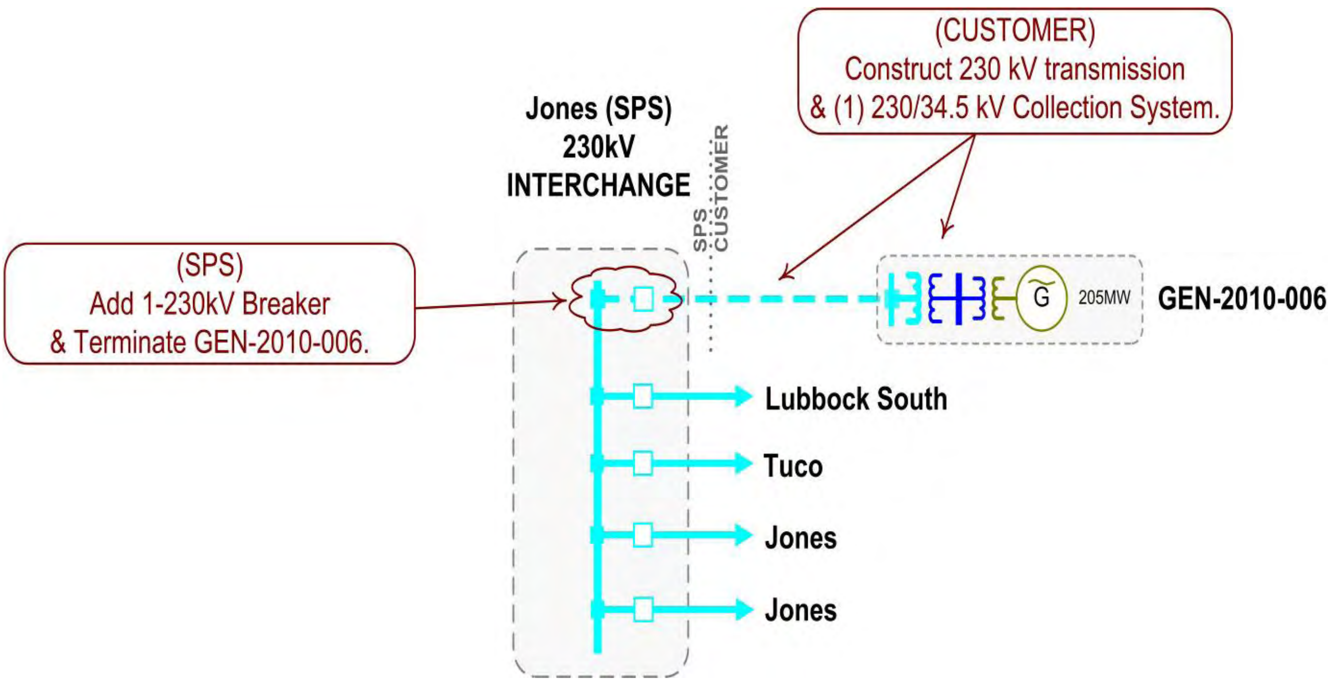

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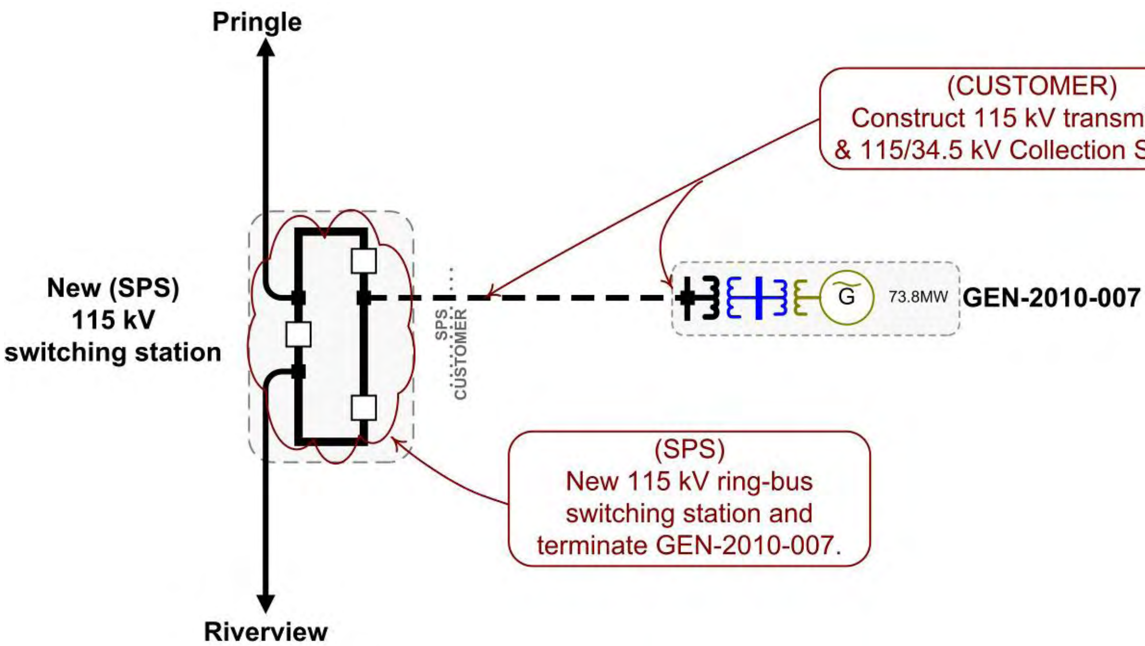

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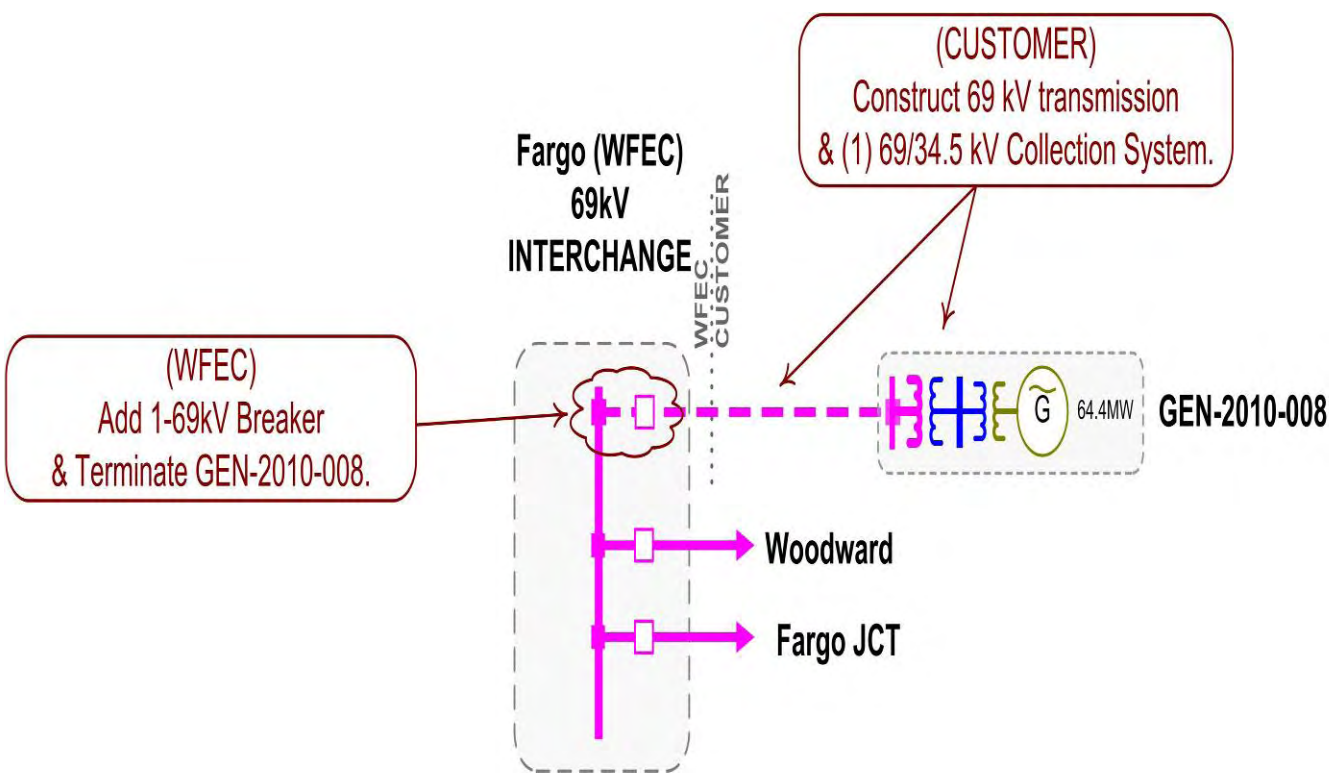

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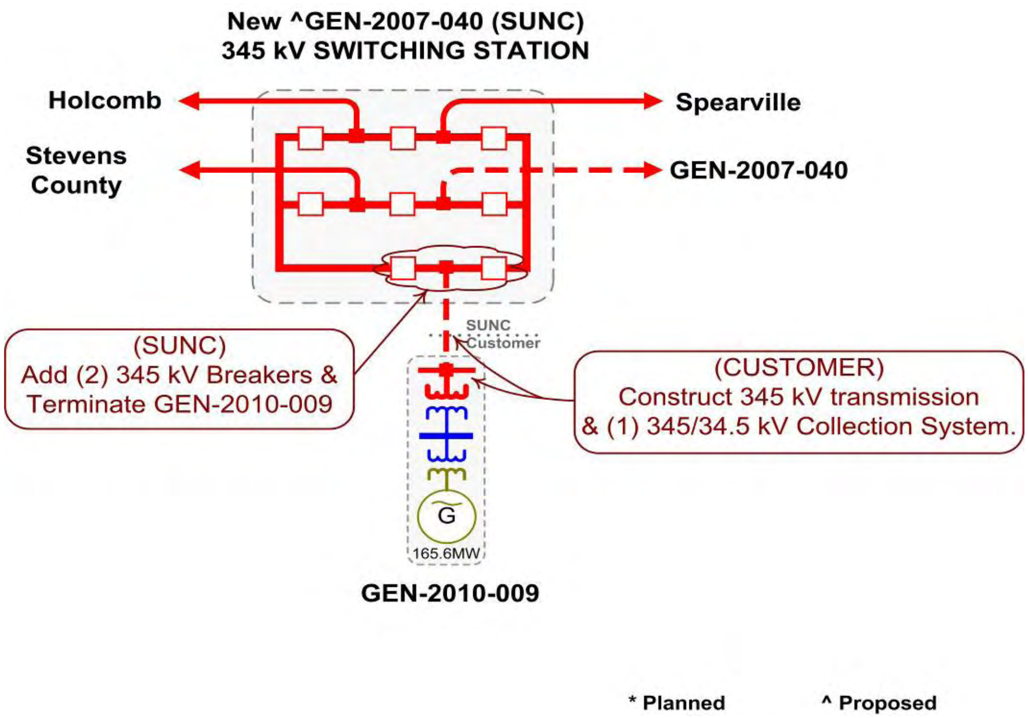

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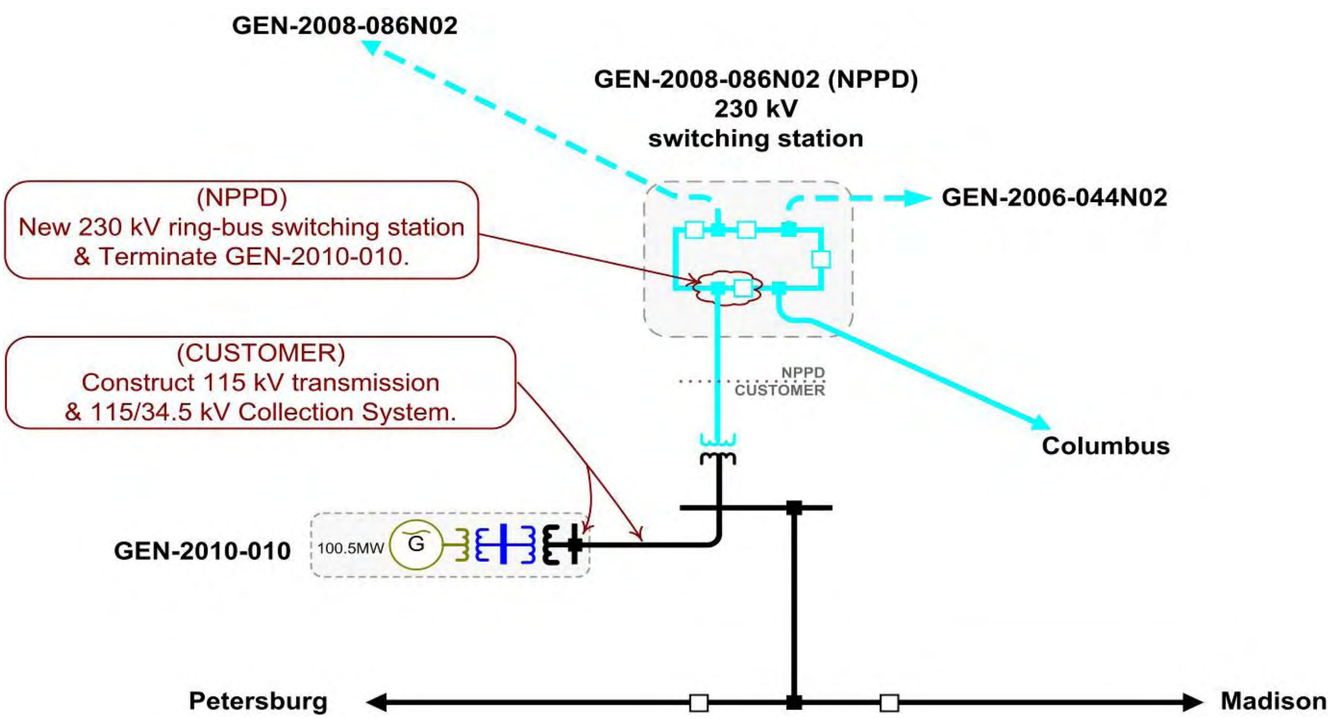

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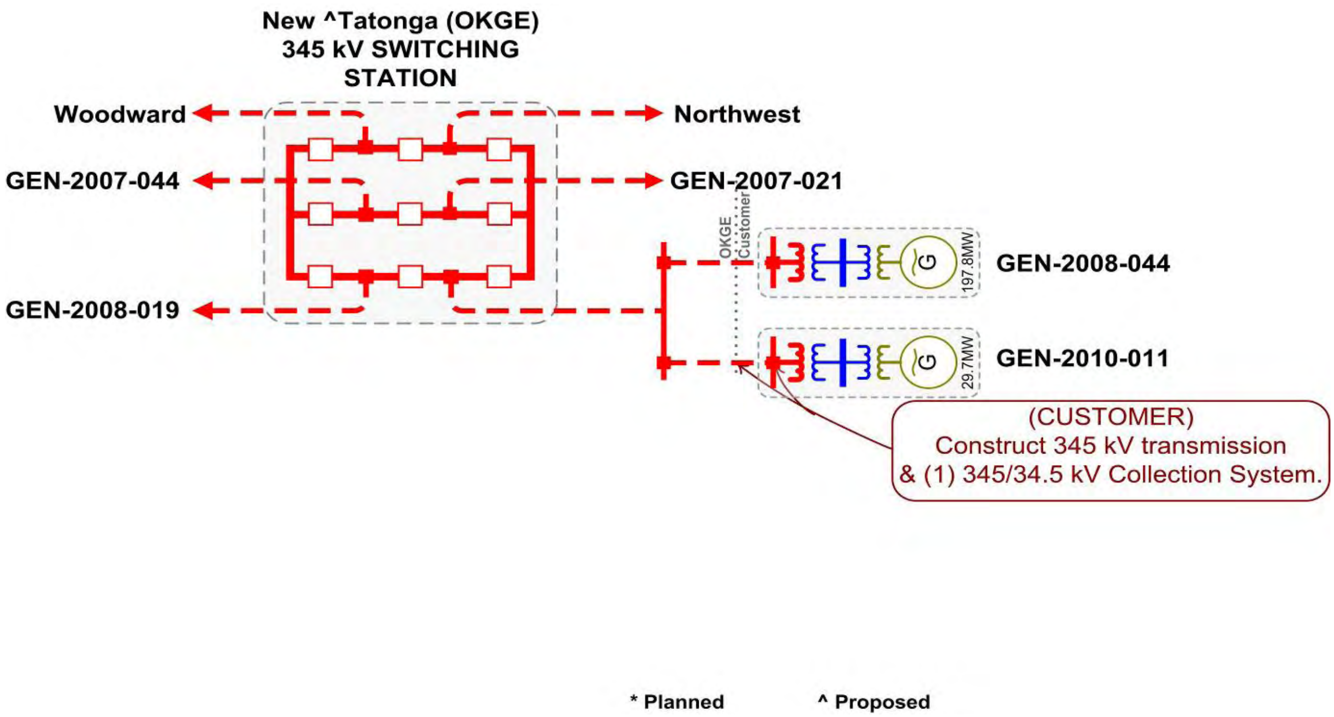

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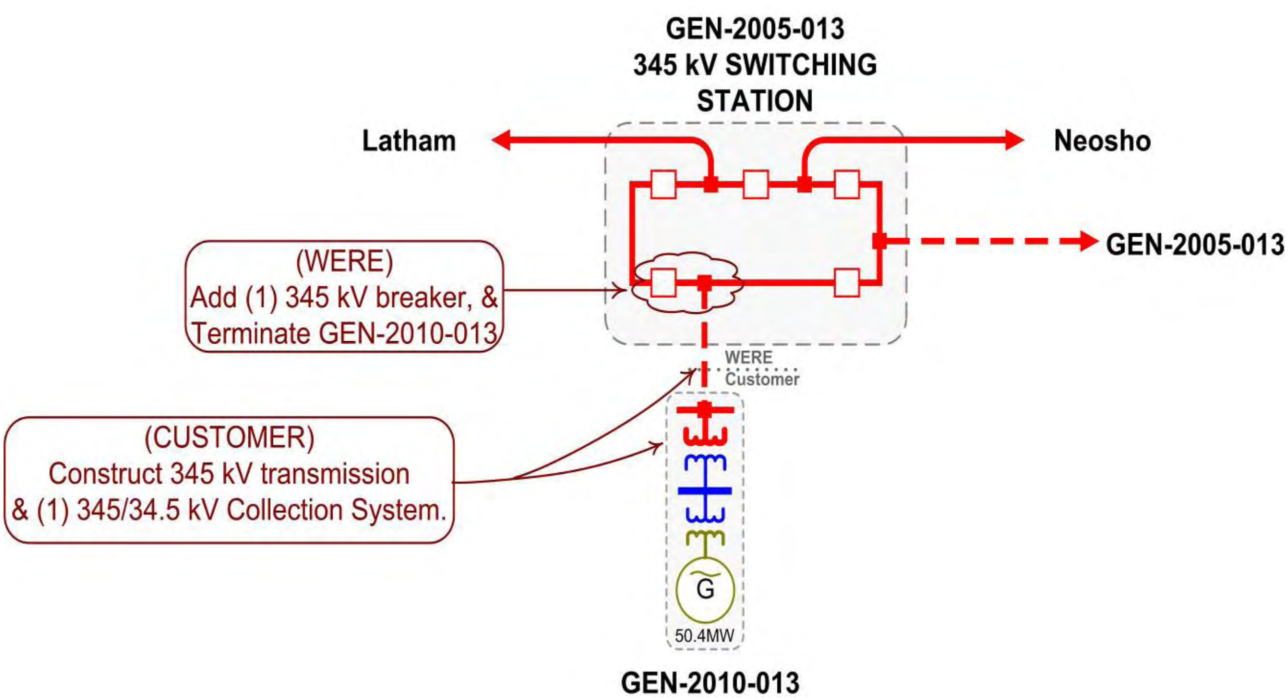

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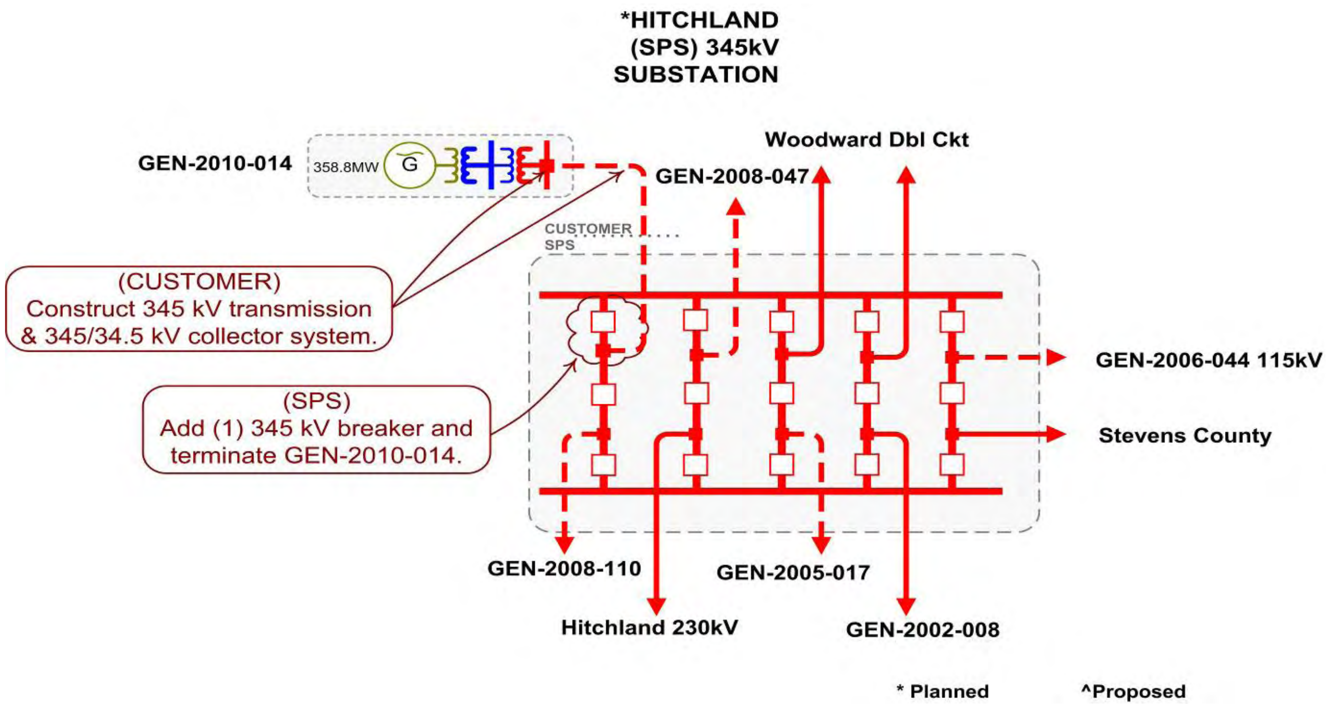

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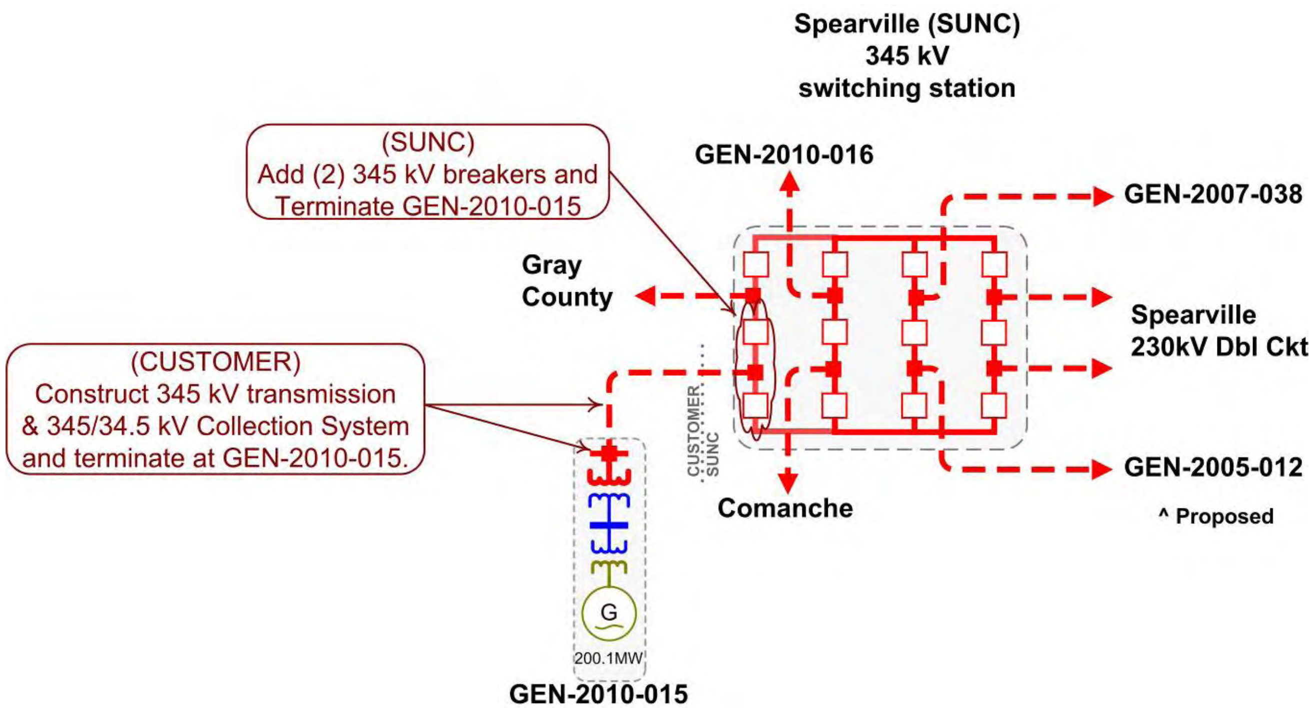

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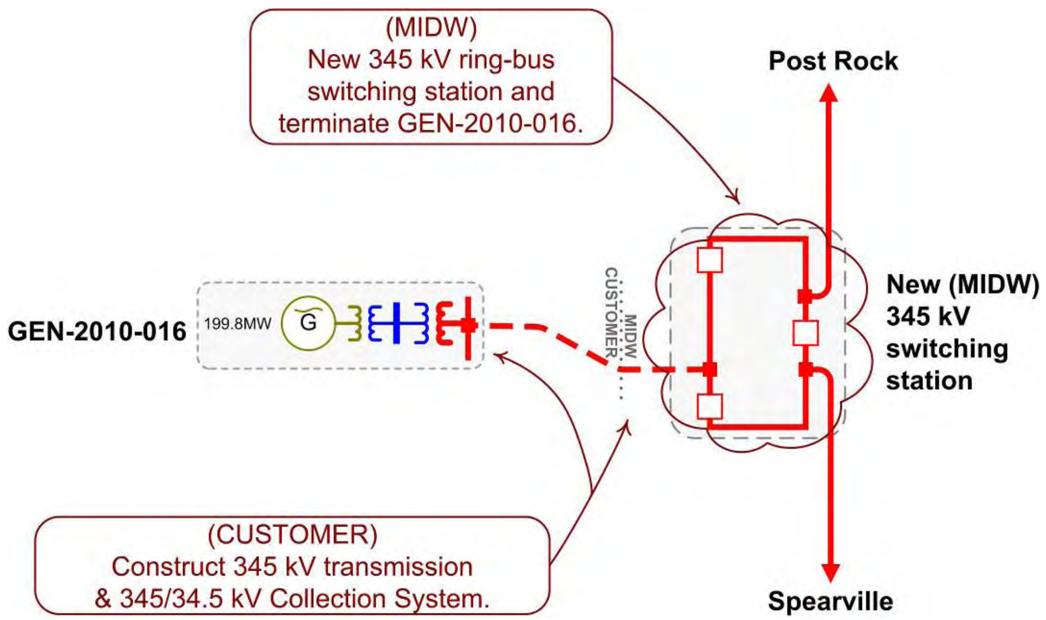
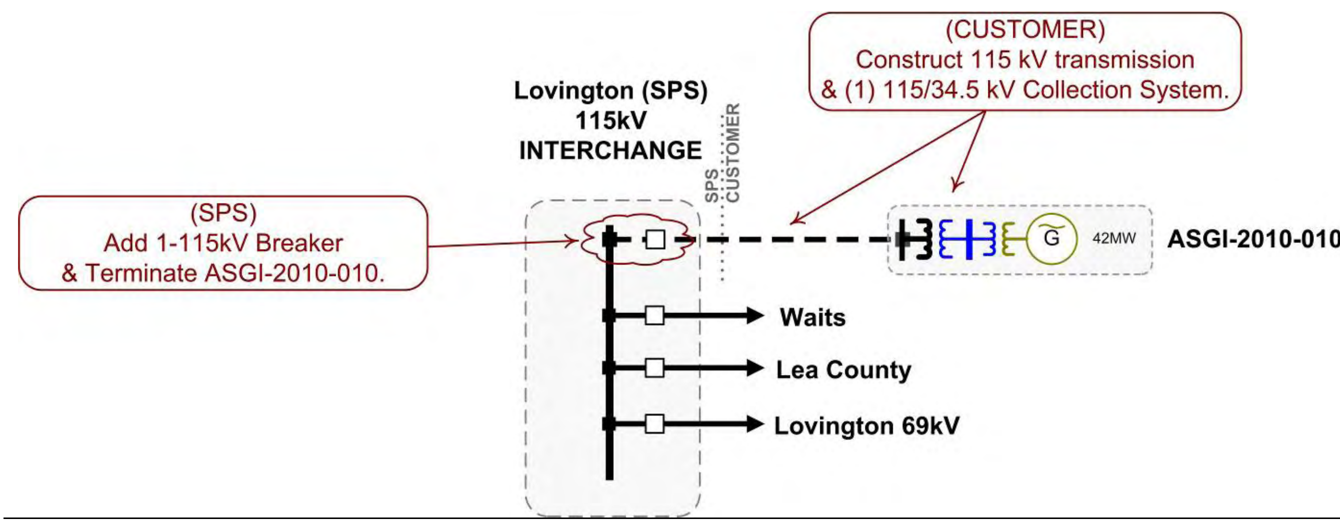
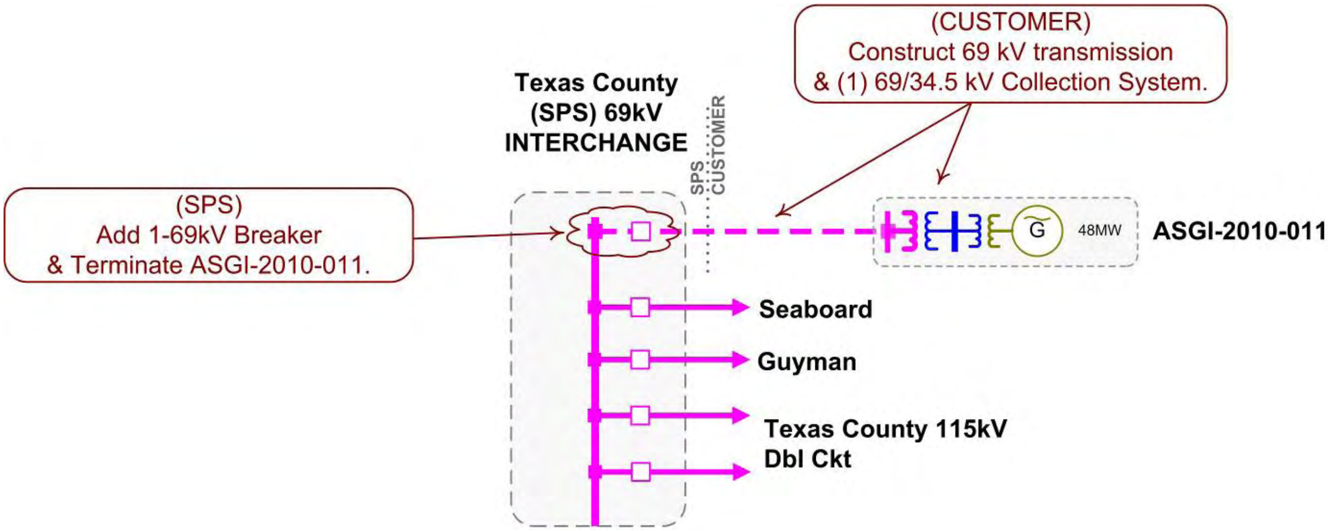


ASGI-2010-010



ASGI-2010-011



E: Cost Allocation per Interconnection Request

This section shows each Generation Interconnection Request Customer, their current study impacted Network Upgrades, and the previously allocated upgrades upon which they rely to accommodate their interconnection to the transmission system.

The costs associated with the current study Network Upgrades are allocated to the Customers shown in this report.

In addition should a higher queued request, defined as one this study includes as a prior queued request, withdraw, the Network Upgrades assigned to the withdrawn request may be reallocated to the remaining requests that have an impact on the Network Upgrade under a restudy. Also, should a Interconnection Request choose to go into service prior to the operation date of any necessary Network Upgrades, the costs associated with those upgrades may be reallocated to the impacted Interconnection Request. The actual costs allocated to each Generation Interconnection Request Customer will be determined at the time of a restudy.

The required interconnection costs listed do not include all costs associated with the deliverability of the energy to final customers. These costs are determined by separate studies if the Customer submits a Transmission Service Request through SPP's Open Access Same Time Information System (OASIS) as required by Attachment Z1 of the SPP OATT. In addition, costs associated with a short circuit analysis will be allocated should the Interconnection Request Customer choose to execute a Facility Study Agreement.

Appendix E. - Cost Allocation Per Request - DIS-2010-001

(Including Previously Allocated Network Upgrades*)

Interconnection Request and Upgrades	Upgrade Type	Allocated Costs	E + C Costs
ASGI-2010-010			
ASGI-2010-010 Interconnection Costs See Oneline Diagram.	Current Study	$2,000,000.00	$2,000,000
	Current Study Total	**$2,000,000.00**	
ASGI-2010-011			
ASGI-2010-011 Interconnection Costs See Oneline Diagram.	Current Study	$1.00	$1
Finney - Hitchland 345kV CKT 1 Reset CTs and Replace Line Traps on 345kV between Hitchland and GEN-2003-013 POI.	Current Study	$31,110.58	$1,000,000
Moore County East - Sherman County Tap 115kV CKT 1 Reset 2 CTs and Replace breaker.	Current Study	$198,300.04	$400,000
Wheeler - Anadarko 345kV CKT 1 Build approximately 120 miles of 345kV.	Current Study	$4,202,524.53	$171,396,736
Hitchland - Wheeler 345kV CKT 1 Build approximately 105 miles of 345kV.	Current Study	$2,800,080.47	$105,000,000
Hitchland - Wheeler 345kV CKT 2 Build approximately 105 miles of 345kV.	Current Study	$2,800,080.47	$105,000,000
Hitchland - Woodward 345kV CKT 2 Priority Project: Hitchland - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$247,005,793
Hitchland - Woodward 345kV CKT 1 Priority Project: Hitchland - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$247,005,793
Comanche - Woodward 345kV CKT 1 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Comanche - Woodward 345kV CKT 2 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Comanche - Medicine Lodge 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Comanche - Medicine Lodge 345kV CKT 1 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Medicine Lodge - Wichita 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$356,300,000
Medicine Lodge - Wichita 345KV CKT 1 ICS-2008-001-2 upgrade.	Previously Allocated		$90,000,000
Wheeler - Woodward 345KV CKT 1 Balanced Portfolio: TUCO - Woodward 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$148,727,500
	Current Study Total	**$10,032,097.09**	

* Current Study Requests' Costs of Previously Allocated Network Upgrades will be determined by a restudy, if neccesary.

Interconnection Request and Upgrades	Upgrade Type	Allocated Costs	E + C Costs
GEN-2006-044N02			
GEN-2006-044N02 Interconnection Costs See Oneline Diagram.	Current Study	$2,000,000.00	$2,000,000
Madison County 230/115/13.8kV Transformer CKT 1 Install 230/115/13.8kV Transformer at New Madison County Tap.	Current Study	$1,231,538.79	$3,000,000
Norfolk - Madison County Tap 115kV CKT 1 Build approximately 20 miles of 115kV between Norfolk and new tap on Petersburg - Madison 115kV CKT 1.	Current Study	$5,952,234.90	$16,000,000
Petersburg - Madison 115kV CKT 1 (East of Madison County Tap) DIS-2009-001-1 upgrade.	Previously Allocated		$22,400,000
	Current Study Total	**$9,183,773.69**	
GEN-2008-022			
GEN-2008-022 Interconnection Costs See Oneline Diagram.	Current Study	$13,000,000.00	$13,000,000
Plant X - Tolk Station West 230kV CKT 1 Rebuild approximately 10 miles of 230kV.	Current Study	$4,760,138.37	$5,000,000
Plant X - Tolk Station East 230kV CKT 2 Rebuild approximately 10 miles of 230kV.	Current Study	$4,762,189.39	$5,000,000
Potter County - Plant X 230kV CKT 1 Replace Line Traps on 230kV between GEN-2006-039 Tap and Potter County.	Current Study	$188,061.62	$200,000
Potter - Bushland 230kV CKT 1 Replace Line Traps.	Current Study	$188,029.05	$200,000
Wheeler - Anadarko 345kV CKT 1 Build approximately 120 miles of 345kV.	Current Study	$25,580,034.20	$171,396,736
Wheeler - TUCO Interchange 345KV CKT 1 Balanced Portfolio: TUCO - Woodward 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$148,727,500
Tolk Station East - TUCO Interchange 230kV CKT 1 ICS-2008-001-2 upgrade.	Previously Allocated		$200,000
Hitchland - Woodward 345kV CKT 2 Priority Project: Hitchland - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$247,005,793
Hitchland - Woodward 345kV CKT 1 Priority Project: Hitchland - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$247,005,793
Comanche - Woodward 345kV CKT 1 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Comanche - Woodward 345kV CKT 2 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
	Current Study Total	**$48,478,452.63**	
GEN-2008-028			
GEN-2008-028 Interconnection Costs See Oneline Diagram.	Current Study	$2,500,000.00	$2,500,000
Finney - Hitchland 345kV CKT 1 Reset CTs and Replace Line Traps on 345kV between Hitchland and GEN-2003-013 POI.	Current Study	$252,262.68	$1,000,000

* Current Study Requests' Costs of Previously Allocated Network Upgrades will be determined by a restudy, if neccesary.

Interconnection Request and Upgrades	Upgrade Type	Allocated Costs	E + C Costs
Wheeler - Anadarko 345kV CKT 1 Build approximately 120 miles of 345kV.	Current Study	$33,980,498.46	$171,396,736
Hitchland - Wheeler 345kV CKT 1 Build approximately 105 miles of 345kV.	Current Study	$26,997,109.90	$105,000,000
Hitchland - Wheeler 345kV CKT 2 Build approximately 105 miles of 345kV.	Current Study	$26,997,109.90	$105,000,000
Moore County East - Sherman County Tap 115kV CKT 1 Reset 2 CTs and Replace breaker.	Current Study	$55,050.79	$400,000
Hitchland - Woodward 345kV CKT 2 Priority Project: Hitchland - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$247,005,793
Hitchland - Woodward 345kV CKT 1 Priority Project: Hitchland - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$247,005,793
Comanche - Woodward 345kV CKT 1 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Comanche - Woodward 345kV CKT 2 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Comanche - Medicine Lodge 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Comanche - Medicine Lodge 345kV CKT 1 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Medicine Lodge - Wichita 345KV CKT 1 ICS-2008-001-2 upgrade.	Previously Allocated		$90,000,000
Medicine Lodge - Wichita 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$356,300,000
Wheeler - TUCO Interchange 345KV CKT 1 Balanced Portfolio: TUCO - Woodward 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$148,727,500
Finney Switching Station - Holcomb 345KV CKT 2 Per GEN-2006-044 Facility Study	Previously Allocated		$6,299,839
	Current Study Total	**$90,782,031.73**	
GEN-2008-037			
GEN-2008-037 Interconnection Costs See Oneline Diagram.	Current Study	$3,500,000.00	$3,500,000
Washita - Blue Canyon 138kV CKT 1 Reset CT on 138kV between GEN-2008-037 POI and Washita.	Current Study	$500,000.00	$500,000
Washita - Anadarko 138kV CKT 2 Build approximately 11 miles of 138kV.	Current Study	$4,680,184.81	$8,800,000
	Current Study Total	**$8,680,184.81**	
GEN-2008-044			
GEN-2008-044 Interconnection Costs See Oneline Diagram.	Current Study	$3,473,684.21	$4,000,000

* Current Study Requests' Costs of Previously Allocated Network Upgrades will be determined by a restudy, if neccesary.

Interconnection Request and Upgrades	Upgrade Type	Allocated Costs	E + C Costs
Wheeler - Anadarko 345kV CKT 1 Build approximately 120 miles of 345kV.	Current Study	$4,192,011.11	$171,396,736
Comanche - Woodward 345kV CKT 1 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Comanche - Woodward 345kV CKT 2 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Wheeler - Woodward 345KV CKT 1 Balanced Portfolio: TUCO - Woodward 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$148,727,500
Comanche - Medicine Lodge 345kV CKT 1 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Comanche - Medicine Lodge 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Medicine Lodge - Wichita 345KV CKT 1 ICS-2008-001-2 upgrade.	Previously Allocated		$90,000,000
Medicine Lodge - Wichita 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$356,300,000
	Current Study Total	**$7,665,695.32**	
GEN-2008-046			
GEN-2008-046 Interconnection Costs See Oneline Diagram.	Current Study	$2,000,000.00	$2,000,000
Sunnyside - Hugo 345kV CKT 1 NTC 20017 & 20018 for In Service 4/1/2012.	Previously Allocated		$202,000,000
	Current Study Total	**$2,000,000.00**	
GEN-2008-047			
GEN-2008-047 Interconnection Costs See Oneline Diagram.	Current Study	$2,500,000.00	$2,500,000
Finney - Hitchland 345kV CKT 1 Reset CTs and Replace Line Traps on 345kV between Hitchland and GEN-2003-013 POI.	Current Study	$210,218.90	$1,000,000
Wheeler - Anadarko 345kV CKT 1 Build approximately 120 miles of 345kV.	Current Study	$28,317,082.05	$171,396,736
Hitchland - Wheeler 345kV CKT 1 Build approximately 105 miles of 345kV.	Current Study	$22,497,591.58	$105,000,000
Hitchland - Wheeler 345kV CKT 2 Build approximately 105 miles of 345kV.	Current Study	$22,497,591.58	$105,000,000
Moore County East - Sherman County Tap 115kV CKT 1 Reset 2 CTs and Replace breaker.	Current Study	$45,875.65	$400,000
Hitchland - Woodward 345kV CKT 2 Priority Project: Hitchland - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$247,005,793
Hitchland - Woodward 345kV CKT 1 Priority Project: Hitchland - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$247,005,793

* Current Study Requests' Costs of Previously Allocated Network Upgrades will be determined by a restudy, if neccesary.

Interconnection Request and Upgrades	Upgrade Type	Allocated Costs	E + C Costs
Comanche - Woodward 345kV CKT 1 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Comanche - Woodward 345kV CKT 2 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Comanche - Medicine Lodge 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Comanche - Medicine Lodge 345kV CKT 1 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Medicine Lodge - Wichita 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$356,300,000
Medicine Lodge - Wichita 345KV CKT 1 ICS-2008-001-2 upgrade.	Previously Allocated		$90,000,000
Wheeler - TUCO Interchange 345KV CKT 1 Balanced Portfolio: TUCO - Woodward 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$148,727,500
Finney Switching Station - Holcomb 345KV CKT 2 Per GEN-2006-044 Facility Study	Previously Allocated		$6,299,839
	Current Study Total	**$76,068,359.76**	
GEN-2008-071			
GEN-2008-071 Interconnection Costs See Oneline Diagram.	Current Study	$1,500,000.00	$1,500,000
Cleveland - Sooner 345kV CKT 1 Balanced Portfolio: Cleveland - Sooner 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$17,000,000
	Current Study Total	**$1,500,000.00**	
GEN-2008-088			
Switch 2749 - Wildorado 69kV CKT 1 Rebuild approximately 4 miles of 69kV.	Current Study	$2,000,000.00	$2,000,000
GEN-2008-088 Interconnection Costs See Oneline Diagram.	Current Study	$900,000.00	$900,000
Wheeler - Anadarko 345kV CKT 1 Build approximately 120 miles of 345kV.	Current Study	$2,934,569.82	$171,396,736
Hitchland - Woodward 345kV CKT 1 Priority Project: Hitchland - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$247,005,793
Hitchland - Woodward 345kV CKT 2 Priority Project: Hitchland - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$247,005,793
Comanche - Woodward 345kV CKT 2 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Comanche - Woodward 345kV CKT 1 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500

* Current Study Requests' Costs of Previously Allocated Network Upgrades will be determined by a restudy, if neccesary.

Interconnection Request and Upgrades	Upgrade Type	Allocated Costs	E + C Costs
Comanche - Medicine Lodge 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Comanche - Medicine Lodge 345kV CKT 1 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Medicine Lodge - Wichita 345KV CKT 1 ICS-2008-001-2 upgrade.	Previously Allocated		$90,000,000
Medicine Lodge - Wichita 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$356,300,000
	Current Study Total	**$5,834,569.82**	
GEN-2008-098			
GEN-2008-098 Interconnection Costs See Oneline Diagram.	Current Study	$10,000,000.00	$10,000,000
Rose Hill - Sooner 345kV CKT 1 (North of GEN-2008-127 Tap) NTC 20059 for In Service 1/1/2013.	Previously Allocated		$79,204,000
Rose Hill - Sooner 345kV CKT 1 (South of GEN-2008-127 Tap) NTC 20059 for In Service 1/1/2013.	Previously Allocated		$79,204,000
	Current Study Total	**$10,000,000.00**	
GEN-2008-110			
GEN-2008-110 Interconnection Costs See Oneline Diagram.	Current Study	$2,500,000.00	$2,500,000
Finney - Hitchland 345kV CKT 1 Reset CTs and Replace Line Traps on 345kV between Hitchland and GEN-2003-013 POI.	Current Study	$210,218.90	$1,000,000
Wheeler - Anadarko 345kV CKT 1 Build approximately 120 miles of 345kV.	Current Study	$28,317,082.05	$171,396,736
Hitchland - Wheeler 345kV CKT 2 Build approximately 105 miles of 345kV.	Current Study	$22,497,591.58	$105,000,000
Hitchland - Wheeler 345kV CKT 1 Build approximately 105 miles of 345kV.	Current Study	$22,497,591.58	$105,000,000
Moore County East - Sherman County Tap 115kV CKT 1 Reset 2 CTs and Replace breaker.	Current Study	$45,875.65	$400,000
Hitchland - Woodward 345kV CKT 1 Priority Project: Hitchland - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$247,005,793
Hitchland - Woodward 345kV CKT 2 Priority Project: Hitchland - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$247,005,793
Comanche - Woodward 345kV CKT 2 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Comanche - Woodward 345kV CKT 1 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Comanche - Medicine Lodge 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000

* Current Study Requests' Costs of Previously Allocated Network Upgrades will be determined by a restudy, if neccesary.

Interconnection Request and Upgrades	Upgrade Type	Allocated Costs	E + C Costs
Comanche - Medicine Lodge 345kV CKT 1 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Medicine Lodge - Wichita 345KV CKT 1 ICS-2008-001-2 upgrade.	Previously Allocated		$90,000,000
Medicine Lodge - Wichita 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$356,300,000
Wheeler - TUCO Interchange 345KV CKT 1 Balanced Portfolio: TUCO - Woodward 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$148,727,500
Finney Switching Station - Holcomb 345KV CKT 2 Per GEN-2006-044 Facility Study	Previously Allocated		$6,299,839
	Current Study Total	**$76,068,359.76**	
GEN-2008-123N			
GEN-2008-123N Interconnection Costs See Oneline Diagram.	Current Study	$4,000,000.00	$4,000,000
Guide Rock - Superior 115kV CKT 1 Rebuild approximately 18 miles of 115kV.	Current Study	$14,400,000.00	$14,400,000
	Current Study Total	**$18,400,000.00**	
GEN-2009-008			
GEN-2009-008 Interconnection Costs See Oneline Diagram.	Current Study	$1,800,000.00	$1,800,000
Knoll 345/230/xxkV Transformer CKT 2 Install second 345/230/xxkV Transformer at Knoll (Post Rock).	Current Study	$4,369,802.17	$4,700,000
South Hays - Hays Plant - Vine Street 115kV CKT 1 Rebuild approximately 4 miles of 115kV.	Current Study	$3,040,900.40	$3,200,000
Mullergren - Rice County 230kV CKT 1 Build approximately 30 miles of 230kV between Mullergren and Rice County.	Current Study	$8,985,374.03	$30,000,000
Rice County 230/115/xxkV Transformer CKT 1 Install 230/115/xxkV Transformer at Rice County.	Current Study	$1,797,074.81	$6,000,000
Spearville - Axtel 345kV CKT 1(North of GEN-2010-016 Tap) Balanced Portfolio: Spearville - Knoll - Axtel 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$112,700,000
Knoll 345/230/xxkV Transformer CKT 1 Balanced Portfolio: Spearville - Knoll - Axtel 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$236,000,000
Axtel - Knoll 345kV CKT 1 Balanced Portfolio: Spearville - Knoll - Axtel 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$112,700,000
Spearville - Comanche 345kV CKT 1 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Spearville - Comanche 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Comanche - Woodward 345kV CKT 2 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500

* Current Study Requests' Costs of Previously Allocated Network Upgrades will be determined by a restudy, if neccesary.

Interconnection Request and Upgrades	Upgrade Type	Allocated Costs	E + C Costs
Comanche - Woodward 345kV CKT 1 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
	Current Study Total	$19,993,151.41	
GEN-2009-020			
GEN-2009-020 Interconnection Costs See Oneline Diagram.	Current Study	$1,800,000.00	$1,800,000
Rice County 230/115/xxkV Transformer CKT 1 Install 230/115/xxkV Transformer at Rice County.	Current Study	$718,243.60	$6,000,000
Mullergren - Rice County 230kV CKT 1 Build approximately 30 miles of 230kV between Mullergren and Rice County.	Current Study	$3,591,218.01	$30,000,000
Knoll 345/230/xxkV Transformer CKT 2 Install second 345/230/xxkV Transformer at Knoll (Post Rock).	Current Study	$288,333.39	$4,700,000
South Hays - Hays Plant - Vine Street 115kV CKT 1 Rebuild approximately 4 miles of 115kV.	Current Study	$159,099.60	$3,200,000
Spearville - Comanche 345kV CKT 1 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Spearville - Comanche 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Axtel - Knoll 345kV CKT 1 Balanced Portfolio: Spearville - Knoll - Axtel 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$112,700,000
Knoll 345/230/xxkV Transformer CKT 1 Balanced Portfolio: Spearville - Knoll - Axtel 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$236,000,000
	Current Study Total	$6,556,894.60	
GEN-2009-030			
GEN-2009-030 Interconnection Costs See Oneline Diagram.	Current Study	$2,000,000.00	$2,000,000
Washita - Weatherford 138kV CKT 1 Build approximately 50 miles of 138kV.	Current Study	$39,704,762.57	$40,000,000
Washita - Anadarko 138kV CKT 2 Build approximately 11 miles of 138kV.	Current Study	$3,215,277.97	$8,800,000
	Current Study Total	$44,920,040.54	
GEN-2009-040			
GEN-2009-040 Interconnection Costs See Oneline Diagram.	Current Study	$3,500,000.00	$3,500,000
Knoll 345/230/xxkV Transformer CKT 2 Install second 345/230/xxkV Transformer at Knoll (Post Rock).	Current Study	$41,864.44	$4,700,000
Knob Hill - Steele City 115kV CKT 1 NPPD RR Project PID:603 UID:10772 & WERE RR Project PID:578 UID:10739	Previously Allocated		$32,227,450
	Current Study Total	$3,541,864.44	

* Current Study Requests' Costs of Previously Allocated Network Upgrades will be determined by a restudy, if neccesary.

Interconnection Request and Upgrades	Upgrade Type	Allocated Costs	E + C Costs
GEN-2009-059			
GEN-2009-059 Interconnection Costs See Oneline Diagram.	Current Study	$3,800,000.00	$3,800,000
GEN-2008-079 Tap - Spearville 115KV CKT 1 Construct approximately 35 miles of new 115kV.	Current Study	$9,923,884.38	$13,800,000
Spearville 345/230/13.8kV Transformer CKT 3 Install 345/230/13.8kV Transformer CKT 3 at Spearville.	Current Study	$4,916,091.16	$6,400,000
Cimarron River Plant - Cimarron River Tap 115kV CKT 1 Rebuild approximately 4 miles of 115kV.	Current Study	$803,586.58	$2,000,000
Rice County 230/115/xxkV Transformer CKT 1 Install 230/115/xxkV Transformer at Rice County.	Current Study	$469,861.41	$6,000,000
Mullergren - Rice County 230kV CKT 1 Build approximately 30 miles of 230kV between Mullergren and Rice County.	Current Study	$2,349,307.03	$30,000,000
Spearville 230/115/13.8kV Transformer CKT 2 DIS-2009-001-1 upgrade.	Previously Allocated		$3,000,000
Spearville 345/230/13.8KV Transformer CKT 2 ICS-2008-001-2 upgrade.	Previously Allocated		$6,400,000
Judson Large - North Judson Large 115KV CKT 2 Construct approximately 1 mile of new 115kV for 2nd circuit	Previously Allocated		$400,000
North Judson Large - Spearville 115KV CKT 2 DIS-2009-001-1 upgrade.	Previously Allocated		$6,000,000
Spearville - Comanche 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Spearville - Comanche 345kV CKT 1 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Spearville - Axtel 345kV CKT 1(South of GEN-2010-016 Tap) Balanced Portfolio: Spearville - Knoll - Axtel 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$112,700,000
Spearville - Axtel 345kV CKT 1(North of GEN-2010-016 Tap) Balanced Portfolio: Spearville - Knoll - Axtel 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$112,700,000
Comanche - Woodward 345kV CKT 1 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Comanche - Woodward 345kV CKT 2 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Medicine Lodge - Wichita 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$356,300,000
Axtel - Knoll 345kV CKT 1 Balanced Portfolio: Spearville - Knoll - Axtel 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$112,700,000
Comanche - Medicine Lodge 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Comanche - Medicine Lodge 345kV CKT 1 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000

* Current Study Requests' Costs of Previously Allocated Network Upgrades will be determined by a restudy, if neccesary.

Interconnection Request and Upgrades	Upgrade Type	Allocated Costs	E + C Costs
	Current Study Total	**$22,262,730.56**	
GEN-2009-060			
GEN-2009-060 Interconnection Costs See Oneline Diagram.	Current Study	$1,000,000.00	$1,000,000
Lake Creek - Lone Wolf 69kV CKT 1 Reset CT.	Current Study	$350,000.00	$350,000
Washita - Anadarko 138kV CKT 2 Build approximately 11 miles of 138kV.	Current Study	$904,537.22	$8,800,000
Washita - Weatherford 138kV CKT 1 Build approximately 50 miles of 138kV.	Current Study	$295,237.43	$40,000,000
	Current Study Total	**$2,549,774.65**	
GEN-2009-062			
GEN-2009-062 Interconnection Costs See Oneline Diagram.	Current Study	$1,800,000.00	$1,800,000
Cimarron River Plant - Cimarron River Tap 115kV CKT 1 Rebuild approximately 4 miles of 115kV.	Current Study	$1,136,783.75	$2,000,000
GEN-2008-079 Tap - Spearville 115KV CKT 1 Construct approximately 35 miles of new 115kV.	Current Study	$3,875,598.68	$13,800,000
Spearville 345/230/13.8kV Transformer CKT 3 Install 345/230/13.8kV Transformer CKT 3 at Spearville.	Current Study	$1,483,908.84	$6,400,000
Mullergren - Rice County 230kV CKT 1 Build approximately 30 miles of 230kV between Mullergren and Rice County.	Current Study	$2,428,423.76	$30,000,000
Rice County 230/115/xxkV Transformer CKT 1 Install 230/115/xxkV Transformer at Rice County.	Current Study	$485,684.75	$6,000,000
Spearville - Comanche 345kV CKT 1 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Spearville - Comanche 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Spearville 230/115/13.8kV Transformer CKT 2 DIS-2009-001-1 upgrade.	Previously Allocated		$3,000,000
Medicine Lodge - Wichita 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$356,300,000
Comanche - Medicine Lodge 345kV CKT 1 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Comanche - Medicine Lodge 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Spearville - Axtel 345kV CKT 1(North of GEN-2010-016 Tap) Balanced Portfolio: Spearville - Knoll - Axtel 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$112,700,000
Spearville - Axtel 345kV CKT 1(South of GEN-2010-016 Tap) Balanced Portfolio: Spearville - Knoll - Axtel 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$112,700,000

* Current Study Requests' Costs of Previously Allocated Network Upgrades will be determined by a restudy, if neccesary.

Interconnection Request and Upgrades	Upgrade Type	Allocated Costs	E + C Costs
Comanche - Woodward 345kV CKT 1 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Comanche - Woodward 345kV CKT 2 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Judson Large - North Judson Large 115KV CKT 2 Construct approximately 1 mile of new 115kV for 2nd circuit	Previously Allocated		$400,000
North Judson Large - Spearville 115KV CKT 2 DIS-2009-001-1 upgrade.	Previously Allocated		$6,000,000
Axtel - Knoll 345kV CKT 1 Balanced Portfolio: Spearville - Knoll - Axtel 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$112,700,000
Spearville 345/230/13.8KV Transformer CKT 2 ICS-2008-001-2 upgrade.	Previously Allocated		$6,400,000
	Current Study Total	**$11,210,399.78**	
GEN-2009-067S			
GEN-2009-067S Interconnection Costs See Oneline Diagram.	Current Study	$1,000,000.00	$1,000,000
Potter County - Plant X 230kV CKT 1 Replace Line Traps on 230kV between GEN-2006-039 Tap and Potter County.	Current Study	$11,938.38	$200,000
Plant X - Tolk Station West 230kV CKT 1 Rebuild approximately 10 miles of 230kV.	Current Study	$239,861.63	$5,000,000
Plant X - Tolk Station East 230kV CKT 2 Rebuild approximately 10 miles of 230kV.	Current Study	$237,810.61	$5,000,000
Wheeler - Anadarko 345kV CKT 1 Build approximately 120 miles of 345kV.	Current Study	$1,731,026.32	$171,396,736
Potter - Bushland 230kV CKT 1 Replace Line Traps.	Current Study	$11,970.95	$200,000
Wheeler - TUCO Interchange 345KV CKT 1 Balanced Portfolio: TUCO - Woodward 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$148,727,500
Tolk Station East - TUCO Interchange 230kV CKT 1 ICS-2008-001-2 upgrade.	Previously Allocated		$200,000
Hitchland - Woodward 345kV CKT 2 Priority Project: Hitchland - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$247,005,793
Hitchland - Woodward 345kV CKT 1 Priority Project: Hitchland - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$247,005,793
Comanche - Woodward 345kV CKT 1 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Comanche - Woodward 345kV CKT 2 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
	Current Study Total	**$3,232,607.89**	

* Current Study Requests' Costs of Previously Allocated Network Upgrades will be determined by a restudy, if neccesary.

Interconnection Request and Upgrades	Upgrade Type	Allocated Costs	E + C Costs
GEN-2010-003			
GEN-2010-003 Interconnection Costs See Oneline Diagram.	Current Study	$2,000,000.00	$2,000,000
Rose Hill - Sooner 345kV CKT 1 (North of GEN-2008-127 Tap) NTC 20059 for In Service 1/1/2013.	Previously Allocated		$79,204,000
Rose Hill - Sooner 345kV CKT 1 (South of GEN-2008-127 Tap) NTC 20059 for In Service 1/1/2013.	Previously Allocated		$79,204,000
	Current Study Total	**$2,000,000.00**	
GEN-2010-005			
GEN-2010-005 Interconnection Costs See Oneline Diagram.	Current Study	$2,000,000.00	$2,000,000
Cleveland - Sooner 345kV CKT 1 Balanced Portfolio: Cleveland - Sooner 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$17,000,000
Rose Hill - Sooner 345kV CKT 1 (North of GEN-2008-127 Tap) NTC 20059 for In Service 1/1/2013.	Previously Allocated		$79,204,000
	Current Study Total	**$2,000,000.00**	
GEN-2010-006			
GEN-2010-006 Interconnection Costs See Oneline Diagram.	Current Study	$2,000,000.00	$2,000,000
Wheeler - TUCO Interchange 345KV CKT 1 Balanced Portfolio: TUCO - Woodward 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$148,727,500
Comanche - Woodward 345kV CKT 1 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Comanche - Woodward 345kV CKT 2 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Hitchland - Woodward 345kV CKT 2 Priority Project: Hitchland - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$247,005,793
Hitchland - Woodward 345kV CKT 1 Priority Project: Hitchland - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$247,005,793
	Current Study Total	**$2,000,000.00**	
GEN-2010-007			
GEN-2010-007 Interconnection Costs See Oneline Diagram.	Current Study	$2,500,000.00	$2,500,000
Finney - Hitchland 345kV CKT 1 Reset CTs and Replace Line Traps on 345kV between Hitchland and GEN-2003-013 POI.	Current Study	$44,626.99	$1,000,000
Wheeler - Anadarko 345kV CKT 1 Build approximately 120 miles of 345kV.	Current Study	$6,023,112.59	$171,396,736
Hitchland - Wheeler 345kV CKT 2 Build approximately 105 miles of 345kV.	Current Study	$3,285,508.54	$105,000,000
Hitchland - Wheeler 345kV CKT 1 Build approximately 105 miles of 345kV.	Current Study	$3,285,508.54	$105,000,000

* Current Study Requests' Costs of Previously Allocated Network Upgrades will be determined by a restudy, if neccesary.

Interconnection Request and Upgrades	Upgrade Type	Allocated Costs	E + C Costs
Hitchland - Woodward 345kV CKT 2 Priority Project: Hitchland - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$247,005,793
Hitchland - Woodward 345kV CKT 1 Priority Project: Hitchland - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$247,005,793
Comanche - Woodward 345kV CKT 2 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Comanche - Woodward 345kV CKT 1 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Comanche - Medicine Lodge 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Comanche - Medicine Lodge 345kV CKT 1 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Medicine Lodge - Wichita 345KV CKT 1 ICS-2008-001-2 upgrade.	Previously Allocated		$90,000,000
Medicine Lodge - Wichita 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$356,300,000
Wheeler - Woodward 345KV CKT 1 Balanced Portfolio: TUCO - Woodward 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$148,727,500
	Current Study Total	**$15,138,756.66**	
GEN-2010-008			
GEN-2010-008 Interconnection Costs See Oneline Diagram.	Current Study	$750,000.00	$750,000
Fargo Junction - Woodward 69kV CKT 1 Rebuild approximately 2 miles of 69kV.	Current Study	$5,000,000.00	$5,000,000
Wheeler - Anadarko 345kV CKT 1 Build approximately 120 miles of 345kV.	Current Study	$1,597,533.48	$171,396,736
Comanche - Woodward 345kV CKT 2 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Comanche - Woodward 345kV CKT 1 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Wheeler - Woodward 345KV CKT 1 Balanced Portfolio: TUCO - Woodward 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$148,727,500
Comanche - Medicine Lodge 345kV CKT 1 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Comanche - Medicine Lodge 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Medicine Lodge - Wichita 345KV CKT 1 ICS-2008-001-2 upgrade.	Previously Allocated		$90,000,000

* Current Study Requests' Costs of Previously Allocated Network Upgrades will be determined by a restudy, if neccesary.

Interconnection Request and Upgrades	Upgrade Type	Allocated Costs	E + C Costs
Medicine Lodge - Wichita 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$356,300,000
	Current Study Total	$7,347,533.48	
GEN-2010-009			
GEN-2010-009 Interconnection Costs See Oneline Diagram.	Current Study	$7,500,000.00	$7,500,000
Rice County 230/115/xxkV Transformer CKT 1 Install 230/115/xxkV Transformer at Rice County.	Current Study	$657,277.18	$6,000,000
Mullergren - Rice County 230kV CKT 1 Build approximately 30 miles of 230kV between Mullergren and Rice County.	Current Study	$3,286,385.89	$30,000,000
GEN-2008-079 Tap - Spearville 115KV CKT 1 Construct approximately 35 miles of new 115kV.	Current Study	$516.94	$13,800,000
Spearville - Comanche 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Spearville - Comanche 345kV CKT 1 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Spearville - Axtel 345kV CKT 1(North of GEN-2010-016 Tap) Balanced Portfolio: Spearville - Knoll - Axtel 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$112,700,000
Spearville - Axtel 345kV CKT 1(South of GEN-2010-016 Tap) Balanced Portfolio: Spearville - Knoll - Axtel 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$112,700,000
Comanche - Medicine Lodge 345kV CKT 1 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Comanche - Medicine Lodge 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Medicine Lodge - Wichita 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$356,300,000
Comanche - Woodward 345kV CKT 2 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Comanche - Woodward 345kV CKT 1 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Axtel - Knoll 345kV CKT 1 Balanced Portfolio: Spearville - Knoll - Axtel 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$112,700,000
	Current Study Total	$11,444,180.01	
GEN-2010-010			
GEN-2010-010 Interconnection Costs See Oneline Diagram.	Current Study	$7,500,000.00	$7,500,000
Madison County 230/115/13.8kV Transformer CKT 1 Install 230/115/13.8kV Transformer at New Madison County Tap.	Current Study	$1,768,461.21	$3,000,000

* Current Study Requests' Costs of Previously Allocated Network Upgrades will be determined by a restudy, if neccesary.

Interconnection Request and Upgrades	Upgrade Type	Allocated Costs	E + C Costs
Norfolk - Madison County Tap 115kV CKT 1 Build approximately 20 miles of 115kV between Norfolk and new tap on Petersburg - Madison 115kV CKT 1.	Current Study	$10,047,765.10	$16,000,000
Petersburg - Madison 115kV CKT 1 (East of Madison County Tap) DIS-2009-001-1 upgrade.	Previously Allocated		$22,400,000
	Current Study Total	**$19,316,226.31**	
GEN-2010-011			
GEN-2008-044 Interconnection Costs See Oneline Diagram.	Current Study	$526,315.79	$4,000,000
Wheeler - Anadarko 345kV CKT 1 Build approximately 120 miles of 345kV.	Current Study	$635,153.20	$171,396,736
Comanche - Woodward 345kV CKT 1 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Comanche - Woodward 345kV CKT 2 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Wheeler - Woodward 345KV CKT 1 Balanced Portfolio: TUCO - Woodward 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$148,727,500
Comanche - Medicine Lodge 345kV CKT 1 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Comanche - Medicine Lodge 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Medicine Lodge - Wichita 345KV CKT 1 ICS-2008-001-2 upgrade.	Previously Allocated		$90,000,000
Medicine Lodge - Wichita 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$356,300,000
	Current Study Total	**$1,161,468.99**	
GEN-2010-013			
GEN-2010-013 Interconnection Costs See Oneline Diagram.	Current Study	$2,000,000.00	$2,000,000
Rose Hill - Sooner 345kV CKT 1 (North of GEN-2008-127 Tap) NTC 20059 for In Service 1/1/2013.	Previously Allocated		$79,204,000
Rose Hill - Sooner 345kV CKT 1 (South of GEN-2008-127 Tap) NTC 20059 for In Service 1/1/2013.	Previously Allocated		$79,204,000
	Current Study Total	**$2,000,000.00**	
GEN-2010-014			
GEN-2010-014 Interconnection Costs See Oneline Diagram.	Current Study	$2,500,000.00	$2,500,000
Finney - Hitchland 345kV CKT 1 Reset CTs and Replace Line Traps on 345kV between Hitchland and GEN-2003-013 POI.	Current Study	$251,561.95	$1,000,000
Wheeler - Anadarko 345kV CKT 1 Build approximately 120 miles of 345kV.	Current Study	$33,886,108.19	$171,396,736

* Current Study Requests' Costs of Previously Allocated Network Upgrades will be determined by a restudy, if neccesary.

Interconnection Request and Upgrades	Upgrade Type	Allocated Costs	E + C Costs
Hitchland - Wheeler 345kV CKT 2 Build approximately 105 miles of 345kV.	Current Study	$26,922,117.92	$105,000,000
Hitchland - Wheeler 345kV CKT 1 Build approximately 105 miles of 345kV.	Current Study	$26,922,117.92	$105,000,000
Moore County East - Sherman County Tap 115kV CKT 1 Reset 2 CTs and Replace breaker.	Current Study	$54,897.87	$400,000
Hitchland - Woodward 345kV CKT 2 Priority Project: Hitchland - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$247,005,793
Hitchland - Woodward 345kV CKT 1 Priority Project: Hitchland - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$247,005,793
Comanche - Woodward 345kV CKT 2 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Comanche - Woodward 345kV CKT 1 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Comanche - Medicine Lodge 345kV CKT 1 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Comanche - Medicine Lodge 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Medicine Lodge - Wichita 345KV CKT 1 ICS-2008-001-2 upgrade.	Previously Allocated		$90,000,000
Medicine Lodge - Wichita 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$356,300,000
Wheeler - TUCO Interchange 345KV CKT 1 Balanced Portfolio: TUCO - Woodward 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$148,727,500
Finney Switching Station - Holcomb 345KV CKT 2 Per GEN-2006-044 Facility Study	Previously Allocated		$6,299,839
	Current Study Total	**$90,536,803.85**	
GEN-2010-015			
GEN-2010-015 Interconnection Costs See Oneline Diagram.	Current Study	$7,500,000.00	$7,500,000
Rice County 230/115/xxkV Transformer CKT 1 Install 230/115/xxkV Transformer at Rice County.	Current Study	$889,403.62	$6,000,000
Mullergren - Rice County 230kV CKT 1 Build approximately 30 miles of 230kV between Mullergren and Rice County.	Current Study	$4,447,018.08	$30,000,000
Cimarron River Plant - Cimarron River Tap 115kV CKT 1 Rebuild approximately 4 miles of 115kV.	Current Study	$59,629.66	$2,000,000
Spearville - Comanche 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Spearville - Comanche 345kV CKT 1 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000

* Current Study Requests' Costs of Previously Allocated Network Upgrades will be determined by a restudy, if neccesary.

Interconnection Request and Upgrades	Upgrade Type	Allocated Costs	E + C Costs
Spearville - Axtel 345kV CKT 1(South of GEN-2010-016 Tap) Balanced Portfolio: Spearville - Knoll - Axtel 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$112,700,000
Spearville - Axtel 345kV CKT 1(North of GEN-2010-016 Tap) Balanced Portfolio: Spearville - Knoll - Axtel 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$112,700,000
Comanche - Woodward 345kV CKT 2 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Comanche - Woodward 345kV CKT 1 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Comanche - Medicine Lodge 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Comanche - Medicine Lodge 345kV CKT 1 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Medicine Lodge - Wichita 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$356,300,000
Axtel - Knoll 345kV CKT 1 Balanced Portfolio: Spearville - Knoll - Axtel 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$112,700,000
Knoll 345/230/xxkV Transformer CKT 1 Balanced Portfolio: Spearville - Knoll - Axtel 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$236,000,000
Wheeler - Woodward 345KV CKT 1 Balanced Portfolio: TUCO - Woodward 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$148,727,500
Wheeler - TUCO Interchange 345KV CKT 1 Balanced Portfolio: TUCO - Woodward 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$148,727,500
	Current Study Total	**$12,896,051.36**	
GEN-2010-016			
GEN-2010-016 Interconnection Costs See Oneline Diagram.	Current Study	$10,000,000.00	$10,000,000
Rice County 230/115/xxkV Transformer CKT 1 Install 230/115/xxkV Transformer at Rice County.	Current Study	$982,454.64	$6,000,000
Mullergren - Rice County 230kV CKT 1 Build approximately 30 miles of 230kV between Mullergren and Rice County.	Current Study	$4,912,273.20	$30,000,000
Spearville - Axtel 345kV CKT 1(North of GEN-2010-016 Tap) Balanced Portfolio: Spearville - Knoll - Axtel 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$112,700,000
Spearville - Comanche 345kV CKT 1 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Spearville - Comanche 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Axtel - Knoll 345kV CKT 1 Balanced Portfolio: Spearville - Knoll - Axtel 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$112,700,000

* Current Study Requests' Costs of Previously Allocated Network Upgrades will be determined by a restudy, if neccesary.

Interconnection Request and Upgrades	Upgrade Type	Allocated Costs	E + C Costs
Knoll 345/230/xxkV Transformer CKT 1 Balanced Portfolio: Spearville - Knoll - Axtel 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$236,000,000
Comanche - Woodward 345kV CKT 1 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Comanche - Woodward 345kV CKT 2 Priority Project: Comanche - Woodward Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$108,227,500
Comanche - Medicine Lodge 345kV CKT 1 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Comanche - Medicine Lodge 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown.	Previously Allocated		$356,300,000
Medicine Lodge - Wichita 345kV CKT 2 Priority Project: Spearville - Comanche - Med Lodge - Wichita Dbl 345kV CKT (Total Project E&C Cost Shown).	Previously Allocated		$356,300,000
	Current Study Total	**$15,894,727.84**	

TOTAL CURRENT STUDY COSTS $662,696,737

* Current Study Requests' Costs of Previously Allocated Network Upgrades will be determined by a restudy, if neccesary.

F: Cost Allocation per Proposed Study Network Upgrade

This section shows each Direct Assigned Facility and Network Upgrade and the Generation Interconnection Request Customer(s) which have an impact in this study assuming all higher queued projects remain in the queue and achieve commercial operation.

The required interconnection costs listed do not include all costs associated with the deliverability of the energy to final customers. These costs are determined by separate studies if the Customer submits a Transmission Service Request through SPP's Open Access Same Time Information System (OASIS) as required by Attachment Z1 of the SPP OATT. In addition, costs associated with a short circuit analysis will be allocated should the Interconnection Request Customer choose to execute a Facility Study Agreement.

There may be additional costs allocated to each Customer. See Appendix E for more details.

Appendix F. - Cost Allocation Per Upgrade Facility - DIS-2010-001

Upgrade Facility and Designated Requests		Allocated Costs	E + C Costs
ASGI-2010-010 Interconnection Costs			**$2,000,000**
See Oneline Diagram.			
ASGI-2010-010		$2,000,000.00	
	Total	**$2,000,000.00**	
ASGI-2010-011 Interconnection Costs			**$1**
See Oneline Diagram.			
ASGI-2010-011		$1.00	
	Total	**$1.00**	
Cimarron River Plant - Cimarron River Tap 115kV CKT 1			**$2,000,000**
Rebuild approximately 4 miles of 115kV.			
GEN-2009-059		$803,586.58	
GEN-2009-062		$1,136,783.75	
GEN-2010-015		$59,629.66	
	Total	**$1,999,999.99**	
Fargo Junction - Woodward 69kV CKT 1			**$5,000,000**
Rebuild approximately 2 miles of 69kV.			
GEN-2010-008		$5,000,000.00	
	Total	**$5,000,000.00**	
Finney - Hitchland 345kV CKT 1			**$1,000,000**
Reset CTs and Replace Line Traps on 345kV between Hitchland and GEN-2003-013 POI.			
ASGI-2010-011		$31,110.58	
GEN-2008-028		$252,262.68	
GEN-2008-047		$210,218.90	
GEN-2008-110		$210,218.90	
GEN-2010-007		$44,626.99	
GEN-2010-014		$251,561.95	
	Total	**$1,000,000.00**	
GEN-2006-044N02 Interconnection Costs			**$2,000,000**
See Oneline Diagram.			
GEN-2006-044N02		$2,000,000.00	
	Total	**$2,000,000.00**	
GEN-2008-022 Interconnection Costs			**$13,000,000**
See Oneline Diagram.			
GEN-2008-022		$13,000,000.00	
	Total	**$13,000,000.00**	
GEN-2008-028 Interconnection Costs			**$2,500,000**
See Oneline Diagram.			
GEN-2008-028		$2,500,000.00	
	Total	**$2,500,000.00**	

Upgrade Facility and Designated Requests	Allocated Costs	E + C Costs
GEN-2008-037 Interconnection Costs		**$3,500,000**
See Oneline Diagram.		
GEN-2008-037	$3,500,000.00	
Total	**$3,500,000.00**	
GEN-2008-044 Interconnection Costs		**$4,000,000**
See Oneline Diagram.		
GEN-2008-044	$3,473,684.21	
GEN-2010-011	$526,315.79	
Total	**$4,000,000.00**	
GEN-2008-046 Interconnection Costs		**$2,000,000**
See Oneline Diagram.		
GEN-2008-046	$2,000,000.00	
Total	**$2,000,000.00**	
GEN-2008-047 Interconnection Costs		**$2,500,000**
See Oneline Diagram.		
GEN-2008-047	$2,500,000.00	
Total	**$2,500,000.00**	
GEN-2008-071 Interconnection Costs		**$1,500,000**
See Oneline Diagram.		
GEN-2008-071	$1,500,000.00	
Total	**$1,500,000.00**	
GEN-2008-079 Tap - Spearville 115KV CKT 1		**$13,800,000**
Construct approximately 35 miles of new 115kV.		
GEN-2009-059	$9,923,884.38	
GEN-2009-062	$3,875,598.68	
GEN-2010-009	$516.94	
Total	**$13,800,000.00**	
GEN-2008-088 Interconnection Costs		**$900,000**
See Oneline Diagram.		
GEN-2008-088	$900,000.00	
Total	**$900,000.00**	
GEN-2008-098 Interconnection Costs		**$10,000,000**
See Oneline Diagram.		
GEN-2008-098	$10,000,000.00	
Total	**$10,000,000.00**	
GEN-2008-110 Interconnection Costs		**$2,500,000**
See Oneline Diagram.		
GEN-2008-110	$2,500,000.00	
Total	**$2,500,000.00**	

Upgrade Facility and Designated Requests		Allocated Costs	E + C Costs
GEN-2008-123N Interconnection Costs			**$4,000,000**
See Oneline Diagram.			
GEN-2008-123N		$4,000,000.00	
	Total	**$4,000,000.00**	
GEN-2009-008 Interconnection Costs			**$1,800,000**
See Oneline Diagram.			
GEN-2009-008		$1,800,000.00	
	Total	**$1,800,000.00**	
GEN-2009-020 Interconnection Costs			**$1,800,000**
See Oneline Diagram.			
GEN-2009-020		$1,800,000.00	
	Total	**$1,800,000.00**	
GEN-2009-030 Interconnection Costs			**$2,000,000**
See Oneline Diagram.			
GEN-2009-030		$2,000,000.00	
	Total	**$2,000,000.00**	
GEN-2009-040 Interconnection Costs			**$3,500,000**
See Oneline Diagram.			
GEN-2009-040		$3,500,000.00	
	Total	**$3,500,000.00**	
GEN-2009-059 Interconnection Costs			**$3,800,000**
See Oneline Diagram.			
GEN-2009-059		$3,800,000.00	
	Total	**$3,800,000.00**	
GEN-2009-060 Interconnection Costs			**$1,000,000**
See Oneline Diagram.			
GEN-2009-060		$1,000,000.00	
	Total	**$1,000,000.00**	
GEN-2009-062 Interconnection Costs			**$1,800,000**
See Oneline Diagram.			
GEN-2009-062		$1,800,000.00	
	Total	**$1,800,000.00**	
GEN-2009-067S Interconnection Costs			**$1,000,000**
See Oneline Diagram.			
GEN-2009-067S		$1,000,000.00	
	Total	**$1,000,000.00**	
GEN-2010-003 Interconnection Costs			**$2,000,000**
See Oneline Diagram.			
GEN-2010-003		$2,000,000.00	
	Total	**$2,000,000.00**	

Upgrade Facility and Designated Requests		Allocated Costs	E + C Costs
GEN-2010-005 Interconnection Costs			**$2,000,000**
See Oneline Diagram.			
GEN-2010-005		$2,000,000.00	
	Total	**$2,000,000.00**	
GEN-2010-006 Interconnection Costs			**$2,000,000**
See Oneline Diagram.			
GEN-2010-006		$2,000,000.00	
	Total	**$2,000,000.00**	
GEN-2010-007 Interconnection Costs			**$2,500,000**
See Oneline Diagram.			
GEN-2010-007		$2,500,000.00	
	Total	**$2,500,000.00**	
GEN-2010-008 Interconnection Costs			**$750,000**
See Oneline Diagram.			
GEN-2010-008		$750,000.00	
	Total	**$750,000.00**	
GEN-2010-009 Interconnection Costs			**$7,500,000**
See Oneline Diagram.			
GEN-2010-009		$7,500,000.00	
	Total	**$7,500,000.00**	
GEN-2010-010 Interconnection Costs			**$7,500,000**
See Oneline Diagram.			
GEN-2010-010		$7,500,000.00	
	Total	**$7,500,000.00**	
GEN-2010-013 Interconnection Costs			**$2,000,000**
See Oneline Diagram.			
GEN-2010-013		$2,000,000.00	
	Total	**$2,000,000.00**	
GEN-2010-014 Interconnection Costs			**$2,500,000**
See Oneline Diagram.			
GEN-2010-014		$2,500,000.00	
	Total	**$2,500,000.00**	
GEN-2010-015 Interconnection Costs			**$7,500,000**
See Oneline Diagram.			
GEN-2010-015		$7,500,000.00	
	Total	**$7,500,000.00**	
GEN-2010-016 Interconnection Costs			**$10,000,000**
See Oneline Diagram.			
GEN-2010-016		$10,000,000.00	
	Total	**$10,000,000.00**	

Upgrade Facility and Designated Requests	Allocated Costs	E + C Costs
Guide Rock - Superior 115kV CKT 1		**$14,400,000**
Rebuild approximately 18 miles of 115kV.		
GEN-2008-123N	$14,400,000.00	
Total	**$14,400,000.00**	
Hitchland - Wheeler 345kV CKT 1		**$105,000,000**
Build approximately 105 miles of 345kV.		
ASGI-2010-011	$2,800,080.47	
GEN-2008-028	$26,997,109.90	
GEN-2008-047	$22,497,591.58	
GEN-2008-110	$22,497,591.58	
GEN-2010-007	$3,285,508.54	
GEN-2010-014	$26,922,117.92	
Total	**$104,999,999.99**	
Hitchland - Wheeler 345kV CKT 2		**$105,000,000**
Build approximately 105 miles of 345kV.		
ASGI-2010-011	$2,800,080.47	
GEN-2008-028	$26,997,109.90	
GEN-2008-047	$22,497,591.58	
GEN-2008-110	$22,497,591.58	
GEN-2010-007	$3,285,508.54	
GEN-2010-014	$26,922,117.92	
Total	**$104,999,999.99**	
Knoll 345/230/xxkV Transformer CKT 2		**$4,700,000**
Install second 345/230/xxkV Transformer at Knoll (Post Rock).		
GEN-2009-008	$4,369,802.17	
GEN-2009-020	$288,333.39	
GEN-2009-040	$41,864.44	
Total	**$4,700,000.00**	
Lake Creek - Lone Wolf 69kV CKT 1		**$350,000**
Reset CT.		
GEN-2009-060	$350,000.00	
Total	**$350,000.00**	
Madison County 230/115/13.8kV Transformer CKT 1		**$3,000,000**
Install 230/115/13.8kV Transformer at New Madison County Tap.		
GEN-2006-044N02	$1,231,538.79	
GEN-2010-010	$1,768,461.21	
Total	**$3,000,000.00**	

Upgrade Facility and Designated Requests	Allocated Costs	E + C Costs
Moore County East - Sherman County Tap 115kV CKT 1		**$400,000**
Reset 2 CTs and Replace breaker.		
ASGI-2010-011	$198,300.04	
GEN-2008-028	$55,050.79	
GEN-2008-047	$45,875.65	
GEN-2008-110	$45,875.65	
GEN-2010-014	$54,897.87	
Total	**$400,000.00**	
Mullergren - Rice County 230kV CKT 1		**$30,000,000**
Build approximately 30 miles of 230kV between Mullergren and Rice County.		
GEN-2009-008	$8,985,374.03	
GEN-2009-020	$3,591,218.01	
GEN-2009-059	$2,349,307.03	
GEN-2009-062	$2,428,423.76	
GEN-2010-009	$3,286,385.89	
GEN-2010-015	$4,447,018.08	
GEN-2010-016	$4,912,273.20	
Total	**$30,000,000.00**	
Norfolk - Madison County Tap 115kV CKT 1		**$16,000,000**
Build approximately 20 miles of 115kV between Norfolk and new tap on Petersburg - Madison 115kV CKT 1.		
GEN-2006-044N02	$5,952,234.90	
GEN-2010-010	$10,047,765.10	
Total	**$16,000,000.00**	
Plant X - Tolk Station East 230kV CKT 2		**$5,000,000**
Rebuild approximately 10 miles of 230kV.		
GEN-2008-022	$4,762,189.39	
GEN-2009-067S	$237,810.61	
Total	**$5,000,000.00**	
Plant X - Tolk Station West 230kV CKT 1		**$5,000,000**
Rebuild approximately 10 miles of 230kV.		
GEN-2008-022	$4,760,138.37	
GEN-2009-067S	$239,861.63	
Total	**$5,000,000.00**	
Potter - Bushland 230kV CKT 1		**$200,000**
Replace Line Traps.		
GEN-2008-022	$188,029.05	
GEN-2009-067S	$11,970.95	
Total	**$200,000.00**	

Upgrade Facility and Designated Requests	Allocated Costs	E + C Costs
Potter County - Plant X 230kV CKT 1		**$200,000**
Replace Line Traps on 230kV between GEN-2006-039 Tap and Potter County.		
GEN-2008-022	$188,061.62	
GEN-2009-067S	$11,938.38	
Total	**$200,000.00**	
Rice County 230/115/xxkV Transformer CKT 1		**$6,000,000**
Install 230/115/xxkV Transformer at Rice County.		
GEN-2009-008	$1,797,074.81	
GEN-2009-020	$718,243.60	
GEN-2009-059	$469,861.41	
GEN-2009-062	$485,684.75	
GEN-2010-009	$657,277.18	
GEN-2010-015	$889,403.62	
GEN-2010-016	$982,454.64	
Total	**$6,000,000.01**	
South Hays - Hays Plant - Vine Street 115kV CKT 1		**$3,200,000**
Rebuild approximately 4 miles of 115kV.		
GEN-2009-008	$3,040,900.40	
GEN-2009-020	$159,099.60	
Total	**$3,200,000.00**	
Spearville 345/230/13.8kV Transformer CKT 3		**$6,400,000**
Install 345/230/13.8kV Transformer CKT 3 at Spearville.		
GEN-2009-059	$4,916,091.16	
GEN-2009-062	$1,483,908.84	
Total	**$6,400,000.00**	
Switch 2749 - Wildorado 69kV CKT 1		**$2,000,000**
Rebuild approximately 4 miles of 69kV.		
GEN-2008-088	$2,000,000.00	
Total	**$2,000,000.00**	
Washita - Anadarko 138kV CKT 2		**$8,800,000**
Build approximately 11 miles of 138kV.		
GEN-2008-037	$4,680,184.81	
GEN-2009-030	$3,215,277.97	
GEN-2009-060	$904,537.22	
Total	**$8,800,000.00**	
Washita - Blue Canyon 138kV CKT 1		**$500,000**
Reset CT on 138kV between GEN-2008-037 POI and Washita.		
GEN-2008-037	$500,000.00	
Total	**$500,000.00**	

Upgrade Facility and Designated Requests	Allocated Costs	E + C Costs
Washita - Weatherford 138kV CKT 1		**$40,000,000**
Build approximately 50 miles of 138kV.		
GEN-2009-030	$39,704,762.57	
GEN-2009-060	$295,237.43	
Total	**$40,000,000.00**	
Wheeler - Anadarko 345kV CKT 1		**$171,396,736**
Build approximately 120 miles of 345kV.		
ASGI-2010-011	$4,202,524.53	
GEN-2008-022	$25,580,034.20	
GEN-2008-028	$33,980,498.46	
GEN-2008-044	$4,192,011.11	
GEN-2008-047	$28,317,082.05	
GEN-2008-088	$2,934,569.82	
GEN-2008-110	$28,317,082.05	
GEN-2009-067S	$1,731,026.32	
GEN-2010-007	$6,023,112.59	
GEN-2010-008	$1,597,533.48	
GEN-2010-011	$635,153.20	
GEN-2010-014	$33,886,108.19	
Total	**$171,396,736.00**	

TOTAL CURRENT STUDY UPGRADE COST **$662,696,737**

G: Powerflow Analysis with Constraints for Mitigation

.

APPENDIX G: DIS-2010-001 Powerflow Analysis (Constraints for Mitigation)

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FNSL-Iteration limit exceeded	2	0	10G	ASGI_11		NCONV	0	0.38225	9999	DBL-HIT-WOOD
FNSL-Iteration limit exceeded	2	0	10G	ASGI_11		NCONV	0	0.38225	9999	DBL-HIT-WOOD
FNSL-Iteration limit exceeded	2	0	10G	G08_028		NCONV	0	0.44548	9999	DBL-HIT-WOOD
FNSL-Iteration limit exceeded	2	0	10G	G08_028		NCONV	0	0.44548	9999	DBL-HIT-WOOD
FNSL-Iteration limit exceeded	2	0	10G	G08_047		NCONV	0	0.44548	9999	DBL-HIT-WOOD
FNSL-Iteration limit exceeded	2	0	10G	G08_047		NCONV	0	0.44548	9999	DBL-HIT-WOOD
FNSL-Iteration limit exceeded	2	0	10G	G08_088		NCONV	0	0.26439	9999	DBL-HIT-WOOD
FNSL-Iteration limit exceeded	2	0	10G	G08_110		NCONV	0	0.44548	9999	DBL-HIT-WOOD
FNSL-Iteration limit exceeded	2	0	10G	G08_110		NCONV	0	0.44548	9999	DBL-HIT-WOOD
FNSL-Iteration limit exceeded	2	0	10G	G10_007		NCONV	0	0.32869	9999	DBL-HIT-WOOD
FNSL-Iteration limit exceeded	2	0	10G	G10_007		NCONV	0	0.32869	9999	DBL-HIT-WOOD
FNSL-Iteration limit exceeded	2	0	10G	G10_014		NCONV	0	0.44548	9999	DBL-HIT-WOOD
FNSL-Iteration limit exceeded	2	0	10G	G10_014		NCONV	0	0.44548	9999	DBL-HIT-WOOD
FDNS	1	0	10G	G10_008	FROM->TO	FARGO JCT - WOODWARD 69KV CKT 1	65	0.9316	146.7839	FT SUPPLY - IODINE 138KV CKT 1
FDNS	1	0	10G	G10_008	FROM->TO	FARGO JCT - WOODWARD 69KV CKT 1	65	0.9316	146.7839	FT SUPPLY - IODINE 138KV CKT 1
FDNS	1	0	10G	G10_008	FROM->TO	FARGO JCT - WOODWARD 69KV CKT 1	65	0.9316	139.0461	IODINE - MOORELAND 138KV CKT 1
FDNS	1	0	10G	G10_008	FROM->TO	FARGO JCT - WOODWARD 69KV CKT 1	65	0.9316	139.0461	IODINE - MOORELAND 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1	143	0.99579	136.394	HYDRO - WEATHERFORD 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1	143	0.99579	136.394	HYDRO - WEATHERFORD 138KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.48982	135.1605	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.48982	135.1605	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.48982	135.1605	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.48982	135.1605	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.48982	135.1605	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.48982	135.1605	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1	143	0.99579	134.5774	HYDRO - SICKLES 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1	143	0.99579	134.5774	HYDRO - SICKLES 138KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.48982	134.5374	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.48982	134.5374	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.48982	134.5374	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.48982	134.5374	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.48982	134.5374	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.48982	134.5374	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	7	0	10G	G08_037	TO->FROM	ANADARKO - WASHITA 138KV CKT 1	228	0.74589	133.1999	SOUTHWESTERN STATION - WASHITA 138KV CKT 1
FDNS	7	0	10G	G08_037	TO->FROM	ANADARKO - WASHITA 138KV CKT 1	228	0.74589	133.1999	SOUTHWESTERN STATION - WASHITA 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	ANADARKO - WASHITA 138KV CKT 1	228	0.36944	133.1999	SOUTHWESTERN STATION - WASHITA 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	ANADARKO - WASHITA 138KV CKT 1	228	0.36944	133.1999	SOUTHWESTERN STATION - WASHITA 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1	143	0.99579	130.5104	BINGER NIJECT - SICKLES 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1	143	0.99579	130.5104	BINGER NIJECT - SICKLES 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1	143	0.99579	128.9132	BINGER NIJECT - ONEY 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1	143	0.99579	128.9132	BINGER NIJECT - ONEY 138KV CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	7	0	10G	G09_030	TO->FROM	CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1	143	0.99579	127.939	ONEY - WASHITA 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1	143	0.99579	127.939	ONEY - WASHITA 138KV CKT 1
FDNS	3	0	10G	G09_059	TO->FROM	CUDAHY - G09-059TAP 115.00 115KV CKT 1	129.5	0.99716	125.4181	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1
FDNS	3	0	10G	G09_059	TO->FROM	CUDAHY - G09-059TAP 115.00 115KV CKT 1	129.5	0.99716	125.4181	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1
FDNS	3	0	10G	G09_059	TO->FROM	CUDAHY - G09-059TAP 115.00 115KV CKT 1	129.5	0.99716	125.4181	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1
FDNS	7	0	10G	G08_037	TO->FROM	SOUTHWESTERN STATION - WASHITA 138KV CKT 1	260	0.8351	124.9992	ANADARKO - WASHITA 138KV CKT 1
FDNS	7	0	10G	G08_037	TO->FROM	SOUTHWESTERN STATION - WASHITA 138KV CKT 1	260	0.8351	124.9992	ANADARKO - WASHITA 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	SOUTHWESTERN STATION - WASHITA 138KV CKT 1	260	0.40963	124.9992	ANADARKO - WASHITA 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	SOUTHWESTERN STATION - WASHITA 138KV CKT 1	260	0.40963	124.9992	ANADARKO - WASHITA 138KV CKT 1
FDNS	7	0	10G	G09_060	TO->FROM	SOUTHWESTERN STATION - WASHITA 138KV CKT 1	260	0.1994	124.9992	ANADARKO - WASHITA 138KV CKT 1
FDNS	7	0	10G	G09_060	TO->FROM	SOUTHWESTERN STATION - WASHITA 138KV CKT 1	260	0.1994	124.9992	ANADARKO - WASHITA 138KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.99716	124.9075	CUDAHY - G09-059TAP 115.00 115KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.99716	124.9075	CUDAHY - G09-059TAP 115.00 115KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.99716	124.9075	CUDAHY - G09-059TAP 115.00 115KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	129.5	0.99716	121.5498	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	129.5	0.99716	121.5498	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	129.5	0.99716	121.5498	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1
FDNS	3	0	10G	G09_059	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	129.5	0.99716	120.1024	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1
FDNS	3	0	10G	G09_059	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	129.5	0.99716	120.1024	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1
FDNS	3	0	10G	G09_059	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	129.5	0.99716	120.1024	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1
FDNS	0	0	14SP	G09_062	FROM->TO	CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1	89.6	0.25335	118.7935	HAYNE 3 115.00 - NORTH LIBERAL TAP 115KV CKT 1
FDNS	0	0	14SP	G09_062	FROM->TO	CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1	89.6	0.25335	118.7935	HAYNE 3 115.00 - NORTH LIBERAL TAP 115KV CKT 1
FDNS	6	0	10G	G08_022	TO->FROM	PLANT X STATION - TOLK STATION WEST 230KV CKT 1	497	0.36342	118.1699	PLANT X STATION - TOLK STATION EAST 230KV CKT 2
FDNS	6	0	10G	G08_022	TO->FROM	PLANT X STATION - TOLK STATION WEST 230KV CKT 1	497	0.36342	118.1699	PLANT X STATION - TOLK STATION EAST 230KV CKT 2
FDNS	6	0	10G	G09_067S	TO->FROM	PLANT X STATION - TOLK STATION WEST 230KV CKT 1	497	0.27489	118.1699	PLANT X STATION - TOLK STATION EAST 230KV CKT 2
FDNS	6	0	10G	G09_067S	TO->FROM	PLANT X STATION - TOLK STATION WEST 230KV CKT 1	497	0.27489	118.1699	PLANT X STATION - TOLK STATION EAST 230KV CKT 2
FDNS	6	0	10G	G08_022	TO->FROM	PLANT X STATION - TOLK STATION EAST 230KV CKT 2	497	0.36038	117.2912	PLANT X STATION - TOLK STATION WEST 230KV CKT 1
FDNS	6	0	10G	G08_022	TO->FROM	PLANT X STATION - TOLK STATION EAST 230KV CKT 2	497	0.36038	117.2912	PLANT X STATION - TOLK STATION WEST 230KV CKT 1
FDNS	6	0	10G	G09_067S	TO->FROM	PLANT X STATION - TOLK STATION EAST 230KV CKT 2	497	0.27246	117.2912	PLANT X STATION - TOLK STATION WEST 230KV CKT 1
FDNS	6	0	10G	G09_067S	TO->FROM	PLANT X STATION - TOLK STATION EAST 230KV CKT 2	497	0.27246	117.2912	PLANT X STATION - TOLK STATION WEST 230KV CKT 1
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	116.0013	GEN336821 1-GRAND GULF UNIT
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	116.0013	GEN336821 1-GRAND GULF UNIT
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	116.0013	GEN336821 1-GRAND GULF UNIT
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	115.8885	GEN532751 1-WOLF CREEK GENERATING STATION UNIT 1
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	115.8885	GEN532751 1-WOLF CREEK GENERATING STATION UNIT 1
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	115.8885	GEN532751 1-WOLF CREEK GENERATING STATION UNIT 1
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	115.8815	GEN336153 1-WATERFORD UNIT#3
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	115.8815	GEN336153 1-WATERFORD UNIT#3
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	115.8815	GEN336153 1-WATERFORD UNIT#3
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	115.7391	GEN337911 1-ARKANSAS NUCLEAR ONE UNIT #2
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	115.7391	GEN337911 1-ARKANSAS NUCLEAR ONE UNIT #2
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	115.7391	GEN337911 1-ARKANSAS NUCLEAR ONE UNIT #2
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	115.7271	GEN335831 1-RIVERBEND UNIT#1
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	115.7271	GEN335831 1-RIVERBEND UNIT#1
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	115.7271	GEN335831 1-RIVERBEND UNIT#1
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	114.7511	BASE CASE
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	114.7511	BASE CASE
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	114.7511	BASE CASE

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	3	0	10G	G09_020	TO->FROM	CIRCLE - MULLERGREN 230KV CKT 1	319	0.20542	114.3535	DBL-SPRVL-CO
FDNS	3	0	10G	G09_059	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.77076	110.8436	HOLCOMB (HOLCOMB) 345/115/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.77076	110.8436	HOLCOMB (HOLCOMB) 345/115/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.77076	110.8436	HOLCOMB (HOLCOMB) 345/115/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_062	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.37742	110.8436	HOLCOMB (HOLCOMB) 345/115/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_062	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.37742	110.8436	HOLCOMB (HOLCOMB) 345/115/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	TO->FROM	CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1	89.6	0.84289	109.3912	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1
FDNS	3	0	10G	G09_059	TO->FROM	CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1	89.6	0.84289	109.3912	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1
FDNS	3	0	10G	G09_059	TO->FROM	CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1	89.6	0.84289	109.3912	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	HYDRO - WEATHERFORD 138KV CKT 1	179	0.99579	108.2942	CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	HYDRO - WEATHERFORD 138KV CKT 1	179	0.99579	108.2942	CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1
FDNS	1	0	10G	G08_028	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.20761	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G08_044	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.43419	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G08_044	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.43419	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G08_044	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.43419	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G08_047	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.20761	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G08_110	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.20761	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G10_011	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.43419	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G10_011	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.43419	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G10_011	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.43419	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G10_014	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.20761	107.6218	DBL-COM-MEDL
FDNS	7	0	10G	G08_037	FROM->TO	GEN08-037 138.00 - WASHITA 138KV CKT 1	324	0.99368	106.9864	BASE CASE
FDNS	7	0	10G	G08_037	FROM->TO	GEN08-037 138.00 - WASHITA 138KV CKT 1	324	0.99368	106.9864	BASE CASE
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.29746	106.9775	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.29746	106.9775	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.29746	106.9775	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.29746	106.9775	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.29746	106.9775	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.29746	106.9775	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.29746	106.3648	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.29746	106.3648	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.29746	106.3648	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.29746	106.3648	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.29746	106.3648	MULLERGREN - SPEARVILLE 230KV CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.29746	106.3648	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	5	0	10G	G08_088	TO->FROM	SWITCH 2749 - WILDORADO 69KV CKT 1	35	1	106.2362	BASE CASE
FDNS	5	0	10G	G08_088	TO->FROM	SWITCH 2749 - WILDORADO 69KV CKT 1	35	1	106.2362	BASE CASE
FDNS	7	0	10G	G09_030	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.37746	105.8721	HYDRO - WEATHERFORD 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.37746	105.8721	HYDRO - WEATHERFORD 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.37746	105.4092	HYDRO - WEATHERFORD 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.37746	105.4092	HYDRO - WEATHERFORD 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.37746	105.3503	HYDRO - SICKLES 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.37746	105.3503	HYDRO - SICKLES 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.37746	104.928	HYDRO - SICKLES 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.37746	104.928	HYDRO - SICKLES 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.37746	104.1771	BINGER NIJECT - SICKLES 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.37746	104.1771	BINGER NIJECT - SICKLES 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.37746	103.8494	BINGER NIJECT - SICKLES 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.37746	103.8494	BINGER NIJECT - SICKLES 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.37746	103.7161	BINGER NIJECT - ONEY 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.37746	103.7161	BINGER NIJECT - ONEY 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.37746	103.4342	ONEY - WASHITA 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.37746	103.4342	ONEY - WASHITA 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.37746	103.4259	BINGER NIJECT - ONEY 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.37746	103.4259	BINGER NIJECT - ONEY 138KV CKT 1
FDNS	5	0	10G	G08_022	FROM->TO	BUSHLAND INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1	351	0.23386	103.3654	G06-39T 230.00 - POTTER COUNTY INTERCHANGE 230KV CKT 1
FDNS	5	0	10G	G09_067S	FROM->TO	BUSHLAND INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1	351	0.22383	103.3654	G06-39T 230.00 - POTTER COUNTY INTERCHANGE 230KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.37746	103.1662	ONEY - WASHITA 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.37746	103.1662	ONEY - WASHITA 138KV CKT 1
FDNS	7	0	10G	G08_037	TO->FROM	SOUTHWESTERN STATION - WASHITA 138KV CKT 1	260	0.58587	102.8178	BASE CASE
FDNS	7	0	10G	G08_037	TO->FROM	SOUTHWESTERN STATION - WASHITA 138KV CKT 1	260	0.58587	102.8178	BASE CASE
FDNS	7	0	10G	G09_030	TO->FROM	SOUTHWESTERN STATION - WASHITA 138KV CKT 1	260	0.27754	102.8178	BASE CASE
FDNS	7	0	10G	G09_030	TO->FROM	SOUTHWESTERN STATION - WASHITA 138KV CKT 1	260	0.27754	102.8178	BASE CASE
FDNS	3	0	10G	G09_059	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.72358	102.6182	GRAY CO 345.00 - SPEARVILLE 345KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.72358	102.6182	GRAY CO 345.00 - SPEARVILLE 345KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.72358	102.6182	GRAY CO 345.00 - SPEARVILLE 345KV CKT 1
FDNS	3	0	10G	G09_062	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.27368	102.6182	GRAY CO 345.00 - SPEARVILLE 345KV CKT 1
FDNS	3	0	10G	G09_062	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.27368	102.6182	GRAY CO 345.00 - SPEARVILLE 345KV CKT 1
FDNS	2	0	10G	ASGI_11	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.19581	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	ASGI_11	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.19581	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G08_028	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.2144	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G08_028	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.2144	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G08_044	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.44097	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G08_047	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.2144	102.1859	DBL-COM-MEDL

APPENDIX G: DIS-2010-001 Powerflow Analysis (Constraints for Mitigation)

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	2	0	10G	G08_047	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.2144	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G08_110	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.2144	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G08_110	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.2144	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G10_011	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.44097	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G10_014	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.2144	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G10_014	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.2144	102.1859	DBL-COM-MEDL
FDNS	7	0	10G	G09_030	FROM->TO	JENSEN ROAD - JENSEN TAP 138KV CKT 1	191	0.34686	100.3972	HYDRO - WEATHERFORD 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	JENSEN ROAD - JENSEN TAP 138KV CKT 1	191	0.34686	100.3972	HYDRO - WEATHERFORD 138KV CKT 1
FCITC	0	0	14SP	G10_010	TO->FROM	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 1	56	1	180.3591	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 2'
FCITC	0	0	14SP	G10_010	TO->FROM	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 2	56	1	180.3591	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 1'
FCITC	0	0	14WP	G10_010	TO->FROM	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 2	56	1	180.3591	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 1'
FCITC	0	0	14WP	G10_010	TO->FROM	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 1	56	1	180.3591	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 2'
FCITC	9	0	10G	G10_010	TO->FROM	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 2	56	1	180.3591	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 1	56	1	180.3591	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 2'
FCITC	0	0	14SP	G10_010	TO->FROM	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 2	56	1	180.3571	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 1'
FCITC	0	0	14SP	G10_010	TO->FROM	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 1	56	1	180.3571	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 2'
FCITC	0	0	14WP	G10_010	TO->FROM	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 1	56	1	180.3571	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 2'
FCITC	0	0	14WP	G10_010	TO->FROM	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 2	56	1	180.3571	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 2	56	1	180.3571	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 1	56	1	180.3571	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 2'
FCITC	1	0	10G	G10_008	FROM->TO	'FARGOJCT2 69.000 - WOODWARD 69KV CKT 1'	64.9	0.9316	168.6015	'FT SUPPLY - IODINE 138KV CKT 1
FCITC	1	0	10G	G10_008	FROM->TO	'FARGOJCT2 69.000 - WOODWARD 69KV CKT 1'	64.9	0.9316	160.281	'IODINE - MOORELAND 138KV CKT 1
FCITC	3	0	10G	G09_059	TO->FROM	'CUDAHY - G09-059TAP 115.00 115KV CKT 1'	128.4	0.99716	156.1187	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'	129.5	0.99716	154.7926	'CUDAHY - G09-059TAP 115.00 115KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1'	330.2	0.48982	154.0558	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'	330.2	0.48982	154.0558	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1'	333.3	0.48982	152.6229	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'	333.3	0.48982	152.6229	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FCITC	3	0	10G	G09_059	FROM->TO	'CUDAHY - KISMET 3 115.00 115KV CKT 1'	127.8	0.99716	151.8438	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1'	330.2	0.48982	150.9303	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'	330.2	0.48982	150.9303	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FCITC	3	0	10G	G09_059	TO->FROM	'CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	127.6	0.99716	150.5928	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'	129.5	0.99716	149.8505	'CUDAHY - KISMET 3 115.00 115KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1'	333.3	0.48982	149.5265	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'	333.3	0.48982	149.5265	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FCITC	7	0	10G	G09_030	TO->FROM	'CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1'	143	0.99579	148.5838	'HYDRO - WEATHERFORD 138KV CKT 1
FCITC	3	0	10G	G09_059	FROM->TO	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'	129.5	0.99716	148.3833	'CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1
FCITC	3	0	10G	G09_059	TO->FROM	'CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1'	89.2	0.84289	147.9705	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'
FCITC	7	0	10G	G09_030	TO->FROM	'CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1'	143	0.99579	146.9055	'HYDRO - SICKLES 138KV CKT 1
FCITC	0	0	14SP	G10_016	TO->FROM	'G10-016 345.00 345/34.5KV TRANSFORMER CKT 1'	138	1	144.9275	'BASE CASE'
FCITC	0	0	14WP	G10_016	TO->FROM	'G10-016 345.00 345/34.5KV TRANSFORMER CKT 1'	138	1	144.9275	'BASE CASE'
FCITC	3	0	10G	G10_016	TO->FROM	'G10-016 345.00 345/34.5KV TRANSFORMER CKT 1'	138	1	144.9275	'BASE CASE'
FCITC	0	0	14SP	G10_016	TO->FROM	'G10-016 345.00 345/34.5KV TRANSFORMER CKT 1'	138	1	144.926	'BASE CASE'
FCITC	0	0	14WP	G10_016	TO->FROM	'G10-016 345.00 345/34.5KV TRANSFORMER CKT 1'	138	1	144.926	'BASE CASE'

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	3	0	10G	G10_016	TO->FROM	'G10-016 345.00 345/34.5KV TRANSFORMER CKT 1'	138	1	144.926	'BASE CASE'
FCITC	9	0	10G	G10_010	TO->FROM	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 2	56	1	144.6418	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 1	56	1	144.6418	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 2'
FCITC	1	0	10G	G10_008	FROM->TO	'FARGOJCT2 69.000 - WOODWARD 69KV CKT 1'	64.9	0.9316	144.3848	'FT SUPPLY - IODINE 138KV CKT 1
FCITC	7	0	10G	G09_030	TO->FROM	'CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1'	143	0.99579	142.7796	'BINGER NIJECT - SICKLES 138KV CKT 1
FCITC	8	0	10G	G10_005	FROM->TO	'G07-25 345.00 - G07-25T 345.00 345KV CKT 1'	417.5	0.99157	142.002	'BASE CASE'
FCITC	7	0	10G	G09_030	TO->FROM	'CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1'	143	0.99579	141.2411	'BINGER NIJECT - ONEY 138KV CKT 1'
FCITC	3	0	10G	G09_059	TO->FROM	'CUDAHY - G09-059TAP 115.00 115KV CKT 1'	128.4	0.99716	140.5866	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'
FCITC	2	0	10G	G10_007	FROM->TO	'HITCHLAND 7 345.00 - STEVENS CO 345.00 345KV CKT 1'	1051.8	0.41446	140.2101	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_047	FROM->TO	'HITCHLAND 7 345.00 - STEVENS CO 345.00 345KV CKT 1'	1051.8	0.5346	140.2101	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_110	FROM->TO	'HITCHLAND 7 345.00 - STEVENS CO 345.00 345KV CKT 1'	1051.8	0.5346	140.2101	'DBL-HITCH-WOOD
FCITC	2	0	10G	G10_014	FROM->TO	'HITCHLAND 7 345.00 - STEVENS CO 345.00 345KV CKT 1'	1051.8	0.5346	140.2101	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_028	FROM->TO	'HITCHLAND 7 345.00 - STEVENS CO 345.00 345KV CKT 1'	1051.8	0.5346	140.2101	'DBL-HITCH-WOOD
FCITC	7	0	10G	G09_030	TO->FROM	'CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1'	143	0.99579	140.1922	'ONEY - WASHITA 138KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'	129.5	0.99716	139.3924	'CUDAHY - G09-059TAP 115.00 115KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'CUDAHY - KISMET 3 115.00 115KV CKT 1'	127.8	0.99716	136.2388	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'
FCITC	1	0	10G	G10_008	FROM->TO	'FARGOJCT2 69.000 - WOODWARD 69KV CKT 1'	64.9	0.9316	136.0643	'IODINE - MOORELAND 138KV CKT 1
FCITC	3	0	10G	G09_059	TO->FROM	'CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	127.6	0.99716	134.9633	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'	129.5	0.99716	134.4503	'CUDAHY - KISMET 3 115.00 115KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'	129.5	0.99716	132.9831	'CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1
FCITC	7	0	10G	G09_030	TO->FROM	'CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1'	143	0.99579	131.6788	'HYDRO - WEATHERFORD 138KV CKT 1
FCITC	7	0	10G	G09_030	TO->FROM	'CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1'	143	0.99579	130.0005	'HYDRO - SICKLES 138KV CKT 1
FCITC	3	0	10G	G09_059	TO->FROM	'CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1'	89.2	0.84289	129.0716	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'
FCITC	8	0	10G	G10_005	FROM->TO	'G07-25 345.00 - G07-25T 345.00 345KV CKT 1'	417.5	0.99157	127.8733	'BASE CASE'
FCITC	0	0	14SP	G09_062	FROM->TO	'CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1'	89.6	0.25335	127.8295	'CIMARRON RIVER PLANT - HAYNE 3 115.00 115KV CKT 1'
FCITC	5	0	10G	G08_088	TO->FROM	'SWITCH 2749 - WILDORADO 69KV CKT 1	35	1	127.1429	'BASE CASE'
FCITC	11	0	10G	G09_040	FROM->TO	'G09-040TAP 115.00 - SMITTYVILLE N.M. COOP (NEMAHA MARSHALL R.E. 115KV CKT 1'	92	0.78242	126.9555	'EAST MANHATTAN - ELMCREK6 230.00 230KV CKT 1'
FCITC	7	0	10G	G09_030	TO->FROM	'CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1'	143	0.99579	125.8746	'BINGER NIJECT - SICKLES 138KV CKT 1
FCITC	11	0	10G	G09_040	TO->FROM	'BAILEYVILLE N.M. STATION (NEMAHA MARSHALL R - SMITTYVILLE N.M. COOP (NEMAHA MARSHALL R.E. 115KV CKT 1'	92	0.78242	125.8686	'EAST MANHATTAN - ELMCREK6 230.00 230KV CKT 1'
FCITC	0	0	14SP	G09_062	FROM->TO	'CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1'	89.6	0.25335	125.4655	'CIMARRON RIVER PLANT - HAYNE 3 115.00 115KV CKT 1'
FCITC	7	0	10G	G09_030	TO->FROM	'ANADARKO - WASHITA 138KV CKT 1	227.3	0.36944	124.8186	'SOUTHWESTERN STATION - WASHITA 138KV CKT 1
FCITC	7	0	10G	G08_037	TO->FROM	'ANADARKO - WASHITA 138KV CKT 1	227.3	0.74589	124.8186	'SOUTHWESTERN STATION - WASHITA 138KV CKT 1
FCITC	7	0	10G	G09_030	TO->FROM	'CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1'	143	0.99579	124.3362	'BINGER NIJECT - ONEY 138KV CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.99437	124.3318	'FTRANDL4 230.00 - MADISONCNTY4230.00 230KV CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.99437	124.3318	'FTRANDL4 230.00 - MADISONCNTY4230.00 230KV CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'FTRANDL4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	320	0.99437	124.293	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'FTRANDL4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	320	0.99437	124.293	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'
FCITC	11	0	10G	G09_040	FROM->TO	'BAILEYVILLE N.M. STATION (NEMAHA MARSHALL R - SOUTH SENECA 115KV CKT 1'	92	0.78242	124.2381	'EAST MANHATTAN - ELMCREK6 230.00 230KV CKT 1'
FCITC	7	0	10G	G09_030	TO->FROM	'CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1'	143	0.99579	123.2872	'ONEY - WASHITA 138KV CKT 1'
FCITC	2	0	10G	G10_007	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.26153	123.0007	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_047	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.35235	123.0007	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_110	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.35235	123.0007	'DBL-HITCH-WOOD

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	2	0	10G	G10_014	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.35235	123.0007	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_028	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.35235	123.0007	'DBL-HITCH-WOOD
FCITC	6	0	10G	G08_022	TO->FROM	'PLANT X STATION - TOLK STATION WEST 230KV CKT 1	496.9	0.36342	121.9614	'PLANT X STATION - TOLK STATION EAST 230KV CKT 2
FCITC	0	0	14WP	G08_088	TO->FROM	'SWITCH 2749 - WILDORADO 69KV CKT 1	35	1	121.1429	'BASE CASE'
FCITC	6	0	10G	G08_022	TO->FROM	'PLANT X STATION - TOLK STATION EAST 230KV CKT 2	496.9	0.36038	121.0131	'PLANT X STATION - TOLK STATION WEST 230KV CKT 1
FCITC	7	0	10G	G09_030	TO->FROM	'HYDRO - WEATHERFORD 138KV CKT 1	177.8	0.99579	119.5021	'CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1'
FCITC	0	0	14SP	G09_062	FROM->TO	'CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1'	89.6	0.25335	119.459	'HAYNE 3 115.00 - NORTH LIBERAL TAP 115KV CKT 1'
FCITC	7	0	10G	G09_030	TO->FROM	'SOUTHWESTERN STATION - WASHITA 138KV CKT 1	255.7	0.40963	119.4094	'ANADARKO - WASHITA 138KV CKT 1
FCITC	7	0	10G	G08_037	TO->FROM	'SOUTHWESTERN STATION - WASHITA 138KV CKT 1	255.7	0.8351	119.4094	'ANADARKO - WASHITA 138KV CKT 1
FCITC	7	0	10G	G09_060	TO->FROM	'SOUTHWESTERN STATION - WASHITA 138KV CKT 1	255.7	0.1994	119.4094	'ANADARKO - WASHITA 138KV CKT 1
FCITC	3	0	10G	G09_059	TO->FROM	'CUDAHY - G09-059TAP 115.00 115KV CKT 1'	128.4	0.99716	119.1807	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'
FCITC	11	0	10G	G09_040	FROM->TO	'G09-040TAP 115.00 - SMITTYVILLE N.M. COOP (NEMAHA MARSHALL R.E. 115KV CKT 1'	92	0.78242	118.8877	'EAST MANHATTAN - ELMCREK6 230.00 230KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'	129.5	0.99716	118.1684	'CUDAHY - G09-059TAP 115.00 115KV CKT 1'
FCITC	11	0	10G	G09_040	TO->FROM	'BAILEYVILLE N.M. STATION (NEMAHA MARSHALL R - SMITTYVILLE N.M. COOP (NEMAHA MARSHALL R.E. 115KV CKT 1'	92	0.78242	117.8007	'EAST MANHATTAN - ELMCREK6 230.00 230KV CKT 1'
FCITC	0	0	14SP	G09_062	FROM->TO	'CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1'	89.6	0.25335	117.095	'HAYNE 3 115.00 - NORTH LIBERAL TAP 115KV CKT 1'
FCITC	11	0	10G	G09_040	FROM->TO	'BAILEYVILLE N.M. STATION (NEMAHA MARSHALL R - SOUTH SENECA 115KV CKT 1'	92	0.78242	116.1703	'EAST MANHATTAN - ELMCREK6 230.00 230KV CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75903	115.594	'DAK02Wapa.B2'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75903	115.594	'DAK02Wapa.B2'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75903	115.5628	'FTRANDL4 230.00 - UTICAJC4 230.00 230KV CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75903	115.5628	'FTRANDL4 230.00 - UTICAJC4 230.00 230KV CKT 1'
FCITC	0	0	14SP	G09_060	TO->FROM	'LAKE CREEK - LONEWOLF 69KV CKT 1'	47.6	0.27219	115.3537	'ELK CITY (ELKCTY-4) 138/69/13.8KV TRANSFORMER CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'CUDAHY - KISMET 3 115.00 115KV CKT 1'	127.8	0.99716	114.7324	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'
FCITC	7	0	10G	G08_037	FROM->TO	'GEN08-037 138.00 - WASHITA 138KV CKT 1'	241.2	0.99368	114.539	'BASE CASE'
FCITC	7	0	10G	G08_037	TO->FROM	'ANADARKO - WASHITA 138KV CKT 1	227.3	0.74589	113.7215	'SOUTHWESTERN STATION - WASHITA 138KV CKT 1
FCITC	11	0	10G	G09_008	TO->FROM	'HAYS PLANT - SOUTH HAYS 115KV CKT 1	96.7	0.36885	113.6753	'KNOLL 230 - S HAYS6 230.00 230KV CKT 1'
FCITC	0	0	14SP	G08_088	TO->FROM	'SWITCH 2749 - WILDORADO 69KV CKT 1	34.9	1	113.467	'BASE CASE'
FCITC	3	0	10G	G09_059	TO->FROM	'CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	127.6	0.99716	113.4232	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'	129.5	0.99716	113.2263	'CUDAHY - KISMET 3 115.00 115KV CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75628	112.979	'FTRANDL4 230.00 - SIOUXCY4 230.00 230KV CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75628	112.979	'FTRANDL4 230.00 - SIOUXCY4 230.00 230KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'	129.5	0.99716	111.7591	'CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1
FCITC	0	0	14WP	G09_060	TO->FROM	'LAKE CREEK - LONEWOLF 69KV CKT 1	48	0.62459	111.489	'GOTEBO - MOUNTAIN VIEW 69KV CKT 1
FCITC	8	0	10G	G10_005	FROM->TO	'G07-25 345.00 - G07-25T 345.00 345KV CKT 1'	417.5	0.99157	111.4843	'BASE CASE'
FCITC	0	0	14SP	G09_060	TO->FROM	'LAKE CREEK - LONEWOLF 69KV CKT 1	47.6	0.62458	111.3737	'GOTEBO - MOUNTAIN VIEW 69KV CKT 1
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1'	330.2	0.29746	110.4154	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'	330.2	0.29746	110.4154	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75131	110.4148	'FTTHOMP3 345.00 - GR ISLD3 345.00 345KV CKT 1'

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75131	110.4148	'FTTHOMP3 345.00 - GR ISLD3 345.00 345KV CKT 1'
FCITC	2	0	10G	ASGI_11	FROM->TO	'HITCHLAND 7 345.00 - STEVENS CO 345.00 345KV CKT 1'	1051.8	0.4696	110.2455	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_047	FROM->TO	'HITCHLAND 7 345.00 - STEVENS CO 345.00 345KV CKT 1'	1051.8	0.5346	110.2455	'DBL-HITCH-WOOD
FCITC	2	0	10G	G09_067S	FROM->TO	'HITCHLAND 7 345.00 - STEVENS CO 345.00 345KV CKT 1'	1051.8	0.23711	110.2455	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_028	FROM->TO	'HITCHLAND 7 345.00 - STEVENS CO 345.00 345KV CKT 1'	1051.8	0.5346	110.2455	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_022	FROM->TO	'HITCHLAND 7 345.00 - STEVENS CO 345.00 345KV CKT 1'	1051.8	0.24227	110.2455	'DBL-HITCH-WOOD
FCITC	2	0	10G	G10_007	FROM->TO	'HITCHLAND 7 345.00 - STEVENS CO 345.00 345KV CKT 1'	1051.8	0.41446	110.2455	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_110	FROM->TO	'HITCHLAND 7 345.00 - STEVENS CO 345.00 345KV CKT 1'	1051.8	0.5346	110.2455	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_088	FROM->TO	'HITCHLAND 7 345.00 - STEVENS CO 345.00 345KV CKT 1'	1051.8	0.34871	110.2455	'DBL-HITCH-WOOD
FCITC	2	0	10G	G10_014	FROM->TO	'HITCHLAND 7 345.00 - STEVENS CO 345.00 345KV CKT 1'	1051.8	0.5346	110.2455	'DBL-HITCH-WOOD
FCITC	3	0	10G	G10_016	TO->FROM	'G10-016 345.00 345/34.5KV TRANSFORMER CKT 1'	138	1	110.1925	'BASE CASE'
FCITC	11	0	10G	G09_008	FROM->TO	'HAYS PLANT - VINE STREET 115KV CKT 1	86.3	0.36885	109.993	'KNOLL 230 - S HAYS6 230.00 230KV CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.9895	'COOPER 3 345.00 345/22.0KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.9895	'COOPER 3 345.00 345/22.0KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.9285	'S3458 3 345.00 345/23.0KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.9285	'S3458 3 345.00 345/23.0KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75191	109.8663	'RASMUSN4 230.00 - UTICAJC4 230.00 230KV CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75191	109.8663	'RASMUSN4 230.00 - UTICAJC4 230.00 230KV CKT 1'
FCITC	6	0	10G	G09_067S	TO->FROM	'PLANT X STATION - TOLK STATION WEST 230KV CKT 1	496.9	0.27489	109.8531	'PLANT X STATION - TOLK STATION EAST 230KV CKT 2
FCITC	6	0	10G	G08_022	TO->FROM	'PLANT X STATION - TOLK STATION WEST 230KV CKT 1	496.9	0.36342	109.8531	'PLANT X STATION - TOLK STATION EAST 230KV CKT 2
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.8347	'S3458 3 345.00 345/18.0KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.8347	'S3458 3 345.00 345/18.0KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.6577	'CBLUFFS3 345.00 345/26.0KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.6577	'CBLUFFS3 345.00 345/26.0KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.5952	'WOLF CREEK 345/25.0KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.5952	'WOLF CREEK 345/25.0KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75096	109.5756	'UTICAJC4 230.00 - VFODNES4 230.00 230KV CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75096	109.5756	'UTICAJC4 230.00 - VFODNES4 230.00 230KV CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.4702	'CBLUFFS3 345.00 345/24.0KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.4702	'CBLUFFS3 345.00 345/24.0KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75191	109.4599	'RASMUSN4 230.00 - SIOUXCY4 230.00 230KV CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75191	109.4599	'RASMUSN4 230.00 - SIOUXCY4 230.00 230KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1'	333.3	0.29746	109.3884	'MULLERGREN - SPEARVILLE 230KV CKT 1'

APPENDIX G: DIS-2010-001 Powerflow Analysis (Constraints for Mitigation)

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'	333.3	0.29746	109.3884	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75011	109.2925	'FTRANDL7 115.00 - SPENCER7 115.00 115KV CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75011	109.2925	'FTRANDL7 115.00 - SPENCER7 115.00 115KV CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75011	109.2612	'NEB001NPP.B2'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75011	109.2612	'NEB001NPP.B2'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75011	109.1674	'ONEILL 7 115.00 - SPENCER7 115.00 115KV CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75011	109.1674	'ONEILL 7 115.00 - SPENCER7 115.00 115KV CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74892	109.1399	'KEYSTON3 345.00 - SIDNEY 3 345.00 345KV CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74892	109.1399	'KEYSTON3 345.00 - SIDNEY 3 345.00 345KV CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.1225	'GENTLMN3 345.00 345/24.0KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.1225	'GENTLMN3 345.00 345/24.0KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.06	'GENTLMN4 230.00 230/23.0KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.06	'GENTLMN4 230.00 230/23.0KV TRANSFORMER CKT 1'
FCITC	6	0	10G	G09_067S	TO->FROM	'PLANT X STATION - TOLK STATION EAST 230KV CKT 2	496.9	0.27246	109.0032	'PLANT X STATION - TOLK STATION WEST 230KV CKT 1
FCITC	6	0	10G	G08_022	TO->FROM	'PLANT X STATION - TOLK STATION EAST 230KV CKT 2	496.9	0.36038	109.0032	'PLANT X STATION - TOLK STATION WEST 230KV CKT 1
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1'	330.2	0.29746	108.5231	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'	330.2	0.29746	108.5231	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	7	0	10G	G08_037	TO->FROM	'SOUTHWESTERN STATION - WASHITA 138KV CKT 1	255.7	0.8351	108.4513	'ANADARKO - WASHITA 138KV CKT 1
FCITC	1	0	10G	G10_008	FROM->TO	'FARGOJCT2 69.000 - WOODWARD 69KV CKT 1'	52.9	0.77527	108.3502	'BASE CASE'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	107.8134	'BASE CASE'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	107.8134	'BASE CASE'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1'	333.3	0.29746	107.5138	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'	333.3	0.29746	107.5138	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	8	0	10G	G10_005	FROM->TO	'G07-25 345.00 - G07-25T 345.00 345KV CKT 1'	417.5	0.99157	106.0741	'G10-05 345.00 345/34.5KV TRANSFORMER CKT 1'
FCITC	8	0	10G	G10_005	FROM->TO	'G07-25 345.00 - G07-25T 345.00 345KV CKT 1'	417.5	0.99157	106.0741	'G10-05 345.00 345/34.5KV TRANSFORMER CKT 1'
FCITC	8	0	10G	G10_005	FROM->TO	'G07-25 345.00 - G07-25T 345.00 345KV CKT 1'	417.5	0.99157	106.0741	'G10-05 34.500 34.5/0.69KV TRANSFORMER CKT 1'
FCITC	8	0	10G	G10_005	FROM->TO	'G07-25 345.00 - G07-25T 345.00 345KV CKT 1'	417.5	0.99157	106.0741	'G10-05 34.500 34.5/0.69KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G10_007	FROM->TO	'G10-07T 115.00 - RIVERVIEW INTERCHANGE 115KV CKT 1'	157.9	0.5416	105.912	'PRINGLE INTERCHANGE 230/115KV TRANSFORMER CKT 1'
FCITC	7	0	10G	G09_030	TO->FROM	'HYDRO - WEATHERFORD 138KV CKT 1	177.8	0.99579	105.9059	'CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1'
FCITC	2	0	10G	G10_007	FROM->TO	'G10-07T 115.00 - RIVERVIEW INTERCHANGE 115KV CKT 1'	157.9	0.42817	105.7767	'DBL-HITCH-WOOD'
FCITC	0	0	14WP	G09_060	TO->FROM	'LAKE CREEK - LONEWOLF 69KV CKT 1	48	0.62459	105.4474	'MOUNTAIN VIEW - PINE RIDGE 69KV CKT 1
FCITC	0	0	14SP	G09_060	TO->FROM	'LAKE CREEK - LONEWOLF 69KV CKT 1	47.6	0.46607	104.7942	'CORDELL - GOTEBO 69KV CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	0	0	14SP	G09_060	TO->FROM	'LAKE CREEK - LONEWOLF 69KV CKT 1	47.6	0.62458	104.4409	'MOUNTAIN VIEW - PINE RIDGE 69KV CKT 1
FCITC	3	0	10G	G09_059	FROM->TO	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'	129.5	0.77076	104.267	'HOLCOMB (HOLCOMB) 345/115/13.8KV TRANSFORMER CKT 1'
FCITC	7	0	10G	G08_037	FROM->TO	'GEN08-037 138.00 - WASHITA 138KV CKT 1'	241.2	0.99368	103.6484	'BASE CASE'
FCITC	3	0	10G	G09_020	TO->FROM	'CIRCLE - MULLERGREN 230KV CKT 1	317.4	0.20542	103.4932	'DBL-SPRVL-COM
FCITC	15	0	10G	G08_123N	FROM->TO	'GUIDE R7 115.00 - SUPEROR7 115.00 115KV CKT 1'	79.6	1	103.2663	'GEN08-123N 115.00 - PAULINE7 115.00 115KV CKT 1'
FCITC	2	0	10G	G08_047	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.9	0.2144	103.0425	'DBL-COM-MEDLO
FCITC	2	0	10G	G08_110	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.9	0.2144	103.0425	'DBL-COM-MEDLO
FCITC	2	0	10G	G10_014	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.9	0.2144	103.0425	'DBL-COM-MEDLO
FCITC	2	0	10G	G08_028	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.9	0.2144	103.0425	'DBL-COM-MEDLO
FCITC	3	0	10G	G09_059	TO->FROM	'CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1'	89.2	0.84289	103.0305	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'
FCITC	11	0	10G	G09_040	FROM->TO	'G09-040TAP 115.00 - SMITTYVILLE N.M. COOP (NEMAHA MARSHALL R.E. 115KV CKT 1'	92	0.70788	103.0251	'WRTOD400'
FCITC	2	0	10G	ASGI_11	TO->FROM	'MOORE COUNTY INTERCHANGE E. - SHERMAN COUNTY TAP 115KV CKT 1'	118	0.29483	102.7558	'HITCHLAND 6 230.00 230/115KV TRANSFORMER CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1'	330.2	0.29746	102.4296	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'	330.2	0.29746	102.4296	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	2	0	10G	G08_047	FROM->TO	'POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1'	558.5	0.19847	102.3843	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_110	FROM->TO	'POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1'	558.5	0.19847	102.3843	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G10_014	FROM->TO	'POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1'	558.5	0.19847	102.3843	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_028	FROM->TO	'POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1'	558.5	0.19847	102.3843	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_047	FROM->TO	'POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1'	558.6	0.19847	102.3838	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_110	FROM->TO	'POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1'	558.6	0.19847	102.3838	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G10_014	FROM->TO	'POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1'	558.6	0.19847	102.3838	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_028	FROM->TO	'POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1'	558.6	0.19847	102.3838	'DBL-HITCH-WOOD'
FCITC	2	0	10G	ASGI_11	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.3032	102.2181	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_047	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.35235	102.2181	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_028	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.35235	102.2181	'DBL-HITCH-WOOD
FCITC	2	0	10G	G10_009	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.59155	102.2181	'DBL-HITCH-WOOD
FCITC	2	0	10G	G10_007	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.26153	102.2181	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_110	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.35235	102.2181	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_088	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.21169	102.2181	'DBL-HITCH-WOOD
FCITC	2	0	10G	G10_014	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.35235	102.2181	'DBL-HITCH-WOOD
FCITC	2	0	10G	G09_062	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.29001	102.2181	'DBL-HITCH-WOOD
FCITC	6	0	10G	G08_022	FROM->TO	'G06-39T 230.00 - POTTER COUNTY INTERCHANGE 230KV CKT 1'	350.2	0.28317	102.1847	'BUSHLAND INTERCHANGE - G06-39T 230.00 230KV CKT 1'
FCITC	11	0	10G	G09_040	TO->FROM	'BAILEYVILLE N.M. STATION (NEMAHA MARSHALL R - SMITTYVILLE N.M. COOP (NEMAHA MARSHALL R.E. 115KV CKT 1'	92	0.70788	101.9382	'WRTOD400'
FCITC	7	0	10G	G09_030	FROM->TO	'CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1'	184.9	0.37746	101.7974	'HYDRO - WEATHERFORD 138KV CKT 1
FCITC	7	0	10G	G09_030	TO->FROM	'WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1'	209.2	0.37746	101.5887	'HYDRO - WEATHERFORD 138KV CKT 1'

APPENDIX G: DIS-2010-001 Powerflow Analysis (Constraints for Mitigation)

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1'	333.3	0.29746	101.4769	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'	333.3	0.29746	101.4769	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	11	0	10G	G09_040	FROM->TO	'G09-040TAP 115.00 - SMITTYVILLE N.M. COOP (NEMAHA MARSHALL R.E. 115KV CKT 1'	92	0.70828	101.4269	'HOYT - JEFFERY ENERGY CENTER 345KV CKT 1'
FCITC	7	0	10G	G09_030	FROM->TO	'CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1'	184.9	0.37746	101.3107	'HYDRO - SICKLES 138KV CKT 1
FCITC	11	0	10G	G09_008	FROM->TO	'SMOKYHLLS6 230.00 - SUMMIT 230KV CKT 1	317.9	0.31015	101.2696	'KNOLL345 345.00 345/230KV TRANSFORMER CKT 1
FCITC	7	0	10G	G09_030	TO->FROM	'WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1'	209.2	0.37746	101.1584	'HYDRO - SICKLES 138KV CKT 1'
FCITC	6	0	10G	G09_067S	TO->FROM	'PLANT X STATION - TOLK STATION WEST 230KV CKT 1	496.9	0.27489	101.1265	'PLANT X STATION - TOLK STATION EAST 230KV CKT 2
FCITC	7	0	10G	G09_030	TO->FROM	'HYDRO - WEATHERFORD 138KV CKT 1'	177.8	0.53561	101.0105	'WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'	129.5	0.72358	100.7754	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1
FCITC	0	0	14SP	G09_059	TO->FROM	'CUDAHY - G09-059TAP 115.00 115KV CKT 1'	129.5	0.99976	100.7498	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'
FCITC	0	0	14SP	G09_059	FROM->TO	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'	129.5	0.99976	100.7498	'CUDAHY - G09-059TAP 115.00 115KV CKT 1'
FCITC	6	0	10G	G09_067S	TO->FROM	'PLANT X STATION - TOLK STATION EAST 230KV CKT 2	496.9	0.27246	100.352	'PLANT X STATION - TOLK STATION WEST 230KV CKT 1
FCITC	11	0	10G	G09_040	TO->FROM	'BAILEYVILLE N.M. STATION (NEMAHA MARSHALL R - SMITTYVILLE N.M. COOP (NEMAHA MARSHALL R.E. 115KV CKT 1'	92	0.70828	100.3399	'HOYT - JEFFERY ENERGY CENTER 345KV CKT 1'
FCITC	11	0	10G	G09_040	FROM->TO	'BAILEYVILLE N.M. STATION (NEMAHA MARSHALL R - SOUTH SENECA 115KV CKT 1'	92	0.70788	100.3078	'WRTOD400'
FCITC	1	0	10G	G10_011	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.43419	100.205	'DBL-COM-MEDLO
FCITC	1	0	10G	G08_044	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.43419	100.205	'DBL-COM-MEDLO
FCITC	1	0	10G	G08_047	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.20761	100.205	'DBL-COM-MEDLO
FCITC	1	0	10G	G08_028	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.20761	100.205	'DBL-COM-MEDLO
FCITC	1	0	10G	G08_110	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.20761	100.205	'DBL-COM-MEDLO
FCITC	1	0	10G	G10_014	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.20761	100.205	'DBL-COM-MEDLO
FCITC	7	0	10G	G09_030	FROM->TO	'CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1'	184.9	0.37746	100.0668	'BINGER NIJECT - SICKLES 138KV CKT 1
FCITC	7	0	10G	G09_030	TO->FROM	'WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1'	209.2	0.37746	100.059	'BINGER NIJECT - SICKLES 138KV CKT 1'
FCITC	1	0	10G	G10_011	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.43419	100.0306	'DBL-COM-MEDLO
FCITC	1	0	10G	G08_044	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.43419	100.0306	'DBL-COM-MEDLO

H: Powerflow Analysis (constraints with greater than 3% TDF)

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FNSL-Iteration limit exceeded	2	0	10G	ASGI_11		NCONV	0	0.38225	9999	DBL-HIT-WOOD
FNSL-Iteration limit exceeded	2	0	10G	ASGI_11		NCONV	0	0.38225	9999	DBL-HIT-WOOD
FNSL-Iteration limit exceeded	2	0	10G	G08_022		NCONV	0	0.15782	9999	DBL-HIT-WOOD
FNSL-Iteration limit exceeded	2	0	10G	G08_028		NCONV	0	0.44548	9999	DBL-HIT-WOOD
FNSL-Iteration limit exceeded	2	0	10G	G08_028		NCONV	0	0.44548	9999	DBL-HIT-WOOD
FNSL-Iteration limit exceeded	2	0	10G	G08_047		NCONV	0	0.44548	9999	DBL-HIT-WOOD
FNSL-Iteration limit exceeded	2	0	10G	G08_047		NCONV	0	0.44548	9999	DBL-HIT-WOOD
FNSL-Iteration limit exceeded	2	0	10G	G08_088		NCONV	0	0.26439	9999	DBL-HIT-WOOD
FNSL-Iteration limit exceeded	2	0	10G	G08_110		NCONV	0	0.44548	9999	DBL-HIT-WOOD
FNSL-Iteration limit exceeded	2	0	10G	G08_110		NCONV	0	0.44548	9999	DBL-HIT-WOOD
FNSL-Iteration limit exceeded	2	0	10G	G09_062		NCONV	0	0.06915	9999	DBL-HIT-WOOD
FNSL-Iteration limit exceeded	2	0	10G	G09_067S		NCONV	0	0.15268	9999	DBL-HIT-WOOD
FNSL-Iteration limit exceeded	2	0	10G	G10_007		NCONV	0	0.32869	9999	DBL-HIT-WOOD
FNSL-Iteration limit exceeded	2	0	10G	G10_007		NCONV	0	0.32869	9999	DBL-HIT-WOOD
FNSL-Iteration limit exceeded	2	0	10G	G10_009		NCONV	0	0.07411	9999	DBL-HIT-WOOD
FNSL-Iteration limit exceeded	2	0	10G	G10_014		NCONV	0	0.44548	9999	DBL-HIT-WOOD
FNSL-Iteration limit exceeded	2	0	10G	G10_014		NCONV	0	0.44548	9999	DBL-HIT-WOOD
FDNS	7	0	10G	G09_030	TO->FROM	CLINTON CITY - FOSS TAP 69KV CKT 1	53	0.08932	180.9885	WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	CLINTON CITY - FOSS TAP 69KV CKT 1	53	0.08932	180.9885	WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	CLINTON CITY - FOSS TAP 69KV CKT 1	53	0.08932	173.3706	WEATHERFORD SOUTHEAST - WEATHERFORD TAP 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	CLINTON CITY - FOSS TAP 69KV CKT 1	53	0.08932	173.3706	WEATHERFORD SOUTHEAST - WEATHERFORD TAP 138KV CKT 1
FDNS	1	0	10G	G08_044	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.03049	167.4577	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G08_044	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.03049	167.4577	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G08_044	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.03049	167.4577	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.06203	167.4577	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.06203	167.4577	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_011	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.03049	167.4577	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_011	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.03049	167.4577	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_011	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.03049	167.4577	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	NINNESC3 115.00 - ST JOHN 115KV CKT 1	79.7	0.05813	161.8006	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	NINNESC3 115.00 - ST JOHN 115KV CKT 1	79.7	0.05813	161.8006	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	NINNESC3 115.00 - ST JOHN 115KV CKT 1	79.7	0.05813	161.8006	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1
FDNS	1	0	10G	G09_060	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.04539	156.9855	CEDARDALE - MOORELAND 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.03425	156.9855	CEDARDALE - MOORELAND 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.03425	156.9855	CEDARDALE - MOORELAND 138KV CKT 1
FDNS	1	0	10G	G09_060	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.04539	155.1676	CEDARDALE - OKEENE 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.03425	155.1676	CEDARDALE - OKEENE 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.03425	155.1676	CEDARDALE - OKEENE 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	154.4355	BASE CASE
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	154.4355	BASE CASE
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05933	152.1101	DBL-COM-MEDL
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05933	152.1101	DBL-COM-MEDL
FDNS	6	0	10G	G06_044N02	FROM->TO	LAWEASOKLUNI	425	0.0301	148.4	BASE CASE
FDNS	6	0	10G	G08_037	FROM->TO	LAWEASOKLUNI	425	0.10221	148.4	BASE CASE
FDNS	6	0	10G	G08_046	FROM->TO	LAWEASOKLUNI	425	0.11084	148.4	BASE CASE
FDNS	6	0	10G	G08_071	FROM->TO	LAWEASOKLUNI	425	0.04694	148.4	BASE CASE
FDNS	6	0	10G	G08_098	FROM->TO	LAWEASOKLUNI	425	0.03736	148.4	BASE CASE
FDNS	6	0	10G	G09_030	FROM->TO	LAWEASOKLUNI	425	0.06441	148.4	BASE CASE
FDNS	6	0	10G	G09_040	FROM->TO	LAWEASOKLUNI	425	0.0306	148.4	BASE CASE

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	6	0	10G	G09_060	FROM->TO	LAWEASOKLUNI	425	0.06278	148.4	BASE CASE
FDNS	6	0	10G	G10_003	FROM->TO	LAWEASOKLUNI	425	0.03736	148.4	BASE CASE
FDNS	6	0	10G	G10_005	FROM->TO	LAWEASOKLUNI	425	0.03558	148.4	BASE CASE
FDNS	6	0	10G	G10_010	FROM->TO	LAWEASOKLUNI	425	0.0301	148.4	BASE CASE
FDNS	6	0	10G	G10_013	FROM->TO	LAWEASOKLUNI	425	0.04065	148.4	BASE CASE
FDNS	1	0	10G	G10_008	FROM->TO	FARGO JCT - WOODWARD 69KV CKT 1	65	0.9316	146.7839	FT SUPPLY - IODINE 138KV CKT 1
FDNS	1	0	10G	G10_008	FROM->TO	FARGO JCT - WOODWARD 69KV CKT 1	65	0.9316	146.7839	FT SUPPLY - IODINE 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05462	144.3208	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05462	144.3208	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	3	0	10G	G09_020	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	0.03543	144.1044	MED-LDG5 345.00 345/138KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	0.04698	144.1044	MED-LDG5 345.00 345/138KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	0.04698	144.1044	MED-LDG5 345.00 345/138KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	0.04698	144.1044	MED-LDG5 345.00 345/138KV TRANSFORMER CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CLINTON CITY - THOMAS TAP 69KV CKT 1	55	0.08932	141.5142	WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CLINTON CITY - THOMAS TAP 69KV CKT 1	55	0.08932	141.5142	WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.12053	141.4473	DBL-SPRVL-CO
FDNS	3	0	10G	G09_059	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.12053	141.4473	DBL-SPRVL-CO
FDNS	3	0	10G	G09_059	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.12053	141.4473	DBL-SPRVL-CO
FDNS	3	0	10G	G09_062	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.05917	141.4473	DBL-SPRVL-CO
FDNS	3	0	10G	G09_062	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.05917	141.4473	DBL-SPRVL-CO
FDNS	3	0	10G	G10_009	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.03436	141.4473	DBL-SPRVL-CO
FDNS	3	0	10G	G10_009	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.03436	141.4473	DBL-SPRVL-CO
FDNS	3	0	10G	G10_009	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.03436	141.4473	DBL-SPRVL-CO
FDNS	3	0	10G	G10_015	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.04406	141.4473	DBL-SPRVL-CO
FDNS	3	0	10G	G10_015	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.04406	141.4473	DBL-SPRVL-CO
FDNS	3	0	10G	G10_015	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.04406	141.4473	DBL-SPRVL-CO
FDNS	3	0	10G	G10_016	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.03502	141.4473	DBL-SPRVL-CO
FDNS	3	0	10G	G10_016	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.03502	141.4473	DBL-SPRVL-CO
FDNS	3	0	10G	G10_016	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.03502	141.4473	DBL-SPRVL-CO
FDNS	7	0	10G	G09_030	FROM->TO	THOMAS TAP - WEATHERFORD 69KV CKT 1	53	0.08932	141.3479	WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	THOMAS TAP - WEATHERFORD 69KV CKT 1	53	0.08932	141.3479	WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1
FDNS	1	0	10G	G09_060	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.04794	141.0153	EL RENO - ROMAN NOSE 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02984	141.0153	EL RENO - ROMAN NOSE 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02984	141.0153	EL RENO - ROMAN NOSE 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.02922	140.8751	DEWEY - TALOGA 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.02922	140.8751	DEWEY - TALOGA 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05926	139.6778	CLEO CORNER - MEN TAP 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05926	139.6778	CLEO CORNER - MEN TAP 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05462	139.6098	G05-15T 345.00 - OKLAUNION 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05462	139.6098	G05-15T 345.00 - OKLAUNION 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05926	139.532	IMO TAP - MEN TAP 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05926	139.532	IMO TAP - MEN TAP 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	139.5095	GEN336821 1-GRAND GULF UNIT
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	139.5095	GEN336821 1-GRAND GULF UNIT
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.06333	139.4437	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.06333	139.4437	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.04639	139.3968	TALOGA (TALOGA) 138/69/13.8KV TRANSFORMER CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.04639	139.3968	TALOGA (TALOGA) 138/69/13.8KV TRANSFORMER CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05798	139.3355	GLASS MOUNTAIN - MOORELAND 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05798	139.3355	GLASS MOUNTAIN - MOORELAND 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05798	139.2413	CLEO CORNER - GLASS MOUNTAIN 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05798	139.2413	CLEO CORNER - GLASS MOUNTAIN 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	139.1611	GEN336153 1-WATERFORD UNIT#3
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	139.1611	GEN336153 1-WATERFORD UNIT#3
FDNS	1	0	10G	G10_008	FROM->TO	FARGO JCT - WOODWARD 69KV CKT 1	65	0.9316	139.0461	IODINE - MOORELAND 138KV CKT 1
FDNS	1	0	10G	G10_008	FROM->TO	FARGO JCT - WOODWARD 69KV CKT 1	65	0.9316	139.0461	IODINE - MOORELAND 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	138.8788	GEN337911 1-ARKANSAS NUCLEAR ONE UNIT #2
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	138.8788	GEN337911 1-ARKANSAS NUCLEAR ONE UNIT #2
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05815	138.5638	DOVER SW - OKEENE 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05815	138.5638	DOVER SW - OKEENE 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	138.5236	GEN335831 1-RIVERBEND UNIT#1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	138.5236	GEN335831 1-RIVERBEND UNIT#1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05469	138.2762	G05-15T 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05469	138.2762	G05-15T 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	138.1274	GEN337910 1-ARKANSAS NUCLEAR ONE UNIT #1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	138.1274	GEN337910 1-ARKANSAS NUCLEAR ONE UNIT #1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.06639	138.0744	WWRDEHV7 345.00 (WWDEHV-T) 345/138/13.8KV TRANSFORMER CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.06639	138.0744	WWRDEHV7 345.00 (WWDEHV-T2) 345/138/13.8KV TRANSFORMER CKT 2
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.06639	138.0744	WWRDEHV7 345.00 (WWDEHV-T) 345/138/13.8KV TRANSFORMER CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.06639	138.0744	WWRDEHV7 345.00 (WWDEHV-T2) 345/138/13.8KV TRANSFORMER CKT 2
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05681	137.9446	ELK CITY - RHWIND4 138.00 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05681	137.9446	ELK CITY - RHWIND4 138.00 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.0555	137.8309	CLINTON JUNCTION - ELK CITY 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.0555	137.8309	CLINTON JUNCTION - ELK CITY 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	137.7355	GEN501801 1-DOLET HILLS UNIT1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	137.7355	GEN501801 1-DOLET HILLS UNIT1
FDNS	1	0	10G	G09_060	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.02529	137.6003	CANTON - TALOGA 69KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05776	137.6003	CANTON - TALOGA 69KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05776	137.6003	CANTON - TALOGA 69KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	137.5764	GEN337653 1-WHITE BLUFF UNIT #2
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	137.5764	GEN337653 1-WHITE BLUFF UNIT #2
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05613	137.5551	COMANCH5 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05613	137.5551	COMANCH5 345.00 - WWRDEHV7 345.00 345KV CKT 2
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05613	137.5551	COMANCH5 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05613	137.5551	COMANCH5 345.00 - WWRDEHV7 345.00 345KV CKT 2
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	137.5392	GEN337652 1-WHITE BLUFF UNIT #1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	137.5392	GEN337652 1-WHITE BLUFF UNIT #1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05991	137.5351	MOORELAND - MOREWOOD SW 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05991	137.5351	MOORELAND - MOREWOOD SW 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05527	137.5277	MED-LDG5 345.00 - WICHITA 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05527	137.5277	MED-LDG5 345.00 - WICHITA 345KV CKT 2
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05527	137.5277	MED-LDG5 345.00 - WICHITA 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05527	137.5277	MED-LDG5 345.00 - WICHITA 345KV CKT 2
FDNS	1	0	10G	G09_060	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.02529	137.4115	CANTON - OKEENE 69KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05776	137.4115	CANTON - OKEENE 69KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05776	137.4115	CANTON - OKEENE 69KV CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05652	137.3904	CEDARDALE - MOORELAND 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05652	137.3904	CEDARDALE - MOORELAND 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05652	137.3425	CEDARDALE - OKEENE 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05652	137.3425	CEDARDALE - OKEENE 138KV CKT 1
FDNS	1	0	10G	G08_044	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.02754	137.3379	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G08_044	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.02754	137.3379	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G08_044	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.02754	137.3379	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.0648	137.3379	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.0648	137.3379	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_011	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.02754	137.3379	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_011	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.02754	137.3379	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_011	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.02754	137.3379	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	137.327	GEN509403 1-PIRKEY GENERATION
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	137.327	GEN509403 1-PIRKEY GENERATION
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	137.3203	GEN338146 1-INDEPENDENCE UNIT #2
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	137.3203	GEN338146 1-INDEPENDENCE UNIT #2
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05481	137.0679	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05481	137.0679	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	137.0247	GEN337041 1-GERALD ANDRUS
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	137.0247	GEN337041 1-GERALD ANDRUS
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	136.9762	GEN515225 1-MUSKOGEE 5G
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	136.9762	GEN515225 1-MUSKOGEE 5G
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	136.965	GEN515226 1-MUSKOGEE 6G
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	136.965	GEN515226 1-MUSKOGEE 6G
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	136.9437	GEN515223 1-MUSKOGEE 4G
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	136.9437	GEN515223 1-MUSKOGEE 4G
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	136.9231	GEN501813 1-RODEMACHER UNIT 3
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	136.9231	GEN501813 1-RODEMACHER UNIT 3
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05505	136.7785	COMANCH5 345.00 - MED-LDG5 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05505	136.7785	COMANCH5 345.00 - MED-LDG5 345.00 345KV CKT 2
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05505	136.7785	COMANCH5 345.00 - MED-LDG5 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05505	136.7785	COMANCH5 345.00 - MED-LDG5 345.00 345KV CKT 2
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	136.7423	GEN509406 1-WELSH #3
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	136.7423	GEN509406 1-WELSH #3
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	136.7422	GEN509404 1-WELSH #1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	136.7422	GEN509405 1-WELSH #2
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	136.7422	GEN509404 1-WELSH #1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	136.7422	GEN509405 1-WELSH #2
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	136.7176	GEN520947 1-HUGO1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	136.7176	GEN520947 1-HUGO1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	136.6451	GEN335206 1-NELSON UNIT 6
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	136.6451	GEN335206 1-NELSON UNIT 6
FDNS	2	0	10G	G06_044N02	FROM->TO	LAWEASOKLUNI	425	0.02641	136.6	BASE CASE
FDNS	2	0	10G	G08_037	FROM->TO	LAWEASOKLUNI	425	0.09852	136.6	BASE CASE
FDNS	2	0	10G	G08_046	FROM->TO	LAWEASOKLUNI	425	0.10715	136.6	BASE CASE
FDNS	2	0	10G	G08_071	FROM->TO	LAWEASOKLUNI	425	0.04325	136.6	BASE CASE
FDNS	2	0	10G	G08_098	FROM->TO	LAWEASOKLUNI	425	0.03366	136.6	BASE CASE
FDNS	2	0	10G	G09_030	FROM->TO	LAWEASOKLUNI	425	0.06072	136.6	BASE CASE
FDNS	2	0	10G	G09_040	FROM->TO	LAWEASOKLUNI	425	0.02691	136.6	BASE CASE
FDNS	2	0	10G	G09_060	FROM->TO	LAWEASOKLUNI	425	0.05908	136.6	BASE CASE
FDNS	2	0	10G	G10_003	FROM->TO	LAWEASOKLUNI	425	0.03366	136.6	BASE CASE

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	2	0	10G	G10_005	FROM->TO	LAWEASOKLUNI	425	0.03189	136.6	BASE CASE
FDNS	2	0	10G	G10_010	FROM->TO	LAWEASOKLUNI	425	0.02641	136.6	BASE CASE
FDNS	2	0	10G	G10_013	FROM->TO	LAWEASOKLUNI	425	0.03696	136.6	BASE CASE
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	136.584	GEN501812 1-RODEMACHER UNIT 2
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	136.584	GEN501812 1-RODEMACHER UNIT 2
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05481	136.5368	HINTON - WEATHERFORD JCT. 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05481	136.5368	HINTON - WEATHERFORD JCT. 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05465	136.5051	CIMARRON - NORTHWEST 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05465	136.5051	CIMARRON - NORTHWEST 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05481	136.4633	CAN_GAS4 138.00 - HINTON 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05481	136.4633	CAN_GAS4 138.00 - HINTON 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1	143	0.99579	136.394	HYDRO - WEATHERFORD 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1	143	0.99579	136.394	HYDRO - WEATHERFORD 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05481	136.3292	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05481	136.3292	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05521	136.2853	JENSEN ROAD - JENSEN TAP 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05521	136.2853	JENSEN ROAD - JENSEN TAP 138KV CKT 1
FDNS	3	0	10G	G09_008	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.08193	135.1605	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_008	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.08193	135.1605	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_020	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.17227	135.1605	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_020	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.17227	135.1605	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.48982	135.1605	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.48982	135.1605	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.48982	135.1605	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.48982	135.1605	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.48982	135.1605	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.48982	135.1605	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_062	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.12821	135.1605	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_062	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.12821	135.1605	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_062	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.12821	135.1605	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_062	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.12821	135.1605	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1	143	0.99579	134.5774	HYDRO - SICKLES 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1	143	0.99579	134.5774	HYDRO - SICKLES 138KV CKT 1
FDNS	3	0	10G	G09_008	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.08193	134.5374	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_008	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.08193	134.5374	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_020	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.17227	134.5374	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	3	0	10G	G09_020	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.17227	134.5374	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.48982	134.5374	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.48982	134.5374	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.48982	134.5374	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.48982	134.5374	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.48982	134.5374	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.48982	134.5374	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_062	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.12821	134.5374	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_062	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.12821	134.5374	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_062	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.12821	134.5374	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_062	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.12821	134.5374	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	5	0	10G	G06_044N02	FROM->TO	LAWEASOKLUNI	425	0.02903	134.5	BASE CASE
FDNS	5	0	10G	G08_037	FROM->TO	LAWEASOKLUNI	425	0.10114	134.5	BASE CASE
FDNS	5	0	10G	G08_046	FROM->TO	LAWEASOKLUNI	425	0.10977	134.5	BASE CASE
FDNS	5	0	10G	G08_071	FROM->TO	LAWEASOKLUNI	425	0.04588	134.5	BASE CASE
FDNS	5	0	10G	G08_098	FROM->TO	LAWEASOKLUNI	425	0.03629	134.5	BASE CASE
FDNS	5	0	10G	G09_030	FROM->TO	LAWEASOKLUNI	425	0.06334	134.5	BASE CASE
FDNS	5	0	10G	G09_040	FROM->TO	LAWEASOKLUNI	425	0.02954	134.5	BASE CASE
FDNS	5	0	10G	G09_060	FROM->TO	LAWEASOKLUNI	425	0.06171	134.5	BASE CASE
FDNS	5	0	10G	G10_003	FROM->TO	LAWEASOKLUNI	425	0.03629	134.5	BASE CASE
FDNS	5	0	10G	G10_005	FROM->TO	LAWEASOKLUNI	425	0.03451	134.5	BASE CASE
FDNS	5	0	10G	G10_010	FROM->TO	LAWEASOKLUNI	425	0.02903	134.5	BASE CASE
FDNS	5	0	10G	G10_013	FROM->TO	LAWEASOKLUNI	425	0.03959	134.5	BASE CASE
FDNS	7	0	10G	G09_030	FROM->TO	CLINTON CITY - THOMAS TAP 69KV CKT 1	55	0.08932	134.3787	WEATHERFORD SOUTHEAST - WEATHERFORD TAP 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CLINTON CITY - THOMAS TAP 69KV CKT 1	55	0.08932	134.3787	WEATHERFORD SOUTHEAST - WEATHERFORD TAP 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	THOMAS TAP - WEATHERFORD 69KV CKT 1	53	0.08932	134.0091	WEATHERFORD SOUTHEAST - WEATHERFORD TAP 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	THOMAS TAP - WEATHERFORD 69KV CKT 1	53	0.08932	134.0091	WEATHERFORD SOUTHEAST - WEATHERFORD TAP 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CLINTON JUNCTION - FOSS TAP 69KV CKT 1	72	0.08932	133.5784	WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CLINTON JUNCTION - FOSS TAP 69KV CKT 1	72	0.08932	133.5784	WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1
FDNS	7	0	10G	G08_037	TO->FROM	ANADARKO - WASHITA 138KV CKT 1	228	0.74589	133.1999	SOUTHWESTERN STATION - WASHITA 138KV CKT 1
FDNS	7	0	10G	G08_037	TO->FROM	ANADARKO - WASHITA 138KV CKT 1	228	0.74589	133.1999	SOUTHWESTERN STATION - WASHITA 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	ANADARKO - WASHITA 138KV CKT 1	228	0.36944	133.1999	SOUTHWESTERN STATION - WASHITA 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	ANADARKO - WASHITA 138KV CKT 1	228	0.36944	133.1999	SOUTHWESTERN STATION - WASHITA 138KV CKT 1
FDNS	7	0	10G	G09_060	TO->FROM	ANADARKO - WASHITA 138KV CKT 1	228	0.17651	133.1999	SOUTHWESTERN STATION - WASHITA 138KV CKT 1
FDNS	7	0	10G	G09_060	TO->FROM	ANADARKO - WASHITA 138KV CKT 1	228	0.17651	133.1999	SOUTHWESTERN STATION - WASHITA 138KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	GREENSBURG - SUN CITY 115KV CKT 1	129.5	0.12053	132.6858	DBL-SPRVL-CO

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	3	0	10G	G09_059	FROM->TO	GREENSBURG - SUN CITY 115KV CKT 1	129.5	0.12053	132.6858	DBL-SPRVL-CO
FDNS	3	0	10G	G09_059	FROM->TO	GREENSBURG - SUN CITY 115KV CKT 1	129.5	0.12053	132.6858	DBL-SPRVL-CO
FDNS	3	0	10G	G09_062	FROM->TO	GREENSBURG - SUN CITY 115KV CKT 1	129.5	0.05917	132.6858	DBL-SPRVL-CO
FDNS	3	0	10G	G09_062	FROM->TO	GREENSBURG - SUN CITY 115KV CKT 1	129.5	0.05917	132.6858	DBL-SPRVL-CO
FDNS	3	0	10G	G10_009	FROM->TO	GREENSBURG - SUN CITY 115KV CKT 1	129.5	0.03436	132.6858	DBL-SPRVL-CO
FDNS	3	0	10G	G10_009	FROM->TO	GREENSBURG - SUN CITY 115KV CKT 1	129.5	0.03436	132.6858	DBL-SPRVL-CO
FDNS	3	0	10G	G10_009	FROM->TO	GREENSBURG - SUN CITY 115KV CKT 1	129.5	0.03436	132.6858	DBL-SPRVL-CO
FDNS	3	0	10G	G10_015	FROM->TO	GREENSBURG - SUN CITY 115KV CKT 1	129.5	0.04406	132.6858	DBL-SPRVL-CO
FDNS	3	0	10G	G10_015	FROM->TO	GREENSBURG - SUN CITY 115KV CKT 1	129.5	0.04406	132.6858	DBL-SPRVL-CO
FDNS	3	0	10G	G10_015	FROM->TO	GREENSBURG - SUN CITY 115KV CKT 1	129.5	0.04406	132.6858	DBL-SPRVL-CO
FDNS	3	0	10G	G10_016	FROM->TO	GREENSBURG - SUN CITY 115KV CKT 1	129.5	0.03502	132.6858	DBL-SPRVL-CO
FDNS	3	0	10G	G10_016	FROM->TO	GREENSBURG - SUN CITY 115KV CKT 1	129.5	0.03502	132.6858	DBL-SPRVL-CO
FDNS	3	0	10G	G10_016	FROM->TO	GREENSBURG - SUN CITY 115KV CKT 1	129.5	0.03502	132.6858	DBL-SPRVL-CO
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05305	132.3428	EL RENO - JENSEN TAP 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05305	132.3428	EL RENO - JENSEN TAP 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	131.926	GEN523971 1-HARRINGTON GEN #1 24 KV
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	131.926	GEN523971 1-HARRINGTON GEN #1 24 KV
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	131.9191	GEN523972 1-HARRINGTON GEN #2 24 KV
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	131.9191	GEN523972 1-HARRINGTON GEN #2 24 KV
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	131.8378	GEN515364 1-CENT 11 0.6000
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	131.8378	GEN515364 1-CENT 11 0.6000
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05282	131.423	CIMARRON - JENSEN TAP 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05282	131.423	CIMARRON - JENSEN TAP 138KV CKT 1
FDNS	1	0	10G	G09_060	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.04618	131.4122	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.0273	131.4122	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.0273	131.4122	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	131.4116	GEN520922 1-SLEEPING 138.00
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	131.4116	GEN520922 1-SLEEPING 138.00
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	131.2502	GEN515790 1-FPLWND2
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	131.2502	GEN515790 1-FPLWND2
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06491	131.2344	DBL-COM-MEDL
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06491	131.2344	DBL-COM-MEDL
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	131.2225	GEN525562 1-TOLK GEN #2 24 KV
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	131.2225	GEN525562 1-TOLK GEN #2 24 KV
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	130.6996	GEN560182 1-G07-50 0.6000
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	130.6996	GEN560182 1-G07-50 0.6000
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	130.6841	GEN525561 1-TOLK GEN #1 24 KV
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	130.6841	GEN525561 1-TOLK GEN #1 24 KV
FDNS	3	0	10G	G09_059	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.10799	130.616	DBL-COM-MEDL
FDNS	3	0	10G	G09_059	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.10799	130.616	DBL-COM-MEDL
FDNS	3	0	10G	G09_059	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.10799	130.616	DBL-COM-MEDL
FDNS	3	0	10G	G09_062	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.05093	130.616	DBL-COM-MEDL
FDNS	3	0	10G	G09_062	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.05093	130.616	DBL-COM-MEDL
FDNS	3	0	10G	G10_009	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.02583	130.616	DBL-COM-MEDL
FDNS	3	0	10G	G10_009	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.02583	130.616	DBL-COM-MEDL
FDNS	3	0	10G	G10_009	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.02583	130.616	DBL-COM-MEDL
FDNS	3	0	10G	G10_015	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.02929	130.616	DBL-COM-MEDL
FDNS	3	0	10G	G10_015	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.02929	130.616	DBL-COM-MEDL
FDNS	3	0	10G	G10_015	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.02929	130.616	DBL-COM-MEDL
FDNS	7	0	10G	G09_030	TO->FROM	CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1	143	0.99579	130.5104	BINGER NIJECT - SICKLES 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1	143	0.99579	130.5104	BINGER NIJECT - SICKLES 138KV CKT 1
FDNS	3	0	10G	G09_059	TO->FROM	MEDICINE LODGE - SUN CITY 115KV CKT 1	129.5	0.12053	130.423	DBL-SPRVL-CO
FDNS	3	0	10G	G09_059	TO->FROM	MEDICINE LODGE - SUN CITY 115KV CKT 1	129.5	0.12053	130.423	DBL-SPRVL-CO

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	3	0	10G	G09_059	TO->FROM	MEDICINE LODGE - SUN CITY 115KV CKT 1	129.5	0.12053	130.423	DBL-SPRVL-CO
FDNS	3	0	10G	G09_062	TO->FROM	MEDICINE LODGE - SUN CITY 115KV CKT 1	129.5	0.05917	130.423	DBL-SPRVL-CO
FDNS	3	0	10G	G09_062	TO->FROM	MEDICINE LODGE - SUN CITY 115KV CKT 1	129.5	0.05917	130.423	DBL-SPRVL-CO
FDNS	3	0	10G	G10_009	TO->FROM	MEDICINE LODGE - SUN CITY 115KV CKT 1	129.5	0.03436	130.423	DBL-SPRVL-CO
FDNS	3	0	10G	G10_009	TO->FROM	MEDICINE LODGE - SUN CITY 115KV CKT 1	129.5	0.03436	130.423	DBL-SPRVL-CO
FDNS	3	0	10G	G10_009	TO->FROM	MEDICINE LODGE - SUN CITY 115KV CKT 1	129.5	0.03436	130.423	DBL-SPRVL-CO
FDNS	3	0	10G	G10_015	TO->FROM	MEDICINE LODGE - SUN CITY 115KV CKT 1	129.5	0.04406	130.423	DBL-SPRVL-CO
FDNS	3	0	10G	G10_015	TO->FROM	MEDICINE LODGE - SUN CITY 115KV CKT 1	129.5	0.04406	130.423	DBL-SPRVL-CO
FDNS	3	0	10G	G10_015	TO->FROM	MEDICINE LODGE - SUN CITY 115KV CKT 1	129.5	0.04406	130.423	DBL-SPRVL-CO
FDNS	3	0	10G	G10_016	TO->FROM	MEDICINE LODGE - SUN CITY 115KV CKT 1	129.5	0.03502	130.423	DBL-SPRVL-CO
FDNS	3	0	10G	G10_016	TO->FROM	MEDICINE LODGE - SUN CITY 115KV CKT 1	129.5	0.03502	130.423	DBL-SPRVL-CO
FDNS	3	0	10G	G10_016	TO->FROM	MEDICINE LODGE - SUN CITY 115KV CKT 1	129.5	0.03502	130.423	DBL-SPRVL-CO
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.06153	129.3682	FPL SWITCH - MOORELAND 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.06153	129.3682	FPL SWITCH - MOORELAND 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	129.2638	GEN560429 1-G08-29 0.6400
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	129.2638	GEN560429 1-G08-29 0.6400
FDNS	7	0	10G	G09_030	TO->FROM	CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1	143	0.99579	128.9132	BINGER NIJECT - ONEY 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1	143	0.99579	128.9132	BINGER NIJECT - ONEY 138KV CKT 1
FDNS	1	0	10G	G09_060	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.03484	128.1379	DEWEY - IODINE 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05914	128.1379	DEWEY - IODINE 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05914	128.1379	DEWEY - IODINE 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	128.1298	GEN560183 1-G07-51 0.6000
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	128.1298	GEN560183 1-G07-51 0.6000
FDNS	7	0	10G	G09_030	FROM->TO	CLINTON JUNCTION - FOSS TAP 69KV CKT 1	72	0.08932	127.9772	WEATHERFORD SOUTHEAST - WEATHERFORD TAP 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CLINTON JUNCTION - FOSS TAP 69KV CKT 1	72	0.08932	127.9772	WEATHERFORD SOUTHEAST - WEATHERFORD TAP 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1	143	0.99579	127.939	ONEY - WASHITA 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1	143	0.99579	127.939	ONEY - WASHITA 138KV CKT 1
FDNS	1	0	10G	G09_060	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.03484	127.3932	IODINE - WWRDEHV4 138.00 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05914	127.3932	IODINE - WWRDEHV4 138.00 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05914	127.3932	IODINE - WWRDEHV4 138.00 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05039	127.0069	CIMARRON - EL RENO 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05039	127.0069	CIMARRON - EL RENO 138KV CKT 1
FDNS	3	0	10G	G09_059	TO->FROM	CUDAHY - G09-059TAP 115.00 115KV CKT 1	129.5	0.99716	125.4181	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1
FDNS	3	0	10G	G09_059	TO->FROM	CUDAHY - G09-059TAP 115.00 115KV CKT 1	129.5	0.99716	125.4181	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1
FDNS	3	0	10G	G09_059	TO->FROM	CUDAHY - G09-059TAP 115.00 115KV CKT 1	129.5	0.99716	125.4181	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1
FDNS	7	0	10G	G08_037	TO->FROM	SOUTHWESTERN STATION - WASHITA 138KV CKT 1	260	0.8351	124.9992	ANADARKO - WASHITA 138KV CKT 1
FDNS	7	0	10G	G08_037	TO->FROM	SOUTHWESTERN STATION - WASHITA 138KV CKT 1	260	0.8351	124.9992	ANADARKO - WASHITA 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	SOUTHWESTERN STATION - WASHITA 138KV CKT 1	260	0.40963	124.9992	ANADARKO - WASHITA 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	SOUTHWESTERN STATION - WASHITA 138KV CKT 1	260	0.40963	124.9992	ANADARKO - WASHITA 138KV CKT 1
FDNS	7	0	10G	G09_060	TO->FROM	SOUTHWESTERN STATION - WASHITA 138KV CKT 1	260	0.1994	124.9992	ANADARKO - WASHITA 138KV CKT 1
FDNS	7	0	10G	G09_060	TO->FROM	SOUTHWESTERN STATION - WASHITA 138KV CKT 1	260	0.1994	124.9992	ANADARKO - WASHITA 138KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.99716	124.9075	CUDAHY - G09-059TAP 115.00 115KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.99716	124.9075	CUDAHY - G09-059TAP 115.00 115KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.99716	124.9075	CUDAHY - G09-059TAP 115.00 115KV CKT 1
FDNS	3	0	10G	G09_020	FROM->TO	NINNESC3 115.00 - PRATT 115KV CKT 1	79.7	0.06985	124.8111	DBL-COM-MEDL
FDNS	3	0	10G	G09_020	FROM->TO	ST JOHN - ST_JOHN 115KV CKT 1	88	0.07034	124.6615	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	ST JOHN - ST_JOHN 115KV CKT 1	88	0.03451	124.6615	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	ST JOHN - ST_JOHN 115KV CKT 1	88	0.03451	124.6615	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	ST JOHN - ST_JOHN 115KV CKT 1	88	0.03451	124.6615	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1
FDNS	2	0	10G	ASGI_11	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04984	124.0918	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	ASGI_11	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04984	124.0918	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1

APPENDIX H: DIS-2010-001 Powerflow Analysis (Constraints 3%+ TDF)

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	2	0	10G	G08_022	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03206	124.0918	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G08_028	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.06037	124.0918	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G08_028	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.06037	124.0918	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G08_044	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.09062	124.0918	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G08_047	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.06037	124.0918	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G08_047	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.06037	124.0918	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G08_088	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03187	124.0918	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G08_110	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.06037	124.0918	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G08_110	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.06037	124.0918	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G09_008	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03058	124.0918	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G09_020	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03317	124.0918	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G09_059	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04614	124.0918	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G09_062	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04587	124.0918	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G09_067S	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03195	124.0918	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G10_007	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04051	124.0918	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G10_007	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04051	124.0918	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G10_009	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04874	124.0918	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G10_011	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.09062	124.0918	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G10_014	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.06037	124.0918	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G10_014	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.06037	124.0918	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G10_015	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04889	124.0918	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G10_016	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04139	124.0918	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G09_060	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.04695	123.9656	DBL-COM-MEDL
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02725	123.9656	DBL-COM-MEDL
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02725	123.9656	DBL-COM-MEDL
FDNS	3	0	10G	ASGI_11	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.02764	123.6699	DBL-SPRVL-CO
FDNS	3	0	10G	G08_028	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.03194	123.6699	DBL-SPRVL-CO
FDNS	3	0	10G	G08_047	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.03194	123.6699	DBL-SPRVL-CO
FDNS	3	0	10G	G08_110	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.03194	123.6699	DBL-SPRVL-CO
FDNS	3	0	10G	G09_059	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.14039	123.6699	DBL-SPRVL-CO
FDNS	3	0	10G	G09_059	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.14039	123.6699	DBL-SPRVL-CO
FDNS	3	0	10G	G09_059	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.14039	123.6699	DBL-SPRVL-CO
FDNS	3	0	10G	G09_062	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.09859	123.6699	DBL-SPRVL-CO
FDNS	3	0	10G	G09_062	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.09859	123.6699	DBL-SPRVL-CO
FDNS	3	0	10G	G10_009	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.11224	123.6699	DBL-SPRVL-CO
FDNS	3	0	10G	G10_009	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.11224	123.6699	DBL-SPRVL-CO
FDNS	3	0	10G	G10_009	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.11224	123.6699	DBL-SPRVL-CO
FDNS	3	0	10G	G10_014	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.03194	123.6699	DBL-SPRVL-CO
FDNS	3	0	10G	G10_015	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.1528	123.6699	DBL-SPRVL-CO
FDNS	3	0	10G	G10_015	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.1528	123.6699	DBL-SPRVL-CO
FDNS	3	0	10G	G10_015	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.1528	123.6699	DBL-SPRVL-CO
FDNS	3	0	10G	G10_016	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.0885	123.6699	DBL-SPRVL-CO
FDNS	3	0	10G	G10_016	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.0885	123.6699	DBL-SPRVL-CO
FDNS	3	0	10G	G10_016	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.0885	123.6699	DBL-SPRVL-CO
FDNS	3	0	10G	G09_008	FROM->TO	ST JOHN - ST_JOHN 115KV CKT 1	88	0.0255	122.9163	CIRCLE - MULLERGREN 230KV CKT 1
FDNS	3	0	10G	G09_020	FROM->TO	ST JOHN - ST_JOHN 115KV CKT 1	88	0.07438	122.9163	CIRCLE - MULLERGREN 230KV CKT 1
FDNS	1	0	10G	G09_060	FROM->TO	CANTON - OKEENE 69KV CKT 1	48	0.04539	122.3364	CEDARDALE - MOORELAND 138KV CKT 1
FDNS	1	0	10G	G10_008	FROM->TO	CANTON - OKEENE 69KV CKT 1	48	0.03425	122.3364	CEDARDALE - MOORELAND 138KV CKT 1
FDNS	1	0	10G	G10_008	FROM->TO	CANTON - OKEENE 69KV CKT 1	48	0.03425	122.3364	CEDARDALE - MOORELAND 138KV CKT 1
FDNS	2	0	10G	G09_008	FROM->TO	SEWARD - ST JOHN 115KV CKT 1	79.7	0.04161	122.0491	DBL-COM-MEDL
FDNS	2	0	10G	G09_020	FROM->TO	SEWARD - ST JOHN 115KV CKT 1	79.7	0.12836	122.0491	DBL-COM-MEDL
FDNS	3	0	10G	G09_059	FROM->TO	GREENSBURG - SUN CITY 115KV CKT 1	129.5	0.10799	122.0339	DBL-COM-MEDL
FDNS	3	0	10G	G09_059	FROM->TO	GREENSBURG - SUN CITY 115KV CKT 1	129.5	0.10799	122.0339	DBL-COM-MEDL

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	3	0	10G	G09_059	FROM->TO	GREENSBURG - SUN CITY 115KV CKT 1	129.5	0.10799	122.0339	DBL-COM-MEDL
FDNS	3	0	10G	G09_062	FROM->TO	GREENSBURG - SUN CITY 115KV CKT 1	129.5	0.05093	122.0339	DBL-COM-MEDL
FDNS	3	0	10G	G09_062	FROM->TO	GREENSBURG - SUN CITY 115KV CKT 1	129.5	0.05093	122.0339	DBL-COM-MEDL
FDNS	3	0	10G	G10_009	FROM->TO	GREENSBURG - SUN CITY 115KV CKT 1	129.5	0.02583	122.0339	DBL-COM-MEDL
FDNS	3	0	10G	G10_009	FROM->TO	GREENSBURG - SUN CITY 115KV CKT 1	129.5	0.02583	122.0339	DBL-COM-MEDL
FDNS	3	0	10G	G10_009	FROM->TO	GREENSBURG - SUN CITY 115KV CKT 1	129.5	0.02583	122.0339	DBL-COM-MEDL
FDNS	3	0	10G	G10_015	FROM->TO	GREENSBURG - SUN CITY 115KV CKT 1	129.5	0.02929	122.0339	DBL-COM-MEDL
FDNS	3	0	10G	G10_015	FROM->TO	GREENSBURG - SUN CITY 115KV CKT 1	129.5	0.02929	122.0339	DBL-COM-MEDL
FDNS	3	0	10G	G10_015	FROM->TO	GREENSBURG - SUN CITY 115KV CKT 1	129.5	0.02929	122.0339	DBL-COM-MEDL
FDNS	1	0	10G	G09_060	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.04828	121.8176	DEWEY - SOUTHARD 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.03017	121.8176	DEWEY - SOUTHARD 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.03017	121.8176	DEWEY - SOUTHARD 138KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	129.5	0.99716	121.5498	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	129.5	0.99716	121.5498	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	129.5	0.99716	121.5498	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1
FDNS	1	0	10G	G09_060	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.04652	121.3249	BASE CASE
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02578	121.3249	BASE CASE
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02578	121.3249	BASE CASE
FDNS	3	0	10G	G09_020	FROM->TO	ST JOHN - ST_JOHN 115KV CKT 1	88	0.08133	121.2218	NINNESC3 115.00 - PRATT 115KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07949	121.0625	MORRISON - STILLWATER 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07949	121.0625	MORRISON - STILLWATER 138KV CKT 1
FDNS	2	0	10G	G09_060	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.04595	120.8777	CEDARDALE - MOORELAND 138KV CKT 1
FDNS	2	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.03481	120.8777	CEDARDALE - MOORELAND 138KV CKT 1
FDNS	1	0	10G	G09_060	FROM->TO	CANTON - OKEENE 69KV CKT 1	48	0.04539	120.8626	CEDARDALE - OKEENE 138KV CKT 1
FDNS	1	0	10G	G10_008	FROM->TO	CANTON - OKEENE 69KV CKT 1	48	0.03425	120.8626	CEDARDALE - OKEENE 138KV CKT 1
FDNS	1	0	10G	G10_008	FROM->TO	CANTON - OKEENE 69KV CKT 1	48	0.03425	120.8626	CEDARDALE - OKEENE 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	120.7193	GEN560152 1-G06-46 0.6000
FDNS	1	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.05435	120.7193	GEN560152 1-G06-46 0.6000
FDNS	7	0	10G	G09_030	TO->FROM	EL RENO - EL RENO SW 69KV CKT 1	27	0.06024	120.5954	JENSEN ROAD - JENSEN TAP 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	EL RENO - EL RENO SW 69KV CKT 1	27	0.06024	120.5954	JENSEN ROAD - JENSEN TAP 138KV CKT 1
FDNS	3	0	10G	G09_059	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	129.5	0.99716	120.1024	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1
FDNS	3	0	10G	G09_059	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	129.5	0.99716	120.1024	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1
FDNS	3	0	10G	G09_059	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	129.5	0.99716	120.1024	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1
FDNS	3	0	10G	G09_008	FROM->TO	NINNESC3 115.00 - PRATT 115KV CKT 1	79.7	0.03071	119.9024	DBL-SPRVL-CO
FDNS	3	0	10G	G09_020	FROM->TO	NINNESC3 115.00 - PRATT 115KV CKT 1	79.7	0.07552	119.9024	DBL-SPRVL-CO
FDNS	3	0	10G	G09_059	TO->FROM	MEDICINE LODGE - SUN CITY 115KV CKT 1	129.5	0.10799	119.7367	DBL-COM-MEDL
FDNS	3	0	10G	G09_059	TO->FROM	MEDICINE LODGE - SUN CITY 115KV CKT 1	129.5	0.10799	119.7367	DBL-COM-MEDL
FDNS	3	0	10G	G09_059	TO->FROM	MEDICINE LODGE - SUN CITY 115KV CKT 1	129.5	0.10799	119.7367	DBL-COM-MEDL
FDNS	3	0	10G	G09_062	TO->FROM	MEDICINE LODGE - SUN CITY 115KV CKT 1	129.5	0.05093	119.7367	DBL-COM-MEDL
FDNS	3	0	10G	G09_062	TO->FROM	MEDICINE LODGE - SUN CITY 115KV CKT 1	129.5	0.05093	119.7367	DBL-COM-MEDL
FDNS	3	0	10G	G10_009	TO->FROM	MEDICINE LODGE - SUN CITY 115KV CKT 1	129.5	0.02583	119.7367	DBL-COM-MEDL
FDNS	3	0	10G	G10_009	TO->FROM	MEDICINE LODGE - SUN CITY 115KV CKT 1	129.5	0.02583	119.7367	DBL-COM-MEDL
FDNS	3	0	10G	G10_009	TO->FROM	MEDICINE LODGE - SUN CITY 115KV CKT 1	129.5	0.02583	119.7367	DBL-COM-MEDL
FDNS	3	0	10G	G10_015	TO->FROM	MEDICINE LODGE - SUN CITY 115KV CKT 1	129.5	0.02929	119.7367	DBL-COM-MEDL
FDNS	3	0	10G	G10_015	TO->FROM	MEDICINE LODGE - SUN CITY 115KV CKT 1	129.5	0.02929	119.7367	DBL-COM-MEDL
FDNS	3	0	10G	G10_015	TO->FROM	MEDICINE LODGE - SUN CITY 115KV CKT 1	129.5	0.02929	119.7367	DBL-COM-MEDL
FDNS	1	0	10G	G09_060	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.04828	119.4715	ROMAN NOSE - SOUTHARD 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.03017	119.4715	ROMAN NOSE - SOUTHARD 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.03017	119.4715	ROMAN NOSE - SOUTHARD 138KV CKT 1
FDNS	1	0	10G	G10_008	FROM->TO	OKEENE - WATONGA SW 69KV CKT 1	48	0.03421	119.2954	DOVER SW - OKEENE 138KV CKT 1
FDNS	1	0	10G	G10_008	FROM->TO	OKEENE - WATONGA SW 69KV CKT 1	48	0.03421	119.2954	DOVER SW - OKEENE 138KV CKT 1
FDNS	2	0	10G	G09_060	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.04595	119.1809	CEDARDALE - OKEENE 138KV CKT 1
FDNS	2	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.03481	119.1809	CEDARDALE - OKEENE 138KV CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.0782	118.9558	MCELROY - STILLWATER 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.0782	118.9558	MCELROY - STILLWATER 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.08009	118.7991	G08-38T 138.00 - WEST PAWHUSKA 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.08009	118.7991	G08-38T 138.00 - WEST PAWHUSKA 138KV CKT 1
FDNS	0	0	14SP	G09_062	FROM->TO	CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1	89.6	0.25335	118.7935	HAYNE 3 115.00 - NORTH LIBERAL TAP 115KV CKT 1
FDNS	0	0	14SP	G09_062	FROM->TO	CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1	89.6	0.25335	118.7935	HAYNE 3 115.00 - NORTH LIBERAL TAP 115KV CKT 1
FDNS	3	0	10G	G09_008	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.05013	118.6178	DBL-SPRVL-CO
FDNS	3	0	10G	G09_020	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.08822	118.6178	DBL-SPRVL-CO
FDNS	3	0	10G	G09_059	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.11869	118.6178	DBL-SPRVL-CO
FDNS	3	0	10G	G09_059	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.11869	118.6178	DBL-SPRVL-CO
FDNS	3	0	10G	G09_059	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.11869	118.6178	DBL-SPRVL-CO
FDNS	3	0	10G	G09_062	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.06567	118.6178	DBL-SPRVL-CO
FDNS	3	0	10G	G09_062	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.06567	118.6178	DBL-SPRVL-CO
FDNS	3	0	10G	G10_009	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.045	118.6178	DBL-SPRVL-CO
FDNS	3	0	10G	G10_009	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.045	118.6178	DBL-SPRVL-CO
FDNS	3	0	10G	G10_009	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.045	118.6178	DBL-SPRVL-CO
FDNS	3	0	10G	G10_015	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.05865	118.6178	DBL-SPRVL-CO
FDNS	3	0	10G	G10_015	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.05865	118.6178	DBL-SPRVL-CO
FDNS	3	0	10G	G10_015	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.05865	118.6178	DBL-SPRVL-CO
FDNS	3	0	10G	G10_016	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.0521	118.6178	DBL-SPRVL-CO
FDNS	3	0	10G	G10_016	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.0521	118.6178	DBL-SPRVL-CO
FDNS	3	0	10G	G10_016	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.0521	118.6178	DBL-SPRVL-CO
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.08009	118.5862	PAWHUSKA TAP - WEST PAWHUSKA 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.08009	118.5862	PAWHUSKA TAP - WEST PAWHUSKA 138KV CKT 1
FDNS	0	0	14SP	G10_005	FROM->TO	CLEARWATER - GILL ENERGY CENTER WEST 138KV CKT 1	110	0.02953	118.4724	BENTON - WICHITA 345KV CKT 1
FDNS	0	0	14SP	G10_005	FROM->TO	CLEARWATER - GILL ENERGY CENTER WEST 138KV CKT 1	110	0.02953	118.4724	BENTON - WICHITA 345KV CKT 1
FDNS	0	0	14SP	G10_005	FROM->TO	CLEARWATER - GILL ENERGY CENTER WEST 138KV CKT 1	110	0.02953	118.4724	BENTON - WICHITA 345KV CKT 1
FDNS	6	0	10G	G08_022	TO->FROM	PLANT X STATION - TOLK STATION WEST 230KV CKT 1	497	0.36342	118.1699	PLANT X STATION - TOLK STATION EAST 230KV CKT 2
FDNS	6	0	10G	G08_022	TO->FROM	PLANT X STATION - TOLK STATION WEST 230KV CKT 1	497	0.36342	118.1699	PLANT X STATION - TOLK STATION EAST 230KV CKT 2
FDNS	6	0	10G	G09_067S	TO->FROM	PLANT X STATION - TOLK STATION WEST 230KV CKT 1	497	0.27489	118.1699	PLANT X STATION - TOLK STATION EAST 230KV CKT 2
FDNS	6	0	10G	G09_067S	TO->FROM	PLANT X STATION - TOLK STATION WEST 230KV CKT 1	497	0.27489	118.1699	PLANT X STATION - TOLK STATION EAST 230KV CKT 2
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06226	117.8834	KNOBHILL - MOORELAND 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06226	117.8834	KNOBHILL - MOORELAND 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06226	117.8	KNOBHILL (KNOBHIL4) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06226	117.8	KNOBHILL (KNOBHIL4) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	2	0	10G	ASGI_11	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.05068	117.6648	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	ASGI_11	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.05068	117.6648	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G08_022	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.0329	117.6648	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G08_028	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.06121	117.6648	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G08_028	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.06121	117.6648	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G08_044	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.09146	117.6648	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G08_047	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.06121	117.6648	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G08_047	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.06121	117.6648	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G08_088	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.0327	117.6648	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G08_110	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.06121	117.6648	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G08_110	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.06121	117.6648	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	2	0	10G	G09_008	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.03142	117.6648	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G09_020	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.03401	117.6648	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G09_059	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.04697	117.6648	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G09_062	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.04671	117.6648	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G09_067S	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.03279	117.6648	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G10_007	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.04135	117.6648	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G10_007	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.04135	117.6648	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G10_009	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.04958	117.6648	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G10_011	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.09146	117.6648	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G10_014	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.06121	117.6648	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G10_014	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.06121	117.6648	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G10_015	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.04973	117.6648	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G10_016	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.04223	117.6648	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06574	117.4224	CEDARDALE - MOORELAND 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06574	117.4224	CEDARDALE - MOORELAND 138KV CKT 1
FDNS	6	0	10G	G08_022	TO->FROM	PLANT X STATION - TOLK STATION EAST 230KV CKT 2	497	0.36038	117.2912	PLANT X STATION - TOLK STATION WEST 230KV CKT 1
FDNS	6	0	10G	G08_022	TO->FROM	PLANT X STATION - TOLK STATION EAST 230KV CKT 2	497	0.36038	117.2912	PLANT X STATION - TOLK STATION WEST 230KV CKT 1
FDNS	6	0	10G	G09_067S	TO->FROM	PLANT X STATION - TOLK STATION EAST 230KV CKT 2	497	0.27246	117.2912	PLANT X STATION - TOLK STATION WEST 230KV CKT 1
FDNS	6	0	10G	G09_067S	TO->FROM	PLANT X STATION - TOLK STATION EAST 230KV CKT 2	497	0.27246	117.2912	PLANT X STATION - TOLK STATION WEST 230KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.0782	117.18	KINZE - MCELROY 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.0782	117.18	KINZE - MCELROY 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06574	117.104	CEDARDALE - OKEENE 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06574	117.104	CEDARDALE - OKEENE 138KV CKT 1
FDNS	2	0	10G	ASGI_11	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.0476	117.0886	DBL-COM-MEDL
FDNS	2	0	10G	ASGI_11	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.0476	117.0886	DBL-COM-MEDL
FDNS	2	0	10G	G08_022	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03201	117.0886	DBL-COM-MEDL
FDNS	2	0	10G	G08_028	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.0573	117.0886	DBL-COM-MEDL
FDNS	2	0	10G	G08_028	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.0573	117.0886	DBL-COM-MEDL
FDNS	2	0	10G	G08_044	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.05449	117.0886	DBL-COM-MEDL
FDNS	2	0	10G	G08_047	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.0573	117.0886	DBL-COM-MEDL
FDNS	2	0	10G	G08_047	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.0573	117.0886	DBL-COM-MEDL
FDNS	2	0	10G	G08_088	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03112	117.0886	DBL-COM-MEDL
FDNS	2	0	10G	G08_110	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.0573	117.0886	DBL-COM-MEDL
FDNS	2	0	10G	G08_110	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.0573	117.0886	DBL-COM-MEDL
FDNS	2	0	10G	G09_008	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.02622	117.0886	DBL-COM-MEDL
FDNS	2	0	10G	G09_020	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.02659	117.0886	DBL-COM-MEDL
FDNS	2	0	10G	G09_059	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04446	117.0886	DBL-COM-MEDL
FDNS	2	0	10G	G09_062	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04538	117.0886	DBL-COM-MEDL
FDNS	2	0	10G	G09_067S	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03194	117.0886	DBL-COM-MEDL
FDNS	2	0	10G	G10_007	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.039	117.0886	DBL-COM-MEDL
FDNS	2	0	10G	G10_007	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.039	117.0886	DBL-COM-MEDL
FDNS	2	0	10G	G10_009	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.0504	117.0886	DBL-COM-MEDL
FDNS	2	0	10G	G10_011	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.05449	117.0886	DBL-COM-MEDL
FDNS	2	0	10G	G10_014	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.0573	117.0886	DBL-COM-MEDL
FDNS	2	0	10G	G10_014	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.0573	117.0886	DBL-COM-MEDL
FDNS	2	0	10G	G10_015	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.05272	117.0886	DBL-COM-MEDL
FDNS	2	0	10G	G10_016	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04261	117.0886	DBL-COM-MEDL
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.08009	117.0478	DOMES - PAWHUSKA TAP 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.08009	117.0478	DOMES - PAWHUSKA TAP 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06577	116.7648	CLEVELAND (CLVAUTO1) 345/138/13.8KV TRANSFORMER CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06577	116.7648	CLEVELAND (CLVAUTO1) 345/138/13.8KV TRANSFORMER CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.08009	116.349	DOMES - MOUND ROAD 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.08009	116.349	DOMES - MOUND ROAD 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07562	116.2979	CLEVELAND - SOONER 345KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07562	116.2979	CLEVELAND - SOONER 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06298	116.0918	EL RENO - ROMAN NOSE 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06298	116.0918	EL RENO - ROMAN NOSE 138KV CKT 1
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	116.0013	GEN336821 1-GRAND GULF UNIT
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	116.0013	GEN336821 1-GRAND GULF UNIT
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	116.0013	GEN336821 1-GRAND GULF UNIT
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	115.8885	GEN532751 1-WOLF CREEK GENERATING STATION UNIT 1
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	115.8885	GEN532751 1-WOLF CREEK GENERATING STATION UNIT 1
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	115.8885	GEN532751 1-WOLF CREEK GENERATING STATION UNIT 1
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	115.8815	GEN336153 1-WATERFORD UNIT#3
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	115.8815	GEN336153 1-WATERFORD UNIT#3
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	115.8815	GEN336153 1-WATERFORD UNIT#3
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	115.7391	GEN337911 1-ARKANSAS NUCLEAR ONE UNIT #2
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	115.7391	GEN337911 1-ARKANSAS NUCLEAR ONE UNIT #2
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	115.7391	GEN337911 1-ARKANSAS NUCLEAR ONE UNIT #2
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	115.7271	GEN335831 1-RIVERBEND UNIT#1
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	115.7271	GEN335831 1-RIVERBEND UNIT#1
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	115.7271	GEN335831 1-RIVERBEND UNIT#1
FDNS	3	0	10G	G09_008	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.03286	115.3492	DBL-COM-MEDL
FDNS	3	0	10G	G09_020	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.07172	115.3492	DBL-COM-MEDL
FDNS	3	0	10G	G09_059	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.10083	115.3492	DBL-COM-MEDL
FDNS	3	0	10G	G09_059	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.10083	115.3492	DBL-COM-MEDL
FDNS	3	0	10G	G09_059	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.10083	115.3492	DBL-COM-MEDL
FDNS	3	0	10G	G09_062	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.05476	115.3492	DBL-COM-MEDL
FDNS	3	0	10G	G09_062	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.05476	115.3492	DBL-COM-MEDL
FDNS	3	0	10G	G10_009	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.03407	115.3492	DBL-COM-MEDL
FDNS	3	0	10G	G10_009	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.03407	115.3492	DBL-COM-MEDL
FDNS	3	0	10G	G10_009	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.03407	115.3492	DBL-COM-MEDL
FDNS	3	0	10G	G10_015	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.0382	115.3492	DBL-COM-MEDL
FDNS	3	0	10G	G10_015	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.0382	115.3492	DBL-COM-MEDL
FDNS	3	0	10G	G10_015	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.0382	115.3492	DBL-COM-MEDL
FDNS	3	0	10G	G10_016	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.03326	115.3492	DBL-COM-MEDL
FDNS	3	0	10G	G10_016	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.03326	115.3492	DBL-COM-MEDL
FDNS	3	0	10G	G10_016	FROM->TO	MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	170	0.03326	115.3492	DBL-COM-MEDL
FDNS	5	0	10G	ASGI_11	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.06124	115.3139	GEN525561 1-TOLK GEN #1 24 KV
FDNS	5	0	10G	G08_028	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.04717	115.3139	GEN525561 1-TOLK GEN #1 24 KV
FDNS	5	0	10G	G08_047	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.04717	115.3139	GEN525561 1-TOLK GEN #1 24 KV
FDNS	5	0	10G	G08_088	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.05786	115.3139	GEN525561 1-TOLK GEN #1 24 KV
FDNS	5	0	10G	G08_088	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.05786	115.3139	GEN525561 1-TOLK GEN #1 24 KV
FDNS	5	0	10G	G08_110	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.04717	115.3139	GEN525561 1-TOLK GEN #1 24 KV

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	5	0	10G	G09_062	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.02614	115.3139	GEN525561 1-TOLK GEN #1 24 KV
FDNS	5	0	10G	G10_007	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.06831	115.3139	GEN525561 1-TOLK GEN #1 24 KV
FDNS	5	0	10G	G10_009	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.02673	115.3139	GEN525561 1-TOLK GEN #1 24 KV
FDNS	5	0	10G	G10_014	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.04717	115.3139	GEN525561 1-TOLK GEN #1 24 KV
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07812	115.0621	BARNSDALL - G08-38T 138.00 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07812	115.0621	BARNSDALL - G08-38T 138.00 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	CLINTON CITY - FOSS TAP 69KV CKT 1	53	0.0908	114.8765	CLINTON JUNCTION - CLINTON NATURAL GAS TAP 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	CLINTON CITY - FOSS TAP 69KV CKT 1	53	0.0908	114.8765	CLINTON JUNCTION - CLINTON NATURAL GAS TAP 138KV CKT 1
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	114.7511	BASE CASE
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	114.7511	BASE CASE
FDNS	8	0	10G	G10_005	FROM->TO	G07-25 345.00 - G07-25T 345.00 345KV CKT 1	420	0.99157	114.7511	BASE CASE
FDNS	3	0	10G	G09_020	TO->FROM	CLEARWATER - MILAN TAP 138KV CKT 1	110	0.03543	114.7451	MED-LDG5 345.00 345/138KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	TO->FROM	CLEARWATER - MILAN TAP 138KV CKT 1	110	0.04698	114.7451	MED-LDG5 345.00 345/138KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	TO->FROM	CLEARWATER - MILAN TAP 138KV CKT 1	110	0.04698	114.7451	MED-LDG5 345.00 345/138KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	TO->FROM	CLEARWATER - MILAN TAP 138KV CKT 1	110	0.04698	114.7451	MED-LDG5 345.00 345/138KV TRANSFORMER CKT 1
FDNS	2	0	10G	ASGI_11	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.05055	114.6987	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	ASGI_11	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.05055	114.6987	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G08_022	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03277	114.6987	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G08_028	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.06108	114.6987	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G08_028	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.06108	114.6987	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G08_047	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.06108	114.6987	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G08_047	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.06108	114.6987	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G08_088	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03258	114.6987	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G08_110	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.06108	114.6987	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G08_110	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.06108	114.6987	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G09_008	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03129	114.6987	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G09_020	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03389	114.6987	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G09_059	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04685	114.6987	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G09_062	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04658	114.6987	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G09_067S	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03266	114.6987	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G10_007	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04122	114.6987	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	2	0	10G	G10_007	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04122	114.6987	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G10_009	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04945	114.6987	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G10_014	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.06108	114.6987	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G10_014	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.06108	114.6987	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G10_015	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.0496	114.6987	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G10_016	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.0421	114.6987	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	1	0	10G	G09_060	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.0338	114.4066	OKEENE (OKEENE) 138/69/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G08_028	TO->FROM	CIRCLE - MULLERGREN 230KV CKT 1	319	0.0254	114.3535	DBL-SPRVL-CO
FDNS	3	0	10G	G08_047	TO->FROM	CIRCLE - MULLERGREN 230KV CKT 1	319	0.0254	114.3535	DBL-SPRVL-CO
FDNS	3	0	10G	G08_110	TO->FROM	CIRCLE - MULLERGREN 230KV CKT 1	319	0.0254	114.3535	DBL-SPRVL-CO
FDNS	3	0	10G	G08_123N	TO->FROM	CIRCLE - MULLERGREN 230KV CKT 1	319	0.03024	114.3535	DBL-SPRVL-CO
FDNS	3	0	10G	G09_008	TO->FROM	CIRCLE - MULLERGREN 230KV CKT 1	319	0.14357	114.3535	DBL-SPRVL-CO
FDNS	3	0	10G	G09_020	TO->FROM	CIRCLE - MULLERGREN 230KV CKT 1	319	0.20542	114.3535	DBL-SPRVL-CO
FDNS	3	0	10G	G09_059	TO->FROM	CIRCLE - MULLERGREN 230KV CKT 1	319	0.10203	114.3535	DBL-SPRVL-CO
FDNS	3	0	10G	G09_059	TO->FROM	CIRCLE - MULLERGREN 230KV CKT 1	319	0.10203	114.3535	DBL-SPRVL-CO
FDNS	3	0	10G	G09_059	TO->FROM	CIRCLE - MULLERGREN 230KV CKT 1	319	0.10203	114.3535	DBL-SPRVL-CO
FDNS	3	0	10G	G09_062	TO->FROM	CIRCLE - MULLERGREN 230KV CKT 1	319	0.08968	114.3535	DBL-SPRVL-CO
FDNS	3	0	10G	G09_062	TO->FROM	CIRCLE - MULLERGREN 230KV CKT 1	319	0.08968	114.3535	DBL-SPRVL-CO
FDNS	3	0	10G	G10_009	TO->FROM	CIRCLE - MULLERGREN 230KV CKT 1	319	0.09147	114.3535	DBL-SPRVL-CO
FDNS	3	0	10G	G10_009	TO->FROM	CIRCLE - MULLERGREN 230KV CKT 1	319	0.09147	114.3535	DBL-SPRVL-CO
FDNS	3	0	10G	G10_009	TO->FROM	CIRCLE - MULLERGREN 230KV CKT 1	319	0.09147	114.3535	DBL-SPRVL-CO
FDNS	3	0	10G	G10_014	TO->FROM	CIRCLE - MULLERGREN 230KV CKT 1	319	0.0254	114.3535	DBL-SPRVL-CO
FDNS	3	0	10G	G10_015	TO->FROM	CIRCLE - MULLERGREN 230KV CKT 1	319	0.11242	114.3535	DBL-SPRVL-CO
FDNS	3	0	10G	G10_015	TO->FROM	CIRCLE - MULLERGREN 230KV CKT 1	319	0.11242	114.3535	DBL-SPRVL-CO
FDNS	3	0	10G	G10_015	TO->FROM	CIRCLE - MULLERGREN 230KV CKT 1	319	0.11242	114.3535	DBL-SPRVL-CO
FDNS	3	0	10G	G10_016	TO->FROM	CIRCLE - MULLERGREN 230KV CKT 1	319	0.10762	114.3535	DBL-SPRVL-CO
FDNS	3	0	10G	G10_016	TO->FROM	CIRCLE - MULLERGREN 230KV CKT 1	319	0.10762	114.3535	DBL-SPRVL-CO
FDNS	3	0	10G	G10_016	TO->FROM	CIRCLE - MULLERGREN 230KV CKT 1	319	0.10762	114.3535	DBL-SPRVL-CO
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05932	113.9199	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05932	113.9199	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07875	113.7064	BARTLESVILLE COMANCHE - MOUND ROAD 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07875	113.7064	BARTLESVILLE COMANCHE - MOUND ROAD 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02968	113.614	PUTNAM - TALOGA 69KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02968	113.614	PUTNAM - TALOGA 69KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06555	113.5494	DOVER SW - OKEENE 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06555	113.5494	DOVER SW - OKEENE 138KV CKT 1
FDNS	2	0	10G	G09_030	TO->FROM	CLINTON CITY - FOSS TAP 69KV CKT 1	53	0.09049	113.3368	WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02968	112.9707	HAMON BUTLER - PUTNAM 69KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02968	112.9707	HAMON BUTLER - PUTNAM 69KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02968	112.9576	ARAPAHO - HAMON BUTLER 69KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02968	112.9576	ARAPAHO - HAMON BUTLER 69KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02968	112.9341	ARAPAHO - INDUSTRIAL PARK 69KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02968	112.9341	ARAPAHO - INDUSTRIAL PARK 69KV CKT 1
FDNS	1	0	10G	G09_060	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.04665	112.5737	KNOBHILL - MOORELAND 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02644	112.5737	KNOBHILL - MOORELAND 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02644	112.5737	KNOBHILL - MOORELAND 138KV CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	1	0	10G	G09_060	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.04665	112.5617	KNOBHILL (KNOBHIL4) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02644	112.5617	KNOBHILL (KNOBHIL4) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02644	112.5617	KNOBHILL (KNOBHIL4) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	1	0	10G	G09_060	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.04601	112.5229	ALVA - CHEROKEE SW 69KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02709	112.5229	ALVA - CHEROKEE SW 69KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02709	112.5229	ALVA - CHEROKEE SW 69KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07386	112.4791	MORRISON - SOONER 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07386	112.4791	MORRISON - SOONER 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02968	112.2245	CORDELL - INDUSTRIAL PARK 69KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02968	112.2245	CORDELL - INDUSTRIAL PARK 69KV CKT 1
FDNS	3	0	10G	G09_020	FROM->TO	ST JOHN - ST_JOHN 115KV CKT 1	88	0.05793	112.0571	DBL-SPRVL-CO
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	111.7583	GEN514805 1-SOONER UNIT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	111.7583	GEN514805 1-SOONER UNIT 1
FDNS	2	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06634	111.577	DBL-COM-MEDL
FDNS	2	0	10G	G08_044	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.02917	111.3727	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06644	111.3727	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G10_011	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.02917	111.3727	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G09_060	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.04688	111.2097	GLASS MOUNTAIN - MOORELAND 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02743	111.2097	GLASS MOUNTAIN - MOORELAND 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02743	111.2097	GLASS MOUNTAIN - MOORELAND 138KV CKT 1
FDNS	1	0	10G	G09_060	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.04688	111.0216	CLEO CORNER - GLASS MOUNTAIN 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02743	111.0216	CLEO CORNER - GLASS MOUNTAIN 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02743	111.0216	CLEO CORNER - GLASS MOUNTAIN 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06233	110.8826	ELK CITY - RHWIND4 138.00 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06233	110.8826	ELK CITY - RHWIND4 138.00 138KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.77076	110.8436	HOLCOMB (HOLCOMB) 345/115/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.77076	110.8436	HOLCOMB (HOLCOMB) 345/115/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.77076	110.8436	HOLCOMB (HOLCOMB) 345/115/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_062	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.37742	110.8436	HOLCOMB (HOLCOMB) 345/115/13.8KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_062	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.37742	110.8436	HOLCOMB (HOLCOMB) 345/115/13.8KV TRANSFORMER CKT 1
FDNS	2	0	10G	ASGI_11	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.04844	110.7466	DBL-COM-MEDL
FDNS	2	0	10G	ASGI_11	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.04844	110.7466	DBL-COM-MEDL
FDNS	2	0	10G	G08_022	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.03285	110.7466	DBL-COM-MEDL
FDNS	2	0	10G	G08_028	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.05814	110.7466	DBL-COM-MEDL
FDNS	2	0	10G	G08_028	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.05814	110.7466	DBL-COM-MEDL
FDNS	2	0	10G	G08_044	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.05533	110.7466	DBL-COM-MEDL
FDNS	2	0	10G	G08_047	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.05814	110.7466	DBL-COM-MEDL
FDNS	2	0	10G	G08_047	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.05814	110.7466	DBL-COM-MEDL
FDNS	2	0	10G	G08_088	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.03196	110.7466	DBL-COM-MEDL
FDNS	2	0	10G	G08_110	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.05814	110.7466	DBL-COM-MEDL
FDNS	2	0	10G	G08_110	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.05814	110.7466	DBL-COM-MEDL
FDNS	2	0	10G	G09_008	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.02706	110.7466	DBL-COM-MEDL
FDNS	2	0	10G	G09_020	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.02743	110.7466	DBL-COM-MEDL
FDNS	2	0	10G	G09_059	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.04529	110.7466	DBL-COM-MEDL
FDNS	2	0	10G	G09_062	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.04622	110.7466	DBL-COM-MEDL

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	2	0	10G	G09_067S	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.03278	110.7466	DBL-COM-MEDL
FDNS	2	0	10G	G10_007	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.03984	110.7466	DBL-COM-MEDL
FDNS	2	0	10G	G10_007	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.03984	110.7466	DBL-COM-MEDL
FDNS	2	0	10G	G10_009	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.05124	110.7466	DBL-COM-MEDL
FDNS	2	0	10G	G10_011	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.05533	110.7466	DBL-COM-MEDL
FDNS	2	0	10G	G10_014	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.05814	110.7466	DBL-COM-MEDL
FDNS	2	0	10G	G10_014	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.05814	110.7466	DBL-COM-MEDL
FDNS	2	0	10G	G10_015	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.05356	110.7466	DBL-COM-MEDL
FDNS	2	0	10G	G10_016	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.04345	110.7466	DBL-COM-MEDL
FDNS	0	0	14SP	ASGI_10	FROM->TO	ROOSEVELT COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1	289.8	0.03217	110.6819	OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1
FDNS	0	0	14SP	ASGI_10	FROM->TO	ROOSEVELT COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1	289.8	0.03217	110.6819	OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1
FDNS	0	0	14SP	G08_022	FROM->TO	ROOSEVELT COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1	289.8	0.03793	110.6819	OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1
FDNS	0	0	14SP	G08_022	FROM->TO	ROOSEVELT COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1	289.8	0.03793	110.6819	OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1
FDNS	0	0	14SP	G09_067S	FROM->TO	ROOSEVELT COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1	289.8	0.03992	110.6819	OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1
FDNS	0	0	14SP	G09_067S	FROM->TO	ROOSEVELT COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1	289.8	0.03992	110.6819	OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	NINNESC3 115.00 - ST JOHN 115KV CKT 1	79.7	0.0295	110.589	MED-LDG5 345.00 345/138KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	NINNESC3 115.00 - ST JOHN 115KV CKT 1	79.7	0.0295	110.589	MED-LDG5 345.00 345/138KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	NINNESC3 115.00 - ST JOHN 115KV CKT 1	79.7	0.0295	110.589	MED-LDG5 345.00 345/138KV TRANSFORMER CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06329	110.3407	DEWEY - SOUTHARD 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06329	110.3407	DEWEY - SOUTHARD 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07054	110.3008	BARTLESVILLE SOUTHEAST - NORTH BARTLESVILLE 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07054	110.3008	BARTLESVILLE SOUTHEAST - NORTH BARTLESVILLE 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06635	110.279	MOORELAND - MOREWOOD SW 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06635	110.279	MOORELAND - MOREWOOD SW 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.0653	110.2621	DOVER SW - HENESSEY 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.0653	110.2621	DOVER SW - HENESSEY 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07054	110.0934	COFFEYVILLE TAP - NORTH BARTLESVILLE 138KV CKT
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07054	110.0934	COFFEYVILLE TAP - NORTH BARTLESVILLE 138KV CKT
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05759	110.086	ALVA - KNOBHILL 69KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05759	110.086	ALVA - KNOBHILL 69KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	110.0723	GEN336821 1-GRAND GULF UNIT
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	110.0723	GEN336821 1-GRAND GULF UNIT
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.1046	109.9309	NEWKIRK4 - PECKHMT4 138.00 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.1046	109.9309	NEWKIRK4 - PECKHMT4 138.00 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.1046	109.927	CRESWELL - PECKHMT4 138.00 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.1046	109.927	CRESWELL - PECKHMT4 138.00 138KV CKT 1
FDNS	7	0	10G	G08_037	TO->FROM	SUNSHINE CANYON - TUTTLE 138KV CKT 1	143	0.09386	109.666	CIMARRON - G07-43T 345.00 345KV CKT 1
FDNS	7	0	10G	G08_037	TO->FROM	SUNSHINE CANYON - TUTTLE 138KV CKT 1	143	0.09386	109.666	CIMARRON - G07-43T 345.00 345KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	SUNSHINE CANYON - TUTTLE 138KV CKT 1	143	0.05288	109.666	CIMARRON - G07-43T 345.00 345KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	SUNSHINE CANYON - TUTTLE 138KV CKT 1	143	0.05288	109.666	CIMARRON - G07-43T 345.00 345KV CKT 1
FDNS	7	0	10G	G09_060	TO->FROM	SUNSHINE CANYON - TUTTLE 138KV CKT 1	143	0.05612	109.666	CIMARRON - G07-43T 345.00 345KV CKT 1
FDNS	7	0	10G	G09_060	TO->FROM	SUNSHINE CANYON - TUTTLE 138KV CKT 1	143	0.05612	109.666	CIMARRON - G07-43T 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.0653	109.6654	HENESSEY - WAUKOMIS 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.0653	109.6654	HENESSEY - WAUKOMIS 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06329	109.624	ROMAN NOSE - SOUTHARD 138KV CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06329	109.624	ROMAN NOSE - SOUTHARD 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	109.5768	GEN336153 1-WATERFORD UNIT#3
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	109.5768	GEN336153 1-WATERFORD UNIT#3
FDNS	1	0	10G	G08_044	TO->FROM	CLEO CORNER - GLASS MOUNTAIN 138KV CKT 1	153	0.02754	109.5297	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G08_044	TO->FROM	CLEO CORNER - GLASS MOUNTAIN 138KV CKT 1	153	0.02754	109.5297	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G08_044	TO->FROM	CLEO CORNER - GLASS MOUNTAIN 138KV CKT 1	153	0.02754	109.5297	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CLEO CORNER - GLASS MOUNTAIN 138KV CKT 1	153	0.0648	109.5297	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CLEO CORNER - GLASS MOUNTAIN 138KV CKT 1	153	0.0648	109.5297	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_011	TO->FROM	CLEO CORNER - GLASS MOUNTAIN 138KV CKT 1	153	0.02754	109.5297	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_011	TO->FROM	CLEO CORNER - GLASS MOUNTAIN 138KV CKT 1	153	0.02754	109.5297	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_011	TO->FROM	CLEO CORNER - GLASS MOUNTAIN 138KV CKT 1	153	0.02754	109.5297	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05932	109.5258	G05-15T 345.00 - OKLAUNION 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05932	109.5258	G05-15T 345.00 - OKLAUNION 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	109.4836	GEN337911 1-ARKANSAS NUCLEAR ONE UNIT #2
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	109.4836	GEN337911 1-ARKANSAS NUCLEAR ONE UNIT #2
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06021	109.4345	MED-LDG5 345.00 - WICHITA 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06021	109.4345	MED-LDG5 345.00 - WICHITA 345KV CKT 2
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06021	109.4345	MED-LDG5 345.00 - WICHITA 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06021	109.4345	MED-LDG5 345.00 - WICHITA 345KV CKT 2
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06576	109.406	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06576	109.406	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	3	0	10G	G09_059	TO->FROM	CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1	89.6	0.84289	109.3912	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1
FDNS	3	0	10G	G09_059	TO->FROM	CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1	89.6	0.84289	109.3912	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1
FDNS	3	0	10G	G09_059	TO->FROM	CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1	89.6	0.84289	109.3912	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	109.3312	GEN514806 1-SOONER UNIT 2
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	109.3312	GEN514806 1-SOONER UNIT 2
FDNS	1	0	10G	G09_060	FROM->TO	CANTON - OKEENE 69KV CKT 1	48	0.04794	109.314	EL RENO - ROMAN NOSE 138KV CKT 1
FDNS	1	0	10G	G10_008	FROM->TO	CANTON - OKEENE 69KV CKT 1	48	0.02984	109.314	EL RENO - ROMAN NOSE 138KV CKT 1
FDNS	1	0	10G	G10_008	FROM->TO	CANTON - OKEENE 69KV CKT 1	48	0.02984	109.314	EL RENO - ROMAN NOSE 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06107	109.2852	COMANCH5 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06107	109.2852	COMANCH5 345.00 - WWRDEHV7 345.00 345KV CKT 2
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06107	109.2852	COMANCH5 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06107	109.2852	COMANCH5 345.00 - WWRDEHV7 345.00 345KV CKT 2
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.0653	109.2591	WAUKOMIS - WAUKOMIS TAP 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.0653	109.2591	WAUKOMIS - WAUKOMIS TAP 138KV CKT 1
FDNS	5	0	10G	G09_030	TO->FROM	CLINTON CITY - FOSS TAP 69KV CKT 1	53	0.09037	109.2169	WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1
FDNS	6	0	10G	G08_022	FROM->TO	PLANT X STATION 230/115KV TRANSFORMER CKT 1	239	0.09909	109.1099	TOLK STATION EAST - TUCO INTERCHANGE 230KV CKT 1
FDNS	6	0	10G	G08_022	FROM->TO	PLANT X STATION 230/115KV TRANSFORMER CKT 1	239	0.09909	109.1099	TOLK STATION EAST - TUCO INTERCHANGE 230KV CKT 1
FDNS	6	0	10G	G09_067S	FROM->TO	PLANT X STATION 230/115KV TRANSFORMER CKT 1	239	0.08065	109.1099	TOLK STATION EAST - TUCO INTERCHANGE 230KV CKT 1
FDNS	6	0	10G	G09_067S	FROM->TO	PLANT X STATION 230/115KV TRANSFORMER CKT 1	239	0.08065	109.1099	TOLK STATION EAST - TUCO INTERCHANGE 230KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	108.9346	GEN335831 1-RIVERBEND UNIT#1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	108.9346	GEN335831 1-RIVERBEND UNIT#1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	108.8691	GEN532751 1-WOLF CREEK GENERATING STATION UNIT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	108.8691	GEN532751 1-WOLF CREEK GENERATING STATION UNIT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06953	108.86	WWRDEHV7 345.00 (WWDEHV-T) 345/138/13.8KV TRANSFORMER CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06953	108.86	WWRDEHV7 345.00 (WWDEHV-T2) 345/138/13.8KV TRANSFORMER CKT 2
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06953	108.86	WWRDEHV7 345.00 (WWDEHV-T) 345/138/13.8KV TRANSFORMER CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06953	108.86	WWRDEHV7 345.00 (WWDEHV-T2) 345/138/13.8KV TRANSFORMER CKT 2
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05216	108.7091	WOODRING (WOODRNG2) 345/138/13.8KV TRANSFORMER CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05216	108.7091	WOODRING (WOODRNG2) 345/138/13.8KV TRANSFORMER CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07043	108.702	CIMARRON - WOODRING 345KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07043	108.702	CIMARRON - WOODRING 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	108.6816	GEN337910 1-ARKANSAS NUCLEAR ONE UNIT #1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	108.6816	GEN337910 1-ARKANSAS NUCLEAR ONE UNIT #1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07492	108.6599	BARNSDALL - SKIATOOK PUMP 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07492	108.6599	BARNSDALL - SKIATOOK PUMP 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07492	108.5504	SKIATOOK PUMP - TULSA NORTH 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07492	108.5504	SKIATOOK PUMP - TULSA NORTH 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06958	108.5266	4OOLOGAH 138.00 - NORTHEAST STATION 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06958	108.5266	4OOLOGAH 138.00 - NORTHEAST STATION 138KV CKT 1
FDNS	0	0	14SP	ASGI_10	FROM->TO	OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1	285	0.03322	108.5086	ROOSEVELT COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1
FDNS	0	0	14SP	ASGI_10	FROM->TO	OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1	285	0.03322	108.5086	ROOSEVELT COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1
FDNS	0	0	14SP	G08_022	FROM->TO	OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1	285	0.03887	108.5086	ROOSEVELT COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1
FDNS	0	0	14SP	G08_022	FROM->TO	OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1	285	0.03887	108.5086	ROOSEVELT COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1
FDNS	0	0	14SP	G09_067S	FROM->TO	OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1	285	0.04296	108.5086	ROOSEVELT COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1
FDNS	0	0	14SP	G09_067S	FROM->TO	OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1	285	0.04296	108.5086	ROOSEVELT COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.09789	108.4969	SOONER (SOONER5) 345/138/13.8KV TRANSFORMER CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.09789	108.4969	SOONER (SOONER5) 345/138/13.8KV TRANSFORMER CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06907	108.4905	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06907	108.4905	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06958	108.4611	CLAREMORE (CLRAUTO4) 161/138/13.8KV TRANSFORMER CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06958	108.4611	4OOLOGAH 138.00 - CLAREMORE 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06958	108.4611	CLAREMORE (CLRAUTO4) 161/138/13.8KV TRANSFORMER CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06958	108.4611	4OOLOGAH 138.00 - CLAREMORE 138KV CKT 1
FDNS	2	0	10G	ASGI_11	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.05139	108.4483	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	ASGI_11	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.05139	108.4483	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	2	0	10G	G08_022	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.03361	108.4483	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G08_028	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.06192	108.4483	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G08_028	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.06192	108.4483	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G08_047	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.06192	108.4483	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G08_047	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.06192	108.4483	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G08_088	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.03342	108.4483	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G08_110	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.06192	108.4483	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G08_110	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.06192	108.4483	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G09_008	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.03213	108.4483	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G09_020	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.03472	108.4483	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G09_059	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.04769	108.4483	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G09_062	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.04742	108.4483	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G09_067S	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.0335	108.4483	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G10_007	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.04206	108.4483	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G10_007	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.04206	108.4483	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G10_009	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.05029	108.4483	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G10_014	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.06192	108.4483	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G10_014	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.06192	108.4483	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G10_015	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.05044	108.4483	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G10_016	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.04294	108.4483	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06973	108.3294	COFFEYVILLE TAP - DEARING 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06973	108.3294	COFFEYVILLE TAP - DEARING 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06944	108.323	GEN337911 1-ARKANSAS NUCLEAR ONE UNIT #2
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06944	108.323	GEN337911 1-ARKANSAS NUCLEAR ONE UNIT #2
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05995	108.3127	COMANCH5 345.00 - MED-LDG5 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05995	108.3127	COMANCH5 345.00 - MED-LDG5 345.00 345KV CKT 2
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05995	108.3127	COMANCH5 345.00 - MED-LDG5 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05995	108.3127	COMANCH5 345.00 - MED-LDG5 345.00 345KV CKT 2
FDNS	7	0	10G	G09_030	TO->FROM	HYDRO - WEATHERFORD 138KV CKT 1	179	0.99579	108.2942	CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	HYDRO - WEATHERFORD 138KV CKT 1	179	0.99579	108.2942	CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05937	108.2613	G05-15T 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05937	108.2613	G05-15T 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06944	108.1995	GEN336821 1-GRAND GULF UNIT

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06944	108.1995	GEN336821 1-GRAND GULF UNIT
FDNS	3	0	10G	G09_020	FROM->TO	ST JOHN - ST_JOHN 115KV CKT 1	88	0.04574	108.1987	CIRCLE - HUTCHINSON ENERGY CENTER 115KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07918	108.1665	MARLAND TAP - OSAGE 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07918	108.1665	MARLAND TAP - OSAGE 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07918	108.1656	BILLING4 - MARLAND TAP 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07918	108.1656	BILLING4 - MARLAND TAP 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.10742	108.1575	FAIRFAX TAP - SHIDLER 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.10742	108.1575	FAIRFAX TAP - SHIDLER 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07086	108.1393	PERRY - SOONER 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07086	108.1393	PERRY - SOONER 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	108.1196	GEN337653 1-WHITE BLUFF UNIT #2
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	108.1196	GEN337653 1-WHITE BLUFF UNIT #2
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06944	108.0893	GEN336153 1-WATERFORD UNIT#3
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06944	108.0893	GEN336153 1-WATERFORD UNIT#3
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	108.0798	GEN337652 1-WHITE BLUFF UNIT #1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	108.0798	GEN337652 1-WHITE BLUFF UNIT #1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05882	108.063	G08-13T 345.00 - WOODRING 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05882	108.063	G08-13T 345.00 - WOODRING 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	108.0451	GEN338146 1-INDEPENDENCE UNIT #2
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	108.0451	GEN338146 1-INDEPENDENCE UNIT #2
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06944	107.9794	GEN337910 1-ARKANSAS NUCLEAR ONE UNIT #1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06944	107.9794	GEN337910 1-ARKANSAS NUCLEAR ONE UNIT #1
FDNS	2	0	10G	G09_060	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.04661	107.6895	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02774	107.6895	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	ASGI_11	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.18903	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G08_022	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.13846	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G08_028	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.20761	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G08_044	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.43419	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G08_044	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.43419	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G08_044	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.43419	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G08_047	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.20761	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G08_088	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.15563	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G08_110	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.20761	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G09_008	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.07993	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G09_020	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.08259	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G09_059	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.14582	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G09_062	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.15096	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G09_067S	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.13753	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G10_007	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.17292	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G10_008	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.18062	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G10_008	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.18062	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G10_009	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.16879	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G10_011	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.43419	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G10_011	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.43419	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G10_011	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.43419	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G10_014	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.20761	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G10_015	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.17345	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G10_016	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.13747	107.6218	DBL-COM-MEDL
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05986	107.5484	CLINTON JUNCTION - ELK CITY 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05986	107.5484	CLINTON JUNCTION - ELK CITY 138KV CKT 1
FDNS	3	0	10G	ASGI_11	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.05025	107.5457	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G08_022	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03248	107.5457	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G08_028	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.06079	107.5457	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	3	0	10G	G08_044	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.09104	107.5457	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G08_047	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.06079	107.5457	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G08_088	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03228	107.5457	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G08_110	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.06079	107.5457	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G09_008	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.031	107.5457	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G09_020	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03359	107.5457	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04655	107.5457	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04655	107.5457	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04655	107.5457	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G09_062	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04628	107.5457	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G09_062	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04628	107.5457	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G09_067S	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03237	107.5457	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G10_007	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04093	107.5457	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G10_009	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04916	107.5457	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G10_009	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04916	107.5457	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G10_009	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04916	107.5457	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G10_011	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.09104	107.5457	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G10_014	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.06079	107.5457	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G10_015	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.0493	107.5457	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G10_015	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.0493	107.5457	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G10_015	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.0493	107.5457	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G10_016	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.0418	107.5457	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G10_016	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.0418	107.5457	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G10_016	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.0418	107.5457	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	107.5453	GEN337041 1-GERALD ANDRUS
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	107.5453	GEN337041 1-GERALD ANDRUS
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	107.4509	GEN512688 2-GRDA1 GSU2 22
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	107.4509	GEN512688 2-GRDA1 GSU2 22
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	107.4069	GEN501801 1-DOLET HILLS UNIT1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	107.4069	GEN501801 1-DOLET HILLS UNIT1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05968	107.3836	G10-016TAP 345.00 - KNOLL345 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05968	107.3836	G10-016TAP 345.00 - KNOLL345 345.00 345KV CKT 1
FDNS	2	0	10G	ASGI_11	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.07273	107.3314	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	ASGI_11	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.07273	107.3314	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G08_022	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.09207	107.3314	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G08_028	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.04448	107.3314	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G08_028	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.04448	107.3314	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G08_047	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.04448	107.3314	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G08_047	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.04448	107.3314	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G08_088	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.11817	107.3314	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G08_110	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.04448	107.3314	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G08_110	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.04448	107.3314	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G09_067S	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.09126	107.3314	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G10_007	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.09807	107.3314	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G10_007	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.09807	107.3314	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G10_014	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.04448	107.3314	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G10_014	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.04448	107.3314	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	3	0	10G	G09_020	FROM->TO	ST JOHN - ST_JOHN 115KV CKT 1	88	0.05603	107.2934	MED-LDG5 345.00 - WICHITA 345KV CKT 1
FDNS	3	0	10G	G09_020	FROM->TO	ST JOHN - ST_JOHN 115KV CKT 1	88	0.05603	107.2934	MED-LDG5 345.00 - WICHITA 345KV CKT 2
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06108	107.2279	KNOBHILL - SALINE 69KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06108	107.2279	KNOBHILL - SALINE 69KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06062	107.1495	HAZELTON JCT - WAKITA 69KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06062	107.1495	HAZELTON JCT - WAKITA 69KV CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.0624	107.1396	ALINE - ALVA 69KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.0624	107.1396	ALINE - ALVA 69KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05982	107.1054	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05982	107.1054	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06108	107.0365	HELENAT2 69.000 - SALINE 69KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06108	107.0365	HELENAT2 69.000 - SALINE 69KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05982	107.0166	CLINTON AIR FORCE BASE TAP - HOBART JUNCTION 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05982	107.0166	CLINTON AIR FORCE BASE TAP - HOBART JUNCTION 138KV CKT 1
FDNS	7	0	10G	G08_037	FROM->TO	GEN08-037 138.00 - WASHITA 138KV CKT 1	324	0.99368	106.9864	BASE CASE
FDNS	7	0	10G	G08_037	FROM->TO	GEN08-037 138.00 - WASHITA 138KV CKT 1	324	0.99368	106.9864	BASE CASE
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.29746	106.9775	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.29746	106.9775	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.29746	106.9775	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.29746	106.9775	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.29746	106.9775	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.29746	106.9775	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	3	0	10G	G09_062	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.09079	106.9775	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	3	0	10G	G09_062	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.09079	106.9775	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	3	0	10G	G09_062	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.09079	106.9775	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	3	0	10G	G09_062	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.09079	106.9775	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.0624	106.9589	ALINE - CLEO 69KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.0624	106.9589	ALINE - CLEO 69KV CKT 1
FDNS	6	0	10G	G08_022	FROM->TO	PLANT X STATION 230/115KV TRANSFORMER CKT 1	239	0.07822	106.9454	LAMB COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1
FDNS	6	0	10G	G08_022	FROM->TO	PLANT X STATION 230/115KV TRANSFORMER CKT 1	239	0.07822	106.9454	LAMB COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1
FDNS	6	0	10G	G09_067S	FROM->TO	PLANT X STATION 230/115KV TRANSFORMER CKT 1	239	0.05807	106.9454	LAMB COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1
FDNS	6	0	10G	G09_067S	FROM->TO	PLANT X STATION 230/115KV TRANSFORMER CKT 1	239	0.05807	106.9454	LAMB COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1
FDNS	6	0	10G	G08_022	FROM->TO	PLANT X STATION 230/115KV TRANSFORMER CKT 1	239	0.07822	106.9289	LAMB COUNTY INTERCHANGE - TOLK STATION WEST 230KV CKT 1
FDNS	6	0	10G	G08_022	FROM->TO	PLANT X STATION 230/115KV TRANSFORMER CKT 1	239	0.07822	106.9289	LAMB COUNTY INTERCHANGE - TOLK STATION WEST 230KV CKT 1
FDNS	6	0	10G	G09_067S	FROM->TO	PLANT X STATION 230/115KV TRANSFORMER CKT 1	239	0.05807	106.9289	LAMB COUNTY INTERCHANGE - TOLK STATION WEST 230KV CKT 1
FDNS	6	0	10G	G09_067S	FROM->TO	PLANT X STATION 230/115KV TRANSFORMER CKT 1	239	0.05807	106.9289	LAMB COUNTY INTERCHANGE - TOLK STATION WEST 230KV CKT 1
FDNS	2	0	10G	G09_060	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.04733	106.5779	DBL-COM-MEDL
FDNS	2	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02763	106.5779	DBL-COM-MEDL
FDNS	3	0	10G	G09_020	FROM->TO	ST JOHN - ST_JOHN 115KV CKT 1	88	0.08133	106.526	MEDICINE LODGE - SAWYER 3 115.00 115KV CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	3	0	10G	G09_020	FROM->TO	ST JOHN - ST_JOHN 115KV CKT 1	88	0.08133	106.5222	PRATT - SAWYER 3 115.00 115KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.29746	106.3648	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.29746	106.3648	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.29746	106.3648	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.29746	106.3648	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.29746	106.3648	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.29746	106.3648	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	3	0	10G	G09_062	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.09079	106.3648	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	3	0	10G	G09_062	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.09079	106.3648	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	3	0	10G	G09_062	FROM->TO	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	0.09079	106.3648	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	3	0	10G	G09_062	FROM->TO	SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1	336	0.09079	106.3648	MULLERGREN - SPEARVILLE 230KV CKT 1
FDNS	5	0	10G	G08_088	TO->FROM	SWITCH 2749 - WILDORADO 69KV CKT 1	35	1	106.2362	BASE CASE
FDNS	5	0	10G	G08_088	TO->FROM	SWITCH 2749 - WILDORADO 69KV CKT 1	35	1	106.2362	BASE CASE
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06944	106.1765	BASE CASE
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06944	106.1765	BASE CASE
FDNS	3	0	10G	G09_020	FROM->TO	ST JOHN - ST_JOHN 115KV CKT 1	88	0.06136	105.9774	MED-LDG5 345.00 345/138KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_020	FROM->TO	ST JOHN - ST_JOHN 115KV CKT 1	88	0.05588	105.9001	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	7	0	10G	G08_088	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.02571	105.8721	HYDRO - WEATHERFORD 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.37746	105.8721	HYDRO - WEATHERFORD 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.37746	105.8721	HYDRO - WEATHERFORD 138KV CKT 1
FDNS	7	0	10G	G09_060	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.03706	105.8721	HYDRO - WEATHERFORD 138KV CKT 1
FDNS	7	0	10G	G09_060	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.03706	105.8721	HYDRO - WEATHERFORD 138KV CKT 1
FDNS	6	0	10G	G08_022	FROM->TO	WOLFFORTH INTERCHANGE - YUMA INTERCHANGE 115KV CKT 1	160	0.09656	105.8665	TOLK STATION EAST - TUCO INTERCHANGE 230KV CKT 1
FDNS	6	0	10G	G08_022	FROM->TO	WOLFFORTH INTERCHANGE - YUMA INTERCHANGE 115KV CKT 1	160	0.09656	105.8665	TOLK STATION EAST - TUCO INTERCHANGE 230KV CKT 1
FDNS	6	0	10G	G09_067S	FROM->TO	WOLFFORTH INTERCHANGE - YUMA INTERCHANGE 115KV CKT 1	160	0.11135	105.8665	TOLK STATION EAST - TUCO INTERCHANGE 230KV CKT 1
FDNS	6	0	10G	G09_067S	FROM->TO	WOLFFORTH INTERCHANGE - YUMA INTERCHANGE 115KV CKT 1	160	0.11135	105.8665	TOLK STATION EAST - TUCO INTERCHANGE 230KV CKT 1
FDNS	3	0	10G	G09_020	FROM->TO	ST JOHN - ST_JOHN 115KV CKT 1	88	0.05718	105.7762	SMOKYHLLS6 230.00 - SUMMIT 230KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	CLINTON CITY - FOSS TAP 69KV CKT 1	53	0.0908	105.6784	CLINTON NATURAL GAS TAP - WEATHERFORD WIND FARM 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	CLINTON CITY - FOSS TAP 69KV CKT 1	53	0.0908	105.6784	CLINTON NATURAL GAS TAP - WEATHERFORD WIND FARM 138KV CKT 1
FDNS	7	0	10G	G08_088	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.02571	105.4092	HYDRO - WEATHERFORD 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.37746	105.4092	HYDRO - WEATHERFORD 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.37746	105.4092	HYDRO - WEATHERFORD 138KV CKT 1
FDNS	7	0	10G	G09_060	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.03706	105.4092	HYDRO - WEATHERFORD 138KV CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	7	0	10G	G09_060	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.03706	105.4092	HYDRO - WEATHERFORD 138KV CKT 1
FDNS	7	0	10G	G08_088	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.02571	105.3503	HYDRO - SICKLES 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.37746	105.3503	HYDRO - SICKLES 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.37746	105.3503	HYDRO - SICKLES 138KV CKT 1
FDNS	7	0	10G	G09_060	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.03706	105.3503	HYDRO - SICKLES 138KV CKT 1
FDNS	7	0	10G	G09_060	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.03706	105.3503	HYDRO - SICKLES 138KV CKT 1
FDNS	2	0	10G	G08_088	FROM->TO	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	69	0.02641	105.3117	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	2	0	10G	G09_030	TO->FROM	CLINTON CITY - FOSS TAP 69KV CKT 1	53	0.09049	105.2981	WEATHERFORD SOUTHEAST - WEATHERFORD TAP 138KV CKT 1
FDNS	2	0	10G	G08_088	FROM->TO	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	69	0.02641	105.1692	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	5	0	10G	ASGI_11	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.06124	105.0147	GEN525562 1-TOLK GEN #2 24 KV
FDNS	5	0	10G	G08_028	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.04717	105.0147	GEN525562 1-TOLK GEN #2 24 KV
FDNS	5	0	10G	G08_047	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.04717	105.0147	GEN525562 1-TOLK GEN #2 24 KV
FDNS	5	0	10G	G08_088	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.05786	105.0147	GEN525562 1-TOLK GEN #2 24 KV
FDNS	5	0	10G	G08_088	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.05786	105.0147	GEN525562 1-TOLK GEN #2 24 KV
FDNS	5	0	10G	G08_110	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.04717	105.0147	GEN525562 1-TOLK GEN #2 24 KV
FDNS	5	0	10G	G09_062	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.02614	105.0147	GEN525562 1-TOLK GEN #2 24 KV
FDNS	5	0	10G	G10_007	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.06831	105.0147	GEN525562 1-TOLK GEN #2 24 KV
FDNS	5	0	10G	G10_009	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.02673	105.0147	GEN525562 1-TOLK GEN #2 24 KV
FDNS	5	0	10G	G10_014	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.04717	105.0147	GEN525562 1-TOLK GEN #2 24 KV
FDNS	7	0	10G	G08_088	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.02571	104.928	HYDRO - SICKLES 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.37746	104.928	HYDRO - SICKLES 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.37746	104.928	HYDRO - SICKLES 138KV CKT 1
FDNS	7	0	10G	G09_060	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.03706	104.928	HYDRO - SICKLES 138KV CKT 1
FDNS	7	0	10G	G09_060	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.03706	104.928	HYDRO - SICKLES 138KV CKT 1
FDNS	3	0	10G	ASGI_11	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.04531	104.797	G10-016TAP 345.00 - KNOLL345 345.00 345KV CKT 1
FDNS	3	0	10G	G08_022	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.03499	104.797	G10-016TAP 345.00 - KNOLL345 345.00 345KV CKT 1
FDNS	3	0	10G	G08_028	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.04868	104.797	G10-016TAP 345.00 - KNOLL345 345.00 345KV CKT 1
FDNS	3	0	10G	G08_044	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.03124	104.797	G10-016TAP 345.00 - KNOLL345 345.00 345KV CKT 1
FDNS	3	0	10G	G08_047	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.04868	104.797	G10-016TAP 345.00 - KNOLL345 345.00 345KV CKT 1
FDNS	3	0	10G	G08_088	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.03916	104.797	G10-016TAP 345.00 - KNOLL345 345.00 345KV CKT 1
FDNS	3	0	10G	G08_110	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.04868	104.797	G10-016TAP 345.00 - KNOLL345 345.00 345KV CKT 1
FDNS	3	0	10G	G09_059	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.11024	104.797	G10-016TAP 345.00 - KNOLL345 345.00 345KV CKT 1
FDNS	3	0	10G	G09_059	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.11024	104.797	G10-016TAP 345.00 - KNOLL345 345.00 345KV CKT 1
FDNS	3	0	10G	G09_059	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.11024	104.797	G10-016TAP 345.00 - KNOLL345 345.00 345KV CKT 1

APPENDIX H: DIS-2010-001 Powerflow Analysis (Constraints 3%+ TDF)

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	3	0	10G	G09_062	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.06954	104.797	G10-016TAP 345.00 - KNOLL345 345.00 345KV CKT 1
FDNS	3	0	10G	G09_062	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.06954	104.797	G10-016TAP 345.00 - KNOLL345 345.00 345KV CKT 1
FDNS	3	0	10G	G09_067S	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.03477	104.797	G10-016TAP 345.00 - KNOLL345 345.00 345KV CKT 1
FDNS	3	0	10G	G10_007	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.04242	104.797	G10-016TAP 345.00 - KNOLL345 345.00 345KV CKT 1
FDNS	3	0	10G	G10_008	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.03242	104.797	G10-016TAP 345.00 - KNOLL345 345.00 345KV CKT 1
FDNS	3	0	10G	G10_009	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.08384	104.797	G10-016TAP 345.00 - KNOLL345 345.00 345KV CKT 1
FDNS	3	0	10G	G10_009	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.08384	104.797	G10-016TAP 345.00 - KNOLL345 345.00 345KV CKT 1
FDNS	3	0	10G	G10_009	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.08384	104.797	G10-016TAP 345.00 - KNOLL345 345.00 345KV CKT 1
FDNS	3	0	10G	G10_011	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.03124	104.797	G10-016TAP 345.00 - KNOLL345 345.00 345KV CKT 1
FDNS	3	0	10G	G10_014	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.04868	104.797	G10-016TAP 345.00 - KNOLL345 345.00 345KV CKT 1
FDNS	3	0	10G	G10_015	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.11536	104.797	G10-016TAP 345.00 - KNOLL345 345.00 345KV CKT 1
FDNS	3	0	10G	G10_015	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.11536	104.797	G10-016TAP 345.00 - KNOLL345 345.00 345KV CKT 1
FDNS	3	0	10G	G10_015	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.11536	104.797	G10-016TAP 345.00 - KNOLL345 345.00 345KV CKT 1
FDNS	3	0	10G	G10_016	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.11536	104.797	G10-016TAP 345.00 - KNOLL345 345.00 345KV CKT 1
FDNS	3	0	10G	G10_016	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.11536	104.797	G10-016TAP 345.00 - KNOLL345 345.00 345KV CKT 1
FDNS	3	0	10G	G10_016	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.11536	104.797	G10-016TAP 345.00 - KNOLL345 345.00 345KV CKT 1
FDNS	2	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.06668	104.6412	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	CLEO CORNER - GLASS MOUNTAIN 138KV CKT 1	153	0.06491	104.6049	DBL-COM-MEDL
FDNS	1	0	10G	G10_008	TO->FROM	CLEO CORNER - GLASS MOUNTAIN 138KV CKT 1	153	0.06491	104.6049	DBL-COM-MEDL
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	104.5463	BASE CASE
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	104.5463	BASE CASE
FDNS	3	0	10G	G09_020	FROM->TO	ST JOHN - ST_JOHN 115KV CKT 1	88	0.06155	104.4807	CIRCLE (CIRCLE1X) 230/115/13.8KV TRANSFORMER CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	EL RENO SW (EL RENO) 138/69/13.8KV TRANSFORMER CKT 1	70	0.09605	104.4462	JENSEN ROAD - JENSEN TAP 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	EL RENO SW (EL RENO) 138/69/13.8KV TRANSFORMER CKT 1	70	0.09605	104.4462	JENSEN ROAD - JENSEN TAP 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.0683	104.3884	FAIRFAX - NAVAL RESERVE 69KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.0683	104.3884	FAIRFAX - NAVAL RESERVE 69KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CLINTON JUNCTION (CLINTJCT) 138/69/13.8KV TRANSFORMER CKT 1	92	0.08932	104.3835	WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CLINTON JUNCTION (CLINTJCT) 138/69/13.8KV TRANSFORMER CKT 1	92	0.08932	104.3835	WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1
FDNS	3	0	10G	G08_037	FROM->TO	LAWEASOKLUNI	425	0.0953	104.3	BASE CASE
FDNS	3	0	10G	G08_046	FROM->TO	LAWEASOKLUNI	425	0.10393	104.3	BASE CASE
FDNS	3	0	10G	G08_071	FROM->TO	LAWEASOKLUNI	425	0.04003	104.3	BASE CASE
FDNS	3	0	10G	G08_098	FROM->TO	LAWEASOKLUNI	425	0.03045	104.3	BASE CASE
FDNS	3	0	10G	G09_030	FROM->TO	LAWEASOKLUNI	425	0.0575	104.3	BASE CASE
FDNS	3	0	10G	G09_060	FROM->TO	LAWEASOKLUNI	425	0.05587	104.3	BASE CASE
FDNS	3	0	10G	G10_003	FROM->TO	LAWEASOKLUNI	425	0.03045	104.3	BASE CASE
FDNS	3	0	10G	G10_005	FROM->TO	LAWEASOKLUNI	425	0.02867	104.3	BASE CASE
FDNS	3	0	10G	G10_013	FROM->TO	LAWEASOKLUNI	425	0.03374	104.3	BASE CASE
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06927	104.2662	DELAWARE - NORTHEAST STATION 345KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06927	104.2662	DELAWARE - NORTHEAST STATION 345KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06944	104.2299	GEN560211 1-G09-25 0.6900
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06944	104.2299	GEN560211 1-G09-25 0.6900
FDNS	7	0	10G	G09_030	FROM->TO	CLINTON JUNCTION (CLINTJCT) 138/69/13.8KV TRANSFORMER CKT 1	92	0.08932	104.2011	WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CLINTON JUNCTION (CLINTJCT) 138/69/13.8KV TRANSFORMER CKT 1	92	0.08932	104.2011	WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1
FDNS	7	0	10G	G08_088	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.02571	104.1771	BINGER NIJECT - SICKLES 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.37746	104.1771	BINGER NIJECT - SICKLES 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.37746	104.1771	BINGER NIJECT - SICKLES 138KV CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	7	0	10G	G09_060	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.03706	104.1771	BINGER NIJECT - SICKLES 138KV CKT 1
FDNS	7	0	10G	G09_060	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.03706	104.1771	BINGER NIJECT - SICKLES 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.08796	104.1769	EL PASO - FARBER 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.08796	104.1769	EL PASO - FARBER 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07103	104.0821	WOODRING (WOODRNG2) 345/138/13.8KV TRANSFORMER CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07103	104.0821	WOODRING (WOODRNG2) 345/138/13.8KV TRANSFORMER CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07016	104.0532	NOWATA - WATOVA 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07016	104.0532	NOWATA - WATOVA 138KV CKT 1
FDNS	2	0	10G	G09_030	TO->FROM	CLINTON CITY - FOSS TAP 69KV CKT 1	53	0.09085	104.0282	CLINTON JUNCTION - CLINTON NATURAL GAS TAP 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07016	103.9267	NORTHEAST STATION - WATOVA 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07016	103.9267	NORTHEAST STATION - WATOVA 138KV CKT 1
FDNS	7	0	10G	G08_088	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.02571	103.8494	BINGER NIJECT - SICKLES 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.37746	103.8494	BINGER NIJECT - SICKLES 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.37746	103.8494	BINGER NIJECT - SICKLES 138KV CKT 1
FDNS	7	0	10G	G09_060	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.03706	103.8494	BINGER NIJECT - SICKLES 138KV CKT 1
FDNS	7	0	10G	G09_060	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.03706	103.8494	BINGER NIJECT - SICKLES 138KV CKT 1
FDNS	1	0	10G	G10_008	FROM->TO	BUFBEAR2 69.000 - BUFFALO 69KV CKT 1	35	0.02881	103.8185	KNOBHILL - MOORELAND 138KV CKT 1
FDNS	1	0	10G	G10_008	FROM->TO	BUFBEAR2 69.000 - BUFFALO 69KV CKT 1	35	0.02881	103.8185	KNOBHILL - MOORELAND 138KV CKT 1
FDNS	1	0	10G	G10_008	FROM->TO	BUFBEAR2 69.000 - BUFFALO 69KV CKT 1	35	0.02881	103.7781	KNOBHILL (KNOBHIL4) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	1	0	10G	G10_008	FROM->TO	BUFBEAR2 69.000 - BUFFALO 69KV CKT 1	35	0.02881	103.7781	KNOBHILL (KNOBHIL4) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	5	0	10G	G08_022	FROM->TO	BUSHLAND INTERCHANGE - COULTER INTERCHANGE 115KV CKT 1	160	0.05398	103.7494	BUSHLAND INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1
FDNS	5	0	10G	G09_067S	FROM->TO	BUSHLAND INTERCHANGE - COULTER INTERCHANGE 115KV CKT 1	160	0.05094	103.7494	BUSHLAND INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1
FDNS	7	0	10G	G08_088	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.02571	103.7161	BINGER NIJECT - ONEY 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.37746	103.7161	BINGER NIJECT - ONEY 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.37746	103.7161	BINGER NIJECT - ONEY 138KV CKT 1
FDNS	7	0	10G	G09_060	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.03706	103.7161	BINGER NIJECT - ONEY 138KV CKT 1
FDNS	7	0	10G	G09_060	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.03706	103.7161	BINGER NIJECT - ONEY 138KV CKT 1
FDNS	2	0	10G	G08_088	FROM->TO	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	69	0.02641	103.6805	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06944	103.6603	GEN532751 1-WOLF CREEK GENERATING STATION UNIT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06944	103.6603	GEN532751 1-WOLF CREEK GENERATING STATION UNIT 1
FDNS	1	0	10G	G09_060	TO->FROM	DOVER SW - OKEENE 138KV CKT 1	130	0.02608	103.5883	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	DOVER SW - OKEENE 138KV CKT 1	130	0.06115	103.5883	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	DOVER SW - OKEENE 138KV CKT 1	130	0.06115	103.5883	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06944	103.5853	GEN572082 1-GEN08-071 0.6900
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06944	103.5853	GEN572082 1-GEN08-071 0.6900
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06846	103.5497	CLEAVELAND - SILVER CITY 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06846	103.5497	CLEAVELAND - SILVER CITY 138KV CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	2	0	10G	G08_088	FROM->TO	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	69	0.02641	103.5245	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	3	0	10G	G09_020	FROM->TO	ST JOHN - ST_JOHN 115KV CKT 1	88	0.05725	103.5195	KNOLL 230 - SMOKYHLLS6 230.00 230KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06971	103.4621	COFFEYVILLE FARMLAND - DELAWARE 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06971	103.4621	COFFEYVILLE FARMLAND - DELAWARE 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06971	103.4565	DELAWARE (DELAWARE) 345/138/13.8KV TRANSFORMER CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06971	103.4565	DELAWARE (DELAWARE) 345/138/13.8KV TRANSFORMER CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06972	103.4518	NEOSHO (NEOSHO1X) 345/138/13.8KV TRANSFORMER CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06972	103.4518	NEOSHO (NEOSHO1X) 345/138/13.8KV TRANSFORMER CKT 1
FDNS	7	0	10G	G08_088	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.02571	103.4342	ONEY - WASHITA 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.37746	103.4342	ONEY - WASHITA 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.37746	103.4342	ONEY - WASHITA 138KV CKT 1
FDNS	7	0	10G	G09_060	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.03706	103.4342	ONEY - WASHITA 138KV CKT 1
FDNS	7	0	10G	G09_060	FROM->TO	CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1	191	0.03706	103.4342	ONEY - WASHITA 138KV CKT 1
FDNS	7	0	10G	G08_088	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.02571	103.4259	BINGER NIJECT - ONEY 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.37746	103.4259	BINGER NIJECT - ONEY 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.37746	103.4259	BINGER NIJECT - ONEY 138KV CKT 1
FDNS	7	0	10G	G09_060	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.03706	103.4259	BINGER NIJECT - ONEY 138KV CKT 1
FDNS	7	0	10G	G09_060	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.03706	103.4259	BINGER NIJECT - ONEY 138KV CKT 1
FDNS	5	0	10G	G08_022	FROM->TO	BUSHLAND INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1	351	0.23386	103.3654	G06-39T 230.00 - POTTER COUNTY INTERCHANGE 230KV CKT 1
FDNS	5	0	10G	G09_067S	FROM->TO	BUSHLAND INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1	351	0.22383	103.3654	G06-39T 230.00 - POTTER COUNTY INTERCHANGE 230KV CKT 1
FDNS	3	0	10G	G09_020	FROM->TO	ST JOHN - ST_JOHN 115KV CKT 1	88	0.05593	103.3553	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	3	0	10G	G09_020	FROM->TO	CLEARWATER - GILL ENERGY CENTER WEST 138KV CKT 1	110	0.03543	103.2723	MED-LDG5 345.00 345/138KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	CLEARWATER - GILL ENERGY CENTER WEST 138KV CKT 1	110	0.04698	103.2723	MED-LDG5 345.00 345/138KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	CLEARWATER - GILL ENERGY CENTER WEST 138KV CKT 1	110	0.04698	103.2723	MED-LDG5 345.00 345/138KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	CLEARWATER - GILL ENERGY CENTER WEST 138KV CKT 1	110	0.04698	103.2723	MED-LDG5 345.00 345/138KV TRANSFORMER CKT 1
FDNS	5	0	10G	ASGI_11	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.10109	103.237	DBL-HIT-WOOD
FDNS	5	0	10G	G08_022	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.07922	103.237	DBL-HIT-WOOD
FDNS	5	0	10G	G08_028	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.08233	103.237	DBL-HIT-WOOD
FDNS	5	0	10G	G08_047	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.08233	103.237	DBL-HIT-WOOD
FDNS	5	0	10G	G08_088	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.12821	103.237	DBL-HIT-WOOD
FDNS	5	0	10G	G08_088	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.12821	103.237	DBL-HIT-WOOD
FDNS	5	0	10G	G08_110	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.08233	103.237	DBL-HIT-WOOD
FDNS	5	0	10G	G09_067S	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.07736	103.237	DBL-HIT-WOOD
FDNS	5	0	10G	G10_007	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.11855	103.237	DBL-HIT-WOOD
FDNS	5	0	10G	G10_014	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.08233	103.237	DBL-HIT-WOOD
FDNS	2	0	10G	G08_028	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.02526	103.2358	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	2	0	10G	G08_028	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.02526	103.2358	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G08_044	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.03445	103.2358	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G08_047	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.02526	103.2358	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G08_047	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.02526	103.2358	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G08_110	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.02526	103.2358	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G08_110	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.02526	103.2358	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G10_008	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.06599	103.2358	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G10_011	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.03445	103.2358	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G10_014	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.02526	103.2358	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	2	0	10G	G10_014	TO->FROM	EL RENO - ROMAN NOSE 138KV CKT 1	153	0.02526	103.2358	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	5	0	10G	G08_088	FROM->TO	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	69	0.02602	103.2094	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	5	0	10G	G08_088	FROM->TO	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	69	0.02602	103.2094	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	7	0	10G	G08_088	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.02571	103.1662	ONEY - WASHITA 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.37746	103.1662	ONEY - WASHITA 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.37746	103.1662	ONEY - WASHITA 138KV CKT 1
FDNS	7	0	10G	G09_060	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.03706	103.1662	ONEY - WASHITA 138KV CKT 1
FDNS	7	0	10G	G09_060	TO->FROM	WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1	210	0.03706	103.1662	ONEY - WASHITA 138KV CKT 1
FDNS	3	0	10G	G09_020	FROM->TO	ST JOHN - ST_JOHN 115KV CKT 1	88	0.05508	103.1415	GEN532751 1-WOLF CREEK GENERATING STATION UNIT 1
FDNS	5	0	10G	G08_088	FROM->TO	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	69	0.02602	103.0781	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	5	0	10G	G08_088	FROM->TO	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	69	0.02602	103.0781	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	0	0	14SP	G06_044N02	FROM->TO	FT RANDAL 230/115KV TRANSFORMER CKT 1	127	0.03256	102.9778	FT RANDAL 230/115KV TRANSFORMER CKT 2
FDNS	0	0	14SP	G06_044N02	FROM->TO	FT RANDAL 230/115KV TRANSFORMER CKT 1	127	0.03256	102.9778	FT RANDAL 230/115KV TRANSFORMER CKT 2
FDNS	0	0	14SP	G06_044N02	FROM->TO	FT RANDAL 230/115KV TRANSFORMER CKT 1	127	0.03256	102.9778	FT RANDAL 230/115KV TRANSFORMER CKT 2
FDNS	0	0	14SP	G10_010	FROM->TO	FT RANDAL 230/115KV TRANSFORMER CKT 1	127	0.03256	102.9778	FT RANDAL 230/115KV TRANSFORMER CKT 2
FDNS	0	0	14SP	G10_010	FROM->TO	FT RANDAL 230/115KV TRANSFORMER CKT 1	127	0.03256	102.9778	FT RANDAL 230/115KV TRANSFORMER CKT 2
FDNS	0	0	14SP	G10_010	FROM->TO	FT RANDAL 230/115KV TRANSFORMER CKT 1	127	0.03256	102.9778	FT RANDAL 230/115KV TRANSFORMER CKT 2
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06952	102.9291	TULSA NORTH (TULSA N) 345/138/13.8KV TRANSFORMER CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06952	102.9291	TULSA NORTH (TULSA N) 345/138/13.8KV TRANSFORMER CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07073	102.8835	BARTLESVILLE SOUTHEAST - RICE CREEK 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07073	102.8835	BARTLESVILLE SOUTHEAST - RICE CREEK 138KV CKT 1
FDNS	3	0	10G	ASGI_11	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.05243	102.8804	DBL-COM-MEDL
FDNS	3	0	10G	G08_022	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.04097	102.8804	DBL-COM-MEDL
FDNS	3	0	10G	G08_028	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.05631	102.8804	DBL-COM-MEDL
FDNS	3	0	10G	G08_044	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.0396	102.8804	DBL-COM-MEDL
FDNS	3	0	10G	G08_047	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.05631	102.8804	DBL-COM-MEDL
FDNS	3	0	10G	G08_088	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.04538	102.8804	DBL-COM-MEDL
FDNS	3	0	10G	G08_110	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.05631	102.8804	DBL-COM-MEDL
FDNS	3	0	10G	G09_059	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.10088	102.8804	DBL-COM-MEDL
FDNS	3	0	10G	G09_059	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.10088	102.8804	DBL-COM-MEDL
FDNS	3	0	10G	G09_059	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.10088	102.8804	DBL-COM-MEDL
FDNS	3	0	10G	G09_062	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.06948	102.8804	DBL-COM-MEDL

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	3	0	10G	G09_062	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.06948	102.8804	DBL-COM-MEDL
FDNS	3	0	10G	G09_067S	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.04074	102.8804	DBL-COM-MEDL
FDNS	3	0	10G	G10_007	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.04909	102.8804	DBL-COM-MEDL
FDNS	3	0	10G	G10_008	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.04089	102.8804	DBL-COM-MEDL
FDNS	3	0	10G	G10_009	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.08062	102.8804	DBL-COM-MEDL
FDNS	3	0	10G	G10_009	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.08062	102.8804	DBL-COM-MEDL
FDNS	3	0	10G	G10_009	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.08062	102.8804	DBL-COM-MEDL
FDNS	3	0	10G	G10_011	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.0396	102.8804	DBL-COM-MEDL
FDNS	3	0	10G	G10_014	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.05631	102.8804	DBL-COM-MEDL
FDNS	3	0	10G	G10_015	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.10398	102.8804	DBL-COM-MEDL
FDNS	3	0	10G	G10_015	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.10398	102.8804	DBL-COM-MEDL
FDNS	3	0	10G	G10_015	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.10398	102.8804	DBL-COM-MEDL
FDNS	3	0	10G	G10_016	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.04636	102.8804	DBL-COM-MEDL
FDNS	3	0	10G	G10_016	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.04636	102.8804	DBL-COM-MEDL
FDNS	3	0	10G	G10_016	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	355.3	0.04636	102.8804	DBL-COM-MEDL
FDNS	2	0	10G	ASGI_11	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04387	102.8208	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	2	0	10G	ASGI_11	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04387	102.8208	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	2	0	10G	G08_022	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03143	102.8208	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	2	0	10G	G08_028	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04766	102.8208	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	2	0	10G	G08_028	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04766	102.8208	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	2	0	10G	G08_044	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03932	102.8208	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	2	0	10G	G08_047	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04766	102.8208	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	2	0	10G	G08_047	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04766	102.8208	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	2	0	10G	G08_088	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03683	102.8208	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	2	0	10G	G08_110	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04766	102.8208	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	2	0	10G	G08_110	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04766	102.8208	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	2	0	10G	G09_059	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03275	102.8208	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	2	0	10G	G09_062	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.0332	102.8208	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	2	0	10G	G09_067S	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03115	102.8208	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	2	0	10G	G10_007	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04059	102.8208	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	2	0	10G	G10_007	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04059	102.8208	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	2	0	10G	G10_009	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03537	102.8208	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	2	0	10G	G10_011	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03932	102.8208	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	2	0	10G	G10_014	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04766	102.8208	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	2	0	10G	G10_014	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04766	102.8208	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	2	0	10G	G10_015	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03453	102.8208	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	2	0	10G	G10_016	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.02897	102.8208	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	7	0	10G	G08_037	TO->FROM	SOUTHWESTERN STATION - WASHITA 138KV CKT 1	260	0.58587	102.8178	BASE CASE
FDNS	7	0	10G	G08_037	TO->FROM	SOUTHWESTERN STATION - WASHITA 138KV CKT 1	260	0.58587	102.8178	BASE CASE
FDNS	7	0	10G	G09_030	TO->FROM	SOUTHWESTERN STATION - WASHITA 138KV CKT 1	260	0.27754	102.8178	BASE CASE
FDNS	7	0	10G	G09_030	TO->FROM	SOUTHWESTERN STATION - WASHITA 138KV CKT 1	260	0.27754	102.8178	BASE CASE
FDNS	7	0	10G	G09_060	TO->FROM	SOUTHWESTERN STATION - WASHITA 138KV CKT 1	260	0.14428	102.8178	BASE CASE
FDNS	7	0	10G	G09_060	TO->FROM	SOUTHWESTERN STATION - WASHITA 138KV CKT 1	260	0.14428	102.8178	BASE CASE
FDNS	2	0	10G	ASGI_11	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04387	102.8139	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	2	0	10G	ASGI_11	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04387	102.8139	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	2	0	10G	G08_022	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03143	102.8139	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	2	0	10G	G08_028	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04766	102.8139	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	2	0	10G	G08_028	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04766	102.8139	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	2	0	10G	G08_044	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03932	102.8139	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	2	0	10G	G08_047	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04766	102.8139	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	2	0	10G	G08_047	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04766	102.8139	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	2	0	10G	G08_088	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03683	102.8139	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	2	0	10G	G08_110	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04766	102.8139	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	2	0	10G	G08_110	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04766	102.8139	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	2	0	10G	G09_059	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03275	102.8139	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	2	0	10G	G09_062	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.0332	102.8139	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	2	0	10G	G09_067S	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03115	102.8139	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	2	0	10G	G10_007	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04059	102.8139	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	2	0	10G	G10_007	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04059	102.8139	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	2	0	10G	G10_009	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03537	102.8139	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	2	0	10G	G10_011	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03932	102.8139	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	2	0	10G	G10_014	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04766	102.8139	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	2	0	10G	G10_014	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04766	102.8139	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	2	0	10G	G10_015	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03453	102.8139	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	2	0	10G	G10_016	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.02897	102.8139	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	1	0	10G	G08_037	FROM->TO	LAWEASOKLUNI	425	0.09523	102.8	BASE CASE
FDNS	1	0	10G	G08_046	FROM->TO	LAWEASOKLUNI	425	0.10386	102.8	BASE CASE
FDNS	1	0	10G	G08_071	FROM->TO	LAWEASOKLUNI	425	0.03996	102.8	BASE CASE
FDNS	1	0	10G	G08_098	FROM->TO	LAWEASOKLUNI	425	0.03038	102.8	BASE CASE
FDNS	1	0	10G	G09_030	FROM->TO	LAWEASOKLUNI	425	0.05743	102.8	BASE CASE
FDNS	1	0	10G	G09_060	FROM->TO	LAWEASOKLUNI	425	0.0558	102.8	BASE CASE
FDNS	1	0	10G	G10_003	FROM->TO	LAWEASOKLUNI	425	0.03038	102.8	BASE CASE
FDNS	1	0	10G	G10_005	FROM->TO	LAWEASOKLUNI	425	0.0286	102.8	BASE CASE
FDNS	1	0	10G	G10_013	FROM->TO	LAWEASOKLUNI	425	0.03367	102.8	BASE CASE
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06944	102.7652	GEN511839 1-NORTHEASTERN STATION #2
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06944	102.7652	GEN511839 1-NORTHEASTERN STATION #2
FDNS	3	0	10G	G09_060	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.04608	102.6693	CEDARDALE - MOORELAND 138KV CKT 1
FDNS	3	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.03494	102.6693	CEDARDALE - MOORELAND 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07073	102.6311	NORTHEAST STATION - RICE CREEK 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.07073	102.6311	NORTHEAST STATION - RICE CREEK 138KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.72358	102.6182	GRAY CO 345.00 - SPEARVILLE 345KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.72358	102.6182	GRAY CO 345.00 - SPEARVILLE 345KV CKT 1
FDNS	3	0	10G	G09_059	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.72358	102.6182	GRAY CO 345.00 - SPEARVILLE 345KV CKT 1
FDNS	3	0	10G	G09_062	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.27368	102.6182	GRAY CO 345.00 - SPEARVILLE 345KV CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	3	0	10G	G09_062	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.27368	102.6182	GRAY CO 345.00 - SPEARVILLE 345KV CKT 1
FDNS	3	0	10G	G10_009	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.05078	102.6182	GRAY CO 345.00 - SPEARVILLE 345KV CKT 1
FDNS	3	0	10G	G10_009	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.05078	102.6182	GRAY CO 345.00 - SPEARVILLE 345KV CKT 1
FDNS	3	0	10G	G10_009	FROM->TO	G08-79T 115.00 - JUDSON LARGE 115KV CKT 1	129.5	0.05078	102.6182	GRAY CO 345.00 - SPEARVILLE 345KV CKT 1
FDNS	2	0	10G	G09_059	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.10929	102.1963	DBL-COM-MEDL
FDNS	2	0	10G	G09_062	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.05223	102.1963	DBL-COM-MEDL
FDNS	2	0	10G	G10_009	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.02713	102.1963	DBL-COM-MEDL
FDNS	2	0	10G	G10_015	FROM->TO	G01-39AT 115.00 - GREENSBURG 115KV CKT 1	129.5	0.03058	102.1963	DBL-COM-MEDL
FDNS	2	0	10G	ASGI_11	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.19581	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	ASGI_11	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.19581	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G08_022	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.14525	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G08_028	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.2144	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G08_028	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.2144	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G08_044	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.44097	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G08_047	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.2144	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G08_047	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.2144	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G08_088	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.16241	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G08_110	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.2144	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G08_110	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.2144	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G08_123N	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.02648	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G09_008	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.08671	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G09_020	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.08937	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G09_059	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.15261	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G09_062	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.15775	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G09_067S	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.14432	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G10_007	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.1797	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G10_007	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.1797	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G10_008	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.1874	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G10_009	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.17557	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G10_011	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.44097	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G10_014	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.2144	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G10_014	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.2144	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G10_015	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.18023	102.1859	DBL-COM-MEDL
FDNS	2	0	10G	G10_016	TO->FROM	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1195	0.14425	102.1859	DBL-COM-MEDL
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.04703	102.1826	IODINE - MOORELAND 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.04703	102.1826	IODINE - MOORELAND 138KV CKT 1
FDNS	3	0	10G	G09_020	FROM->TO	ST JOHN - ST_JOHN 115KV CKT 1	88	0.05508	102.1191	GEN532652 1-JEFFREY ENERGY CENTER UNIT 2
FDNS	3	0	10G	G09_020	FROM->TO	ST JOHN - ST_JOHN 115KV CKT 1	88	0.05508	102.1191	GEN532653 1-JEFFREY ENERGY CENTER UNIT 3
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	101.9752	GEN560241 1-G10-08 0.6900
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	101.9752	GEN560241 1-G10-08 0.6900
FDNS	5	0	10G	G08_088	FROM->TO	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	69	0.02602	101.9537	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	5	0	10G	G08_088	FROM->TO	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	69	0.02602	101.9537	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	EL RENO SW (EL RENO) 138/69/13.8KV TRANSFORMER CKT 1	70	0.09605	101.9205	JENSEN ROAD - JENSEN TAP 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	EL RENO SW (EL RENO) 138/69/13.8KV TRANSFORMER CKT 1	70	0.09605	101.9205	JENSEN ROAD - JENSEN TAP 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.09238	101.8951	PS31TP 4 138.00 - WHITE EAGLE 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.09238	101.8951	PS31TP 4 138.00 - WHITE EAGLE 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.04703	101.8866	FT SUPPLY - IODINE 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.04703	101.8866	FT SUPPLY - IODINE 138KV CKT 1

APPENDIX H: DIS-2010-001 Powerflow Analysis (Constraints 3%+ TDF)

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	2	0	10G	G09_060	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.04668	101.8448	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	2	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.02781	101.8448	TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06436	101.8207	CLEVELAND - TULSA NORTH 345KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06436	101.8207	CLEVELAND - TULSA NORTH 345KV CKT 1
FDNS	5	0	10G	G08_088	FROM->TO	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	69	0.02602	101.8094	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	5	0	10G	G08_088	FROM->TO	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	69	0.02602	101.8094	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	3	0	10G	G09_020	FROM->TO	ST JOHN - ST_JOHN 115KV CKT 1	88	0.05508	101.7899	GEN532651 1-JEFFREY ENERGY CENTER UNIT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05885	101.7525	CIMARRON - WOODRING 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05885	101.7525	CIMARRON - WOODRING 345KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	101.7213	GEN515364 1-CENT 11 0.6000
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	101.7213	GEN515364 1-CENT 11 0.6000
FDNS	3	0	10G	G09_020	FROM->TO	ST JOHN - ST_JOHN 115KV CKT 1	88	0.05629	101.6481	AXTELL - KNOLL345 345.00 345KV CKT 1
FDNS	5	0	10G	ASGI_11	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.07111	101.6143	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	5	0	10G	G08_022	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.09045	101.6143	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	5	0	10G	G08_028	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.04286	101.6143	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	5	0	10G	G08_047	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.04286	101.6143	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	5	0	10G	G08_088	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.11655	101.6143	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	5	0	10G	G08_088	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.11655	101.6143	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	5	0	10G	G08_110	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.04286	101.6143	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	5	0	10G	G09_067S	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.08964	101.6143	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	5	0	10G	G10_007	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.09645	101.6143	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	5	0	10G	G10_014	FROM->TO	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	351	0.04286	101.6143	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	6	0	10G	G08_022	FROM->TO	PLANT X STATION 230/115KV TRANSFORMER CKT 1	239	0.09404	101.4471	DEAF SMITH COUNTY INTERCHANGE - PLANT X STATION 230KV CKT 1
FDNS	6	0	10G	G08_022	FROM->TO	PLANT X STATION 230/115KV TRANSFORMER CKT 1	239	0.09404	101.4471	DEAF SMITH COUNTY INTERCHANGE - PLANT X STATION 230KV CKT 1
FDNS	6	0	10G	G09_067S	FROM->TO	PLANT X STATION 230/115KV TRANSFORMER CKT 1	239	0.07959	101.4471	DEAF SMITH COUNTY INTERCHANGE - PLANT X STATION 230KV CKT 1
FDNS	6	0	10G	G09_067S	FROM->TO	PLANT X STATION 230/115KV TRANSFORMER CKT 1	239	0.07959	101.4471	DEAF SMITH COUNTY INTERCHANGE - PLANT X STATION 230KV CKT 1
FDNS	1	0	10G	G09_060	FROM->TO	CANTON - OKEENE 69KV CKT 1	48	0.04618	101.4413	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	FROM->TO	CANTON - OKEENE 69KV CKT 1	48	0.0273	101.4413	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_008	FROM->TO	CANTON - OKEENE 69KV CKT 1	48	0.0273	101.4413	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	5	0	10G	G09_030	TO->FROM	CLINTON CITY - FOSS TAP 69KV CKT 1	53	0.09037	101.3672	WEATHERFORD SOUTHEAST - WEATHERFORD TAP 138KV CKT 1
FDNS	2	0	10G	G09_060	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.04858	101.256	EL RENO - ROMAN NOSE 138KV CKT 1
FDNS	2	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.03047	101.256	EL RENO - ROMAN NOSE 138KV CKT 1
FDNS	1	0	10G	ASGI_11	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.05014	101.1637	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G08_022	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03236	101.1637	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G08_028	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.06067	101.1637	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G08_044	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.09092	101.1637	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G08_044	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.09092	101.1637	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G08_044	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.09092	101.1637	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G08_047	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.06067	101.1637	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G08_088	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03217	101.1637	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G08_110	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.06067	101.1637	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G09_008	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03089	101.1637	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G09_020	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03348	101.1637	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G09_059	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04644	101.1637	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	1	0	10G	G09_062	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04617	101.1637	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G09_067S	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03225	101.1637	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_007	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04082	101.1637	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_009	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04904	101.1637	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_011	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.09092	101.1637	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_011	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.09092	101.1637	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_011	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.09092	101.1637	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_014	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.06067	101.1637	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_015	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04919	101.1637	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G10_016	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04169	101.1637	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.09238	101.1589	MILLER - PS31TP 4 138.00 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.09238	101.1589	MILLER - PS31TP 4 138.00 138KV CKT 1
FDNS	3	0	10G	ASGI_11	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.05109	101.0264	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G08_022	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.03332	101.0264	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G08_028	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.06163	101.0264	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G08_044	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.09188	101.0264	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G08_047	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.06163	101.0264	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G08_088	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.03312	101.0264	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G08_110	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.06163	101.0264	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G09_008	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.03184	101.0264	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G09_020	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.03443	101.0264	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G09_059	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.04739	101.0264	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G09_059	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.04739	101.0264	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G09_059	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.04739	101.0264	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G09_062	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.04712	101.0264	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G09_062	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.04712	101.0264	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G09_067S	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.03321	101.0264	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G10_007	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.04177	101.0264	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G10_009	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.05	101.0264	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G10_009	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.05	101.0264	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G10_009	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.05	101.0264	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G10_011	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.09188	101.0264	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G10_014	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.06163	101.0264	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G10_015	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.05014	101.0264	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G10_015	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.05014	101.0264	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G10_015	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.05014	101.0264	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G10_016	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.04264	101.0264	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G10_016	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.04264	101.0264	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	3	0	10G	G10_016	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	287	0.04264	101.0264	NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FDNS	1	0	10G	G09_030	TO->FROM	CLINTON CITY - FOSS TAP 69KV CKT 1	53	0.0906	101.0231	WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1
FDNS	3	0	10G	G09_060	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.04608	101.0213	CEDARDALE - OKEENE 138KV CKT 1
FDNS	3	0	10G	G10_008	TO->FROM	CANTON - TALOGA 69KV CKT 1	39	0.03494	101.0213	CEDARDALE - OKEENE 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.09238	100.9948	MILLER - SOONER 138KV CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.09238	100.9948	MILLER - SOONER 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	100.9681	GEN523971 1-HARRINGTON GEN #1 24 KV
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	100.9681	GEN523971 1-HARRINGTON GEN #1 24 KV
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	100.9575	GEN523972 1-HARRINGTON GEN #2 24 KV
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	100.9575	GEN523972 1-HARRINGTON GEN #2 24 KV
FDNS	3	0	10G	G09_020	FROM->TO	ST JOHN - ST_JOHN 115KV CKT 1	88	0.05508	100.9563	GEN532694 1-HUTCHINSON ENERGY CENTER UNIT 4
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06699	100.9167	FAIRFAX 138/69KV TRANSFORMER CKT 1
FDNS	8	0	10G	G08_071	FROM->TO	AECI-FS-6&7 138.00 - FAIRFAX 138KV CKT 1	174	0.06699	100.9167	FAIRFAX 138/69KV TRANSFORMER CKT 1
FDNS	3	0	10G	G09_020	FROM->TO	ST JOHN - ST_JOHN 115KV CKT 1	88	0.05509	100.8375	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	3	0	10G	ASGI_11	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04807	100.7108	DBL-COM-MEDL
FDNS	3	0	10G	G08_022	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03248	100.7108	DBL-COM-MEDL
FDNS	3	0	10G	G08_028	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.05777	100.7108	DBL-COM-MEDL
FDNS	3	0	10G	G08_044	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.05496	100.7108	DBL-COM-MEDL
FDNS	3	0	10G	G08_047	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.05777	100.7108	DBL-COM-MEDL
FDNS	3	0	10G	G08_088	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03159	100.7108	DBL-COM-MEDL
FDNS	3	0	10G	G08_110	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.05777	100.7108	DBL-COM-MEDL
FDNS	3	0	10G	G09_008	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.02669	100.7108	DBL-COM-MEDL
FDNS	3	0	10G	G09_020	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.02706	100.7108	DBL-COM-MEDL
FDNS	3	0	10G	G09_059	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04493	100.7108	DBL-COM-MEDL
FDNS	3	0	10G	G09_059	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04493	100.7108	DBL-COM-MEDL
FDNS	3	0	10G	G09_059	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04493	100.7108	DBL-COM-MEDL
FDNS	3	0	10G	G09_062	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04585	100.7108	DBL-COM-MEDL
FDNS	3	0	10G	G09_062	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04585	100.7108	DBL-COM-MEDL
FDNS	3	0	10G	G09_067S	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03241	100.7108	DBL-COM-MEDL
FDNS	3	0	10G	G10_007	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03947	100.7108	DBL-COM-MEDL
FDNS	3	0	10G	G10_009	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.05087	100.7108	DBL-COM-MEDL
FDNS	3	0	10G	G10_009	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.05087	100.7108	DBL-COM-MEDL
FDNS	3	0	10G	G10_009	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.05087	100.7108	DBL-COM-MEDL
FDNS	3	0	10G	G10_011	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.05496	100.7108	DBL-COM-MEDL
FDNS	3	0	10G	G10_014	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.05777	100.7108	DBL-COM-MEDL
FDNS	3	0	10G	G10_015	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.05319	100.7108	DBL-COM-MEDL
FDNS	3	0	10G	G10_015	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.05319	100.7108	DBL-COM-MEDL
FDNS	3	0	10G	G10_015	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.05319	100.7108	DBL-COM-MEDL
FDNS	3	0	10G	G10_016	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04308	100.7108	DBL-COM-MEDL
FDNS	3	0	10G	G10_016	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04308	100.7108	DBL-COM-MEDL
FDNS	3	0	10G	G10_016	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04308	100.7108	DBL-COM-MEDL
FDNS	2	0	10G	ASGI_11	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03752	100.6228	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	ASGI_11	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03752	100.6228	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G08_022	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.0352	100.6228	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G08_028	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04444	100.6228	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G08_028	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04444	100.6228	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G08_044	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.0406	100.6228	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G08_047	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04444	100.6228	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G08_047	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04444	100.6228	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G08_088	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.0265	100.6228	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G08_110	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04444	100.6228	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G08_110	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04444	100.6228	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G09_059	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03272	100.6228	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G09_062	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.0327	100.6228	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G09_067S	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03548	100.6228	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G10_007	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.0312	100.6228	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G10_007	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.0312	100.6228	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G10_009	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03484	100.6228	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G10_011	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.0406	100.6228	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G10_014	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04444	100.6228	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G10_014	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04444	100.6228	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G10_015	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03469	100.6228	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	2	0	10G	G10_016	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.02914	100.6228	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	11	0	10G	G09_040	FROM->TO	KNOLL - N HAYS3 115.00 115KV CKT 1	88	0.02878	100.5478	KNOLL 230 230/115KV TRANSFORMER CKT 1
FDNS	11	0	10G	G09_040	FROM->TO	KNOLL - N HAYS3 115.00 115KV CKT 1	88	0.02878	100.5478	KNOLL 230 230/115KV TRANSFORMER CKT 1
FDNS	2	0	10G	ASGI_11	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.06424	100.51	GEN525561 1-TOLK GEN #1 24 KV

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	2	0	10G	ASGI_11	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.06424	100.51	GEN525561 1-TOLK GEN #1 24 KV
FDNS	2	0	10G	G08_028	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.05017	100.51	GEN525561 1-TOLK GEN #1 24 KV
FDNS	2	0	10G	G08_028	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.05017	100.51	GEN525561 1-TOLK GEN #1 24 KV
FDNS	2	0	10G	G08_047	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.05017	100.51	GEN525561 1-TOLK GEN #1 24 KV
FDNS	2	0	10G	G08_047	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.05017	100.51	GEN525561 1-TOLK GEN #1 24 KV
FDNS	2	0	10G	G08_088	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.06087	100.51	GEN525561 1-TOLK GEN #1 24 KV
FDNS	2	0	10G	G08_110	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.05017	100.51	GEN525561 1-TOLK GEN #1 24 KV
FDNS	2	0	10G	G08_110	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.05017	100.51	GEN525561 1-TOLK GEN #1 24 KV
FDNS	2	0	10G	G09_059	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.02596	100.51	GEN525561 1-TOLK GEN #1 24 KV
FDNS	2	0	10G	G09_062	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.02914	100.51	GEN525561 1-TOLK GEN #1 24 KV
FDNS	2	0	10G	G10_007	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.07131	100.51	GEN525561 1-TOLK GEN #1 24 KV
FDNS	2	0	10G	G10_007	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.07131	100.51	GEN525561 1-TOLK GEN #1 24 KV
FDNS	2	0	10G	G10_009	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.02973	100.51	GEN525561 1-TOLK GEN #1 24 KV
FDNS	2	0	10G	G10_014	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.05017	100.51	GEN525561 1-TOLK GEN #1 24 KV
FDNS	2	0	10G	G10_014	TO->FROM	DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1	351	0.05017	100.51	GEN525561 1-TOLK GEN #1 24 KV
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	100.4653	GEN560182 1-G07-50 0.6000
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	100.4653	GEN560182 1-G07-50 0.6000
FDNS	7	0	10G	G08_088	FROM->TO	JENSEN ROAD - JENSEN TAP 138KV CKT 1	191	0.02534	100.3972	HYDRO - WEATHERFORD 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	JENSEN ROAD - JENSEN TAP 138KV CKT 1	191	0.34686	100.3972	HYDRO - WEATHERFORD 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	JENSEN ROAD - JENSEN TAP 138KV CKT 1	191	0.34686	100.3972	HYDRO - WEATHERFORD 138KV CKT 1
FDNS	7	0	10G	G09_060	FROM->TO	JENSEN ROAD - JENSEN TAP 138KV CKT 1	191	0.05264	100.3972	HYDRO - WEATHERFORD 138KV CKT 1
FDNS	7	0	10G	G09_060	FROM->TO	JENSEN ROAD - JENSEN TAP 138KV CKT 1	191	0.05264	100.3972	HYDRO - WEATHERFORD 138KV CKT 1
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	100.3474	GEN560152 1-G06-46 0.6000
FDNS	1	0	10G	G10_008	TO->FROM	GLASS MOUNTAIN - MOORELAND 138KV CKT 1	124	0.05913	100.3474	GEN560152 1-G06-46 0.6000
FDNS	2	0	10G	G08_088	FROM->TO	KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1	90	0.02641	100.2694	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	2	0	10G	G08_088	FROM->TO	KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1	90	0.02641	100.2667	BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	2	0	10G	ASGI_11	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03627	100.2631	WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	2	0	10G	ASGI_11	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03627	100.2631	WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	2	0	10G	G08_028	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04594	100.2631	WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	2	0	10G	G08_028	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04594	100.2631	WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	2	0	10G	G08_044	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04595	100.2631	WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	2	0	10G	G08_047	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04594	100.2631	WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	2	0	10G	G08_047	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04594	100.2631	WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	2	0	10G	G08_110	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04594	100.2631	WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	2	0	10G	G08_110	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04594	100.2631	WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	2	0	10G	G09_020	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.02642	100.2631	WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	2	0	10G	G09_059	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03643	100.2631	WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	2	0	10G	G09_062	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03603	100.2631	WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	2	0	10G	G10_007	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.02767	100.2631	WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	2	0	10G	G10_007	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.02767	100.2631	WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	2	0	10G	G10_009	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03823	100.2631	WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	2	0	10G	G10_011	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04595	100.2631	WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	2	0	10G	G10_014	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04594	100.2631	WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	2	0	10G	G10_014	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.04594	100.2631	WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	2	0	10G	G10_015	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03866	100.2631	WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	2	0	10G	G10_016	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	0.03288	100.2631	WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	0	0	14SP	ASGI_10	TO->FROM	CURRY COUNTY INTERCHANGE - ROOSEVELT COUNTY INTERCHANGE 115KV CKT 2	185	0.02638	100.1786	OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1
FDNS	0	0	14SP	ASGI_10	TO->FROM	CURRY COUNTY INTERCHANGE - ROOSEVELT COUNTY INTERCHANGE 115KV CKT 2	185	0.02638	100.1786	OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1
FDNS	0	0	14SP	G08_022	TO->FROM	CURRY COUNTY INTERCHANGE - ROOSEVELT COUNTY INTERCHANGE 115KV CKT 2	185	0.03111	100.1786	OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1
FDNS	0	0	14SP	G08_022	TO->FROM	CURRY COUNTY INTERCHANGE - ROOSEVELT COUNTY INTERCHANGE 115KV CKT 2	185	0.03111	100.1786	OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1
FDNS	0	0	14SP	G09_067S	TO->FROM	CURRY COUNTY INTERCHANGE - ROOSEVELT COUNTY INTERCHANGE 115KV CKT 2	185	0.03274	100.1786	OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1
FDNS	0	0	14SP	G09_067S	TO->FROM	CURRY COUNTY INTERCHANGE - ROOSEVELT COUNTY INTERCHANGE 115KV CKT 2	185	0.03274	100.1786	OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CLINTON JUNCTION (CLINTJCT) 138/69/13.8KV TRANSFORMER CKT 1	92	0.08932	100.1271	WEATHERFORD SOUTHEAST - WEATHERFORD TAP 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CLINTON JUNCTION (CLINTJCT) 138/69/13.8KV TRANSFORMER CKT 1	92	0.08932	100.1271	WEATHERFORD SOUTHEAST - WEATHERFORD TAP 138KV CKT 1
FDNS	5	0	10G	G09_030	TO->FROM	CLINTON CITY - FOSS TAP 69KV CKT 1	53	0.09073	100.1174	CLINTON JUNCTION - CLINTON NATURAL GAS TAP 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CLINTON JUNCTION (CLINTJCT) 138/69/13.8KV TRANSFORMER CKT 1	92	0.08932	100.1094	WEATHERFORD SOUTHEAST - WEATHERFORD TAP 138KV CKT 1
FDNS	7	0	10G	G09_030	FROM->TO	CLINTON JUNCTION (CLINTJCT) 138/69/13.8KV TRANSFORMER CKT 1	92	0.08932	100.1094	WEATHERFORD SOUTHEAST - WEATHERFORD TAP 138KV CKT 1
FDNS	7	0	10G	G08_037	TO->FROM	NORGE ROAD - SOUTHWESTERN STATION 138KV CKT 1	143	0.09714	100.0841	SOUTHWESTERN STATION - VERDEN 138KV CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FDNS	7	0	10G	G08_037	TO->FROM	NORGE ROAD - SOUTHWESTERN STATION 138KV CKT 1	143	0.09714	100.0841	SOUTHWESTERN STATION - VERDEN 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	NORGE ROAD - SOUTHWESTERN STATION 138KV CKT 1	143	0.05547	100.0841	SOUTHWESTERN STATION - VERDEN 138KV CKT 1
FDNS	7	0	10G	G09_030	TO->FROM	NORGE ROAD - SOUTHWESTERN STATION 138KV CKT 1	143	0.05547	100.0841	SOUTHWESTERN STATION - VERDEN 138KV CKT 1
FDNS	7	0	10G	G09_060	TO->FROM	NORGE ROAD - SOUTHWESTERN STATION 138KV CKT 1	143	0.04053	100.0841	SOUTHWESTERN STATION - VERDEN 138KV CKT 1
FDNS	7	0	10G	G09_060	TO->FROM	NORGE ROAD - SOUTHWESTERN STATION 138KV CKT 1	143	0.04053	100.0841	SOUTHWESTERN STATION - VERDEN 138KV CKT 1
FCITC	0	0	14SP	G10_010	TO->FROM	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 1'	56	1	180.3591	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 2'
FCITC	0	0	14SP	G10_010	TO->FROM	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 2	56	1	180.3591	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 1'
FCITC	0	0	14WP	G10_010	TO->FROM	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 2	56	1	180.3591	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 1'
FCITC	0	0	14WP	G10_010	TO->FROM	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 1	56	1	180.3591	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 2'
FCITC	9	0	10G	G10_010	TO->FROM	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 2	56	1	180.3591	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 1	56	1	180.3591	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 2'
FCITC	0	0	14SP	G10_010	TO->FROM	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 2	56	1	180.3571	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 1'
FCITC	0	0	14SP	G10_010	TO->FROM	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 1	56	1	180.3571	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 2'
FCITC	0	0	14WP	G10_010	TO->FROM	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 1	56	1	180.3571	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 2'
FCITC	0	0	14WP	G10_010	TO->FROM	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 2	56	1	180.3571	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 2	56	1	180.3571	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 1	56	1	180.3571	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 2'
FCITC	7	0	10G	G09_030	TO->FROM	'CLINTON CITY - FOSS TAP 69KV CKT 1'	52.7	0.08932	178.1987	'WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1'
FCITC	7	0	10G	G09_030	TO->FROM	'CLINTON CITY - FOSS TAP 69KV CKT 1'	52.7	0.08932	177.4598	'WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	101.5	0.05435	176.5539	'BASE CASE'
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.06203	175.4107	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	101.5	0.05435	172.1955	'BASE CASE'
FCITC	7	0	10G	G09_030	TO->FROM	'CLINTON CITY - FOSS TAP 69KV CKT 1'	52.7	0.08932	169.4701	'WEATHERFORD SOUTHEAST - WEATHERFORD TAP 138KV CKT 1'
FCITC	7	0	10G	G09_030	TO->FROM	'CLINTON CITY - FOSS TAP 69KV CKT 1'	52.7	0.08932	168.7312	'WEATHERFORD SOUTHEAST - WEATHERFORD TAP 138KV CKT 1'
FCITC	1	0	10G	G10_008	FROM->TO	'FARGOJCT2 69.000 - WOODWARD 69KV CKT 1'	64.9	0.9316	168.6015	'FT SUPPLY - IODINE 138KV CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.05933	162.0938	'DBL-COM-MEDLO
FCITC	1	0	10G	G10_008	FROM->TO	'FARGOJCT2 69.000 - WOODWARD 69KV CKT 1'	64.9	0.9316	160.281	'IODINE - MOORELAND 138KV CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.05933	156.1589	'DBL-COM-MEDLO
FCITC	3	0	10G	G09_059	TO->FROM	'CUDAHY - G09-059TAP 115.00 115KV CKT 1'	128.4	0.99716	156.1187	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'	129.5	0.99716	154.7926	'CUDAHY - G09-059TAP 115.00 115KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1'	330.2	0.48982	154.0558	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'	330.2	0.48982	154.0558	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1'	333.3	0.48982	152.6229	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'	333.3	0.48982	152.6229	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FCITC	3	0	10G	G09_059	FROM->TO	'NINNESC3 115.00 - ST JOHN 115KV CKT 1'	76.6	0.05813	152.0733	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1
FCITC	3	0	10G	G09_059	FROM->TO	'CUDAHY - KISMET 3 115.00 115KV CKT 1'	127.8	0.99716	151.8438	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1'	330.2	0.48982	150.9303	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'	330.2	0.48982	150.9303	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FCITC	3	0	10G	G09_059	TO->FROM	'CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	127.6	0.99716	150.5928	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'NINNESC3 115.00 - ST JOHN 115KV CKT 1'	76.6	0.05813	150.4845	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1
FCITC	3	0	10G	G09_059	FROM->TO	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'	129.5	0.99716	149.8505	'CUDAHY - KISMET 3 115.00 115KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1'	333.3	0.48982	149.5265	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'	333.3	0.48982	149.5265	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.02922	149.4021	'DEWEY - TALOGA 138KV CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.06333	148.6891	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	7	0	10G	G09_030	TO->FROM	'CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1'	143	0.99579	148.5838	'HYDRO - WEATHERFORD 138KV CKT 1
FCITC	3	0	10G	G09_059	FROM->TO	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'	129.5	0.99716	148.3833	'CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1
FCITC	3	0	10G	G09_059	TO->FROM	'CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1'	89.2	0.84289	147.9705	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.04639	147.6742	'TALOGA (TALOGA) 138/69/13.8KV TRANSFORMER CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.05798	147.5639	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1
FCITC	7	0	10G	G09_030	TO->FROM	'CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1'	143	0.99579	146.9055	'HYDRO - SICKLES 138KV CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.05798	146.774	'CLEO CORNER - GLASS MOUNTAIN 138KV CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.06639	146.4179	'WWRDEHV7 345.00 (WWDEHV-T2) 345/138/13.8KV TRANSFORMER CKT 2'
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.06639	146.4179	'WWRDEHV7 345.00 (WWDEHV-T) 345/138/13.8KV TRANSFORMER CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.02922	146.3429	'DEWEY - TALOGA 138KV CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.05681	146.0696	'ELK CITY - RHWIND4 138.00 138KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.0555	145.8575	'CLINTON JUNCTION - ELK CITY 138KV CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.05991	145.653	'MOORELAND - MOREWOOD SW 138KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.05652	145.5567	'CEDARDALE - MOORELAND 138KV CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.05613	145.3987	'COMANCH5 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.05613	145.3987	'COMANCH5 345.00 - WWRDEHV7 345.00 345KV CKT 2'
FCITC	0	0	14SP	G10_016	TO->FROM	'G10-016 345.00 345/34.5KV TRANSFORMER CKT 1'	138	1	144.9275	'BASE CASE'
FCITC	0	0	14WP	G10_016	TO->FROM	'G10-016 345.00 345/34.5KV TRANSFORMER CKT 1'	138	1	144.9275	'BASE CASE'
FCITC	3	0	10G	G10_016	TO->FROM	'G10-016 345.00 345/34.5KV TRANSFORMER CKT 1'	138	1	144.9275	'BASE CASE'
FCITC	0	0	14SP	G10_016	TO->FROM	'G10-016 345.00 345/34.5KV TRANSFORMER CKT 1'	138	1	144.926	'BASE CASE'
FCITC	0	0	14WP	G10_016	TO->FROM	'G10-016 345.00 345/34.5KV TRANSFORMER CKT 1'	138	1	144.926	'BASE CASE'
FCITC	3	0	10G	G10_016	TO->FROM	'G10-016 345.00 345/34.5KV TRANSFORMER CKT 1'	138	1	144.926	'BASE CASE'
FCITC	9	0	10G	G10_010	TO->FROM	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 2	56	1	144.6418	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 1	56	1	144.6418	'EMERICK 7115.00 115/34.5KV TRANSFORMER CKT 2'
FCITC	1	0	10G	G10_008	FROM->TO	'FARGOJCT2 69.000 - WOODWARD 69KV CKT 1'	64.9	0.9316	144.3848	'FT SUPPLY - IODINE 138KV CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.05459	144.3567	'CIMARRON - WOODRING 345KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.04639	144.2883	'TALOGA (TALOGA) 138/69/13.8KV TRANSFORMER CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.05408	144.2615	'CIMARRON (CIMARON1) 345/138/13.8KV TRANSFORMER CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.05409	144.1825	'CIMARRON (CIMARON2) 345/138/13.8KV TRANSFORMER CKT 1'
FCITC	15	0	10G	G08_123N	FROM->TO	'EGYCNTR7 115.00 - HASTCTY7 115.00 115KV CKT 1'	105	0.10574	144.1314	'GEN08-123N 115.00 - PAULINE7 115.00 115KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.05435	143.9985	'PNM BLACKWATER DC TIE - ROSEVELT_S 6230.00 230KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.05798	143.7683	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.05462	143.5195	'G05-15T 345.00 - OKLAUNION 345KV CKT 1'
FCITC	7	0	10G	G09_030	TO->FROM	'CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1'	143	0.99579	142.7796	'BINGER NIJECT - SICKLES 138KV CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.05681	142.6823	'ELK CITY - RHWIND4 138.00 138KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.0555	142.3002	'CLINTON JUNCTION - ELK CITY 138KV CKT 1
FCITC	8	0	10G	G10_005	FROM->TO	'G07-25 345.00 - G07-25T 345.00 345KV CKT 1'	417.5	0.99157	142.002	'BASE CASE'
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.05469	141.7853	'G05-15T 345.00 - TUCO INTERCHANGE 345KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.05613	141.7001	'COMANCH5 345.00 - WWRDEHV7 345.00 345KV CKT 2'
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.05613	141.7001	'COMANCH5 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.05527	141.3407	'MED-LDG5 345.00 - WICHITA 345KV CKT 2
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.05527	141.3407	'MED-LDG5 345.00 - WICHITA 345KV CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	7	0	10G	G09_030	TO->FROM	'CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1'	143	0.99579	141.2411	'BINGER NIJECT - ONEY 138KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.05481	141.0015	'WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.05465	140.7564	'CIMARRON - NORTHWEST 345KV CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.05459	140.7534	'CIMARRON - WOODRING 345KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.05408	140.7276	'CIMARRON (CIMARON1) 345/138/13.8KV TRANSFORMER CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.05409	140.6491	'CIMARRON (CIMARON2) 345/138/13.8KV TRANSFORMER CKT 1'
FCITC	3	0	10G	G09_059	TO->FROM	'CUDAHY - G09-059TAP 115.00 115KV CKT 1'	128.4	0.99716	140.5866	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.05435	140.5043	'PNM BLACKWATER DC TIE - ROSEVELT_S 6230.00 230KV CKT 1'
FCITC	3	0	10G	G09_062	FROM->TO	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1'	330.2	0.12821	140.4131	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'
FCITC	3	0	10G	G09_062	FROM->TO	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'	330.2	0.12821	140.4131	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FCITC	2	0	10G	G10_007	FROM->TO	'HITCHLAND 7 345.00 - STEVENS CO 345.00 345KV CKT 1'	1051.8	0.41446	140.2101	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_047	FROM->TO	'HITCHLAND 7 345.00 - STEVENS CO 345.00 345KV CKT 1'	1051.8	0.5346	140.2101	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_110	FROM->TO	'HITCHLAND 7 345.00 - STEVENS CO 345.00 345KV CKT 1'	1051.8	0.5346	140.2101	'DBL-HITCH-WOOD
FCITC	2	0	10G	G10_014	FROM->TO	'HITCHLAND 7 345.00 - STEVENS CO 345.00 345KV CKT 1'	1051.8	0.5346	140.2101	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_028	FROM->TO	'HITCHLAND 7 345.00 - STEVENS CO 345.00 345KV CKT 1'	1051.8	0.5346	140.2101	'DBL-HITCH-WOOD
FCITC	7	0	10G	G09_030	TO->FROM	'CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1'	143	0.99579	140.1922	'ONEY - WASHITA 138KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'	129.5	0.99716	139.3924	'CUDAHY - G09-059TAP 115.00 115KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'CANTON - TALOGA 69KV CKT 1	38.6	0.03425	139.3575	'CEDARDALE - MOORELAND 138KV CKT 1
FCITC	3	0	10G	G09_062	FROM->TO	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1'	333.3	0.12821	139.1072	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'
FCITC	3	0	10G	G09_062	FROM->TO	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'	333.3	0.12821	139.1072	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	126.6	0.06139	138.9345	'FPL SWITCH - WOODWARD 138KV CKT 1
FCITC	7	0	10G	G09_030	FROM->TO	'CLINTON CITY - THOMAS TAP 69KV CKT 1'	54.8	0.08932	138.8882	'WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'HARPER - MILAN TAP 138KV CKT 1	91.3	0.04698	138.3419	'MED-LDG5 345.00 345/138KV TRANSFORMER CKT 1'
FCITC	3	0	10G	G09_020	FROM->TO	'HARPER - MILAN TAP 138KV CKT 1	91.3	0.03543	138.3419	'MED-LDG5 345.00 345/138KV TRANSFORMER CKT 1'
FCITC	7	0	10G	G09_030	FROM->TO	'THOMAS TAP - WEATHERFORD 69KV CKT 1'	52.8	0.08932	138.2779	'WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1'
FCITC	7	0	10G	G09_030	FROM->TO	'CLINTON CITY - THOMAS TAP 69KV CKT 1'	54.8	0.08932	138.1776	'WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1'
FCITC	7	0	10G	G09_030	FROM->TO	'THOMAS TAP - WEATHERFORD 69KV CKT 1'	52.8	0.08932	137.5404	'WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'CUDAHY - KISMET 3 115.00 115KV CKT 1'	127.8	0.99716	136.2388	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'
FCITC	1	0	10G	G10_008	FROM->TO	'FARGOJCT2 69.000 - WOODWARD 69KV CKT 1'	64.9	0.9316	136.0643	'IODINE - MOORELAND 138KV CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'CANTON - TALOGA 69KV CKT 1	38.6	0.03425	135.4715	'CEDARDALE - OKEENE 138KV CKT 1
FCITC	3	0	10G	G09_059	TO->FROM	'CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	127.6	0.99716	134.9633	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'	129.5	0.99716	134.4503	'CUDAHY - KISMET 3 115.00 115KV CKT 1'
FCITC	1	0	10G	G10_011	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.02754	133.6968	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	1	0	10G	G08_044	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.02754	133.6968	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.0648	133.6968	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	3	0	10G	G09_059	FROM->TO	'HARPER - MILAN TAP 138KV CKT 1	91.3	0.04698	133.3184	'MED-LDG5 345.00 345/138KV TRANSFORMER CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'	129.5	0.99716	132.9831	'CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1
FCITC	3	0	10G	G09_059	FROM->TO	'HARPER - MILAN TAP 138KV CKT 1	91.3	0.04698	132.2508	'MED-LDG5 345.00 345/138KV TRANSFORMER CKT 1'
FCITC	7	0	10G	G09_030	FROM->TO	'CARTER JCT - LAKE CREEK 69KV CKT 1	34.4	0.02971	131.6881	'SPP-SWPS-03b'
FCITC	7	0	10G	G09_030	TO->FROM	'CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1'	143	0.99579	131.6788	'HYDRO - WEATHERFORD 138KV CKT 1

APPENDIX H: DIS-2010-001 Powerflow Analysis (Constraints 3%+ TDF)

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	7	0	10G	G09_030	FROM->TO	'CLINTON JUNCTION - FOSS TAP 69KV CKT 1'	71.8	0.08932	131.352	'WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1'
FCITC	7	0	10G	G09_030	FROM->TO	'CARTER JCT - LAKE CREEK 69KV CKT 1	34.4	0.02978	130.8366	'BECKHAM CO 230.00 - WHEELER 6 230.00 230KV CKT 1'
FCITC	7	0	10G	G09_030	FROM->TO	'CLINTON JUNCTION - FOSS TAP 69KV CKT 1'	71.8	0.08932	130.8096	'WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1'
FCITC	3	0	10G	G10_015	FROM->TO	'G01-39AT 115.00 - GREENSBURG 115KV CKT 1'	128.8	0.04406	130.6002	'DBL-SPRVL-COM
FCITC	3	0	10G	G10_009	FROM->TO	'G01-39AT 115.00 - GREENSBURG 115KV CKT 1'	128.8	0.03436	130.6002	'DBL-SPRVL-COM
FCITC	3	0	10G	G09_059	FROM->TO	'G01-39AT 115.00 - GREENSBURG 115KV CKT 1'	128.8	0.12053	130.6002	'DBL-SPRVL-COM
FCITC	3	0	10G	G10_016	FROM->TO	'G01-39AT 115.00 - GREENSBURG 115KV CKT 1'	128.8	0.03502	130.6002	'DBL-SPRVL-COM
FCITC	3	0	10G	G09_062	FROM->TO	'G01-39AT 115.00 - GREENSBURG 115KV CKT 1'	128.8	0.05917	130.6002	'DBL-SPRVL-COM
FCITC	2	0	10G	G10_007	FROM->TO	'BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	350.4	0.1191	130.5629	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_047	FROM->TO	'BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	350.4	0.08288	130.5629	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_110	FROM->TO	'BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	350.4	0.08288	130.5629	'DBL-HITCH-WOOD
FCITC	2	0	10G	G10_014	FROM->TO	'BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	350.4	0.08288	130.5629	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_028	FROM->TO	'BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	350.4	0.08288	130.5629	'DBL-HITCH-WOOD
FCITC	7	0	10G	G09_030	FROM->TO	'CARTER JCT - LAKE CREEK 69KV CKT 1'	34.4	0.02978	130.5459	'GRAPEVINE INTERCHANGE - WHEELER 6 230.00 230KV CKT 1'
FCITC	7	0	10G	G09_030	FROM->TO	'CLINTON CITY - THOMAS TAP 69KV CKT 1'	54.8	0.08932	130.494	'WEATHERFORD SOUTHEAST - WEATHERFORD TAP 138KV CKT 1'
FCITC	7	0	10G	G09_030	TO->FROM	'CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1'	143	0.99579	130.0005	'HYDRO - SICKLES 138KV CKT 1
FCITC	2	0	10G	G10_007	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.04051	129.8251	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G08_047	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.06037	129.8251	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G08_110	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.06037	129.8251	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G10_014	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.06037	129.8251	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G08_028	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.06037	129.8251	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	7	0	10G	G09_030	FROM->TO	'CLINTON CITY - THOMAS TAP 69KV CKT 1'	54.8	0.08932	129.7834	'WEATHERFORD SOUTHEAST - WEATHERFORD TAP 138KV CKT 1'
FCITC	7	0	10G	G09_030	FROM->TO	'THOMAS TAP - WEATHERFORD 69KV CKT 1'	52.8	0.08932	129.5658	'WEATHERFORD SOUTHEAST - WEATHERFORD TAP 138KV CKT 1'
FCITC	1	0	10G	G10_011	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.02754	129.3856	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	1	0	10G	G08_044	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.02754	129.3856	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	3	0	10G	G09_059	TO->FROM	'CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1'	89.2	0.84289	129.0716	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'
FCITC	7	0	10G	G09_030	TO->FROM	'EL RENO - EL RENO SW 69KV CKT 1	26.5	0.06024	128.9971	'JENSEN ROAD - JENSEN TAP 138KV CKT 1'
FCITC	7	0	10G	G09_030	FROM->TO	'THOMAS TAP - WEATHERFORD 69KV CKT 1'	52.8	0.08932	128.8282	'WEATHERFORD SOUTHEAST - WEATHERFORD TAP 138KV CKT 1'
FCITC	7	0	10G	G09_030	TO->FROM	'EL RENO - EL RENO SW 69KV CKT 1	26.5	0.06024	128.6198	'OGE3TERM10'
FCITC	3	0	10G	G10_015	FROM->TO	'G01-39AT 115.00 - GREENSBURG 115KV CKT 1'	128.8	0.04406	127.9288	'DBL-SPRVL-COM
FCITC	3	0	10G	G10_016	FROM->TO	'G01-39AT 115.00 - GREENSBURG 115KV CKT 1'	128.8	0.03502	127.9288	'DBL-SPRVL-COM
FCITC	8	0	10G	G10_005	FROM->TO	'G07-25 345.00 - G07-25T 345.00 345KV CKT 1'	417.5	0.99157	127.8733	'BASE CASE'
FCITC	0	0	14SP	G09_062	FROM->TO	'CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1'	89.6	0.25335	127.8295	'CIMARRON RIVER PLANT - HAYNE 3 115.00 115KV CKT 1'
FCITC	5	0	10G	G08_088	TO->FROM	'SWITCH 2749 - WILDORADO 69KV CKT 1	35	1	127.1429	'BASE CASE'
FCITC	11	0	10G	G09_040	FROM->TO	'G09-040TAP 115.00 - SMITTYVILLE N.M. COOP (NEMAHA MARSHALL R.E. 115KV CKT 1'	92	0.78242	126.9555	'EAST MANHATTAN - ELMCREK6 230.00 230KV CKT 1'
FCITC	7	0	10G	G09_030	TO->FROM	'CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1'	143	0.99579	125.8746	'BINGER NIJECT - SICKLES 138KV CKT 1
FCITC	11	0	10G	G09_040	TO->FROM	'BAILEYVILLE N.M. STATION (NEMAHA MARSHALL R - SMITTYVILLE N.M. COOP (NEMAHA MARSHALL R.E. 115KV CKT 1'	92	0.78242	125.8686	'EAST MANHATTAN - ELMCREK6 230.00 230KV CKT 1'
FCITC	2	0	10G	G10_007	FROM->TO	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	363.5	0.1191	125.8026	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_047	FROM->TO	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	363.5	0.08288	125.8026	'DBL-HITCH-WOOD'

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	2	0	10G	G08_110	FROM->TO	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	363.5	0.08288	125.8026	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G10_014	FROM->TO	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	363.5	0.08288	125.8026	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_028	FROM->TO	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	363.5	0.08288	125.8026	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G10_007	FROM->TO	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	364.4	0.1191	125.5467	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_047	FROM->TO	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	364.4	0.08288	125.5467	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_110	FROM->TO	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	364.4	0.08288	125.5467	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G10_014	FROM->TO	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	364.4	0.08288	125.5467	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_028	FROM->TO	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	364.4	0.08288	125.5467	'DBL-HITCH-WOOD'
FCITC	0	0	14SP	G09_062	FROM->TO	'CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1'	89.6	0.25335	125.4655	'CIMARRON RIVER PLANT - HAYNE 3 115.00 115KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.06491	125.3492	'DBL-COM-MEDLO
FCITC	1	0	10G	G08_044	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.02754	125.1245	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	7	0	10G	G09_030	FROM->TO	'CLINTON JUNCTION - FOSS TAP 69KV CKT 1'	71.8	0.08932	124.9453	'WEATHERFORD SOUTHEAST - WEATHERFORD TAP 138KV CKT 1'
FCITC	7	0	10G	G09_030	TO->FROM	'ANADARKO - WASHITA 138KV CKT 1	227.3	0.36944	124.8186	'SOUTHWESTERN STATION - WASHITA 138KV CKT 1
FCITC	7	0	10G	G08_037	TO->FROM	'ANADARKO - WASHITA 138KV CKT 1	227.3	0.74589	124.8186	'SOUTHWESTERN STATION - WASHITA 138KV CKT 1
FCITC	7	0	10G	G09_060	TO->FROM	'ANADARKO - WASHITA 138KV CKT 1	227.3	0.17651	124.8186	'SOUTHWESTERN STATION - WASHITA 138KV CKT 1
FCITC	7	0	10G	G09_030	FROM->TO	'CLINTON JUNCTION - FOSS TAP 69KV CKT 1'	71.8	0.08932	124.403	'WEATHERFORD SOUTHEAST - WEATHERFORD TAP 138KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'CANTON - TALOGA 69KV CKT 1	38.6	0.02984	124.3776	'EL RENO - ROMAN NOSE 138KV CKT 1'
FCITC	7	0	10G	G09_030	TO->FROM	'CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1'	143	0.99579	124.3362	'BINGER NIJECT - ONEY 138KV CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.99437	124.3318	'FTRANDL4 230.00 - MADISONCNTY4230.00 230KV CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.99437	124.3318	'FTRANDL4 230.00 - MADISONCNTY4230.00 230KV CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'FTRANDL4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	320	0.99437	124.293	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'FTRANDL4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	320	0.99437	124.293	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'
FCITC	11	0	10G	G09_040	FROM->TO	'BAILEYVILLE N.M. STATION (NEMAHA MARSHALL R - SOUTH SENECA 115KV CKT 1'	92	0.78242	124.2381	'EAST MANHATTAN - ELMCREK6 230.00 230KV CKT 1'
FCITC	2	0	10G	G10_007	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.04135	124.07	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G08_047	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.06121	124.07	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G08_110	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.06121	124.07	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G10_014	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.06121	124.07	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G08_028	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.06121	124.07	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.0648	124.0612	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	7	0	10G	G09_030	TO->FROM	'CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1'	143	0.99579	123.2872	'ONEY - WASHITA 138KV CKT 1'
FCITC	2	0	10G	G10_007	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.04122	123.1591	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G08_047	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.06108	123.1591	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G08_110	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.06108	123.1591	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	2	0	10G	G10_014	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.06108	123.1591	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G08_028	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.06108	123.1591	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G10_007	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.26153	123.0007	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_047	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.35235	123.0007	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_110	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.35235	123.0007	'DBL-HITCH-WOOD
FCITC	2	0	10G	G10_014	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.35235	123.0007	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_028	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.35235	123.0007	'DBL-HITCH-WOOD
FCITC	3	0	10G	G10_015	FROM->TO	'GREENSBURG - SUN CITY 115KV CKT 1'	128.8	0.04406	122.448	'DBL-SPRVL-COM
FCITC	3	0	10G	G10_009	FROM->TO	'GREENSBURG - SUN CITY 115KV CKT 1'	128.8	0.03436	122.448	'DBL-SPRVL-COM
FCITC	3	0	10G	G09_059	FROM->TO	'GREENSBURG - SUN CITY 115KV CKT 1'	128.8	0.12053	122.448	'DBL-SPRVL-COM
FCITC	3	0	10G	G10_016	FROM->TO	'GREENSBURG - SUN CITY 115KV CKT 1'	128.8	0.03502	122.448	'DBL-SPRVL-COM
FCITC	3	0	10G	G09_062	FROM->TO	'GREENSBURG - SUN CITY 115KV CKT 1'	128.8	0.05917	122.448	'DBL-SPRVL-COM
FCITC	6	0	10G	G08_022	TO->FROM	'PLANT X STATION - TOLK STATION WEST 230KV CKT 1	496.9	0.36342	121.9614	'PLANT X STATION - TOLK STATION EAST 230KV CKT 2
FCITC	1	0	10G	G10_011	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.02754	121.3568	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	0	0	14WP	G08_088	TO->FROM	'SWITCH 2749 - WILDORADO 69KV CKT 1	35	1	121.1429	'BASE CASE'
FCITC	3	0	10G	G10_015	FROM->TO	'G01-39AT 115.00 - GREENSBURG 115KV CKT 1'	128.8	0.02929	121.0821	'DBL-COM-MEDLO
FCITC	3	0	10G	G10_009	FROM->TO	'G01-39AT 115.00 - GREENSBURG 115KV CKT 1'	128.8	0.02583	121.0821	'DBL-COM-MEDLO
FCITC	3	0	10G	G09_059	FROM->TO	'G01-39AT 115.00 - GREENSBURG 115KV CKT 1'	128.8	0.10799	121.0821	'DBL-COM-MEDLO
FCITC	3	0	10G	G09_062	FROM->TO	'G01-39AT 115.00 - GREENSBURG 115KV CKT 1'	128.8	0.05093	121.0821	'DBL-COM-MEDLO
FCITC	6	0	10G	G08_022	TO->FROM	'PLANT X STATION - TOLK STATION EAST 230KV CKT 2	496.9	0.36038	121.0131	'PLANT X STATION - TOLK STATION WEST 230KV CKT 1
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1	172.2	0.07969	120.9762	'OGE3TERM2'
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1	172.2	0.07969	120.6365	'OGE3TERM2'
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1	172.2	0.07949	120.6353	'MORRISON - STILLWATER 138KV CKT 1
FCITC	2	0	10G	G10_007	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.039	120.4278	'DBL-COM-MEDLO
FCITC	2	0	10G	G08_047	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.0573	120.4278	'DBL-COM-MEDLO
FCITC	2	0	10G	G08_110	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.0573	120.4278	'DBL-COM-MEDLO
FCITC	2	0	10G	G10_014	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.0573	120.4278	'DBL-COM-MEDLO
FCITC	2	0	10G	G08_028	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.0573	120.4278	'DBL-COM-MEDLO
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1	172.2	0.07949	120.2792	'MORRISON - STILLWATER 138KV CKT 1
FCITC	3	0	10G	G10_015	FROM->TO	'GREENSBURG - SUN CITY 115KV CKT 1'	128.8	0.04406	119.7766	'DBL-SPRVL-COM
FCITC	3	0	10G	G10_016	FROM->TO	'GREENSBURG - SUN CITY 115KV CKT 1'	128.8	0.03502	119.7766	'DBL-SPRVL-COM
FCITC	7	0	10G	G09_030	TO->FROM	'HYDRO - WEATHERFORD 138KV CKT 1	177.8	0.99579	119.5021	'CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1'
FCITC	0	0	14SP	G09_062	FROM->TO	'CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1'	89.6	0.25335	119.459	'HAYNE 3 115.00 - NORTH LIBERAL TAP 115KV CKT 1'
FCITC	7	0	10G	G09_030	TO->FROM	'SOUTHWESTERN STATION - WASHITA 138KV CKT 1	255.7	0.40963	119.4094	'ANADARKO - WASHITA 138KV CKT 1
FCITC	7	0	10G	G08_037	TO->FROM	'SOUTHWESTERN STATION - WASHITA 138KV CKT 1	255.7	0.8351	119.4094	'ANADARKO - WASHITA 138KV CKT 1
FCITC	7	0	10G	G09_060	TO->FROM	'SOUTHWESTERN STATION - WASHITA 138KV CKT 1	255.7	0.1994	119.4094	'ANADARKO - WASHITA 138KV CKT 1
FCITC	3	0	10G	G09_059	TO->FROM	'CUDAHY - G09-059TAP 115.00 115KV CKT 1'	128.4	0.99716	119.1807	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'
FCITC	3	0	10G	G10_015	FROM->TO	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	168.2	0.05865	118.9288	'DBL-SPRVL-COM
FCITC	3	0	10G	G10_016	FROM->TO	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	168.2	0.0521	118.9288	'DBL-SPRVL-COM
FCITC	11	0	10G	G09_040	FROM->TO	'G09-040TAP 115.00 - SMITTYVILLE N.M. COOP (NEMAHA MARSHALL R.E. 115KV CKT 1'	92	0.78242	118.8877	'EAST MANHATTAN - ELMCREK6 230.00 230KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'G01-39AT 115.00 - GREENSBURG 115KV CKT 1'	128.8	0.12053	118.7674	'DBL-SPRVL-COM
FCITC	3	0	10G	G10_015	TO->FROM	'MEDICINE LODGE - SUN CITY 115KV CKT 1	127.1	0.04406	118.5783	'DBL-SPRVL-COM
FCITC	3	0	10G	G10_009	TO->FROM	'MEDICINE LODGE - SUN CITY 115KV CKT 1	127.1	0.03436	118.5783	'DBL-SPRVL-COM
FCITC	3	0	10G	G09_059	TO->FROM	'MEDICINE LODGE - SUN CITY 115KV CKT 1	127.1	0.12053	118.5783	'DBL-SPRVL-COM
FCITC	3	0	10G	G10_016	TO->FROM	'MEDICINE LODGE - SUN CITY 115KV CKT 1	127.1	0.03502	118.5783	'DBL-SPRVL-COM
FCITC	3	0	10G	G09_062	TO->FROM	'MEDICINE LODGE - SUN CITY 115KV CKT 1	127.1	0.05917	118.5783	'DBL-SPRVL-COM
FCITC	2	0	10G	G10_015	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.04889	118.294	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G10_011	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.09062	118.294	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	ASGI_11	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.04984	118.294	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	2	0	10G	G08_044	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.09062	118.294	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G08_047	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.06037	118.294	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G09_067S	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.03195	118.294	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G08_028	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.06037	118.294	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G08_022	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.03206	118.294	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G10_009	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.04874	118.294	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G10_007	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.04051	118.294	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G09_059	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.04614	118.294	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G08_110	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.06037	118.294	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G08_088	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.03187	118.294	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G09_020	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.03317	118.294	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G09_008	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.03058	118.294	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G10_014	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.06037	118.294	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G10_016	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.04139	118.294	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G09_062	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.04587	118.294	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1	172.2	0.0782	118.247	'MCELROY - STILLWATER 138KV CKT 1
FCITC	3	0	10G	G09_059	FROM->TO	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'	129.5	0.99716	118.1684	'CUDAHY - G09-059TAP 115.00 115KV CKT 1'
FCITC	3	0	10G	G10_015	FROM->TO	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	168.2	0.05865	118.0515	'DBL-SPRVL-COM
FCITC	3	0	10G	G10_009	FROM->TO	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	168.2	0.045	118.0515	'DBL-SPRVL-COM
FCITC	3	0	10G	G09_059	FROM->TO	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	168.2	0.11869	118.0515	'DBL-SPRVL-COM
FCITC	3	0	10G	G09_020	FROM->TO	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	168.2	0.08822	118.0515	'DBL-SPRVL-COM
FCITC	3	0	10G	G09_008	FROM->TO	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	168.2	0.05013	118.0515	'DBL-SPRVL-COM
FCITC	3	0	10G	G10_016	FROM->TO	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	168.2	0.0521	118.0515	'DBL-SPRVL-COM
FCITC	3	0	10G	G09_062	FROM->TO	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	168.2	0.06567	118.0515	'DBL-SPRVL-COM
FCITC	11	0	10G	G09_040	TO->FROM	'BAILEYVILLE N.M. STATION (NEMAHA MARSHALL R - SMITTYVILLE N.M. COOP (NEMAHA MARSHALL R.E. 115KV CKT 1'	92	0.78242	117.8007	'EAST MANHATTAN - ELMCREK6 230.00 230KV CKT 1'
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1	172.2	0.08009	117.6347	'G08-38T 138.00 - WEST PAWHUSKA 138KV CKT 1'
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1	172.2	0.07645	117.6295	'OGE3TERM47'
FCITC	2	0	10G	G10_007	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.04206	117.4135	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G08_047	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.06192	117.4135	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G08_110	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.06192	117.4135	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G10_014	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.06192	117.4135	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G08_028	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.06192	117.4135	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1	172.2	0.08009	117.3443	'PAWHUSKA TAP - WEST PAWHUSKA 138KV CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.06491	117.308	'DBL-COM-MEDLO
FCITC	0	0	14SP	G09_062	FROM->TO	'CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1'	89.6	0.25335	117.095	'HAYNE 3 115.00 - NORTH LIBERAL TAP 115KV CKT 1'
FCITC	2	0	10G	G10_007	TO->FROM	'MOORE COUNTY INTERCHANGE E. - SHERMAN COUNTY TAP 115KV CKT 1'	118	0.02715	116.8703	'HITCHLAND 6 230.00 230/115KV TRANSFORMER CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'G01-39AT 115.00 - GREENSBURG 115KV CKT 1'	128.8	0.12053	116.8273	'DBL-SPRVL-COM
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1	172.2	0.07645	116.7751	'OGE3TERM47'
FCITC	3	0	10G	G09_059	FROM->TO	'ST JOHN - ST_JOHN 115KV CKT 1'	85.4	0.03451	116.5793	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1
FCITC	3	0	10G	G09_020	FROM->TO	'ST JOHN - ST_JOHN 115KV CKT 1'	85.4	0.07034	116.5793	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1	172.2	0.0782	116.3307	'KINZE - MCELROY 138KV CKT 1
FCITC	11	0	10G	G09_040	FROM->TO	'BAILEYVILLE N.M. STATION (NEMAHA MARSHALL R - SOUTH SENECA 115KV CKT 1'	92	0.78242	116.1703	'EAST MANHATTAN - ELMCREK6 230.00 230KV CKT 1'
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1	172.2	0.07483	115.9506	'KINZE - STILLWATER KINZIE 138KV CKT 1

APPENDIX H: DIS-2010-001 Powerflow Analysis (Constraints 3%+ TDF)

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	3	0	10G	G09_020	FROM->TO	'ST JOHN - ST_JOHN 115KV CKT 1'	85.4	0.07438	115.9379	'CIRCLE - MULLERGREN 230KV CKT 1
FCITC	3	0	10G	G09_008	FROM->TO	'ST JOHN - ST_JOHN 115KV CKT 1'	85.4	0.0255	115.9379	'CIRCLE - MULLERGREN 230KV CKT 1
FCITC	3	0	10G	G10_015	TO->FROM	'MULLERGREN - SPEARVILLE 230KV CKT 1	353.5	0.1528	115.9051	'DBL-SPRVL-COM
FCITC	3	0	10G	G10_016	TO->FROM	'MULLERGREN - SPEARVILLE 230KV CKT 1	353.5	0.0885	115.9051	'DBL-SPRVL-COM
FCITC	3	0	10G	G10_015	TO->FROM	'MEDICINE LODGE - SUN CITY 115KV CKT 1	127.1	0.04406	115.8712	'DBL-SPRVL-COM
FCITC	3	0	10G	G10_016	TO->FROM	'MEDICINE LODGE - SUN CITY 115KV CKT 1	127.1	0.03502	115.8712	'DBL-SPRVL-COM
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1	172.2	0.08009	115.7764	'DOMES - PAWHUSKA TAP 138KV CKT 1
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1'	172.2	0.06577	115.6587	'CLEVELAND (CLVAUTO1) 345/138/13.8KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G10_008	TO->FROM	'CANTON - TALOGA 69KV CKT 1	38.7	0.03481	115.5952	'CEDARDALE - MOORELAND 138KV CKT 1
FCITC	2	0	10G	G09_060	TO->FROM	'CANTON - TALOGA 69KV CKT 1	38.7	0.04595	115.5952	'CEDARDALE - MOORELAND 138KV CKT 1
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75903	115.594	'DAK02Wapa.B2'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75903	115.594	'DAK02Wapa.B2'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75903	115.5628	'FTRANDL4 230.00 - UTICAJC4 230.00 230KV CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75903	115.5628	'FTRANDL4 230.00 - UTICAJC4 230.00 230KV CKT 1'
FCITC	0	0	14SP	G09_060	TO->FROM	'LAKE CREEK - LONEWOLF 69KV CKT 1'	47.6	0.27219	115.3537	'ELK CITY (ELKCTY-4) 138/69/13.8KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G10_007	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	351	0.09903	115.3068	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_047	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	351	0.08773	115.3068	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_110	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	351	0.08773	115.3068	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G10_014	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	351	0.08773	115.3068	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_028	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	351	0.08773	115.3068	'DBL-HITCH-WOOD'
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1	172.2	0.07562	115.2091	'CLEVELAND - SOONER 345KV CKT 1
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1	172.2	0.07483	115.0766	'KINZE - STILLWATER KINZIE 138KV CKT 1
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1	172.2	0.08009	115.0214	'DOMES - MOUND ROAD 138KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'CANTON - TALOGA 69KV CKT 1	38.6	0.0273	114.8891	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	3	0	10G	G09_059	FROM->TO	'CUDAHY - KISMET 3 115.00 115KV CKT 1'	127.8	0.99716	114.7324	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'
FCITC	2	0	10G	G10_007	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.03984	114.6504	'DBL-COM-MEDLO
FCITC	2	0	10G	G08_047	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.05814	114.6504	'DBL-COM-MEDLO
FCITC	2	0	10G	G08_110	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.05814	114.6504	'DBL-COM-MEDLO
FCITC	2	0	10G	G10_014	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.05814	114.6504	'DBL-COM-MEDLO
FCITC	2	0	10G	G08_028	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.05814	114.6504	'DBL-COM-MEDLO
FCITC	3	0	10G	G09_020	FROM->TO	'ST JOHN - ST_JOHN 115KV CKT 1'	85.4	0.08133	114.6423	'NINNESC3 115.00 - PRATT 115KV CKT 1'
FCITC	7	0	10G	G08_037	FROM->TO	'GEN08-037 138.00 - WASHITA 138KV CKT 1'	241.2	0.99368	114.539	'BASE CASE'
FCITC	3	0	10G	G10_015	FROM->TO	'G01-39AT 115.00 - GREENSBURG 115KV CKT 1'	128.8	0.04406	114.2174	'DBL-SPRVL-COM
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1	172.2	0.07812	113.9461	'BARNSDALL - G08-38T 138.00 138KV CKT 1'
FCITC	7	0	10G	G09_030	FROM->TO	'CARTER JCT - LAKE CREEK 69KV CKT 1	34.4	0.02752	113.894	'CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
FCITC	7	0	10G	G08_037	TO->FROM	'ANADARKO - WASHITA 138KV CKT 1	227.3	0.74589	113.7215	'SOUTHWESTERN STATION - WASHITA 138KV CKT 1
FCITC	11	0	10G	G09_008	TO->FROM	'HAYS PLANT - SOUTH HAYS 115KV CKT 1	96.7	0.36885	113.6753	'KNOLL 230 - S HAYS6 230.00 230KV CKT 1'
FCITC	3	0	10G	G10_015	FROM->TO	'G01-39AT 115.00 - GREENSBURG 115KV CKT 1'	128.8	0.02929	113.5938	'DBL-COM-MEDLO
FCITC	0	0	14SP	G08_088	TO->FROM	'SWITCH 2749 - WILDORADO 69KV CKT 1	34.9	1	113.467	'BASE CASE'
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.06226	113.4496	'KNOBHILL - MOORELAND 138KV CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1'	122.8	0.06226	113.4496	'KNOBHILL (KNOBHIL4) 138/69/13.2KV TRANSFORMER CKT 1'

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	3	0	10G	G09_059	TO->FROM	'CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	127.6	0.99716	113.4232	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.06574	113.2745	'CEDARDALE - MOORELAND 138KV CKT 1
FCITC	2	0	10G	G10_008	TO->FROM	'CANTON - TALOGA 69KV CKT 1	38.7	0.03481	113.2697	'CEDARDALE - OKEENE 138KV CKT 1
FCITC	2	0	10G	G09_060	TO->FROM	'CANTON - TALOGA 69KV CKT 1	38.7	0.04595	113.2697	'CEDARDALE - OKEENE 138KV CKT 1
FCITC	3	0	10G	G09_059	FROM->TO	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'	129.5	0.99716	113.2263	'CUDAHY - KISMET 3 115.00 115KV CKT 1'
FCITC	2	0	10G	G10_007	TO->FROM	'GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1'	350.9	0.09991	113.1718	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_047	TO->FROM	'GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1'	350.9	0.07782	113.1718	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_110	TO->FROM	'GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1'	350.9	0.07782	113.1718	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G10_014	TO->FROM	'GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1'	350.9	0.07782	113.1718	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_028	TO->FROM	'GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1'	350.9	0.07782	113.1718	'DBL-HITCH-WOOD'
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1	172.2	0.07562	113.0794	'CLEVELAND - SOONER 345KV CKT 1
FCITC	3	0	10G	G10_015	FROM->TO	'GREENSBURG - SUN CITY 115KV CKT 1'	128.8	0.02929	113.0076	'DBL-COM-MEDLO
FCITC	3	0	10G	G10_009	FROM->TO	'GREENSBURG - SUN CITY 115KV CKT 1'	128.8	0.02583	113.0076	'DBL-COM-MEDLO
FCITC	3	0	10G	G09_059	FROM->TO	'GREENSBURG - SUN CITY 115KV CKT 1'	128.8	0.10799	113.0076	'DBL-COM-MEDLO
FCITC	3	0	10G	G09_062	FROM->TO	'GREENSBURG - SUN CITY 115KV CKT 1'	128.8	0.05093	113.0076	'DBL-COM-MEDLO
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75628	112.979	'FTRANDL4 230.00 - SIOUXCY4 230.00 230KV CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75628	112.979	'FTRANDL4 230.00 - SIOUXCY4 230.00 230KV CKT 1'
FCITC	1	0	10G	G10_008	FROM->TO	'OKEENE - WATONGA SW 69KV CKT 1	46.3	0.03123	112.9562	'OGE3TERM9'
FCITC	5	0	10G	ASGI_11	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	350.6	0.06124	112.9439	'TOLK STATION EAST 230/24.0KV TRANSFORMER CKT 1'
FCITC	5	0	10G	G08_047	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	350.6	0.04717	112.9439	'TOLK STATION EAST 230/24.0KV TRANSFORMER CKT 1'
FCITC	5	0	10G	G08_028	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	350.6	0.04717	112.9439	'TOLK STATION EAST 230/24.0KV TRANSFORMER CKT 1'
FCITC	5	0	10G	G10_009	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	350.6	0.02673	112.9439	'TOLK STATION EAST 230/24.0KV TRANSFORMER CKT 1'
FCITC	5	0	10G	G10_007	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	350.6	0.06831	112.9439	'TOLK STATION EAST 230/24.0KV TRANSFORMER CKT 1'
FCITC	5	0	10G	G08_110	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	350.6	0.04717	112.9439	'TOLK STATION EAST 230/24.0KV TRANSFORMER CKT 1'
FCITC	5	0	10G	G08_088	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	350.6	0.05786	112.9439	'TOLK STATION EAST 230/24.0KV TRANSFORMER CKT 1'
FCITC	5	0	10G	G10_014	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	350.6	0.04717	112.9439	'TOLK STATION EAST 230/24.0KV TRANSFORMER CKT 1'
FCITC	5	0	10G	G09_062	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	350.6	0.02614	112.9439	'TOLK STATION EAST 230/24.0KV TRANSFORMER CKT 1'
FCITC	3	0	10G	G10_009	FROM->TO	'G01-39AT 115.00 - GREENSBURG 115KV CKT 1'	128.8	0.03436	112.8712	'DBL-SPRVL-COM
FCITC	3	0	10G	G10_016	FROM->TO	'G01-39AT 115.00 - GREENSBURG 115KV CKT 1'	128.8	0.03502	112.8137	'DBL-SPRVL-COM
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1'	172.2	0.07875	112.6967	'BARTLESVILLE COMANCHE - MOUND ROAD 138KV CKT 1'
FCITC	3	0	10G	G09_062	FROM->TO	'G01-39AT 115.00 - GREENSBURG 115KV CKT 1'	128.8	0.05917	112.6588	'DBL-SPRVL-COM
FCITC	2	0	10G	G10_015	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.04973	112.5245	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G10_011	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.09146	112.5245	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	ASGI_11	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.05068	112.5245	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G08_044	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.09146	112.5245	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G08_047	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.06121	112.5245	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	2	0	10G	G09_067S	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.03279	112.5245	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G08_028	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.06121	112.5245	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G08_022	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.0329	112.5245	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G10_009	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.04958	112.5245	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G10_007	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.04135	112.5245	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G09_059	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.04697	112.5245	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G08_110	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.06121	112.5245	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G08_088	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.0327	112.5245	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G09_020	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.03401	112.5245	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G09_008	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.03142	112.5245	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G10_014	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.06121	112.5245	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G10_016	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.04223	112.5245	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G09_062	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.04671	112.5245	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	7	0	10G	G09_030	FROM->TO	'CARTER JCT - LAKE CREEK 69KV CKT 1'	34.4	0.02752	112.4405	'CLINTON AIR FORCE BASE TAP - HOBART JUNCTION 138KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.06574	112.3788	'CEDARDALE - OKEENE 138KV CKT 1
FCITC	3	0	10G	G10_015	FROM->TO	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	168.2	0.0382	112.3419	'DBL-COM-MEDLO
FCITC	3	0	10G	G10_009	FROM->TO	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	168.2	0.03407	112.3419	'DBL-COM-MEDLO
FCITC	3	0	10G	G09_059	FROM->TO	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	168.2	0.10083	112.3419	'DBL-COM-MEDLO
FCITC	3	0	10G	G09_020	FROM->TO	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	168.2	0.07172	112.3419	'DBL-COM-MEDLO
FCITC	3	0	10G	G09_008	FROM->TO	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	168.2	0.03286	112.3419	'DBL-COM-MEDLO
FCITC	3	0	10G	G10_016	FROM->TO	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	168.2	0.03326	112.3419	'DBL-COM-MEDLO
FCITC	3	0	10G	G09_062	FROM->TO	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	168.2	0.05476	112.3419	'DBL-COM-MEDLO
FCITC	7	0	10G	G09_030	TO->FROM	'CLINTON CITY - FOSS TAP 69KV CKT 1'	52.7	0.0908	112.198	'CLINTON JUNCTION - CLINTON NATURAL GAS TAP 138KV CKT 1'
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1	172.2	0.07386	112.1877	'MORRISON - SOONER 138KV CKT 1'
FCITC	3	0	10G	G10_009	FROM->TO	'G01-39AT 115.00 - GREENSBURG 115KV CKT 1'	128.8	0.03436	111.8042	'DBL-SPRVL-COM
FCITC	3	0	10G	G09_059	FROM->TO	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'	129.5	0.99716	111.7591	'CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1
FCITC	2	0	10G	ASGI_11	FROM->TO	'BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	350.4	0.10164	111.5272	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_047	FROM->TO	'BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	350.4	0.08288	111.5272	'DBL-HITCH-WOOD
FCITC	2	0	10G	G09_067S	FROM->TO	'BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	350.4	0.07791	111.5272	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_028	FROM->TO	'BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	350.4	0.08288	111.5272	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_022	FROM->TO	'BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	350.4	0.07977	111.5272	'DBL-HITCH-WOOD
FCITC	2	0	10G	G10_007	FROM->TO	'BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	350.4	0.1191	111.5272	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_110	FROM->TO	'BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	350.4	0.08288	111.5272	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_088	FROM->TO	'BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	350.4	0.12876	111.5272	'DBL-HITCH-WOOD
FCITC	2	0	10G	G10_014	FROM->TO	'BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1	350.4	0.08288	111.5272	'DBL-HITCH-WOOD
FCITC	5	0	10G	G08_088	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	350.6	0.05786	111.526	'TOLK STATION EAST 230/24.0KV TRANSFORMER CKT 1'
FCITC	0	0	14WP	G09_060	TO->FROM	'LAKE CREEK - LONEWOLF 69KV CKT 1	48	0.62459	111.489	'GOTEBO - MOUNTAIN VIEW 69KV CKT 1
FCITC	8	0	10G	G10_005	FROM->TO	'G07-25 345.00 - G07-25T 345.00 345KV CKT 1'	417.5	0.99157	111.4843	'BASE CASE'
FCITC	0	0	14SP	G09_060	TO->FROM	'LAKE CREEK - LONEWOLF 69KV CKT 1	47.6	0.62458	111.3737	'GOTEBO - MOUNTAIN VIEW 69KV CKT 1
FCITC	3	0	10G	G10_015	TO->FROM	'MULLERGREN - SPEARVILLE 230KV CKT 1	353.5	0.1528	111.2633	'DBL-SPRVL-COM
FCITC	3	0	10G	ASGI_11	TO->FROM	'MULLERGREN - SPEARVILLE 230KV CKT 1	353.5	0.02764	111.2633	'DBL-SPRVL-COM
FCITC	3	0	10G	G08_047	TO->FROM	'MULLERGREN - SPEARVILLE 230KV CKT 1	353.5	0.03194	111.2633	'DBL-SPRVL-COM
FCITC	3	0	10G	G08_028	TO->FROM	'MULLERGREN - SPEARVILLE 230KV CKT 1	353.5	0.03194	111.2633	'DBL-SPRVL-COM
FCITC	3	0	10G	G10_009	TO->FROM	'MULLERGREN - SPEARVILLE 230KV CKT 1	353.5	0.11224	111.2633	'DBL-SPRVL-COM
FCITC	3	0	10G	G09_059	TO->FROM	'MULLERGREN - SPEARVILLE 230KV CKT 1	353.5	0.14039	111.2633	'DBL-SPRVL-COM
FCITC	3	0	10G	G08_110	TO->FROM	'MULLERGREN - SPEARVILLE 230KV CKT 1	353.5	0.03194	111.2633	'DBL-SPRVL-COM
FCITC	3	0	10G	G10_014	TO->FROM	'MULLERGREN - SPEARVILLE 230KV CKT 1	353.5	0.03194	111.2633	'DBL-SPRVL-COM
FCITC	3	0	10G	G10_016	TO->FROM	'MULLERGREN - SPEARVILLE 230KV CKT 1	353.5	0.0885	111.2633	'DBL-SPRVL-COM
FCITC	3	0	10G	G09_062	TO->FROM	'MULLERGREN - SPEARVILLE 230KV CKT 1	353.5	0.09859	111.2633	'DBL-SPRVL-COM
FCITC	2	0	10G	G08_047	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	147	0.02526	111.057	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	2	0	10G	G08_110	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	147	0.02526	111.057	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G10_014	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	147	0.02526	111.057	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G08_028	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	147	0.02526	111.057	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.06298	111.0278	'EL RENO - ROMAN NOSE 138KV CKT 1'
FCITC	0	0	14SP	G10_010	FROM->TO	'FTRANDL7 115.00 - SPENCER7 115.00 115KV CKT 1'	118.9	0.0613	110.7944	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'
FCITC	0	0	14SP	G06_044N02	FROM->TO	'FTRANDL7 115.00 - SPENCER7 115.00 115KV CKT 1'	118.9	0.0613	110.7944	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'
FCITC	2	0	10G	G10_007	TO->FROM	'CLINTON JUNCTION - ELK CITY 138KV CKT 1	169.2	0.04726	110.7018	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_047	TO->FROM	'CLINTON JUNCTION - ELK CITY 138KV CKT 1	169.2	0.03423	110.7018	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_110	TO->FROM	'CLINTON JUNCTION - ELK CITY 138KV CKT 1	169.2	0.03423	110.7018	'DBL-HITCH-WOOD
FCITC	2	0	10G	G10_014	TO->FROM	'CLINTON JUNCTION - ELK CITY 138KV CKT 1	169.2	0.03423	110.7018	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_028	TO->FROM	'CLINTON JUNCTION - ELK CITY 138KV CKT 1	169.2	0.03423	110.7018	'DBL-HITCH-WOOD
FCITC	3	0	10G	G09_059	FROM->TO	'GREENSBURG - SUN CITY 115KV CKT 1'	128.8	0.12053	110.6153	'DBL-SPRVL-COM
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1'	330.2	0.29746	110.4154	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'	330.2	0.29746	110.4154	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75131	110.4148	'FTTHOMP3 345.00 - GR ISLD3 345.00 345KV CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75131	110.4148	'FTTHOMP3 345.00 - GR ISLD3 345.00 345KV CKT 1'
FCITC	2	0	10G	G10_007	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	351	0.07131	110.3716	'TOLK STATION EAST 230/24.0KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G08_047	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	351	0.05017	110.3716	'TOLK STATION EAST 230/24.0KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G08_110	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	351	0.05017	110.3716	'TOLK STATION EAST 230/24.0KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G10_014	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	351	0.05017	110.3716	'TOLK STATION EAST 230/24.0KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G08_028	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	351	0.05017	110.3716	'TOLK STATION EAST 230/24.0KV TRANSFORMER CKT 1'
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1'	172.2	0.07054	110.2971	'BARTLESVILLE SOUTHEAST - NORTH BARTLESVILLE 138KV CKT 1'
FCITC	2	0	10G	ASGI_11	FROM->TO	'HITCHLAND 7 345.00 - STEVENS CO 345.00 345KV CKT 1'	1051.8	0.4696	110.2455	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_047	FROM->TO	'HITCHLAND 7 345.00 - STEVENS CO 345.00 345KV CKT 1'	1051.8	0.5346	110.2455	'DBL-HITCH-WOOD
FCITC	2	0	10G	G09_067S	FROM->TO	'HITCHLAND 7 345.00 - STEVENS CO 345.00 345KV CKT 1'	1051.8	0.23711	110.2455	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_028	FROM->TO	'HITCHLAND 7 345.00 - STEVENS CO 345.00 345KV CKT 1'	1051.8	0.5346	110.2455	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_022	FROM->TO	'HITCHLAND 7 345.00 - STEVENS CO 345.00 345KV CKT 1'	1051.8	0.24227	110.2455	'DBL-HITCH-WOOD
FCITC	2	0	10G	G10_007	FROM->TO	'HITCHLAND 7 345.00 - STEVENS CO 345.00 345KV CKT 1'	1051.8	0.41446	110.2455	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_110	FROM->TO	'HITCHLAND 7 345.00 - STEVENS CO 345.00 345KV CKT 1'	1051.8	0.5346	110.2455	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_088	FROM->TO	'HITCHLAND 7 345.00 - STEVENS CO 345.00 345KV CKT 1'	1051.8	0.34871	110.2455	'DBL-HITCH-WOOD
FCITC	2	0	10G	G10_014	FROM->TO	'HITCHLAND 7 345.00 - STEVENS CO 345.00 345KV CKT 1'	1051.8	0.5346	110.2455	'DBL-HITCH-WOOD
FCITC	3	0	10G	G10_016	TO->FROM	'G10-016 345.00 345/34.5KV TRANSFORMER CKT 1'	138	1	110.1925	'BASE CASE'
FCITC	3	0	10G	G09_059	FROM->TO	'G01-39AT 115.00 - GREENSBURG 115KV CKT 1'	128.8	0.10799	110.1322	'DBL-COM-MEDLO
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1'	172.2	0.07054	110.0648	'COFFEYVILLE TAP - NORTH BARTLESVILLE 138KV CKT 1'
FCITC	11	0	10G	G09_008	FROM->TO	'HAYS PLANT - VINE STREET 115KV CKT 1	86.3	0.36885	109.993	'KNOLL 230 - S HAYS6 230.00 230KV CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.9895	'COOPER 3 345.00 345/22.0KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.9895	'COOPER 3 345.00 345/22.0KV TRANSFORMER CKT 1'

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.9285	'S3458 3 345.00 345/23.0KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.9285	'S3458 3 345.00 345/23.0KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75191	109.8663	'RASMUSN4 230.00 - UTICAJC4 230.00 230KV CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75191	109.8663	'RASMUSN4 230.00 - UTICAJC4 230.00 230KV CKT 1'
FCITC	6	0	10G	G09_067S	TO->FROM	'PLANT X STATION - TOLK STATION WEST 230KV CKT 1	496.9	0.27489	109.8531	'PLANT X STATION - TOLK STATION EAST 230KV CKT 2
FCITC	6	0	10G	G08_022	TO->FROM	'PLANT X STATION - TOLK STATION WEST 230KV CKT 1	496.9	0.36342	109.8531	'PLANT X STATION - TOLK STATION EAST 230KV CKT 2
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.8347	'S3458 3 345.00 345/18.0KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.8347	'S3458 3 345.00 345/18.0KV TRANSFORMER CKT 1'
FCITC	6	0	10G	G08_022	TO->FROM	'SOUTH PLAINS REC-YUMA - WOLFFORTH INTERCHANGE 115KV CKT 1'	159.9	0.09656	109.7361	'TOLK STATION EAST - TUCO INTERCHANGE 230KV CKT 1'
FCITC	2	0	10G	G09_020	FROM->TO	'SEWARD - ST JOHN 115KV CKT 1'	79.2	0.12836	109.6741	'DBL-COM-MEDLO
FCITC	2	0	10G	G09_008	FROM->TO	'SEWARD - ST JOHN 115KV CKT 1'	79.2	0.04161	109.6741	'DBL-COM-MEDLO
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.6577	'CBLUFFS3 345.00 345/26.0KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.6577	'CBLUFFS3 345.00 345/26.0KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.5952	'WOLF CREEK 345/25.0KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.5952	'WOLF CREEK 345/25.0KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75096	109.5756	'UTICAJC4 230.00 - VFODNES4 230.00 230KV CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75096	109.5756	'UTICAJC4 230.00 - VFODNES4 230.00 230KV CKT 1'
FCITC	2	0	10G	G10_015	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.0496	109.5142	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	ASGI_11	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.05055	109.5142	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G08_047	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.06108	109.5142	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G09_067S	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.03266	109.5142	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G08_028	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.06108	109.5142	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G08_022	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.03277	109.5142	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G10_009	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.04945	109.5142	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G10_007	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.04122	109.5142	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G09_059	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.04685	109.5142	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G08_110	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.06108	109.5142	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G08_088	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.03258	109.5142	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	2	0	10G	G09_020	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.03389	109.5142	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G09_008	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.03129	109.5142	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G10_014	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.06108	109.5142	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G10_016	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.0421	109.5142	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G09_062	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.04658	109.5142	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.4702	'CBLUFFS3 345.00 345/24.0KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.4702	'CBLUFFS3 345.00 345/24.0KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75191	109.4599	'RASMUSN4 230.00 - SIOUXCY4 230.00 230KV CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75191	109.4599	'RASMUSN4 230.00 - SIOUXCY4 230.00 230KV CKT 1'
FCITC	7	0	10G	G09_030	FROM->TO	'CARTER JCT - LAKE CREEK 69KV CKT 1'	34.4	0.02915	109.4307	'WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1'	333.3	0.29746	109.3884	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'	333.3	0.29746	109.3884	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.06555	109.3032	'DOVER SW - OKEENE 138KV CKT 1
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75011	109.2925	'FTRANDL7 115.00 - SPENCER7 115.00 115KV CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75011	109.2925	'FTRANDL7 115.00 - SPENCER7 115.00 115KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'NINNESC3 115.00 - ST JOHN 115KV CKT 1'	76.6	0.0295	109.2733	'MED-LDG5 345.00 345/138KV TRANSFORMER CKT 1
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75011	109.2612	'NEB001NPP.B2'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75011	109.2612	'NEB001NPP.B2'
FCITC	7	0	10G	G09_030	FROM->TO	'ELK CITY (ELKCTY-4) 138/69/13.8KV TRANSFORMER CKT 1'	71.9	0.02971	109.1804	'SPP-SWPS-03b'
FCITC	7	0	10G	G09_030	FROM->TO	'ELK CITY (ELKCTY-4) 138/69/13.8KV TRANSFORMER CKT 1'	72	0.02971	109.1676	'SPP-SWPS-03b'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75011	109.1674	'ONEILL 7 115.00 - SPENCER7 115.00 115KV CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.75011	109.1674	'ONEILL 7 115.00 - SPENCER7 115.00 115KV CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74892	109.1399	'KEYSTON3 345.00 - SIDNEY 3 345.00 345KV CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74892	109.1399	'KEYSTON3 345.00 - SIDNEY 3 345.00 345KV CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.1225	'GENTLMN3 345.00 345/24.0KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.1225	'GENTLMN3 345.00 345/24.0KV TRANSFORMER CKT 1'
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.06	'GENTLMN4 230.00 230/23.0KV TRANSFORMER CKT 1'

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	109.06	'GENTLMN4 230.00 230/23.0KV TRANSFORMER CKT 1'
FCITC	3	0	10G	G10_015	TO->FROM	'MEDICINE LODGE - SUN CITY 115KV CKT 1	127.1	0.02929	109.0117	'DBL-COM-MEDLO
FCITC	3	0	10G	G10_009	TO->FROM	'MEDICINE LODGE - SUN CITY 115KV CKT 1	127.1	0.02583	109.0117	'DBL-COM-MEDLO
FCITC	3	0	10G	G09_059	TO->FROM	'MEDICINE LODGE - SUN CITY 115KV CKT 1	127.1	0.10799	109.0117	'DBL-COM-MEDLO
FCITC	3	0	10G	G09_062	TO->FROM	'MEDICINE LODGE - SUN CITY 115KV CKT 1	127.1	0.05093	109.0117	'DBL-COM-MEDLO
FCITC	6	0	10G	G09_067S	TO->FROM	'PLANT X STATION - TOLK STATION EAST 230KV CKT 2	496.9	0.27246	109.0032	'PLANT X STATION - TOLK STATION WEST 230KV CKT 1
FCITC	6	0	10G	G08_022	TO->FROM	'PLANT X STATION - TOLK STATION EAST 230KV CKT 2	496.9	0.36038	109.0032	'PLANT X STATION - TOLK STATION WEST 230KV CKT 1
FCITC	6	0	10G	G08_022	FROM->TO	'PLANT X STATION 230/115KV TRANSFORMER CKT 1'	237.3	0.07822	108.751	'LAMB COUNTY INTERCHANGE - TOLK STATION WEST 230KV CKT 1'
FCITC	6	0	10G	G08_022	FROM->TO	'PLANT X STATION 230/115KV TRANSFORMER CKT 1'	237.3	0.07822	108.751	'LAMB COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'GREENSBURG - SUN CITY 115KV CKT 1'	128.8	0.12053	108.6751	'DBL-SPRVL-COM
FCITC	7	0	10G	G09_030	TO->FROM	'CLINTON CITY - FOSS TAP 69KV CKT 1'	52.7	0.0908	108.6732	'CLINTON JUNCTION - CLINTON NATURAL GAS TAP 138KV CKT 1'
FCITC	7	0	10G	G09_030	FROM->TO	'ELK CITY (ELKCTY-4) 138/69/13.8KV TRANSFORMER CKT 1'	71.9	0.02978	108.6339	'BECKHAM CO 230.00 - WHEELER 6 230.00 230KV CKT 1'
FCITC	7	0	10G	G09_030	FROM->TO	'ELK CITY (ELKCTY-4) 138/69/13.8KV TRANSFORMER CKT 1'	71.9	0.02978	108.6339	'GRAPEVINE INTERCHANGE - WHEELER 6 230.00 230KV CKT 1'
FCITC	7	0	10G	G09_030	FROM->TO	'ELK CITY (ELKCTY-4) 138/69/13.8KV TRANSFORMER CKT 1'	72	0.02978	108.6219	'BECKHAM CO 230.00 - WHEELER 6 230.00 230KV CKT 1'
FCITC	7	0	10G	G09_030	FROM->TO	'ELK CITY (ELKCTY-4) 138/69/13.8KV TRANSFORMER CKT 1'	72	0.02978	108.6219	'GRAPEVINE INTERCHANGE - WHEELER 6 230.00 230KV CKT 1'
FCITC	2	0	10G	G10_015	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.05272	108.5428	'DBL-COM-MEDLO
FCITC	2	0	10G	G10_011	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.05449	108.5428	'DBL-COM-MEDLO
FCITC	2	0	10G	ASGI_11	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.0476	108.5428	'DBL-COM-MEDLO
FCITC	2	0	10G	G08_044	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.05449	108.5428	'DBL-COM-MEDLO
FCITC	2	0	10G	G08_047	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.0573	108.5428	'DBL-COM-MEDLO
FCITC	2	0	10G	G09_067S	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.03194	108.5428	'DBL-COM-MEDLO
FCITC	2	0	10G	G08_028	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.0573	108.5428	'DBL-COM-MEDLO
FCITC	2	0	10G	G08_022	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.03201	108.5428	'DBL-COM-MEDLO
FCITC	2	0	10G	G10_009	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.0504	108.5428	'DBL-COM-MEDLO
FCITC	2	0	10G	G10_007	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.039	108.5428	'DBL-COM-MEDLO
FCITC	2	0	10G	G09_059	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.04446	108.5428	'DBL-COM-MEDLO
FCITC	2	0	10G	G08_110	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.0573	108.5428	'DBL-COM-MEDLO
FCITC	2	0	10G	G08_088	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.03112	108.5428	'DBL-COM-MEDLO
FCITC	2	0	10G	G09_020	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.02659	108.5428	'DBL-COM-MEDLO
FCITC	2	0	10G	G09_008	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.02622	108.5428	'DBL-COM-MEDLO
FCITC	2	0	10G	G10_014	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.0573	108.5428	'DBL-COM-MEDLO
FCITC	2	0	10G	G10_016	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.04261	108.5428	'DBL-COM-MEDLO
FCITC	2	0	10G	G09_062	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.04538	108.5428	'DBL-COM-MEDLO
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1'	330.2	0.29746	108.5231	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'	330.2	0.29746	108.5231	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1	172.2	0.06944	108.5057	'SHIDWFC4 138.00 - WEBB CITY TAP 138KV CKT 1
FCITC	3	0	10G	G09_059	FROM->TO	'NINNESC3 115.00 - ST JOHN 115KV CKT 1'	76.6	0.0295	108.4589	'MED-LDG5 345.00 345/138KV TRANSFORMER CKT 1
FCITC	7	0	10G	G08_037	TO->FROM	'SOUTHWESTERN STATION - WASHITA 138KV CKT 1	255.7	0.8351	108.4513	'ANADARKO - WASHITA 138KV CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.06645	108.451	'OGE3TERM9'
FCITC	3	0	10G	G09_059	FROM->TO	'G01-39AT 115.00 - GREENSBURG 115KV CKT 1'	128.8	0.10799	108.3905	'DBL-COM-MEDLO
FCITC	6	0	10G	G08_022	FROM->TO	'PLANT X STATION 230/115KV TRANSFORMER CKT 1'	237.3	0.09909	108.3552	'TOLK STATION EAST - TUCO INTERCHANGE 230KV CKT 1'
FCITC	1	0	10G	G10_008	FROM->TO	'FARGOJCT2 69.000 - WOODWARD 69KV CKT 1'	52.9	0.77527	108.3502	'BASE CASE'

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	3	0	10G	G09_059	FROM->TO	'ST JOHN - ST_JOHN 115KV CKT 1'	85.4	0.03451	108.3109	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1'	172.2	0.06958	108.2216	'4OOLOGAH 138.00 - NORTHEAST STATION 138KV CKT 1'
FCITC	0	0	14SP	G10_007	FROM->TO	'NICHOLS STATION - WHITAKER SUB 115KV CKT 1'	226.5	0.05093	108.1982	'EAST PLANT INTERCHANGE - HARRINGTON STATION 230KV CKT 1'
FCITC	2	0	10G	G10_007	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.04059	108.1657	'BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FCITC	2	0	10G	G08_047	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.04766	108.1657	'BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FCITC	2	0	10G	G08_110	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.04766	108.1657	'BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FCITC	2	0	10G	G10_014	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.04766	108.1657	'BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FCITC	2	0	10G	G08_028	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.04766	108.1657	'BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FCITC	2	0	10G	G10_007	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.04059	108.1657	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G08_047	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.04766	108.1657	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G08_110	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.04766	108.1657	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G10_014	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.04766	108.1657	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G08_028	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.04766	108.1657	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'
FCITC	0	0	14SP	G10_007	FROM->TO	'NICHOLS STATION - WHITAKER SUB 115KV CKT 1'	226.5	0.05093	108.154	'EAST PLANT INTERCHANGE 230/115KV TRANSFORMER CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'CANTON - TALOGA 69KV CKT 1	38.6	0.02725	108.1451	'DBL-COM-MEDLO
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1	172.2	0.10742	108.065	'FAIRFAX TAP - SHIDLER 138KV CKT 1
FCITC	9	0	10G	G10_010	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	107.8134	'BASE CASE'
FCITC	9	0	10G	G06_044N02	TO->FROM	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'	319.9	0.74874	107.8134	'BASE CASE'
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.06226	107.8051	'KNOBHILL - MOORELAND 138KV CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1'	122.8	0.06226	107.8051	'KNOBHILL (KNOBHIL4) 138/69/13.2KV TRANSFORMER CKT 1'
FCITC	3	0	10G	G09_059	TO->FROM	'CLEARWATER - MILAN TAP 138KV CKT 1	102.7	0.04698	107.6009	'MED-LDG5 345.00 345/138KV TRANSFORMER CKT 1'
FCITC	3	0	10G	G09_020	TO->FROM	'CLEARWATER - MILAN TAP 138KV CKT 1	102.7	0.03543	107.6009	'MED-LDG5 345.00 345/138KV TRANSFORMER CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'CANTON - TALOGA 69KV CKT 1	38.6	0.03017	107.5929	'DEWEY - SOUTHARD 138KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.06574	107.5793	'CEDARDALE - MOORELAND 138KV CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'CANTON - TALOGA 69KV CKT 1	32.5	0.02578	107.5382	'BASE CASE'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1'	333.3	0.29746	107.5138	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'	333.3	0.29746	107.5138	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'ST JOHN - ST_JOHN 115KV CKT 1'	85.4	0.03451	107.4772	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1
FCITC	2	0	10G	ASGI_11	FROM->TO	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	363.5	0.10164	107.4529	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_047	FROM->TO	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	363.5	0.08288	107.4529	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G09_067S	FROM->TO	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	363.5	0.07791	107.4529	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_028	FROM->TO	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	363.5	0.08288	107.4529	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_022	FROM->TO	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	363.5	0.07977	107.4529	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G10_007	FROM->TO	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	363.5	0.1191	107.4529	'DBL-HITCH-WOOD'

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	2	0	10G	G08_110	FROM->TO	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	363.5	0.08288	107.4529	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_088	FROM->TO	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	363.5	0.12876	107.4529	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G10_014	FROM->TO	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	363.5	0.08288	107.4529	'DBL-HITCH-WOOD'
FCITC	0	0	14SP	G10_010	FROM->TO	'FTRANDL4 230.00 230/115KV TRANSFORMER CKT 1	126.1	0.03256	107.4382	'FTRANDL4 230.00 230/115KV TRANSFORMER CKT 2
FCITC	0	0	14SP	G06_044N02	FROM->TO	'FTRANDL4 230.00 230/115KV TRANSFORMER CKT 1	126.1	0.03256	107.4382	'FTRANDL4 230.00 230/115KV TRANSFORMER CKT 2
FCITC	7	0	10G	G09_030	FROM->TO	'CARTER JCT - LAKE CREEK 69KV CKT 1	34.4	0.02915	107.3958	'HINTON - WEATHERFORD JCT. 138KV CKT 1
FCITC	2	0	10G	G10_011	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.02917	107.2568	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G08_044	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.02917	107.2568	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.06644	107.2568	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	ASGI_11	FROM->TO	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	364.4	0.10164	107.2424	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_047	FROM->TO	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	364.4	0.08288	107.2424	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G09_067S	FROM->TO	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	364.4	0.07791	107.2424	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_028	FROM->TO	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	364.4	0.08288	107.2424	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_022	FROM->TO	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	364.4	0.07977	107.2424	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G10_007	FROM->TO	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	364.4	0.1191	107.2424	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_110	FROM->TO	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	364.4	0.08288	107.2424	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_088	FROM->TO	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	364.4	0.12876	107.2424	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G10_014	FROM->TO	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	364.4	0.08288	107.2424	'DBL-HITCH-WOOD'
FCITC	3	0	10G	G10_015	FROM->TO	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	168.2	0.0382	107.1108	'DBL-COM-MEDLO
FCITC	3	0	10G	G10_016	FROM->TO	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	168.2	0.03326	107.1108	'DBL-COM-MEDLO
FCITC	2	0	10G	G10_007	TO->FROM	'BECKHAM CO 230.00 - WHEELER 6 230.00 230KV CKT 1'	349.1	0.12242	107.0373	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_047	TO->FROM	'BECKHAM CO 230.00 - WHEELER 6 230.00 230KV CKT 1'	349.1	0.0862	107.0373	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_110	TO->FROM	'BECKHAM CO 230.00 - WHEELER 6 230.00 230KV CKT 1'	349.1	0.0862	107.0373	'DBL-HITCH-WOOD
FCITC	2	0	10G	G10_014	TO->FROM	'BECKHAM CO 230.00 - WHEELER 6 230.00 230KV CKT 1'	349.1	0.0862	107.0373	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_028	TO->FROM	'BECKHAM CO 230.00 - WHEELER 6 230.00 230KV CKT 1'	349.1	0.0862	107.0373	'DBL-HITCH-WOOD
FCITC	2	0	10G	G10_007	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.02767	106.9046	'WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G08_047	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.04594	106.9046	'WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G08_110	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.04594	106.9046	'WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G10_014	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.04594	106.9046	'WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G08_028	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.04594	106.9046	'WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1'
FCITC	7	0	10G	G09_030	FROM->TO	'CARTER JCT - LAKE CREEK 69KV CKT 1	34.4	0.02915	106.8144	'CAN_GAS4 138.00 - HINTON 138KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.06233	106.772	'ELK CITY - RHWIND4 138.00 138KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.06574	106.6835	'CEDARDALE - OKEENE 138KV CKT 1
FCITC	3	0	10G	G09_059	TO->FROM	'MEDICINE LODGE - SUN CITY 115KV CKT 1	127.1	0.12053	106.5873	'DBL-SPRVL-COM
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1	172.2	0.03325	106.5391	'KILDARE4 - WHITE EAGLE 138KV CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.05913	106.4407	'SOONER 138/22.0KV TRANSFORMER CKT 1'

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.06635	106.269	'MOORELAND - MOREWOOD SW 138KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.06329	106.2646	'DEWEY - SOUTHARD 138KV CKT 1'
FCITC	3	0	10G	G09_020	FROM->TO	'ST JOHN - ST_JOHN 115KV CKT 1'	85.4	0.05793	106.1733	'DBL-SPRVL-COM
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1'	122.8	0.06576	106.1306	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	8	0	10G	G10_005	FROM->TO	'G07-25 345.00 - G07-25T 345.00 345KV CKT 1'	417.5	0.99157	106.0741	'G10-05 345.00 345/34.5KV TRANSFORMER CKT 1'
FCITC	8	0	10G	G10_005	FROM->TO	'G07-25 345.00 - G07-25T 345.00 345KV CKT 1'	417.5	0.99157	106.0741	'G10-05 345.00 345/34.5KV TRANSFORMER CKT 1'
FCITC	8	0	10G	G10_005	FROM->TO	'G07-25 345.00 - G07-25T 345.00 345KV CKT 1'	417.5	0.99157	106.0741	'G10-05 34.500 34.5/0.69KV TRANSFORMER CKT 1'
FCITC	8	0	10G	G10_005	FROM->TO	'G07-25 345.00 - G07-25T 345.00 345KV CKT 1'	417.5	0.99157	106.0741	'G10-05 34.500 34.5/0.69KV TRANSFORMER CKT 1'
FCITC	3	0	10G	G10_015	FROM->TO	'GREENSBURG - SUN CITY 115KV CKT 1'	128.8	0.04406	106.0652	'DBL-SPRVL-COM
FCITC	3	0	10G	G09_059	FROM->TO	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	168.2	0.11869	106.0272	'DBL-SPRVL-COM
FCITC	1	0	10G	G10_008	FROM->TO	'OKEENE - WATONGA SW 69KV CKT 1	46.3	0.03421	106.0247	'DOVER SW - OKEENE 138KV CKT 1'
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1	172.2	0.10742	105.9745	'G08-38T 138.00 - SHIDLER 138KV CKT 1'
FCITC	7	0	10G	G09_030	FROM->TO	'CARTER JCT - LAKE CREEK 69KV CKT 1	34.4	0.02915	105.9423	'CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.0653	105.9377	'DOVER SW - HENESSEY 138KV CKT 1'
FCITC	2	0	10G	G10_007	FROM->TO	'G10-07T 115.00 - RIVERVIEW INTERCHANGE 115KV CKT 1'	157.9	0.5416	105.912	'PRINGLE INTERCHANGE 230/115KV TRANSFORMER CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1'	122.8	0.05216	105.9097	'WOODRING (WOODRNG2) 345/138/13.8KV TRANSFORMER CKT 1'
FCITC	7	0	10G	G09_030	TO->FROM	'HYDRO - WEATHERFORD 138KV CKT 1	177.8	0.99579	105.9059	'CLINTON JUNCTION - G07-32T 138.00 138KV CKT 1'
FCITC	0	0	14SP	G08_022	FROM->TO	'ROOSEVELT COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1'	289.3	0.03793	105.869	'OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G10_007	FROM->TO	'G10-07T 115.00 - RIVERVIEW INTERCHANGE 115KV CKT 1'	157.9	0.42817	105.7767	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_047	FROM->TO	'G10-07T 115.00 - RIVERVIEW INTERCHANGE 115KV CKT 1'	157.9	0.0281	105.7767	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_110	FROM->TO	'G10-07T 115.00 - RIVERVIEW INTERCHANGE 115KV CKT 1'	157.9	0.0281	105.7767	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G10_014	FROM->TO	'G10-07T 115.00 - RIVERVIEW INTERCHANGE 115KV CKT 1'	157.9	0.0281	105.7767	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_028	FROM->TO	'G10-07T 115.00 - RIVERVIEW INTERCHANGE 115KV CKT 1'	157.9	0.0281	105.7767	'DBL-HITCH-WOOD'
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1	172.2	0.06944	105.7764	'BASE CASE'
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.05759	105.758	'ALVA - KNOBHILL 69KV CKT 1
FCITC	0	0	14SP	G10_007	FROM->TO	'EAST PLANT INTERCHANGE - MANHATTAN SUB 115KV CKT 1'	151.8	0.03932	105.6717	'EAST PLANT INTERCHANGE - PIERCE STREET TAP 115KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.06298	105.6439	'EL RENO - ROMAN NOSE 138KV CKT 1'
FCITC	0	0	14SP	G10_010	TO->FROM	'ONEILL 7 115.00 - SPENCER7 115.00 115KV CKT 1'	112.4	0.0613	105.5468	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'
FCITC	0	0	14SP	G06_044N02	TO->FROM	'ONEILL 7 115.00 - SPENCER7 115.00 115KV CKT 1'	112.4	0.0613	105.5468	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'
FCITC	3	0	10G	G10_015	FROM->TO	'GREENSBURG - SUN CITY 115KV CKT 1'	128.8	0.02929	105.5193	'DBL-COM-MEDLO
FCITC	5	0	10G	ASGI_11	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	350.6	0.06124	105.4983	'TOLK STATION WEST 230/24.0KV TRANSFORMER CKT 1'
FCITC	5	0	10G	G08_047	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	350.6	0.04717	105.4983	'TOLK STATION WEST 230/24.0KV TRANSFORMER CKT 1'
FCITC	5	0	10G	G08_028	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	350.6	0.04717	105.4983	'TOLK STATION WEST 230/24.0KV TRANSFORMER CKT 1'
FCITC	5	0	10G	G10_009	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	350.6	0.02673	105.4983	'TOLK STATION WEST 230/24.0KV TRANSFORMER CKT 1'
FCITC	5	0	10G	G10_007	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	350.6	0.06831	105.4983	'TOLK STATION WEST 230/24.0KV TRANSFORMER CKT 1'

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	5	0	10G	G08_110	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	350.6	0.04717	105.4983	'TOLK STATION WEST 230/24.0KV TRANSFORMER CKT 1'
FCITC	5	0	10G	G08_088	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	350.6	0.05786	105.4983	'TOLK STATION WEST 230/24.0KV TRANSFORMER CKT 1'
FCITC	5	0	10G	G10_014	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	350.6	0.04717	105.4983	'TOLK STATION WEST 230/24.0KV TRANSFORMER CKT 1'
FCITC	5	0	10G	G09_062	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	350.6	0.02614	105.4983	'TOLK STATION WEST 230/24.0KV TRANSFORMER CKT 1'
FCITC	0	0	14WP	G09_060	TO->FROM	'LAKE CREEK - LONEWOLF 69KV CKT 1	48	0.62459	105.4474	'MOUNTAIN VIEW - PINE RIDGE 69KV CKT 1
FCITC	2	0	10G	G10_007	TO->FROM	'PALO DURO SUB - RANDALL COUNTY INTERCHANGE 115KV CKT 1'	99	0.03171	105.3764	'DBL-HITCH-WOOD'
FCITC	1	0	10G	G10_008	FROM->TO	'CANTON - OKEENE 69KV CKT 1	47.2	0.03425	105.2797	'CEDARDALE - MOORELAND 138KV CKT 1
FCITC	2	0	10G	G08_047	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	147	0.02558	105.2228	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G08_110	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	147	0.02558	105.2228	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G10_014	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	147	0.02558	105.2228	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G08_028	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	147	0.02558	105.2228	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G10_007	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.02992	105.2026	'IODINE - WWRDEHV4 138.00 138KV CKT 1'
FCITC	2	0	10G	G08_047	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.0484	105.2026	'IODINE - WWRDEHV4 138.00 138KV CKT 1'
FCITC	2	0	10G	G08_110	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.0484	105.2026	'IODINE - WWRDEHV4 138.00 138KV CKT 1'
FCITC	2	0	10G	G10_014	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.0484	105.2026	'IODINE - WWRDEHV4 138.00 138KV CKT 1'
FCITC	2	0	10G	G08_028	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.0484	105.2026	'IODINE - WWRDEHV4 138.00 138KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1'	122.8	0.06953	105.1489	'WWRDEHV7 345.00 (WWDEHV-T) 345/138/13.8KV TRANSFORMER CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1'	122.8	0.06953	105.1489	'WWRDEHV7 345.00 (WWDEHV-T2) 345/138/13.8KV TRANSFORMER CKT 2'
FCITC	2	0	10G	G10_007	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	351	0.07131	105.0505	'TOLK STATION WEST 230/24.0KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G08_047	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	351	0.05017	105.0505	'TOLK STATION WEST 230/24.0KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G08_110	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	351	0.05017	105.0505	'TOLK STATION WEST 230/24.0KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G10_014	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	351	0.05017	105.0505	'TOLK STATION WEST 230/24.0KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G08_028	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	351	0.05017	105.0505	'TOLK STATION WEST 230/24.0KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G10_007	TO->FROM	'HARRNG_EST6 230.00 - PRINGLE INTERCHANGE 230KV CKT 1'	238.8	0.13255	104.8992	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_047	TO->FROM	'HARRNG_EST6 230.00 - PRINGLE INTERCHANGE 230KV CKT 1'	238.8	0.07488	104.8992	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_110	TO->FROM	'HARRNG_EST6 230.00 - PRINGLE INTERCHANGE 230KV CKT 1'	238.8	0.07488	104.8992	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G10_014	TO->FROM	'HARRNG_EST6 230.00 - PRINGLE INTERCHANGE 230KV CKT 1'	238.8	0.07488	104.8992	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_028	TO->FROM	'HARRNG_EST6 230.00 - PRINGLE INTERCHANGE 230KV CKT 1'	238.8	0.07488	104.8992	'DBL-HITCH-WOOD'
FCITC	0	0	14SP	G09_060	TO->FROM	'LAKE CREEK - LONEWOLF 69KV CKT 1	47.6	0.46607	104.7942	'CORDELL - GOTEBO 69KV CKT 1
FCITC	0	0	14SP	G10_007	FROM->TO	'MANHATTAN TAP - OSAGE SWITCHING STATION 115KV CKT 1'	159.2	0.0294	104.7585	'EAST PLANT INTERCHANGE - PIERCE STREET TAP 115KV CKT 1'
FCITC	3	0	10G	G10_009	FROM->TO	'GREENSBURG - SUN CITY 115KV CKT 1	128.8	0.03436	104.7191	'DBL-SPRVL-COM

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	6	0	10G	G09_067S	FROM->TO	'PLANT X STATION 230/115KV TRANSFORMER CKT 1'	237.3	0.05807	104.6927	'LAMB COUNTY INTERCHANGE - TOLK STATION WEST 230KV CKT 1'
FCITC	6	0	10G	G08_022	FROM->TO	'PLANT X STATION 230/115KV TRANSFORMER CKT 1'	237.3	0.07822	104.6927	'LAMB COUNTY INTERCHANGE - TOLK STATION WEST 230KV CKT 1'
FCITC	6	0	10G	G09_067S	FROM->TO	'PLANT X STATION 230/115KV TRANSFORMER CKT 1'	237.3	0.05807	104.6927	'LAMB COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1'
FCITC	6	0	10G	G08_022	FROM->TO	'PLANT X STATION 230/115KV TRANSFORMER CKT 1'	237.3	0.07822	104.6927	'LAMB COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1'
FCITC	3	0	10G	G10_016	FROM->TO	'GREENSBURG - SUN CITY 115KV CKT 1'	128.8	0.03502	104.6615	'DBL-SPRVL-COM
FCITC	3	0	10G	G09_059	TO->FROM	'MEDICINE LODGE - SUN CITY 115KV CKT 1	127.1	0.12053	104.6212	'DBL-SPRVL-COM
FCITC	3	0	10G	G09_059	FROM->TO	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	168.2	0.11869	104.5706	'DBL-SPRVL-COM
FCITC	2	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.06634	104.5168	'DBL-COM-MEDLO
FCITC	3	0	10G	G09_062	FROM->TO	'GREENSBURG - SUN CITY 115KV CKT 1'	128.8	0.05917	104.5066	'DBL-SPRVL-COM
FCITC	1	0	10G	G10_008	TO->FROM	'CANTON - TALOGA 69KV CKT 1	38.6	0.03017	104.4842	'ROMAN NOSE - SOUTHARD 138KV CKT 1'
FCITC	3	0	10G	G10_015	FROM->TO	'G01-39AT 115.00 - GREENSBURG 115KV CKT 1'	128.8	0.02929	104.4705	'DBL-COM-MEDLO
FCITC	3	0	10G	G09_062	FROM->TO	'G01-39AT 115.00 - GREENSBURG 115KV CKT 1'	128.8	0.05093	104.4697	'DBL-COM-MEDLO
FCITC	0	0	14SP	G09_060	TO->FROM	'LAKE CREEK - LONEWOLF 69KV CKT 1	47.6	0.62458	104.4409	'MOUNTAIN VIEW - PINE RIDGE 69KV CKT 1
FCITC	3	0	10G	G10_015	FROM->TO	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	168.2	0.05865	104.4174	'DBL-SPRVL-COM
FCITC	7	0	10G	G09_030	FROM->TO	'CARTER JCT - LAKE CREEK 69KV CKT 1	34.4	0.0447	104.4032	'HYDRO - WEATHERFORD 138KV CKT 1
FCITC	2	0	10G	G10_007	TO->FROM	'CLINTON JUNCTION - ELK CITY 138KV CKT 1	169.2	0.04709	104.3947	'CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
FCITC	2	0	10G	G08_047	TO->FROM	'CLINTON JUNCTION - ELK CITY 138KV CKT 1	169.2	0.02654	104.3947	'CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
FCITC	2	0	10G	G08_110	TO->FROM	'CLINTON JUNCTION - ELK CITY 138KV CKT 1	169.2	0.02654	104.3947	'CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
FCITC	2	0	10G	G10_014	TO->FROM	'CLINTON JUNCTION - ELK CITY 138KV CKT 1	169.2	0.02654	104.3947	'CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
FCITC	2	0	10G	G08_028	TO->FROM	'CLINTON JUNCTION - ELK CITY 138KV CKT 1	169.2	0.02654	104.3947	'CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
FCITC	0	0	14SP	G08_022	FROM->TO	'OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1'	284.3	0.03887	104.3479	'ROOSEVELT COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'	129.5	0.77076	104.267	'HOLCOMB (HOLCOMB) 345/115/13.8KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G10_007	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.02992	104.2022	'DEWEY - IODINE 138KV CKT 1'
FCITC	2	0	10G	G08_047	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.0484	104.2022	'DEWEY - IODINE 138KV CKT 1'
FCITC	2	0	10G	G08_110	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.0484	104.2022	'DEWEY - IODINE 138KV CKT 1'
FCITC	2	0	10G	G10_014	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.0484	104.2022	'DEWEY - IODINE 138KV CKT 1'
FCITC	2	0	10G	G08_028	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.0484	104.2022	'DEWEY - IODINE 138KV CKT 1'
FCITC	7	0	10G	G09_030	FROM->TO	'CARTER JCT - LAKE CREEK 69KV CKT 1	34.4	0.0447	104.1125	'HYDRO - SICKLES 138KV CKT 1
FCITC	3	0	10G	G09_020	FROM->TO	'ST JOHN - ST_JOHN 115KV CKT 1'	85.4	0.04574	104.1123	'CIRCLE - HUTCHINSON ENERGY CENTER 115KV CKT 1
FCITC	3	0	10G	G10_009	FROM->TO	'G01-39AT 115.00 - GREENSBURG 115KV CKT 1'	128.8	0.02583	104.0536	'DBL-COM-MEDLO
FCITC	2	0	10G	G10_007	TO->FROM	'PALO DURO SUB - RANDALL COUNTY INTERCHANGE 115KV CKT 1'	99	0.03813	104.0109	'G07-48T 230.00 - SWISHER COUNTY INTERCHANGE 230KV CKT 1'
FCITC	2	0	10G	G10_007	TO->FROM	'CLINTON JUNCTION - ELK CITY 138KV CKT 1	169.2	0.04248	103.866	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G08_047	TO->FROM	'CLINTON JUNCTION - ELK CITY 138KV CKT 1	169.2	0.02701	103.866	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G08_110	TO->FROM	'CLINTON JUNCTION - ELK CITY 138KV CKT 1	169.2	0.02701	103.866	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G10_014	TO->FROM	'CLINTON JUNCTION - ELK CITY 138KV CKT 1	169.2	0.02701	103.866	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G08_028	TO->FROM	'CLINTON JUNCTION - ELK CITY 138KV CKT 1	169.2	0.02701	103.866	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	5	0	10G	G08_088	TO->FROM	'DEAF SMITH COUNTY INTERCHANGE - G06-39T 230.00 230KV CKT 1'	350.6	0.05786	103.8386	'TOLK STATION WEST 230/24.0KV TRANSFORMER CKT 1'
FCITC	0	0	14SP	G10_010	FROM->TO	'FTRANDL4 230.00 230/115KV TRANSFORMER CKT 1	126.1	0.03256	103.7974	'FTRANDL4 230.00 230/115KV TRANSFORMER CKT 2
FCITC	2	0	10G	G08_088	FROM->TO	'SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1'	68	0.02641	103.7837	'BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1'
FCITC	2	0	10G	G08_088	FROM->TO	'SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1'	68	0.02641	103.7837	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'
FCITC	0	0	14SP	G06_044N02	FROM->TO	'FTRANDL4 230.00 230/115KV TRANSFORMER CKT 1	126.1	0.03256	103.7716	'FTRANDL4 230.00 230/115KV TRANSFORMER CKT 2
FCITC	2	0	10G	G10_015	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.05044	103.7571	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	2	0	10G	ASGI_11	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.05139	103.7571	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G08_047	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.06192	103.7571	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G09_067S	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.0335	103.7571	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G08_028	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.06192	103.7571	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G08_022	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.03361	103.7571	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G10_009	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.05029	103.7571	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G10_007	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.04206	103.7571	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G09_059	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.04769	103.7571	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G08_110	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.06192	103.7571	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G08_088	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.03342	103.7571	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G09_020	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.03472	103.7571	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G09_008	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.03213	103.7571	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G10_014	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.06192	103.7571	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G10_016	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.04294	103.7571	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G09_062	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.04742	103.7571	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.06555	103.6606	'DOVER SW - OKEENE 138KV CKT 1'
FCITC	3	0	10G	G10_009	FROM->TO	'GREENSBURG - SUN CITY 115KV CKT 1'	128.8	0.03436	103.652	'DBL-SPRVL-COM
FCITC	7	0	10G	G08_037	FROM->TO	'GEN08-037 138.00 - WASHITA 138KV CKT 1'	241.2	0.99368	103.6484	'BASE CASE'
FCITC	3	0	10G	G10_016	FROM->TO	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	168.2	0.0521	103.6385	'DBL-SPRVL-COM
FCITC	0	0	14SP	G10_010	FROM->TO	'FTRANDL7 115.00 - SPENCER7 115.00 115KV CKT 1'	118.9	0.0613	103.5251	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'
FCITC	2	0	10G	G10_007	TO->FROM	'CLINTON JUNCTION - ELK CITY 138KV CKT 1'	169.2	0.04709	103.5082	'CLINTON AIR FORCE BASE TAP - HOBART JUNCTION 138KV CKT 1'
FCITC	2	0	10G	G08_047	TO->FROM	'CLINTON JUNCTION - ELK CITY 138KV CKT 1'	169.2	0.02654	103.5082	'CLINTON AIR FORCE BASE TAP - HOBART JUNCTION 138KV CKT 1'
FCITC	2	0	10G	G08_110	TO->FROM	'CLINTON JUNCTION - ELK CITY 138KV CKT 1'	169.2	0.02654	103.5082	'CLINTON AIR FORCE BASE TAP - HOBART JUNCTION 138KV CKT 1'
FCITC	2	0	10G	G10_014	TO->FROM	'CLINTON JUNCTION - ELK CITY 138KV CKT 1'	169.2	0.02654	103.5082	'CLINTON AIR FORCE BASE TAP - HOBART JUNCTION 138KV CKT 1'
FCITC	2	0	10G	G08_028	TO->FROM	'CLINTON JUNCTION - ELK CITY 138KV CKT 1'	169.2	0.02654	103.5082	'CLINTON AIR FORCE BASE TAP - HOBART JUNCTION 138KV CKT 1'
FCITC	6	0	10G	G09_067S	FROM->TO	'PLANT X STATION 230/115KV TRANSFORMER CKT 1'	237.3	0.08065	103.4988	'TOLK STATION EAST - TUCO INTERCHANGE 230KV CKT 1'
FCITC	6	0	10G	G08_022	FROM->TO	'PLANT X STATION 230/115KV TRANSFORMER CKT 1'	237.3	0.09909	103.4988	'TOLK STATION EAST - TUCO INTERCHANGE 230KV CKT 1'
FCITC	3	0	10G	G10_015	TO->FROM	'CIRCLE - MULLERGREN 230KV CKT 1	317.4	0.11242	103.4932	'DBL-SPRVL-COM
FCITC	3	0	10G	G08_123N	TO->FROM	'CIRCLE - MULLERGREN 230KV CKT 1	317.4	0.03024	103.4932	'DBL-SPRVL-COM
FCITC	3	0	10G	G08_047	TO->FROM	'CIRCLE - MULLERGREN 230KV CKT 1	317.4	0.0254	103.4932	'DBL-SPRVL-COM

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	3	0	10G	G08_028	TO->FROM	'CIRCLE - MULLERGREN 230KV CKT 1	317.4	0.0254	103.4932	'DBL-SPRVL-COM
FCITC	3	0	10G	G10_009	TO->FROM	'CIRCLE - MULLERGREN 230KV CKT 1	317.4	0.09147	103.4932	'DBL-SPRVL-COM
FCITC	3	0	10G	G09_059	TO->FROM	'CIRCLE - MULLERGREN 230KV CKT 1	317.4	0.10203	103.4932	'DBL-SPRVL-COM
FCITC	3	0	10G	G08_110	TO->FROM	'CIRCLE - MULLERGREN 230KV CKT 1	317.4	0.0254	103.4932	'DBL-SPRVL-COM
FCITC	3	0	10G	G09_020	TO->FROM	'CIRCLE - MULLERGREN 230KV CKT 1	317.4	0.20542	103.4932	'DBL-SPRVL-COM
FCITC	3	0	10G	G09_008	TO->FROM	'CIRCLE - MULLERGREN 230KV CKT 1	317.4	0.14357	103.4932	'DBL-SPRVL-COM
FCITC	3	0	10G	G10_014	TO->FROM	'CIRCLE - MULLERGREN 230KV CKT 1	317.4	0.0254	103.4932	'DBL-SPRVL-COM
FCITC	3	0	10G	G10_016	TO->FROM	'CIRCLE - MULLERGREN 230KV CKT 1	317.4	0.10762	103.4932	'DBL-SPRVL-COM
FCITC	3	0	10G	G09_062	TO->FROM	'CIRCLE - MULLERGREN 230KV CKT 1	317.4	0.08968	103.4932	'DBL-SPRVL-COM
FCITC	0	0	14SP	G06_044N02	FROM->TO	'FTRANDL7 115.00 - SPENCER7 115.00 115KV CKT 1'	118.9	0.0613	103.4735	'COLMBUS4 230.00 - MADISONCNTY4230.00 230KV CKT 1'
FCITC	0	0	14SP	ASGI_10	FROM->TO	'ROOSEVELT COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1'	289.3	0.03217	103.351	'OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1'
FCITC	0	0	14SP	G09_067S	FROM->TO	'ROOSEVELT COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1'	289.3	0.03992	103.351	'OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1'
FCITC	0	0	14SP	G08_022	FROM->TO	'ROOSEVELT COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1'	289.3	0.03793	103.351	'OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G08_088	FROM->TO	'SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1'	68.4	0.02641	103.3229	'BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1'
FCITC	2	0	10G	G08_088	FROM->TO	'SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1'	68.4	0.02641	103.3229	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'
FCITC	5	0	10G	G08_088	FROM->TO	'SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1'	67.6	0.02602	103.2944	'BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1'
FCITC	5	0	10G	G08_088	FROM->TO	'SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1'	67.6	0.02602	103.2944	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'
FCITC	15	0	10G	G08_123N	FROM->TO	'GUIDE R7 115.00 - SUPEROR7 115.00 115KV CKT 1'	79.6	1	103.2663	'GEN08-123N 115.00 - PAULINE7 115.00 115KV CKT 1'
FCITC	3	0	10G	G10_015	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	281.3	0.0493	103.2589	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	3	0	10G	G10_011	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	281.3	0.09104	103.2589	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	3	0	10G	ASGI_11	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	281.3	0.05025	103.2589	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	3	0	10G	G08_044	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	281.3	0.09104	103.2589	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	3	0	10G	G08_047	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	281.3	0.06079	103.2589	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	3	0	10G	G09_067S	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	281.3	0.03237	103.2589	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	3	0	10G	G08_028	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	281.3	0.06079	103.2589	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	3	0	10G	G08_022	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	281.3	0.03248	103.2589	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	3	0	10G	G10_009	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	281.3	0.04916	103.2589	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	3	0	10G	G10_007	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	281.3	0.04093	103.2589	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	3	0	10G	G09_059	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	281.3	0.04655	103.2589	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	3	0	10G	G08_110	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	281.3	0.06079	103.2589	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	3	0	10G	G08_088	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	281.3	0.03228	103.2589	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	3	0	10G	G09_020	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	281.3	0.03359	103.2589	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	3	0	10G	G09_008	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	281.3	0.031	103.2589	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	3	0	10G	G10_014	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	281.3	0.06079	103.2589	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	3	0	10G	G10_016	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	281.3	0.0418	103.2589	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	3	0	10G	G09_062	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	281.3	0.04628	103.2589	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	3	0	10G	G10_009	FROM->TO	'G01-39AT 115.00 - GREENSBURG 115KV CKT 1'	128.8	0.02583	103.2514	'DBL-COM-MEDLO
FCITC	7	0	10G	G09_030	FROM->TO	'CARTER JCT - LAKE CREEK 69KV CKT 1	34.4	0.0447	103.2404	'BINGER NIJECT - SICKLES 138KV CKT 1
FCITC	2	0	10G	G10_011	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	147	0.03445	103.2069	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G08_044	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	147	0.03445	103.2069	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G08_047	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	147	0.02526	103.2069	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G08_028	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	147	0.02526	103.2069	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G10_008	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	147	0.06599	103.2069	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G08_110	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	147	0.02526	103.2069	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	2	0	10G	G10_014	TO->FROM	'EL RENO - ROMAN NOSE 138KV CKT 1'	147	0.02526	103.2069	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	3	0	10G	G09_059	TO->FROM	'CLEARWATER - MILAN TAP 138KV CKT 1	102.7	0.04698	103.135	'MED-LDG5 345.00 345/138KV TRANSFORMER CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'CANTON - TALOGA 69KV CKT 1	38.6	0.02968	103.1076	'PUTNAM - TALOGA 69KV CKT 1
FCITC	2	0	10G	G10_007	FROM->TO	'G07-48T 230.00 - SWISHER COUNTY INTERCHANGE 230KV CKT 1'	350.4	0.11156	103.0844	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_047	FROM->TO	'G07-48T 230.00 - SWISHER COUNTY INTERCHANGE 230KV CKT 1'	350.4	0.0789	103.0844	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_110	FROM->TO	'G07-48T 230.00 - SWISHER COUNTY INTERCHANGE 230KV CKT 1'	350.4	0.0789	103.0844	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G10_014	FROM->TO	'G07-48T 230.00 - SWISHER COUNTY INTERCHANGE 230KV CKT 1'	350.4	0.0789	103.0844	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_028	FROM->TO	'G07-48T 230.00 - SWISHER COUNTY INTERCHANGE 230KV CKT 1'	350.4	0.0789	103.0844	'DBL-HITCH-WOOD'
FCITC	3	0	10G	G10_015	TO->FROM	'CIRCLE - MULLERGREN 230KV CKT 1	317.4	0.11242	103.0675	'DBL-SPRVL-COM
FCITC	3	0	10G	G10_016	TO->FROM	'CIRCLE - MULLERGREN 230KV CKT 1	317.4	0.10762	103.0675	'DBL-SPRVL-COM
FCITC	2	0	10G	G10_007	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.9	0.1797	103.0425	'DBL-COM-MEDLO
FCITC	2	0	10G	G08_047	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.9	0.2144	103.0425	'DBL-COM-MEDLO
FCITC	2	0	10G	G08_110	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.9	0.2144	103.0425	'DBL-COM-MEDLO
FCITC	2	0	10G	G10_014	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.9	0.2144	103.0425	'DBL-COM-MEDLO
FCITC	2	0	10G	G08_028	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.9	0.2144	103.0425	'DBL-COM-MEDLO
FCITC	3	0	10G	G09_059	TO->FROM	'CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1'	89.2	0.84289	103.0305	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'
FCITC	11	0	10G	G09_040	FROM->TO	'G09-040TAP 115.00 - SMITTYVILLE N.M. COOP (NEMAHA MARSHALL R.E. 115KV CKT 1'	92	0.70788	103.0251	'WRTOD400'
FCITC	2	0	10G	G10_007	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.04128	102.9915	'SPP-SWPS-03b'
FCITC	2	0	10G	G08_047	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.04841	102.9915	'SPP-SWPS-03b'
FCITC	2	0	10G	G08_110	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.04841	102.9915	'SPP-SWPS-03b'
FCITC	2	0	10G	G10_014	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.04841	102.9915	'SPP-SWPS-03b'
FCITC	2	0	10G	G08_028	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.04841	102.9915	'SPP-SWPS-03b'
FCITC	3	0	10G	G10_009	FROM->TO	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	168.2	0.045	102.9548	'DBL-SPRVL-COM
FCITC	6	0	10G	G08_022	FROM->TO	'PLANT X STATION 230/115KV TRANSFORMER CKT 1'	237.3	0.09404	102.8706	'DEAF SMITH COUNTY INTERCHANGE - PLANT X STATION 230KV CKT 1'
FCITC	2	0	10G	ASGI_11	TO->FROM	'MOORE COUNTY INTERCHANGE E. - SHERMAN COUNTY TAP 115KV CKT 1'	118	0.29483	102.7558	'HITCHLAND 6 230.00 230/115KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G10_015	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.05356	102.7515	'DBL-COM-MEDLO
FCITC	2	0	10G	G10_011	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.05533	102.7515	'DBL-COM-MEDLO
FCITC	2	0	10G	ASGI_11	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.04844	102.7515	'DBL-COM-MEDLO
FCITC	2	0	10G	G08_044	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.05533	102.7515	'DBL-COM-MEDLO
FCITC	2	0	10G	G08_047	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.05814	102.7515	'DBL-COM-MEDLO
FCITC	2	0	10G	G09_067S	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.03278	102.7515	'DBL-COM-MEDLO
FCITC	2	0	10G	G08_028	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.05814	102.7515	'DBL-COM-MEDLO
FCITC	2	0	10G	G08_022	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.03285	102.7515	'DBL-COM-MEDLO
FCITC	2	0	10G	G10_009	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.05124	102.7515	'DBL-COM-MEDLO
FCITC	2	0	10G	G10_007	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.03984	102.7515	'DBL-COM-MEDLO
FCITC	2	0	10G	G09_059	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.04529	102.7515	'DBL-COM-MEDLO
FCITC	2	0	10G	G08_110	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.05814	102.7515	'DBL-COM-MEDLO
FCITC	2	0	10G	G08_088	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.03196	102.7515	'DBL-COM-MEDLO
FCITC	2	0	10G	G09_020	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.02743	102.7515	'DBL-COM-MEDLO
FCITC	2	0	10G	G09_008	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.02706	102.7515	'DBL-COM-MEDLO
FCITC	2	0	10G	G10_014	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.05814	102.7515	'DBL-COM-MEDLO
FCITC	2	0	10G	G10_016	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.04345	102.7515	'DBL-COM-MEDLO
FCITC	2	0	10G	G09_062	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.04622	102.7515	'DBL-COM-MEDLO
FCITC	7	0	10G	G09_030	FROM->TO	'CLINTON JUNCTION (CLINTJCT) 138/69/13.8KV TRANSFORMER CKT 1'	91.8	0.08932	102.735	'WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1'

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.06645	102.7303	'OGE3TERM9'
FCITC	7	0	10G	G09_030	FROM->TO	'CLINTON JUNCTION - CLINTON NATURAL GAS TAP 138KV CKT 1'	142.6	0.18232	102.6661	'WEATHERFORD WIND FARM 34 KV 34.5/0.575KV TRANSFORMER CKT 1'
FCITC	7	0	10G	G08_037	FROM->TO	'CLINTON JUNCTION - CLINTON NATURAL GAS TAP 138KV CKT 1'	142.6	0.02519	102.6661	'WEATHERFORD WIND FARM 34 KV 34.5/0.575KV TRANSFORMER CKT 1'
FCITC	7	0	10G	G09_060	FROM->TO	'CLINTON JUNCTION - CLINTON NATURAL GAS TAP 138KV CKT 1'	142.6	0.03539	102.6661	'WEATHERFORD WIND FARM 34 KV 34.5/0.575KV TRANSFORMER CKT 1'
FCITC	7	0	10G	G09_030	FROM->TO	'CARTER JCT - LAKE CREEK 69KV CKT 1	34.4	0.0447	102.659	'BINGER NIJECT - ONEY 138KV CKT 1
FCITC	7	0	10G	G09_030	FROM->TO	'CARTER JCT - LAKE CREEK 69KV CKT 1	34.4	0.0447	102.659	'ONEY - WASHITA 138KV CKT 1
FCITC	7	0	10G	G09_030	FROM->TO	'CLINTON JUNCTION (CLINTJCT) 138/69/13.8KV TRANSFORMER CKT 1'	91.9	0.08932	102.6232	'WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1'
FCITC	3	0	10G	G09_062	FROM->TO	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1'	330.2	0.09079	102.5866	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	3	0	10G	G09_062	FROM->TO	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'	330.2	0.09079	102.5866	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	5	0	10G	G08_088	FROM->TO	'SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1'	68.2	0.02602	102.5323	'BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1'
FCITC	5	0	10G	G08_088	FROM->TO	'SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1'	68.2	0.02602	102.5323	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G10_007	TO->FROM	'HAPPY INTERCHANGE - PALO DURO SUB 115KV CKT 1	99	0.03171	102.4471	'DBL-HITCH-WOOD
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1'	330.2	0.29746	102.4296	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	3	0	10G	G09_062	FROM->TO	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1'	330.2	0.09079	102.4296	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'	330.2	0.29746	102.4296	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	3	0	10G	G09_062	FROM->TO	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'	330.2	0.09079	102.4296	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	2	0	10G	G10_007	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.04123	102.4171	'GRAPEVINE INTERCHANGE - WHEELER 6 230.00 230KV CKT 1'
FCITC	2	0	10G	G08_047	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.0483	102.4171	'GRAPEVINE INTERCHANGE - WHEELER 6 230.00 230KV CKT 1'
FCITC	2	0	10G	G08_110	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.0483	102.4171	'GRAPEVINE INTERCHANGE - WHEELER 6 230.00 230KV CKT 1'
FCITC	2	0	10G	G10_014	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.0483	102.4171	'GRAPEVINE INTERCHANGE - WHEELER 6 230.00 230KV CKT 1'
FCITC	2	0	10G	G08_028	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1'	279.9	0.0483	102.4171	'GRAPEVINE INTERCHANGE - WHEELER 6 230.00 230KV CKT 1'
FCITC	2	0	10G	G10_007	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.04123	102.4171	'BECKHAM CO 230.00 - WHEELER 6 230.00 230KV CKT 1'
FCITC	2	0	10G	G08_047	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.0483	102.4171	'BECKHAM CO 230.00 - WHEELER 6 230.00 230KV CKT 1'
FCITC	2	0	10G	G08_110	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.0483	102.4171	'BECKHAM CO 230.00 - WHEELER 6 230.00 230KV CKT 1'
FCITC	2	0	10G	G10_014	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.0483	102.4171	'BECKHAM CO 230.00 - WHEELER 6 230.00 230KV CKT 1'
FCITC	2	0	10G	G08_028	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	279.9	0.0483	102.4171	'BECKHAM CO 230.00 - WHEELER 6 230.00 230KV CKT 1'
FCITC	2	0	10G	G10_007	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.04143	102.4058	'BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FCITC	2	0	10G	G08_047	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.0485	102.4058	'BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FCITC	2	0	10G	G08_110	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.0485	102.4058	'BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FCITC	2	0	10G	G10_014	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.0485	102.4058	'BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FCITC	2	0	10G	G08_028	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1	280.3	0.0485	102.4058	'BECKHAM CO 230.00 - ELK CITY 230KV 230KV CKT 1
FCITC	2	0	10G	G10_007	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.04143	102.4058	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G08_047	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.0485	102.4058	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	2	0	10G	G08_110	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.0485	102.4058	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G10_014	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.0485	102.4058	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G08_028	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.0485	102.4058	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'
FCITC	0	0	14SP	ASGI_10	FROM->TO	'ROOSEVELT COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1'	289.3	0.03217	102.4027	'OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G08_047	FROM->TO	'POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1'	558.5	0.19847	102.3843	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_110	FROM->TO	'POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1'	558.5	0.19847	102.3843	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G10_014	FROM->TO	'POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1'	558.5	0.19847	102.3843	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_028	FROM->TO	'POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1'	558.5	0.19847	102.3843	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_047	FROM->TO	'POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1'	558.6	0.19847	102.3838	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_110	FROM->TO	'POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1'	558.6	0.19847	102.3838	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G10_014	FROM->TO	'POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1'	558.6	0.19847	102.3838	'DBL-HITCH-WOOD'
FCITC	2	0	10G	G08_028	FROM->TO	'POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1'	558.6	0.19847	102.3838	'DBL-HITCH-WOOD'
FCITC	1	0	10G	G10_008	TO->FROM	'CANTON - TALOGA 69KV CKT 1	38.6	0.02968	102.3304	'HAMON BUTLER - PUTNAM 69KV CKT 1
FCITC	7	0	10G	G09_030	FROM->TO	'CLINTON JUNCTION (CLINTJCT) 138/69/13.8KV TRANSFORMER CKT 1'	91.8	0.08932	102.3108	'WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1'
FCITC	2	0	10G	ASGI_11	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.3032	102.2181	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_047	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.35235	102.2181	'DBL-HITCH-WOOD
FCITC	2	0	10G	G09_067S	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.12624	102.2181	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_028	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.35235	102.2181	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_022	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.13018	102.2181	'DBL-HITCH-WOOD
FCITC	2	0	10G	G10_009	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.59155	102.2181	'DBL-HITCH-WOOD
FCITC	2	0	10G	G10_007	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.26153	102.2181	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_110	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.35235	102.2181	'DBL-HITCH-WOOD
FCITC	2	0	10G	G08_088	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.21169	102.2181	'DBL-HITCH-WOOD
FCITC	2	0	10G	G10_014	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.35235	102.2181	'DBL-HITCH-WOOD
FCITC	2	0	10G	G09_062	FROM->TO	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1	1326.2	0.29001	102.2181	'DBL-HITCH-WOOD
FCITC	6	0	10G	G09_067S	TO->FROM	'SOUTH PLAINS REC-YUMA - WOLFFORTH INTERCHANGE 115KV CKT 1'	159.9	0.11135	102.2164	'TOLK STATION EAST - TUCO INTERCHANGE 230KV CKT 1'
FCITC	6	0	10G	G08_022	TO->FROM	'SOUTH PLAINS REC-YUMA - WOLFFORTH INTERCHANGE 115KV CKT 1'	159.9	0.09656	102.2164	'TOLK STATION EAST - TUCO INTERCHANGE 230KV CKT 1'
FCITC	0	0	14SP	G09_067S	FROM->TO	'ROOSEVELT COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1'	289.3	0.03992	102.2117	'OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1'
FCITC	7	0	10G	G09_030	FROM->TO	'CLINTON JUNCTION (CLINTJCT) 138/69/13.8KV TRANSFORMER CKT 1'	91.9	0.08932	102.1995	'WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1'
FCITC	3	0	10G	G09_059	TO->FROM	'CLEARWATER - MILAN TAP 138KV CKT 1	102.7	0.04698	102.186	'MED-LDG5 345.00 345/138KV TRANSFORMER CKT 1
FCITC	6	0	10G	G08_022	FROM->TO	'G06-39T 230.00 - POTTER COUNTY INTERCHANGE 230KV CKT 1'	350.2	0.28317	102.1847	'BUSHLAND INTERCHANGE - G06-39T 230.00 230KV CKT 1'
FCITC	0	0	14SP	G08_022	TO->FROM	'CURRY COUNTY INTERCHANGE - ROOSEVELT COUNTY INTERCHANGE 115KV CKT 2'	184.7	0.03111	102.1835	'OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1'
FCITC	7	0	10G	G09_030	FROM->TO	'CLINTON JUNCTION - CLINTON NATURAL GAS TAP 138KV CKT 1'	142.6	0.18232	102.1752	'WASHITA - WEATHERFORD WIND FARM 34 KV 34.5KV CKT 1'

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	7	0	10G	G08_037	FROM->TO	'CLINTON JUNCTION - CLINTON NATURAL GAS TAP 138KV CKT 1'	142.6	0.02519	102.1752	'WASHITA - WEATHERFORD WIND FARM 34 KV 34.5KV CKT 1'
FCITC	7	0	10G	G09_060	FROM->TO	'CLINTON JUNCTION - CLINTON NATURAL GAS TAP 138KV CKT 1'	142.6	0.03539	102.1752	'WASHITA - WEATHERFORD WIND FARM 34 KV 34.5KV CKT 1'
FCITC	7	0	10G	G09_030	FROM->TO	'CLINTON JUNCTION - CLINTON NATURAL GAS TAP 138KV CKT 1'	142.6	0.18232	102.1752	'WEATHERFORD WIND FARM 138/34.5KV TRANSFORMER CKT 1'
FCITC	7	0	10G	G08_037	FROM->TO	'CLINTON JUNCTION - CLINTON NATURAL GAS TAP 138KV CKT 1'	142.6	0.02519	102.1752	'WEATHERFORD WIND FARM 138/34.5KV TRANSFORMER CKT 1'
FCITC	7	0	10G	G09_060	FROM->TO	'CLINTON JUNCTION - CLINTON NATURAL GAS TAP 138KV CKT 1'	142.6	0.03539	102.1752	'WEATHERFORD WIND FARM 138/34.5KV TRANSFORMER CKT 1'
FCITC	7	0	10G	G09_030	TO->FROM	'CLINTON CITY - FOSS TAP 69KV CKT 1'	52.7	0.0908	102.1411	'CLINTON NATURAL GAS TAP - WEATHERFORD WIND FARM 138KV CKT 1'
FCITC	7	0	10G	G09_030	FROM->TO	'CARTER JCT - LAKE CREEK 69KV CKT 1	34.4	0.02609	102.1369	'MOORELAND - MOREWOOD SW 138KV CKT 1'
FCITC	1	0	10G	G10_008	FROM->TO	'CANTON - OKEENE 69KV CKT 1	47.2	0.03425	102.1017	'CEDARDALE - OKEENE 138KV CKT 1
FCITC	3	0	10G	G09_059	FROM->TO	'GREENSBURG - SUN CITY 115KV CKT 1'	128.8	0.10799	102.0577	'DBL-COM-MEDLO
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1'	122.8	0.06576	102.0429	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	7	0	10G	G09_030	TO->FROM	'SUNSHINE CANYON - TUTTLE 138KV CKT 1	141.1	0.05288	101.9804	'CIMARRON - G07-43T 345.00 345KV CKT 1'
FCITC	7	0	10G	G08_037	TO->FROM	'SUNSHINE CANYON - TUTTLE 138KV CKT 1	141.1	0.09386	101.9804	'CIMARRON - G07-43T 345.00 345KV CKT 1'
FCITC	7	0	10G	G09_060	TO->FROM	'SUNSHINE CANYON - TUTTLE 138KV CKT 1	141.1	0.05612	101.9804	'CIMARRON - G07-43T 345.00 345KV CKT 1'
FCITC	3	0	10G	G10_015	TO->FROM	'MEDICINE LODGE - SUN CITY 115KV CKT 1	127.1	0.04406	101.9764	'DBL-SPRVL-COM
FCITC	11	0	10G	G09_040	TO->FROM	'BAILEYVILLE N.M. STATION (NEMAHA MARSHALL R - SMITTYVILLE N.M. COOP (NEMAHA MARSHALL R.E. 115KV CKT 1'	92	0.70788	101.9382	'WRTOD400'
FCITC	3	0	10G	G09_062	FROM->TO	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	168.2	0.06567	101.9334	'DBL-SPRVL-COM
FCITC	0	0	14SP	G10_007	TO->FROM	'CHERRY SUB - NICHOLS STATION 115KV CKT 1	159.8	0.02735	101.8923	'NICHOLS STATION - WHITAKER SUB 115KV CKT 1
FCITC	3	0	10G	G10_009	FROM->TO	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	168.2	0.045	101.8847	'DBL-SPRVL-COM
FCITC	0	0	14SP	G10_007	FROM->TO	'EAST PLANT INTERCHANGE - PIERCE STREET TAP 115KV CKT 1'	159.9	0.03913	101.8734	'EAST PLANT INTERCHANGE - MANHATTAN SUB 115KV CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'CANTON - TALOGA 69KV CKT 1	38.6	0.02968	101.8122	'ARAPAHO - HAMON BUTLER 69KV CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'CANTON - TALOGA 69KV CKT 1	38.6	0.02968	101.8122	'ARAPAHO - INDUSTRIAL PARK 69KV CKT 1
FCITC	7	0	10G	G09_030	FROM->TO	'CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1'	184.9	0.37746	101.7974	'HYDRO - WEATHERFORD 138KV CKT 1
FCITC	0	0	14SP	G10_010	FROM->TO	'FTRANDL4 230.00 230/115KV TRANSFORMER CKT 2	133.1	0.03256	101.7878	'FTRANDL4 230.00 230/115KV TRANSFORMER CKT 1
FCITC	0	0	14SP	G06_044N02	FROM->TO	'FTRANDL4 230.00 230/115KV TRANSFORMER CKT 2	133.1	0.03256	101.7878	'FTRANDL4 230.00 230/115KV TRANSFORMER CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.06233	101.7827	'ELK CITY - RHWIND4 138.00 138KV CKT 1'
FCITC	0	0	14SP	ASGI_10	FROM->TO	'OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1'	284.3	0.03322	101.7176	'ROOSEVELT COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1'
FCITC	0	0	14SP	G09_067S	FROM->TO	'OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1'	284.3	0.04296	101.7176	'ROOSEVELT COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1'
FCITC	0	0	14SP	G08_022	FROM->TO	'OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1'	284.3	0.03887	101.7176	'ROOSEVELT COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1'
FCITC	3	0	10G	G09_062	FROM->TO	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1'	333.3	0.09079	101.6324	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	3	0	10G	G09_062	FROM->TO	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'	333.3	0.09079	101.6324	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	7	0	10G	G09_030	TO->FROM	'WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1'	209.2	0.37746	101.5887	'HYDRO - WEATHERFORD 138KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.05913	101.5214	'SOONER 138/22.0KV TRANSFORMER CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1'	333.3	0.29746	101.4769	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	3	0	10G	G09_062	FROM->TO	'SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1'	333.3	0.09079	101.4769	'MULLERGREN - SPEARVILLE 230KV CKT 1'

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	3	0	10G	G09_059	FROM->TO	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'	333.3	0.29746	101.4769	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	3	0	10G	G09_062	FROM->TO	'SPEARVILLE (SPEARVL2) 345/230/13.8KV TRANSFORMER CKT 1'	333.3	0.09079	101.4769	'MULLERGREN - SPEARVILLE 230KV CKT 1'
FCITC	11	0	10G	G09_040	FROM->TO	'G09-040TAP 115.00 - SMITTYVILLE N.M. COOP (NEMAHA MARSHALL R.E. 115KV CKT 1'	92	0.70828	101.4269	'HOYT - JEFFERY ENERGY CENTER 345KV CKT 1'
FCITC	3	0	10G	G10_015	TO->FROM	'MEDICINE LODGE - SUN CITY 115KV CKT 1	127.1	0.02929	101.4232	'DBL-COM-MEDLO
FCITC	7	0	10G	G09_030	FROM->TO	'CLINTON JUNCTION - CLINTON NATURAL GAS TAP 138KV CKT 1'	142.6	0.18232	101.3899	'WEATHERFORD WIND FARM 34 KV 34.5/0.575KV TRANSFORMER CKT 1'
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1	172.2	0.09238	101.3856	'PS31TP 4 138.00 - WHITE EAGLE 138KV CKT 1'
FCITC	6	0	10G	G08_022	TO->FROM	'SOUTH PLAINS REC-YUMA - WOLFFORTH INTERCHANGE 115KV CKT 1'	159.9	0.06609	101.3302	'ALLEN SUB - LUBBOCK SOUTH INTERCHANGE 115KV CKT 1'
FCITC	7	0	10G	G09_030	FROM->TO	'CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1'	184.9	0.37746	101.3107	'HYDRO - SICKLES 138KV CKT 1
FCITC	11	0	10G	G09_008	FROM->TO	'SMOKYHLLS6 230.00 - SUMMIT 230KV CKT 1	317.9	0.31015	101.2696	'KNOLL345 345.00 345/230KV TRANSFORMER CKT 1
FCITC	2	0	10G	G10_007	TO->FROM	'HAPPY INTERCHANGE - PALO DURO SUB 115KV CKT 1'	99	0.03813	101.1826	'G07-48T 230.00 - SWISHER COUNTY INTERCHANGE 230KV CKT 1'
FCITC	7	0	10G	G09_030	TO->FROM	'WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1'	209.2	0.37746	101.1584	'HYDRO - SICKLES 138KV CKT 1'
FCITC	2	0	10G	G10_007	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.02851	101.1465	'WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G08_047	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.04678	101.1465	'WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G08_110	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.04678	101.1465	'WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G10_014	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.04678	101.1465	'WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1'
FCITC	2	0	10G	G08_028	TO->FROM	'FPL SWITCH - WOODWARD 138KV CKT 1'	280.3	0.04678	101.1465	'WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1'
FCITC	1	0	10G	G10_011	TO->FROM	'CLEO CORNER - GLASS MOUNTAIN 138KV CKT 1	147.7	0.02754	101.1372	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	1	0	10G	G08_044	TO->FROM	'CLEO CORNER - GLASS MOUNTAIN 138KV CKT 1	147.7	0.02754	101.1372	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'CLEO CORNER - GLASS MOUNTAIN 138KV CKT 1	147.7	0.0648	101.1372	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	6	0	10G	G09_067S	TO->FROM	'PLANT X STATION - TOLK STATION WEST 230KV CKT 1	496.9	0.27489	101.1265	'PLANT X STATION - TOLK STATION EAST 230KV CKT 2
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.06635	101.0964	'MOORELAND - MOREWOOD SW 138KV CKT 1'
FCITC	0	0	14SP	G08_022	FROM->TO	'EDDY COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1'	166.2	0.06807	101.0957	'CHAVES COUNTY INTERCHANGE - EDDY COUNTY INTERCHANGE 230KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'CANTON - TALOGA 69KV CKT 1	38.6	0.02968	101.035	'CORDELL - INDUSTRIAL PARK 69KV CKT 1
FCITC	7	0	10G	G09_030	TO->FROM	'HYDRO - WEATHERFORD 138KV CKT 1'	177.8	0.53561	101.0105	'WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1'	122.8	0.06953	100.9364	'WWRDEHV7 345.00 (WWDEHV-T2) 345/138/13.8KV TRANSFORMER CKT 2'
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1'	122.8	0.06953	100.9364	'WWRDEHV7 345.00 (WWDEHV-T) 345/138/13.8KV TRANSFORMER CKT 1'
FCITC	7	0	10G	G09_030	FROM->TO	'CLINTON JUNCTION - CLINTON NATURAL GAS TAP 138KV CKT 1'	142.6	0.18232	100.899	'WASHITA - WEATHERFORD WIND FARM 34 KV 34.5KV CKT 1'
FCITC	7	0	10G	G09_030	FROM->TO	'CLINTON JUNCTION - CLINTON NATURAL GAS TAP 138KV CKT 1'	142.6	0.18232	100.899	'WEATHERFORD WIND FARM 138/34.5KV TRANSFORMER CKT 1'
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1'	122.8	0.05216	100.8455	'WOODRING (WOODRNG2) 345/138/13.8KV TRANSFORMER CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'	129.5	0.72358	100.7754	'GRAY CO 345.00 - SPEARVILLE 345KV CKT 1
FCITC	0	0	14SP	G09_059	TO->FROM	'CUDAHY - G09-059TAP 115.00 115KV CKT 1'	129.5	0.99976	100.7498	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'
FCITC	0	0	14SP	G09_059	FROM->TO	'G08-79T 115.00 - JUDSON LARGE 115KV CKT 1'	129.5	0.99976	100.7498	'CUDAHY - G09-059TAP 115.00 115KV CKT 1'
FCITC	0	0	14SP	ASGI_10	FROM->TO	'OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1'	284.3	0.03322	100.737	'ROOSEVELT COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1'

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.05913	100.7192	'BASE CASE'
FCITC	7	0	10G	G09_030	FROM->TO	'ELK CITY (ELKCTY-4) 138/69/13.8KV TRANSFORMER CKT 1'	71.9	0.02752	100.6669	'CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1'
FCITC	7	0	10G	G09_030	FROM->TO	'ELK CITY (ELKCTY-4) 138/69/13.8KV TRANSFORMER CKT 1'	72	0.02752	100.666	'CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1'
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1	172.2	0.09238	100.6307	'MILLER - PS31TP 4 138.00 138KV CKT 1'
FCITC	3	0	10G	G10_009	TO->FROM	'MEDICINE LODGE - SUN CITY 115KV CKT 1	127.1	0.03436	100.6122	'DBL-SPRVL-COM
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.06329	100.6112	'DEWEY - SOUTHARD 138KV CKT 1'
FCITC	3	0	10G	G10_016	TO->FROM	'MEDICINE LODGE - SUN CITY 115KV CKT 1	127.1	0.03502	100.5539	'DBL-SPRVL-COM
FCITC	0	0	14SP	G09_067S	FROM->TO	'OASIS INTERCHANGE 230/115KV TRANSFORMER CKT 1'	284.3	0.04296	100.5484	'ROOSEVELT COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1'
FCITC	1	0	10G	G10_011	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	285.1	0.09092	100.5181	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	1	0	10G	G08_044	FROM->TO	'FPL SWITCH - MOORELAND 138KV CKT 1	285.1	0.09092	100.5181	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1
FCITC	8	0	10G	G08_071	TO->FROM	'4FAIRFAX 138.00 - AECI-FS-6&7 138.00 138KV CKT 1	172.2	0.09238	100.5145	'MILLER - SOONER 138KV CKT 1
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.05759	100.477	'ALVA - KNOBHILL 69KV CKT 1
FCITC	2	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1'	122.8	0.06668	100.4678	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	ASGI_11	TO->FROM	'G10-07T 115.00 - PRINGLE INTERCHANGE 115KV CKT 1'	92.9	0.08098	100.4166	'PRINGLE INTERCHANGE 230/115KV TRANSFORMER CKT 1'
FCITC	3	0	10G	G09_062	TO->FROM	'MEDICINE LODGE - SUN CITY 115KV CKT 1	127.1	0.05917	100.397	'DBL-SPRVL-COM
FCITC	6	0	10G	G09_067S	TO->FROM	'PLANT X STATION - TOLK STATION EAST 230KV CKT 2	496.9	0.27246	100.352	'PLANT X STATION - TOLK STATION WEST 230KV CKT 1
FCITC	11	0	10G	G09_040	TO->FROM	'BAILEYVILLE N.M. STATION (NEMAHA MARSHALL R - SMITTYVILLE N.M. COOP (NEMAHA MARSHALL R.E. 115KV CKT 1'	92	0.70828	100.3399	'HOYT - JEFFERY ENERGY CENTER 345KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'GREENSBURG - SUN CITY 115KV CKT 1'	128.8	0.10799	100.316	'DBL-COM-MEDLO
FCITC	1	0	10G	G10_008	TO->FROM	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1	122.8	0.0653	100.3088	'DOVER SW - HENESSEY 138KV CKT 1'
FCITC	11	0	10G	G09_040	FROM->TO	'BAILEYVILLE N.M. STATION (NEMAHA MARSHALL R - SOUTH SENECA 115KV CKT 1'	92	0.70788	100.3078	'WRTOD400'
FCITC	3	0	10G	G09_020	FROM->TO	'ST JOHN - ST_JOHN 115KV CKT 1'	85.4	0.05603	100.2829	'MED-LDG5 345.00 - WICHITA 345KV CKT 1
FCITC	3	0	10G	G09_020	FROM->TO	'ST JOHN - ST_JOHN 115KV CKT 1'	85.4	0.05603	100.2829	'MED-LDG5 345.00 - WICHITA 345KV CKT 2
FCITC	2	0	10G	G10_007	TO->FROM	'CLINTON JUNCTION - ELK CITY 138KV CKT 1'	169.2	0.04271	100.2813	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G08_047	TO->FROM	'CLINTON JUNCTION - ELK CITY 138KV CKT 1'	169.2	0.02724	100.2813	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G08_110	TO->FROM	'CLINTON JUNCTION - ELK CITY 138KV CKT 1'	169.2	0.02724	100.2813	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G10_014	TO->FROM	'CLINTON JUNCTION - ELK CITY 138KV CKT 1'	169.2	0.02724	100.2813	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	2	0	10G	G08_028	TO->FROM	'CLINTON JUNCTION - ELK CITY 138KV CKT 1'	169.2	0.02724	100.2813	'TATONGA EHV 345.00 - WWRDEHV7 345.00 345KV CKT 1'
FCITC	3	0	10G	G09_059	FROM->TO	'MEDICINE LODGE 138/115KV TRANSFORMER CKT 1	168.2	0.10083	100.2776	'DBL-COM-MEDLO
FCITC	1	0	10G	G10_015	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.17345	100.205	'DBL-COM-MEDLO
FCITC	1	0	10G	G10_011	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.43419	100.205	'DBL-COM-MEDLO
FCITC	1	0	10G	ASGI_11	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.18903	100.205	'DBL-COM-MEDLO
FCITC	1	0	10G	G08_044	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.43419	100.205	'DBL-COM-MEDLO
FCITC	1	0	10G	G08_047	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.20761	100.205	'DBL-COM-MEDLO
FCITC	1	0	10G	G09_067S	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.13753	100.205	'DBL-COM-MEDLO
FCITC	1	0	10G	G08_028	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.20761	100.205	'DBL-COM-MEDLO
FCITC	1	0	10G	G08_022	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.13846	100.205	'DBL-COM-MEDLO
FCITC	1	0	10G	G10_008	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.18062	100.205	'DBL-COM-MEDLO
FCITC	1	0	10G	G10_009	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.16879	100.205	'DBL-COM-MEDLO
FCITC	1	0	10G	G10_007	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.17292	100.205	'DBL-COM-MEDLO
FCITC	1	0	10G	G09_059	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.14582	100.205	'DBL-COM-MEDLO

APPENDIX H: DIS-2010-001 Powerflow Analysis (Constraints 3%+ TDF)

SOLUTIONTYPE	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT COMMON NAME	RATEB	TDF	TC%LOADING	CONTENGENCY NAME
FCITC	1	0	10G	G08_110	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.20761	100.205	'DBL-COM-MEDLO
FCITC	1	0	10G	G08_088	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.15563	100.205	'DBL-COM-MEDLO
FCITC	1	0	10G	G09_020	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.08259	100.205	'DBL-COM-MEDLO
FCITC	1	0	10G	G09_008	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.07993	100.205	'DBL-COM-MEDLO
FCITC	1	0	10G	G10_014	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.20761	100.205	'DBL-COM-MEDLO
FCITC	1	0	10G	G10_016	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.13747	100.205	'DBL-COM-MEDLO
FCITC	1	0	10G	G09_062	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.15096	100.205	'DBL-COM-MEDLO
FCITC	7	0	10G	G09_030	FROM->TO	'CAN_GAS4 138.00 - JENSEN ROAD 138KV CKT 1'	184.9	0.37746	100.0668	'BINGER NIJECT - SICKLES 138KV CKT 1
FCITC	7	0	10G	G09_030	TO->FROM	'WEATHERFORD JCT. - WEATHERFORD SOUTHEAST 138KV CKT 1'	209.2	0.37746	100.059	'BINGER NIJECT - SICKLES 138KV CKT 1'
FCITC	1	0	10G	G10_011	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.43419	100.0306	'DBL-COM-MEDLO
FCITC	1	0	10G	G08_044	TO->FROM	'NORTHWEST - TATONGA EHV 345.00 345KV CKT 1	1194.3	0.43419	100.0306	'DBL-COM-MEDLO

I: Stability Study for Group 1

R67-10

Draft Generator Interconnection Impact Study DISIS-2010-001 (Group 1)

Prepared for

Southwest Power Pool, Inc.

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Contents

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Section

1

Introduction

1.1 Background

Pursuant to the tariff and at the request of the Southwest Power Pool (SPP), Siemens PTI performed the following Impact Study to satisfy the Impact Study Agreement executed by the requesting customers and SPP. The requests for interconnection were placed with SPP in accordance to SPP's Open Access Transmission Tariff, which covers new generation interconnections on SPP's transmission system.

The purpose of this report is to present the results of the stability steady state and power factor analysis performed to evaluate the impact of the proposed DISIS-2010-001 cluster of interconnections with regard to Group 1 projects on the Southwest Power Pool system. Eventual indicative solutions to the identified issues are proposed based on the impact of each generation interconnection on the Southwest Power Pool system.

Three projects in this cluster are connected to two different Points of Interconnection (to be known hereafter as POI) at two different voltage levels 345 kV and 69 kV. Section 2 describes all proposed wind farm projects in detail.

Transient stability analysis was performed using the package provide by SPP. It contains the latest stability database in PSS®E version 30.3.3. The stability package also includes the dynamic data for the previously queued projects.

1.2 Purpose

The steady state and stability study was carried out to:

(a) Determine the ability of the proposed generation facilities to remain in synchronism and within applicable planning standards following system faults with unsuccessful reclosing.

(b) Determine the amount of reactive support required from the costumer to meet the power factor requirement at the POI.

(c) Determine the ability of the wind projects to meet FERC Order 661A (low voltage ride through and wind farm recovery to pre-fault voltage) without and, eventually, with additional reactive support.

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Section

2

Model Development

The study has considered the 2009 winter peak and 2010 summer peak load flow models provided by SPP with the required interconnection generations modeled. The base cases also contain all the significant previous queued generation interconnection projects in the interconnection queue.

2.1 Power Flow Data

The Group 1 of DISIS-2010-001 contains three proposed wind generation projects. Table 2-1 presents the size of the wind generation projects, the Wind Turbine Generator (WTGs) manufacturers, the reactive capability of the wind farm as well as the point of interconnection and the PSS®E bus numbers in the load flow models.

Table 2-1 Details of the Interconnection Requests

Request Size	(MW)	Wind Turbine Model	Reactive Capability of Wind Farm		Point of Interconnection
			Max (Mvar)	Min (Mvar)	
GEN-2008-044	197.8	Siemens SWT 2.3MW	95.78	-95.78	Tatonga 345kV (515378)
GEN-2010-008	64.4	Siemens SWT 2.3MW	20.0	-22.0	Fargo Jct 69kV (521196)
GEN-2010-011	29.7	Siemens SWT 9x2.3 plus 3x3.0 MW	2.88	-2.88	Addition to Gen-2008-044 34.5kV bus (576503)

The analysis was carried out using the database package provided by SPP which also includes the modeling data for the previously queued projects, as shown in Table 2-2:

Table 2-2 Details of the Prior Queued Interconnection Requests

Request	Size (MW)	Wind Turbine Model	Point of Interconnection
GEN-2001-014	94	Suzlon 2.1MW	Fort Supply 138kV (520920)
GEN-2001-037	102	GE 1.5MW	Woodward-Mooreland 138kV (515785)
GEN-2002-005	120	Acciona 1.5MW	Moorewood – Elk City 138kV (521116)

Request	Size (MW)	Wind Turbine Model	Point of Interconnection
GEN-2005-008	120	GE 1.5MW	Woodward 138kV (514785)
GEN-2006-024S	18.9	Suzlon 2.1MW	Buffalo Bear 69kV (521120)
GEN-2006-046	130	Mitsubishi 2.4MW	Dewey 138kV (514787)
GEN-2007-006	160	Suzlon 2.1MW	Roman Nose 138kV (514823)
GEN-2007-021	201	GE 1.5MW	Tatonga 345kV (515378)
GEN-2007-044	300	GE 1.5MW	Tatonga 345kV (515378)
GEN-2007-050	171	Siemens 2.3MW	Woodward 138kV (515376)
GEN-2007-051	200	GE 1.5MW	Mooreland 138kV (520999)
GEN-2007-062	765	GE 1.5MW	Woodward 345kV (515375)
GEN-2008-003	101	Siemens 2.3MW	Woodward 138kV (515376)
GEN-2008-019	300	Mitsubishi 2.4MW	Tatonga 345kV (515378)
GEN-2008-029	250	GE 1.5MW	Woodward 138kV (515376)

Figures 2-1 to 2-4 present the surrounding area of the Group 1 points of interconnection, showing the line flows and voltage profile for the load flow models considered in the study for summer and winter peak scenarios, respectively.

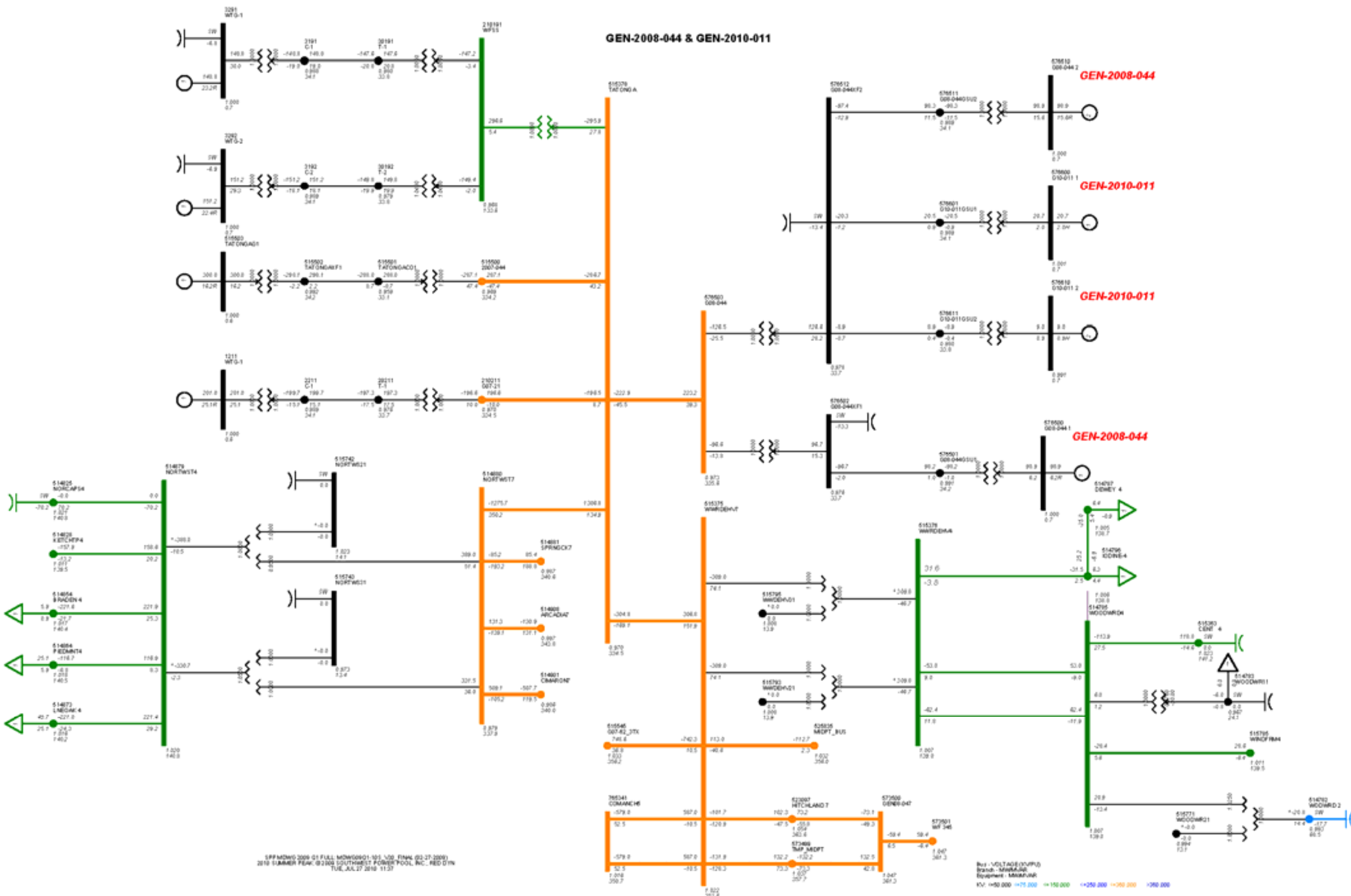

Figure 2-1 Group 1 Points of Interconnection Surrounding Area – Diagram 1 - Summer Peak

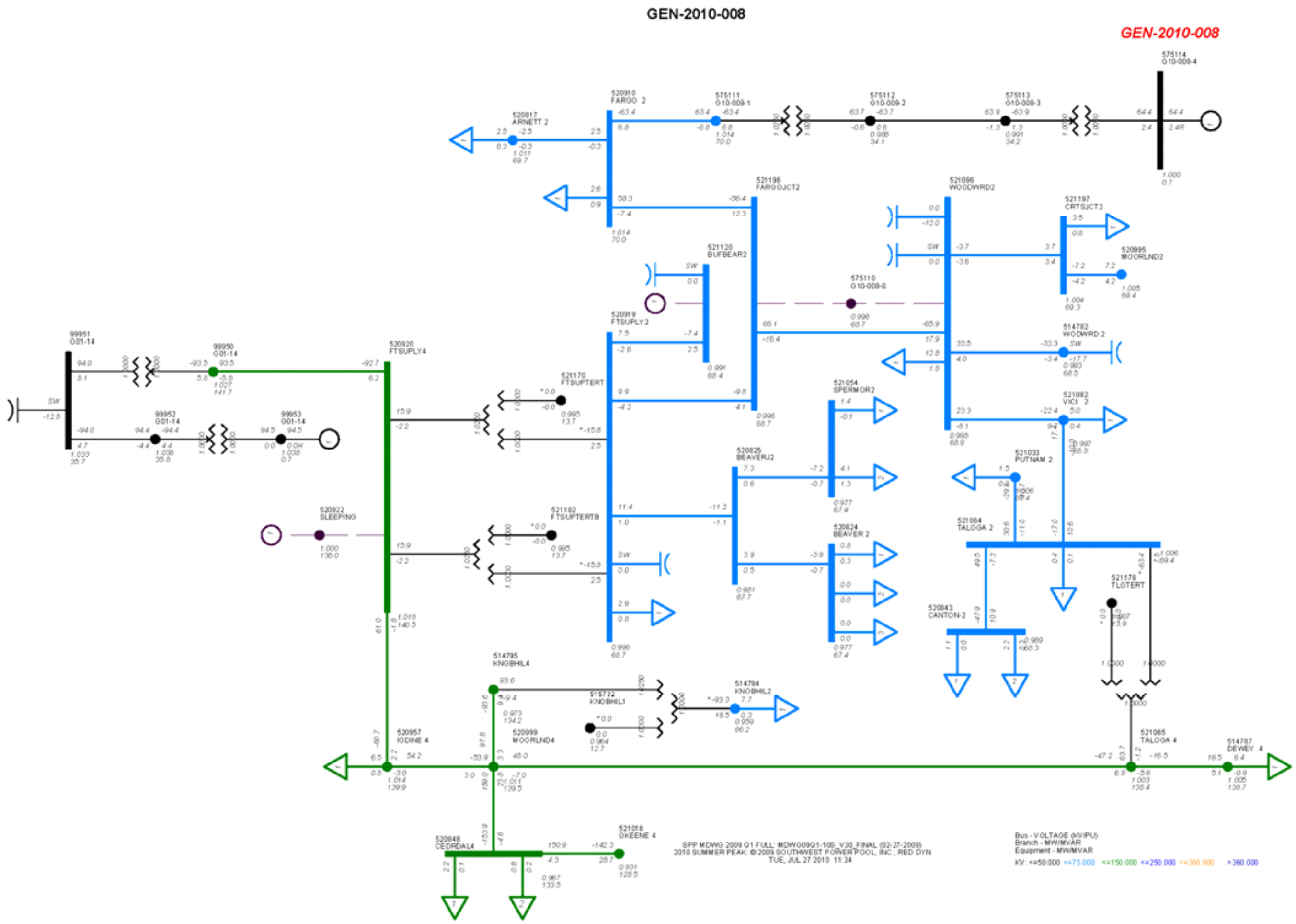

Figure 2-2 Group 1 Points of Interconnection Surrounding Area – Diagram 2 - Summer Peak

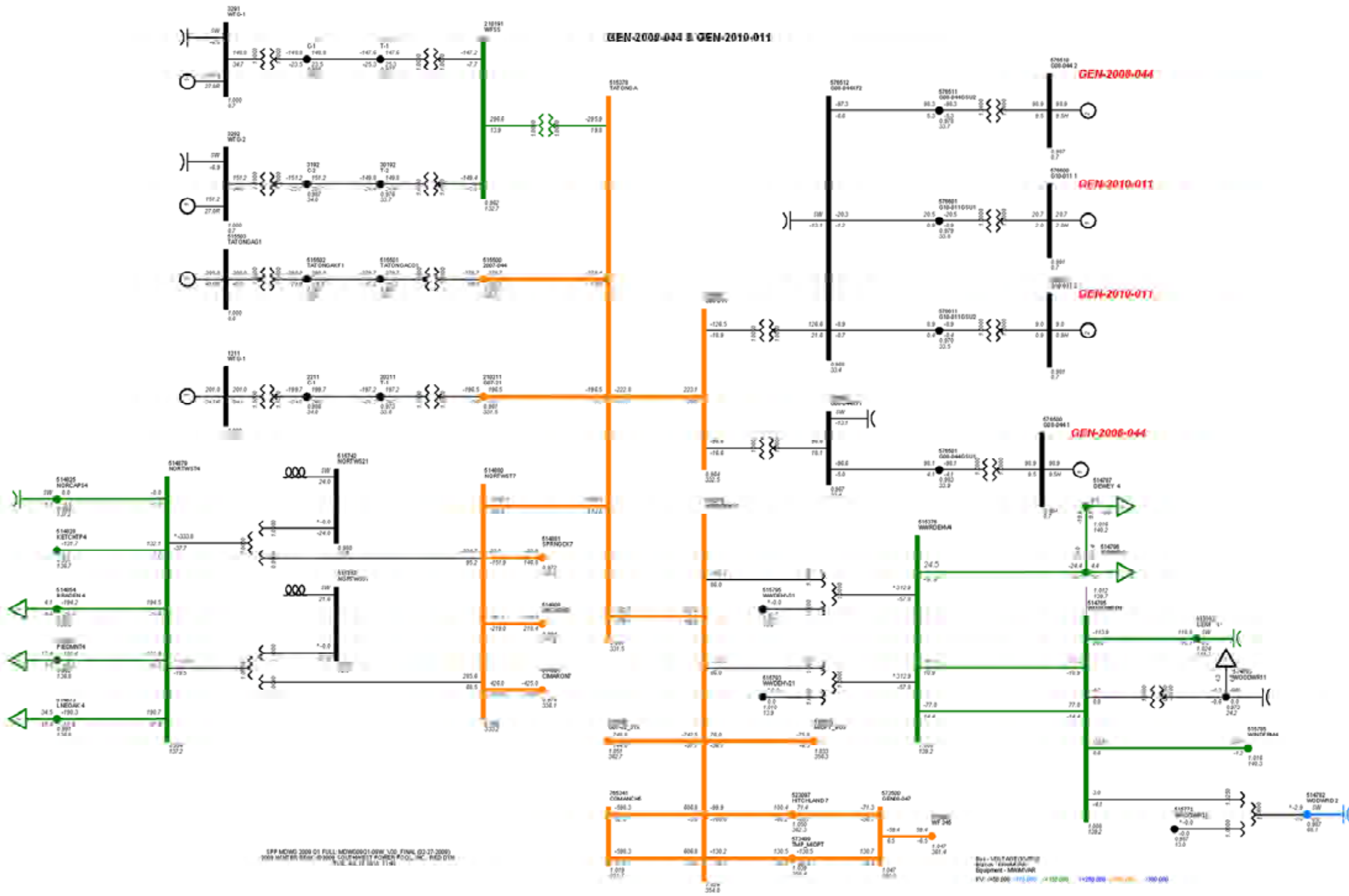

Figure 2-3 Group 1 Points of Interconnection Surrounding Area – Diagram 1 - Winter Peak

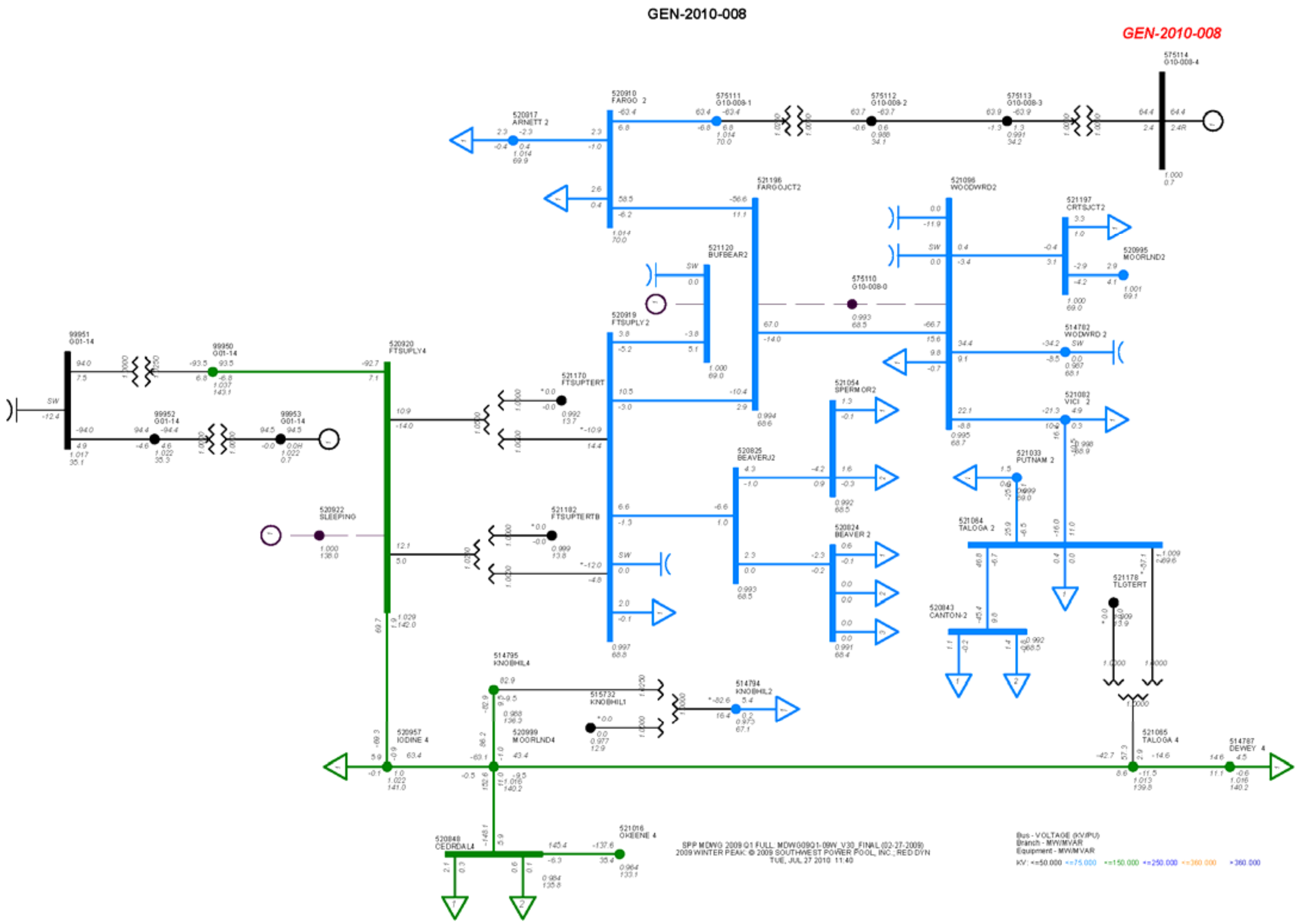

Figure 2-4 Group 1 Points of Interconnection Surrounding Area – Diagram 2 - Winter Peak

Appendix A presents the single line diagrams showing, for each of the Group 1 projects, the modeling details and impedance data of the transformers and collector systems.

2.2 Stability Database

The transient stability analysis was performed using the data provided by SPP. Stability models for the Group 1 interconnection requests were added to the dynamic database, based on the technical documentation given. All turbine parameters used in the simulation models are the default parameters in the wind turbine package. It is assumed that each wind turbine generators (WTGs) would be controlling the voltage of its own bus.

The default voltage protection model set points recommended by the manufacturer were used. The wind units were modeled with their built-in voltage ride through capability. Also, the default frequency protection model set points recommended by the manufacturer were used.

The PSS®E dynamic models output list is shown in Appendix B, documenting the model parameters of each one of the Group 1 wind turbines modeled in the stability study.

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Section

3

Methodology and Assumptions

The study considered the 2009 and 2010 power flow cases with the required interconnection generation requests modeled as described in Section 2. The base case also contains all the significant previous queued projects in the interconnection queue.

The monitored areas in this study are shown in Table 3-1.

Table 3-1 Areas of Interest

Area Number	Area Name
520	AEPW
524	OKGE
525	WFEC
526	SPS
531	MIDW
534	SUNC
536	WERE

3.1 Methodology

3.1.1 Steady State Simulations

3.1.1.1 N-1 Contingency Analysis

An N-1 contingency analysis was performed to evaluate voltage violations, if any, caused by disturbances (tripping of the faulted line). The voltages at each POI were monitored for deviations from the base case voltage and the percentage deviations were documented.

The summer peak and winter peak load flow cases were adjusted to ensure there are no relevant pre contingency voltage criteria violations. During contingency analysis it was reported voltages of any monitored bus found to be outside the range of the post-contingency criteria and having more than 1% of project impact.

3.1.1.2 Power Factor Analysis

The analysis will determine what power factor is necessary at the POI for each contingency.

If the required power factor at the POI is beyond the capability of the studied wind turbines to meet the requirement at the POI, capacitor banks will be considered.

A QV analysis was performed to determine the reactive support requirement at each project's POI. Mvar injections, tabulated for base case and contingency conditions, are used to determine the reactive power support required at each POI, in order to maintain the bus scheduled pre contingency voltages.

These tables are obtained through a series of AC load flow calculations. Starting with no reactive support at a bus, the voltage is computed for a series of power flows as the reactive support is changed in steps, until the power flow experiences convergence difficulties as the system approaches the voltage collapse point.

3.1.2 Stability Simulations

The dynamic simulations were performed using the PSS®E version 30.3.3 with the latest stability database provided by SPP. Three-phase faults and single-phase faults in the neighborhood of DISIS-2010-001 – Group 1 Points of interconnection were simulated. Any adverse impact on the system stability was documented and further investigated with appropriate solutions to determine whether a static or dynamic VAR device is required or not.

The Group 1 projects were also evaluated on the matter of ability to meet FERC Order 661A (low voltage ride through and wind farm recovery to pre-fault voltage) without and, eventually, with additional reactive support.

3.2 Disturbances for Stability Analysis

The faults simulated are single line to ground, and three phase faults. The fault clearing may include unsuccessful line reclosing. The complete fault clearing process includes either one of the following sequence of events:

Unsuccessful Reclosing

1) Line fault, cleared after 5 cycles by tripping the both line terminals

2) After 20 cycles the line is unsuccessful reclosed (reclosing under fault conditions)

3) The fault is cleared by tripping both ends of the faulted line again, 5 cycles later.

Normally Cleared

1) Line fault, cleared after 5 cycles by tripping both line terminals.

The disturbances evaluated along with corresponding clearing methods are listed in Table 3-2:

Table 3-2 Disturbances for Stability Analysis

Cont. No.	Cont. Name	Description
1	FLT01-3PH	3 phase fault on one of the Woodward (515375) to Tatonga (515378) 345kV lines, near Woodward. a. Apply fault at the Woodward 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
2	FLT02-1PH	*Single phase fault and sequence like previous*
3	FLT03-3PH	3 phase fault on the Woodward (515375) to Hitchland (523097) 345kV line, near Woodward. a. Apply fault at the Woodward 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
4	FLT04-1PH	*Single phase fault and sequence like previous*
5	FLT05-3PH	3 phase fault on one of the Woodward (515375) to Comanche (765341) 345kV line, near Woodward. a. Apply fault at the Woodward 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
6	FLT06-1PH	*Single phase fault and sequence like previous*
7	FLT07-3PH	3 phase fault on the Woodward 345kV (515375) to 138kV (515376) transformer, near the 345 kV bus. a. Apply fault at the Woodward 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
8	FLT08-1PH	*Single phase fault and sequence like previous*
9	FLT09-3PH	3 phase fault on the Northwest (514880) to Tatonga (515378) 345kV line, near Tatonga. a. Apply fault at the Tatonga 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
10	FLT10-1PH	*Single phase fault and sequence like previous*
11	FLT11-3PH	3 phase fault on the Northwest (514880) to Spring Creek (514881) 345kV line, near Northwest. a. Apply fault at the Northwest 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
12	FLT12-1PH	*Single phase fault and sequence like previous*

Cont. No.	Cont. Name	Description
13	FLT13-3PH	3 phase fault on the Northwest (514880) to Cimarron (514901) 345kV line, near Northwest. a. Apply fault at the Northwest 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
14	FLT14-1PH	*Single phase fault and sequence like previous*
15	FLT15-3PH	3 phase fault on Northwest 345kV (514880) to 138kV (514879) transformer T2, near the 345 kV bus. a. Apply fault at the Northwest 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
16	FLT16-1PH	*Single phase fault and sequence like previous*
17	FLT17-3PH	3 phase fault on the Woodward (515375) to GEN-2008-047 (573500) 345kV line, near GEN-2008-047. a. Apply fault at the GEN-2008-047 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
18	FLT18-1PH	*Single phase fault and sequence like previous*
19	FLT19-3PH	3 phase fault on the Northwest (514880) to Arcadia (514908) 345kV line, near Arcadia. a. Apply fault at the Arcadia 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
20	FLT20-1PH	*Single phase fault and sequence like previous*
21	FLT21-3PH	3 phase fault on the Woodward EHV (515376) to Iodine (514796) 138kV line, near Woodward EHV. a. Apply fault at the Woodward EHV 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
22	FLT22-1PH	*Single phase fault and sequence like previous*
23	FLT23-3PH	3 phase fault on the Woodward (514785) to GEN-2001-037 (515785) 138kV line, near Woodward. a. Apply fault at the Woodward 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
24	FLT24-1PH	*Single phase fault and sequence like previous*

Cont. No.	Cont. Name	Description
25	FLT25-3PH	3 phase fault on the Mooreland (520999) to GEN-2001-037 (515785) 138kV line, near Mooreland. a. Apply fault at the Mooreland 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
26	FLT26-1PH	*Single phase fault and sequence like previous*
27	FLT27-3PH	3 phase fault on the Mooreland (520999) to Glass Mountain (514788) 138kV line, near Mooreland. a. Apply fault at the Mooreland 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
28	FLT28-1PH	*Single phase fault and sequence like previous*
29	FLT29-3PH	3 phase fault on the Mooreland (520999) to Morewood (521001) 138kV line, near Mooreland. a. Apply fault at the Mooreland 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
30	FLT30-1PH	*Single phase fault and sequence like previous*
31	FLT31-3PH	3 phase fault on the Taloga (521065) to Dewey (514787) 138kV line, near Taloga. a. Apply fault at the Taloga 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
32	FLT32-1PH	*Single phase fault and sequence like previous*
33	FLT33-3PH	3 phase fault on the Dewey (514787) to Southard (514822) 138kV line, near Dewey. a. Apply fault at the Dewey 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
34	FLT34-1PH	*Single phase fault and sequence like previous*
35	FLT35-3PH	3 phase fault on the Woodward (515375) to Midpoint/Wheeler (525835) 345kV line, near Woodward. a. Apply fault at the Woodward 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
36	FLT36-1PH	*Single phase fault and sequence like previous*
37	FLT37-3PH	3 phase fault on the Hitchland (523097) 345kV to Hitchland (523095) 230kV transformer, 230 kV bus. a. Apply fault at the Hitchland 230kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.

Cont. No.	Cont. Name	Description
38	FLT38-3PH	3 phase fault on the Fargo Jct (521196) to Fargo (520910) 69kV line, near Fargo Jct. a. Apply fault at the Fargo Jct 69kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
39	FLT39-1PH	*Single phase fault and sequence like previous*
40	FLT40-3PH	3 phase fault on the Fargo Jct (521196) to Ft. Supply (520919) 69kV line, near Fargo Jct. a. Apply fault at the Fargo Jct 69kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
41	FLT41-1PH	*Single phase fault and sequence like previous*
42	FLT42-3PH	3 phase fault on the Mooreland (520999) to Knob Hill (514795) 138kV line, near Knob Hill. a. Apply fault at the Knob Hill 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
43	FLT43-1PH	*Single phase fault and sequence like previous*
44	FLT44-3PH	3 phase fault on the Mooreland (520999) to Cedardale (520848) 138kV line, near Cedardale. a. Apply fault at Cedardale 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
45	FLT45-1PH	*Single phase fault and sequence like previous*
46	FLT46-3PH	3 phase fault on the Mooreland (520999) to Iodine (520957) 138kV line, near Iodine. a. Apply fault at Iodine 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
47	FLT47-1PH	*Single phase fault and sequence like previous*
48	FLT48-3PH	3 phase fault on the Mooreland (520999) to Taloga (521065) 138kV line, near Taloga. a. Apply fault at Taloga 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
49	FLT49-1PH	*Single phase fault and sequence like previous*
50	FLT50-3PH	3 phase fault on one of the Ft. Supply (520919) 69kV to Ft. Supply (520920) 230kV transformer, 230 kV bus. a. Apply fault at the Ft. Supply 230kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.

Cont. No.	Cont. Name	Description
51	FLT51-3PH	3 phase fault on the Woodward (515375) to Comanche (765341) 345kV lines. a. Apply fault at the Woodward 345kV bus. b. Clear fault after 5 cycles and c. Woodward (515375) to Comanche (765341) 345kV line ckt 1 d. Woodward (515375) to Comanche (765341) 345kV line ckt 2

In order to simulate single line to ground faults, equivalent reactances were determined to be applied at the buses. Table 3-3 presents the values obtained for the summer and winter peak cases.

Table 3-3 Equivalent Reactances – Line to Ground Faults

BUS	Equivalent Reactance (Mvar)	
	WP	SP
515375	5900	6300
515378	3000	3300
514880	6900	8500
573500	3000	3100
514908	7200	8200
515376	3600	4100
514785	3500	4000
520999	2700	2900
521065	1000	
514787	1000	
521196	700	
514795	400	
520848	700	
520957	1100	

The following Figures 3-1 and 3-2 present the fault locations within the study area.

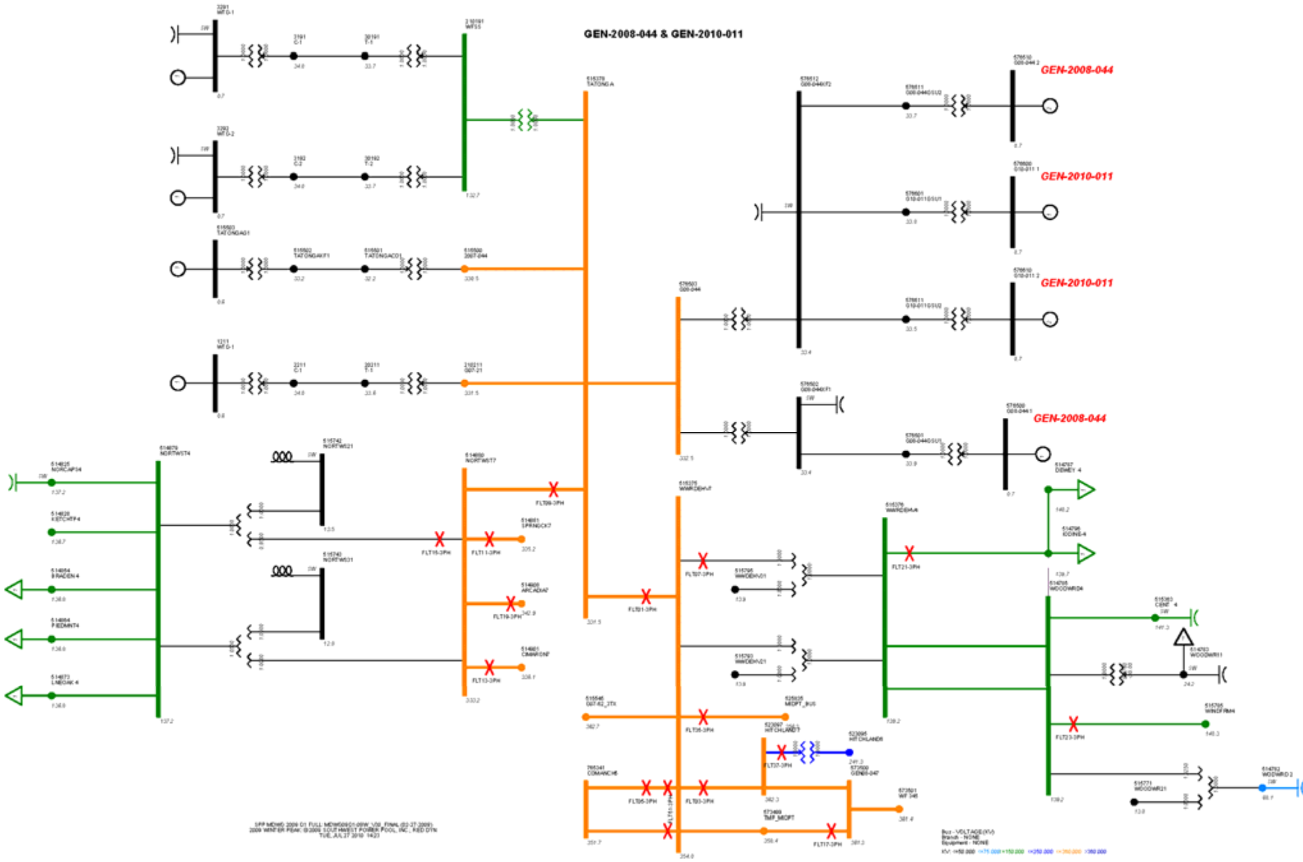

Figure 3-1 Fault Locations in the Study Area – Diagram1

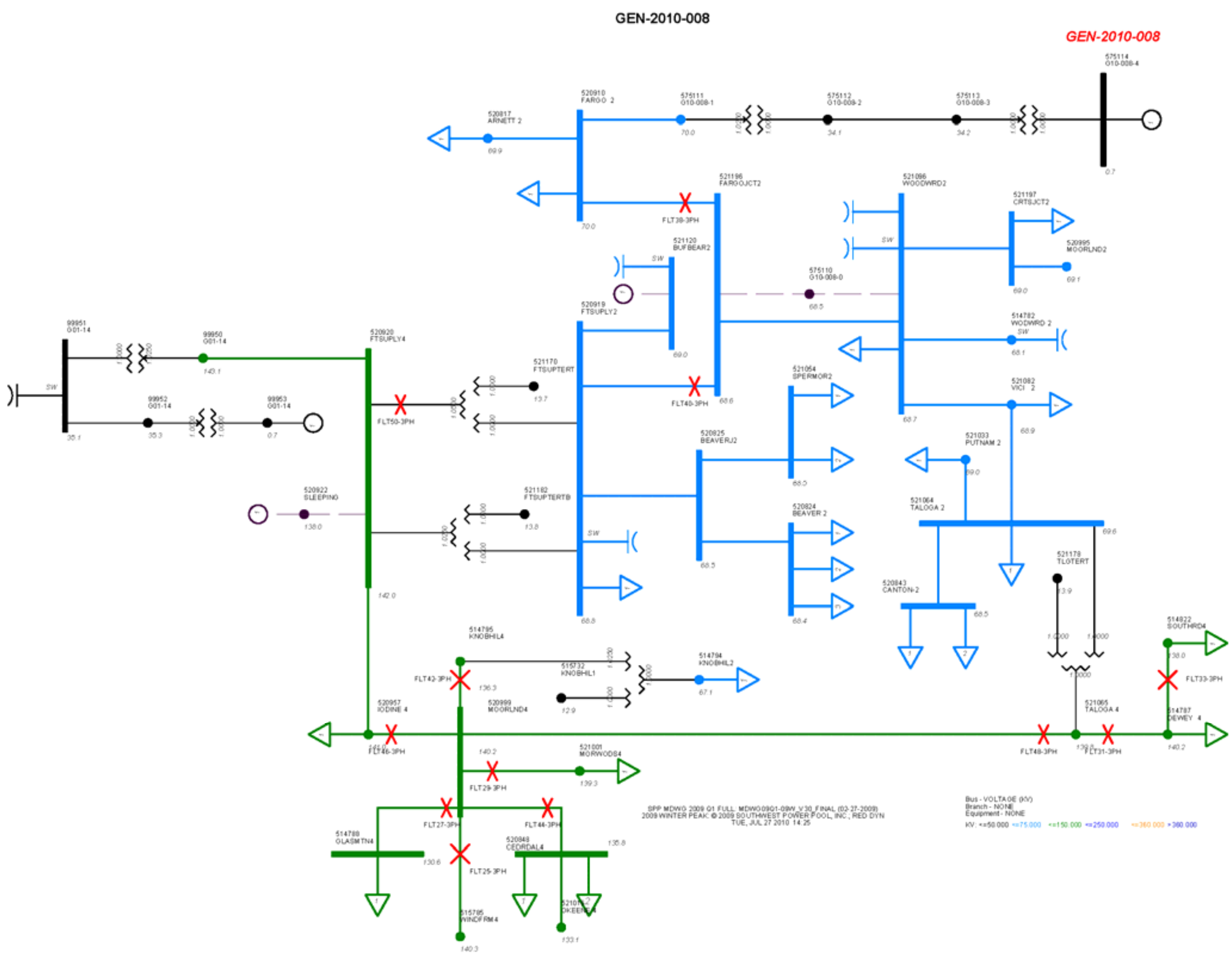

Figure 3-2 Fault Locations in the Study Area – Diagram2

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Section

4

Analysis Performed

4.1 Steady State Performance

Steady state analysis was carried out to evaluate the system performance under contingencies. In general, the contingencies analyzed cause more than 1% impact on the voltage profile of the monitored system when compared to base case conditions. Significant voltage criteria violations (outside the range 0.95 – 1.05 V pu), caused by the projects, were identified through the simulations performed.

Table 4-1 and Table 4-2 summarize the results obtained from the steady state analysis for Summer Peak and Winter Peak base cases, respectively. The tables list the voltage deviations at the Points of Interconnection of the proposed study projects of Group 1 as well as the prior queued projects. Note that only the contingencies that cause a voltage criterion violation and have an impact of at least 1% in the POI's voltages are listed.

4.1.1 Summer Peak

Table 4-1 Results Obtained – Steady State Analysis – Summer Peak

Bus #	Bus Name	Base kV	Cont. Name	Cont. Voltage	Base Voltage	% Deviation
514823	ROMNOSE4	138	FLT01PH	0.94643	0.96211	-1.57%
514823	ROMNOSE4	138	FLT07PH	0.94977	0.96211	-1.23%
514787	DEWEY 4	138	FLT09PH	0.92157	1.00489	-8.33%
514823	ROMNOSE4	138		0.83004	0.96211	-13.21%
521116	RHWIND4	138		0.93749	1.00173	-6.42%
521120	BUFBEAR2	69		0.91972	0.99059	-7.09%
514823	ROMNOSE4	138	FLT27PH	0.9492	0.96211	-1.29%
514823	ROMNOSE4	138	FLT51PH	0.89755	0.96211	-6.46%
515378	TATONGA	345		0.93297	0.96963	-3.67%
576503	G08-044	345		0.93966	0.97288	-3.32%

4.1.2 Winter Peak

Table 4-2 Results Obtained – Steady State Analysis – Winter Peak

Bus #	Bus Name	Base kV	Cont. Name	Cont. Voltage	Base Voltage	% Deviation
515378	TATONGA	345	FLT01PH	0.9397	0.96074	-2.10%
576503	G08-044	345		0.94273	0.96382	-2.11%
514785	WOODWRD4	138	FLT09PH	0.94751	1.00842	-6.09%
514787	DEWEY 4	138		0.91698	1.01589	-9.89%
514823	ROMNOSE4	138		0.83164	0.98646	-15.48%
515375	WWRDEHV7	345		0.94837	1.02599	-7.76%
515376	WWRDEHV4	138		0.94743	1.00848	-6.11%
515378	TATONGA	345		0.92683	0.96074	-3.39%
515785	WINDFRM4	138		0.92991	1.01644	-8.65%
520920	FTSUPLY4	138		0.93751	1.0288	-9.13%
520999	MOORLND4	138		0.92943	1.01629	-8.69%
521116	RHWIND4	138		0.94303	1.01203	-6.90%
521120	BUFBEAR2	69		0.90374	1.00034	-9.66%
521196	FARGOJCT2	69		0.93102	0.99399	-6.30%
576503	G08-044	345		0.92982	0.96382	-3.40%
520920	FTSUPLY4	138	FLT46PH	1.07229	1.0288	4.35%
514823	ROMNOSE4	138	FLT51PH	0.88781	0.98646	-9.87%
515378	TATONGA	345		0.86851	0.96074	-9.22%
521120	BUFBEAR2	69		0.94256	1.00034	-5.78%
576503	G08-044	345		0.87132	0.96382	-9.25%

For the two load scenarios studied summer and winter, in general the lowest voltages and greater number of violations of voltage criterion occur during the winter peak case. As such the descriptions below refer mostly to the winter peak case only.

- A voltage deviation of about 2% with a low voltage of 0.939 V pu occurs at the Tatonga 345 kV bus and similar low voltages occur at several adjacent buses, caused by the loss of the Woodward Haven to Tatonga 345 kV line (FLT01), in which the reactive power support from Woodward Haven 345 kV that feeds the heavily loaded Tatonga to North West 345 kV line is lost.

- Several low voltages occur at buses adjacent to the Tatonga 345 kV bus that has a voltage deviation of about 3% and a voltage of 0.926 V pu, due to the loss of the Northwest to Tatonga 345 kV line (FLT09), that causes a significant increase in power flow on the Tatonga to Woodward Haven 345 kV line and therefore increased the reactive power consumption along this line.

- A voltage deviation of about 4.3% with a high voltage of 1.072 V pu occurs at the Fort Supply 138 kV bus (POI for project GEN-2001-014), caused by the loss of the Iodine to Mooreland 138 kV line (FLT46), that forces the power generated by GEN-2001-014 to flow through two 138/69 kV transformers. The high voltage can be mitigated by switching offline one of the two 12 Mvar switched shunt capacitors at GEN-2001-014 34.5 kV bus.

- Several low voltages occur at buses adjacent to the Tatonga 345 kV bus that has a voltage deviation of about 9.2% and a voltage of 0.868 V pu, caused by the loss of the two Woodward Haven to Comanche 345 kV lines (FLT051), which leads to significant increase in power flow on the Tatonga to Northwest 345 kV line and, as a consequence, also increases the reactive power consumption along this line.

4.2 Power Factor Analysis

A QV analysis was performed to determine the amount of reactive support required to maintain either the scheduled base case voltages or 1.0 V pu (whichever is higher) at the points of interconnection of each one of the proposed wind facilities. The contingencies described in Table 3-2 were evaluated in steady state conditions for summer and winter peak base cases, with variable Mvar injection at the POI's.

Table 4-3 presents the Mvar requirements the projects must be able to provide under contingencies in order to meet the power factor requirement. Tables showing the injected Mvar for each controlled voltage level in base case and contingencies are presented in Appendix D for both summer peak and winter peak scenarios. The values chosen are the highest between the two scenarios.

Note that the projects connecting at Tatonga surrounding area (GEN-2008-044 & GEN-2010-011) were modeled in cases, with different combinations, based on their queue positions.

The results obtained in the power factor analysis corroborate the results of the voltage analysis presented by section 4.1: accentuated voltage drops following several contingencies, mostly in the Tatonga 345 kV area. The lack of reactive support demands unrealistic power factor requirement from the studied projects. Section 5 labeled "Sensitivity Analysis" discusses the addition of system reinforcements in the SPP transmission system and its impact on the new projects' performance.

Table 4-3 Mvar Requirements and Power Factor at the POI for the Proposed Projects Interconnection

Project	Point of Interconnection	V Sched. (p.u)	MVAR Requirements at POI (MVAR)	Existing Mvar Capacity	Total Mvar required	Contingency	Power Factor POI (lagging)
GEN-2008-044 & GEN-2010-011	G08-044 345 kV (576503)	1.00	+480.0	+28.0	+508.0	FLT513PH	0.4
GEN-2010-008	Fargo Jct 69 kV (521196)	1.00	+72.0	0.00	+72.0	FLT093PH	0.68
GEN-2008-044 Only	G08-044 345 kV (576503)	1.00	+491.0	0.00	+491.0	FLT513PH	0.36
GEN-2010-011 Only	G08-044 345 kV (576503)	1.00	+452.0	0.00	+452.0	FLT513PH	0.065

4.3 Dynamic Analysis

The stability analysis was carried out for both summer and winter peak load flow models.

In order to determine the impact of the project on the overall system dynamics as well as to determine the requirements to meet the FERC Order 661-A Guidelines, 51 contingencies listed by Table 3-2 were simulated. The results obtained are described in this sub-section.

Tables 4-4 and 4-5 summarize the results obtained from the stability simulations for both summer and winter peak base cases, respectively. The table lists the dynamic performance of the proposed study projects of Group 1 as well as the prior queued projects. Note that only the critical contingencies that lead to trips due to LVRT, frequency protection or loss of synchronism are listed.

The stability results indicate that none of the Group 1 projects trip during the contingencies tested, that is, no trips occurred due to LVRT, overvoltage or frequency protection. However in the winter peak scenario, one of the prior queued projects tripped due to over voltage.

Table 4-4: Results Obtained – Summer Peak Base Case

Contingency Name	Wind Projects Dynamic Performance
No Trips occurred in the Studied Projects nor in the Prior Queued Projects	

Table 4-5: Results Obtained – Winter Peak Base Case

Name	Wind Projects Dynamic Performance
FLT046-3PH	GEN-2001-014 (99953) Tripped for over voltage at 2.745s

As GEN-2001-014 units are a prior queued project, the units over voltage relay was disabled and the contingency re-ran with system stable results.

Additionally, for a three phase or single line to ground fault on the Fargo Jct to Fargo 69 kV line in winter and summer peak load conditions (FLT-38), the Group 1 project GEN-2010-008 units (Siemens 2.3 MW) are isolated by the contingency. Therefore, the units were tripped following the contingency to prevent simulation issues.

Even though the results obtained in the voltage and power factor analysis show accentuated voltage drops following contingencies, it was not identified low voltage trips. It is due to two main facts: the units present a very robust LVRT characteristic and the voltage recovery is sufficient to prevent trips, but not to reach post-contingency voltages within the voltage criterion.

Besides the GEN-2001-014 trip due to overvoltage, the results obtained show:

- The new proposed projects, did not trip during any of the contingencies tested, that is, no trips occurred due to LVRT or frequency protection.
- Furthermore, trips were not identified in the prior queued wind projects.
- All synchronous generators in the monitored areas were stable and remained in synchronism during all contingencies and the system conditions considered.
- Acceptable damping and voltage recovery was observed, within applicable standards.

Stability plots of contingencies: FLT09, FLT23, FLT35, FLT37, FLT38, FLT44 and FLT46 evaluated for both summer peak and winter peak scenarios are presented in Appendix C.

Section

5

Sensitivity Analysis

The following system reinforcements were modeled to the power flow study cases as studied in the previous sections of this report:

- double 345 kV circuit from Hitchland (523097) – Midpt_Bus (525835)
- single 345kV circuit from Midpt_Bus (525835) – Anadarko (511541)

The following steady state, QV and stability analysis have been performed on the winter peak sensitivity case only (with the changes described above), as the winter case in general is the most problematic case from a steady state voltage perspective.

5.1 Steady State Performance

Table 5-1 shows the voltage results obtained for the same criteria, methodology and contingencies as described in sections 3 and 4 for the winter peak sensitivity case only.

Table 5-1 Results Obtained – Steady State Analysis – Winter Peak Sensitivity

Bus #	Bus Name	Base kV	Cont. Name	Cont. Voltage	Base Voltage	% Deviation
515378	TATONGA	345	FLT01PH	0.94054	0.97117	3.06%
576503	G08-044	345		0.94357	0.97428	3.07%
514823	ROMNOSE4	138	FLT09PH	0.92444	1.00199	7.75%
520920	FTSUPLY4	138	FLT46PH	1.07861	1.03429	-4.43%
515378	TATONGA	345	FLT51PH	0.93296	0.97117	3.82%
576503	G08-044	345		0.93597	0.97428	3.83%

The violations shown in Table 5-1 are caused by the same reasons given in section 4.1.2 only to a lesser extent, with the added three 345 kV lines the total number of voltage violations is significantly less and the voltages are not as low when compared to the results in section 4.1.2.

5.2 Power Factor Analysis

Table 5-2 shows the results obtained for the winter peak sensitivity case using the same methodology as described in section 4.2. The results show that with the three system reinforcements in 345 kV, significant less reactive support is required.

Additionally, steady state voltage analysis was performed with the addition of the indicated shunt capacitors placed at each POI, as derived from PF analysis given in Table 5-2. The results show that with the exception of a low voltage of 0.92 V pu at the Roman Nose 138 kV bus for the loss of the North West to Tatonga 345 kV line (FLT09), the voltage violations shown in Table 5-1 above are all resolved. As the single remaining voltage violation occurs at a prior queued projects POI no further analysis is performed.

Note that, for the POI's where the requirement is below 0.95, the power factor shall be limited to 0.95 by SPP's tariff.

Table 5-2 Mvar Requirements and Power Factor at the POI for the Proposed Projects Interconnection - Winter Peak Sensitivity

Project	POI	V Scheduled (p.u)	Additional MVAR Requirements at POI	Existing Mvar Capacity	Total Mvar required	Contingency	Power Factor POI (lagging)
GEN-2008-044 & GEN-2010-011	G08-044 345 kV (576503)	1.00	+336.0	+28.0	+364.0	FLT513PH	0.48
GEN-2008-044	G08-044 345 kV (576503)	1.00	+350.0	0.00	+350.0	FLT513PH	0.47
GEN-2010-008	Fargo Jct 69 kV (521196)	1.00	+32.0	0.00	+32.0	FLT093PH	0.94
GEN-2010-011	G08-044 345 kV (576503)	1.00	+326.0	0.00	+326.0	FLT513PH	0.091

5.3 Stability Analysis

The following three phase contingencies were selected for stability analysis based on results from section 4.3, for the winter peak sensitivity case:

- FLT09, FLT23, FLT35, FLT37, FLT38, FLT44 and FLT46.

The results show that the system remains stable for the contingencies and conditions studied.

Appendix E contains the plots of the winter peak sensitivity case.

Section

6

Conclusions

he three projects of DISIS-2010-001 Group 1 have been evaluated to determine the impact of the proposed cluster of interconnections on the Southwest Power Pool system.

Steady state and stability analysis were carried out to evaluate the system performance under contingencies. Also to identify the system requirements to meet the FERC Order 661-A Guidelines for Low Voltage Ride Through (LVRT) and therefore, to allow the Group 1 projects to deliver their full power to the SPP transmission system.

In general the Group 1 interconnection requests do have significant impact on the voltage profile of the monitored system, with results showing significant voltage drop following contingencies in the Tatonga 345 kV vicinity.

The power factor analysis determined the amount of reactive support required to maintain the scheduled voltages at each one of the points of interconnection under contingency conditions. Due to the lack of reactive support on the Tatonga 345 kV vicinity, Table 4-3 shows unrealistic amounts of reactive support is required at G08-044 345 kV bus to maintain scheduled voltage.

A sensitivity analysis was performed to discuss the addition of system reinforcements in the SPP transmission system and its impact on the new projects' performance. The winter peak scenario was analyzed with the addition of the following transmission lines:

- double 345 kV circuit from Hitchland (523097) – Midpt_Bus (525835)
- single 345kV circuit from Midpt_Bus (525835) – Anadarko (511541)

The sensitivity voltage analysis results show that all the relevant voltage violations identified can be resolved with the addition of the three 345 kV transmission lines plus the addition of some reactive support. For those POIs where the requirement is below 0.95, the power factor shall be limited to 0.95 by SPP's tariff.

The amount of reactive support indicated by Table 5-2 is significantly reduced when compared to those on Table 4.3. If this amount of reactive compensation is provided, the Group 1 projects do not have an adverse impact on the SPP system, for the contingencies and system conditions tested.

In general, the stability analysis demonstrates that none the new proposed or prior queued projects trip by low voltage protection during any of the contingencies tested. That is, no trips occurred due to LVRT. Also, all other generators in the monitored areas were stable and remained in synchronism.

Appendix

A

Power Flow Diagrams

Appendix

B

WTG Stability Models

This appendix shows the modeling data used to represent the turbines in the stability simulations.

Appendix

C

Stability Plots

Appendix

D

QV Analysis

Appendix

E

Sensitivity Plots

J: Stability Study for Group 2

R68-10

Draft Generator Interconnection Impact Study DISIS-2010-001 (Group 2)

Prepared for

Southwest Power Pool, Inc.

Submitted by:

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Draft Report: July 30, 2010

Siemens PTI Project Number:P/23-115087-B-1

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Contents

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Section

1

Introduction

1.1 Background

Pursuant to the tariff and at the request of the Southwest Power Pool (SPP), Siemens PTI performed the following Impact Study to satisfy the Impact Study Agreement executed by the requesting customers and SPP. The requests for interconnection were placed with SPP in accordance to SPP's Open Access Transmission Tariff, which covers new generation interconnections on SPP's transmission system.

The purpose of this report is to present the results of the stability, steady state and power factor analysis performed to evaluate the impact of the proposed DISIS-2010-001 cluster of interconnections with regard to Group 2 projects on the Southwest Power Pool system. Eventual indicative solutions to the identified issues are proposed based on the impact of each generation interconnection on the Southwest Power Pool system.

Five projects in this cluster are connected to three different Points of Interconnection (to be known hereafter as POI) at two different voltage levels 345 kV and 115 kV. Section 2 describes all proposed wind farm projects in detail.

Transient stability analysis was performed using the package provide by SPP. It contains the latest stability database in PSS®E version 30.3.3. The stability package also includes the dynamic data for the previously queued projects.

1.2 Purpose

The steady state and stability study was carried out to:

(a) Determine the ability of the proposed generation facilities to remain in synchronism and within applicable planning standards following system faults with unsuccessful reclosing.

(b) Determine the amount of reactive support required from the costumer to meet the power factor requirement at the POI.

(c) Determine the ability of the wind projects to meet FERC Order 661A (low voltage ride through and wind farm recovery to pre-fault voltage) without and, eventually, with additional reactive support.

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Section

2

Model Development

The study has considered the 2009 winter peak and 2010 summer peak load flow models provided by SPP with the required interconnection generations modeled. The base cases also contain all the significant previous queued generation interconnection projects in the interconnection queue.

2.1 Power Flow Data

The Group 2 of DISIS-2010-001 contains five proposed wind generation projects. Table 2-1 presents the size of the wind generation projects, the Wind Turbine Generator (WTGs) manufacturers, the reactive capability of the wind farm as well as the point of interconnection and the PSS®E bus numbers in the load flow models.

Table 2-1 Details of the Interconnection Requests

Request	Size (MW)	Wind Turbine Model	Reactive Capability of Wind Farm		Point of Interconnection
			Max (Mvar)	Min (Mvar)	
GEN-2008-028	360	GE 1.5MW	118.3	-118.3	Hitchland 345kV (523097)
GEN-2008-047	300	GE 1.5MW	98.6	-98.6	Hitchland 345kV (523097
GEN-2008-110	300	GE 1.5MW	144.9	-144.9	Hitchland 345kV (523097)
GEN-2010-007	73.8	Vestas V100 1.8MW	0	0	Tap Riverside – Pringle 115kV (523266-523377)
GEN-2010-014	358.8	Siemens SWT 2.3MW	108.4	108.4	Hitchland 345kV (523097)

The analysis was carried out using the database package provided by SPP which also includes the modeling data for the previously queued projects, as shown in Table 2-2:

Table 2-2 Details of the Prior Queued Interconnection Requests

Request	Size (MW)	Wind Turbine Model	Point of Interconnection
GEN-2002-006	150	GE 1.5MW	Texas Co. 115kV (523090)
GEN-2002-008	240	GE 1.5MW	Hitchland 345kV (523097)
GEN-2002-009	80	Suzlon 2.1MW	Hansford 115kV (523195)

Request	Size (MW)	Wind Turbine Model	Point of Interconnection
GEN-2003-013	196	GE 1.5 MW	Hitchland – Finney 345kV (560029)
GEN-2003-020	160	GE 1.5 MW	Carson Co. 115kV (523924)
GEN-2005-017	340	GE 1.5 MW	Hitchland – Potter 345kV (51700)
GEN-2006-020	19.5	GE 1.5 MW	Hitchland – Sherman Tap 115kV (560200)
GEN-2006-044	370	GE 1.5 MW	Hitchland 345kV (523097)
GEN-2006-049	400	GE 1.5 MW	Hitchland – Finney 345kV (560029)
GEN-2007-005	200	Furhlander 2.5MW	Pringle 115kV (523666)
GEN-2007-046	199.5	GE 1.5MW	Hitchland 115kV (523093)
GEN-2007-057	34.5	GE 1.5MW	Moore Co. East 115kV (523308)

Figures 2-1 to 2-2 present the surrounding area of the Group 2 points of interconnection, showing the line flows and voltage profile for the load flow models considered in the study for summer and winter peak scenarios, respectively.

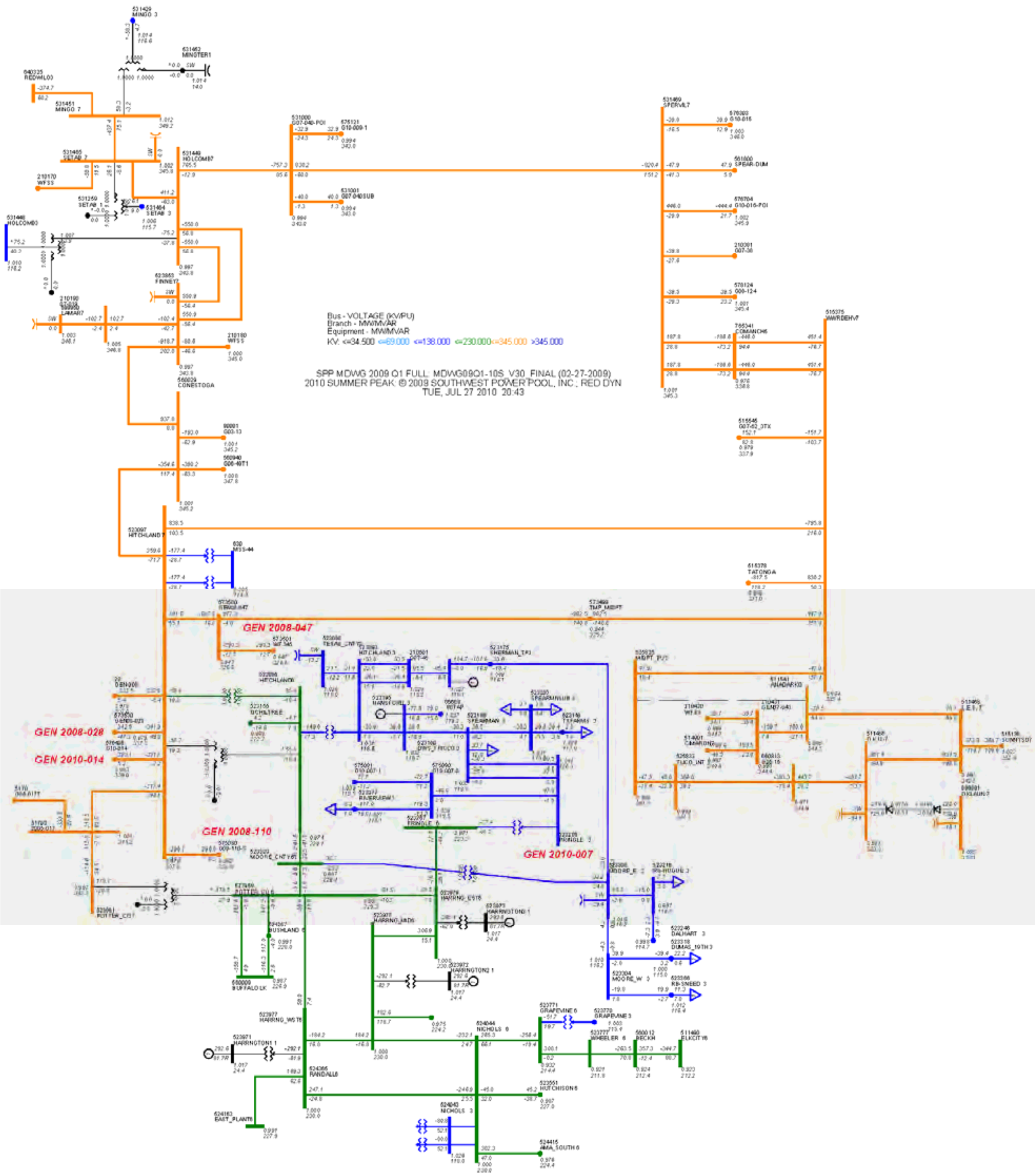

Figure 2-1 Group 2 Points of Interconnection Surrounding Area - Summer Peak

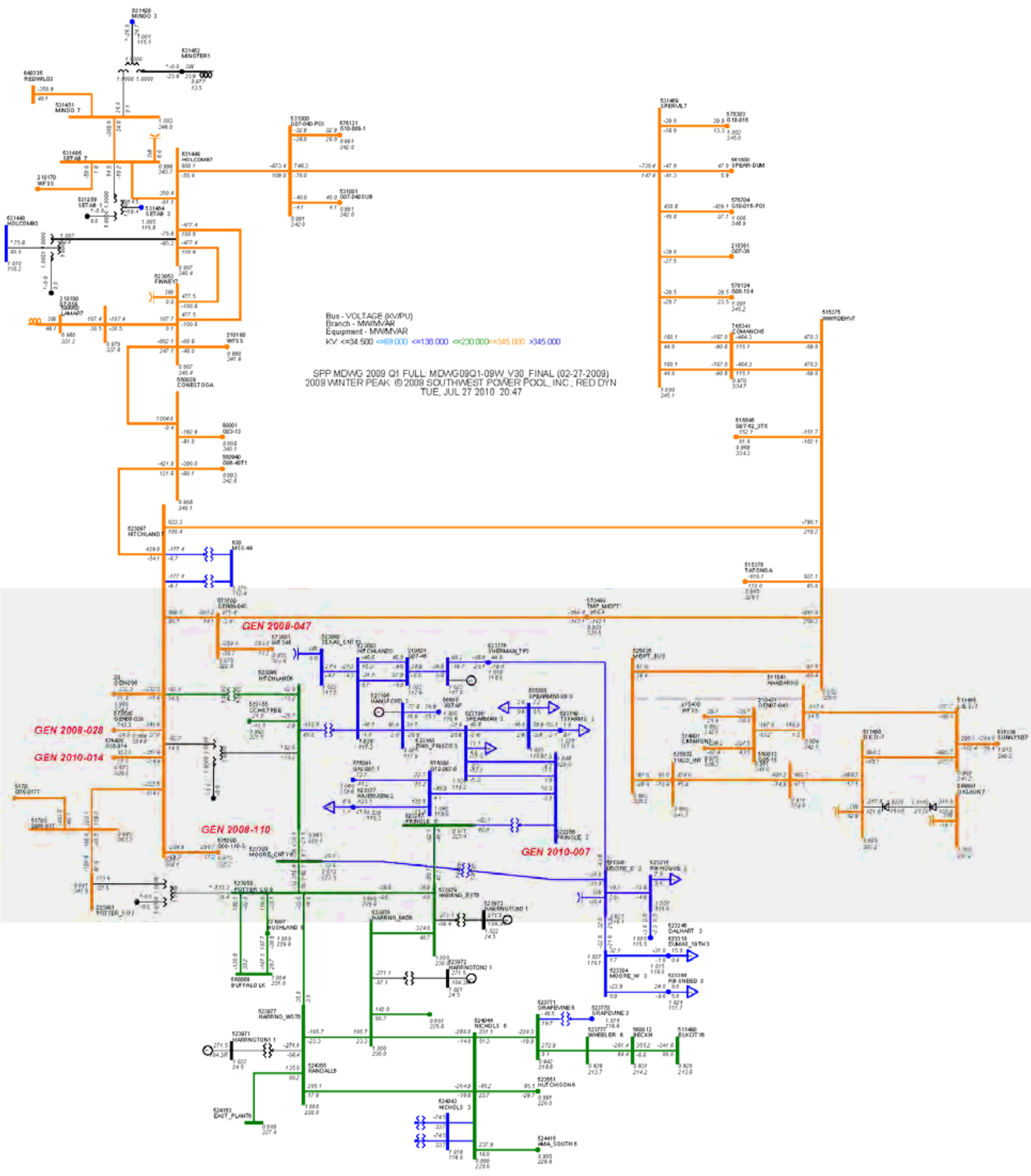

Figure 2-2 Group 2 Points of Interconnection Surrounding Area - Winter Peak

Appendix A presents the single line diagrams showing, for each of the Group 2 projects, the modeling details and impedance data of the transformers and collector systems.

2.2 Stability Database

The transient stability analysis was performed using the data provided by SPP. Stability models for the Group 2 interconnection requests were added to the dynamic database, based on the technical documentation given. All turbine parameters used in the simulation models are the default parameters in the wind turbine package. It is assumed that each wind turbine generators (WTGs) would be controlling the voltage of its own bus.

The default voltage protection model set points recommended by the manufacturer were used. The wind units were modeled with their built-in voltage ride through capability. Also, the default frequency protection model set points recommended by the manufacturer were used.

The PSS®E dynamic models output list is shown in Appendix B, documenting the model parameters of each one of the Group 2 wind turbines modeled in the stability study.

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Section

3

Methodology and Assumptions

The study considered the 2009 and 2010 power flow cases with the required interconnection generation requests modeled as described in Section 2. The power flow case also contains all the significant previous queued projects in the interconnection queue.

The monitored areas in this study are shown in Table 3-1.

Table 3-1 Areas of Interest

Area Number	Area Name
520	AEPW
524	OKGE
525	WFEC
526	SPS
531	MIDW
534	SUNC
536	WERE

3.1 Methodology

3.1.1 Steady State Simulations

3.1.1.1 N-1 Contingency Analysis

An N-1 contingency analysis was performed to evaluate voltage violations, if any, caused by disturbances (tripping of the faulted line). The voltages at each POI were monitored for deviations from the base case voltage and the percentage deviations were documented.

The summer peak and winter peak load flow cases were adjusted to ensure there are no relevant pre contingency voltage criteria violations. During contingency analysis it was reported voltages of any monitored bus found to be outside the range of the post-contingency criteria and having more than 1% of project impact.

3.1.1.2 Power Factor Analysis

The analysis will determine what power factor is necessary at the POI for each contingency.

If the required power factor at the POI is beyond the capability of the studied wind turbines to meet the requirement at the POI, capacitor banks will be considered.

A QV analysis was performed to determine the reactive support requirement at each project's POI. Mvar injections, tabulated for base case and contingency conditions, are used to determine the reactive power support required at each POI, in order to maintain the bus scheduled pre contingency voltages.

These tables are obtained through a series of AC load flow calculations. Starting with no reactive support at a bus, the voltage is computed for a series of power flows as the reactive support is changed in steps, until the power flow experiences convergence difficulties as the system approaches the voltage collapse point.

3.1.2 Stability Simulations

The dynamic simulations were performed using the PSS®E version 30.3.3 with the latest stability database provided by SPP. Three-phase faults and single-phase faults in the neighborhood of DISIS-2010-001 – Group 2 Points of interconnection were simulated. Any adverse impact on the system stability was documented and further investigated with appropriate solutions to determine whether a static or dynamic VAR device is required or not.

The Group 2 projects were also evaluated on the matter of ability to meet FERC Order 661A (low voltage ride through and wind farm recovery to pre-fault voltage) without and, eventually, with additional reactive support.

3.2 Disturbances for Stability Analysis

The faults simulated are single line to ground, and three phase faults. The fault clearing may include unsuccessful line reclosing. The complete fault clearing process includes either one of the following sequence of events:

Unsuccessful Reclosing

1) Line fault, cleared after 5 cycles by tripping the both line terminals

2) After 20 cycles the line is unsuccessful reclosed (reclosing under fault conditions)

3) The fault is cleared by tripping both ends of the faulted line again, 5 cycles later.

Normally Cleared

1) Line fault, cleared after 5 cycles by tripping both line terminals.

The disturbances evaluated along with corresponding clearing methods are listed in Table 3-2:

Table 3-2 Disturbances for Stability Analysis

Cont. No.	Cont. Name	Description
1	FLT01-3PH	3 phase fault on the Hitchland (523097) to GEN-2003-013 (560029) 345kV line, near Hitchland. a. Apply fault at the Hitchland 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.

Cont. No.	Cont. Name	Description
2	FLT02-1PH	Single phase fault on the line in previous b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
3	FLT03-3PH	3 phase fault on the Hitchland (523097) to GEN-2005-017 (51700) 345kV line, near Hitchland. a. Apply fault at the Hitchland 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
4	FLT04-1PH	Single phase fault on the line in previous b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
5	FLT05-3PH	3 phase fault on one of the Hitchland (523097) to GEN-2008-047 (573500) 345kV lines, near Hitchland. a. Apply fault at the Hitchland 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
6	FLT06-1PH	Single phase fault on the line in previous b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
7	FLT08-3PH	3 phase fault on the Hitchland 230kV (523095) to 345kV (523097) transformer, near the 230kV bus. a. Apply fault at the Hitchland 230kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
8	FLT10-3PH	3 phase fault on the Hitchland (523095) to Moore Co (523309) 230kV near Moore Co. a. Apply fault at the Moore Co 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
9	FLT14-3PH	3 phase fault on the GEN-2005-017 (51700) to Potter Co. (523961) 345kV line, near GEN-2005-017. a. Apply fault at the GEN-2005-017 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
10	FLT15-1PH	Single phase fault on the line in previous b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
11	FLT16-3PH	3 phase fault on the Moore Co. (523309) to Potter Co (523959) 230kV line, near Potter Co. a. Apply fault at the Potter Co. 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
12	FLT20-3PH	3 phase fault on the Pringle (523267) to Harrington (523979) 230kV line, near Pringle. a. Apply fault at the Pringle 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
13	FLT21-1PH	*Single phase fault and sequence like previous*

Cont. No.	Cont. Name	Description
14	FLT22-3PH	3 phase fault on the GEN-2003-013 (560029) to Finney (523853) 345kV line, near GEN-2003-013. a. Apply fault at the GEN-2003-013 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line
15	FLT23-1PH	Single phase fault on the line in previous b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
16	FLT24-3PH	3 phase fault on the Holcomb (531449) to Setab (531465) 345kV line, near Holcomb. a. Apply fault at the Holcomb 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
17	FLT25-1PH	*Single phase fault and sequence like previous*
18	FLT26-3PH	3 phase fault on the Holcomb (531449) to GEN-2007-040 (531000) 345kV line, near Holcomb. a. Apply fault at the Holcomb 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
19	FLT27-1PH	*Single phase fault and sequence like previous*
20	FLT28-3PH	3 phase fault on the Woodward (515375) to Tatonga (515378) 345kV line, near Woodward. a. Apply fault at the Woodward 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
21	FLT31-3PH	3 phase fault on the Hitchland (523093) to GEN-2007-046 (210501) to GEN-2006-020 (560863) to Sherman Tap (523175) to Moore Co. East (523308) and to Sherman (523168) 115kV line, near Hitchland. a. Apply fault at the Hitchland 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line (all segments listed above). c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
22	FLT32-1PH	*Single phase fault and sequence like previous*
23	FLT33-3PH	3 phase fault on the Hitchland (523093) to Hansford (523195) 115kV line, near Hitchland. a. Apply fault at the Hitchland 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
24	FLT34-1PH	*Single phase fault and sequence like previous*
25	FLT35-3PH	3 phase fault on the Hitchland 115kV (523093) to 230kV (523095) transformer, near the 115 kV bus. a. Apply fault at the Hitchland 115kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
26	FLT36-3PH	3 phase fault on the Pringle (523266) to Spearman (523186) 115kV line #1, near Pringle. a. Apply fault at the Pringle 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
27	FLT37-1PH	*Single phase fault and sequence like previous*

Cont. No.	Cont. Name	Description
28	FLT40-3PH	3 phase fault on the Moore Co. East (523308) to RB Hogu (523216) 115kV line, near Moore Co. East. a. Apply fault at the Moore Co. East 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
29	FLT41-1PH	*Single phase fault and sequence like previous*
30	FLT42-3PH	3 phase fault on the Moore Co. West (523304) to Dumas (523318) 115kV line, near Moore Co. West. a. Apply fault at the Moore Co. West 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
31	FLT43-1PH	*Single phase fault and sequence like previous*
32	FLT44-3PH	3 phase fault on the Moore Co. West (523304) to RB Sneed (523366) 115kV line, near Moore Co. West. a. Apply fault at the Moore Co. West 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
33	FLT45-1PH	*Single phase fault and sequence like previous*
34	FLT46-3PH	3 phase fault on the Moore Co. East 115kV (523308) to 230kV (523309) transformer, near the 115 kV bus. a. Apply fault at the Moore Co. East 115kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
35	FLT47-1PH	*Single phase fault and sequence like previous*
36	FLT52-3PH	3 phase fault on the Spearman (523186) to Spearman Sub (523203) 115kV line, near Spearman. a. Apply fault at the Spearman 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
37	FLT53-1PH	*Single phase fault and sequence like previous*
38	FLT57-3PH	3 phase fault on the Texas Co. 115kV phase shifting transformer (523090 to 523106), near the main 115 kV bus. a. Apply fault at the main Texas Co. 115kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
39	FLT60-3PH	3 phase fault on the TMP_MIDPT (573499) to GEN-2008-047 (573500) 345kV lines, near GEN-2008-047. a. Apply fault at the GEN-2008-047 345kV bus. b. Clear fault after 5 cycles by tripping the GEN-2008-047 – TMP_MIDPT – Woodward 345kV line.
40	FLT61-1PH	Single phase fault on the line in previous b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
41	FLT69-3PH	3 phase fault on the Gen-2010-007 Tap (575090) to Pringle (523266) 115kV line, near Gen-2010-007 Tap. a. Apply fault at the Gen-2010-007 Tap 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.

Cont. No.	Cont. Name	Description
42	FLT70-1PH	*Single phase fault and sequence like previous*
43	FLT71-3PH	3 phase fault on the Gen-2010-007 Tap (575090) to Riverview (523377) 115kV line, near Gen-2010-007 Tap. a. Apply fault at the Gen-2010-007 Tap 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
44	FLT72-1PH	*Single phase fault and sequence like previous*
45	FLT73-3PH	3 phase fault on the Pringle 115kV (523266) to Pringle 230kV (523267) transformer near the 115 kV bus. a. Apply fault at the Pringle 115kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
46	FLT74-3PH	3 phase fault on the Riverview (523377) to Harrington Tap (523352) 115kV line, near Riverview. a. Apply fault at the Riverview 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
47	FLT75-1PH	*Single phase fault and sequence like previous*
48	FLT76_3PH	3 phase fault on the Riverview (523377) to CRMWA#1 (523403) 115kV line, near Riverview. a. Apply fault at the Riverview 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
49	FLT77_1PH	*Single phase fault and sequence like previous*
50	FLT78_3PH	3 phase fault on the Hutchison 115kV (523546) to the Hutchison 230kV (523551) transformer near the 115 kV bus. a. Apply fault at the Hutchison 115kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
51	FLT79-3PH	3 phase fault on the Pringle (523266) to Q_RYTON_TP (523478) 115kV line #1, near Pringle. a. Apply fault at the Pringle 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
52	FLT_80-1PH	*Single phase fault and sequence like previous*
53	FLT81-3PH	3 phase fault on the TMP_MIDPT (573499) – Woodward (515375) 345 kV line, at TMP_MIDPT (573499). a Apply fault at TMP_MIDPT (573499) b. Clear fault after 5 cycles, and c. Trip GEN-2008-047 (573500) – TMP_MIDPT (573499) – Woodward (515375) 345kV, and d. Trip Hitchland (523097) – Woodward (515375) 345kV ckt2 line
54	FLT82-3PH	3 phase fault on the Hitchland (523097) – Woodward (515375) 345kV line, near Hitchland. a. Apply fault at the Hitchland 345kV bus. b. Clear fault after 5 cycles by tripping faulted line.

In order to simulate single line to ground faults, equivalent reactances were determined to be applied at the buses. Table 3-3 presents the values obtained for the summer and winter peak cases.

Table 3-3 Equivalent Reactances – Line to Ground Faults

BUS	Equivalent Reactance (Mvar)	
	WP	SP
523097	4300	4100
51700	2700	
523267	1200	1100
560029	2900	2700
531449	3800	3700
523093	1600	
523266	1600	
523308	1700	1500
523304	1700	1500
523186	1200	
573500	2400	2300
531000	3500	3400
575090	1400	
523377	1900	1800

Figure 3-1 presents the fault locations within the study area.

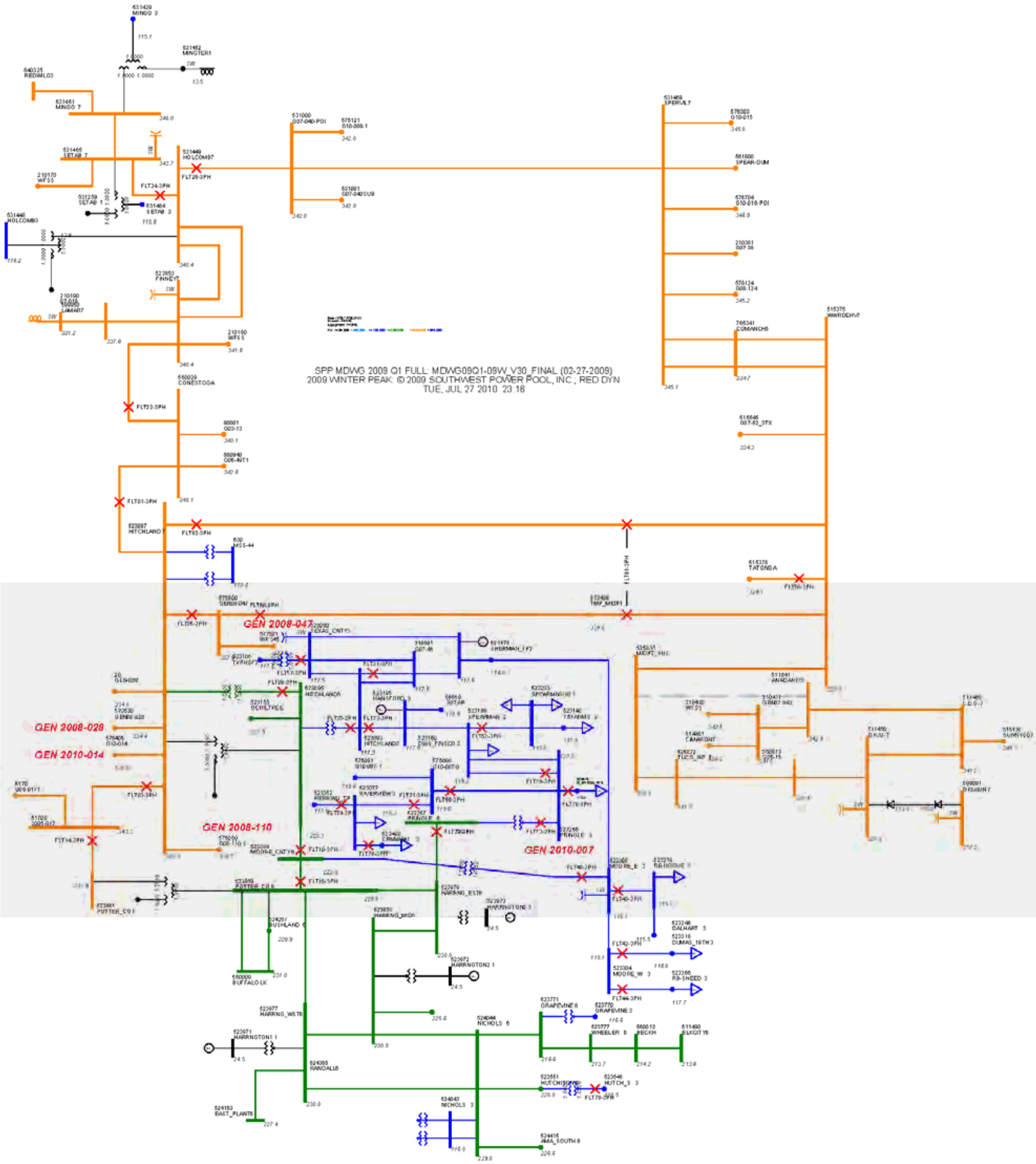

Figure 3-1 Fault Locations in the Study Area

Section

4

Analysis Performed

4.1 Steady State Performance

Steady state analysis was carried out to evaluate the system performance under contingencies. In general, the contingencies analyzed cause more than 1% impact on the voltage profile of the monitored system when compared to base case conditions. Significant voltage criteria violations (outside the range 0.95 – 1.05 V pu), caused by the projects, were identified through the simulations performed.

Table 4-1 and Table 4-2 summarize the results obtained from the steady state analysis for Summer Peak and Winter Peak base cases, respectively. The tables list the voltage deviations at the Points of Interconnection of the proposed study projects of Group 2 as well as the prior queued projects. Note that only the contingencies that cause a voltage criterion violation and have an impact of at least 1% in the POI's voltages are listed.

4.1.1 Summer Peak

Table 4-1 Results Obtained – Steady State Analysis – Summer Peak

Bus #	Bus Name	Base kV	Cont. Name	Cont. Voltage	Base Voltage	% Deviation
573500	GEN08-047	345	BASE CASE	0.94665	0.94665	0.00%
515375	WWRDEHV7	345	FLT01_3PH	0.91397	0.96359	-4.96%
523095	HITCHLAND6	230		0.94228	0.97444	-3.22%
523097	HITCHLAND 7	345		0.93792	0.97841	-4.05%
573500	GEN08-047	345		0.878	0.94665	-6.87%
N/A	N/A	N/A	FLT22_3PH	Voltage Collapse		
515375	WWRDEHV7	345	FLT24_3PH	0.94682	0.96359	-1.68%
573500	GEN08-047	345		0.92925	0.94665	-1.74%
515375	WWRDEHV7	345	FLT26_3PH	0.9173	0.96359	-4.63%
523097	HITCHLAND 7	345		0.94835	0.97841	-3.01%
573500	GEN08-047	345		0.88237	0.94665	-6.43%
515375	WWRDEHV7	345	FLT28_3PH	0.94425	0.96359	-1.93%
N/A	N/A	N/A	FLT60_3PH	Voltage Collapse		
N/A	N/A	N/A	FLT81_3PH	Voltage Collapse		
515375	WWRDEHV7	345	FLT82_3PH	0.92793	0.96359	-3.57%
523095	HITCHLAND6	230		0.94527	0.97444	-2.92%

Bus #	Bus Name	Base kV	Cont. Name	Cont. Voltage	Base Voltage	% Deviation
523097	HITCHLAND 7	345		0.94121	0.97841	-3.72%
560029	CONESTOGA	345		0.93511	1.00065	-6.55%
573500	GEN08-047	345		0.84536	0.94665	-10.13%

4.1.2 Winter Peak

Table 4-2 Results Obtained – Steady State Analysis – Winter Peak

Bus #	Bus Name	Base kV	Cont. Name	Cont. Voltage	Base Voltage	% Deviation
573500	GEN08-047	345	BASE CASE	0.93518	0.93518	0.00%
N/A	N/A	N/A	FLT01_3PH	Voltage Collapse		
523095	HITCHLAND6	230	FLT05_3PH	0.94415	0.96549	-2.13%
523097	HITCHLAND 7	345		0.94036	0.96835	-2.80%
560029	CONESTOGA	345		0.93659	0.98587	-4.93%
N/A	N/A	N/A	FLT22_3PH	Voltage Collapse		
515375	WWRDEHV7	345	FLT24_3PH	0.93732	0.95317	-1.58%
573500	GEN08-047	345		0.91906	0.93518	-1.61%
515375	WWRDEHV7	345	FLT26_3PH	0.90964	0.95317	-4.35%
523095	HITCHLAND6	230		0.9447	0.96549	-2.08%
523097	HITCHLAND 7	345		0.94231	0.96835	-2.60%
573500	GEN08-047	345		0.87703	0.93518	-5.82%
515375	WWRDEHV7	345	FLT28_3PH	0.92241	0.95317	-3.08%
573500	GEN08-047	345		0.92068	0.93518	-1.45%
N/A	N/A	N/A	FLT60_3PH	Voltage Collapse		
N/A	N/A	N/A	FLT81_3PH	Voltage Collapse		
515375	WWRDEHV7	345	FLT82_3PH	0.90021	0.95317	-5.30%
523095	HITCHLAND6	230		0.92027	0.96549	-4.52%
523097	HITCHLAND 7	345		0.91146	0.96835	-5.69%
560029	CONESTOGA	345		0.89202	0.98587	-9.39%
573500	GEN08-047	345		0.80646	0.93518	-12.87%

For the two load scenarios studied summer and winter, in general the lowest voltages and greater number of violations of voltage criterion occur during the winter peak case. As such the descriptions below refer mostly to the winter peak case.

- Severe voltage collapse occurs and the contingency does not solve for the loss of the Hitchland to Conestoga 345 kV line (FLT01), due to increased power flow on the Hitchland to Woodward Haven 345 kV lines and therefore increased reactive power consumption along this line.

- Low voltages occur at Conestoga and Hitchland 345 kV buses (and several adjacent buses) that have voltage deviations of about 4.9% and 2.8% and voltages of 0.936 V pu and 0.94 V pu, respectively, for the loss of the Hitchland to GEN-2008-047 345 kV line (FLT05). This causes increased power flow on the Htichland to Conestoga 345 kV line and the remaining Hitchland to Woodward 345 kV line, resulting in increased reactive power consumption along this line.

- Severe voltage collapse occurs and the contingency does not solve for the loss of the Finney to Conestoga 345 kV line (FLT22), due to increased power flow on the Hitchland to Woodward 345 kV.

- Low voltages occur at Woodward Haven 345 kV bus and taps along the Woodward Haven to Hitchland 345 kV line with voltage deviations of about 1.6% and voltages of 0.93 V pu and 0.91 V pu, respectively, for the loss of the Holcomb to Setab 345 kV line (FLT24). This results in a general increased power flow on the remaining local 345 kV system.

- Low voltages occur at Woodward Haven and Hitchland 345 kV buses (and several adjacent buses) with voltage deviations of about 4.35% and 2.6% with voltages of 0.91 V pu and 0.94 V pu, respectively, for the loss of the Holcomb to GEN-2007-040 345 line (FLT26). This causes an increased power flow on the Woodward Haven to Hitchland 345 kV lines.

- Several low voltages occur at the Woodward Haven 345 kV bus (and several adjacent buses) with a voltage deviation of about 3% and voltage of 0.92 V pu, caused by the loss of the Woodward Haven to Tatonga 345 kV line (FLT28). This causes increased power flow in several 345 kV lines connecting to Woodward Haven 345 kV bus.

- Severe voltage collapse occurs and the contingency does not solve for the loss of the GEN-2008-047 to TMP mid point to Woodward Haven 345 kV lines (FLT60). Caused by the same reasons given above for FLT05.

- Severe voltage collapse occurs and the contingency does not solve for the loss of the GEN-2008-047 to Mid point to Woodward Haven 345 kV line and the loss of the Hitchland to Woodward Haven circuit 2 345 kV line (FLT81). This causes a significant increase in power flow on the 345 kV lines from Hitchland 345 kV bus though to Commanche 345 kV bus via Conestoga, Finney, Holcomb and Spearvile.

- Several low voltages occur at Woodward Haven, Tatonga, Hitchland, Conestoga, Finnney 345 kV buses and several adjacent buses, caused by the loss of the Hitchland to Woodward Haven ckt 2 345 kV line (FLT82). The lowest voltage occurs at the Conestoga 345 kV bus with a voltage deviation of about 9% and a voltage of 0.89 V pu.

Voltage sag below 0.94 V pu occurs at project GEN-2008-047 POI for base case conditions and during several contingencies.

4.2 Power Factor Analysis

A QV analysis was performed to determine the amount of reactive support required to maintain either the scheduled base case voltages or 1.0 V pu (whichever is higher) at the points of interconnection of each one of the proposed wind facilities. The contingencies described in Table 3-2 were evaluated in steady state conditions for summer and winter peak base cases, with variable Mvar injection at the POI's.

Table 4-3 presents the Mvar requirements the projects must be able to provide under contingencies in order to meet the power factor requirement. Tables showing the injected Mvar for each controlled voltage level in base case and contingencies are presented in Appendix D for both summer peak and winter peak scenarios. The values chosen are the highest between the two scenarios.

The results obtained in the power factor analysis corroborate the results of the voltage analysis presented by section 4.1: accentuated voltage drops following several contingencies, mostly in the Hitchland 345 kV area. The lack of reactive support demands unrealistic power factor requirement from the studied projects. Section 5 labeled "Sensitivity Analysis" discusses the addition of system reinforcements in the SPP transmission system and its impact on the new projects' performance.

Table 4-3 Mvar Requirements and Power Factor at the POI for the Proposed Projects Interconnection

Project	Point of Interconnection	V Scheduled (p.u)	Mvar Requirements at POI (MVAR)	Existing Mvar Capacity	Total Mvar required	Contingency	Power Factor POI (lagging)
GEN-2008-047	Hitchland 345.0 kV (523097)	1.000	988.0	0	988.0	FLT223PH FLT813PH did not converge	0.27
GEN-2010-007	G10-007-0 115 kV (575090)	1.046	34.0	0	34.0	FLT203PH/FLT733PH FLT013PH did not converge FLT223PH did not converge FLT603PH did not converge FLT813PH did not converge	0.95
GEN-2008-028	Hitchland 345.0 kV (523097)	1.000	699.0	0	699.0	FLT813PH	0.48
GEN-2008-028 & GEN-2008-110	Hitchland 345.0 kV (523097)	1.000	839.0	0	839.0	FLT223PH FLT813PH did not converge	0.62
GEN-2008-028 & GEN-2008-110 & GEN-2010-014	Hitchland 345.0 kV (523097)	1.000	740.0	0	740.0	FLT603PH FLT223PH did not converge FLT813PH did not converge	0.79

4.3 Dynamic Analysis

The stability analysis was carried out for both summer and winter peak load flow models.

In order to determine the impact of the project on the overall system dynamics as well as to determine the requirements to meet the FERC Order 661-A Guidelines, 54 contingencies listed by Table 3-2 were simulated. The results obtained are described in this sub-section.

Tables 4-4 and 4-5 summarize the results obtained from the stability simulations for both summer and winter peak base cases, respectively. The table lists the dynamic performance of the proposed study projects of Group 2 as well as the prior queued projects. Note that only the critical contingencies that lead to trips due to LVRT, frequency protection or loss of synchronism are listed.

The stability results indicate that several of the Group 2 projects and prior queued projects trip during contingencies FLT 22, FLT23 and FLT81.

Table 4-4 Results Obtained - Summer Peak Base Case

Name	Wind Projects Dynamic Performance
FLT22-3PH	GEN-2003-013 (90840) tripped for low voltage at 0.6042s
FLT23-3PH	GEN-2003-013 (90840) tripped for low voltage at 2.2584s GEN-2008-047 (573506 573510) tripped for low voltage at 2.6417s GEN-2006-044 (90601) tripped for low voltage at 2.650s Gen-2006-049 (560946 560947) tripped for low voltage at 2.7625s GEN-2006-044 (90601) tripped for low voltage at 2.7792s GEN-2008-115 (90027 90028 90029) tripped for low voltage at 2.8167s
FLT81-3PH	GEN-2003-013 (90840) tripped for low voltage at 1.1917s Gen-2006-049 (560946 560947) tripped for low voltage at 1.3708s GEN-2005-017 (90171&90172&90173) for over frequency at 1.4875s GEN-2006-020 (90201) tripped for over frequency at 1.4917s GEN-2002-006 (90911&90921&90941&90951) for over frequency at 1.50s GEN-2006-044 (90601) tripped for low voltage at 1.50s Gen-2008-028 (573539) tripped for low voltage at 1.50s Gen-2006-043 (560957) tripped for low voltage at 1.50s GEN-2007-046 (1050) tripped for over frequency at 1.5084s Gen-2006-035 (560934 560935) tripped for low voltage at 8.56s Gen-2006-002 (560929) tripped for low voltage a 8.89s Gen-2005-015 (560811) tripped for low voltage at 10.2624s

Table 4-5 Results Obtained - Winter Peak Base Case

Name	Wind Projects Dynamic Performance
FLT22-3PH	GEN-2003-013 (90840) tripped for low voltage at 0.6042s
FLT23-3PH	GEN-2003-013 (90840) tripped for low voltage at 1.5209s GEN-2008-047 (573506 573510) tripped for low voltage at 1.9334s GEN-2006-044 (90601) tripped for low voltage at 2.650s Gen-2006-049 (560946 560947) tripped for low voltage at 1,8584s GEN-2006-044 (90601) tripped for low voltage at 1.9417s GEN-2008-115 (90027 90028 90029) tripped for low voltage at 1.9417s Gen-2008-028 (573539 573543) tripped for low voltage at 2.0834s Gen-2006-035 (560934 560935) tripped for low voltage at 2.0709s
FLT81-3PH	GEN-2003-013 (90840) tripped for low voltage at 1.1917s Gen-2006-049 (560946 560947) tripped for low voltage at 1.2708s GEN-2005-017 (90171&90172&90173) for over frequency at 1.379s GEN-2006-020 (90201) tripped for over frequency at 1.4917s GEN-2002-006 (90911&90921&90941&90951) for over frequency at 1.39s GEN-2007-046 (1050) tripped for over frequency at 1.40s

As GEN-2003-013 unit is a prior queued project, the LVRT relay was disabled and the contingency re-ran for both summer and winter peak load cases with stable results.

FLT23 is the single line to ground fault with auto reclose (FLT22 is the same contingency without auto reclose) and the outage of GEN-2003-013 to Finney 345kV line, while contingency FLT81 causes the loss of the two 345 kV lines between Hitchland and Woodward Haven. Both cause a significant MW increase flow through the Hitchland to Conestega 345 kV line, and leaves Hitchland 345 kV and the connected system mostly radial.

Also, GEN-2006-020 trips for over frequency for the loss of the Hitchland to GEN-2007-046 to Sherman Tap to Moore Co East and to Sherman 115 kV lines, however is islanded by the contingency.

As Tables 4-4 and 4-5 demonstrate, the lack of reactive support in the area causes poor voltage recovery, leading to the LVRT trips. No attempts were made to address the stability issues given the amount of reactive compensation indicated by table 4-3. Section 5 labeled “Sensitivity Analysis” discusses the addition of system reinforcements in the SPP transmission system and its impact on the new projects’ stability performance.

Stability plots of contingencies: FLT01, FLT22, FLT28 (winter only), FLT31(summer only) and FLT81 evaluated for both summer peak and winter peak scenarios are presented in Appendix C.

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Section

5

Sensitivity Analysis

The following system reinforcements were modeled to the power flow study cases as studied in the previous sections of this report:

- double 345 kV circuit from Hitchland (523097) – Midpt_Bus (525835)
- single 345kV circuit from Midpt_Bus (525835) – Anadarko (511541)

The following steady state, QV and stability analysis have been performed on the winter peak sensitivity case only (with the changes described above), as the winter case in general is the most problematic case from a steady state voltage and dynamic stability perspective.

Figure 5-1 shows the power flow diagram of the project POI's and the surrounding system with the additional transmission lines as described above.

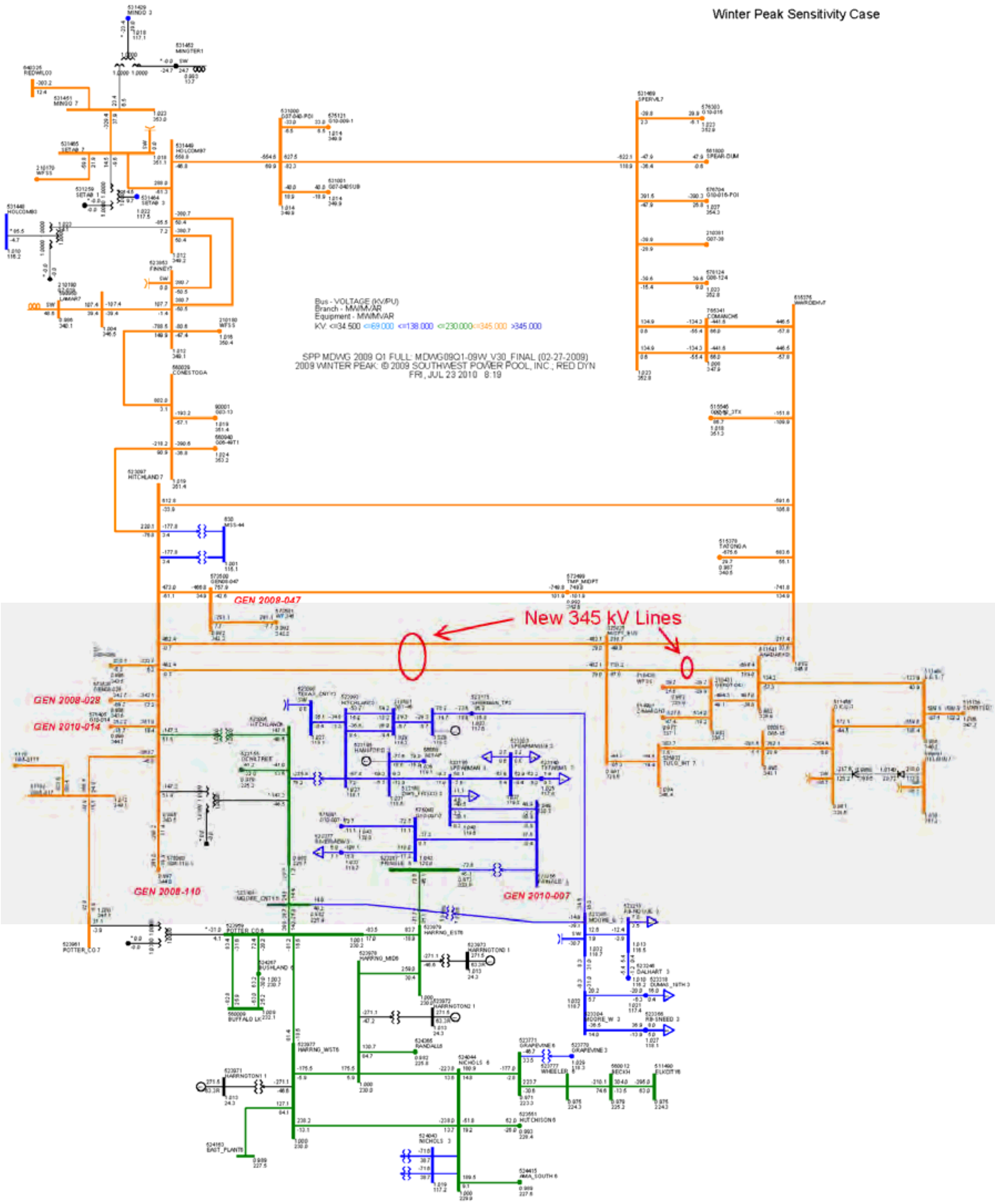

Figure 5-1 Group 2 Points of Interconnection Surrounding Area - Winter Peak Sensitivity

5.1 Steady State Performance

Table 5-1 shows the voltage results obtained using the same criteria, methodology and contingencies as described in sections 3 and 4 for the winter peak sensitivity case only.

Table 5-1 Results Obtained – Steady State Analysis – Winter Peak Sensitivity

Bus #	Bus Name	Base kV	Cont. Name	Cont. Voltage	Base Voltage	% Deviation
515375	WWRDEHV7	345	FLT22_3PH	0.93176	1.00245	-7.07%
523095	HITCHLAND6	230		0.94022	0.98546	-4.52%
523097	HITCHLAND 7	345		0.93766	0.9957	-5.80%
N/A	N/A	N/A	FLT81_3PH	Voltage Collapse		

The violations shown in Table 5-1 are caused by the same reasons given in section 4.1.2 only to a lesser extent. With the addition of the three 345 kV lines the total number of voltage violations is significantly less and the voltages are not as low when compared to the results in section 4.1.2.

5.2 Power Factor Analysis

Table 5-2 shows the results obtained for the winter peak sensitivity case using the same methodology as described in section 4.2. The results show that with the added 345 kV lines, less reactive support is required.

Steady state voltage analysis was performed with the addition of the indicated reactive compensation placed at each POI, as derived from PF analysis given in Table 5-2 (Section 5.2). The results show the voltage violations shown in Table 5-1 above are resolved.

Note that, for the POIs where the requirement is below 0.95, the power factor shall be limited to 0.95 by SPP's tariff.

Table 5-2 Mvar Requirements and Power Factor at the POI for the Proposed Projects Interconnection - Winter Peak Sensitivity

Project	POI	V Scheduled (p.u)	Additional MVAR Requirements at POI	Existing Mvar Capacity	Total Mvar required	Contingency	Power Factor POI (lagging)
GEN-2008-047	Hitchland 345.0 kV (523097)	1.000	+355.0	0	+355.0	FLT223PH	0.64
GEN-2008-028 & GEN-2008-110	Hitchland 345.0 kV (523097)	1.000	+448.0	0	+448.0	FLT813PH	0.52
GEN-2010-007	G10-007-0 115 kV (575090)	1.043	+19.0	0	+19.0	FLT733PH/FLT203PH FLT813PH does not converge	0.99
GEN-2008-028	Hitchland 345.0 kV (523097)	1.000	+263.0	0	+263.0	FLT813PH	0.9
GEN-2008-028 & GEN-2008-110 & GEN-2010-014	Hitchland 345.0 kV (523097)	1.000	+750.0	0	+750.0	FLT813PH	0.83

5.3 Stability Analysis

The following three phase contingencies were selected for stability analysis based on results from section 4.3, for the winter peak sensitivity case: -

- FLT01, FLT22, FLT28 and FLT81.

Contingency FLT83 (only valid for the sensitivity case) was also tested that removes the two added Hitchland to Mid point 345 kV lines, as described in Table 5-3 below.

Table 5-3 Contingency FLT83 (only valid for the sensitivity case)

54	FLT83-3PH	3 phase fault on the Hitchland (523097) – Mid point (525835) 345 kV lines, at Hitchland (523097). a Apply fault at Hitchland (523097). b. Clear fault after 5 cycles, and c. Hitchland (523097) – Mid point (525835) 345 kV line ckt 1, and d. Hitchland (523097) – Mid point (525835) 345 kV line ckt 2

Tables 5-3 and 5-4 show the results of the winter and summer peak conditions respectively.

Table 5-4 Results Obtained - Winter Peak Sensitivity Case

Name	Wind Projects Dynamic Performance
FLT22-3PH	GEN-2003-013 (90840) tripped for low voltage at 0.604s

Table 5-5 Results Obtained - Summer Peak Sensitivity Case

Name	Wind Projects Dynamic Performance
FLT22-3PH	GEN-2003-013 (90840) tripped for low voltage at 0.604s

As GEN-2003-013 unit is a prior queued project, the LVRT relay was disabled and the contingency (FLT22) re-ran with stable results

The results show that with the addition of the 345 kV system upgrades described above the stability of the system, in particular for contingency FLT81 is significantly improved, as highlighted in Figure 5-2 below that compares the dynamic voltage recovery at Hitchland 345 kV bus between the sensitivity and original cases.

Appendix E contains the plots of the winter peak sensitivity case.

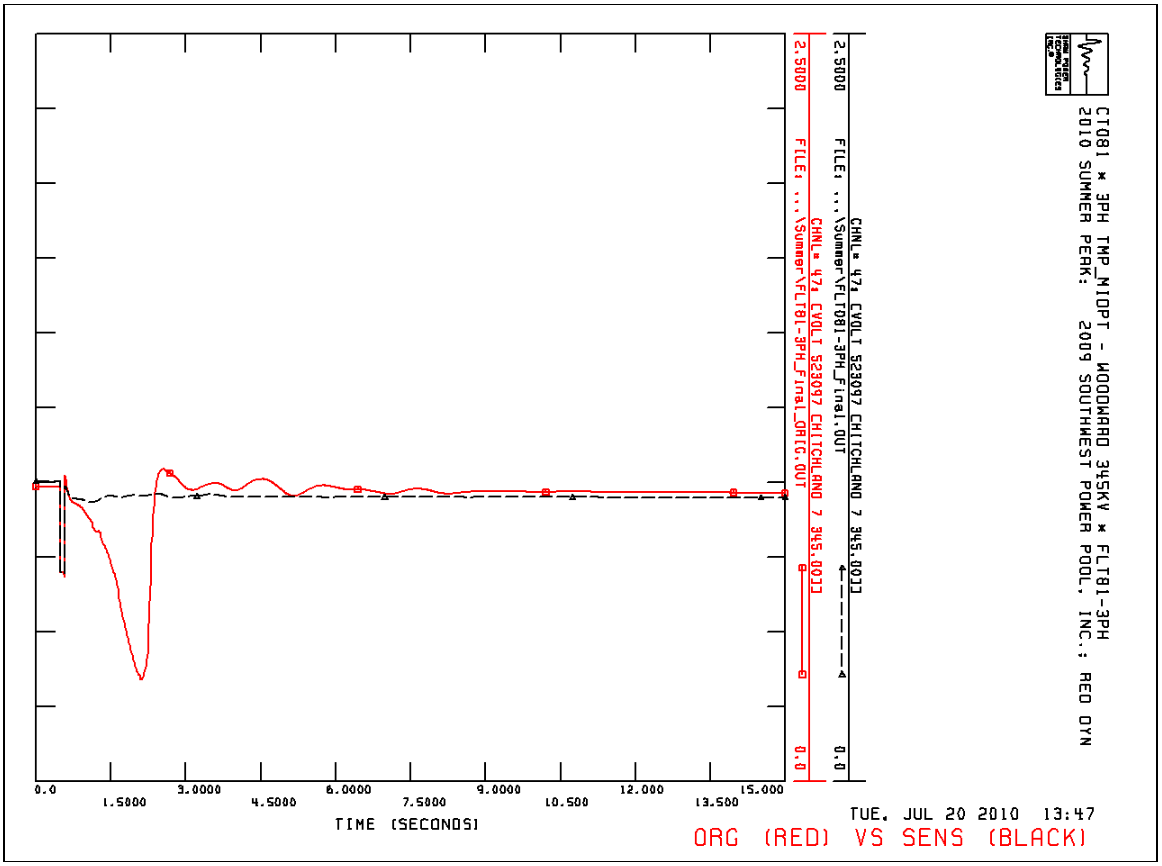

Figure 5-2 Comparison of voltages at the Hitchland 345 kV bus for FLT81 in summer peak base case (ORG) versus summer peak sensitivity case (SENS)

Section

6

Conclusions

The five projects of DISIS-2010-001 Group 2 have been evaluated to determine the impact of the proposed cluster of interconnections on the Southwest Power Pool system.

Steady state and stability analysis were carried out to evaluate the system performance under contingencies. Also to identify the system requirements to meet the FERC Order 661-A Guidelines for Low Voltage Ride Through (LVRT) and therefore, to allow the Group 2 projects to deliver their full power to the SPP transmission system.

In general the Group 1 interconnection requests do have significant impact on the voltage profile of the monitored system. The summer and winter peak scenarios analyzed in section 4 shows severe low voltages mainly at Hitchland 345 kV.

The power factor analysis determined the amount of reactive support required to maintain the scheduled voltages at each one of the points of interconnection under contingency conditions. Due to the lack of reactive support on the Hitchland 345 kV vicinity, Table 4-3 shows unrealistic amounts of reactive support is required to maintain the scheduled base case voltage.

The stability results demonstrate that the lack of reactive support in the area causes poor voltage recovery, leading to the LVRT trips in several study projects as well as prior queued projects.

A sensitivity analysis was performed to discuss the addition of system reinforcements in the SPP transmission system and its impact on the new projects' performance. The winter peak scenario was analyzed with the addition of the following transmission lines:

- double 345 kV circuit from Hitchland (523097) – Midpt_Bus (525835)
- single 345kV circuit from Midpt_Bus (525835) – Anadarko (511541)

Steady state and stability analysis was performed for the winter peak scenario with results showing all the voltage violations found can be resolved with the addition of 345 kV reinforcements lines plus the addition of some reactive support.

The power factor sensitivity analysis determined the new amount of reactive support required to maintain the scheduled voltages at each one of the point of interconnection, as shown in Table 5-2. For those POIs where the requirement is below 0.95, the power factor shall be limited to 0.95 by SPP's tariff.

Also, the system upgrades improve significantly the system dynamic performance. The stability analysis demonstrates that none the new proposed projects trip by low voltage protection during any of the contingencies tested. That is, no trips occurred due to LVRT. Also, all other generators in the monitored areas were stable and remained in synchronism.

GEN-2003-013 project trips due to LVRT issues. Since this is a prior queued project, the LVRT relay was disabled and the contingency (FLT22) re-processed with stable results.

With the 345 kV system upgrades described above and the recommended amount of reactive support, Group 2 projects do not have an adverse impact on the SPP system, for the contingencies and system conditions tested.

K: <u>Stability Study for Group 3</u>

SPP DISIS-2010-001 Group 3 Impact Study

Draft Report for

Southwest Power Pool

Prepared by:
Excel Engineering, Inc.

July 27, 2010

Principal Contributors:

Shu Liu, P.E.
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0. Certification

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the Laws of the State of **Kansas**.

William Quaintance
Kansas Registration Number: 20756

Excel Engineering, Inc.
Kansas Authorization Number: 1611

1. Background and Scope

The DISIS-2010-001 Group 3 Impact Study is a generation interconnection study performed by Excel Engineering, Inc. for its non-affiliated client, Southwest Power Pool (SPP). Its purpose is to study the impacts of interconnecting the projects shown in Table 1-1. The in-service date assumed for the generation addition was 2010.

Table 1-1. Interconnection Requests Evaluated

Request	Size (MW)	Generator Model	Point of Interconnection
GEN-2009-059	100.5	GE 1.5MW	Tap G08-79T – Cudahay 115kV (573029-539659)
GEN-2009-062	115.0	GENROU	Hugoton 115kV (531481)
GEN-2010-009	165.6	Siemens SWT 2.3MW	Gray County 345kV (531000)(G07-040-POI)
GEN-2010-015	200.1	Siemens SWT 2.3MW	Spearville 345kV (531469)
GEN-2010-016	199.8	Vestas V90 1.8MW	Tap Spearville (531469) – Knoll (560004) 345kV

The previously-queued requests shown in Table 1-2 were included in this study. These previously-queued requests were dispatched at 100% of rated capacity.

Table 1-2. Nearby Interconnection Requests Already in the Queue

Request	Size (MW)	Generator Model	Point of Interconnection
GEN-2001-039A	105.0	Clipper 2.5MW	Judson Large – Greensburg 115kV (103)
GEN-2002-025A	150.0	GE 1.5 MW	Spearville 230kV (539695)
GEN-2004-014	154.5	GE 1.5 MW	Spearville 230kV (539695)
GEN-2005-012	250.0	Vestas V90 3.0MW	Spearville 345kV (531469)
GEN-2006-006	205.0	GE 1.5 MW	Spearville 230kV (539695)
GEN-2006-021	100.0	Clipper 2.5MW	Tap Harper (539668) – Medicine Lodge (539674) 138kV. (Bus 539638)
GEN-2006-022	150.0	Clipper 2.5MW	Pratt 115kV (539687)
GEN-2007-038	200.0	Clipper 2.5MW	Spearville 345kV (531469)
GEN-2008-018	405.0	GE 1.5 MW	Finney 345kV (523853)
GEN-2007-040	200.0	Siemens 2.3MW	Holcomb (531449) – Spearville (531469) 345kV. (Bus 531000)
GEN-2008-079	100.5	G.E. 1.5 MW	Tap Cudahy (539659) – Judson Large (539671) 115kV. (Bus 573029)
GEN-2008-124	200.0	Siemens 2.3MW	Spearville (531469) 345kV

The study included stability analysis of each proposed interconnection request. Contingencies that resulted in a prior-queued project tripping off-line, if any, were re-run with the prior-queued project's voltage and frequency tripping disabled. A power factor analysis was performed for the wind farms in Table 1-1.

ATC (Available Transfer Capability) studies were not performed as part of this study. These studies will be required at the time transmission service is actually requested. Additional transmission upgrades may be required based on that analysis.

Study assumptions in general have been based on Excel's knowledge of the electric power system and on the specific information and data provided by SPP. The accuracy of the conclusions contained within this study is sensitive to the assumptions made with respect to other generation additions and transmission improvements being contemplated by other entities. Changes in the assumptions of the timing of other generation additions or transmission improvements will affect this study's conclusions.

2. Executive Summary

The DISIS-2010-001 Group 3 Impact Study evaluated the impacts of interconnecting the projects GEN-2009-059, GEN-2009-062, GEN-2010-009, GEN-2010-015, and GEN-2010-016 to the SPP electric system.

No stability problems were found during summer or winter peak conditions due to the addition of these generators.

Power factor requirements were determined, and the study plants must install sufficient reactive power resources to meet the requirements listed in Table 4-2. These results indicate that GEN-2010-015 will need to add 17 Mvar of capacitors at its 34.5kV substation bus (576302) and 17 Mvar of capacitors at its 34.5kV substation bus (576312). GEN-2010-016 will need to add 96 Mvar of capacitors at its 34.5kV substation bus (576702). The reactive power resources need not be dynamically controlled. However, any change in wind turbine model or controls could change the stability results, possibly resulting in a need for a dynamically controlled reactive power supply.

DISIS-2010-001 Group 3 should be able to reliably connect to the SPP transmission grid if the reactive compensation requirements listed above are implemented.

3. Study Development and Assumptions

3.1 Simulation Tools

The Siemens Power Technologies, Inc. PSS/E power system simulation program Version 30.3.3 was used in this study.

3.2 Models Used

SPP provided its latest stability database cases for both summer and winter peak seasons. Each plant's PSS/E model had been developed prior to this study and was included in the power flow case and the dynamics database. As a result, no additional generator modeling was required. Power flow and dynamic model data for the study plants are provided in Appendix D.

Power flow one-line diagrams of the study projects in summer peak conditions are shown in Figure 3-1 to Figure 3-5. As the figures show, each wind farm model includes explicit representation of the radial transmission line, if any; the substation transformer(s) from transmission voltage to 34.5kV; and the substation reactive power device(s), if any. The remainder of each wind farm is represented by one or more lumped equivalents including a generator, a step-up transformer, and a collector system impedance.

No special modeling is required of line relays in these cases, except for the special modeling related to the wind-turbine tripping.

3.3 Monitored Facilities

All generators in Areas 520, 524, 525, 526, 531, 534, 536, 539, 541, 640, 645, 650, and 652 were monitored.

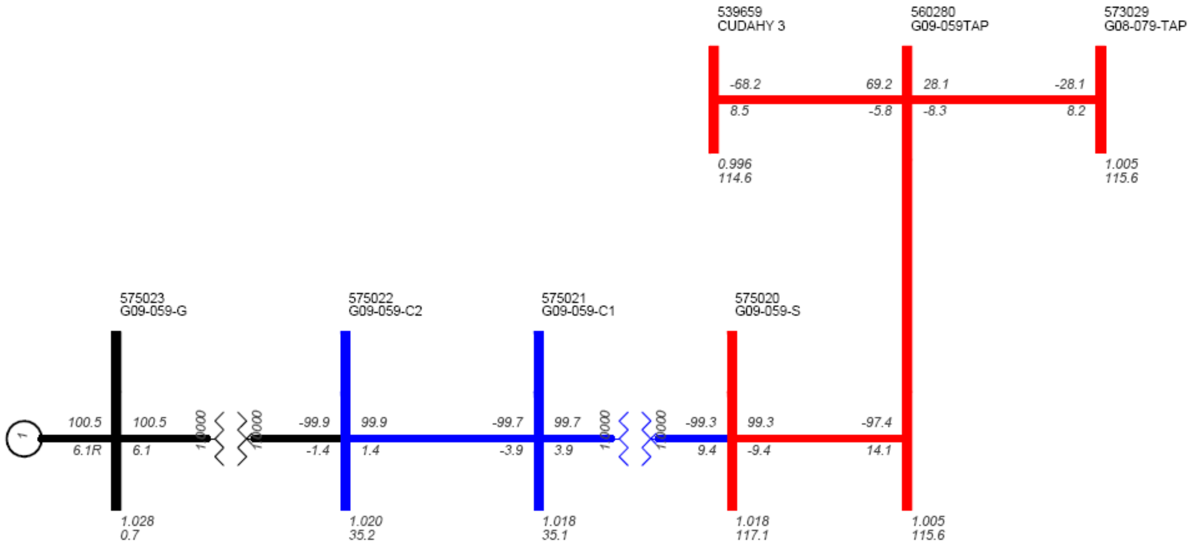

Figure 3-1. Power Flow One-line for GEN-2009-059 and adjacent equipment (SP)

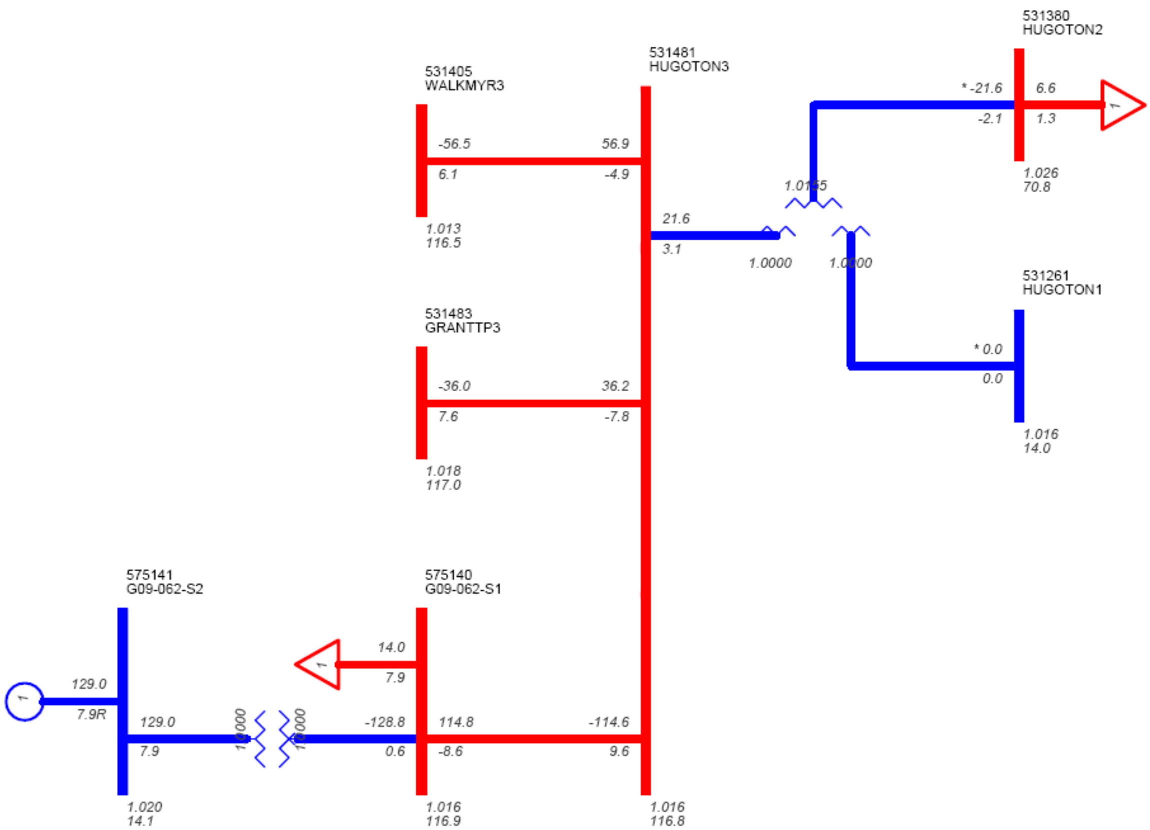

Figure 3-2. Power Flow One-line for GEN-2009-062 and adjacent equipment (SP)

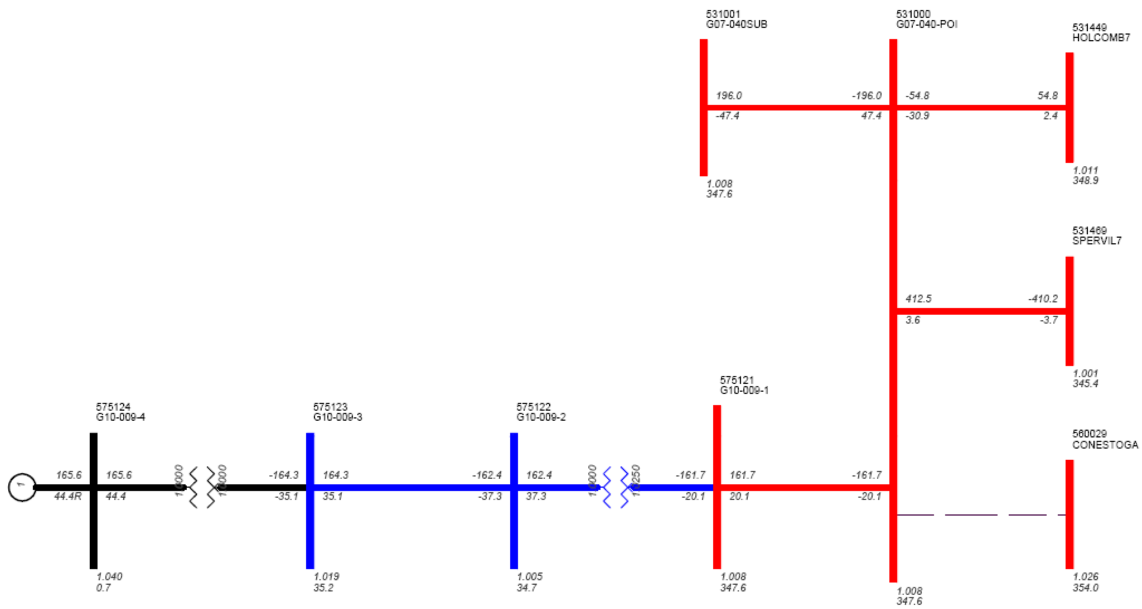

Figure 3-3. Power Flow One-line for GEN-2010-009 and adjacent equipment (SP)

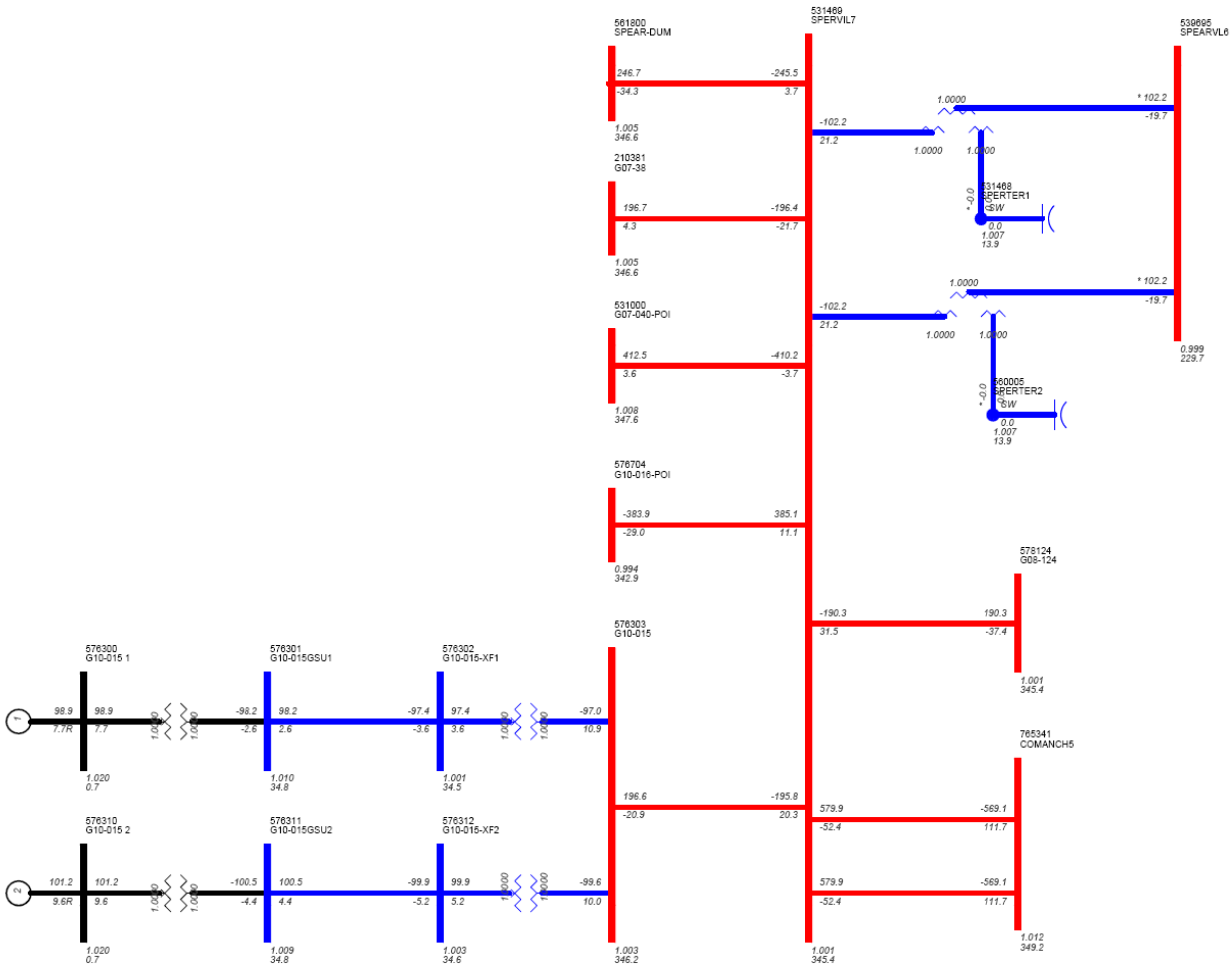

Figure 3-4. Power Flow One-line for GEN-2010-015 and adjacent equipment (SP)

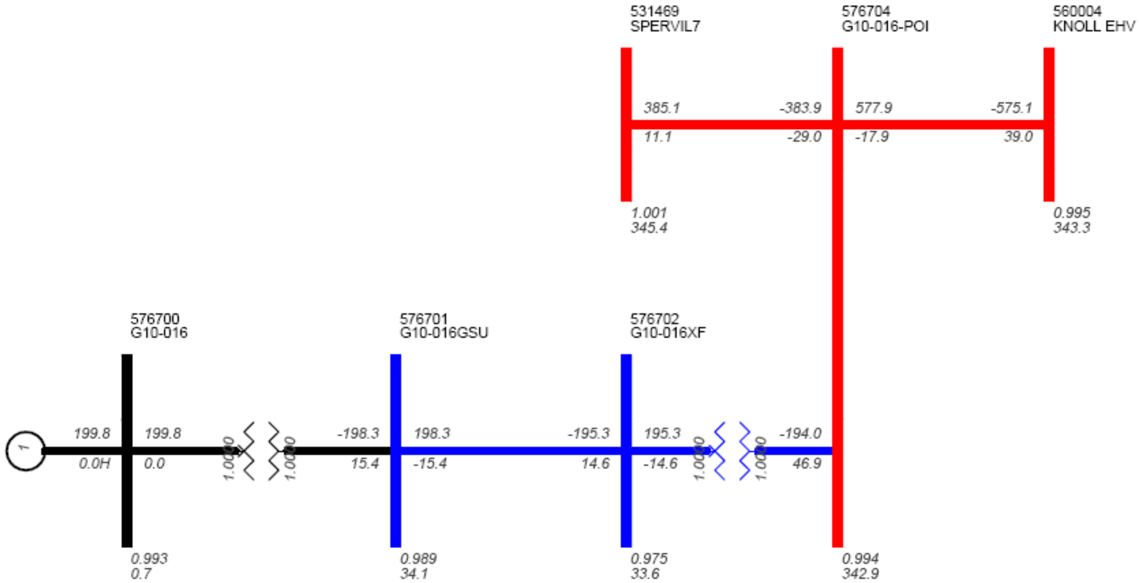

Figure 3-5. Power Flow One-line for GEN-2010-016 and adjacent equipment (SP)

3.4 Performance Criteria

The wind generators must comply with FERC Order 661A on low voltage ride through for wind farms. Therefore, the wind generators must not trip off line for faults at the Point of Interconnection. If a wind generator trips off line, an appropriately sized SVC or STATCOM device may need to be specified to keep the wind generator on-line for the fault. SPP was consulted to determine if the addition of an SVC or STATCOM is warranted for the specific condition.

Contingencies that resulted in a prior-queued project tripping off-line, if any, were re-run with the prior-queued project's voltage and frequency tripping disabled to check for stability issues.

3.5 Performance Evaluation Methods

Since some of the interconnection requests are wind projects, a power factor analysis was performed. The power factor analysis consisted of modeling a var generator in each wind farm holding a voltage schedule at the POI. The voltage schedule was set equal to the higher of the voltage with the wind farm off-line or 1.0 per unit.

If the required power factor at the POI is beyond the capability of the studied wind turbines, then capacitor banks would be considered. Factors used in sizing capacitor banks would include two requirements of FERC Order 661A: the ability of the wind farm to ride through low voltage with and without capacitor banks and the ability of the wind farm to recover to pre-fault voltage. If a wind generator trips on high voltage, a leading power factor may be required.

ATC studies were not performed as part of this study. These studies will be required at the time transmission service is actually requested. Additional transmission facilities may be required based on subsequent ATC analysis.

Stability analysis was performed for the proposed interconnection request. Faults were simulated on transmission lines at the POIs and on other nearby transmission equipment. The faults in Table 3-1 were run for each case (three phase and single phase as noted).

Table 3-1. Fault Definitions for DISIS-2010-001 Group 3

Cont. No.	Cont. Name	Description
1	FLT01-3PH	3 phase fault on the Finney (523853) to GEN-2003-013 (560029) 345kV line, near Finney. a. Apply fault at the Finney 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
2	FLT02-1PH	Single phase fault on the line in previous a. Apply single phase fault. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
3	FLT03-3PH	3 phase fault on one of the Finney (523853) to Holcomb (531449) 345kV lines, near Finney. a. Apply fault at the Finney 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
4	FLT04-1PH	Single phase fault on the line in previous a. Apply single phase fault. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
5	FLT05-3PH	3 phase fault on the Holcomb (531449) to Setab (531465) 345kV line, near Holcomb. a. Apply fault at the Holcomb 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
6	FLT06-1PH	Single phase fault on the line in previous a. Apply single phase fault. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
7	FLT07-3PH	3 phase fault on the Holcomb (531449) to GEN-2007-040 (531000) 345kV line, near GEN-2007-040. a. Apply fault at the GEN-2007-040 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
8	FLT08-1PH	Single phase fault on the line in previous a. Apply single phase fault. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
9	FLT09-3PH	3 phase fault on the Holcomb 345kV (531449) to 115kV (531448) transformer, near the 345kV bus. a. Apply fault at the Holcomb 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
10	FLT10-3PH	3 phase fault on the Finney (523853) to Gen-2007-019 (210190) 345kV line, near Lamar. a. Apply fault at Gen-2007-019 (210190) 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
11	FLT11-1PH	*Single phase fault and sequence like previous*

Cont. No.	Cont. Name	Description
12	FLT12-3PH	3 phase fault on the Spearville (531469) to GEN-2007-040 (531000) 345kV line, near GEN-2007-040. a. Apply fault at the GEN-2007-040 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
13	FLT13-1PH	*Single phase fault and sequence like previous*
14	FLT14-3PH	3 phase fault on one of the Spearville (531469) to Comanche (765341) 345kV lines, near Spearville. a. Apply fault at the Spearville 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
15	FLT15-1PH	Single phase fault on the line in previous a. Apply single phase fault. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
16	FLT16-3PH	3 phase fault on the Spearville 345kV (531469) to 230kV (539695) transformer, near the 345kV bus. a. Apply fault at the Spearville 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
17	FLT17-3PH	3 phase fault on the Spearville 230kV (539695) to 115kV (539694) transformer #2, near the 230kV bus. a. Apply fault at the Spearville 230kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
18	FLT18-3PH	3 phase fault on the Spearville (539695) to Mullergren (539679) 230kV line, near Spearville. a. Apply fault at the Spearville 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
19	FLT19-1PH	*Single phase fault and sequence like previous*
20	FLT20-3PH	3 phase fault on the Mullergren (539679) to South Hays (530582) 230kV line, near Mullergren. a. Apply fault at the Mullergren 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
21	FLT21-1PH	*Single phase fault and sequence like previous*
22	FLT22-3PH	3 phase fault on the Mullergren (539679) to Circle (532871) 230kV line, near Mullergren. a. Apply fault at the Mullergren 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
23	FLT23-1PH	*Single phase fault and sequence like previous*

Cont. No.	Cont. Name	Description
24	FLT24-3PH	3 phase fault on the Comanche (765341) to Medicine Lodge (765342) 345kV line, near Comanche. a. Apply fault at the Comanche 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
25	FLT25-1PH	*Single phase fault and sequence like previous*
26	FLT26-3PH	3 phase fault on the Comanche (765341) to Woodward (515375) 345kV line, near Comanche. a. Apply fault at the Comanche 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
27	FLT27-1PH	*Single phase fault and sequence like previous*
28	FLT28-3PH	3 phase fault on the GEN-2003-013 (560029) to Hitchland (523097) 345kV line, near GEN-2003-013. a. Apply fault at the GEN-2003-013 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
29	FLT29-1PH	Single phase fault on the line in previous a. Apply single phase fault. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
30	FLT30-3PH	3 phase fault on the Hitchland (523097) to Woodward (515375) 345kV line, near Woodward. a. Apply fault at the Woodward 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
31	FLT31-1PH	Single phase fault on the line in previous a. Apply single phase fault. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
32	FLT32-3PH	3 phase fault on the Knoll (530558) to Smoky Hills (530592) 230kV line, near Knoll. a. Apply fault at the Knoll 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
33	FLT33-1PH	*Single phase fault and sequence like previous*
34	FLT34-3PH	3 phase fault on the Knoll (560004) to Axtell (640065) 345kV line, near Knoll. a. Apply fault at the Knoll 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
35	FLT35-3PH	3 phase fault on the Knoll 345kV (560004) to 230kV (530558) transformer, near the 345kV bus. a. Apply fault at the Knoll 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.

Cont. No.	Cont. Name	Description
36	FLT36-3PH	3 phase fault on the GEN-2001-039A (103) to Judson Large (539671) 115kV line, near GEN-2001-039A. a. Apply fault at the GEN-2001-039A 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
37	FLT37-1PH	*Single phase fault and sequence like previous*
38	FLT38-3PH	3 phase fault on the Conestoga (560029) to GEN-2007-040 (531000) 345kV line, near GEN-2007-040. a. Apply fault at the GEN-2007-040 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
39	FLT39-1PH	Single phase fault on the line in previous a. Apply single phase fault. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
40	FLT40-3PH	3 phase fault on the GEN-2010-016 (576704) to Spearville (531469) 345kV line, near GEN-2010-016. a. Apply fault at GEN-2010-016 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
41	FLT41-1PH	Single phase fault on the line in previous a. Apply single phase fault. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
42	FLT42-3PH	3 phase fault on the GEN-2010-016 (576704) to Knoll (560004) 345kV line, near GEN-2010-016. a. Apply fault at GEN-2010-016 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
43	FLT43-1PH	Single phase fault on the line in previous a. Apply single phase fault. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
44	FLT44-3PH	3 phase fault on the GEN-2009-059 (560280) to G08-079-TAP (573029) 115kV line, near GEN-2009-059. a. Apply fault at the GEN-2009-059 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
45	FLT45-1PH	*Single phase fault and sequence like previous*
46	FLT46-3PH	3 phase fault on the GEN-2009-059 (560280) to Cudahay (539659) 115kV line, near GEN-2009-059. a. Apply fault at the GEN-2009-059 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
47	FLT47-1PH	*Single phase fault and sequence like previous*

Cont. No.	Cont. Name	Description
48	FLT48-3PH	3 phase fault on the Cudahay (539659) to Kismet (539646) 115kV line, near Kismet. a. Apply fault at the Kismet 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
49	FLT49-1PH	*Single phase fault and sequence like previous*
50	FLT50-3PH	3 phase fault on the Kismet (539646) to CMRIVTP (539652) 115kV line, near Kismet. a. Apply fault at the Kismet 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
51	FLT51-1PH	*Single phase fault and sequence like previous*
52	FLT52-3PH	3 phase fault on the CMRIVTP (539652) to E-Liberty (539672) 115kV line, near CMRIVTP. a. Apply fault at the CMRIVTP 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
53	FLT53-1PH	*Single phase fault and sequence like previous*
54	FLT54-3PH	3 phase fault on the Hugoton (531481) to Walkmyr (531405) 115kV line, near Hugoton. a. Apply fault at the Hugoton 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
55	FLT55-1PH	*Single phase fault and sequence like previous*
56	FLT56-3PH	3 phase fault on the Hugoton (531481) to GrantTP (531483)115kV line, near Hugoton. a. Apply fault at the Hugoton 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
57	FLT57-1PH	*Single phase fault and sequence like previous*
58	FLT58-3PH	3 phase fault on the Pioneer (531391) to Puckett (531400) 115kV line, near Pioneer. a. Apply fault at the Pioneer 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
59	FLT59-1PH	*Single phase fault and sequence like previous*
60	FLT60-3PH	3 phase fault on the Pioneer (531391) to Hickock (531378) 115kV line, near Pioneer. a. Apply fault at the Pioneer 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
61	FLT61-1PH	*Single phase fault and sequence like previous*
62	FLT62-3PH	3 phase fault on both of the Spearville (531469) to Comanche (765341) 345kV lines, near Spearville. a. Apply fault at the Spearville 345kV bus. b. Clear fault after 5 cycles by tripping the faulted lines.

Cont. No.	Cont. Name	Description
63	FLT63-3PH	3 phase fault on both of the Comanche (765341) to Medicine Lodge (765342) 345kV line, near Comanche. a. Apply fault at the Comanche 345kV bus. b. Clear fault after 5 cycles by tripping the faulted lines. c. Wait 20 cycles, and then re-close the lines in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the lines in (b) and remove fault.
64	FLT64-3PH	3 phase fault on both of the Comanche (765341) to Woodward (515375) 345kV line, near Comanche. a. Apply fault at the Comanche 345kV bus. b. Clear fault after 5 cycles by tripping the faulted lines. c. Wait 20 cycles, and then re-close the lines in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the lines in (b) and remove fault.
65	FLT65-3PH	3 phase fault on both of the Wichita (532796) to Medicine Lodge (765342) 345kV line, near Medicine Lodge. a. Apply fault at the Medicine Lodge 345kV bus. b. Clear fault after 5 cycles by tripping the faulted lines. c. Wait 20 cycles, and then re-close the lines in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the lines in (b) and remove fault.

4. Results and Observations

4.1 Stability Analysis Results

All faults were run for both summer and winter peak conditions. If a previously-queued generator tripped for any of these faults, the voltage and frequency tripping was disabled, and the fault was re-run to check for system stability.

Table 4-1 summarizes the overall results for all faults run. Figure 4-1 and Figure 4-10 show representative summer peak season plots for faults at the POI for the study projects. Complete sets of plots for both summer and winter peak seasons for each fault are included in Appendices A and B.

The system remains stable for all simulated faults. The study projects and the prior-queued projects stay on-line and are stable for all simulated faults.

Table 4-1. Summary of Stability Results

Cont. No.	Cont. Name	Description	Summer Peak Results	Winter Peak Results
1	FLT01-3PH	3 phase fault on the Finney (523853) to GEN-2003-013 (560029) 345kV line, near Finney.	OK	OK
2	FLT02-1PH	Single phase fault on the line in previous	OK	OK
3	FLT03-3PH	3 phase fault on one of the Finney (523853) to Holcomb (531449) 345kV lines, near Finney.	OK	OK
4	FLT04-1PH	Single phase fault on the line in previous	OK	OK
5	FLT05-3PH	3 phase fault on the Holcomb (531449) to Setab (531465) 345kV line, near Holcomb.	OK	OK
6	FLT06-1PH	Single phase fault on the line in previous	OK	OK
7	FLT07-3PH	3 phase fault on the Holcomb (531449) to GEN-2007-040 (531000) 345kV line, near GEN-2007-040.	OK	OK
8	FLT08-1PH	Single phase fault on the line in previous	OK	OK
9	FLT09-3PH	3 phase fault on the Holcomb 345kV (531449) to 115kV (531448) transformer, near the 345 kV bus.	OK	OK
10	FLT10-3PH	3 phase fault on the Finney (523853) to Gen-2007-019 (210190) 345kV line, near Lamar.	OK	OK
11	FLT11-1PH	Single phase fault and sequence like previous	OK	OK
12	FLT12-3PH	3 phase fault on the Spearville (531469) to GEN-2007-040 (531000) 345kV line, near GEN-2007-040.	OK	OK
13	FLT13-1PH	Single phase fault and sequence like previous	OK	OK
14	FLT14-3PH	3 phase fault on one of the Spearville (531469) to Comanche (765341) 345kV lines, near Spearville.	OK	OK
15	FLT15-1PH	Single phase fault on the line in previous	OK	OK
16	FLT16-3PH	3 phase fault on the Spearville 345kV (531469) to 230kV (539695) transformer, near the 345 kV bus.	OK	OK
17	FLT17-3PH	3 phase fault on the Spearville 230kV (539695) to 115kV (539694) transformer #2, near the 230 kV bus.	OK	OK
18	FLT18-3PH	3 phase fault on the Spearville (539695) to Mullergren (539679) 230kV line, near Spearville.	OK	OK
19	FLT19-1PH	Single phase fault and sequence like previous	OK	OK
20	FLT20-3PH	3 phase fault on the Mullergren (539679) to South Hays (530582) 230kV line, near Mullergren.	OK	OK
21	FLT21-1PH	Single phase fault and sequence like previous	OK	OK
22	FLT22-3PH	3 phase fault on the Mullergren (539679) to Circle (532871) 230kV line, near Mullergren.	OK	OK
23	FLT23-1PH	Single phase fault and sequence like previous	OK	OK
24	FLT24-3PH	3 phase fault on the Comanche (765341) to Medicine Lodge (765342) 345kV line, near Comanche.	OK	OK
25	FLT25-1PH	Single phase fault and sequence like previous	OK	OK
26	FLT26-3PH	3 phase fault on the Comanche (765341) to Woodward (515375) 345kV line, near Comanche.	OK	OK
27	FLT27-1PH	Single phase fault and sequence like previous	OK	OK
28	FLT28-3PH	3 phase fault on the GEN-2003-013 (560029) to Hitchland (523097)	OK	OK

Cont. No.	Cont. Name	Description	Summer Peak Results	Winter Peak Results
		345kV line, near GEN-2003-013.		
29	FLT29-1PH	Single phase fault on the line in previous	OK	OK
30	FLT30-3PH	3 phase fault on the Hitchland (523097) to Woodward (515375) 345kV line, near Woodward.	OK	OK
31	FLT31-1PH	Single phase fault on the line in previous	OK	OK
32	FLT32-3PH	3 phase fault on the Knoll (530558) to Smoky Hills (530592) 230kV line, near Knoll.	OK	OK
33	FLT33-1PH	Single phase fault and sequence like previous	OK	OK
34	FLT34-3PH	3 phase fault on the Knoll (560004) to Axtell (640065) 345kV line, near Knoll.	OK	OK
35	FLT35-3PH	3 phase fault on the Knoll 345kV (560004) to 230kV (530558) transformer, near the 345 kV bus.	OK	OK
36	FLT36-3PH	3 phase fault on the GEN-2001-039A (103) to Judson Large (539671) 115kV line, near GEN-2001-039A.	OK	OK
37	FLT37-1PH	Single phase fault and sequence like previous	OK	OK
38	FLT38-3PH	3 phase fault on the Conestoga (560029) to GEN-2007-040 (531000) 345kV line, near GEN-2007-040.	OK	OK
39	FLT39-1PH	Single phase fault on the line in previous	OK	OK
40	FLT40-3PH	3 phase fault on the GEN-2010-016 (576704) to Spearville (531469) 345kV line, near GEN-2010-016.	OK	OK
41	FLT41-1PH	Single phase fault on the line in previous	OK	OK
42	FLT42-3PH	3 phase fault on the GEN-2010-016 (576704) to Knoll (560004) 345kV line, near GEN-2010-016.	OK	OK
43	FLT43-1PH	Single phase fault on the line in previous	OK	OK
44	FLT44-3PH	3 phase fault on the GEN-2009-059 (560280) to G08-079-TAP (573029) 115kV line, near GEN-2009-059.	OK	OK
45	FLT45-1PH	Single phase fault and sequence like previous	OK	OK
46	FLT46-3PH	3 phase fault on the GEN-2009-059 (560280) to Cudahay (539659) 115kV line, near GEN-2009-059.	OK	OK
47	FLT47-1PH	Single phase fault and sequence like previous	OK	OK
48	FLT48-3PH	3 phase fault on the Cudahay (539659) to Kismet (539646) 115kV line, near Kismet.	OK	OK
49	FLT49-1PH	Single phase fault and sequence like previous	OK	OK
50	FLT50-3PH	3 phase fault on the Kismet (539646) to CMRIVTP (539652) 115kV line, near Kismet.	OK	OK
51	FLT51-1PH	Single phase fault and sequence like previous	OK	OK
52	FLT52-3PH	3 phase fault on the CMRIVTP (539652) to E-Liberty (539672) 115kV line, near CMRIVTP.	OK	OK
53	FLT53-1PH	Single phase fault and sequence like previous	OK	OK
54	FLT54-3PH	3 phase fault on the Hugoton (531481) to Walkmyr (531405) 115kV line, near Hugoton.	OK	OK
55	FLT55-1PH	Single phase fault and sequence like previous	OK	OK
56	FLT56-3PH	3 phase fault on the Hugoton (531481) to GrantTP (531483)115kV line, near Hugoton.	OK	OK
57	FLT57-1PH	Single phase fault and sequence like previous	OK	OK
58	FLT58-3PH	3 phase fault on the Pioneer (531391) to Puckett (531400) 115kV	OK	OK

Cont. No.	Cont. Name	Description	Summer Peak Results	Winter Peak Results
		line, near Pioneer.		
59	FLT59-1PH	Single phase fault and sequence like previous	OK	OK
60	FLT60-3PH	3 phase fault on the Pioneer (531391) to Hickock (531378) 115kV line, near Pioneer.	OK	OK
61	FLT61-1PH	Single phase fault and sequence like previous	OK	OK
62	FLT62-3PH	3 phase fault on both of the Spearville (531469) to Comanche (765341) 345kV lines, near Spearville.	OK	OK
63	FLT63-3PH	3 phase fault on both of the Comanche (765341) to Medicine Lodge (765342) 345kV line, near Comanche.	OK	OK
64	FLT64-3PH	3 phase fault on both of the Comanche (765341) to Woodward (515375) 345kV line, near Comanche.	OK	OK
65	FLT65-3PH	3 phase fault on both of the Wichita (532796) to Medicine Lodge (765342) 345kV line, near Medicine Lodge.	OK	OK

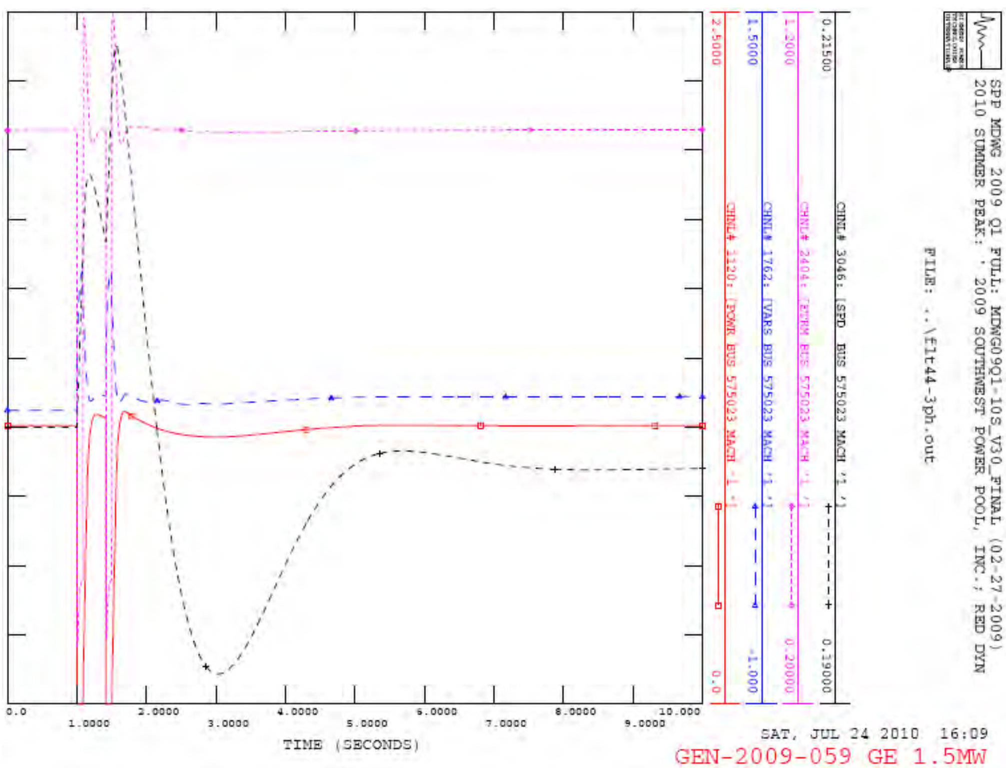

Figure 4-1. GEN-2009-059 Plot for Fault 44 – 3-Phase Fault on the GEN-2009-059 to G08-079-TAP 115kV line, near GEN-2009-059

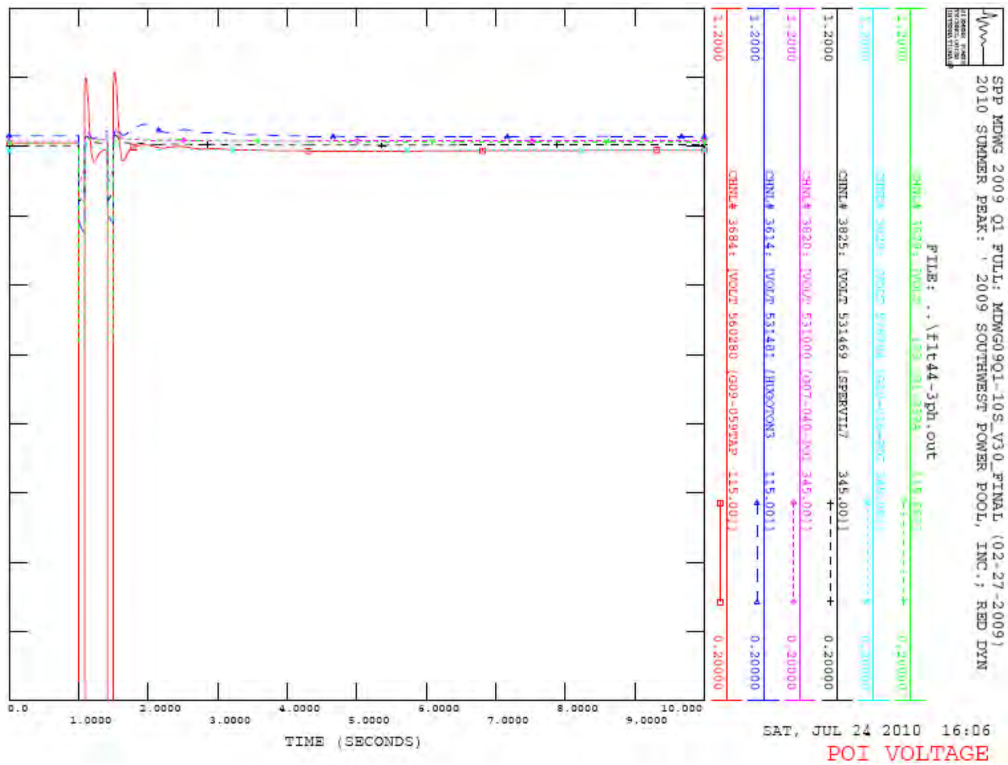

Figure 4-2. POI Voltage Plot for Fault 44 – 3-Phase Fault on the GEN-2009-059 to G08-079-TAP 115kV line, near GEN-2009-059

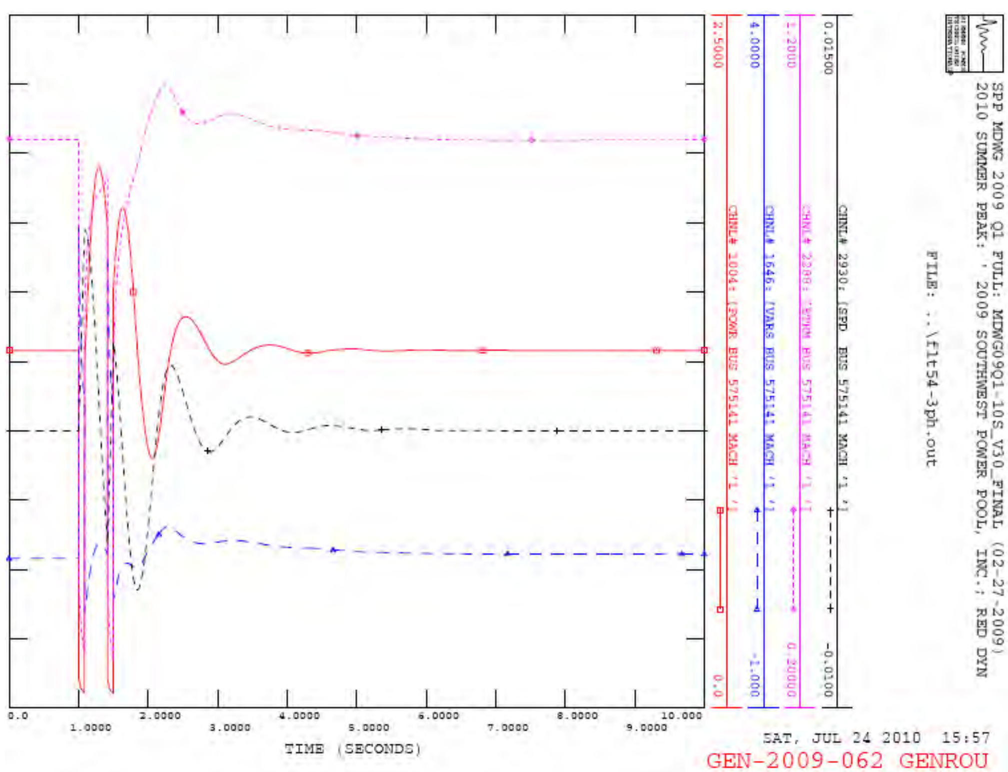

Figure 4-3. GEN-2009-062 Plot for Fault 54 – 3-Phase Fault on the Hugoton to Walkmyr 115kV line, near Hugoton

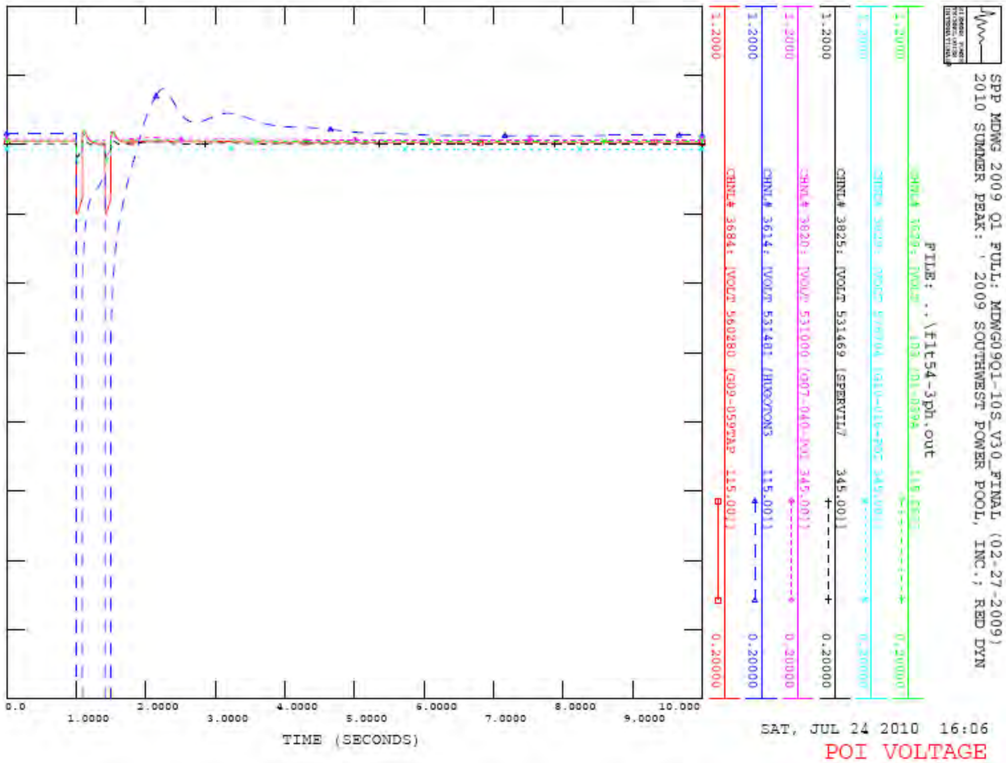

Figure 4-4. POI Voltage Plot for Fault 54 – 3-Phase Fault on the Hugoton to Walkmyr 115kV line, near Hugoton

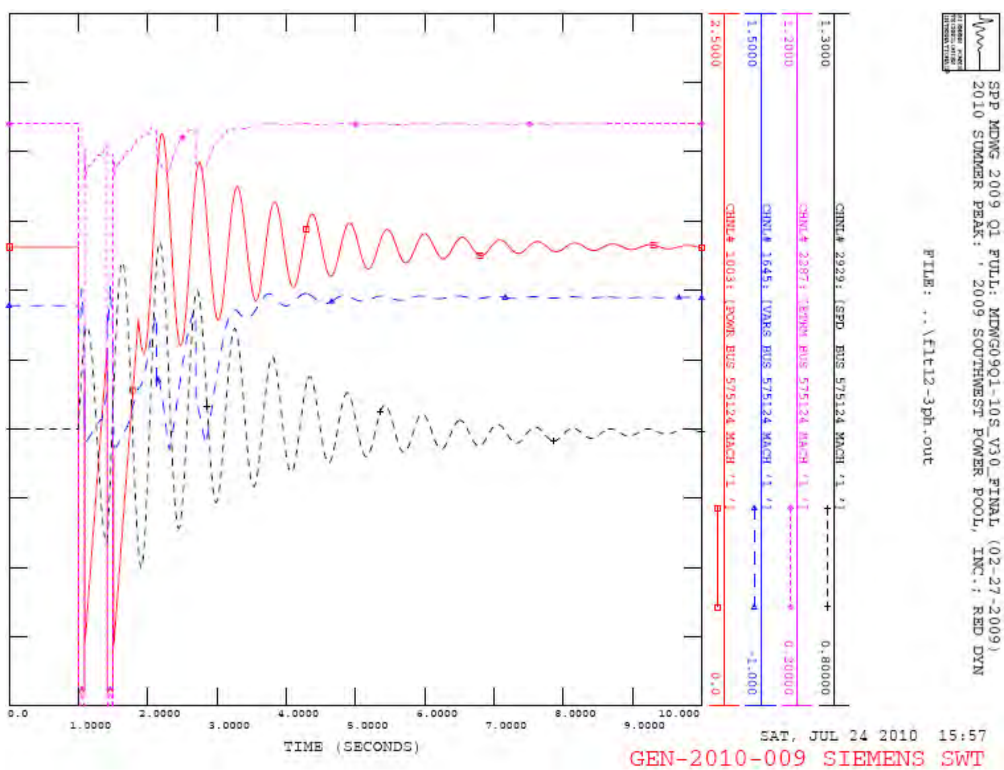

Figure 4-5. GEN-2010-009 Plot for Fault 12 – 3-Phase Fault on the Spearville to GEN-2007-040 345kV line, near GEN-2007-040

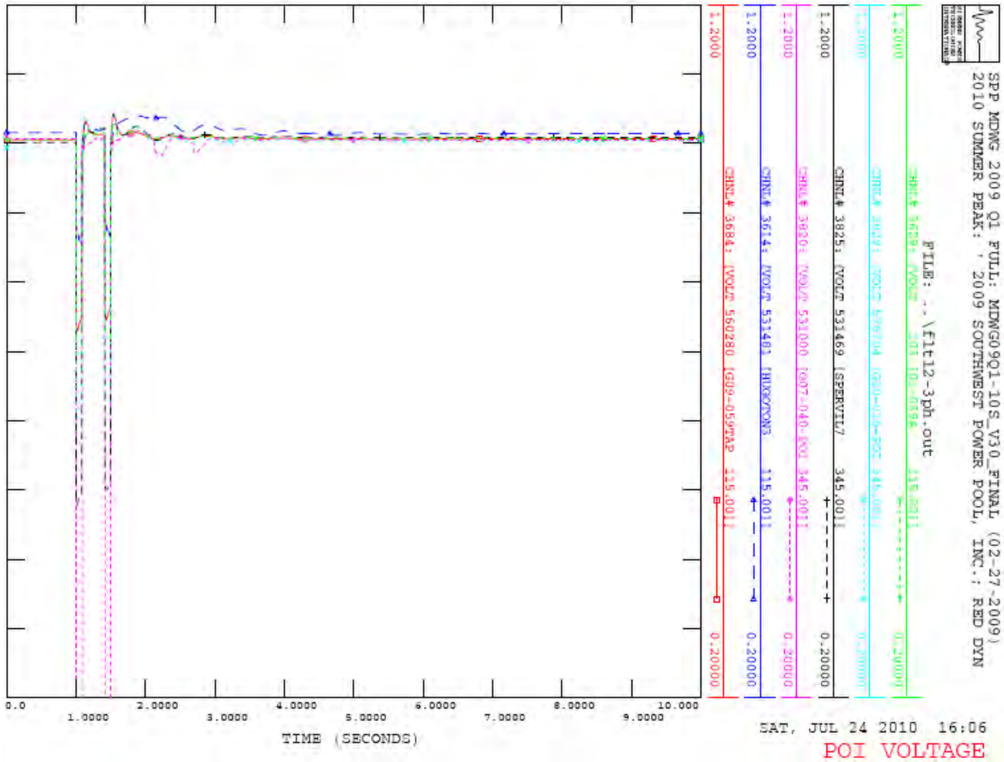

Figure 4-6. **POI Voltage Plot for Fault 12 – 3-Phase Fault on the Spearville to GEN-2007-040 345kV line, near GEN-2007-040**

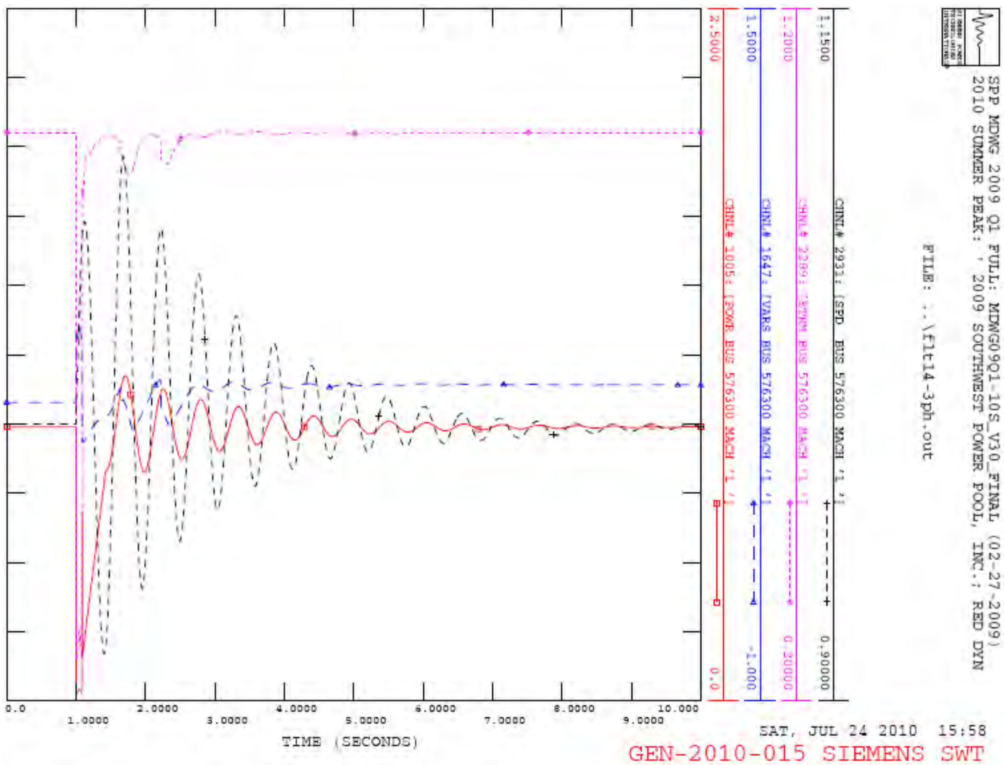

Figure 4-7. **GEN-2010-015 Plot for Fault 14 – 3-Phase Fault on one of the Spearville to Comanche 345kV lines, near Spearville**

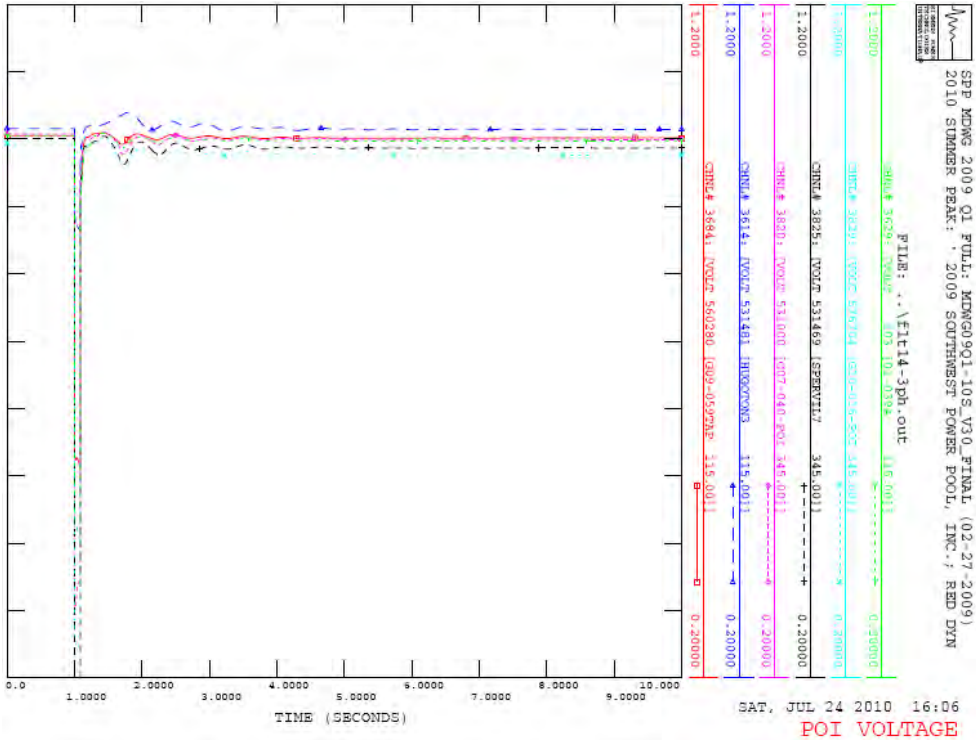

Figure 4-8. POI Voltage Plot for Fault 14 – 3-Phase Fault on one of the Spearville to Comanche 345kV lines, near Spearville

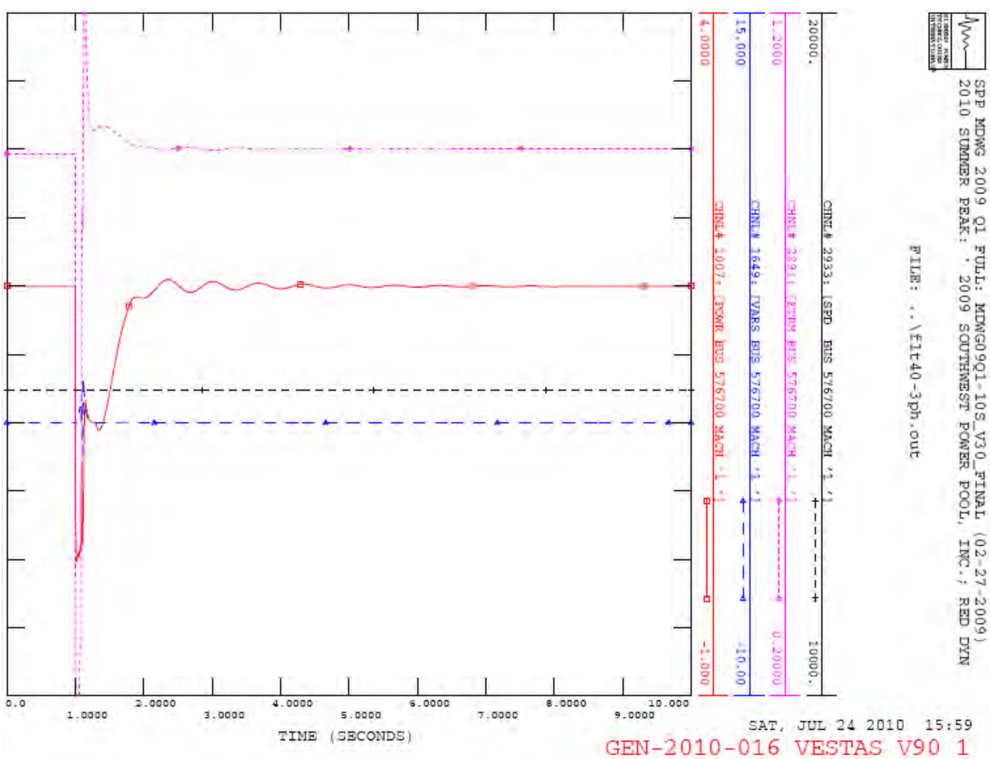

Figure 4-9. GEN-2010-016 Plot for Fault 40 – 3-Phase Fault on the GEN-2010-016 to Spearville 345kV line, near GEN-2010-016

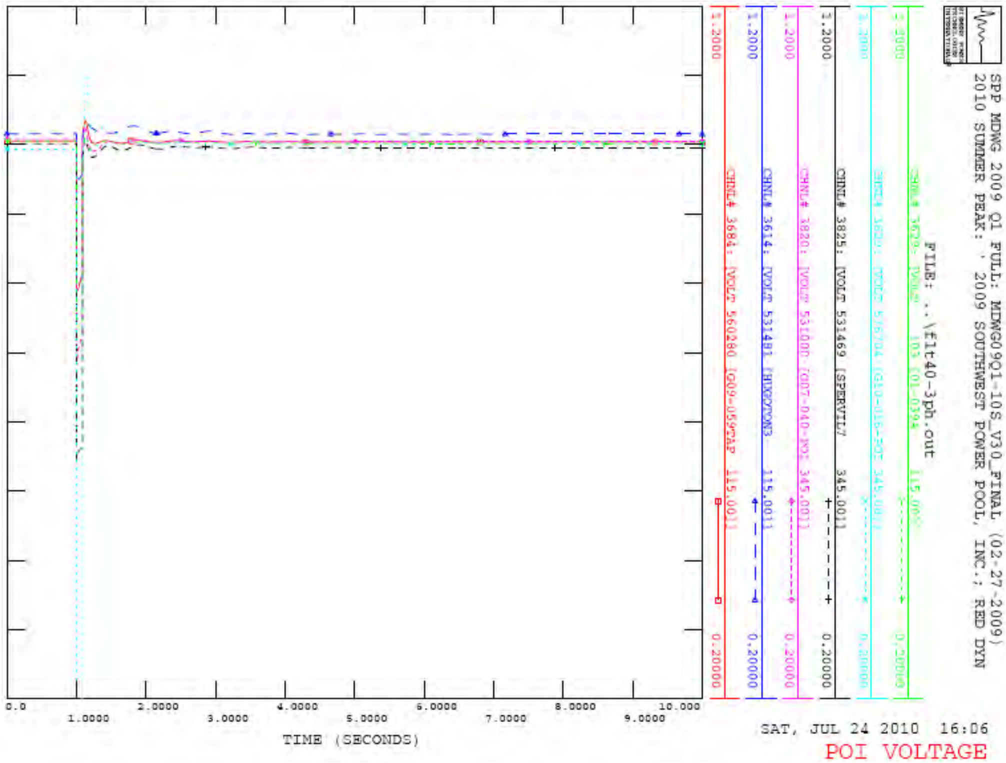

Figure 4-10. POI Voltage Plot for Fault 40 – 3-Phase Fault on the GEN-2010-016 to Spearville 345kV line, near GEN-2010-016

4.2 Power Factor Requirements

All stability faults were tested as power flow contingencies to determine the power factor requirements for the wind farm study projects to maintain scheduled voltage at their respective points of interconnection (POI). The voltage schedules are set equal to the voltages at the POIs before the projects are added, with a minimum of 1.0 per unit. Fictitious reactive power sources were added to the study projects to maintain scheduled voltage during all studied contingencies. The MW and Mvar injections from the study projects at the POIs were recorded and the resulting power factors were calculated for all contingencies for summer peak and winter peak cases. The most leading and most lagging power factors determine the minimum power factor range capability that the study projects must install before commercial operation.

If more than one study project shared a single POI (none in this case), the projects were grouped together and a common power factor requirement was determined for those study projects. This ensures that none of the study projects is required to provide more or less than its fair share of the reactive power requirements at a single POI. *Prior-queued* projects at the same POI, if any, were not grouped with the study projects because their interconnection requirements were determined in previous studies. The voltages schedules of prior-queued and study projects at the same POI were coordinated.

Per FERC and SPP Tariff requirements, if the power factor needed to maintain scheduled voltage was less than 0.95 lagging, then the requirement was set to 0.95 lagging. This limit was reached for GEN-2010-015 and GEN-2010-016. Much greater reactive power supply would be needed to meet the voltage schedules under some contingencies, but only 0.95 lagging will be required. The limit for leading power factor requirement is also 0.95, and this limit was not reached for any study project. If the project never operated leading under any contingency, then the leading requirement is set to 1.0. Similar for lagging.

The final power factor requirements are shown in Table 4-2 below. These are only the minimum power factor ranges based on steady-state analysis. A project developer may install more capability than this if desired.

The study plant must install sufficient reactive power resources to meet these requirements listed in Table 4-2. The following method is used to decide if a study project needs to install additional capacitors:

1. Use the power flow case with fictitious reactive power sources added
2. Apply the contingency to cause the lowest reactive power flow from POI to the study project (leading is positive, lagging is negative)
3. If the study plant could provide enough reactive power to meet the power factor requirement, no additional capacitor is needed.
   If the study plant could not provide enough reactive power to meet the power factor requirement, the size of the additional capacitor was determined.

The results indicate that GEN-2010-015 will need to add 17 Mvar of capacitors at its 34.5kV substation bus (576302) and 17 Mvar of capacitors at its 34.5kV substation bus (576312) for a total of 35 Mvar. GEN-2010-016 will need to add 96 Mvar of capacitors at its 34.5kV substation bus (576702). The reactive power resources need not be dynamically controlled. However, any change in wind turbine model or controls could change the stability results, possibly resulting in a need for a dynamically controlled reactive power supply.

The full details for each contingency in summer and winter peak cases are given in Appendix C.

Table 4-2. Power Factor Requirements [1]

Request	Size (MW)	Generator Model	Point of Interconnection	Final PF Requirement		Estimated Capacitor Requirement (Mvar)
				Lagging [2]	Leading [3]	
GEN-2009-059	100.5	GE 1.5MW	Tap G08-79T – Cudahay 115kV (573029-539659)	1.000	0.955	0
GEN-2010-009	165.6	Siemens SWT 2.3MW	Gray County 345kV (531000)(G07-040-POI)	0.993	0.983	0
GEN-2010-015	200.1	Siemens SWT 2.3MW	Spearville 345kV (531469)	0.950	0.998	34
GEN-2010-016	199.8	Vestas V90 1.8MW	Tap Spearville (531469) – Knoll (560004) 345kV	0.950	0.995	96

Notes:
1. For each plant, the table shows the minimum required power factor capability at the point of interconnection that must be designed and installed with the wind farm. The power factor capability at the POI includes the net effect of the wind turbine generators, transformer and collector line impedances, and any reactive compensation devices installed on the plant side of the meter. Installing more capability than the minimum requirement is acceptable.
2. Lagging is when the generating plant is supplying reactive power to the transmission grid. In this situation, the alternating current sinusoid “lags” behind the alternating voltage sinusoid, meaning that the current peaks shortly after the voltage.
3. Leading is when the generating plant is taking reactive power from the transmission grid. In this situation, the alternating current sinusoid “leads” the alternating voltage sinusoid, meaning that the current peaks shortly before the voltage.

5. Conclusions

The DISIS-2010-001 Group 3 Impact Study evaluated the impacts of interconnecting the projects shown below.

Table 5-1. Interconnection Requests Evaluated

Request	Size (MW)	Generator Model	Point of Interconnection
GEN-2009-059	100.5	GE 1.5MW	Tap G08-79T – Cudahay 115kV (573029-539659)
GEN-2009-062	115.0	GENROU	Hugoton 115kV (531481)
GEN-2010-009	165.6	Siemens SWT 2.3MW	Gray County 345kV (531000)(G07-040-POI)
GEN-2010-015	200.1	Siemens SWT 2.3MW	Spearville 345kV (531469)
GEN-2010-016	199.8	Vestas V90 1.8MW	Tap Spearville (531469) – Knoll (560004) 345kV

No stability problems were found during summer or winter peak conditions due to the addition of these generators.

Power factor requirements were determined, and the study plant must install sufficient reactive power resources to meet these requirements listed in Table 4-2. These results indicate that GEN-2010-015 will need to add 17 Mvar of capacitors at its 34.5kV substation bus (576302) and 17 Mvar of capacitors at its 34.5kV substation bus (576312) for a total of 35 Mvar. GEN-2010-016 will need to add 96 Mvar of capacitors at its 34.5kV substation bus (576702). The reactive power resources need not be dynamically controlled. However, any change in wind turbine model or controls could change the stability results, possibly resulting in a need for a dynamically controlled reactive power supply.

DISIS-2010-001 Group 3 should be able to reliably connect to the SPP transmission grid if the reactive compensation requirements listed above are implemented.

Appendix A – Summer Peak Plots

See attachment.

Appendix B – Winter Peak Plots

See attachment.

Appendix C – Power Factor Details

See attachment.

Appendix D – Project Model Data

See attachment.

L: Stability Study for Group 4

No requests in Group 4

M: Stability Study for Group 5

POWER SYSTEMS DIVISION
GRID SYSTEMS CONSULTING

Interconnection Impact Study for DISIS-2010-001 (Group 5)

DRAFT REPORT

REPORT NO.: 2010-E4983-R0
Issued On: July 09, 2010

Prepared for:
Southwest Power Pool, Inc.

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Power Systems Division
Grid Systems Consulting
940 Main Campus Drive, Suite 300
Raleigh, NC 27606

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ABB Inc – Grid Systems Consulting **Technical Report**

Southwest Power Pool, Inc.	**No.** 2010-E4983-R0	
Interconnection Impact Study for DISIS-2010-001 (Group 5)	Date: 07/09/10	# Pages 21

Author(s):	**Reviewed by:**	**Approved by:**
Trinadh Dwibhashyam	Seshadri Subramanian	Willie Wong

Executive Summary

Southwest Power Pool, Inc. (SPP) has commissioned ABB Inc. to perform a Definitive System Impact Study (DISIS) for Group 5 generation project(s) which included a wind-farm generation of 50.6 MW on the SPP system. The proposed wind farm is located in Oldham,Texas with the Point of Interconnection (POI) at Vega 69 kV substation.

Request	Size	Wind Turbine Model	Point of Interconnection	County
GEN-2008-088	50.6	Siemens SWT 2.3MW	Vega 69kV (#523888)	Oldham,Texas

The main objectives of this study were

1) To determine the need of reactive power compensation, if any, for the proposed wind farm
2) To determine the impact of proposed Group 5 Project (GEN-08-088, 50.6 MW) generation on system stability and the nearby transmission system and generating stations.
3) To validate the compliance with FERC LVRT requirement for the subject wind farm interconnection.

To achieve these objectives the following analyses were performed on the 2010 Summer Peak and 2009 Winter Peak system conditions with GEN-08-088 in-service

- o Power factor analysis for selected contingencies.
- o Transient stability analysis under various local and regional contingencies.
- o LVRT performance under selected contingencies near the POI.

Assumptions

1. The following prior queued projects were included in the powerflow cases provided by SPP.

Request	Size (MW)	Wind Turbine Model	Point of Interconnection
GEN-2002-022	240	Siemens 2.3MW	Bushland 230kV (524267)
GEN-2005-021	85.5	GE 1.5MW	Kirby 115kV (524088)
GEN-2006-039	400	Clipper 2.5MW	Buffalo Lk 230kV (560009)
GEN-2006-045	240	Suzlon 2.1MW	Buffalo Lk 230kV (560009)
GEN-2006-047	240	Suzlon 2.1 MW	Buffalo Lk 230kV (560009)
GEN-2007-002	160	Steam Turbine	Grapevine 115kV (523770)
GEN-2007-048	400	Furhlander	Amarillo South – Swisher 230kV line (525228)
GEN-2008-051	322	Siemens 2.3MW	Potter 345kV (523961)

Following is the summary of study findings:

Power factor analysis

SPP requires that the Customer's wind farm maintain +/- 0.95 power factor at the POI for any system condition. An analysis was conducted to determine whether the proposed wind-farm has sufficient reactive power capability to meet the power factor criteria. The results from this analysis indicated sufficient reactive power capability in the wind-farm to maintain +/-0.95 power factor at the POI and therefore no additional reactive power compensation was required.

Stability Analysis

The stability analysis was performed to determine the impact, if any, of the proposed project on the stability of the SPP system. The system was found to be Stable following all tested 3-phase faults and single-line-to-ground (SLG) faults with line re-closing, where applicable.

FERC Order 661A Compliance

Selected faults were simulated at the Point of Interconnection (POI) of the proposed Group 5 wind farm to determine the compliance with FERC 661 – A post-transition period LVRT standard. The results indicated that the proposed project meets the FERC LVRT requirement for wind farms.

Based on the results of the analysis, it can be concluded that the proposed Group 5 interconnection does not adversely impact the stability of the Study System.

The results of this analysis are based on available data and assumptions made at the time of conducting this study. If any of the data and/or assumptions made in developing the study model change, the results provided in this report may not apply and additional analysis may be required.

Rev No.	Revision Description	Date	Authored by	Reviewed by	Approved by
0	Draft Report	06/26/10	Dwibhasyam, T	Subramanian, S	Wong, W
DISTRIBUTION: Ray Offenbacker – Southwest Power Pool, Inc.					

TABLE OF CONTENTS

1 INTRODUCTION

Southwest Power Pool, Inc. (SPP) has commissioned ABB Inc. to perform a DISIS for Group 5 Project(s), which included a wind-based generation of 50.6 MW (Queue # GEN-08-088) on the SPP system. The proposed wind farm is located in Oldham, Texas and the POI is at Vega 69 kV. Figure 1-1 shows the approximate location of the proposed generation project on a Geographical Transmission Map.

The study evaluated the impact of the Group 5 project on the stability of the SPP system. The scope of this study was limited to the transient stability analysis and power factor evaluation.

The main objectives of this study were

1) To determine the need of reactive power compensation, if any, for the proposed wind farm
2) To determine the impact of the proposed Project (GEN-08-088, 50.6 MW) generation on system stability and the nearby transmission system and generating stations.
3) To validate the compliance with FERC LVRT requirement for the wind farm.

To achieve these objectives the following analyses were performed on the 2010 Summer Peak and 2009 Winter Peak system conditions with Group 5 project in-service

- Power factor analysis for selected contingencies.
- Transient stability analysis for various local and regional contingencies.
- LVRT performance under selected contingencies near the POI.

The study was performed on 2010 Summer Peak and 2009 winter peak cases, provided by SPP. This report documents the methods, analysis and results of the system impact study.

Table 1-1: Group 5 Project Description

Request	Size	Wind Turbine Model	Point of Interconnection	County
GEN-2008-088	50.6	Siemens SWT 2.3MW	Vega 69kV (#523888)	Oldham, Texas

1.1 Report Organization

This report is organized as follows:

Section 2: Description of project
Section 3: Study methodology
Section 4: Model Development
Section 5: Power Factor Analysis Results
Section 6: Stability Analysis Results
Section 7: Conclusions

The detailed study results are compiled in separate Appendices.

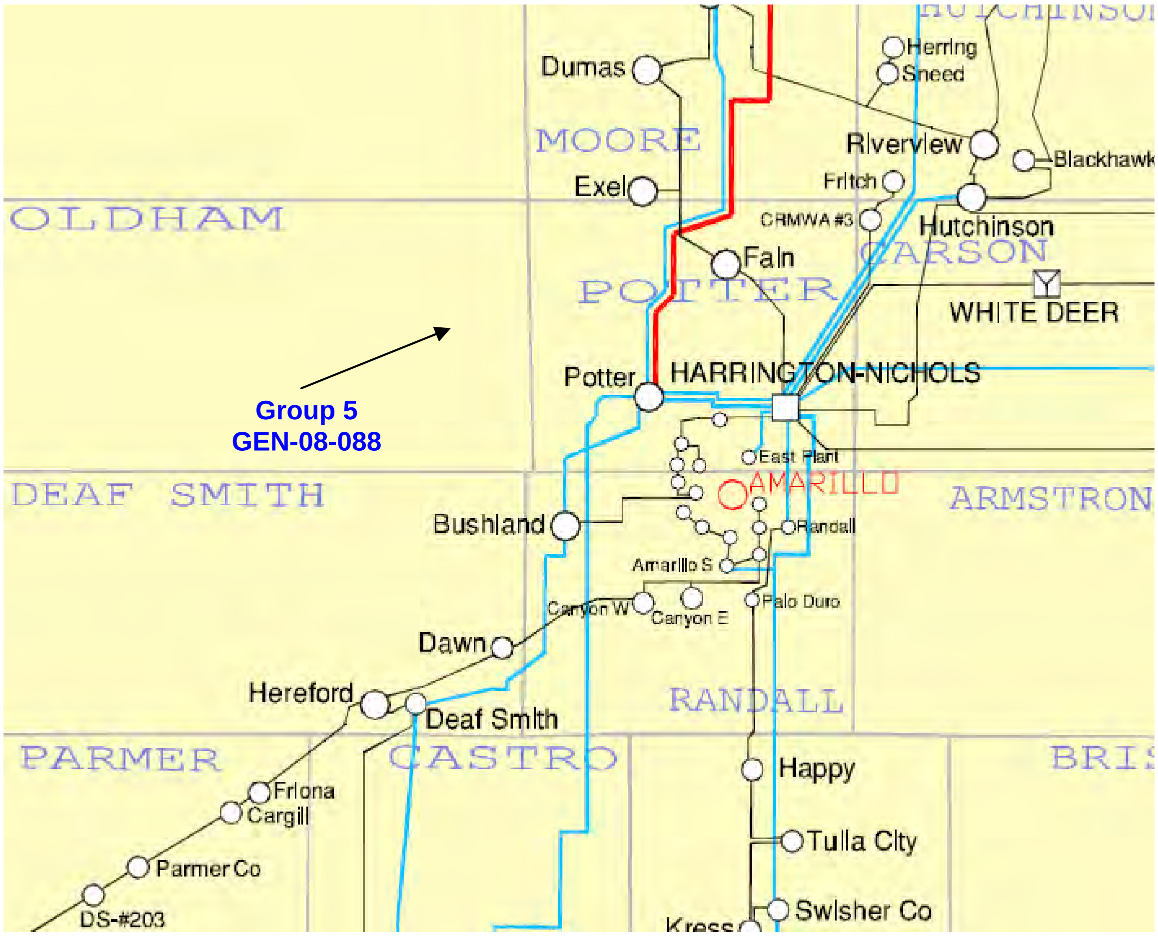

Figure 1-1 Group 5 Project location

2 DESCRIPTION OF THE PROJECT

The details of load flow and dynamic data for the Group 5 wind farm project is included in Appendix A.

- Wind farm rating: 50.6 MW
- Interconnection:

  Voltage: 69 kV

  Location: Vega 69 kV substation. The wind farm will be connected to the proposed POI via 69 kV line.

  Transformer: One (1) step-up transformer connecting to the 69 kV

  MVA: 58 MVA

  Voltage: 69/34.5 kV

  Z: 18.09 % on 100 MVA

- Wind Turbines:

  Number: Twenty two (22)

  Manufacturer: Siemens

  Type: Doubly-fed induction generator (DFIG)

  Machine Terminal voltage: 0.69 kV

  Rated Power: 2.3 MW

  Frequency: 60 Hz

  Generator Step-up Transformer

  MVA: 2.6
  High voltage: 34.5 kV,
  Low voltage: 0.69 kV
  Z: 6.06% on 2.6 MVA

- Reactive Power Capability: 0.9 lagging/ 0.9 leading
- Fault Ride-through: Manufacturer's default ride-through capability was modeled
- PSSE Model Used: SMK223_model.obj

3 STUDY METHODOLOGY

3.1 POWER FACTOR ANALYSIS

SPP requires an Interconnection Customer's wind farm to maintain +/- 0.95 power factor at the POI for any system condition. The purpose of the power factor analysis was to determine whether the proposed wind farm project will meet the power factor requirement at the Point of Interconnection (POI) in system intact and contingency conditions.

The Power Factor Analysis involved following steps:

- A VAR generator with large capacity (+/- 9999 MVar) was modeled at the POI of the subject wind farm. The VAR generator was then set to hold the POI voltage consistent with the voltage schedule given in the SPP provided power flow base cases. The reactive power capability of the wind farm was set to zero.
- A list of selected contingencies in the vicinity of the subject wind farm project was simulated. The results were used to identify the most-limiting contingency from steady state voltage and power factor perspective.
- If the required reactive power support, to maintain an acceptable power factor at the POI, was found to be beyond the capability of proposed wind farm then the additional reactive power compensation (e.g. shunt capacitor banks) was considered.

It is important to note that the reactive power compensation identified in this analysis is primarily required to meet the steady state criteria. The need for dynamic reactive power support, if any, will be determined during transient stability analysis.

3.2 TRANSIENT STABILITY ANALYSIS

The purpose of the transient stability analysis was to determine the impact, if any, of the proposed wind farm project on the stability of the transmission system and generating stations in the interconnection vicinity.

Using Planning Standards approved by NERC, the following stability definition was applied in the Transient Stability Analysis:

"Power system stability is defined as that condition in which the differences of the angular positions of synchronous machine rotors become constant following an aperiodic system disturbance."

Stability analysis was performed using Siemens-PTI's PSS/E™ dynamics program V30.3.3. Three-phase and single-line-to-ground (SLG) re-closure faults were simulated for the specified duration and synchronous machine rotor angles and wind turbine generator speeds were monitored to check whether synchronism is maintained following fault removal.

For three-phase faults, a fault admittance of –j2E9 was used (essentially infinite admittance representing a bolted fault). The PSS/E dynamics program only simulates the positive sequence network. Unbalanced faults (like single-phase line faults) involve the positive, negative, and zero sequence networks. For unbalanced faults, the equivalent fault admittance was inserted in the PSS/E positive sequence model at the faulted bus to simulate the effect of the negative and zero sequence networks. For a single-line-to-ground (SLG) fault, the fault admittance equals the inverse of the sum of the positive, negative and zero sequence Thevenin impedances at the faulted bus. Since PSS/E inherently models the positive sequence fault impedance, the sum of the negative and zero sequence Thevenin impedances needs to be added and entered as the fault impedance at the faulted bus. The fault impedance was estimated to give a positive sequence voltage at the fault location of approximately 60% of pre-fault voltage, which is typical.

Transient Voltage Criteria

In addition to criteria for the stability of the machines, SPP has evaluation criteria for the transient voltage dip as follows:

- 3-phase fault or single-line-ground fault with normal clearing resulting in the loss of a single component (generator, transmission circuit or transformer) or a loss of a single component without fault:
  Not to exceed 20% for more than 20 cycles at any bus
  Not to exceed 25% at any load bus
  Not to exceed 30% at any non-load bus

- 3-phase faults with normal clearing resulting in the loss of two or more components (generator, transmission circuit or transformer), and SLG fault with delayed clearing resulting in the loss of one or more components:
  Not to exceed 20% for more than 40 cycles at any bus
  Not to exceed 30% at any bus

The duration of the transient voltage dip excludes the duration of the fault. The transient voltage dip criteria will not be applied to three-phase faults followed by stuck breaker conditions unless the determined impact is extremely widespread.

The voltages at all local buses (115 kV and above) were monitored during each of the fault cases as appropriate.

Another important aspect of the stability analysis was to determine the ability of the wind generators to stay connected to the grid during disturbances. This is primarily determined by their low-voltage ride-through capabilities – or lack thereof – as represented in the models by low-voltage trip settings. The Federal Energy Regulatory Commission (FERC) Post-transition period LVRT standard for Interconnection of Wind generating plants includes a Low Voltage Ride Through (LVRT) requirement. The key features of LVRT requirements are:

- o A wind generating plant must remain in-service during three-phase faults with normal clearing (maximum 9 cycles) and single-line-to-ground faults with delayed clearing, and have subsequent post-fault recovery to pre-fault voltage unless the clearing of the fault effectively disconnects the generator from the system.

- The maximum clearing time the wind generating plant shall be required to withstand a three-phase fault shall be 9 cycles after which, if the fault remains following the location-specific normal clearing time for three-phase faults, the wind generating plant may disconnect from the transmission system. A wind generating plant shall remain interconnected during such a fault on transmission system for a voltage level as low as zero volts, as measured at the high voltage side of the GSU connected at POI.

These criteria were used to evaluate the LVRT capability of the wind farm.

4 MODEL DEVELOPMENT

Two power flow cases dispatched against the proposed Group 5 project – “DISIS_10SP-G5.sav” and “DISIS_09WP-G5.sav” –representing the 2010 Summer Peak and 2009 Winter Peak conditions respectively were provided by SPP. The following prior-queued projects are included in the power flow cases.

Request	Size (MW)	Wind Turbine Model	Point of Interconnection
GEN-2002-022	240	Siemens 2.3MW	Bushland 230kV (524267)
GEN-2005-021	85.5	GE 1.5MW	Kirby 115kV (524088)
GEN-2006-039	400	Clipper 2.5MW	Buffalo Lk 230kV (560009)
GEN-2006-045	240	Suzlon 2.1MW	Buffalo Lk 230kV (560009)
GEN-2006-047	240	Suzlon 2.1 MW	Buffalo Lk 230kV (560009)
GEN-2007-002	160	Steam Turbine	Grapevine 115kV (523770)
GEN-2007-048	400	Furhlander	Amarillo South – Swisher 230kV line (525228)
GEN-2008-051	322	Siemens 2.3MW	Potter 345kV (523961)

4.1 MODEL DEVELOPMENT FOR GROUP 5 PROJECT

The power flow cases provided were modified to reflect the network upgrade information provided by SPP.

Thus two power flow cases including the upgrades were established and named as ‘DISIS_10SP-G5-UPGRADES.sav’ (2010 summer peak) and ‘DISIS_09WP-G5-UPGRADES.sav’ (2009 winter peak).

Figure 4-1 and Figure 4-2 show the one-line diagram in the local area of Group 5 for 2010 summer peak and 2009 winter peak conditions respectively.

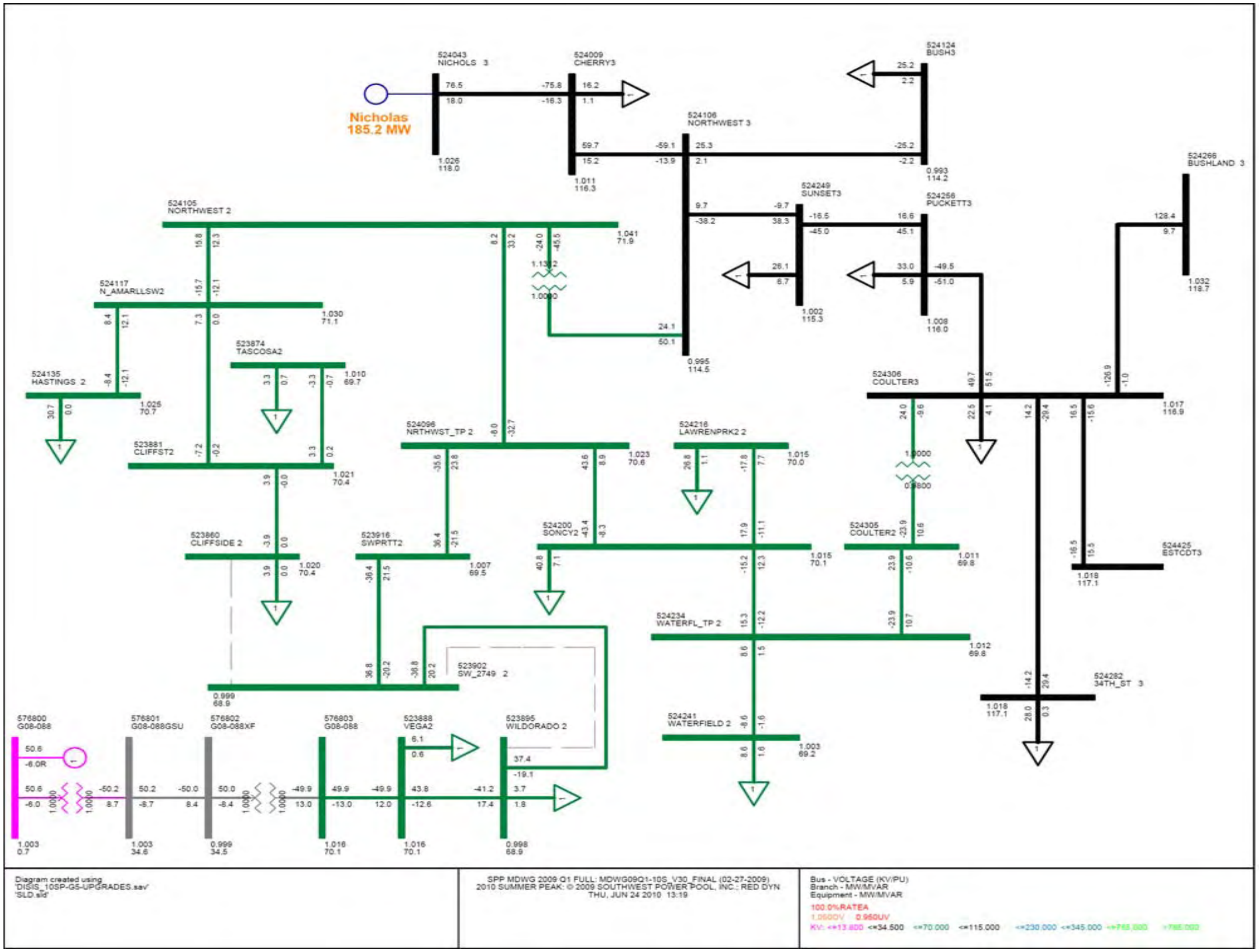

Figure 4-1 Single Line Diagram showing Power Flow in Group5 Interconnection Vicinity (2010 Summer Peak)

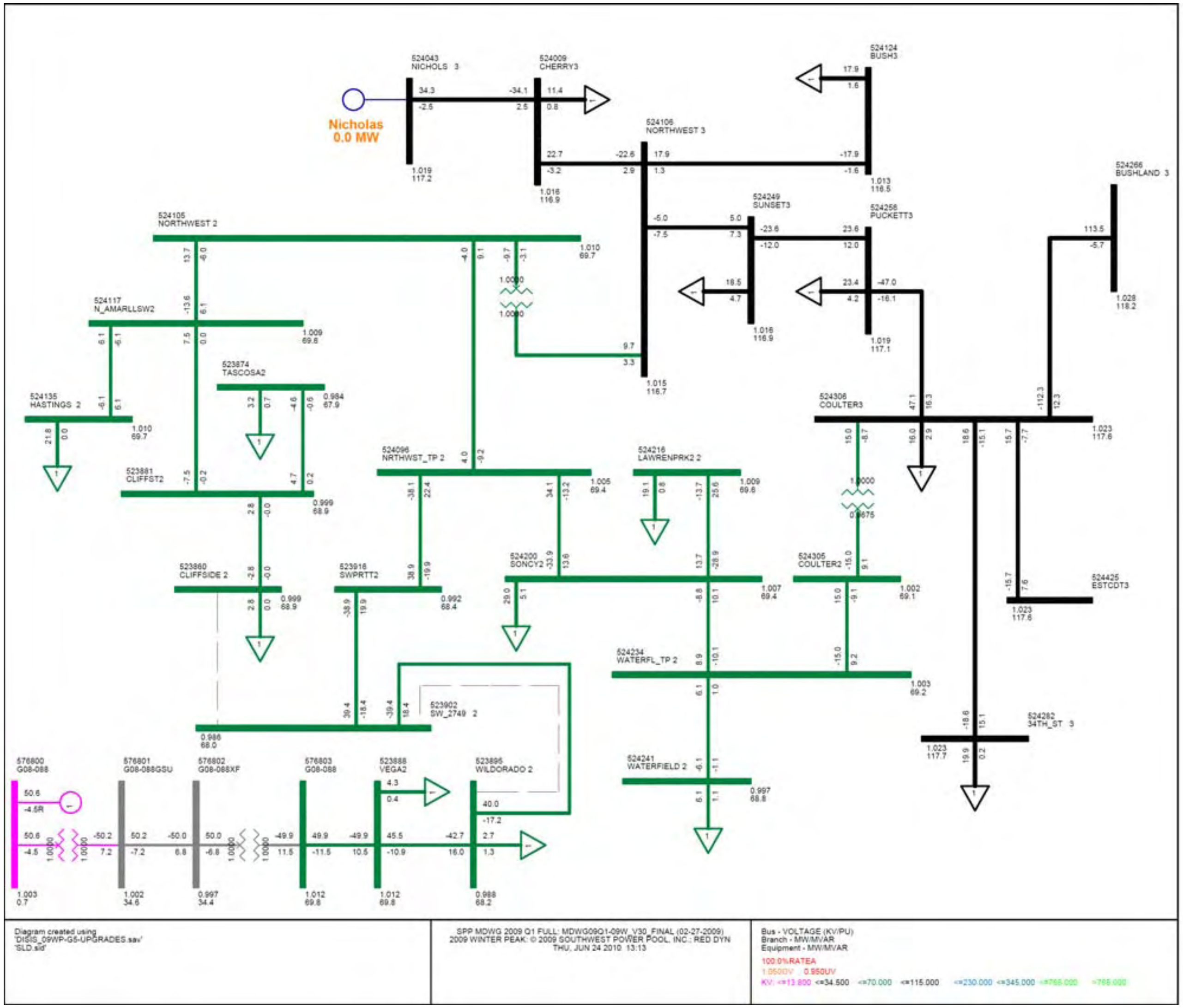

Figure 4-2 Single Line Diagram showing Power Flow in Group5 Interconnection Vicinity (2009 Winter Peak)

5 POWER FACTOR ANALYSIS RESULTS

Table 5-1 lists the contingencies simulated for Power Factor analysis.

Table 5-1: List of contingencies simulated for Power Factor Analysis

Contingency Name	Contingency Description
CONT_01	Loss of Potter Co. (523961) to GEN-2005-017 (51700) 345kV line
CONT_02	Loss of Potter Co. 345kV (523961) to 230kV (523959) transformer
CONT_03	Loss of Tuco 230kV (525830) to 345kV (525832) transformer
CONT_04	Loss of Grapevine (523771) to Nichols (524044) 230kV line
CONT_05	Loss of Conway (524079) to Yarnell (524072) 115kV line
CONT_06	Loss of Conway (524079) to Kirby (524088) 115kV line
CONT_07	Loss of Grapevine 230kV (523771) to 115kV (523770) transformer
CONT_08	Loss of Tuco (525832) to Wheeler/Midpoint (525835) 345kV line
CONT_09	Loss of Kirby (524088) to McClellan (523804) 115kV line
CONT_10	Loss of Potter (523959) to Moore County (523309) 230kV line
CONT_11	Loss of Potter (523959) to Harrington West (523977) 230kV line
CONT_12	Loss of Potter (523959) to Bushland (524267) 230kV line
CONT_13	Loss of Potter (523959) to GEN-2006-039 (560009) 230kV line
CONT_14	Loss of Northwest Tap (524096) to Northwest (524105) 69kV line
CONT_15	Loss of Northwest Tap (524096) to Soncy (524200) 69kV line
CONT_16	Loss of Northwest 115/69kV autotransformer(#524105)
CONT_17	Loss of Coulter 115/69kV autotransformer (#524305)
CONT_18	Loss of Bushland 230kV (524267) to 115kV (5524266) transformer
CONT_19	Loss of Northwest (524106) to Sunset (524249) 115kV line
CONT_20	Loss of Nichols (524043) to Cherry (524009) 115kV line
CONT_21	Loss of Nichols 230kV (524044) to 115kV (524043) transformer

As described in section 3.1, a VAR generator was modeled at POI. The VAR generator was set to hold the 69 kV POI voltage consistent with the pre-contingency voltage schedule. The reactive power capability of the wind farm was set to zero.

The contingencies listed in Table 5-1 were simulated on 2010 summer peak and 2009 winter peak system conditions. Table 5-2 lists the reactive power output of the VAR generator for the simulated contingencies under summer peak and winter peak conditions.

Table 5-2 VAR generator output at the GEN-08-088 POI

Contingency	2010 Summer Peak	2009 Winter Peak
BASE CASE	**6.4	**4.8
CONT_01	6.4	4.6
CONT_02	6.4	4.8
CONT_03	6.4	4.7
CONT_04	6.4	4.7
CONT_05	6.4	4.8
CONT_06	6.4	4.8
CONT_07	6.4	4.6
CONT_08	6.4	4.6
CONT_09	6.4	4.7
CONT_10	6.4	4.7
CONT_11	6.3	4.7
CONT_12	5.9	4.4
CONT_13	6.1	4.5
CONT_14	0.0	3.1
CONT_15	**10.3**	3.3
CONT_16	0.0	4.1
CONT_17	7.0	**5.4**
CONT_18	5.1	4.1
CONT_19	6.1	4.6
CONT_20	4.3	4.3
CONT_21	6.4	5.1

**The reactive power capability of the wind farm was set to unity p.f at machine terminal (i.e Qmax=Qmin=Qgen= 0 Mvar).

For year 2010 summer peak load conditions, *CONT*_15 (Northwest Tap to Soncy 69kV line outage) showed maximum reactive power output from the VAR generator at POI following interconnection of the proposed Group 5 project. This implies that contingency requires the highest reactive power from the proposed wind-farm for summer peak conditions.

For year 2009 winter peak load conditions, the loss of Coulter 115/69kV autotransformer (CONT_17) showed the maximum reactive power output from the VAR generator at POI following interconnection of the proposed Group 5 project. This implies that contingency requires the highest reactive power from the proposed wind-farm for winter load conditions.

For the tested conditions (i.e. summer peak and winter peak), the maximum reactive power requirement corresponding to the relevant contingencies was found to be within the reactive capability of the proposed wind-farm.

In addition to the above analysis, the contingencies in Table 5-1 were re-simulated, this time without the VAR generator modeled at the POI. The goal here is to check the POI voltage satisfies the steady state voltage criteria. The voltage at the POI was monitored. Table 5-3 lists the POI bus voltage for three contingencies; 1) CONT_14 2) CONT_15 and 3) CONT_17. These three contingencies represent the loss of outlets to the proposed Group 5 project. The evaluation of these three contingencies indicated acceptable bus voltage at the POI. Table 5-3 summarizes the post-contingency voltage and the associated p.f. at the POI.

Table 5-3: Voltage & p.f. at POI without VAR generator: GEN-2008-088

System condition		Voltage (in p.u.)	P.F.
2010 summer peak	System Intact	1.02	0.97
	Post-contingency (1)	1.00	0.99
	Post-contingency (2)	1.02	0.96
	Post-contingency (3)	1.02	0.97
2009 winter peak	System Intact	1.01	0.98
	Post-contingency (1)	1.01	0.98
	Post-contingency (2)	1.01	0.98
	Post-contingency (3)	1.01	0.98

(1) *CONT_14*: Loss of Northwest Tap (524096) to Northwest (524105) 69kV line
(2) *CONT_*15: Loss of Northwest Tap to Soncy 69kV line
(3) *CONT_17*: Loss of Coulter 115/69kV autotransformer

The results of the above contingency analysis are included in Appendix B.

6 STABILITY ANALYSIS RESULTS

Stability simulations were performed to examine the transient behavior of the GEN-2008-088 project and impact of the proposed addition of generation on the SPP system. A number of three-phase and single phase faults with re-closing were simulated. The fault clearing times and re-closing times used for the simulations are given in Table 6-1.

Table 6-1: Fault Clearing Times

Faulted bus kV level	Normal Clearing	Time before reclosing
69	5 cycles	20 cycles
115	5 cycles	20 cycles
230	5 cycles	20 cycles

Table 6-2 lists all the faults simulated for transient stability analysis.

Twenty one (21) three phase and fifteen (15) single-line-to-ground faults with re-closing were simulated. For all cases analyzed, the initial disturbance was applied at t = 0.1 seconds. The breaker clearing was applied at the appropriate time following this fault inception.

Table 6-2 List of Simulated Faults for GEN-2008-088 SIS

Cont. No.	Cont. Name	Description
1	FLT01-3PH	3 phase fault on the Potter Co. (523961) to GEN-2005-017 (51700) 345kV line, near Potter Co. a. Apply fault at the Potter Co. 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
2	FLT02-1PH	*Single phase fault and sequence like previous*
3	FLT05-3PH	3 phase fault on the Potter Co. 345kV (523961) to 230kV (523959) transformer, near the 345kV kV bus. a. Apply fault at the Potter Co. 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
4	FLT13-3PH	3 phase fault on the Tuco 230kV (525830) to 345kV (525832) transformer, near the 230kV bus. a. Apply fault at the Tuco 230kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
5	FLT19-3PH	3 phase fault on the Grapevine (523771) to Nichols (524044) 230kV line, near Grapevine. a. Apply fault at the Grapevine 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
6	FLT20-1PH	*Single phase fault and sequence like previous*
7	FLT21-3PH	3 phase fault on the Conway (524079) to Yarnell (524072) 115kV line, near Conway. a. Apply fault at the Conway 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
8	FLT22-1PH	*Single phase fault and sequence like previous*
9	FLT23-3PH	3 phase fault on the Conway (524079) to Kirby (524088) 115kV line, near Conway. a. Apply fault at the Conway 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
10	FLT24-1PH	*Single phase fault and sequence like previous*

Cont. No.	Cont. Name	Description
11	FLT33-3PH	3 phase fault on the Grapevine 230kV (523771) to 115kV (523770) transformer, near the 230kV bus. a. Apply fault at the Grapevine 230kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
12	FLT35-3PH	3 phase fault on the Tuco (525832) to Wheeler/Midpoint (525835) 345kV line, near Tuco. a. Apply fault at the Tuco 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
13	FLT36-1PH	*Single phase fault and sequence like previous*
14	FLT39-3PH	3 phase fault on the Kirby (524088) to McClellan (523804) 115kV line, near Kirby. a. Apply fault at the Kirby 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
15	FLT40-1PH	*Single phase fault and sequence like previous*
16	FLT39-3PH	3 phase fault on the Potter (523959) to Moore County (523309) 230kV line, near Potter. a. Apply fault at the Potter 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
17	FLT40-1PH	*Single phase fault and sequence like previous*
18	FLT41-3PH	3 phase fault on the Potter (523959) to Harrington West (523977) 230kV line, near Potter. a. Apply fault at the Potter 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
19	FLT42-1PH	*Single phase fault and sequence like previous*
20	FLT43-3PH	3 phase fault on the Potter (523959) to Bushland (524267) 230kV line, near Potter. a. Apply fault at the Potter 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
21	FLT40-1PH	*Single phase fault and sequence like previous*
22	FLT45-3PH	3 phase fault on the Potter (523959) to GEN-2006-039 (560009) 230kV line, near Potter. a. Apply fault at the Potter 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
23	FLT46-1PH	*Single phase fault and sequence like previous*
24	FLT49-3PH	3 phase fault on the Northwest Tap (524096) to Northwest (524105) 69kV line, near Northwest. a. Apply fault at the Northwest 69kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
25	FLT50-1PH	*Single phase fault and sequence like previous*
26	FLT51-3PH	3 phase fault on the Northwest Tap (524096) to Soncy (524200) 69kV line, near Northwest. a. Apply fault at the Northwest 69kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
27	FLT52-1PH	*Single phase fault and sequence like previous*
28	FLT53-3PH	3 phase fault on the Northwest 115/69kV autotransformer on the 69kV bus (#524105) a. Apply fault at the Northwest 69kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.

Cont. No.	Cont. Name	Description
29	FLT54-3PH	3 phase fault on the Coulter 115/69kV autotransformer on the 69kV bus (#524305) a. Apply fault at the Coulter 69kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
30	FLT55-3PH	3 phase fault on the Bushland 230kV (524267) to 115kV (5524266) transformer, near the 230kV bus. a. Apply fault at the Bushland 230kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
31	FLT56-3PH	3 phase fault on the Northwest (524106) to Sunset (524249) 115kV line, near Northwest. a. Apply fault at the Northwest 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
32	FLT57-1PH	*Single phase fault and sequence like previous*
33	FLT58-3PH	3 phase fault on the Nichols (524043) to Cherry (524009) 115kV line, near Nichols. a. Apply fault at the Nichols 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
34	FLT59-1PH	*Single phase fault and sequence like previous*
35	FLT60-3PH	3 phase fault on the Nichols 230kV (524044) to 115kV (524043) transformer, near the 230kV bus. a. Apply fault at the Nichols 230kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
36	FLT61-1PH	*Single phase fault and sequence like previous*

The system was stable following all the simulated 3-Phase and single-phase faults. Also, no tripping of the wind farms in the system was observed following the simulated faults. Table 6-3 summarizes the stability analysis results for 2010 summer peak and 2009 winter peak system conditions. The system performance indicated acceptable voltage recovery; the system response was well-damped.

Figure 6-1 and Figure 6-2 show the response of GEN-2008-088 following faults FLT_51_3PH and FLT_52_1PH respectively These faults are in the POI vicinity of Group 5 and involve the loss of Northwest tap – Soncy line, the highest loaded line in the vicinity of Group 5. The Group 5 project was stable following the fault.

The plots from the transient stability analysis are included in Appendix C.

Table 6-3 Results of stability analysis

FAULT	2010 Summer Peak			2009 Winter Peak		
	Pre-Project	Post-Project		Pre-Project	Post-Project	
		Stable?	Acceptable Voltages?		Stable?	Acceptable Voltages?
FLT_01_3PH	---	STABLE	YES	---	STABLE	YES
FLT_02_1PH	---	STABLE	YES	---	STABLE	YES
FLT_05_3PH	---	STABLE	YES	---	STABLE	YES
FLT_13_3PH	---	STABLE	YES	---	STABLE	YES
FLT_19_3PH	---	STABLE	YES	---	STABLE	YES

FAULT	2010 Summer Peak			2009 Winter Peak		
	Pre-Project	Post-Project		Pre-Project	Post-Project	
		Stable?	Acceptable Voltages?		Stable?	Acceptable Voltages?
FLT_20_1PH	---	STABLE	YES	---	STABLE	YES
FLT_21_3PH	---	STABLE	YES	---	STABLE	YES
FLT_22_1PH	---	STABLE	YES	---	STABLE	YES
FLT_23_3PH	---	STABLE	YES	---	STABLE	YES
FLT_24_1PH	---	STABLE	YES	---	STABLE	YES
FLT_33_3PH	---	STABLE	YES	---	STABLE	YES
FLT_35_3PH	---	STABLE	YES	---	STABLE	YES
FLT_36_1PH	---	STABLE	YES	---	STABLE	YES
FLT_39_3PH	---	STABLE	YES	---	STABLE	YES
FLT_40_1PH	---	STABLE	YES	---	STABLE	YES
FLT_39A_3PH	---	STABLE	YES	---	STABLE	YES
FLT_40A_1PH	---	STABLE	YES	---	STABLE	YES
FLT_41_3PH	---	STABLE	YES	---	STABLE	YES
FLT_42_1PH	---	STABLE	YES	---	STABLE	YES
FLT_43_3PH	---	STABLE	YES	---	STABLE	YES
FLT_44_1PH	---	STABLE	YES	---	STABLE	YES
FLT_45_3PH	---	STABLE	YES	---	STABLE	YES
FLT_46_1PH	---	STABLE	YES	---	STABLE	YES
FLT_49_3PH	---	STABLE	YES	---	STABLE	YES
FLT_50_1PH	---	STABLE	YES	---	STABLE	YES
FLT_51_3PH	---	STABLE	YES	---	STABLE	YES
FLT_52_1PH	---	STABLE	YES	---	STABLE	YES
FLT_53_3PH	---	STABLE	YES	---	STABLE	YES
FLT_54_3PH	---	STABLE	YES	---	STABLE	YES
FLT_55_3PH	---	STABLE	YES	---	STABLE	YES
FLT_56_3PH	---	STABLE	YES	---	STABLE	YES
FLT_57_1PH	---	STABLE	YES	---	STABLE	YES
FLT_58_3PH	---	STABLE	YES	---	STABLE	YES
FLT_59_1PH	---	STABLE	YES	---	STABLE	YES
FLT_60_3PH	---	STABLE	YES	---	STABLE	YES
FLT_61_1PH	---	STABLE	YES	---	STABLE	YES

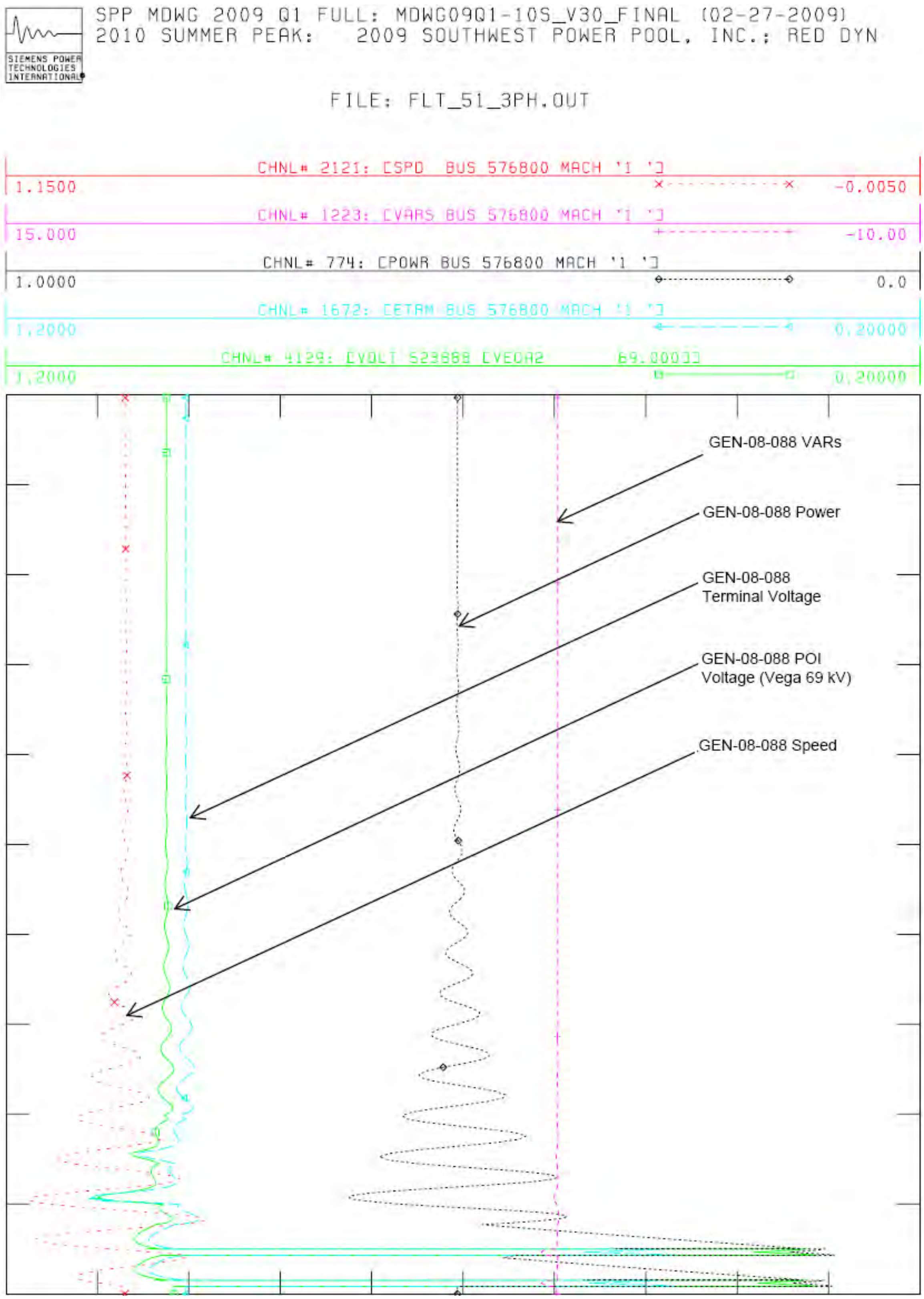

Figure 6-1 GEN-2008-088 Wind farm and POI Plot for FLT_51_3PH under Summer Peak Conditions

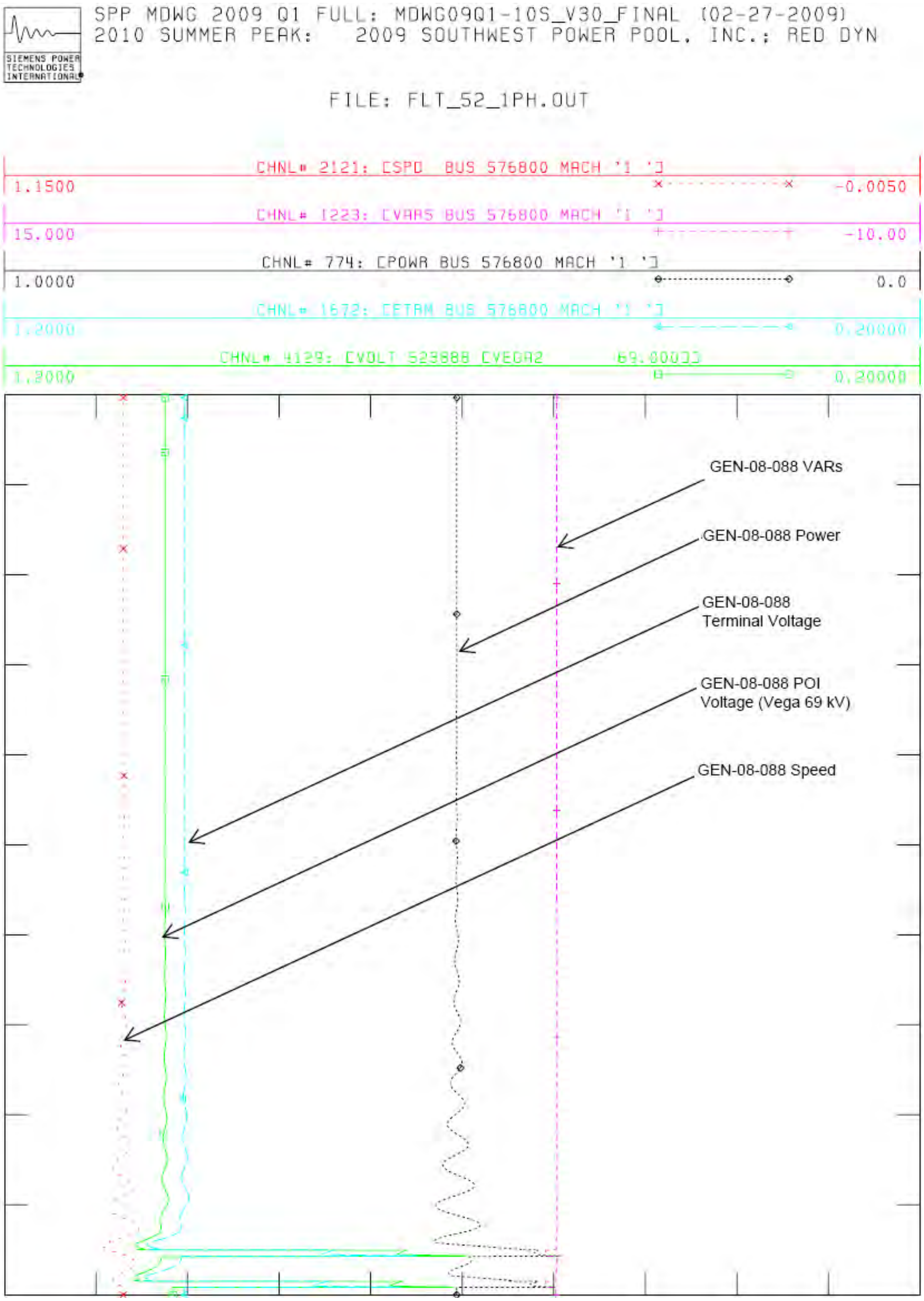

Figure 6-2 GEN-2008-088 Wind farm and POI Plot for FLT_52_1PH under Summer Peak Load Conditions

6.1 FERC LVRT COMPLIANCE

As explained in section 2, the proposed project was modeled with the low voltage ride through capability. To determine the compliance of the subject wind farm project three (3) faults were simulated. Faults were simulated at the POI of wind farm project and cleared after 9 cycles. Table 6-4 gives the description of fault simulated for LVRT analysis.

Table 6-4: List of faults for FERC LVRT compliance

Fault Name	Description
FLT_01_LVRT_3PH	3 phase fault on the Wildorado (523895) to Vega (523888) 69 kV line,near Wildorado. a. Apply fault at the Wildorado 69kV bus. b. Clear fault after 9 cycles.
FLT_02_LVRT_3PH	3 phase fault on the Northwest 115/69 kV Transformer near 115 kV bus (524106) a. Apply fault at the Northwest 115 kV bus. b. Clear fault after 9 cycles by tripping the transformer
FLT_03_LVRT_3PH	3 phase fault on the Wildorado (523895) to Vega (523888) 69 kV line,near Vega a. Apply fault at the Vega 69kV bus. b. Clear fault after 9 cycles.

The results of the simulations indicated that the Group 5 wind farm project meets the FERC LVRT criteria for the interconnection of the wind farm generation (FERC Order 661 – A). The response of Group 5 project for FLT_03_LVRT_3PH is given in Figure 6-3. This fault is a 3 Phase fault on the POI of the project and the project remains online following fault clearing.

The results of the FERC LVRT compliance are included in Appendix D for reference.

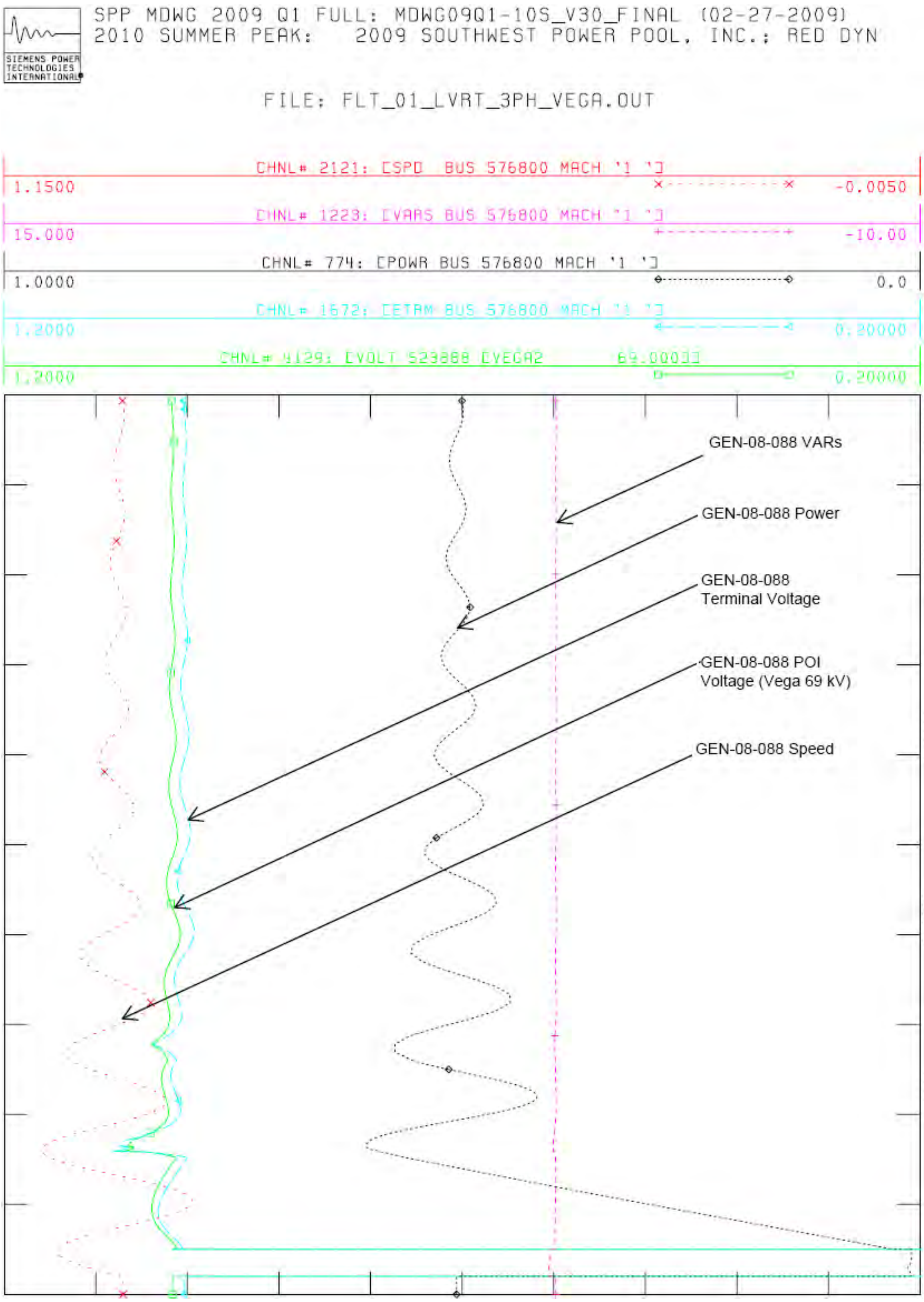

Figure 6-3 GEN-2008-088 Wind farm and POI Plot for FLT_03_LVRT_3PH under Summer Peak Load Conditions

7 CONCLUSIONS

The main objectives of this study were

1) To determine the need of reactive power compensation, if any, for the proposed wind farms
2) To determine the impact of proposed Group 5 project (GEN-08-088, 50.6 MW) on system stability of the nearby transmission system and generating stations.
3) To validate the compliance with FERC LVRT requirement for the wind farm.

The study was performed on 2010 Summer Peak and 2009 winter peak cases, provided by SPP.

To achieve these objective the following analyses were performed on the 2010 Summer Peak and 2009 winter peak system conditions with Group5 project in-service (GEN-2008-088, 50.6 MW)

- o Power factor Analysis for selected contingencies.
- o Transient Stability analysis under various local and regional contingencies.
- o LVRT performance under selected contingencies near the POI.

Following is the summary of study findings:

Power factor analysis

An analysis was conducted to determine whether the wind turbines are sufficient to meet the power factor criteria for the wind farm. SPP requires that the Customer's wind farm maintain +/- 0.95 power factor at the POI for any system condition. No additional reactive power compensation was required for the proposed wind farm to maintain +/- 0.95 power factor at the POI.

Stability Analysis

The stability analysis was performed to determine the impact, if any, of the proposed Group 5 project on the stability of the SPP system. The system was stable following all simulated 3-Phase and single-phase faults with re-closure. Also, no tripping of wind farms in the system was observed following the simulated faults. The voltage recovery post fault clearing was acceptable and the system response was well-damped.

FERC Order 661A Compliance

Selected faults were simulated at the Point of Interconnection (POI) of the proposed Group 5 wind farm to determine the compliance with FERC 661 – A post-transition period LVRT standard. The results indicated that the proposed project meet the FERC LVRT requirement for wind farms.

Based on the results of the analysis, it can be concluded that the proposed Group 5 project does not adversely impact the stability of the Study System.

The results of this analysis are based on available data and assumptions made at the time of conducting this study. If any of the data and/or assumptions made in developing the study model change, the results provided in this report may not apply and a restudy may be required.

N: Stability Study for Group 6

Draft Report

For

Southwest Power Pool

From

S&C Electric Company

DEFINITIVE IMPACT STUDY
DISIS-2010-001 (Group 6)

S&C Project No. 4681

July 29, 2010

S&C Electric Company

S&C Electric Company, Chicago, IL 60626-3997, Phone: (773) 338-1000
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TABLE OF CONTENTS

Report Revision History:

Date of Report	Issue	Comments
July 29, 2010	Rev. A	Draft report

Report prepared by:

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Manager – Consulting and Analytical Services

EXECUTIVE SUMMARY

S&C Electric Company has performed an interconnection impact study for the Definitive Impact Study DISIS-2010-001 (Group 6) in response to a request through the Southwest Power Pool (SPP) Tariff studies. Group 6 consists of GEN-2008-022 (300 MW wind farm in Chavez County, NM), GEN-2009-067S (20 MW solar project in Eddy County, NM), GEN-2010-006 [205 MW (Winter)/180 MW (Summer) Gas in Lubbock, TX], and ASGI-2010-010 (42 MW in Lovington, NM). Summer 2010 and winter 2009 peak loading cases were studied with Group 6 wind farms and prior queued projects operating at rated output power (100% output power) and other wind farms at 20% output power. GEN-2008-022 consists of GE 2.5 MW wind turbine generators.

GEN-2008-022 and GEN-2009-067S can successfully interconnect into the transmission system at their desired locations provided they can supply the reactive power needed to meet a voltage schedule equal to the base case voltage or nominal voltage, whichever is higher at the Point of Interconnection (POI) for outage contingencies specified by SPP. The requirements for the worst case contingencies consist of the following:

- 99.98% lagging power factor (capacitive) from GEN-2008-022 to the Eddy County – GEN-2007-34T 345kV wind farm tap for an outage of the 230 kV line from Eddy Co to Seven Rivers in the winter 2009 peak case.
- 99.97 % leading power factor (inductive) from GEN 2009-067S to the Seven Rivers 69 kV substation for an outage of the 345 kV line from GEN-2007-034 to GEN-2008-022 in the winter 2009 peak case.

The Satcon PowerGate PV inverters from GEN 2009-067S in the standard configuration can provide 80% leading to 80% lagging power factor at the expense of active power. At the expected 20 MW nameplate rating, the inverter can only deliver unity power factor at its terminals. To deliver the 99.97% leading power factor at the POI at rated 20 MW, an external source of reactive power such as a capacitor bank is needed. For this study, the power requirement at the POI is met with the addition of a 1.8 MVAR capacitor bank at the 13.8 kV collector bus. Alternatively, the number of inverters can be increased in order to deliver 2 MVAR (lagging power factor of 99.5% at 0.48 kV) at rated 20 MW.

The GE 2.5 MW wind turbine generators from GEN-2008-022 can be configured to meet the above power factor requirement by using switched capacitor banks or by regulating the voltage at either the POI or at each wind turbine generator. For this study, the power factor requirement at the POI is met when the GE 2.5 MW turbines are set to regulate their terminal voltage to 717.6 Volts (1.04 pu).

There power factor requirements for GEN-2010-006 and ASGI-2010-010 are +/-95% per the SPP Tariff.

Transient stability analysis has indicated that prior queued generators GEN-2001-033 and GEN-2001-036 may trip off for certain faults. These prior queued generation interconnection requests are grandfathered and are not required to adhere to FERC Order #661A and the tripping is considered acceptable.

DISIS-2010-001 (Group 6) projects will survive each fault contingency studied and the angular positions of synchronous machines rotor becomes constant. However, GEN-2009-067S will unintentionally be islanded due to 3-phase faults on the high side of the Seven Rivers 115/69kV transformer.

1. INTRODUCTION

S&C Electric Company has performed an interconnection impact study for the Definitive Impact Study DISIS-2010-001 (Group 6) in response to a request through the Southwest Power Pool (SPP). Studies were performed for summer 2010 and winter 2009 peak loading with Group 6 wind farms and prior queued projects operating at rated output power (100% output power).

Definitive Impact Study DISIS-2010-001 (Group 6) consists of the following wind generation projects:

- **GEN-2008-022** – GE 2.5 MW – 300 MW – Interconnection at Eddy County to GEN-2007-034T 345 kV line Tap; Chavez County, NM.
- **GEN-2009-067S** – Statcon PowerGate PV Inverters – 20 MW – Interconnection at Seven Rivers 69 kV substation; Eddy County, NM.
- **GEN-2010-006** – Siemens Gas Generator - 208 MW (Winter) / 180 MW (Summer) – Interconnection at Jones 230 kV substation; Lubbock, TX.
- **ASGI-2010-010** – Wärtsilä engine Type W20V33 – 42 MW – Interconnection at Lovington 115 kV substation; Lovington, NM.

2 TRANSMISSION SYSTEM AND STUDY AREA

The wind generation projects in Group 6 will interconnect into Southwestern Public Service (SPS). In addition to SPS, the following areas were monitored for power flow and dynamic stability analysis:

Midwest Energy, Inc. (MIDW)

AEP West (AEPW)

Oklahome Gas and Electric (OKGE)

Western Farmers Electric Cooperative (WFEC)

Sunflower Electric Power Company (SUNC)

Westar Energy, Inc (WERE)

3. POWER FLOW BASE CASES

The following power flow base cases were received from SPP:

DISIS_10SP-G6.sav – Summer peak 2010, which includes aggregate representation of wind turbine generators for Definitive Impact Study DISIS-2010-001 (Group 6) generation projects and prior queued projects at 100% output power. Other cluster projects were also included with wind farms at 20% output power.

DISIS_09WP-G6.sav – Winter peak 2009, which includes aggregate representation of generation interconnect projects for Definitive Impact Study DISIS-2010-001 (Group 6) wind farms and prior queued projects at 100% output power. Other cluster projects were also included with wind farms at 20% output power.

SPP provided further updates to the base cases:

- System upgrades IDEV found in Appendix A.

- Upgrades to GEN-2001-033:
  - Include two(2) 17 MVAR capacitor banks at 34.5 kV
  - Include two(2) 15 MVAR capacitor banks at 34.5 kV
  - Remove the 20 MVAR capacitor bank at 230 kV

4 Wind Farm Models

Definitive Impact Study DISIS-2010-001 (Group 6) wind farms and prior queued projects were modeled as aggregates of wind turbine generators. The aggregate models were part of the base case supplied by SPP.

4.1 General Electric GE – 2.5 MW / 60 Hz Wind Turbine Generator

The GE 2.5 MW wind turbine generator is a variable-speed doubly-fed induction generator with power converter and electrical pitch control. The standard GE turbine can operate continuously between 95% leading (inductive) to 95% lagging (capacitive). In load flow, a number of turbines are lumped as a single generator, which is connected to a 0.69 kV P/V bus.

4.2 Statcon PowerGate Photovoltaic Inverters

Like the GE turbines, in load flow, a number of inverters can be represented with a single generator connected to a 0.48 kV P/V bus. In standard configuration, each inverter can provide 80% leading to 80% lagging power factor at the expense of active power. At the expected 20 MW nameplate rating, the inverter can only deliver unity power factor at its terminals.

4.3 Siemens Gas Generator

The plant is represented as a single conventional generator. For the summer case, the dispatched output of the plant is 205 MW while for winter it is 180 MW. The generator has a 88.11% leading to 88.11% lagging power factor range and regulates its terminal voltage to 1.03 pu.

4.4 Wärtsilä engine Type W20V33

The plant is represented by five conventional generators or 8.44 MW with power factor range of 93.17 leading to 80% lagging power factor. It controls its terminal voltage to 1.02 pu.

5. Power Factor Requirements at the Point of Interconnection

SPP has specific voltage requirements for interconnecting wind farm and solar projects. Such projects are required to meet a voltage schedule at the POI consistent with the voltage in the SPP base case or nominal voltage, whichever is higher, for single transmission facility outage contingencies specified by SPP.

5.1 Facility Outage Contingencies

Single transmission facility outage contingencies specified by SPP are listed in Table 5.1.

Table 5.1: List of Power Flow Contingencies

Contingency	Description
0	Normal system conditions
1	Outage of the Eddy Co. 230kV (527800) to 345kV (527802) transformer
2	Outage of the GEN-2007-034 (210340) to GEN-2008-022 (577104) 345kV line
3	Outage of the GEN-2007-034 (210340) to Tolk (525549) 345kV line
4	Outage of the Tolk 230kV (525543) to 345kV (525549) transformer
5	Outage of the Tolk E (525524) to Tuco (525830) 230kV line
6	Outage of the Grassland (526676) to Lynn Co. (526656) 115kV line
7	Outage of the Grassland 230kV (526677) to 115kV (526676) transformer
8	Outage of the Grassland (526677) to Borden (526830) 230kV line
9	Outage of the Grassland (526677) to Jones (526338) 230kV line
10	Outage of the Jones (526338) to Lubbock E (526299) 230kV line
11	Outage of the Jones (526337) to Tuco (525830) 230kV line
12	Outage of the Tuco (525830) to Swisher (525213) 230kV line
13	Outage of the Tuco 230kV (525830) to 345kV (525832) transformer
14	Outage of the GEN-2005-015 (560813) to Tuco (525832) 345kV line
15	Outage of the GEN-2005-015 (560813) to Oklaunion (511456) 345kV line
16	Outage of the Tuco (525832) to Wheeler/Midpoint (525835) 345kV line
17	Outage of the Roosevelt S (524911) to Tolk (525554) 230kV line
18	Outage of the San Juan (524885) to Oasis (524875) 230kV line
19	Outage of the Seven Rivers (528094) 115kv to Severn Rivers (528093) 69kV transformer
20	Outage of the Seven Rivers (528094) 115kv to Severn Rivers (528095) 230kV transformer
21	Outage of the Lovington (527848) 115kV to Lea County (527849) 230kV transformer
22	Outage of the Lovington (528334) to Lea County (527848) 115kV line

Contingency	Description
23	Outage of the GEN-2008-022 (577104) to Eddy County (527802) 345kV line
24	Outage of the Eddy Co. (527800) to Chaves Co (527483) 230kV line
25	Outage of the Eddy Co. (527800) to Cunningham (527866) 230kV line
26	Outage of the Eddy Co. (527800) to Seven Rivers (528095) 230kV line

Voltage schedules at the point of interconnect locations from the original Definitive Impact Study DISIS-2010-001 (Group 6) base cases are listed in Table 5.2.

Table 5.2: Base Case Voltage of Point of Interconnection Locations

Point of Interconnection	Summer Peak 2010 (pu)	Winter Peak 2009 (pu)
Seven Rivers 69 kV substation	1.019	1.016
Tap of Eddy County to GEN-2007-034T 345 kV line	1.018	1.018

The power factor needs to maintain a voltage schedule at the POI consistent with SPP requirements for the worst case contingencies is summarized in Table 5.3.

Table 5.3: Power factor needs at POI

Point of Interconnection	Interconnection Request	Leading Power Factor Requirements		Lagging Power Factor Requirements	
		Contingency (table 5.2)	Power Factor	Contingency (table 5.2)	Power Factor
Seven Rivers 69 kV substation	GEN-2009-067S	No. 26 winter	-99.97 %		
Tap of Eddy County to GEN-2007-034T 345 kV line	GEN-2008-022			No. 2 winter	99.98%

The Satcon PowerGate PV inverters from GEN 2009-067S in the standard configuration can provide 80% leading to 80% lagging power factor at the expense of active power. At the expected 20 MW nameplate rating, the inverter can only deliver unity power factor at its terminals. To deliver the 99.97% leading power factor at the POI at rated 20 MW, an external source of reactive power such as a capacitor bank is needed. For this study, the power requirement at the POI is met with the addition of a 1.8 MVAR capacitor bank at the 13.8 kV collector bus. Alternatively, the number of inverters can be increased in order to deliver 2 MVAR (lagging power factor of 99.5% at 0.48 kV) at rated 20 MW.

The GE 2.5 MW wind turbine generators from GEN-2008-022 can be configured to meet the above power factor requirement by using switched capacitor banks or by regulating the voltage at either the POI or at each wind turbine generator. For this study, the power factor requirement at the POI is met when the GE 2.5 MW turbines are set to regulate their terminal voltage to 717.6 Volts (1.04 pu).

Table 5.4: Summary of wind farm control, capacitor bank sizes and transformer tap settings assumptions for transient stability analysis

Project Name	Wind Turbine Generator			Voltage Schedule at POI to be Met by Project Request		Cap Bank Requirement	XFMR No-Load Tap Setting (% of High Side Winding)	
	Make	PF Range (%)	Control Scheme	Summer (pu)	Winter (pu)		Substation XFMR	WTG GSU
GEN-2009-067S	Satcon PowerGate PV	+/- 80	Operate inverters at fixed unity power factor	1.019	1.016	1.8 MVAR@13.8 kV	100	100
GEN-2008-022	GE 2.5 MW WTG	+/- 95	Control generator voltage to 1.04 pu	1.018	1.018	none	100	100

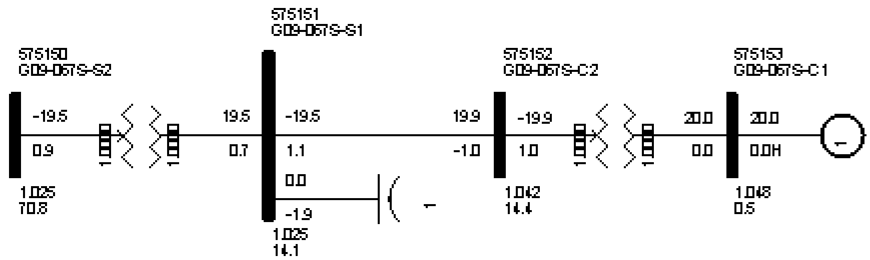

Figure 5.1: Power flow diagram of GEN-2009-067S for contingency No. 26, winter

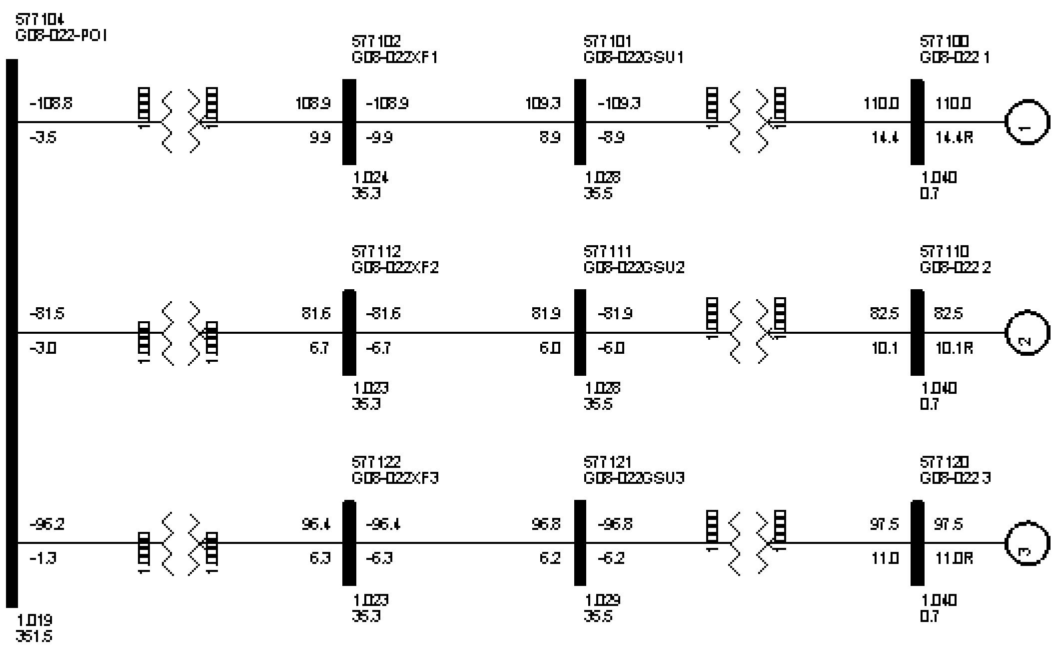

Figure 5.2: Power flow diagram of GEN-2008-022 for contingency No. 2, winter

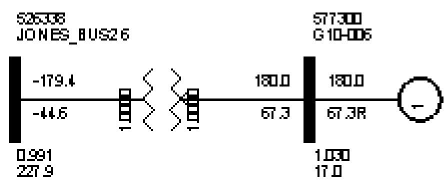

Figure 5.3: Power flow diagram of GEN-2010-006 for normal system, winter

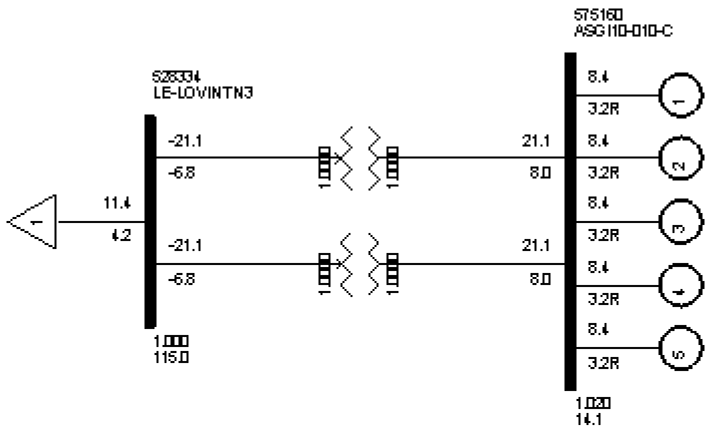

Figure 5.4: Power flow diagram of GEN-2010-010 for normal system, winter

6. Transient Stability Analysis and Results

Transient stability analysis was performed for fault contingencies in Table 6.1.

Table 6.1: SPP fault contingencies

Cont. No.	Cont. Name	Description
1	FLT01-3PH	3 phase fault on the Eddy Co. 230kV to 345kV transformer, near the 230kV bus. a. Apply fault at the Eddy Co. 230kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
2	FLT02-3PH	3 phase fault on the GEN-2007-034 to GEN-2008-022 345kV line, near GEN-2007-034. a. Apply fault at the GEN-2007-034 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in back into the fault. d. Leave fault on for 5 cycles, then trip the line in and remove fault.
3	FLT03-1PH	*Single phase fault and sequence like previous*
4	FLT04-3PH	3 phase fault on the GEN-2007-034 to Tolk 345kV line, near GEN-2007-034. a. Apply fault at the GEN-2007-034 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in back into the fault. d. Leave fault on for 5 cycles, then trip the line in and remove fault.
5	FLT05-1PH	*Single phase fault and sequence like previous*
6	FLT06-3PH	3 phase fault on the Tolk 230kV to 345kV transformer, near the 230kV bus. a. Apply fault at the Tolk 230kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
7	FLT07-3PH	3 phase fault on the Tolk E to Tuco 230kV line, near Tolk E. a. Apply fault at the Tolk E 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in back into the fault. d. Leave fault on for 5 cycles, then trip the line in and remove fault.
8	FLT08-1PH	*Single phase fault and sequence like previous*
9	FLT09-3PH	3 phase fault on the Grassland to Lynn Co. 115kV line, near Grassland. a. Apply fault at the Grassland 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in back into the fault. d. Leave fault on for 5 cycles, then trip the line in and remove fault.
10	FLT10-1PH	*Single phase fault and sequence like previous*
11	FLT11-3PH	3 phase fault on the Grassland 230kV to 115kV transformer, near the 230kV bus. a. Apply fault at the Grassland 230kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
12	FLT13-3PH	3 phase fault on the Grassland to Borden 230kV line, near Grassland. a. Apply fault at the Grassland 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in back into the fault.

		d. Leave fault on for 5 cycles, then trip the line in and remove fault.
13	FLT14-1PH	*Single phase fault and sequence like previous*
14	FLT15-3PH	3 phase fault on the Grassland to Jones 230kV line, near Grassland. a. Apply fault at the Grassland 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in back into the fault. d. Leave fault on for 5 cycles, then trip the line in and remove fault.
15	FLT16-1PH	*Single phase fault and sequence like previous*
16	FLT17-3PH	3 phase fault on the Jones to Lubbock E 230kV line, near Jones Bus2. a. Apply fault at the Jones 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in back into the fault. d. Leave fault on for 5 cycles, then trip the line in and remove fault.
17	FLT18-3PH	3 phase fault on the Jones to Tuco 230kV line, near Jones Bus1. a. Apply fault at the Jones 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in back into the fault. d. Leave fault on for 5 cycles, then trip the line in and remove fault.
18	FLT19-1PH	*Single phase fault and sequence like previous*
19	FLT20-3PH	3 phase fault on the Tuco to Swisher 230kV line, near Tuco. a. Apply fault at the Tuco 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in back into the fault. d. Leave fault on for 5 cycles, then trip the line in and remove fault.
20	FLT21-1PH	*Single phase fault and sequence like previous*
21	FLT22-3PH	3 phase fault on the Tuco 230kV to 345kV transformer, near the 230kV bus. a. Apply fault at the Tuco 230kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
22	FLT23-3PH	3 phase fault on the GEN-2005-015 to Tuco 345kV line, near GEN-2005-015. a. Apply fault at the GEN-2005-015 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in back into the fault. d. Leave fault on for 5 cycles, then trip the line in and remove fault.
23	FLT24-1PH	*Single phase fault and sequence like previous*
24	FLT25-3PH	3 phase fault on the GEN-2005-015 to Oklaunion 345kV line, near GEN-2005-015. a. Apply fault at the GEN-2005-015 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in back into the fault. d. Leave fault on for 5 cycles, then trip the line in and remove fault.
25	FLT26-1PH	*Single phase fault and sequence like previous*
26	FLT29-3PH	3 phase fault on the Tuco to Wheeler/Midpoint 345kV line, near Tuco. a. Apply fault at the Tuco 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in back into the fault. d. Leave fault on for 5 cycles, then trip the line in and remove fault.
27	FLT30-1PH	*Single phase fault and sequence like previous*

28	FLT31-3PH	3 phase fault on the Roosevelt S to Tolk 230kV line, near Roosevelt S. a. Apply fault at the Roosevelt S 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in back into the fault. d. Leave fault on for 5 cycles, then trip the line in and remove fault.
29	FLT32-1PH	*Single phase fault and sequence like previous*
30	FLT33-3PH	3 phase fault on the San Juan to Oasis 230kV line, near Oasis. a. Apply fault at the Oasis 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in back into the fault. d. Leave fault on for 5 cycles, then trip the line in and remove fault.
31	FLT34-1PH	*Single phase fault and sequence like previous*
32	FLT44-3PH	3 phase fault on the Grassland 230kV to 115kV transformer, near the 230kV bus. a. Apply fault at the Grassland 230kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
33	FLT74-3PH	3 phase fault on the Seven Rivers 115kv to Severn Rivers 69kV transformer, near Seven Rivers 115kV a. Apply fault at the Seven Rivers 115kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
34	FLT75-3PH	3 phase fault on the Seven Rivers 115kv to Severn Rivers 230kV transformer, near Seven Rivers 230kV a. Apply fault at the Seven Rivers 230kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
35	FLT76-3PH	3 phase fault on the Lovington 115kV to Lea County 230kV transformer, near Lea County 230kV a. Apply fault at the Lea County 230kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
36	FLT77-3PH	3 phase fault on the Lovington to Lea County 115kV line, near Lea County a. Apply fault at the Lea county 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
37	FLT79-3PH	3 phase fault on the GEN-2008-022 to Eddy County 345kV line, near GEN-2008-022. a. Apply fault at the GEN-2008-022 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in back into the fault. d. Leave fault on for 5 cycles, then trip the line in and remove fault.
38	FLT80-1PH	*Single phase fault and sequence like previous*
39	FLT81-3PH	3 phase fault on the GEN-2008-022 to GEN-2007-034T 345kV line, near GEN-2008-022. a. Apply fault at the GEN-2008-022 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in back into the fault. d. Leave fault on for 5 cycles, then trip the line in and remove fault.
40	FLT82-1PH	*Single phase fault and sequence like previous*
41	FLT83-3PH	3 phase fault on the Eddy Co. to Chaves Co 230kV line, near Eddy Co. a. Apply fault at the Eddy Co. 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in back into the fault.

		d. Leave fault on for 5 cycles, then trip the line in and remove fault.
42	FLT84-1PH	*Single phase fault and sequence like previous*
43	FLT85-3PH	3 phase fault on the Eddy Co. to Cunningham 230kV line, near Eddy Co. a. Apply fault at the Eddy Co. 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in back into the fault. d. Leave fault on for 5 cycles, then trip the line in and remove fault.
44	FLT86-1PH	*Single phase fault and sequence like previous*
45	FLT87-3PH	3 phase fault on the Eddy Co. to Seven Rivers 230kV line, near Eddy Co. a. Apply fault at the Eddy Co. 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in back into the fault. d. Leave fault on for 5 cycles, then trip the line in and remove fault.
46	FLT88-1PH	*Single phase fault and sequence like previous*

The prior queued projects monitored are listed in Table 6.2.

Table 6.2: Prior queued wind farm projects monitored

Request	Size (MW)	Wind Turbine Model	Point of Interconnection
GEN-2001-033	180	Mitsubishi MWT-1000	San Juan Mesa 230kV
GEN-2001-036	80	Mitsubishi MWT-1000[1]	Curry-Tucumcari 115kV
GEN-2005-010	160	Gamesa	Tolk – Roosevelt 230kV
GEN-2005-015	150	Gamesa	Tuco – Oklaunion 345kV
GEN-2007-034	150	GE 1.5MW	Tolk – Eddy County 345kV
GEN-2008-008	60	GE 1.5MW	Graham 69kV
GEN-2008-009	60	GE 1.5MW	San Juan Mesa 230kV
GEN-2008-014	150	Vestas V90	Tuco – Oklaunion 345kV
GEN-2008-016	248	Vestas V90	Grassland 230kV
GEN-2009-017	150	Siemens 2.3MW	Tap Pembrook – Stiles 138kV

Note 1: Modeled as CIMTR

6.1 Stability Criteria

Disturbances including three-phase and single-phase to ground faults should not cause synchronous and asynchronous plants to become unstable or disconnect from the transmission grid.

The criterion for synchronous generator stability as defined by NERC is:

"Power system stability is defined as that condition in which the difference of the angular positions of synchronous machine rotor becomes constant following an aperiodic system disturbance."

Voltage magnitudes and frequencies at terminals of asynchronous generators should not exceed magnitudes and durations that will cause protection elements to operate. Furthermore, the response after the disturbance needs to be studied at the terminals of the machine to insure that there are no sustained oscillations in power output, speed, frequency, etc.

Voltage magnitudes and angles after the disturbance should settle to a constant and reasonable operating level. Frequencies should settle to the nominal 60 Hz power frequency.

6.2 Modeling of GE 2.5 MW Wind Turbine Generators

The dynamic model for the GE 2.5 MW wind turbine generator was provided by SPP. Model parameters are found in Appendix B. The voltage and frequency relay settings used with the GE 25 MW model are listed in Table 6.3.

Table 6.3: GE 2.5 MW protection settings

<table>
<tr><th>Relay type</th><th>Description</th><th>Trip setting and time delay</th><th>Units</th></tr>
<tr><td>Undervoltage (27-1)</td><td>Relay trips if |Vbus|<
for t =</td><td>0.75
1.90</td><td>Pu
S</td></tr>
<tr><td>Undervoltage (27-2)</td><td>Relay trips if |Vbus|<
for t =</td><td>0.50
1.2</td><td>Pu
S</td></tr>
<tr><td>Undervoltage (27-3)</td><td>Relay trips if |Vbus|<
for t =</td><td>0.30
0.70</td><td>Pu
S</td></tr>
<tr><td>Undervoltage (27-4)</td><td>Relay trips if |Vbus|<
for t =</td><td>0.15
0.20</td><td>Pu
S</td></tr>
<tr><td>Overvoltage (59-1)</td><td>Relay trips if |Vbus|>
for t =</td><td>1.1
1.0</td><td>Pu
S</td></tr>
<tr><td>Overvoltage (59-2)</td><td>Relay trips if |Vbus|>
for t =</td><td>1.15
0.1</td><td>Pu
S</td></tr>
<tr><td>Overvoltage (59-3)</td><td>Relay trips if |Vbus|>
for t =</td><td>1.3
0.02</td><td>Pu
S</td></tr>
<tr><td>Underfrequency (81U-1)</td><td>Relay trips if Fbus <
for t =</td><td>57.5
10.0</td><td>Hz
S</td></tr>
<tr><td>Underfrequency (81U-2)</td><td>Relay trips if Fbus <
for t =</td><td>55.0
0.02</td><td>Hz
S</td></tr>
<tr><td>Overfrequency (81O-1)</td><td>Relay trips if Fbus >
for t =</td><td>62.5
10.0</td><td>Hz
S</td></tr>
<tr><td>Overfrequency (81U-2)</td><td>Relay trips if Fbus >
for t =</td><td>65.0
0.02</td><td>Hz
S</td></tr>
</table>

6.3 Modeling of Satcon's PowerGate Photovoltaic Inverters

The dynamic model was provided by SPP. Model parameters are found in Appendix B. The voltage and frequency relay settings used with the model are listed in Table 6.4.

Table 6.4: Satcon PowerGate PV protection settings

Relay type	Description	Trip setting and time delay	Units
Undervoltage (27-1)	Relay trips if |Vbus|< for t =	00.88 1.00	Pu S
Undervoltage (27-2)	Relay trips if |Vbus|< for t =	0.50 0.16	Pu S
Overvoltage (59-1)	Relay trips if |Vbus|> for t =	1.1 1.0	Pu S
Overvoltage (59-2)	Relay trips if |Vbus|> for t =	1.3 0.16	Pu S
Underfrequency (81U-1)	Relay trips if Fbus < for t =	59.5 0.16	Hz S
Overfrequency (81O-1)	Relay trips if Fbus > for t =	60.5 0.16	Hz S

6.4 Modeling of Siemens Gas Generator

The dynamic model was provided by SPP. Machine parameters and specifications are found in Appendix B.

6.5 Modeling of Wärtsilä engine Type W20V33

The dynamic model was provided by SPP. Machine parameters and specifications are found in Appendix B.

6.6 Transient Stability Results: Summer Peak 2010

An undisturbed run of 30 seconds was performed on the Summer Peak 2010 power flow case to verify proper initialization of dynamic models. GEN-2006-046, which is being dispatched at 20% of rated output power, failed to initialize properly and disconnected during initialization. This may be a problem with the Mitsubishi MWT-92/95 model. The problem was brought up and discussed with SPP previously. The presence or absence of GEN-2006-046 will have little impact on the results due to its low penetration into the study area.

The system will become unstable for fault #30. Figure 6.1 is a plot of the voltage and frequency at the San Juan wind farm tap. The San Juan tap to Oasis 230 kV line is used to transfer some of the reactive power needed at San Juan. Once out of service, there is lack of reactive power support at the San Juan tap. The system will remain stable with the two (2) 28.8 MVAR capacitor banks at Chavez County, which were offline in the provided base cases, should be online to provide the reactive power support to maintain system stability as seen in Figure 6.2.

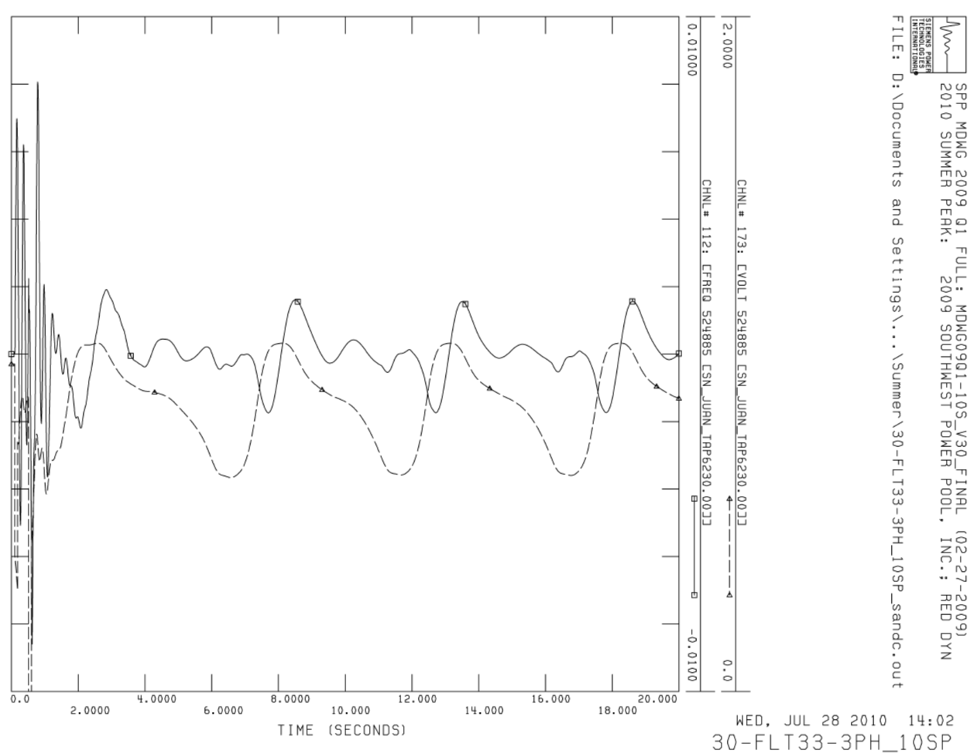

Figure 6.1: Voltage at the 230 kV San Juan Tap for Fault #30, Summer Peak 2010 without Chaves capacitor banks in service

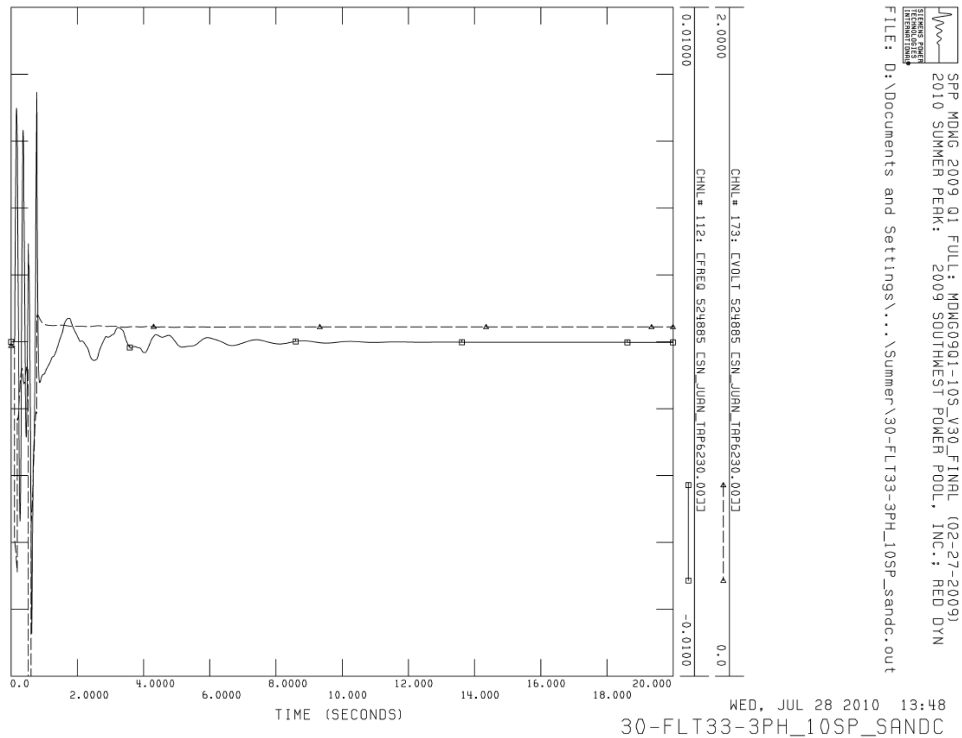

Figure 6.2: Voltage at the 230 kV San Juan Tap for Fault #30 with Cap Banks at Chavez County online, Summer Peak 2010

Furthermore, transient stability analysis results show that prior queued project GEN-2001-036 will not survive fault #7 and #28 and prior queued project GEN-2001-033 will not survive fault #30 as seen in Figure 6.3 even with the two(2) 28.8 MVAR capacitors at Chavez County online. With its generator protection disabled or not functioning as intended,GEN-2001-036 will see voltage collapse for fault #7 and #28 as seen in Figure 6.4. GEN-2001-033 will be stable for fault #30 if generation protection is disabled or not functioning as intended as seen in Figure 6.4. However, these grandfathered generators are not required to withstand these faults and are intended to trip off.

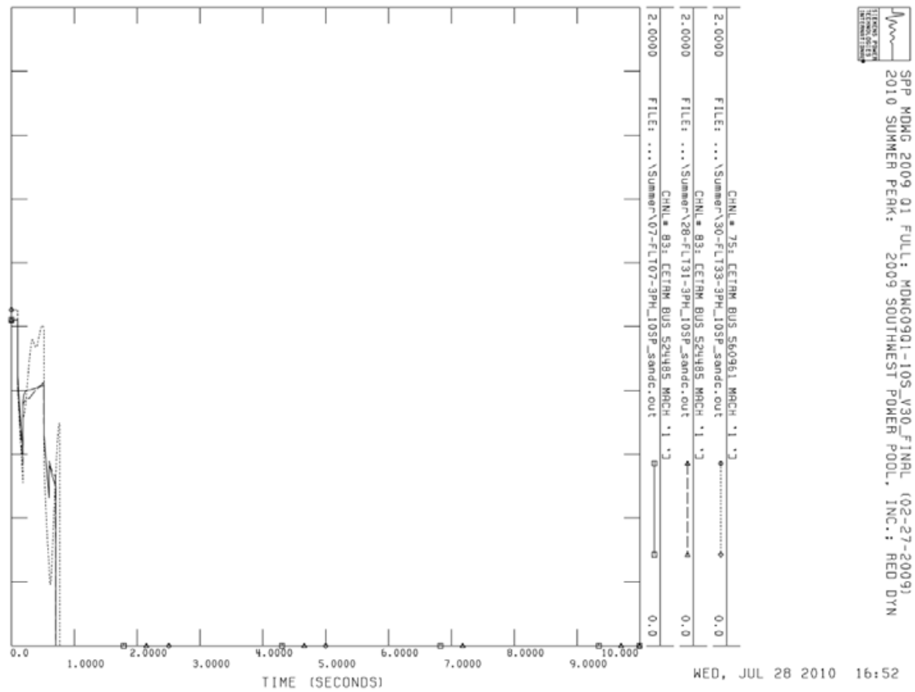

Figure 6.3: Terminal voltage of GEN-2001-036 and GEN-2001-033 generators for fault #7, #28 and #30, summer peak 2010

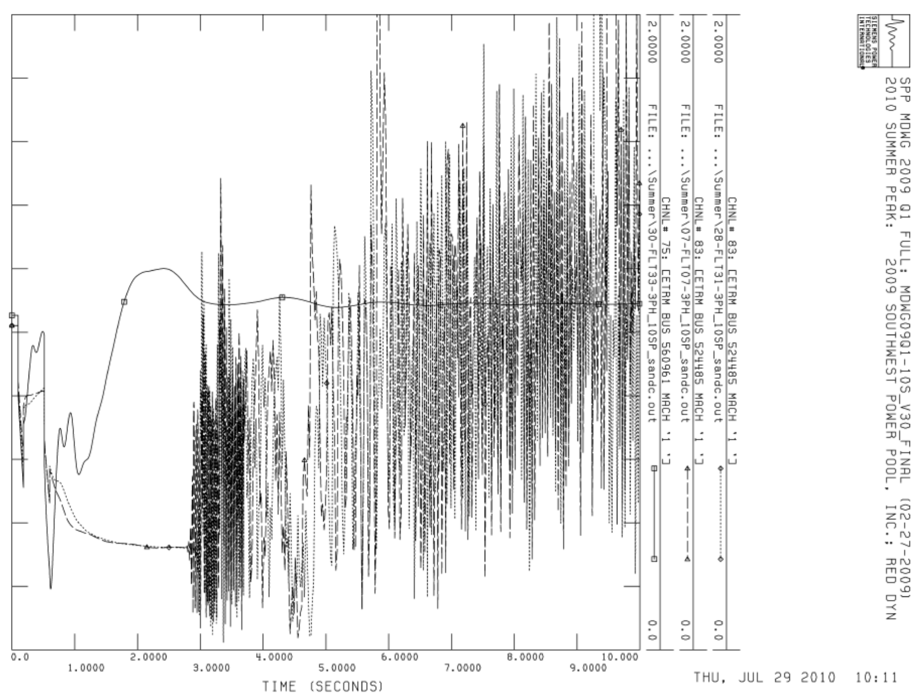

Figure 6.4: Terminal Voltage of GEN-2001-036 and GEN-2001-033 Generators for Fault #7, #28 and #30, Summer Peak 2010 (Generator Protection Disabled)

Either a SVC or STATCOM device could help maintain system stability in the case in which GEN-2001-036 remains connected for fault #7 and #28 as seen in Figure 6.5. In this arrangement, it has been determined that there is need for a 10 MVAR STATCOM device at GEN-2001-036 and a 20 MVAR capacitor bank at the 230 kV San Juan tap. However, even with these additions, GEN-2001-033 will disconnect for fault #30 as seen in Figure 6.6. No further action needs to be pursued to keep the wind farm connected.

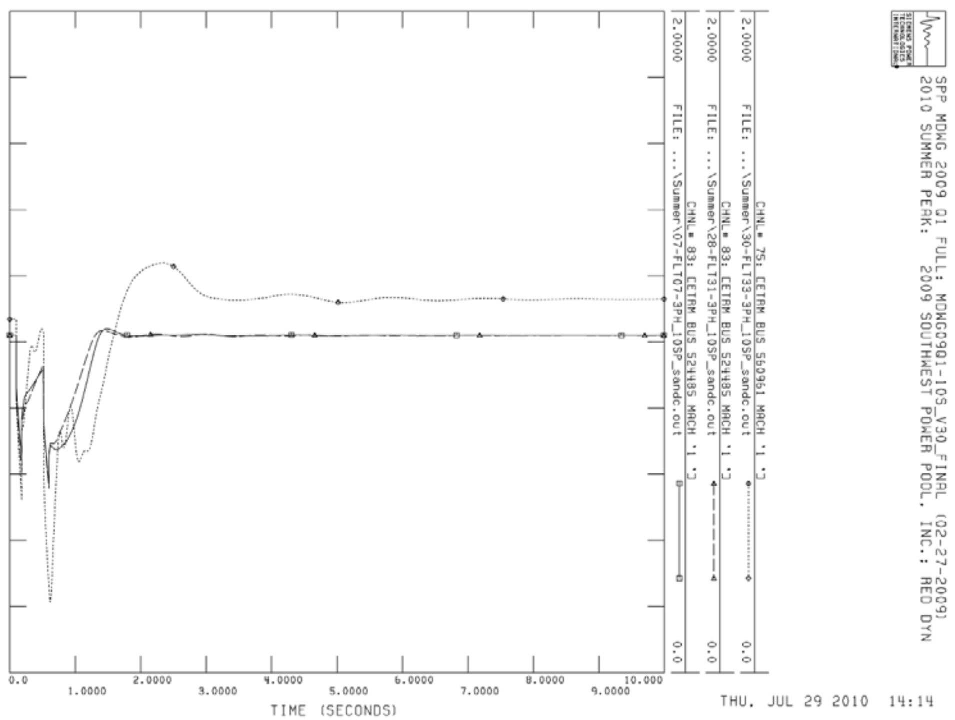

Figure 6.5: Terminal voltage of GEN-2001-036 and GEN-2001-033 generators for fault #7, #28 and #30 with STATCON at GEN-2001-036 and Cap Bank at 230 kV San Juan Tap, Summer Peak 2010 (Generator Protection Disabled)

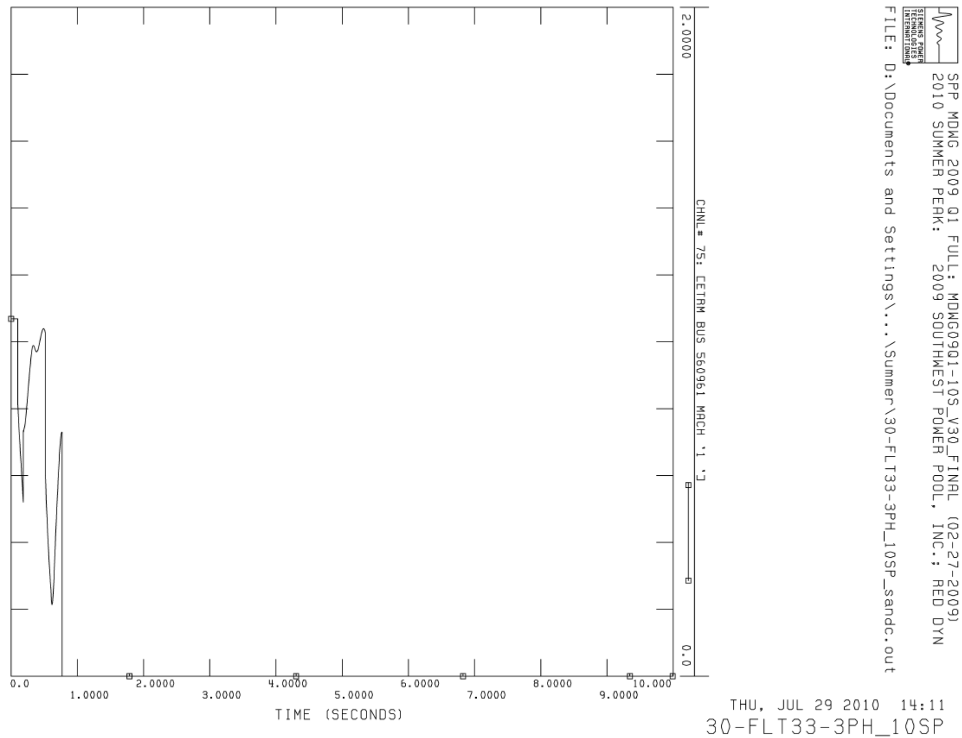

Figure 6.6: Terminal voltage of GEN-2001-033 generators for fault #30 with STATCON at GEN-2001-036 and Cap Bank at 230 kV San Juan Tap, Summer Peak 2010

With the two 28.8 MVAR capacitor banks at Chavez County online, 10 MVAR STATCOM device at GEN-2001-036 and 20 MVAR capacitor bank at the 230 kV San Juan tap, the areas being monitored remain stable and Definitive Impact Study DISIS-2010-001 (Group 6) and prior queued project will survive each fault contingency for the fault contingencies in Table 6.1. GEN-2001-033 will disconnect for fault #30 as shown in Figure 6.6. In the event that wind turbine protection at GEN-2001-033 were to fail or not operate as intended, the system will be stable as shown in Figure 6.5. Transient stability analysis results for summer peak 2010 are summarized in Table 6.5. Stability plots are found in Appendix A.

6.7 Transient Stability Results: Winter Peak 2009

An undisturbed run of 30 seconds was performed on the Summer Peak 2010 power flow case to verify proper initialization of dynamic models. Similarly to the summer peak case, GEN-2006-046, which is being dispatched at 20% of rated output power, failed to initialize properly and disconnected during initialization. The presence or absence of GEN-2006-046 will have little impact on the results due to its low penetration into the study area.

Likewise to the summer peak case, the system will become unstable for fault #30. Figure 6.7 is a plot of the voltage and frequency at the San Juan wind farm tap. The two (2) 28.8 MVAR capacitor banks at Chavez County should be online to provide the reactive power support to maintain system stability as seen in Figure 6.8.

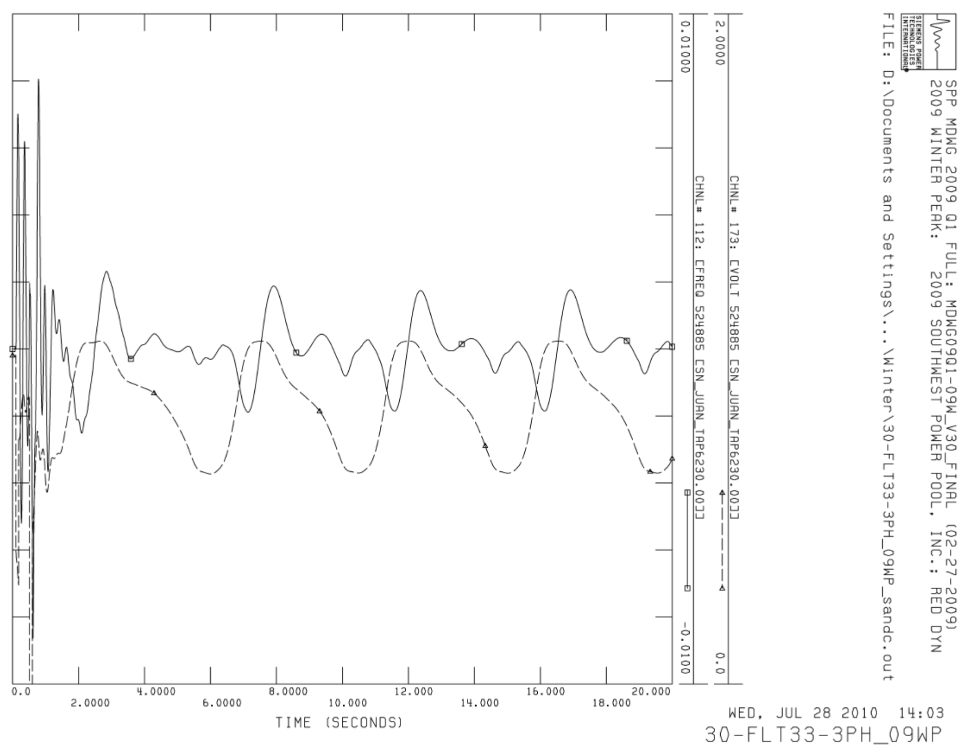

Figure 6.7: Voltage at the 230 kV San Juan Tap for Fault #30, Winter Peak 2009 without Chaves capacitor banks in service

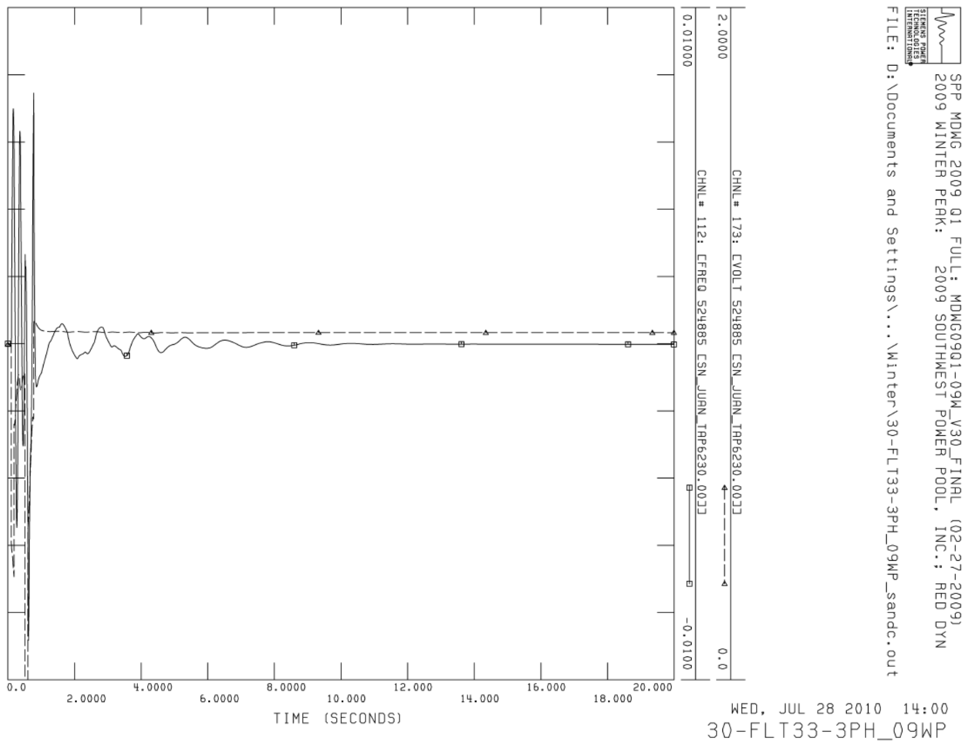

Figure 6.8: Voltage at the 230 kV San Juan Tap for Fault #30 with Cap Banks at Chavez County online, Winter Peak 2009

Results also show that prior queued project GEN-2001-036 will not survive fault #7 and #28 and prior queued project GEN-2001-033 will not survive fault #30 as seen in Figure 6.9 with the two(2) 28.8 MVAR capacitors at Chavez County online. Without generation protection, GEN-2001-036 will see voltage collapse for fault #7 and #28 as seen in Figure 6.10. GEN-2001-033 will be stable for fault #30 without generation protection as seen in Figure 6.4. As stated in the summer peak, these generators are intended to trip off.

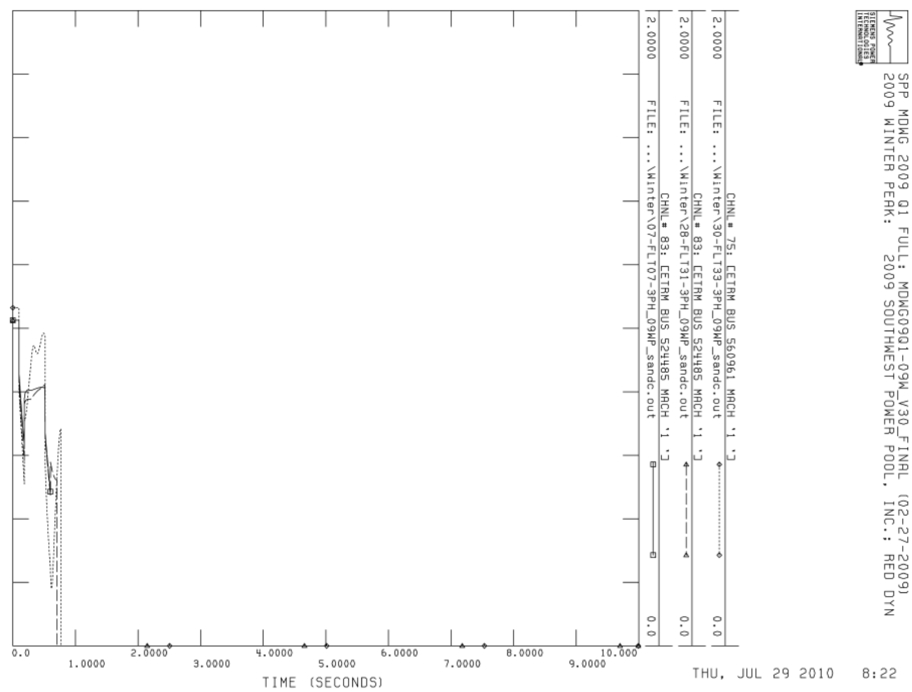

Figure 6.9: Terminal voltage of GEN-2001-036 and GEN-2001-033 generators for fault #7, #28 and #30, Winter Peak 2009

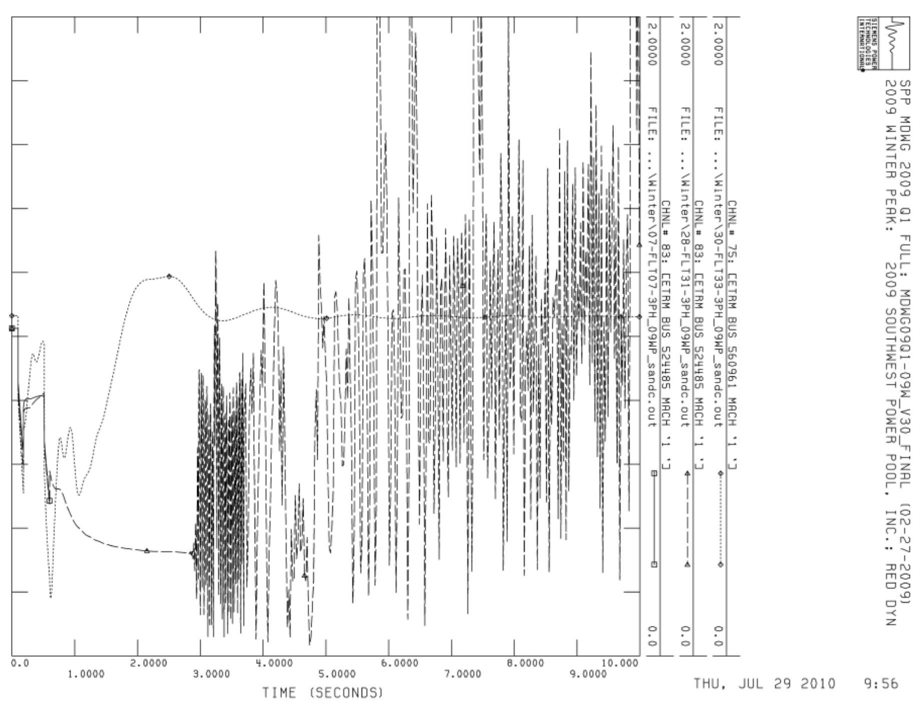

Figure 6.10: Terminal Voltage of GEN-2001-036 and GEN-2001-033 Generators for Fault #7, #28 and #30, Winter Peak 2009 (Generator Protection Disabled)

The proposed 10 MVAR STATCOM device at GEN-2001-036 and a 20 MVAR capacitor bank at the 230 kV San Juan tap will help GEN-2001-036 with the stability issues; however, even with these additions, GEN-2001-033 will disconnect for fault #30 as seen in Figure 6.11. No further action needs to be pursued to keep the wind farm connected.

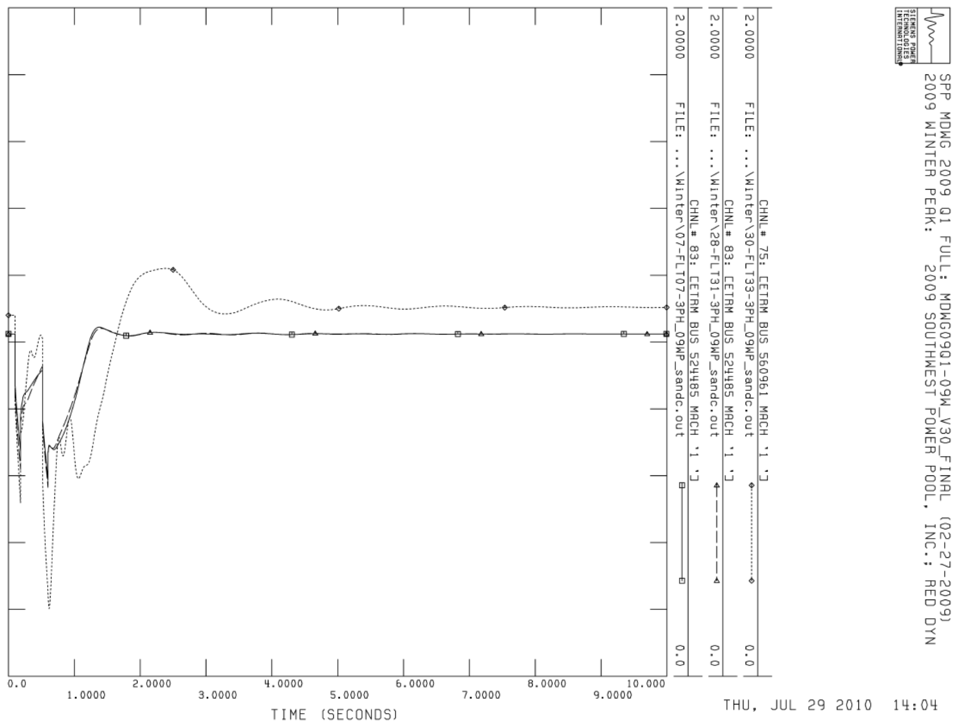

Figure 6.11: Terminal voltage of GEN-2001-036 and GEN-2001-033 generators for fault #7, #28 and #30 with STATCON at GEN-2001-036 and Cap Bank at 230 kV San Juan Tap, Winter Peak 2009 (Generator Protection Disabled)

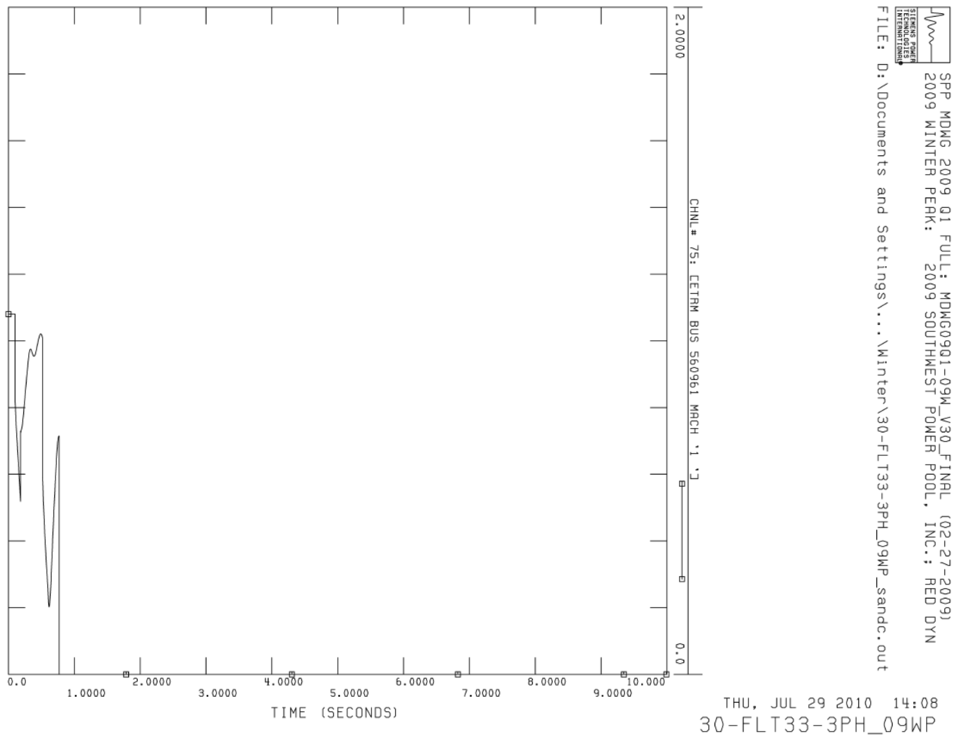

Figure 6.12: Terminal voltage of GEN-2001-033 generators for fault #30 with STATCON at GEN-2001-036 and Cap Bank at 230 kV San Juan Tap, Winter Peak 2009

With the two 28.8 MVAR capacitor banks at Chavez County online, 10 MVAR STATCOM device at GEN-2001-036 and 20 MVAR capacitor bank at the 230 kV San Juan tap, the areas being monitored remain stable and Definitive Impact Study DISIS-2010-001 (Group 6) and prior queued project will survive each fault contingency for the fault contingencies in Table 6.1. GEN-2001-033 will disconnect for fault #30 as seen in Figure 6.12. In the event that wind turbine protection at GEN-2001-033 were to fail or not operate as intended, the system will be stable as seen in Figure 6.11. Transient stability analysis results for summer peak 2010 are summarized in Table 6.5. Stability plots are found in Appendix A.

Table 6.5: Transient Stability Results Summary
(with upgrades and recommended STATCON and capacitor banks)

Cont. No.	Cont. Name	Summer Peak 2010	Winter Peak 2009
1	FLT01-3PH	STABLE	STABLE
2	FLT02-3PH	STABLE	STABLE
3	FLT03-1PH	STABLE	STABLE
4	FLT04-3PH	STABLE	STABLE
5	FLT05-1PH	STABLE	STABLE
6	FLT06-3PH	STABLE	STABLE
7	FLT07-3PH	STABLE	STABLE
8	FLT08-1PH	STABLE	STABLE
9	FLT09-3PH	STABLE	STABLE
10	FLT10-1PH	STABLE	STABLE
11	FLT11-3PH	STABLE	STABLE
12	FLT13-3PH	STABLE	STABLE
13	FLT14-1PH	STABLE	STABLE
14	FLT15-3PH	STABLE	STABLE
15	FLT16-1PH	STABLE	STABLE
16	FLT17-3PH	STABLE	STABLE
17	FLT18-3PH	STABLE	STABLE
18	FLT19-1PH	STABLE	STABLE
19	FLT20-3PH	STABLE	STABLE
20	FLT21-1PH	STABLE	STABLE
21	FLT22-3PH	STABLE	STABLE
22	FLT23-3PH	STABLE	STABLE
23	FLT24-1PH	STABLE	STABLE
24	FLT25-3PH	STABLE	STABLE
25	FLT26-1PH	STABLE	STABLE
26	FLT29-3PH	STABLE	STABLE
27	FLT30-1PH	STABLE	STABLE
28	FLT31-3PH	STABLE	STABLE
29	FLT32-1PH	STABLE	STABLE
30	FLT33-3PH	STABLE GEN-2001-033 disconnects	STABLE GEN-2001-033 disconnects
31	FLT34-1PH	STABLE	STABLE
32	FLT44-3PH	STABLE	STABLE
33	FLT74-3PH	STABLE GEN-2009-067S is unintentionally islanded	STABLE GEN-2009-067S is unintentionally islanded
34	FLT75-3PH	STABLE	STABLE
35	FLT76-3PH	STABLE	STABLE
36	FLT77-3PH	STABLE	STABLE
37	FLT79-3PH	STABLE	STABLE
38	FLT80-1PH	STABLE	STABLE
39	FLT81-3PH	STABLE	STABLE

Cont. No.	Cont. Name	Summer Peak 2010	Winter Peak 2009
40	FLT82-1PH	STABLE	STABLE
41	FLT83-3PH	STABLE	STABLE
42	FLT84-1PH	STABLE	STABLE
43	FLT85-3PH	STABLE	STABLE
44	FLT86-1PH	STABLE	STABLE
45	FLT87-3PH	STABLE	STABLE
46	FLT88-1PH	STABLE	STABLE

7. CONCLUSIONS AND RECOMMENDATIONS

1 Definitive Impact Study DISIS-2010-001 (Group 6) wind and solar projects are required to demonstrate that they can operate at the following power factors for the worst single transmission facility outage contingency in each case.

- 99.98% lagging power factor (capacitive) from GEN-2008-022 to the Eddy County – GEN-2007-34T 345kV wind farm tap for an outage of the 230 kV line from Eddy Co to Seven Rivers in the winter 2009 peak case.
- 99.97 % leading power factor (inductive) from GEN 2009-067S to the Seven Rivers 69 kV substation for an outage of the 345 kV line from GEN-2007-034 to GEN-2008-022 in the winter 2009 peak case.

2 Prior queued project GEN-2001-033 and GEN-2001-036 may disconnect for faults #7, #28, and #30. These previously queued generators are grandfathered under previous rules and this tripping is allowed to keep the transmission system stable.

O: Stability Study for Group 7

SPP DISIS-2010-001 Group 7 Impact Study

Draft Report for

Southwest Power Pool

Prepared by:
Excel Field Services, Inc.

July 17, 2010

Principal Contributors:

Shu Liu, P.E.
William Quaintance, P.E.

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0. Certification

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the Laws of the State of **Oklahoma**.

William Quaintance
Oklahoma Registration Number: 24320

Excel Field Services, Inc.
Oklahoma License Number: 5844

1. Background and Scope

The DISIS-2010-001 Group 7 Impact Study is a generation interconnection study performed by Excel Field Services, Inc. for its non-affiliated client, Southwest Power Pool (SPP). Its purpose is to study the impacts of interconnecting the projects shown in Table 1-1. The in-service date assumed for the generation addition was 2010.

Table 1-1. Interconnection Requests Evaluated

Request	Size (MW)	Generator Model	Point of Interconnection
GEN-2008-037	100.8	Vestas V90 1.8MW	Washita (521089)
GEN-2009-030	100.8	GE 1.6MW	Weatherford 138kV (521092)
GEN-2009-060	85.5	GE 1.5MW	Gotebo 69kV (520925)

The previously-queued requests shown in Table 1-2 were included in this study. These previously-queued requests were dispatched at 100% of rated capacity.

Table 1-2. Nearby Interconnection Requests Already in the Queue

Request	Size (MW)	Generator Model	Point of Interconnection
Blue Canyon I	74	CIMTR	Washita 138kV (521089)
Blue Canyon II (GEN-2003-004)	151	Vestas V80	Washita 138kV (521089)
Weatherford	147	G.E. 1.5MW	Weatherford 138kV (511506)
GEN-2003-005	100	G.E. 1.5MW	Anadarko – Paradise 138kV (560916)
GEN-2006-002	150	Gamesa	Beckham County 230kV (560012)
GEN-2006-035	224	Gamesa	Beckham County 230kV (560012)
GEN-2006-043	99	G.E. 1.5MW	Beckham County 230kV (560012)
GEN-2007-032	150	Acciona 1.5MW	Clinton Jct. – Clinton 138kV (560939)
GEN-2007-043	200	G.E. 1.5MW	Cimarron – Anadarko 345kV (210431)
GEN-2007-052	150	Gas Turbine	Anadarko 138kV (520814)
GEN-2008-023	150	G.E. 1.5MW	Hobart Junction (511463) 138kV
GEN-2009-016	140.3	Siemens 2.3MW	Falcon Road 138KV (511511)

The study included stability analysis of each proposed interconnection request. Contingencies that resulted in a prior-queued project tripping off-line, if any, were re-run with the prior-queued project's voltage and frequency tripping disabled. A power factor analysis was performed for the wind farms in Table 1-1.

ATC (Available Transfer Capability) studies were not performed as part of this study. These studies will be required at the time transmission service is actually requested. Additional transmission upgrades may be required based on that analysis.

Study assumptions in general have been based on Excel's knowledge of the electric power system and on the specific information and data provided by SPP. The accuracy of the conclusions contained within this study is sensitive to the assumptions made with respect to other generation additions and transmission improvements being contemplated by other entities. Changes in the assumptions of the timing of other generation additions or transmission improvements will affect this study's conclusions.

2. Executive Summary

The DISIS-2010-001 Group 7 Impact Study evaluated the impacts of interconnecting the projects GEN-2008-037, GEN-2009-030, and GEN-2009-060 to the SPP electric system.

Prior-queued project Blue Canyon I is an older design that will trip for many faults in the area. By including the Blue Canyon I under-voltage tripping model, the system remains stable for all simulated faults. All the study projects and the rest of the prior-queued projects stay on-line and stable for all simulated faults.

With Blue Canyon I under-voltage tripping model disabled, prior-queued project Blue Canyon II becomes unstable following faults 32 and 33 in both summer and winter peak cases. The unstable behavior of Blue Canyon II causes high frequency oscillations of local bus voltages and influences study project GEN-2008-037 and prior-queued project Blue Canyon I.

Power factor requirements were determined, and the study plant must install sufficient reactive power resources to meet these requirements listed in Table 4-2. These results indicate that GEN-2008-037 will need to add 55 Mvar of capacitors at its 34.5kV substation bus (573572), assuming the 12 Mvar capacitor at Blue Canyon I (521103) is also turned on. The reactive power resources need not be dynamically controlled. However, any change in wind turbine model or controls could change the stability results, possibly resulting in a need for a dynamically controlled reactive power supply.

With the 55 Mvar capacitor added at GEN-2008-037 and the 12 Mvar Blue Canyon I capacitor turned on, faults 32 and 33 were tested again with Blue Canyon I tripping disabled. Results show all the study projects and prior-queued projects are stable and stay on-line following faults 32 and 33 in both summer and winter peak cases.

DISIS-2010-001 Group 7 should be able to reliably connect to the SPP transmission grid if the reactive compensation requirements listed above are implemented.

3. Study Development and Assumptions

3.1 Simulation Tools

The Siemens Power Technologies, Inc. PSS/E power system simulation program Version 30.3.3 was used in this study.

3.2 Models Used

SPP provided its latest stability database cases for both summer and winter peak seasons. Each plant's PSS/E model had been developed prior to this study and was included in the power flow case and the dynamics database. As a result, no additional generator modeling was required. Power flow and dynamic model data for the study plants are provided in Appendix D.

Power flow one-line diagrams of the study projects in summer peak conditions are shown in Figure 3-1 to Figure 3-3. As the figures show, each wind farm model includes explicit representation of the radial transmission line, if any; the substation transformer(s) from transmission voltage to 34.5kV; and the substation reactive power device(s), if any. The remainder of each wind farm is represented by one or more lumped equivalents including a generator, a step-up transformer, and a collector system impedance.

No special modeling is required of line relays in these cases, except for the special modeling related to the wind-turbine tripping.

3.3 Monitored Facilities

All generators in Areas 520, 524, 525, 526, 531, 534, 536, and 900 were monitored.

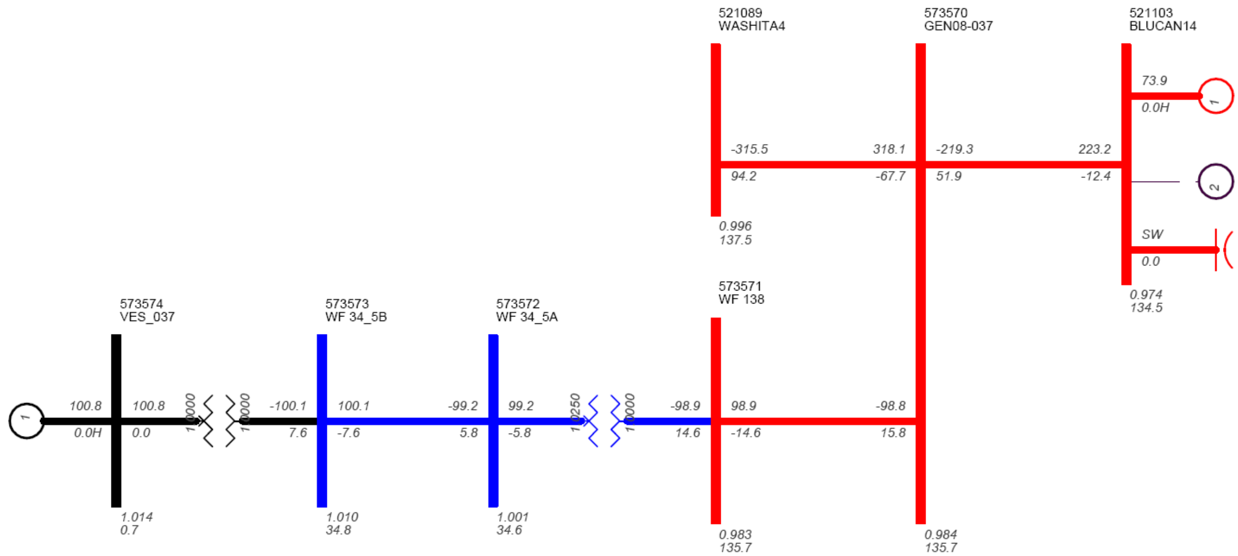

Figure 3-1. Power Flow One-line for GEN-2008-037 and adjacent equipment (SP)

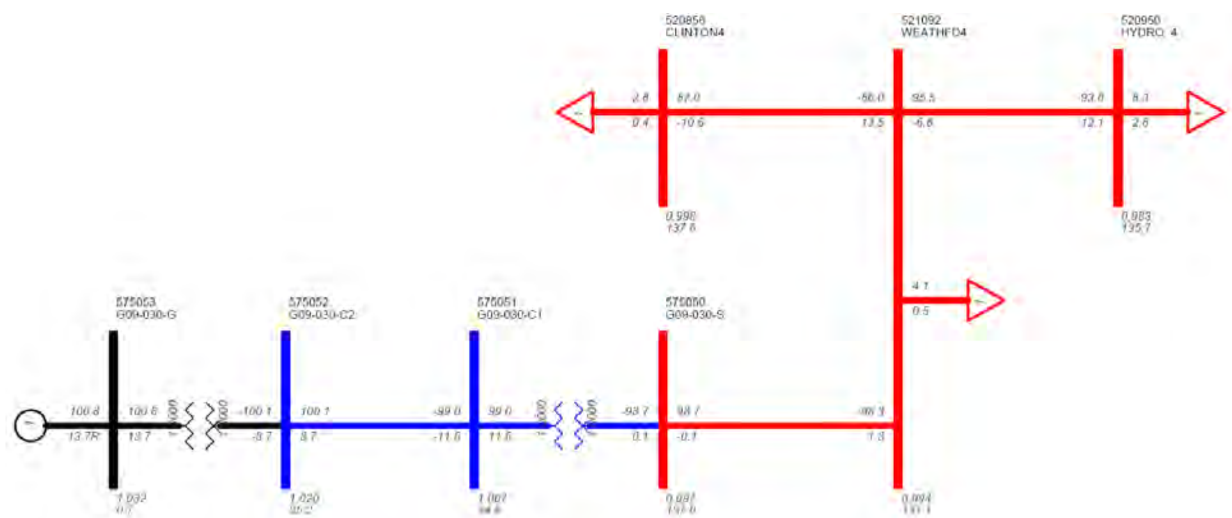

Figure 3-2. Power Flow One-line for GEN-2009-030 and adjacent equipment (SP)

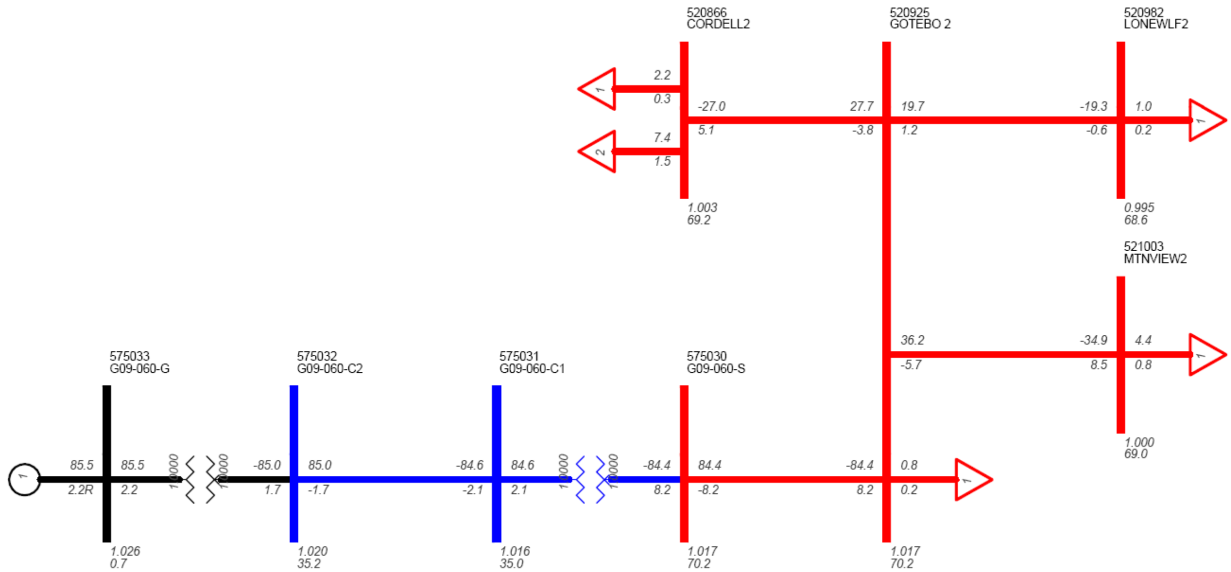

Figure 3-3. Power Flow One-line for GEN-2009-060 and adjacent equipment (SP)

3.4 Performance Criteria

The wind generators must comply with FERC Order 661A on low voltage ride through for wind farms. Therefore, the wind generators must not trip off line for faults at the Point of Interconnection. If a wind generator trips off line, an appropriately sized SVC or STATCOM device may need to be specified to keep the wind generator on-line for the fault. SPP was consulted to determine if the addition of an SVC or STATCOM is warranted for the specific condition.

Contingencies that resulted in a prior-queued project tripping off-line, if any, were re-run with the prior-queued project's voltage and frequency tripping disabled to check for stability issues.

3.5 Performance Evaluation Methods

Since some of the interconnection requests are wind projects, a power factor analysis was performed. The power factor analysis consisted of modeling a var generator in each wind farm holding a voltage schedule at the POI. The voltage schedule was set equal to the higher of the voltage with the wind farm off-line or 1.0 per unit.

If the required power factor at the POI is beyond the capability of the studied wind turbines, then capacitor banks would be considered. Factors used in sizing capacitor banks would include two requirements of FERC Order 661A: the ability of the wind farm to ride through low voltage with and without capacitor banks and the ability of the wind farm to recover to pre-fault voltage. If a wind generator trips on high voltage, a leading power factor may be required.

ATC studies were not performed as part of this study. These studies will be required at the time transmission service is actually requested. Additional transmission facilities may be required based on subsequent ATC analysis.

Stability analysis was performed for the proposed interconnection request. Faults were simulated on transmission lines at the POIs and on other nearby transmission equipment. The faults in Table 3-1 were run for each case (three phase and single phase as noted).

Table 3-1. Fault Definitions for DISIS-2010-001 Group 7

Cont. No.	Cont. Name	Description
1	FLT01-3PH	3 phase fault on the GEN-2007-043 (210431) to Anadarko (511541) 345kV line, near GEN-2007-043. a. Apply fault at the GEN-2007-043 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
2	FLT02-1PH	*Single phase fault and sequence like previous*
3	FLT03-3PH	3 phase fault on the Lawton Eastside (511468) to Sunnyside (515136) 345kV line, near Lawton Eastside. a. Apply fault at the Lawton Eastside 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
4	FLT04-1PH	*Single phase fault and sequence like previous*
5	FLT05-3PH	3 phase fault on the Weatherford WFEC (GEN-2009-030) (521092) to Clinton. (520856) 138kV line, near Weatherford. a. Apply fault at the Weatherford 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
6	FLT06-1PH	*Single phase fault and sequence like previous*
7	FLT07-3PH	3 phase fault on the Clinton Jct. (511485) to CL_NGTP (511534) 138kV line, near Clinton Jct. a. Apply fault at the Clinton Jct. 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
8	FLT08-1PH	*Single phase fault and sequence like previous*
9	FLT09-3PH	3 phase fault on the Weatherford WFEC (GEN-2009-030) (521092) to Hydro. (520950) 138kV line, near Weatherford. a. Apply fault at the Weatherford 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
10	FLT10-1PH	*Single phase fault and sequence like previous*
11	FLT11-3PH	3 phase fault on the Elk City (511458) to Clinton AFB (511446) 138kV line, near Elk City. a. Apply fault at the Elk City 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
12	FLT12-1PH	*Single phase fault and sequence like previous*
13	FLT13-3PH	3 phase fault on the Elk City 138kV (511458) to 230kV (511490) transformer, near the 138kV bus. a. Apply fault at the Elk City 138kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.

Cont. No.	Cont. Name	Description
14	FLT14-3PH	3 phase fault on the Anadarko 138kV (520814) to 345kV (511541) transformer, near the 138kV bus. a. Apply fault at the Anadarko 138kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
15	FLT15-3PH	3 phase fault on the Hobart Jct (511463) to Carnegie South (511445) 138kV line, near Hobart Jct. a. Apply fault at Hobart Jct. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
16	FLT16-1PH	*Single phase fault and sequence like previous*
17	FLT17-3PH	3 phase fault on the Hobart Jct. (511463) to Tamarack Tap (511495) 138kV line, near Hobart Jct. a. Apply fault at Hobart Jct. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
18	FLT18-1PH	*Single phase fault and sequence like previous*
19	FLT19-3PH	3 phase fault on the Hobart Jct. (511463) 138/69kv auto. a. Apply fault at Hobart Jct. b. Clear fault after 5 cycles by tripping the faulted auto.
20	FLT20-3PH	3 phase fault on the Altus (511440) to Snyder (511435) 138kV line, near Altus. a. Apply fault at Altus 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
21	FLT21-1PH	*Single phase fault and sequence like previous*
22	FLT22-3PH	3 phase fault on the Morewood (521001) to Mooreland (520999) 138kV line, near Morewood. a. Apply fault at Morewood 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
23	FLT23-1PH	*Single phase fault and sequence like previous*
24	FLT24-3PH	3 phase fault on the Anadarko (520814) to Southwest (511477) 138kV line, near Anadarko. a. Apply fault at the Anadarko 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
25	FLT25-1PH	*Single phase fault and sequence like previous*
26	FLT26-3PH	3 phase fault on the Southwest (511477) to Verden (511421) 138kV line, near Southwest. a. Apply fault at the Southwest 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
27	FLT27-1PH	*Single phase fault and sequence like previous*

Cont. No.	Cont. Name	Description
28	FLT28-3PH	3 phase fault on the Southwest (511477) to Elgin Jct. (511486) 138kV line, near Southwest. a. Apply fault at the Southwest 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
29	FLT29-1PH	*Single phase fault and sequence like previous*
30	FLT30-3PH	3 phase fault on the Anadarko (520814) to Cornville Tap (520867) 138kV line, near Anadarko. a. Apply fault at the Anadarko 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
31	FLT31-1PH	*Single phase fault and sequence like previous*
32	FLT32-3PH	3 phase fault on the Southwest (511477) to Washita (521089) 138kV line, near Washita. a. Apply fault at the Washita 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
33	FLT33-1PH	*Single phase fault and sequence like previous*
34	FLT34-3PH	3 phase fault on the Anadarko (520814) to Washita (521089) 138kV line, near Washita. a. Apply fault at the Washita 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
35	FLT35-1PH	*Single phase fault and sequence like previous*
36	FLT36-3PH	3 phase fault on the Oney (521017) to Washita (521089) 138kV line, near Washita. a. Apply fault at the Washita 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
37	FLT37-1PH	*Single phase fault and sequence like previous*
38	FLT38-3PH	3 phase fault on the Carter Jct. (520846) to Dill Jct. (520876) 69kV line, near Carter Jct. a. Apply fault at the Carter Jct. 69kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
39	FLT39-1PH	*Single phase fault and sequence like previous*
40	FLT40-3PH	3 phase fault on the Carter Jct. (520846) to Lake Creek (520978) 69kV line, near Carter Jct. a. Apply fault at the Carter Jct. 69kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
41	FLT41-1PH	*Single phase fault and sequence like previous*

Cont. No.	Cont. Name	Description
42	FLT42-3PH	3 phase fault on the Lake Creek (520978) to Lone Wolf (520982) 69kV line, near Lake Creek. a. Apply fault at the Lake Creek 69kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
43	FLT43-1PH	*Single phase fault and sequence like previous*
44	FLT44-3PH	3 phase fault on the Lake Creek (520978) to Granite (520927) 69kV line, near Lake Creek. a. Apply fault at the Lake Creek 69kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
45	FLT45-1PH	*Single phase fault and sequence like previous*
46	FLT46-3PH	3 phase fault on the Clinton Jct (511485) to Elk City (511458) 138kV line, near Clinton Jct. a. Apply fault at the Clinton Jct 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
47	FLT47-1PH	*Single phase fault and sequence like previous*
48	FLT48-3PH	3 phase fault on the Gotebo (520925) to Cordell (520866) 69kV line, near Gotebo. a. Apply fault at the Gotebo 69kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
49	FLT49-1PH	*Single phase fault and sequence like previous*
50	FLT50-3PH	3 phase fault on the Gotebo (520925) to Lonewolf (520982) 69kV line, near Lonewolf. a. Apply fault at the Lonewolf 69kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
51	FLT51-1PH	*Single phase fault and sequence like previous*
52	FLT52-3PH	3 phase fault on the Gotebo (520925) to Mountain View (521003) 69kV line, near Mountain View. a. Apply fault at the Mountain View 69kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
53	FLT53-1PH	*Single phase fault and sequence like previous*

4. Results and Observations

4.1 Stability Analysis Results

All faults were run for both summer and winter peak conditions. If a previously-queued generator tripped for any of these faults, the voltage and frequency tripping was disabled, and the fault was re-run to check for system stability. No tripping occurred in this study.

Table 4-1 summarizes the overall results for all faults run. Figure 4-1 and Figure 4-6 show representative summer peak season plots for faults at the POI for the study projects. Complete sets of plots for both summer and winter peak seasons for each fault are included in Appendices A and B.

Prior-queued project Blue Canyon I is an older design that will trip for many faults in the area. By including the Blue Canyon I under-voltage tripping model, the system remains stable for all simulated faults. All the study projects and the rest of the prior-queued projects stay on-line and stable for all simulated faults.

With Blue Canyon I under-voltage tripping disabled, prior-queued project Blue Canyon II becomes unstable following faults 32 and 33 in both summer and winter peak cases. These two faults are 3-Phase and 1-Phase faults on the Southwest to Washita 138kV line, near Washita. Washita 138kV bus is the POI of Blue Canyon I and II and study project GEN-2008-037. The unstable behavior of Blue Canyon II causes high frequency oscillations of local bus voltages and influences GEN-2008-037 and Blue Canyon I. Figure 4-7 to Figure 4-10 show summer peak season plots for the above three projects and the POI voltages following fault 32.

By turning off the study projects, the pre-project summer and winter peak conditions were created and tested for faults 32 and 33. Results show Blue Canyon II becomes unstable following faults 32 and 33 in both summer and winter peak cases when Blue Canyon I tripping is disabled. These results indicate this is an existing issue before adding the study projects. Figure 4-11 and Figure 4-12 show summer peak season plots for Blue Canyon II and Blue Canyon I following fault 32 in pre-project condition.

Power factor analysis shown in Section 4.2 indicate that GEN-2008-037 will need to add 55 Mvar of capacitors at its 34.5kV substation bus (573572) with the capacitor at Blue Canyon I (521103) turned on at the maximum value 12 Mvar. With the 55 Mvar capacitor added and the Blue Canyon I capacitor turned on at 12 Mvar, faults 32 and 33 were tested for post-project conditions. Results show all the study projects and prior-queued projects are stable and stay on-line following faults 32 and 33 in both summer and winter peak cases. Figure 4-13 to Figure 4-15 show summer peak season plots following fault 32.

Table 4-1. Summary of Stability Results

Cont. No.	Cont. Name	Description	Summer Peak Results	Winter Peak Results
1	FLT01-3PH	3 phase fault on the GEN-2007-043 (210431) to Anadarko (511541) 345kV line, near GEN-2007-043.	OK	OK
2	FLT02-1PH	Single phase fault and sequence like previous	OK	OK
3	FLT03-3PH	3 phase fault on the Lawton Eastside (511468) to Sunnyside (515136) 345kV line, near Lawton Eastside.	OK	OK
4	FLT04-1PH	Single phase fault and sequence like previous	OK	OK
5	FLT05-3PH	3 phase fault on the Weatherford WFEC (GEN-2009-030) (521092) to Clinton. (520856) 138kV line, near Weatherford.	OK	OK
6	FLT06-1PH	Single phase fault and sequence like previous	OK	OK
7	FLT07-3PH	3 phase fault on the Clinton Jct. (511485) to CL_NGTP (511534) 138kV line, near Clinton Jct.	OK	OK
8	FLT08-1PH	Single phase fault and sequence like previous	OK	OK
9	FLT09-3PH	3 phase fault on the Weatherford WFEC (GEN-2009-030) (521092) to Hydro. (520950) 138kV line, near Weatherford.	OK	OK
10	FLT10-1PH	Single phase fault and sequence like previous	OK	OK
11	FLT11-3PH	3 phase fault on the Elk City (511458) to Clinton AFB (511446) 138kV line, near Elk City.	OK	OK
12	FLT12-1PH	Single phase fault and sequence like previous	OK	OK
13	FLT13-3PH	3 phase fault on the Elk City 138kV (511458) to 230kV (511490) transformer, near the 138kV bus.	OK	OK
14	FLT14-3PH	3 phase fault on the Anadarko 138kV (520814) to 345kV (511541) transformer, near the 138kV bus.	OK	OK
15	FLT15-3PH	3 phase fault on the Hobart Jct (511463) to Carnegie South (511445) 138kV line, near Hobart Jct.	OK	OK
16	FLT16-1PH	Single phase fault and sequence like previous	OK	OK
17	FLT17-3PH	3 phase fault on the Hobart Jct. (511463) to Tamarack Tap (511495) 138kV line, near Hobart Jct.	OK	OK
18	FLT18-1PH	Single phase fault and sequence like previous	OK	OK
19	FLT19-3PH	3 phase fault on the Hobart Jct. (511463) 138/69kv auto.	OK	OK

Cont. No.	Cont. Name	Description	Summer Peak Results	Winter Peak Results
20	FLT20-3PH	3 phase fault on the Altus (511440) to Snyder (511435) 138kV line, near Altus.	OK	OK
21	FLT21-1PH	Single phase fault and sequence like previous	OK	OK
22	FLT22-3PH	3 phase fault on the Morewood (521001) to Mooreland (520999) 138kV line, near Morewood.	OK	OK
23	FLT23-1PH	Single phase fault and sequence like previous	OK	OK
24	FLT24-3PH	3 phase fault on the Anadarko (520814) to Southwest (511477) 138kV line, near Anadarko.	OK	OK
25	FLT25-1PH	Single phase fault and sequence like previous	OK	OK
26	FLT26-3PH	3 phase fault on the Southwest (511477) to Verden (511421) 138kV line, near Southwest.	OK	OK
27	FLT27-1PH	Single phase fault and sequence like previous	OK	OK
28	FLT28-3PH	3 phase fault on the Southwest (511477) to Elgin Jct. (511486) 138kV line, near Southwest.	OK	OK
29	FLT29-1PH	Single phase fault and sequence like previous	OK	OK
30	FLT30-3PH	3 phase fault on the Anadarko (520814) to Cornville Tap (520867) 138kV line, near Anadarko.	OK	OK
31	FLT31-1PH	Single phase fault and sequence like previous	OK	OK
32	FLT32-3PH	3 phase fault on the Southwest (511477) to Washita (521089) 138kV line, near Washita.	**Blue Canyon I Tripped**	**Blue Canyon I Tripped**
32 _NT	FLT32-3PH _NT	3 phase fault on the Southwest (511477) to Washita (521089) 138kV line, near Washita. Tripping disabled.	**Blue Canyon II Unstable**	**Blue Canyon II Unstable**
32 _NT_SW	FLT32-3PH _NT_SW	3 phase fault on the Southwest (511477) to Washita (521089) 138kV line, near Washita. Tripping disabled. Capacitors added.	**OK**	**OK**
33	FLT33-1PH	Single phase fault and sequence like previous	**Blue Canyon I Tripped**	**Blue Canyon I Tripped**
33 _NT	FLT33-1PH _NT	Single phase fault and sequence like previous. Tripping disabled.	**Blue Canyon II Unstable**	**Blue Canyon II Unstable**
33 _NT_SW	FLT33-1PH _NT_SW	Single phase fault and sequence like previous. Tripping disabled. Capacitors added.	**OK**	**OK**
34	FLT34-3PH	3 phase fault on the Anadarko (520814) to Washita (521089) 138kV line, near Washita.	OK	OK

Cont. No.	Cont. Name	Description	Summer Peak Results	Winter Peak Results
35	FLT35-1PH	Single phase fault and sequence like previous	OK	OK
36	FLT36-3PH	3 phase fault on the Oney (521017) to Washita (521089) 138kV line, near Washita.	OK	OK
37	FLT37-1PH	Single phase fault and sequence like previous	OK	OK
38	FLT38-3PH	3 phase fault on the Carter Jct. (520846) to Dill Jct. (520876) 69kV line, near Carter Jct.	OK	OK
39	FLT39-1PH	Single phase fault and sequence like previous	OK	OK
40	FLT40-3PH	3 phase fault on the Carter Jct. (520846) to Lake Creek (520978) 69kV line, near Carter Jct.	OK	OK
41	FLT41-1PH	Single phase fault and sequence like previous	OK	OK
42	FLT42-3PH	3 phase fault on the Lake Creek (520978) to Lone Wolf (520982) 69kV line, near Lake Creek.	OK	OK
43	FLT43-1PH	Single phase fault and sequence like previous	OK	OK
44	FLT44-3PH	3 phase fault on the Lake Creek (520978) to Granite (520927) 69kV line, near Lake Creek.	OK	OK
45	FLT45-1PH	Single phase fault and sequence like previous	OK	OK
46	FLT46-3PH	3 phase fault on the Clinton Jct (511485) to Elk City (511458) 138kV line, near Clinton Jct.	OK	OK
47	FLT47-1PH	Single phase fault and sequence like previous	OK	OK
48	FLT48-3PH	3 phase fault on the Gotebo (520925) to Cordell (520866) 69kV line, near Gotebo.	OK	OK
49	FLT49-1PH	Single phase fault and sequence like previous	OK	OK
50	FLT50-3PH	3 phase fault on the Gotebo (520925) to Lonewolf (520982) 69kV line, near Lonewolf.	OK	OK
51	FLT51-1PH	Single phase fault and sequence like previous	OK	OK
52	FLT52-3PH	3 phase fault on the Gotebo (520925) to Mountain View (521003) 69kV line, near Mountain View.	OK	OK
53	FLT53-1PH	Single phase fault and sequence like previous	OK	OK

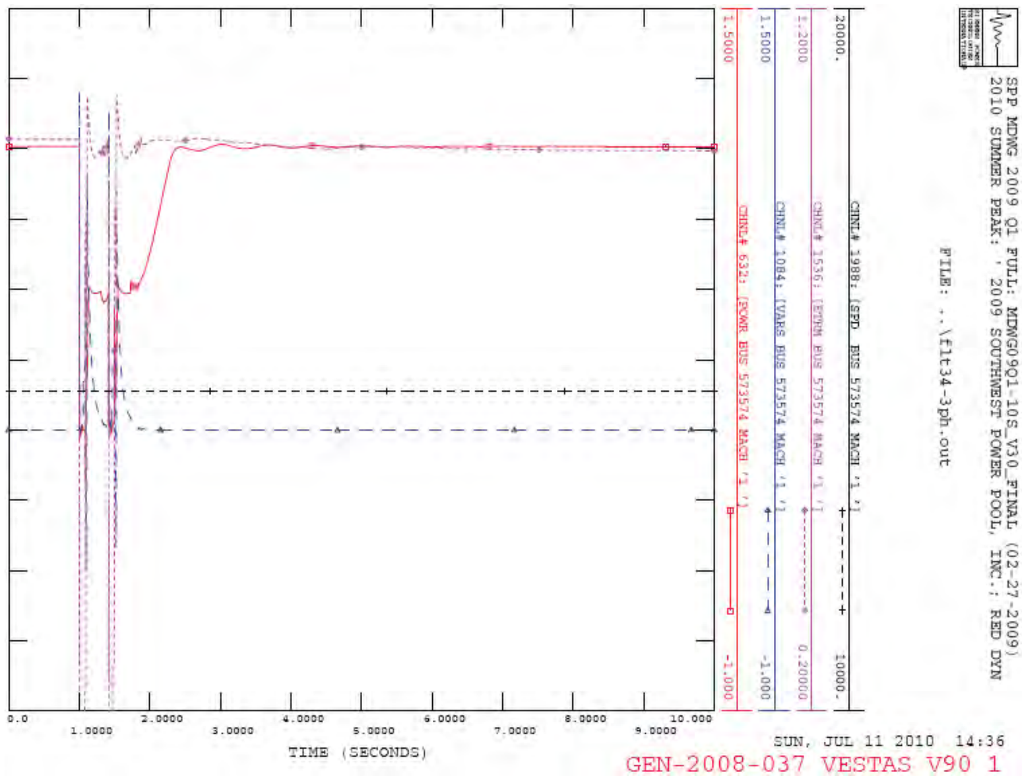

Figure 4-1. GEN-2008-037 Plot for Fault 34 – 3 phase fault on the Anadarko to Washita 138kV line, near Washita

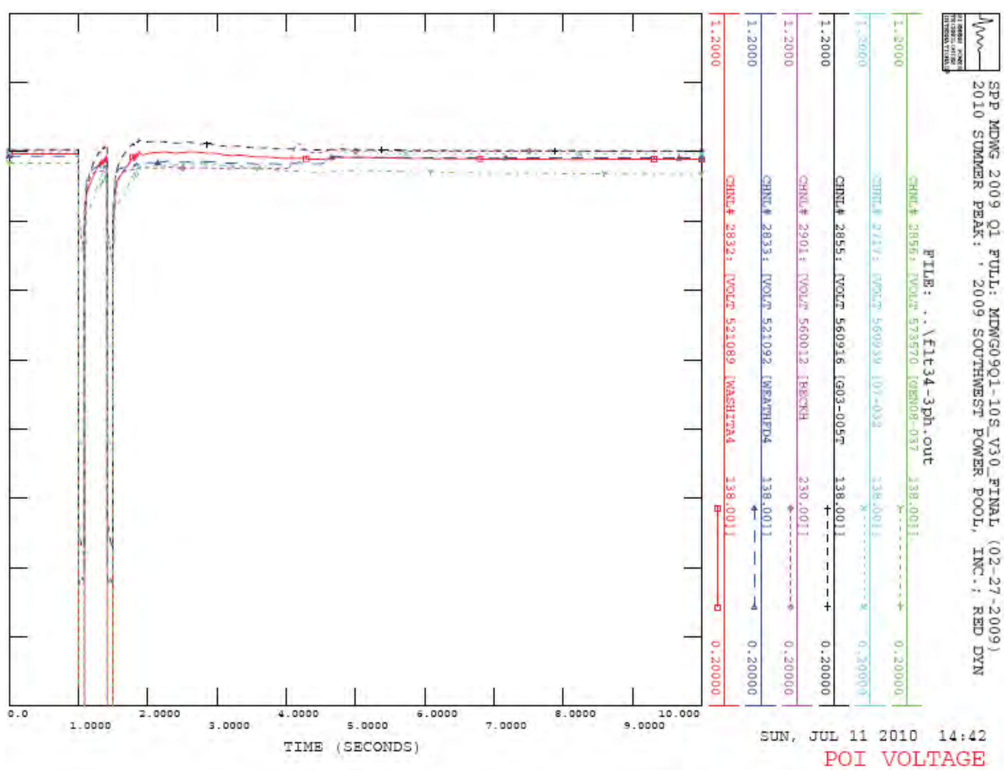

Figure 4-2. POI Voltage Plot for Fault 34 – 3 phase fault on the Anadarko to Washita 138kV line, near Washita

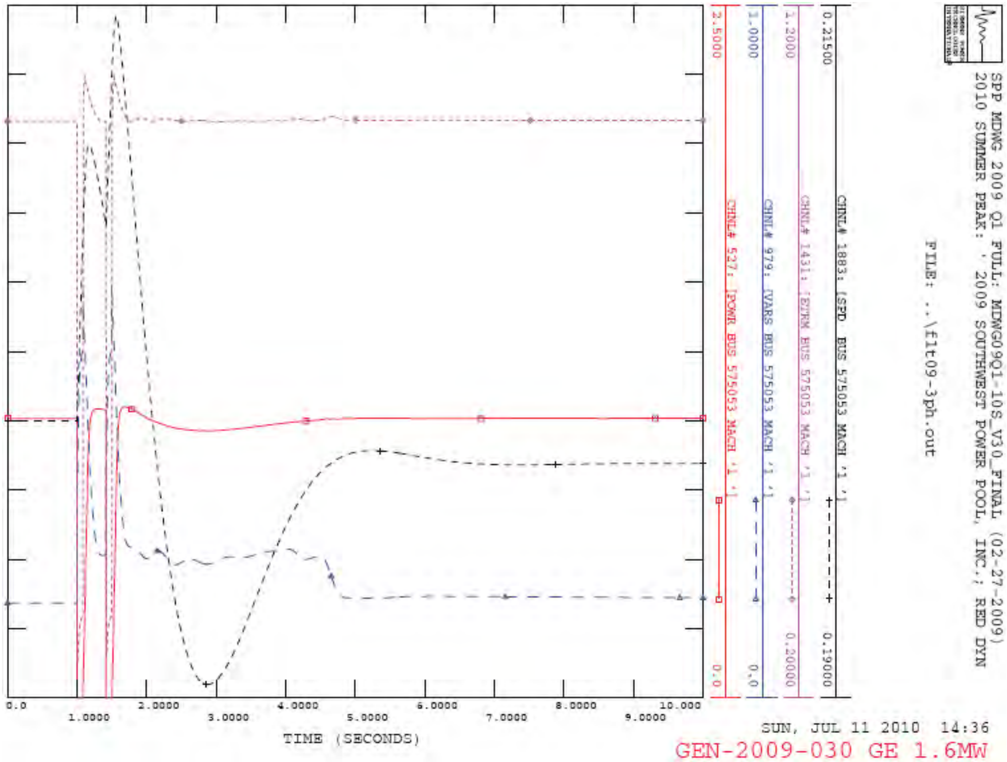

Figure 4-3. GEN-2009-030 Plot for Fault 9 – 3-Phase Fault on the Weatherford WFEC (GEN-2009-030) to Hydro. 138kV line, near Weatherford

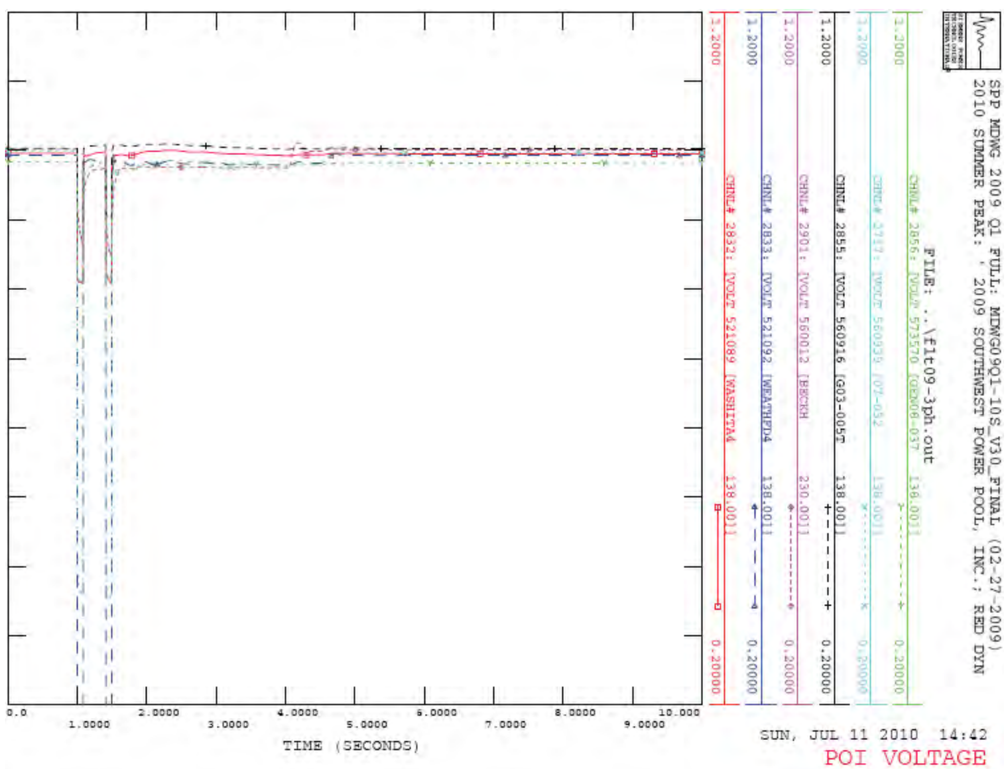

Figure 4-4. POI Voltage Plot for Fault 9 – 3-Phase Fault on the Weatherford WFEC (GEN-2009-030) to Hydro. 138kV line, near Weatherford

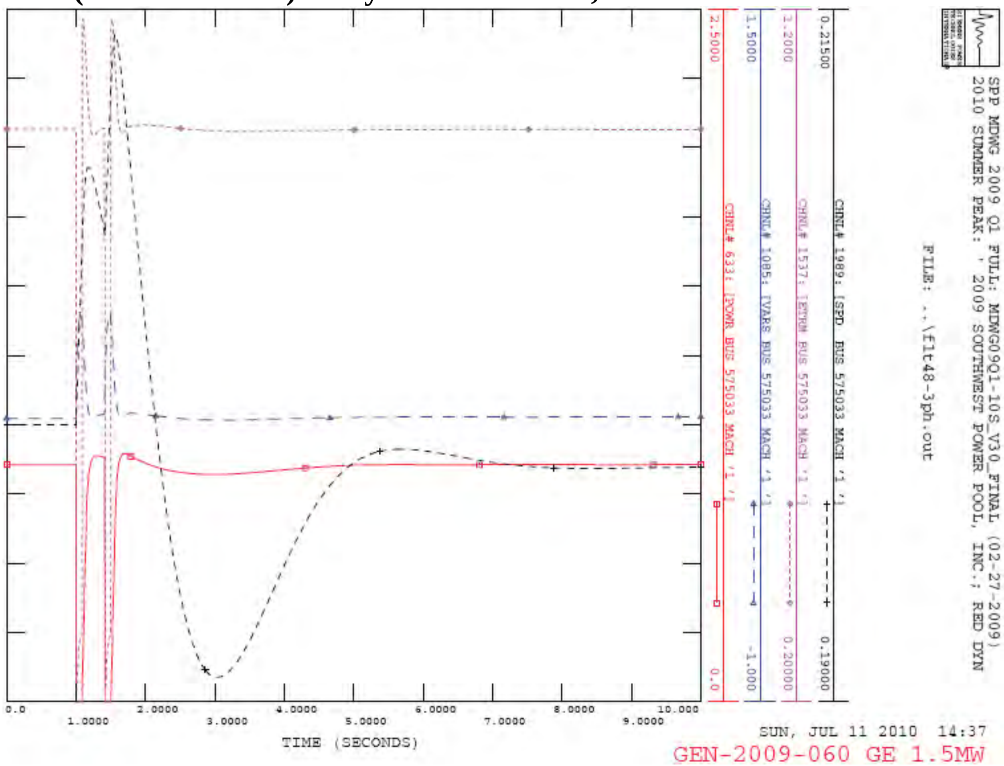

Figure 4-5. GEN-2009-060 Plot for Fault 48 – 3-Phase Fault on the Gotebo to Cordell 69kV line, near Gotebo

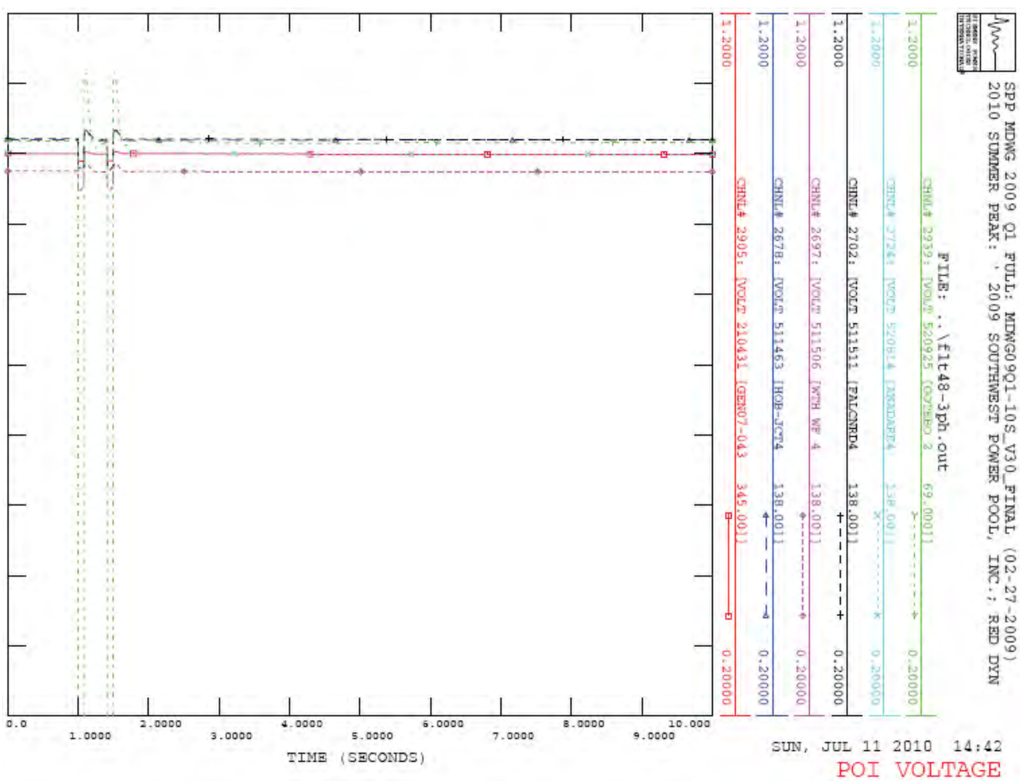

Figure 4-6. POI Voltage Plot for Fault 48 – 3-Phase Fault on the Gotebo to Cordell 69kV line, near Gotebo

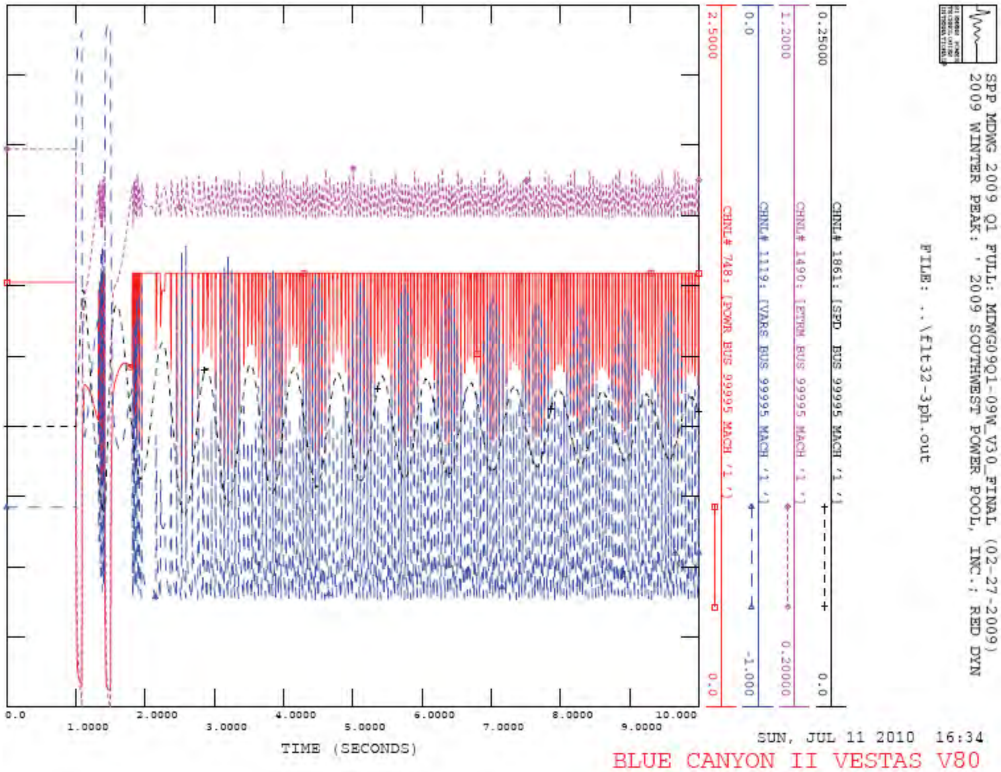

Figure 4-7. Blue Canyon II Plot for Fault 32 – 3-Phase Fault on the Southwest to Washita 138kV line, near Washita, BC1 tripping disabled

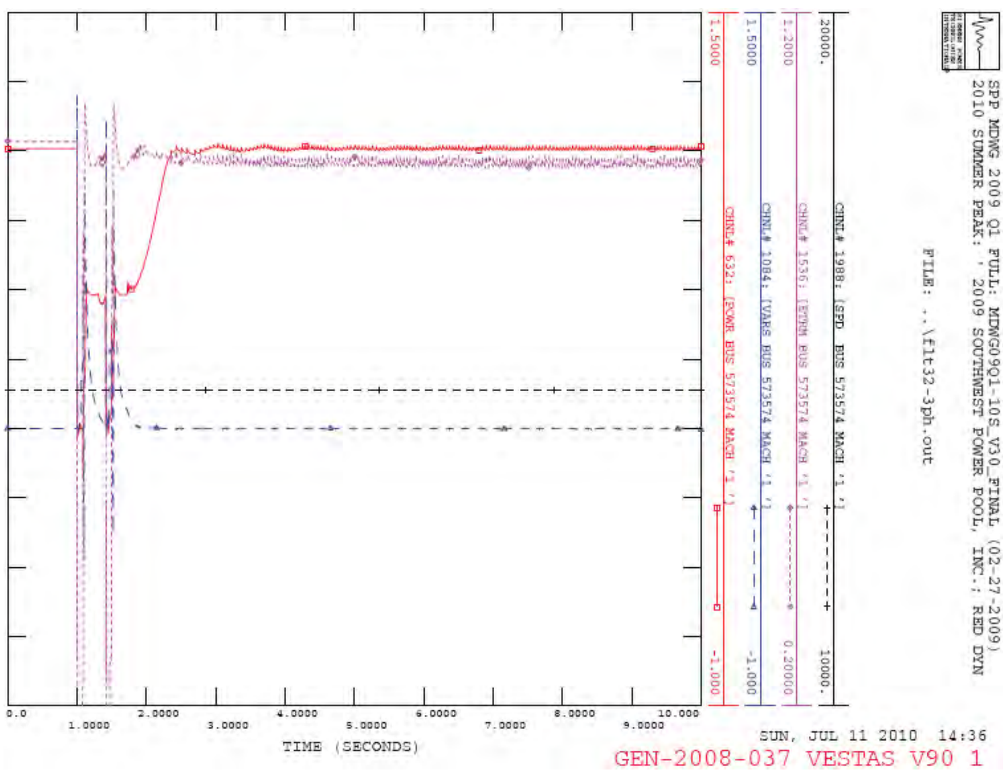

Figure 4-8. GEN-2008-037 Plot for Fault 32 – 3-Phase Fault on the Southwest to Washita 138kV line, near Washita, BC1 tripping disabled

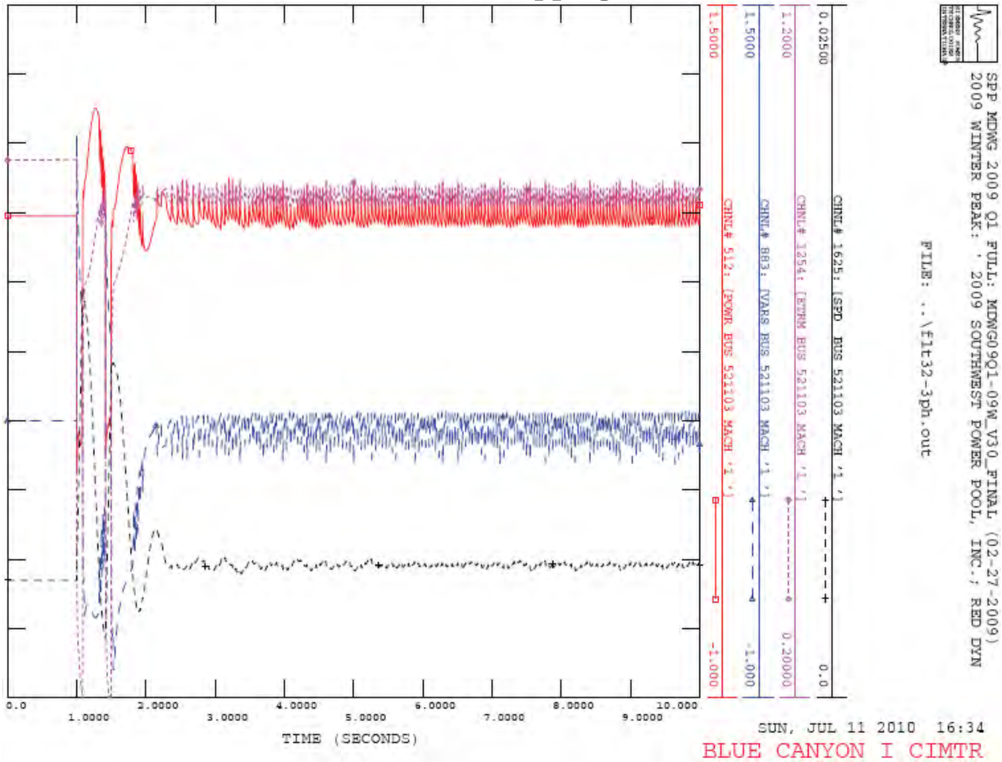

Figure 4-9. Blue Canyon I Plot for Fault 32 – 3-Phase Fault on the Southwest to Washita 138kV line, near Washita, BC1 tripping disabled

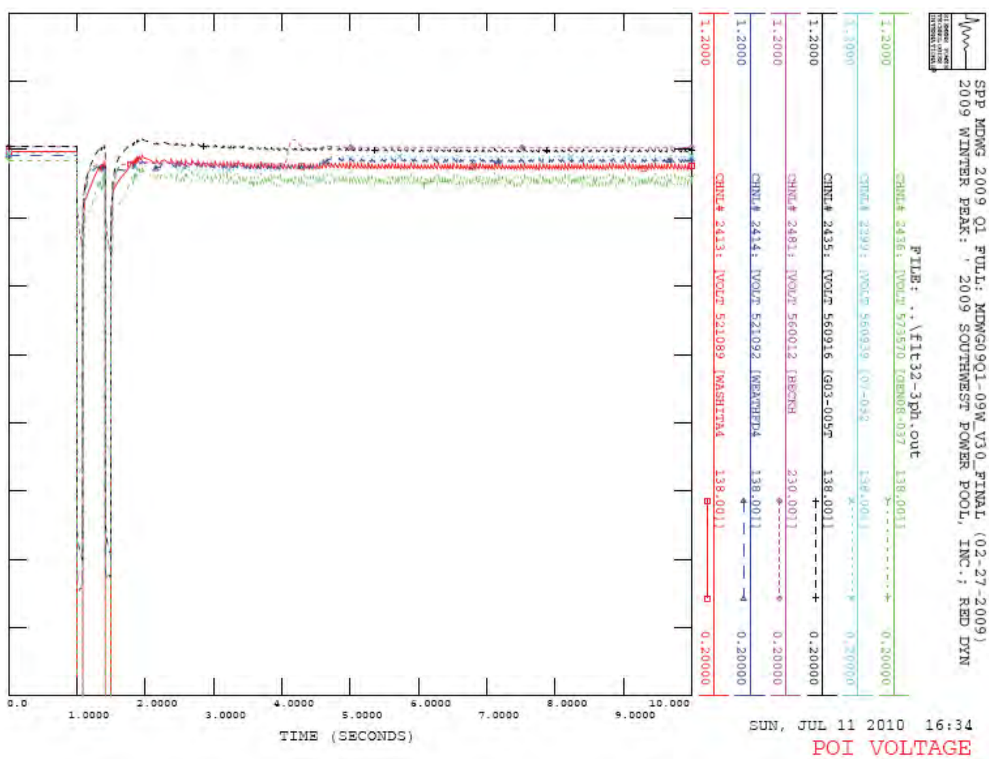

Figure 4-10. POI Voltage Plot for Fault 32 – 3-Phase Fault on the Southwest to Washita 138kV line, near Washita, BC1 tripping disabled

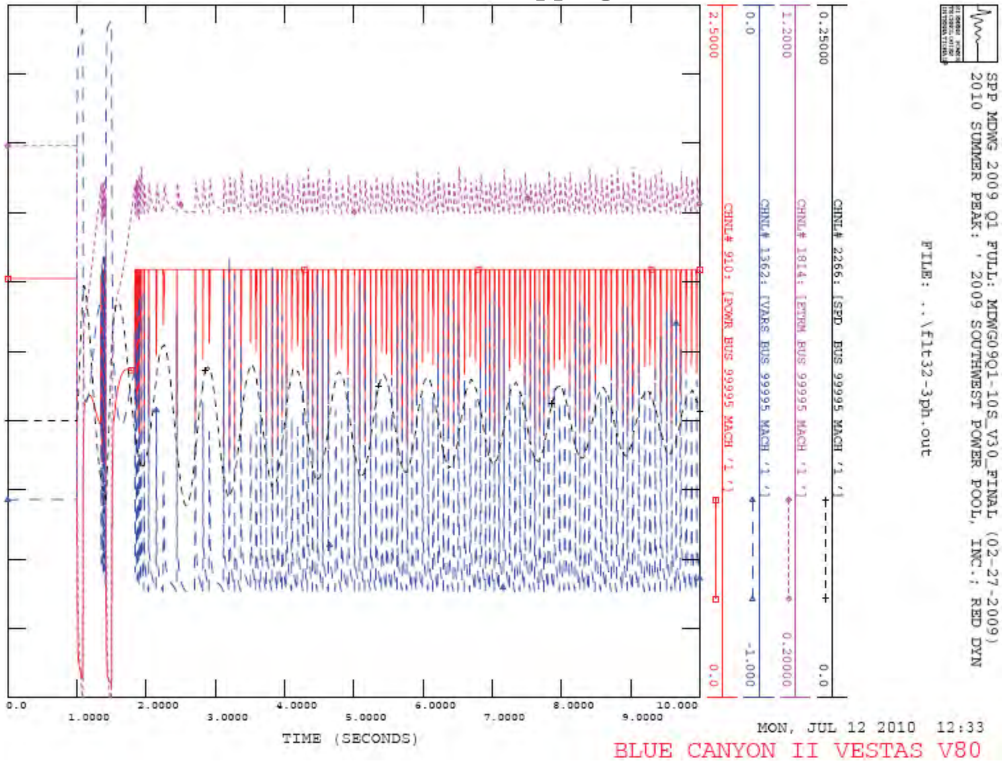

Figure 4-11. Blue Canyon II Plot for Fault 32 – (Pre-project Conditions), BC1 tripping disabled

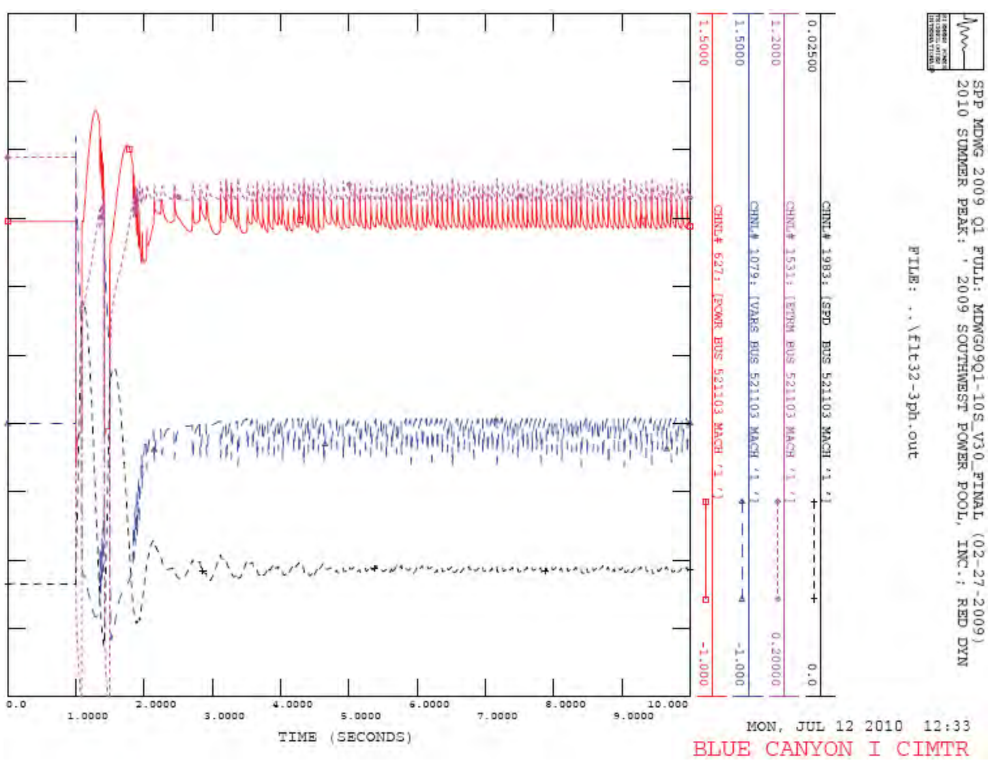

Figure 4-12. Blue Canyon I Plot for Fault 32 – (Pre-project Conditions), BC1 tripping disabled

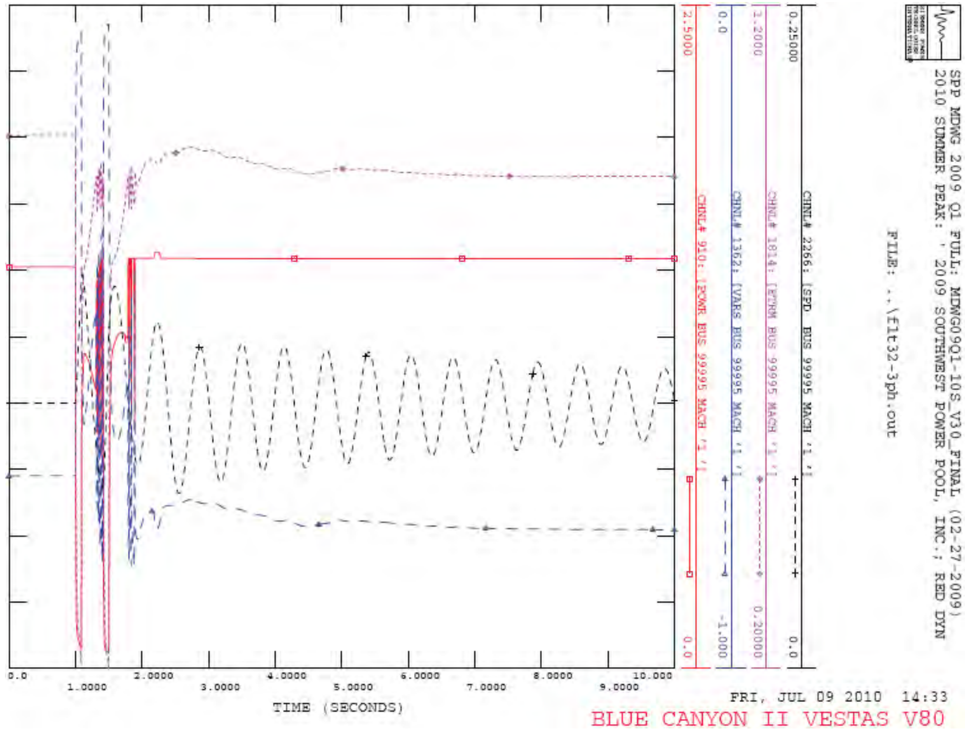

Figure 4-13. Blue Canyon II Plot for Fault 32 – 3-Phase Fault on the Southwest to Washita 138kV line, near Washita (Post-project Conditions with 55 Mvar Capacitor at GEN-2008-037)

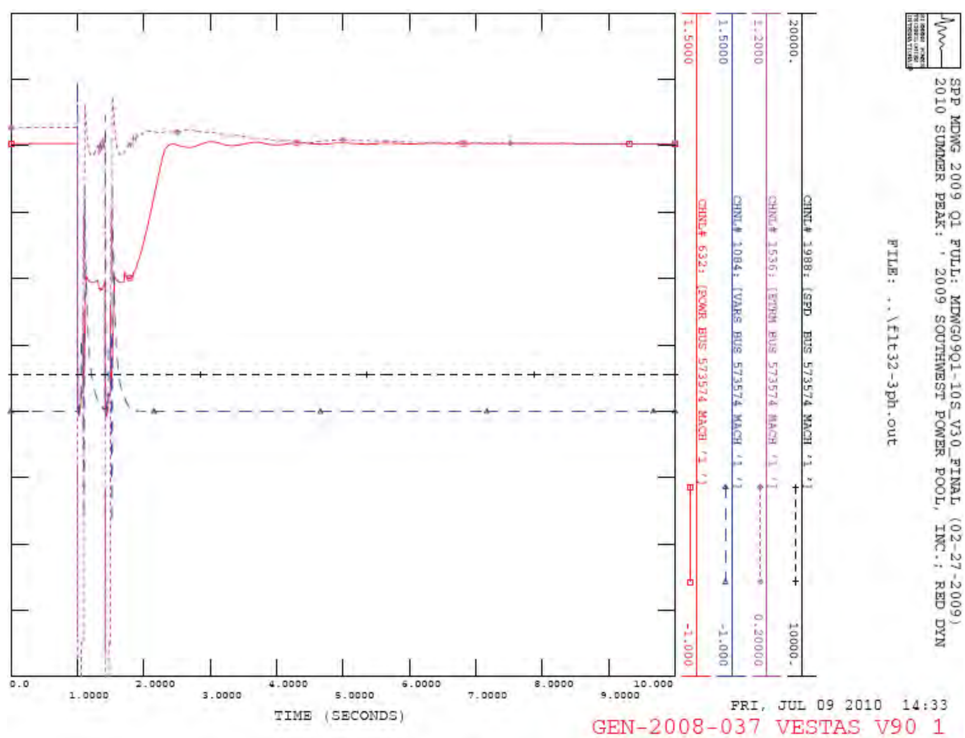

Figure 4-14. GEN-2008-037 Plot for Fault 32 – 3-Phase Fault on the Southwest to Washita 138kV line, near Washita (Post-project Conditions with 55 Mvar Capacitor at GEN-2008-037)

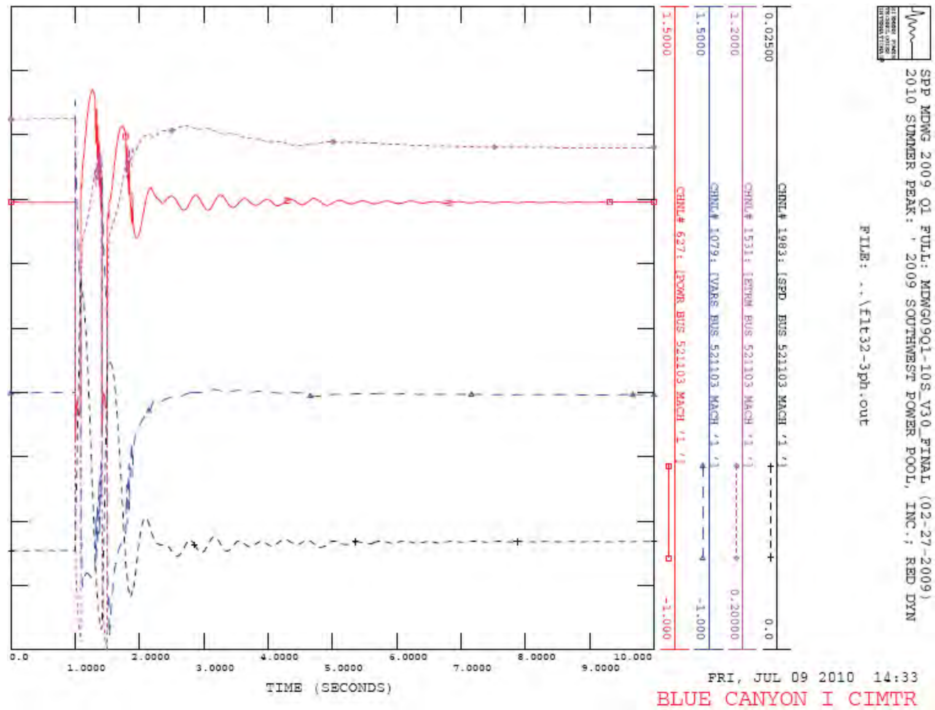

Figure 4-15. Blue Canyon I Plot for Fault 32 – 3-Phase Fault on the Southwest to Washita 138kV line, near Washita (Post-project Conditions with 55 Mvar Capacitor at GEN-2008-037)

4.2 Power Factor Requirements

All stability faults were tested as power flow contingencies to determine the power factor requirements for the wind farm study projects to maintain scheduled voltage at their respective points of interconnection (POI). The voltage schedules are set equal to the voltages at the POIs before the projects are added, with a minimum of 1.0 per unit. Fictitious reactive power sources were added to the study projects to maintain scheduled voltage during all studied contingencies. The MW and Mvar injections from the study projects at the POIs were recorded and the resulting power factors were calculated for all contingencies for summer peak and winter peak cases. The most leading and most lagging power factors determine the minimum power factor range capability that the study projects must install before commercial operation.

If more than one study project shared a single POI (none in this case), the projects were grouped together and a common power factor requirement was determined for those study projects. This ensures that none of the study projects is required to provide more or less than its fair share of the reactive power requirements at a single POI. *Prior-queued* projects at the same POI, if any, were not grouped with the study projects because their interconnection requirements were determined in previous studies. The voltages schedules of prior-queued and study projects at the same POI were coordinated.

Per FERC and SPP Tariff requirements, if the power factor needed to maintain scheduled voltage were less than 0.95 lagging, then the requirement would be set to 0.95 lagging. This limit was not reached for any study project. The limit for leading power factor requirement is also 0.95, and this limit was not reached for any study project. If the project never operated leading under any contingency, then the leading requirement is set to 1.0. Similar for lagging.

The final power factor requirements are shown in Table 4-2 below. These are only the minimum power factor ranges based on steady-state analysis. A project developer may install more capability than this if desired.

The study plant must install sufficient reactive power resources to meet the requirements listed in Table 4-2. The following method is used to decide if a study project needs to install additional capacitors:

1. Use the power flow case with fictitious reactive power sources added
2. Apply the contingency to cause the lowest reactive power flow from POI to the study project (leading is positive, lagging is negative)
3. If the study plant could provide enough reactive power to meet the power factor requirement, no additional capacitor is needed.
   If the study plant could not provide enough reactive power to meet the power factor requirement, the size of the additional capacitor is determined.

The results indicate that GEN-2008-037 will need to add 55 Mvar of capacitors at its 34.5kV substation bus (573572) with the capacitor at Blue Canyon I (521103) turned on at the maximum value 12 Mvar. The reactive power resources need not be dynamically controlled. However, any change in wind turbine model or controls could change the stability results, possibly resulting in a need for a dynamically controlled reactive power supply.

The full details for each contingency in summer and winter peak cases are given in Appendix C.

Table 4-2. Power Factor Requirements [1]

Request	Size (MW)	Generator Model	Point of Interconnection	Final PF Requirement		Estimated Capacitor Requirement (Mvar)
				Lagging [2]	Leading [3]	
GEN-2008-037	100.8	Vestas V90 1.8MW	Washita (521089)	1.000	0.974	55
GEN-2009-030	100.8	GE 1.6MW	Weatherford 138kV (521092)	0.962	0.971	0
GEN-2009-060	85.5	GE 1.5MW	Gotebo 69kV (520925)	1.000	0.960	0

Notes:

1. For each plant, the table shows the minimum required power factor capability at the point of interconnection that must be designed and installed with the wind farm. The power factor capability at the POI includes the net effect of the wind turbine generators, transformer and collector line impedances, and any reactive compensation devices installed on the plant side of the meter. Installing more capability than the minimum requirement is acceptable.
2. Lagging is when the generating plant is supplying reactive power to the transmission grid. In this situation, the alternating current sinusoid “lags” behind the alternating voltage sinusoid, meaning that the current peaks shortly after the voltage.
3. Leading is when the generating plant is taking reactive power from the transmission grid. In this situation, the alternating current sinusoid “leads” the alternating voltage sinusoid, meaning that the current peaks shortly before the voltage.

4.3 Generator Performance

Prior-queued projects GEN-2006-002 and GEN-2006-035 show low voltages for around 3 seconds following some faults (e.g. fault 13). These two projects are using Gamesa wind turbines model. It is normal for Gamesa turbines to run at reduced var output for some seconds after a fault. This behavior also causes the project POI to experience low terminal voltages following faults. Figure 4-16 to Figure 4-18 show the summer peak season plots for these two prior-queued projects and the POI voltage following fault 13.

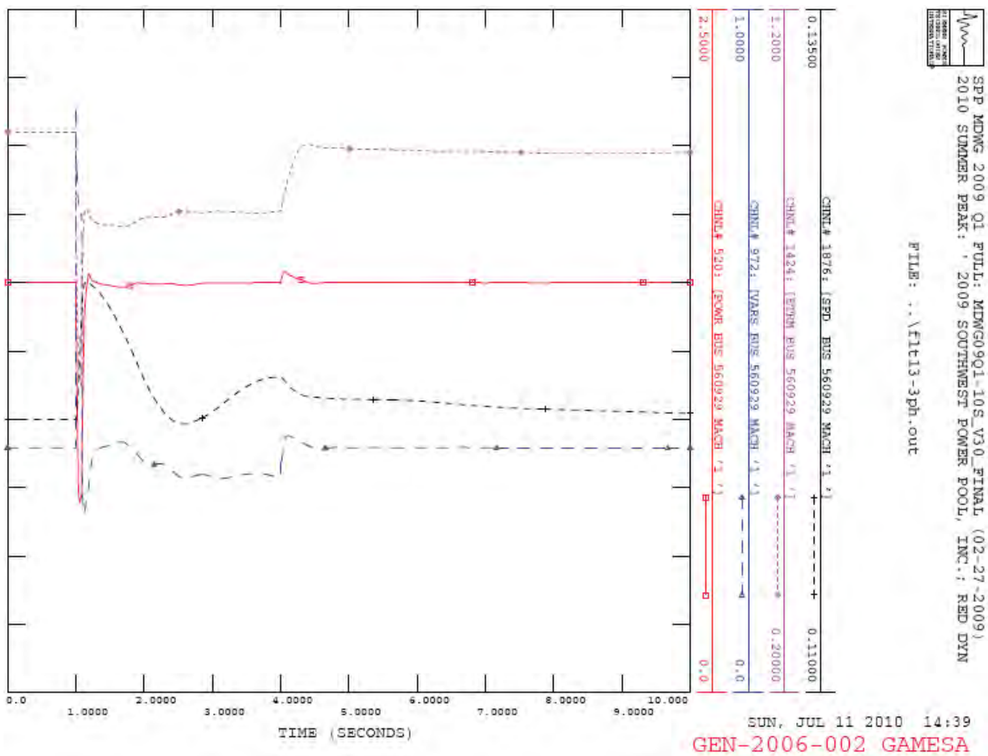

Figure 4-16. GEN-2006-002 Plot for Fault 13 – 3-Phase Fault on the Elk City 138/230kV Transformer, near the 138kV Bus

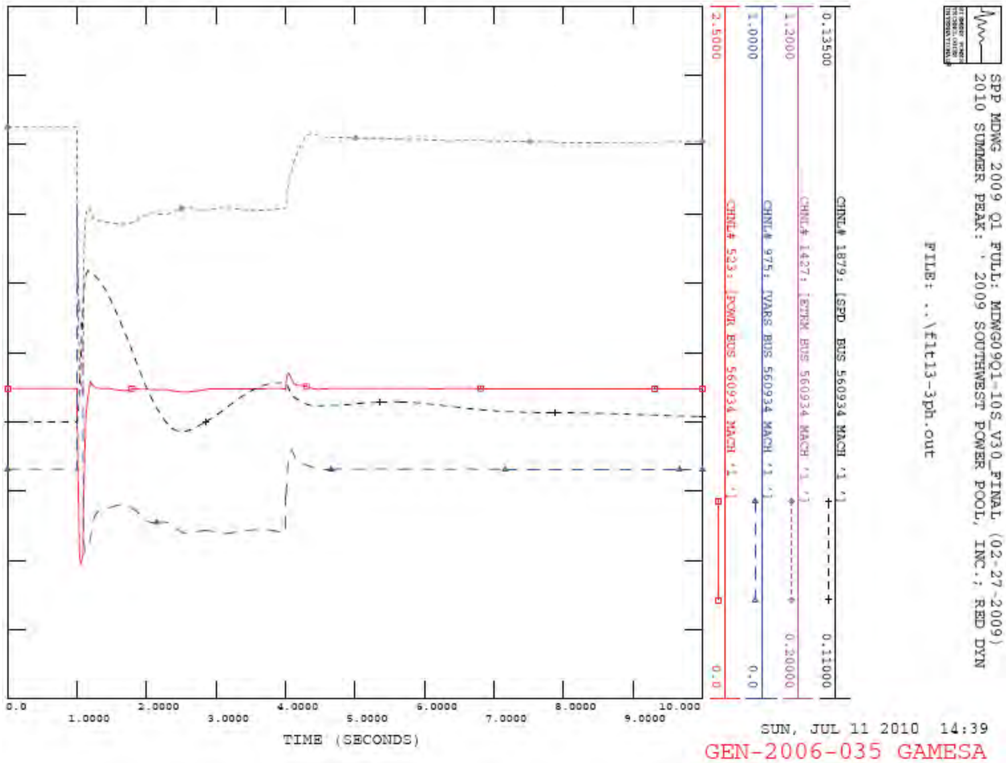

Figure 4-17. GEN-2006-035 Plot for Fault 13 – 3-Phase Fault on the Elk City 138/230kV Transformer, near the 138kV Bus

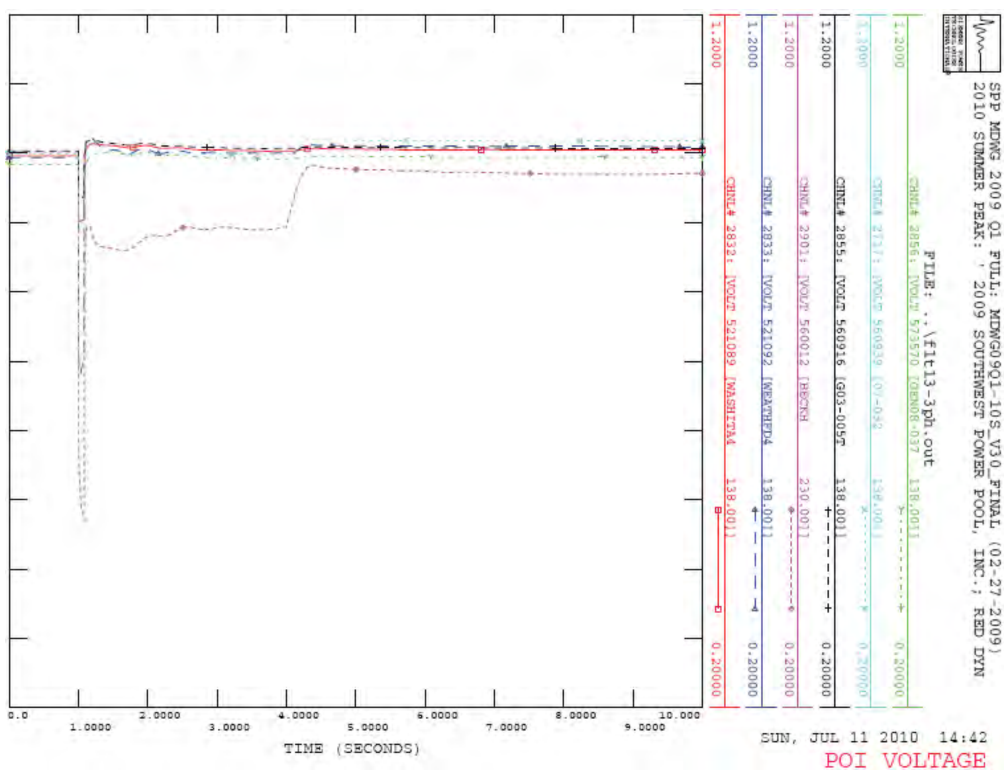

Figure 4-18. POI Voltage Plot for Fault 13 – 3-Phase Fault on the Elk City 138/230kV Transformer, near the 138kV Bus

5. Conclusions

The DISIS-2010-001 Group 7 Impact Study evaluated the impacts of interconnecting the projects shown below.

Table 5-1. Interconnection Requests Evaluated

Request	Size (MW)	Generator Model	Point of Interconnection
GEN-2008-037	100.8	Vestas V90 1.8MW	Washita (521089)
GEN-2009-030	100.8	GE 1.6MW	Weatherford 138kV (521092)
GEN-2009-060	85.5	GE 1.5MW	Gotebo 69kV (520925)

Prior-queued project Blue Canyon I is an older design that will trip for many faults in the area. By including the Blue Canyon I under-voltage tripping model, the system remains stable for all simulated faults. All the study projects and the rest of the prior-queued projects stay on-line and stable for all simulated faults.

With Blue Canyon I under-voltage tripping model disabled, prior-queued project Blue Canyon II becomes unstable following faults 32 and 33 in both summer and winter peak cases. The unstable behavior of Blue Canyon II causes high frequency oscillations of local bus voltages and influences study project GEN-2008-037 and prior-queued project Blue Canyon I.

Power factor requirements were determined, and the study plant must install sufficient reactive power resources to meet these requirements listed in Table 4-2. These results indicate that GEN-2008-037 will need to add 55 Mvar of capacitors at its 34.5kV substation bus (573572), assuming the 12 Mvar capacitor at Blue Canyon I (521103) is also turned on. The reactive power resources need not be dynamically controlled. However, any change in wind turbine model or controls could change the stability results, possibly resulting in a need for a dynamically controlled reactive power supply.

With the 55 Mvar capacitor added at GEN-2008-037 and the 12 Mvar Blue Canyon I capacitor turned on, faults 32 and 33 were tested again with Blue Canyon I tripping disabled. Results show all the study projects and prior-queued projects are stable and stay on-line following faults 32 and 33 in both summer and winter peak cases.

DISIS-2010-001 Group 7 should be able to reliably connect to the SPP transmission grid if the reactive compensation requirements listed above are implemented.

Appendix A – Summer Peak Plots

See attachment.

Appendix B – Winter Peak Plots

See attachment.

Appendix C – Power Factor Details

See attachment.

Appendix D – Project Model Data

See attachment.

P: Stability Study for Group 8

Pterra Consulting

Technical Report R141-10

Definitive Impact Study for Generation Interconnection DISIS-2010-001 (Group 8) (DRAFT)

Submitted to

Southwest Power Pool

July 2010

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Contents

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Executive Summary

This report presents the results of impact study comprising of power factor and stability analyses of the proposed interconnection projects under DISIS-2010-001 Group 8 (the "Project") as described in the following table:

Request	Size (MW)	Wind Turbine Model	Point of Interconnection
GEN-2008-071	76.8	GE 1.6MW	Newkirk 138kV (514759)
GEN-2008-098	100.8	Vestas V90 1.8MW	Wolf Creek (532797) – LaCygne (542981) 345kV
GEN-2010-003	100.8	Vestas V90 1.8MW	Gen-2008-098 (572091) addition
GEN-2010-005	300	Clipper C96 2.5MW	Gen-2007-025 (532781) 345kV
GEN-2010-013	50.4	Vestas V90 1.8MW	Gen-2005-013 (574000) 345kV

The analysis was conducted through the Southwest Power Pool ("SPP") Tariff. Power factor analysis and transient stability simulations were conducted with all five projects in service at their full output.

Two base cases, DISIS_10SP-G8.sav and DISIS_09WP-G8.sav, summer and winter conditions respectively, each comprising of a power flow and corresponding dynamics database, were provided by SPP. The five plants are already modeled in the base cases. Upgrades were included per SPP guidelines (_ADD ALL UPGRADES.idv).

The results of the power factor analysis showed that with the MVAR capability of the five WTG's projects and without reactive compensation, each of the wind farms will not be able to keep the voltage schedule at their respective POI's consistent with the voltage schedule in the provided power flow cases for summer and winter. For each project, additional VAR compensating devices need to be installed in order to control the power factor at the POI to be within +/- 0.95 range.

For the five proposed projects, the stability simulations with sixty specified test disturbances did not show angular or voltage instability problems in the SPP system, except for the oscillating response that can be damped out by adding required capacitor banks to prior queued projects GEN-2004-010, GEN-2005-013 and a Statcon device for the study project GEN-2008-098.

1.1. Project Overview

This report presents the results of impact study comprising of power factor and stability analyses of the proposed interconnection projects under DISIS-2010-001 Group 8 (the "Project") as described in Table 1-1:

Table 1-1 Projects Included Under DISIS-2010-001 Group 8

Request	Size (MW)	Wind Turbine Model	Point of Interconnection
GEN-2008-071	76.8	GE 1.6MW	Newkirk 138kV (514759)
GEN-2008-098	100.8	Vestas V90 1.8MW	Wolf Creek (532797) – LaCygne (542981) 345kV
GEN-2010-003	100.8	Vestas V90 1.8MW	Gen-2008-098 (572091) addition
GEN-2010-005	300	Clipper C96 2.5MW	Gen-2007-025 (532781) 345kV
GEN-2010-013	50.4	Vestas V90 1.8MW	Gen-2005-013 (574000) 345kV

Figures 1-1 through 1-5 show the interconnection diagram of the Projects to SPP's system as modeled in the power flow cases.

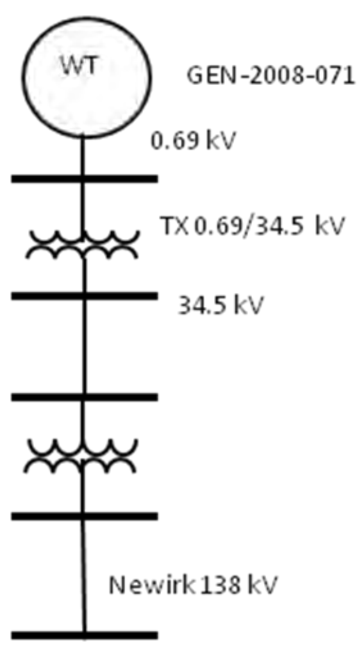

Figure 1-1 Power Flow Model for Gen-2008-071

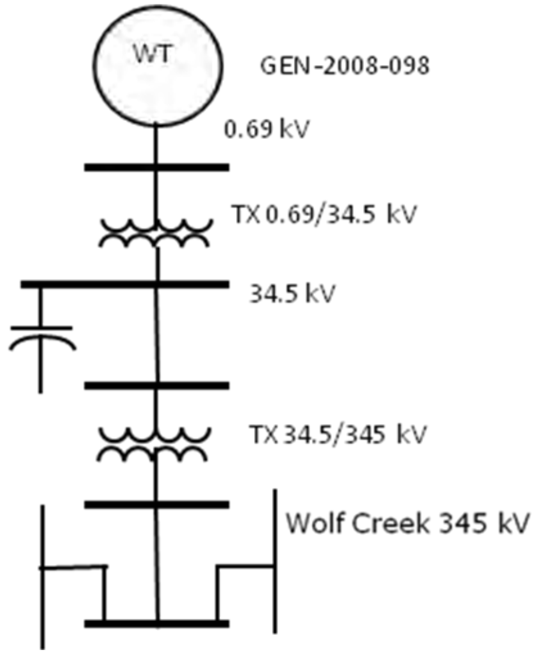

Figure 1-2 Power Flow Model for Gen 2008-098

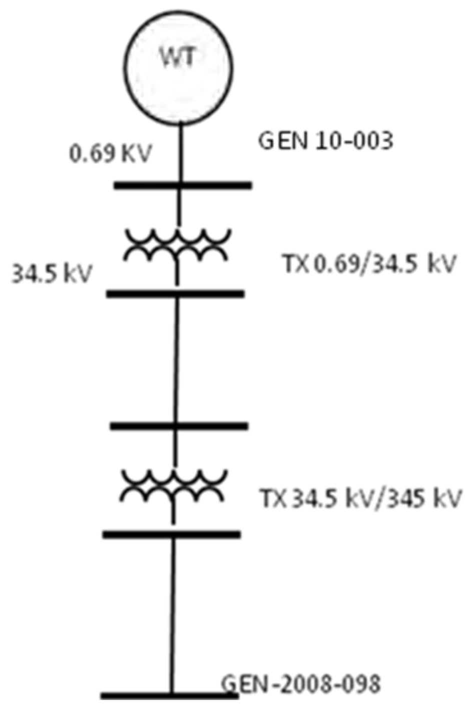

Figure 1-3 Power Flow Model for Gen 2010-003

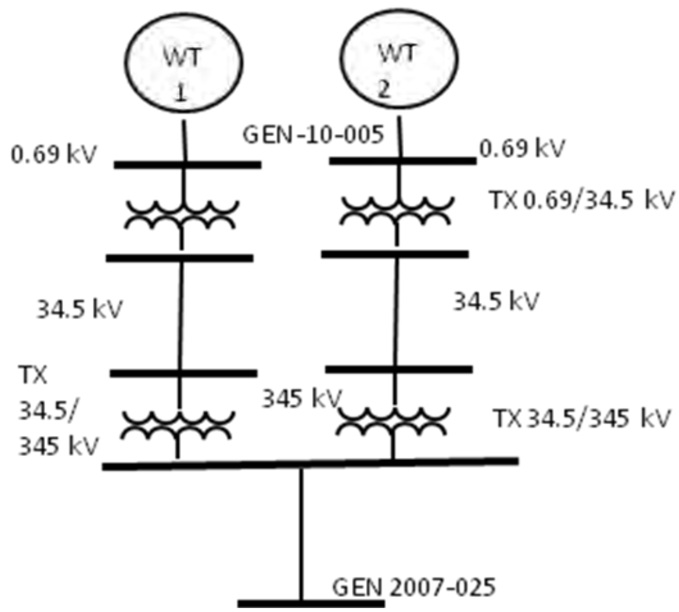

Figure 1-4 Power Flow Model for Gen-2010-005

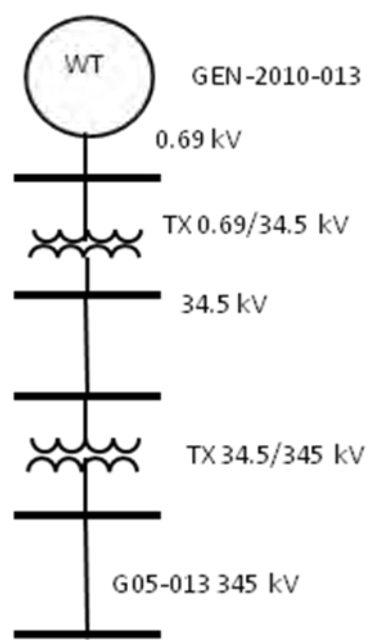

Figure 1-5 Power Flow Model for Gen-2010-013

Table 1-2 shows the list of prior queued projects modeled in the base case.

Table 1-2 List of Prior Queued Projects

Request	Size (MW)	Generator Model	Point of Interconnection
GEN-2002-004	150	GE.1.5MW	Latham 345kV (532800)
GEN-2004-010	300	Clipper 2.5MW	Latham 345kV (532800)
GEN-2005-013	201	G.E. 1.5MW	Latham – Neosho 345kV (574000)
GEN-2005-016	150	Gamesa 2MW	Latham – Neosho 345kV (574000)
GEN-2007-025	300	Clipper 2.5MW	Wichita-Woodring 345kV (532781)
GEN-2008-013	300	G.E. 1.5MW	Wichita – Woodring 345kV (210130)
GEN-2008-021	1250	Nuclear Steam Turbine	Wolf Creek 345kV (532751)
GEN-2008-038	150	G.E. 1.5MW	Tap Shidler (510403) – Pawhuska (510382) 138kV. Bus # 570838
GEN-2008-127	200	Siemens 2.3MW	Tap Sooner (514803) – Rose Hill (532794) 345kV. Bus # 573039
GEN-2009-025	60	GE 1.5MW	Tap Deerck (514741) – Sincblk2 (514728) 69KV. Bus # 573049

1.2. Objectives

The objectives of the study are to conduct power factor analysis and to determine the impact on system stability of interconnecting the proposed wind farms to SPP's transmission system.

Section 2. Power Factor Analysis

2.1. Methodology

Power factor analysis was conducted for the Project using a methodology which is summarized as follows:

1. Model a VAR generator at the Project's 345 or 138 kV bus, whichever is applicable. The VAR generator is set to hold a voltage schedule at the POI consistent with the voltage schedule in the provided power flow cases for summer and winter or 1.0 pu voltage, whichever is higher.

2. Steady state contingency analysis is conducted to determine the power factor necessary at the POI for each contingency.

3. According to the contingency analysis results, determine whether capacitors are required for the Project or not.

4. If the required power factor at the POI is beyond the capability of the studied wind turbines to meet (at the POI) capacitor banks are considered. The preference is to locate the capacitance banks on the 34.5 kV Customer side. Factors to sizing capacitor banks include:

    4.1. The ability of the wind farm to meet FERC Order 661A (low voltage ride through) with and without capacitor banks.

    4.2. The ability of the wind farm to meet FERC Order 661A (wind farm recovery to pre-fault voltage).

    4.3. If wind farms trips on high voltage, power factor lower than unity may be required.

2.2. Analysis

Analysis was performed for each proposed project with all five projects in service. A var generator was modeled at each point of interconnection and was set to hold a voltage schedule at the POI consistent with the voltage schedule in the provided power flow cases except for project GEN-2010-013, which voltage is less than 1.0 pu in the loadflow cases. For this project the var generator schedule voltage was set to 1.0 pu. These voltages for all five projects are summarized in Table 2-1.

No changes were made in the base cases provided other than the addition of the var generators. Contingency analysis was run for thirty contingencies.

Table 2-1 Pre-contingency Voltages at POI

Request	Point of Interconnection	Size (MW)	Base Case Voltage (p.u.)	
			Summer Peak	Winter Peak
GEN-2008-071	Newkirk 138kV (514759)	76.8	1.021	1.015
GEN-2008-098	Wolf Creek (532797) – LaCygne (542981) 345kV	100.8	1.012	1.012
GEN-2010-003	Gen-2008-098 (572091) addition	100.8	1.013	1.013
GEN-2010-005	Gen-2007-025 (532781) 345kV	300	1.009	1.013
GEN-2010-013	Gen-2005-013 (574000) 345kV	50.4	0.981 (1.000)[1]	0.986 (1.000)[2]

A. Gen-2008-071

POI: Newkirk 138kV

The VAR generator either supplies or absorbs reactive power at different contingencies as summarized in Table 2-1. The highest values obtained are as follows:

1. For the summer case, the VAR generator supplies 12.1 MVar for the outage of Creswell - Newkirk 138KV line and absorbs 9.4 MVar for the loss of Kildare - Newkirk 138kV line.

2. For the winter case, the VAR generator supplies 9.3 MVar for the outage of Kildare - Newkirk 138KV line and absorbs 8.6 MVar for the loss of Creswell - Newkirk 138KV line.

[1] Var generator voltage schedule
[2] Var generator voltage schedule

Table 2-2 VAR Generator Output in Summer and Winter Peak Cases for GEN-2008-071

CASE	CONTINGENCY	PF @ POI	PF	MW @ POI	MVAR @ POI
SP	BASE CASE	1	Lead	74.7	0.0
	WOLF CREEK – BENTON 345KV LINE	1	Lead	74.7	1.3
	WOLF CREEK – ROSE HILL 345KV LINE	1	Lead	74.7	1.5
	WOLF CREEK – GEN-2008-098 345KV LINE	1	Lead	74.7	1.4
	STILWELL – LACYGNE 345KV LINE	1	Lead	74.7	0.5
	NEOSHO – LACYGNE 345KV LINE	1	Lead	74.7	0.6
	WEST GARDNER – LACYGNE 345KV LINE	1	Lead	74.7	0.3
	GEN-2008-098 - LACYGNE 345KV LINE	1	Lead	74.7	1.7
	ROSE HILL - GEN-2008-127 345KV LINE	1	Lead	74.7	1.6
	SOONER - WOODRING 345KV LINE	1	Lead	74.7	0.3
	SOONER - CLEVELAND 345KV LINE	1	Lead	74.7	0.3
	ROSE HILL - LATHAM 345KV LINE	1	Lead	74.7	0.1[3]
	GEN-2008-038 - SHIDLER 138KV LINE	1	Lead	74.7	0.2
	EMPORIA – SWISSVALE 345KV LINE	1	Lag	74.7	0.0
	EMPORIA – LANG 345KV LINE	1	Lead	74.7	0.0
	SWISSVALE – WEST GARDNER 345KV LINE	1	Lag	74.7	0.1
	SWISSVALE – 345/230KV AUTOTRANSFORMER	1	Lead	74.7	0.0
	NORTHEASTERN - DELAWARE 345KV LINE	1	Lead	74.7	0.2
	EMPORIA – MORRIS COUNTY 345KV LINE	1	Lead	74.7	0.0
	CRESWELL - NEWKIRK 138KV LINE	0.987	Lead	74.7	12.1
	CHIKASIA 138/69KV AUTOTRANSFORMER	0.998	Lag	74.7	5.0
	KILDARE - NEWKIRK 138KV LINE	0.992	Lag	74.7	9.4
	OSAGE - WEBB CITY TAP 138KV LINE	0.999	Lag	74.7	2.8
	SOONER - SOONER PUMP TAP 138KV LINE	0.992	Lead	74.7	9.4
	SOONER - MILLER 138KV LINE	0.992	Lead	74.7	9.6
	EMPORIA – WICHITA 345KV LINE	1	Lead	74.7	0.2
	WOODRING - GEN-2008-013 345KV LINE	1	Lead	74.7	1.6
	GEN-2008-013 - GEN-2007-025 345KV LINE	1	Lead	74.7	0.3
	LATHAM - GEN-2005-013 345KV LINE	1	Lead	74.7	0.5
	GEN-2005-016 - GEN-2005-013 345KV LINE	1	Lead	74.7	1.2
	BLACKBERRY - NEOSHO 345KV LINE	1	Lead	74.7	0.1

[3] It was necessary to add a condenser providing 176.7 MVAR @ GEN-05-013 Bus to achieve convergence. Very low voltage conditions are developed around this bus for this contingency.

CASE	CONTINGENCY	PF @ POI	PF	MW @ POI	MVAR @ POI
WP	BASE CASE	1	Lead	74.7	0.0
	WOLF CREEK – BENTON 345KV LINE	1	Lead	74.7	1.5
	WOLF CREEK – ROSE HILL 345KV LINE	1	Lead	74.7	1.6
	WOLF CREEK – GEN-2008-098 345KV LINE	1	Lead	74.7	2.0
	STILWELL – LACYGNE 345KV LINE	1	Lead	74.7	1.1
	NEOSHO – LACYGNE 345KV LINE	1	Lead	74.7	1.0
	WEST GARDNER – LACYGNE 345KV LINE	1	Lead	74.7	0.7
	GEN-2008-098 - LACYGNE 345KV LINE	1	Lead	74.7	2.2
	ROSE HILL - GEN-2008-127 345KV LINE	1	Lead	74.7	1.5
	SOONER - WOODRING 345KV LINE	1	Lead	74.7	0.2
	SOONER - CLEVELAND 345KV LINE	1	Lag	74.7	0.0
	ROSE HILL - LATHAM 345KV LINE	1	Lag	74.7	0.5[4]
	GEN-2008-038 - SHIDLER 138KV LINE	1	Lag	74.7	0.7
	EMPORIA – SWISSVALE 345KV LINE	1	Lag	74.7	0.4
	EMPORIA – LANG 345KV LINE	1	Lag	74.7	0.2
	SWISSVALE – WEST GARDNER 345KV LINE	1	Lag	74.7	0.5
	SWISSVALE – 345/230KV AUTOTRANSFORMER	1	Lag	74.7	0.1
	NORTHEASTERN - DELAWARE 345KV LINE	1	Lead	74.7	0.4
	EMPORIA – MORRIS COUNTY 345KV LINE	1	Lead	74.7	0.1
	CRESWELL - NEWKIRK 138KV LINE	0.993	Lag	74.7	8.6
	CHIKASIA 138/69KV AUTOTRANSFORMER	1	Lead	74.7	1.0
	KILDARE - NEWKIRK 138KV LINE	0.992	Lead	74.7	9.3
	OSAGE - WEBB CITY TAP 138KV LINE	0.999	Lag	74.7	2.6
	SOONER - SOONER PUMP TAP 138KV LINE	0.996	Lead	74.7	6.4
	SOONER - MILLER 138KV LINE	0.996	Lead	74.7	6.7
	EMPORIA – WICHITA 345KV LINE	1	Lead	74.7	0.8
	WOODRING - GEN-2008-013 345KV LINE	0.999	Lead	74.7	2.7
	GEN-2008-013 - GEN-2007-025 345KV LINE	1	Lead	74.7	0.6
	LATHAM - GEN-2005-013 345KV LINE	1	Lead	74.7	0.5
	GEN-2005-016 - GEN-2005-013 345KV LINE	1	Lead	74.7	1.5
	DELWARE7 - NEOSHO 345KV LINE	1	Lead	74.7	0.6

[4] It was necessary to add a condenser providing 214.2 MVAR @ GEN-05-013 Bus to achieve convergence. Very low voltage conditions are developed around this bus for this contingency.

B. Gen-2008-098

POI: Wolf Creek (532797) and LaCygne (542981) 345kV
For the purpose of the power factor analysis, GEN08-098 (572090) 345 kV bus is considered as the common POI for this project. It should be noted that there is a 2.0 MVAR fixed capacitor at the high side of the step-up transformer for the
GEN-2008-098 project, bus 572093 WF 34_5B.

The VAR generator either supplies or absorbs reactive power at different contingencies as summarized in Table 2-2. The highest values obtained are as follows:

1. For the summer case, the VAR generator supplies 70.7 MVar for the outage of Wolf Creek – Rose Hill 345kV line and absorbs 55.2 MVar for the loss of Wolf Creek – GEN-2008-098 345KV line.

2. For the winter case, the VAR generator supplies 55.2 MVar for the outage of WOLF CREEK – ROSE HILL 345KV LINE and absorbs 38.9 MVar for the loss of GEN-2008-098 - Lacygne 345KV line.

Table 2-2 VAR Generator Output in Summer and Winter Peak Cases for GEN-2008-098

CASE	CONTINGENCY	PF @ POI	PF	MW @ POI	MVAR @ POI
SP	BASE CASE	1	Lead	100.8	0.1
	WOLF CREEK – BENTON 345KV LINE	0.866	Lead	100.8	58.2
	WOLF CREEK – ROSE HILL 345KV LINE	0.819	Lead	100.8	70.7
	WOLF CREEK – GEN-2008-098 345KV LINE	0.877	Lag	100.8	55.2
	STILWELL – LACYGNE 345KV LINE	0.95	Lag	100.8	33.3
	NEOSHO – LACYGNE 345KV LINE	0.994	Lag	100.8	10.7
	WEST GARDNER – LACYGNE 345KV LINE	0.975	Lag	100.8	23.1
	GEN-2008-098 - LACYGNE 345KV LINE	0.939	Lag	100.8	36.9
	ROSE HILL - GEN-2008-127 345KV LINE	0.999	Lead	100.8	4.6
	SOONER - WOODRING 345KV LINE	1	Lead	100.8	0.2
	SOONER - CLEVELAND 345KV LINE	0.991	Lead	100.8	13.4
	ROSE HILL - LATHAM 345KV LINE	0.98	Lag	100.8	20.6[5]

[5] It was necessary to add a condenser providing 176.9 MVAR @ GEN-05-013 Bus to achieve convergence. Very low voltage conditions are developed around this bus for this contingency.

CASE	CONTINGENCY	PF @ POI	PF	MW @ POI	MVAR @ POI
	GEN-2008-038 - SHIDLER 138KV LINE	1	Lag	100.8	0.6
	EMPORIA – SWISSVALE 345KV LINE	0.98	Lead	100.8	20.6
	EMPORIA – LANG 345KV LINE	1	Lead	100.8	0.5
	SWISSVALE – WEST GARDNER 345KV LINE	0.962	Lead	100.8	28.5
	SWISSVALE – 345/230KV AUTOTRANSFORMER	1	Lead	100.8	0.1
	NORTHEASTERN - DELAWARE 345KV LINE	0.998	Lead	100.8	6.2
	EMPORIA – MORRIS COUNTY 345KV LINE	1	Lead	100.8	1.0
	CRESWELL - NEWKIRK 138KV LINE	1	Lag	100.8	1.2
	CHIKASIA 138/69KV AUTOTRANSFORMER	1	Lead	100.8	0.2
	KILDARE - NEWKIRK 138KV LINE	1	Lead	100.8	1.0
	OSAGE - WEBB CITY TAP 138KV LINE	1	Lead	100.8	0.6
	SOONER - SOONER PUMP TAP 138KV LINE	1	Lead	100.8	0.0
	SOONER - MILLER 138KV LINE	1	Lag	100.8	0.1
	EMPORIA – WICHITA 345KV LINE	0.999	Lead	100.8	5.5
	WOODRING - GEN-2008-013 345KV LINE	0.993	Lead	100.8	12.0
	GEN-2008-013 - GEN-2007-025 345KV LINE	0.999	Lead	100.8	4.7
	LATHAM - GEN-2005-013 345KV LINE	0.999	Lead	100.8	5.3
	GEN-2005-016 - GEN-2005-013 345KV LINE	0.974	Lead	100.8	23.5
	BLACKBERRY - NEOSHO 345KV LINE	0.998	Lead	100.8	6.4
WP	BASE CASE	1	Lead	100.8	0.7
	WOLF CREEK – BENTON 345KV LINE	0.904	Lead	100.8	47.8
	WOLF CREEK – ROSE HILL 345KV LINE	0.877	Lead	100.8	55.2
	WOLF CREEK – GEN-2008-098 345KV LINE	0.965	Lag	100.8	27.3
	STILWELL – LACYGNE 345KV LINE	0.982	Lag	100.8	19.3
	NEOSHO – LACYGNE 345KV LINE	0.993	Lag	100.8	11.9
	WEST GARDNER – LACYGNE 345KV LINE	0.991	Lag	100.8	13.5
	GEN-2008-098 - LACYGNE 345KV LINE	0.933	Lag	100.8	38.9
	ROSE HILL - GEN-2008-127 345KV LINE	0.999	Lead	100.8	4.7
	SOONER - WOODRING 345KV LINE	1	Lead	100.8	0.8
	SOONER - CLEVELAND 345KV LINE	0.996	Lead	100.8	9.2
	ROSE HILL - LATHAM 345KV LINE	0.984	Lag	100.8	18.3[6]
	GEN-2008-038 - SHIDLER 138KV LINE	1	Lead	100.8	0.3

[6] It was necessary to add a condenser providing 214.3 MVAR @ GEN-05-013 Bus to achieve convergence. Very low voltage conditions are developed around this bus for this contingency.

CASE	CONTINGENCY	PF @ POI	PF	MW @ POI	MVAR @ POI
	EMPORIA – SWISSVALE 345KV LINE	0.995	Lead	100.8	10.1
	EMPORIA – LANG 345KV LINE	1	Lead	100.8	0.2
	SWISSVALE – WEST GARDNER 345KV LINE	0.986	Lead	100.8	17.1
	SWISSVALE – 345/230KV AUTOTRANSFORMER	1	Lead	100.8	0.0
	NORTHEASTERN - DELAWARE 345KV LINE	0.999	Lead	100.8	4.1
	EMPORIA – MORRIS COUNTY 345KV LINE	1	Lead	100.8	1.0
	CRESWELL - NEWKIRK 138KV LINE	1	Lag	100.8	0.4
	CHIKASIA 138/69KV AUTOTRANSFORMER	1	Lead	100.8	0.7
	KILDARE - NEWKIRK 138KV LINE	1	Lead	100.8	1.3
	OSAGE - WEBB CITY TAP 138KV LINE	1	Lead	100.8	1.1
	SOONER - SOONER PUMP TAP 138KV LINE	1	Lead	100.8	0.7
	SOONER - MILLER 138KV LINE	1	Lead	100.8	0.7
	EMPORIA – WICHITA 345KV LINE	0.998	Lead	100.8	6.8
	WOODRING - GEN-2008-013 345KV LINE	0.996	Lead	100.8	8.9
	GEN-2008-013 - GEN-2007-025 345KV LINE	0.999	Lead	100.8	3.7
	LATHAM - GEN-2005-013 345KV LINE	0.999	Lead	100.8	4.7
	GEN-2005-016 - GEN-2005-013 345KV LINE	0.982	Lead	100.8	19.5
	DELWARE7 - NEOSHO 345KV LINE	0.999	Lead	100.8	5.0

C. Gen-2010-003

POI: Gen-2008-098 345 kV (572091) addition

The VAR generator either supplies or absorbs reactive power for all specified contingencies as summarized in Table 2-3.

1. For the summer case, the VAR generator supplies 32.0 MVar for the outage of Wolf Creek – Rose Hill 345kV line and absorbs 45.9 MVar for the loss of Wolf Creek – GEN-2008-098 345KV line.

2. For the winter case, the VAR generator supplies 24.1 MVar for the outage of Wolf Creek – Rose Hill 345kV line and absorbs 22.5 MVar for the loss of Wolf Creek – GEN-2008-098 345KV line.

Table 2-3 VAR Generator Output in Summer and Winter Peak Cases for GEN-2010-003

CASE	CONTINGENCY	PF @ POI	PF	MW @ POI	MVAR @ POI
SP	BASE CASE	1	Lead	100.8	0.0
	WOLF CREEK – BENTON 345KV LINE	0.967	Lead	100.8	26.4
	WOLF CREEK – ROSE HILL 345KV LINE	0.953	Lead	100.8	32.0
	WOLF CREEK – GEN-2008-098 345KV LINE	0.91	Lag	100.8	45.9
	STILWELL – LACYGNE 345KV LINE	0.989	Lag	100.8	15.3

CASE	CONTINGENCY	PF @ POI	PF	MW @ POI	MVAR @ POI
	NEOSHO – LACYGNE 345KV LINE	0.999	Lag	100.8	5.0
	WEST GARDNER – LACYGNE 345KV LINE	0.995	Lag	100.8	10.6
	GEN-2008-098 - LACYGNE 345KV LINE	0.984	Lag	100.8	18.1
	ROSE HILL - GEN-2008-127 345KV LINE	1	Lead	100.8	2.0
	SOONER - WOODRING 345KV LINE	1	Lead	100.8	0.0
	SOONER - CLEVELAND 345KV LINE	0.998	Lead	100.8	6.0
	ROSE HILL - LATHAM 345KV LINE	0.996	Lag	100.8	9.4[7]
	GEN-2008-038 - SHIDLER 138KV LINE	1	Lag	100.8	0.3
	EMPORIA – SWISSVALE 345KV LINE	0.996	Lead	100.8	9.3
	EMPORIA – LANG 345KV LINE	1	Lead	100.8	0.1
	SWISSVALE – WEST GARDNER 345KV LINE	0.992	Lead	100.8	12.8
	SWISSVALE – 345/230KV AUTOTRANSFORMER	1	Lag	100.8	0.0
	NORTHEASTERN - DELAWARE 345KV LINE	1	Lead	100.8	2.7
	EMPORIA – MORRIS COUNTY 345KV LINE	1	Lead	100.8	0.4
	CRESWELL - NEWKIRK 138KV LINE	1	Lag	100.8	0.6
	CHIKASIA 138/69KV AUTOTRANSFORMER	1	Lead	100.8	0.0
	KILDARE - NEWKIRK 138KV LINE	1	Lead	100.8	0.4
	OSAGE - WEBB CITY TAP 138KV LINE	1	Lead	100.8	0.2
	SOONER - SOONER PUMP TAP 138KV LINE	1	Lag	100.8	0.1
	SOONER - MILLER 138KV LINE	1	Lag	100.8	0.1
	EMPORIA – WICHITA 345KV LINE	1	Lead	100.8	2.4
	WOODRING - GEN-2008-013 345KV LINE	0.999	Lead	100.8	5.3
	GEN-2008-013 - GEN-2007-025 345KV LINE	1	Lead	100.8	2.1
	LATHAM - GEN-2005-013 345KV LINE	1	Lead	100.8	2.3
	GEN-2005-016 - GEN-2005-013 345KV LINE	0.995	Lead	100.8	10.6
	BLACKBERRY - NEOSHO 345KV LINE	1	Lead	100.8	2.8
WP	BASE CASE	1	Lag	100.8	0.1
	WOLF CREEK – BENTON 345KV LINE	0.979	Lead	100.8	20.7
	WOLF CREEK – ROSE HILL 345KV LINE	0.973	Lead	100.8	24.1
	WOLF CREEK – GEN-2008-098 345KV LINE	0.976	Lag	100.8	22.5
	STILWELL – LACYGNE 345KV LINE	0.996	Lag	100.8	9.0
	NEOSHO – LACYGNE 345KV LINE	0.998	Lag	100.8	5.7

[7] It was necessary to add a condenser providing 176.8 MVAR @ GEN-05-013 Bus to achieve convergence. Very low voltage conditions are developed around this bus for this contingency.

CASE	CONTINGENCY	PF @ POI	PF	MW @ POI	MVAR @ POI
	WEST GARDNER – LACYGNE 345KV LINE	0.998	Lag	100.8	6.4
	GEN-2008-098 - LACYGNE 345KV LINE	0.982	Lag	100.8	19.5
	ROSE HILL - GEN-2008-127 345KV LINE	1	Lead	100.8	1.6
	SOONER - WOODRING 345KV LINE	1	Lag	100.8	0.1
	SOONER - CLEVELAND 345KV LINE	0.999	Lead	100.8	3.6
	ROSE HILL - LATHAM 345KV LINE	0.996	Lag	100.8	8.5[8]
	GEN-2008-038 - SHIDLER 138KV LINE	1	Lag	100.8	0.3
	EMPORIA – SWISSVALE 345KV LINE	0.999	Lead	100.8	4.0
	EMPORIA – LANG 345KV LINE	1	Lag	100.8	0.4
	SWISSVALE – WEST GARDNER 345KV LINE	0.997	Lead	100.8	7.1
	SWISSVALE – 345/230KV AUTOTRANSFORMER	1	Lag	100.8	0.4
	NORTHEASTERN - DELAWARE 345KV LINE	1	Lead	100.8	1.4
	EMPORIA – MORRIS COUNTY 345KV LINE	1	Lead	100.8	0.0
	CRESWELL - NEWKIRK 138KV LINE	1	Lag	100.8	0.6
	CHIKASIA 138/69KV AUTOTRANSFORMER	1	Lag	100.8	0.1
	KILDARE - NEWKIRK 138KV LINE	1	Lead	100.8	0.1
	OSAGE - WEBB CITY TAP 138KV LINE	1	Lead	100.8	0.0
	SOONER - SOONER PUMP TAP 138KV LINE	1	Lag	100.8	0.1
	SOONER - MILLER 138KV LINE	1	Lag	100.8	0.1
	EMPORIA – WICHITA 345KV LINE	1	Lead	100.8	2.6
	WOODRING - GEN-2008-013 345KV LINE	0.999	Lead	100.8	3.5
	GEN-2008-013 - GEN-2007-025 345KV LINE	1	Lead	100.8	1.2
	LATHAM - GEN-2005-013 345KV LINE	1	Lead	100.8	1.6
	GEN-2005-016 - GEN-2005-013 345KV LINE	0.997	Lead	100.8	8.2
	DELWARE7 - NEOSHO 345KV LINE	1	Lead	100.8	1.8

D. Gen-2010-005

POI: Gen-2007-025 (532781) 345kV

The VAR generator either supplies or absorbs reactive power for all specified contingencies as summarized in Table 2-4.

[8] It was necessary to add a condenser providing 214.3 MVAR @ GEN-05-013 Bus to achieve convergence. Very low voltage conditions are developed around this bus for this contingency.

1. For the summer case, the VAR generator supplies 86.5 MVar for the outage of Woodring - GEN-2008-013 345KV line and absorbs 1.2 MVar for the loss of Swissvale – West Gardner 345KV line.

2. For the winter case, the VAR generator supplies 87.8 MVar for the outage of Woodring - GEN-2008-013 345KV line and absorbs 7.4 MVar for the loss of Swissvale – West Gardner 345KV line.

Table 2-4 VAR Generator Output in Summer and Winter Peak Cases for GEN-2010-005

CASE	CONTINGENCY	PF @ POI	PF	MW @ POI	MVAR @ POI
SP	BASE CASE	1	Lead	300	3.0
	WOLF CREEK – BENTON 345KV LINE	0.999	Lead	300	16.3
	WOLF CREEK – ROSE HILL 345KV LINE	0.999	Lead	300	14.6
	WOLF CREEK – GEN-2008-098 345KV LINE	0.998	Lead	300	20.8
	STILWELL – LACYGNE 345KV LINE	1	Lead	300	9.1
	NEOSHO – LACYGNE 345KV LINE	1	Lead	300	5.8
	WEST GARDNER – LACYGNE 345KV LINE	1	Lead	300	7.7
	GEN-2008-098 - LACYGNE 345KV LINE	0.993	Lead	300	36.1
	ROSE HILL - GEN-2008-127 345KV LINE	0.999	Lead	300	12.0
	SOONER - WOODRING 345KV LINE	1	Lead	300	2.7
	SOONER - CLEVELAND 345KV LINE	1	Lead	300	5.1
	ROSE HILL - LATHAM 345KV LINE	1	Lead	300	3.9[9]
	GEN-2008-038 - SHIDLER 138KV LINE	1	Lead	300	3.0
	EMPORIA – SWISSVALE 345KV LINE	1	Lag	300	0.3
	EMPORIA – LANG 345KV LINE	1	Lead	300	3.0
	SWISSVALE – WEST GARDNER 345KV LINE	1	Lag	300	1.2
	SWISSVALE – 345/230KV AUTOTRANSFORMER	1	Lead	300	3.0
	NORTHEASTERN - DELAWARE 345KV LINE	1	Lead	300	4.4
	EMPORIA – MORRIS COUNTY 345KV LINE	1	Lead	300	5.0
	CRESWELL - NEWKIRK 138KV LINE	1	Lead	300	5.2
	CHIKASIA 138/69KV AUTOTRANSFORMER	1	Lead	300	2.8
	KILDARE - NEWKIRK 138KV LINE	1	Lead	300	3.1

[9] It was necessary to add a condenser providing 176.7 MVAR @ GEN-05-013 Bus to achieve convergence. Very low voltage conditions are developed around this bus for this contingency.

CASE	CONTINGENCY	PF @ POI	PF	MW @ POI	MVAR @ POI
	OSAGE - WEBB CITY TAP 138KV LINE	1	Lead	300	3.0
	SOONER - SOONER PUMP TAP 138KV LINE	1	Lead	300	3.4
	SOONER - MILLER 138KV LINE	1	Lead	300	3.4
	EMPORIA – WICHITA 345KV LINE	0.998	Lead	300	18.3
	WOODRING - GEN-2008-013 345KV LINE	0.961	Lead	300	86.5
	GEN-2008-013 - GEN-2007-025 345KV LINE	0.988	Lead	300	46.6
	LATHAM - GEN-2005-013 345KV LINE	1	Lead	300	5.8
	GEN-2005-016 - GEN-2005-013 345KV LINE	0.999	Lead	300	12.7
	BLACKBERRY - NEOSHO 345KV LINE	1	Lead	300	3.2
WP	BASE CASE	1	Lead	300	0.0
	WOLF CREEK – BENTON 345KV LINE	0.997	Lead	300	21.6
	WOLF CREEK – ROSE HILL 345KV LINE	0.998	Lead	300	19.8
	WOLF CREEK – GEN-2008-098 345KV LINE	0.993	Lead	300	35.0
	STILWELL – LACYGNE 345KV LINE	0.999	Lead	300	13.1
	NEOSHO – LACYGNE 345KV LINE	1	Lead	300	7.1
	WEST GARDNER – LACYGNE 345KV LINE	1	Lead	300	9.2
	GEN-2008-098 - LACYGNE 345KV LINE	0.983	Lead	300	56.3
	ROSE HILL - GEN-2008-127 345KV LINE	0.999	Lead	300	15.2
	SOONER - WOODRING 345KV LINE	1	Lag	300	0.6
	SOONER - CLEVELAND 345KV LINE	1	Lead	300	2.2
	ROSE HILL - LATHAM 345KV LINE	1	Lag	300	1.7[10]
	GEN-2008-038 - SHIDLER 138KV LINE	1	Lag	300	0.1
	EMPORIA – SWISSVALE 345KV LINE	1	Lag	300	6.1
	EMPORIA – LANG 345KV LINE	1	Lag	300	2.6
	SWISSVALE – WEST GARDNER 345KV LINE	1	Lag	300	7.4
	SWISSVALE – 345/230KV AUTOTRANSFORMER	1	Lag	300	1.0
	NORTHEASTERN - DELAWARE 345KV LINE	1	Lead	300	2.9
	EMPORIA – MORRIS COUNTY 345KV LINE	1	Lead	300	4.1
	CRESWELL - NEWKIRK 138KV LINE	1	Lead	300	2.5
	CHIKASIA 138/69KV AUTOTRANSFORMER	1	Lead	300	0.0
	KILDARE - NEWKIRK 138KV LINE	1	Lead	300	0.2
	OSAGE - WEBB CITY TAP 138KV LINE	1	Lead	300	0.0

[10] It was necessary to add a condenser providing 214.2 MVAR @ GEN-05-013 Bus to achieve convergence. Very low voltage conditions are developed around this bus for this contingency.

CASE	CONTINGENCY	PF @ POI	PF	MW @ POI	MVAR @ POI
	SOONER - SOONER PUMP TAP 138KV LINE	1	Lead	300	0.3
	SOONER - MILLER 138KV LINE	1	Lead	300	0.4
	EMPORIA – WICHITA 345KV LINE	0.998	Lead	300	19.1
	WOODRING - GEN-2008-013 345KV LINE	0.96	Lead	300	87.8
	GEN-2008-013 - GEN-2007-025 345KV LINE	0.995	Lead	300	31.3
	LATHAM - GEN-2005-013 345KV LINE	1	Lead	300	4.0
	GEN-2005-016 - GEN-2005-013 345KV LINE	0.999	Lead	300	15.6
	DELWARE7 - NEOSHO 345KV LINE	1	Lead	300	4.1

E. Gen-2010-013
POI: Gen-2005-013 (574000) 345kV

The VAR generator scheduled voltage is set at 1.000 pu instead of 0.98 pu as in the provided base case. The VAR generator either supplies or absorbs reactive power for all specified contingencies as summarized in Table 2-5.

1. For the summer case, the VAR generator supplies 194.5 MVar for the outage of GEN-2008-098 - Lacygne 345KV line and absorbs 25.6 MVar for the loss of Latham - GEN-2005-013 345KV line.

2. For the winter case, the VAR generator supplies 214.2 MVar for the outage of Rose Hill - Latham 345KV line and absorbs 7.0 MVar for the loss of Latham - GEN-2005-013 345KV line.

Table 2-5 VAR Generator Output in Summer and Winter Peak Cases for GEN-2010-013

CASE	CONTINGENCY	PF @ POI	PF	MW @ POI	MVAR @ POI
SP	BASE CASE	0.449	Lead	50.4	100.4
	WOLF CREEK – BENTON 345KV LINE	0.379	Lead	50.4	123.0
	WOLF CREEK – ROSE HILL 345KV LINE	0.387	Lead	50.4	119.9
	WOLF CREEK – GEN-2008-098 345KV LINE	0.301	Lead	50.4	159.8
	STILWELL – LACYGNE 345KV LINE	0.396	Lead	50.4	116.9
	NEOSHO – LACYGNE 345KV LINE	0.343	Lead	50.4	138.1
	WEST GARDNER – LACYGNE 345KV LINE	0.421	Lead	50.4	108.6
	GEN-2008-098 - LACYGNE 345KV LINE	0.251	Lead	50.4	194.5
	ROSE HILL - GEN-2008-127 345KV LINE	0.358	Lead	50.4	131.3
	SOONER - WOODRING 345KV LINE	0.449	Lead	50.4	100.3
	SOONER - CLEVELAND 345KV LINE	0.401	Lead	50.4	115.1
	ROSE HILL - LATHAM 345KV LINE	0.274	Lead	50.4	176.7

CASE	CONTINGENCY	PF @ POI	PF	MW @ POI	MVAR @ POI
	GEN-2008-038 - SHIDLER 138KV LINE	0.451	Lead	50.4	99.8
	EMPORIA – SWISSVALE 345KV LINE	0.436	Lead	50.4	103.9
	EMPORIA – LANG 345KV LINE	0.447	Lead	50.4	100.8
	SWISSVALE – WEST GARDNER 345KV LINE	0.437	Lead	50.4	103.9
	SWISSVALE – 345/230KV AUTOTRANSFORMER	0.448	Lead	50.4	100.5
	NORTHEASTERN - DELAWARE 345KV LINE	0.41	Lead	50.4	112.2
	EMPORIA – MORRIS COUNTY 345KV LINE	0.446	Lead	50.4	101.1
	CRESWELL - NEWKIRK 138KV LINE	0.441	Lead	50.4	102.6
	CHIKASIA 138/69KV AUTOTRANSFORMER	0.449	Lead	50.4	100.2
	KILDARE - NEWKIRK 138KV LINE	0.443	Lead	50.4	102.1
	OSAGE - WEBB CITY TAP 138KV LINE	0.447	Lead	50.4	100.8
	SOONER - SOONER PUMP TAP 138KV LINE	0.447	Lead	50.4	100.8
	SOONER - MILLER 138KV LINE	0.447	Lead	50.4	100.8
	EMPORIA – WICHITA 345KV LINE	0.429	Lead	50.4	106.1
	WOODRING - GEN-2008-013 345KV LINE	0.378	Lead	50.4	123.5
	GEN-2008-013 - GEN-2007-025 345KV LINE	0.418	Lead	50.4	109.5
	LATHAM - GEN-2005-013 345KV LINE	0.892	Lag	50.4	25.6
	GEN-2005-016 - GEN-2005-013 345KV LINE	0.321	Lead	50.4	148.8
	BLACKBERRY - NEOSHO 345KV LINE	0.435	Lead	50.4	104.2
WP	BASE CASE	0.596	Lead	50.4	67.9
	WOLF CREEK – BENTON 345KV LINE	0.474	Lead	50.4	93.7
	WOLF CREEK – ROSE HILL 345KV LINE	0.491	Lead	50.4	89.5
	WOLF CREEK – GEN-2008-098 345KV LINE	0.345	Lead	50.4	137.1
	STILWELL – LACYGNE 345KV LINE	0.492	Lead	50.4	89.1
	NEOSHO – LACYGNE 345KV LINE	0.43	Lead	50.4	105.7
	WEST GARDNER – LACYGNE 345KV LINE	0.533	Lead	50.4	80.0
	GEN-2008-098 - LACYGNE 345KV LINE	0.27	Lead	50.4	179.8
	ROSE HILL - GEN-2008-127 345KV LINE	0.462	Lead	50.4	96.9
	SOONER - WOODRING 345KV LINE	0.597	Lead	50.4	67.7
	SOONER - CLEVELAND 345KV LINE	0.543	Lead	50.4	78.0
	ROSE HILL - LATHAM 345KV LINE	0.229	Lead	50.4	214.2
	GEN-2008-038 - SHIDLER 138KV LINE	0.598	Lead	50.4	67.6
	EMPORIA – SWISSVALE 345KV LINE	0.602	Lead	50.4	66.8
	EMPORIA – LANG 345KV LINE	0.602	Lead	50.4	66.8
	SWISSVALE – WEST GARDNER 345KV LINE	0.606	Lead	50.4	66.2
	SWISSVALE – 345/230KV AUTOTRANSFORMER	0.6	Lead	50.4	67.2
	NORTHEASTERN - DELAWARE 345KV LINE	0.529	Lead	50.4	80.8
	EMPORIA – MORRIS COUNTY 345KV LINE	0.586	Lead	50.4	69.7

CASE	CONTINGENCY	PF @ POI	PF	MW @ POI	MVAR @ POI
	CRESWELL - NEWKIRK 138KV LINE	0.590	Lead	50.4	68.9
	CHIKASIA 138/69KV AUTOTRANSFORMER	0.595	Lead	50.4	68.0
	KILDARE - NEWKIRK 138KV LINE	0.588	Lead	50.4	69.2
	OSAGE - WEBB CITY TAP 138KV LINE	0.594	Lead	50.4	68.3
	SOONER - SOONER PUMP TAP 138KV LINE	0.594	Lead	50.4	68.3
	SOONER - MILLER 138KV LINE	0.594	Lead	50.4	68.2
	EMPORIA – WICHITA 345KV LINE	0.548	Lead	50.4	76.9
	WOODRING - GEN-2008-013 345KV LINE	0.472	Lead	50.4	94.1
	GEN-2008-013 - GEN-2007-025 345KV LINE	0.548	Lead	50.4	77.0
	LATHAM - GEN-2005-013 345KV LINE	0.99	Lag	50.4	7.0
	GEN-2005-016 - GEN-2005-013 345KV LINE	0.408	Lead	50.4	112.8
	DELWARE7 - NEOSHO 345KV LINE	0.504	Lead	50.4	86.5

2.3. Conclusions

The results of the power factor analysis showed that with the MVAR capability of the five WTG's projects and without reactive compensation, each of the wind farms will not be able to keep the voltage schedule at their respective POI's consistent with the voltage schedule in the provided power flow cases for summer and winter. For each project, additional VAR compensating devices need to be installed in order to control the power factor at the POI to be within +/- 0.95 range.

For many contingency instances, the tables above indicate that reactive power is required, particularly for the contingency Rose Hill - Latham 345KV line which outage requires a capacitor in the neighborhood of the GEN-2005-013 345 kV bus to solve the loadflow case suggesting a potential voltage collapse neighborhood.

The following assumptions were adopted for the dynamic simulations:

1. Constant maximum and uniform wind speed for the entire period of study.
2. Wind turbine control models with their values as provided by SPP.
3. Under/over voltage/frequency protection use settings provided by SPP in the dynamic data base.

3.1. Faults Simulated

Sixty (60) faults were considered for the transient stability simulations which included three phase faults, as well as single phase line faults, at the locations defined by SPP. Single-phase line faults were simulated by applying a fault impedance to the positive sequence network at the fault location to represent the effect of the negative and zero sequence networks on the positive sequence network.

The fault impedance was computed to give a positive sequence voltage at the specified fault location of approximately 60% of pre-fault voltage. This method is in agreement with SPP current practice. Prior queued projects shown in Table 1-2 and units in areas 520, 523, 525, 524, 536, 540, and 541 were monitored during the simulations.

Table 3-1 shows the list of simulated contingencies. It also shows the fault clearing time and the time delay before re-closing for all the study contingencies.

Table 3-1 List of Simulated Faults

Cont. No.	Cont. Name	Description
1	FLT01-3PH	3 phase fault on the Wolf Creek (532797) – Benton (532791) 345kV line near Wolf Creek. a. Apply fault at the Wolf Creek 345kV bus. b. Clear fault after 3.6 cycles by tripping the faulted line and remove the fault.
2	FLT02-1PH	Single-phase fault on the Wolf Creek (532797) – Benton (532791) 345kV line near Wolf Creek. a. Apply fault at the Wolf Creek 345kV bus. b. Clear fault after 3.6 cycles by tripping the faulted line. c. Wait 300 cycles and reclose Benton 345 kV end back into the fault. d. Leave fault on for 3.6 cycles, then trip the line and remove the fault.
3	FLT03-3PH	3 phase fault on the Wolf Creek (532797) – Rose Hill (532794) 345kV line near Wolf Creek. a. Apply fault at the Wolf Creek 345kV bus. b. Clear fault after 3.6 cycles by tripping the faulted line and remove the fault.

Cont. No.	Cont. Name	Description
4	FLT04-1PH	Single-phase fault on the Wolf Creek (532797) – Rose Hill (532794) 345kV line near Wolf Creek. a. Apply fault at the Wolf Creek 345kV bus. b. Clear fault after 3.6 cycles by tripping the faulted line. c. Wait 300 cycles and reclose Rose Hill 345 kV end back into the fault. d. Leave fault on for 3.6 cycles, then trip the line and remove the fault.
5	FLT05-3PH	3 phase fault on the Wolf Creek (532797) – GEN-2008-098 (572098) 345kV line near GEN-2008-098. a. Apply fault at the GEN-2008-098 345kV bus. b. Clear fault after 3.6 cycles by tripping the faulted line and remove the fault.
6	FLT06-1PH	Single phase fault on the Wolf Creek (532797) – GEN-2008-098 (572098) 345kV line near GEN-2008-098. a. Apply fault at the GEN-2008-098 345kV bus. b. Clear fault after 3.6 cycles by tripping the faulted line and remove the fault.
7	FLT07-3PH	3 phase fault on the Stilwell (542968) – LaCygne (542981) 345kV line near Stilwell. a. Apply fault at the Stilwell 345kV bus. b. Clear fault after 3.6 cycles by tripping the faulted line. c. Wait 1200 cycles, and then re-close the Stilwell end of the line back into the fault. d. Leave fault on for 3.6 cycles, then trip the line and remove fault.
8	FLT08-1PH	*Single phase fault and sequence like previous*
9	FLT09-3PH	3 phase fault on the Neosho (532793) – LaCygne (542981) 345kV line near Neosho. a. Apply fault at the Neosho 345kV bus. b. Clear fault after 3.6 cycles by tripping the faulted line and remove the fault
10	FLT10-1PH	Single-phase fault on the Neosho (532793) – LaCygne (542981) 345kV line near Neosho. a. Apply fault at the Neosho 345kV bus. b. Clear fault after 3.6 cycles by tripping the faulted line. c. Wait 300 cycles, and then re-close Neosho 345 kV end back into the fault d. Leave the fault on for 3.6 cycles, then trip the line and remove the fault.
11	FLT11-3PH	3 phase fault on the West Gardner (542965) – LaCygne (542981) 345kV line near LaCygne. a. Apply fault at the LaCygne 345kV bus. b. Clear fault after 3.6 cycles by tripping the faulted line. c. Wait 1200 cycles, and then re-close the West Gardner end of the line back into the fault. d. Leave fault on for 3.6 cycles, then trip the line in (b) and remove fault.
12	FLT12-1PH	*Single phase fault and sequence like previous*
13	FLT13-3PH	3 phase fault on the GEN-2008-098 (572090) to LaCygne (542981) 345kV line, near GEN-2008-098. a. Apply fault at the GEN-2008-098 345kV bus. b. Clear fault after 3 cycles by tripping the faulted line.

Cont. No.	Cont. Name	Description
14	FLT14-1PH	Single phase fault on the GEN-2008-098 (572090) to LaCygne (542981) (542573039) 345kV line, near GEN-2008-098. a. Apply fault at the GEN-2008-098 345kV bus. b. Clear fault after 3 cycles by tripping the faulted line.
15	FLT15-3PH	3 phase fault on the Rose Hill (532794) to GEN-2008-127 (573039) 345kV line, near Rose Hill. a. Apply fault at the Rose Hill 345kV bus. b. Clear fault after 3.6 cycles by tripping the faulted line.
16	FLT16-1PH	Single-phase fault on the Rose Hill (532794) to GEN-2008-127 (573039) 345kV line, near GEN-Rose Hill. a. Apply fault at the Rose Hill 345kV bus. b. Clear fault after 3.6 cycles by tripping the faulted line. c. Wait 300 cycles, and then re-close the Rose Hill end of the line in (b) back into the fault. d. Leave fault on for 3.6 cycles, then trip the line in (b) and remove fault.
17	FLT17-3PH	3 phase fault on the Sooner (514803) to Woodring (514715) 345kV line, near Woodring. a. Apply fault at the Woodring 345kV bus. b. Clear fault after 3 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 3 cycles, then trip the line in (b) and remove fault.
18	FLT18-1PH	*Single phase fault and sequence like previous*
19	FLT19-3PH	3 phase fault on the Sooner (514803) to Cleveland (512694) 345kV line, near Cleveland. a. Apply fault at the Cleveland 345kV bus. b. Clear fault after 3 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 3 cycles, then trip the line in (b) and remove fault.
20	FLT20-1PH	*Single phase fault and sequence like previous*
21	FLT21-3PH	3 phase fault on the Rose Hill (532794) to Latham (532800) 345kV line, near Rose Hill. a. Apply fault at the Rose Hill 345V bus. b. Clear fault after 4 cycles by tripping the faulted line and remove the fault.
22	FLT22-1PH	Single-phase fault on the Rose Hill (532794) to Latham (532800) 345kV line, near Rose Hill. a. Apply fault at the Rose Hill 345V bus. b. Clear fault after 4 cycles by tripping the faulted line. c. Wait 30 cycles, and then re-close the Rose Hill end of the line in (b) back into the fault. d. Leave fault on for 4 cycles, then trip the line in (b) and remove fault.

Cont. No.	Cont. Name	Description
23	FLT23-3PH	3 phase fault on the GEN-2008-038 (570838) to Shidler (510403) 138kV line, near Shidler. a. Apply fault at the Shidler 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
24	FLT24-1PH	*Single phase fault and sequence like previous*
25	FLT25-3PH	3 phase fault on the Emporia (532768) – Swissvale (532774) 345kV line near Swissvale. a. Apply fault at the Swissvale 345kV bus. b. Clear fault after 3.6 cycles by tripping the faulted line and remove the fault.
26	FLT26-1PH	Single phase fault on the Emporia (532768) – Swissvale (532774) 345kV line near Swissvale. a. Apply fault at the Swissvale 345kV bus. b. Clear fault after 3.6 cycles by tripping the faulted line and remove the fault. c. Wait 300 cycles and reclose d. Clear fault after 3.6 cycles
27	FLT27-3PH	3 phase fault on the Emporia (532768) – Lang (532769) 345kV line near Emporia. a. Apply fault at the Emporia 345kV bus. b. Clear fault after 3.6 cycles by tripping the faulted line and remove the fault.
28	FLT28-1PH	Single phase fault the Emporia (532768) – Lang (532769) 345kV line near Emporia. a. Apply fault at Emporia 345kV bus. b. Clear fault after 3.6 cycles by tripping the faulted line and remove the fault. c. Wait 300 cycles and reclose d. Clear fault after 3.6 cycles
29	FLT29-3PH	3 phase fault on the Swissvale (532774) – West Gardner (542965) 345kV line near Swissvale. a. Apply fault at the Swissvale 345kV bus. b. Clear fault after 3.6 cycles by tripping the faulted line and remove the fault.
30	FLT29-1PH	Single phase fault on the Swissvale (532774) – West Gardner (542965) 345kV line near Swissvale. a. Apply fault at the Swissvale 345kV bus. b. Clear fault after 3.6 cycles by tripping the faulted line and remove the fault.
31	FLT30-3PH	3 phase fault on the Swissvale (532774) – 345/230kV autotransformer. a. Apply fault at the Swissvale 345kV bus. b. Clear fault after 3.6 cycles by tripping the faulted transformer.
32	FLT30-1PH	Single phase fault on the Swissvale (532774) – 345/230kV autotransformer. a. Apply fault at the Swissvale 345kV bus. b. Clear fault after 3.6 cycles by tripping the faulted transformer.

Cont. No.	Cont. Name	Description
33	FLT31-3PH	3 phase fault on the Northeastern (510406) to Delaware (510380) 345kV line, near Delaware. a. Apply fault at the Delaware 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
34	FLT32-1PH	*Single phase fault and sequence like previous*
35	FLT33-3PH	3 phase fault on the Emporia (532768) – Morris County (532770) 345kV line near Emporia. a. Apply fault at the Emporia 345kV bus. b. Clear fault after 3.6 cycles by tripping the faulted line and remove the fault.
36	FLT34-1PH	Single phase fault on the Emporia (532768) – Morris County (532770) 345kV line near Emporia. a. Apply fault at the Emporia 345kV bus. b. Clear fault after 3.6 cycles by tripping the faulted line and remove the fault. c. Wait 300 cycles and reclose d. Clear fault after 3.6 cycles
37	FLT35-3PH	3 phase fault on the Creswell (515381) to Newkirk (514759) 138kV line, near Newkirk. a. Apply fault at the Newkirk 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
38	FLT36-1PH	*Single phase fault and sequence like previous*
39	FLT37-3PH	3 phase fault on the Chikasia 138/69kV autotransformer near the 138kV bus (514757). a. Apply fault at the Chikasia 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
40	FLT38-1PH	*Single phase fault and sequence like previous*
41	FLT39-3PH	3 phase fault on the Kildare (514760) to Newkirk (514759) 138kV line, near Newkirk. a. Apply fault at the Newkirk 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
42	FLT40-1PH	*Single phase fault and sequence like previous*

Cont. No.	Cont. Name	Description
43	FLT41-3PH	3 phase fault on the Osage (514743) to Webb City Tap (510376) 138kV line, near Osage. a. Apply fault at the Osage 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
44	FLT42-1PH	*Single phase fault and sequence like previous*
45	FLT43-3PH	3 phase fault on the Sooner (514802) to Sooner Pump Tap (514798) 138kV line, near Sooner. a. Apply fault at the Sooner 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
46	FLT44-1PH	*Single phase fault and sequence like previous*
47	FLT45-3PH	3 phase fault on the Sooner (514802) to Miller (514704) 138kV line, near Sooner. a. Apply fault at the Sooner 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
48	FLT46-1PH	*Single phase fault and sequence like previous*
49	FLT47-3PH	3 phase fault on the Emporia (532768) – Wichita (532796) 345kV line near Emporia. a. Apply fault at the Emporia 345kV bus. b. Clear fault after 3.6 cycles by tripping the faulted line and remove the fault.
50	FLT48-1PH	Single phase fault on the Emporia (532768) – Wichita (532796) 345kV line near Emporia. a. Apply fault at the Emporia 345kV bus. b. Clear fault after 3.6 cycles by tripping the faulted line and remove the fault. c. Wait 300 cycles and reclose d. Clear fault after 3.6 cycles
51	FLT49-3PH	3 phase fault on the Woodring (514715) to GEN-2008-013 (210130) 345kV line, near Woodring. a. Apply fault at the Woodring 345kV bus. b. Clear fault after 3 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 3 cycles, then trip the line in (b) and remove fault.
52	FLT50-1PH	*Single phase fault and sequence like previous*
53	FLT51-3PH	3 phase fault on the GEN-2008-013 (210130) to GEN-2007-025 (532781) 345kV line, near GEN-2007-025. a. Apply fault at the GEN-2007-025 345kV bus. b. Clear fault after 3 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 3 cycles, then trip the line in (b) and remove fault.

Cont. No.	Cont. Name	Description
54	FLT52-1PH	*Single phase fault and sequence like previous*
55	FLT53-3PH	3 phase fault on the Latham (532800) to GEN-2005-013 (574000) 345kV line, near Latham. a. Apply fault at the Latham 345kV bus. b. Clear fault after 3 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 3 cycles, then trip the line in (b) and remove fault.
56	FLT54-1PH	*Single phase fault and sequence like previous*
57	FLT55-3PH	3 phase fault on the GEN-2005-016 (156) to GEN-2005-013 (574000) 345kV line, near GEN-2005-016. a. Apply fault at the GEN-2005-016 345kV bus. b. Clear fault after 3 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 3 cycles, then trip the line in (b) and remove fault.
58	FLT56-1PH	*Single phase fault and sequence like previous*
59	FLT57-3PH	3 phase fault on the Blackberry[11] (300739) to Neosho (532793) 345kV line, near Neosho. a. Apply fault at the Neosho 345kV bus. b. Clear fault after 3 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 3 cycles, then trip the line in (b) and remove fault.
60	FLT58-1PH	*Single phase fault and sequence like previous*

Simulations were performed with a 0.1-second steady-state run followed by the appropriate disturbance as described in Table 3-1. Simulations were run for a minimum 20-second duration to confirm proper machine damping.

3.2. Simulation Results

The simulations conducted in the study did not show any angular or voltage instability problems for the 60 disturbances.

Table 3-5 show the bus numbers for machines of the Study Projects which are plotted for each contingency. Electric power, terminal and POI voltage are plotted.

Table 3-6 show the bus numbers for machines of the Queue Projects which are plotted for each contingency. Electric power, terminal and POI voltage and frequency are plotted.

Table 3-7 show the bus numbers for machines of the additional monitored generators which are plotted for each contingency. Electric power and angle are included.

Additionally, several bus voltages, the average angle and the angle spread are also plotted for each contingency.

[11] Delware7(510380) replaced Blackberry (300739) for the Winter case simulations. Blackberry bus was not in the Winter case.

Table 3-5 Machine Bus Numbers for Study Projects

Request	Size (MW)	Wind Turbine Model	Machine Bus Number
GEN-2008-071	76.8	GE 1.6MW	577000
GEN-2008-098	100.8	Vestas V90 1.8MW	572094
GEN-2010-003	100.8	Vestas V90 1.8MW	577200
GEN-2010-005	300	Clipper C96 2.5MW	576100 & 576110
GEN-2010-013	50.4	Vestas V90 1.8MW	576200

Table 3-6 Machine Bus Numbers for Queue Projects

Request	Size (MW)	Generator Model	Machine Bus Number
GEN-2002-004	150	GE.1.5MW	547504 & 547505
GEN-2004-010	300	Clipper 2.5MW	574008 & 574011
GEN-2005-013	201	G.E. 1.5MW	574004
GEN-2005-016	150	Gamesa 2MW	90151 through 90154
GEN-2007-025	300	Clipper 2.5MW	1251 & 1252
GEN-2008-013	300	G.E. 1.5MW	1131 through 1133
GEN-2008-021	1250	Nuclear Steam Turbine	532751
GEN-2008-038	150	G.E. 1.5MW	381
GEN-2008-127	200	Siemens 2.3MW	573033 and 573036
GEN-2009-025	60	GE 1.5MW	573053

Table 3-7 Machine Bus Numbers for Monitored Generators

Additional Monitored Machines	Size (MW)	AREA	Machine Bus Number	Machine ID
FLINTCR1	528	520	509394	1
KERRGR5	28.5	523	512635	4
GRDA17-1	520	523	512688	2
SOONER1G	540	524	514805	1
ANADRK4	94	525	520811	1
HUGO1	440	525	520947	1
JEC U1	744	536	532651	1
SIBLY3 1	400.6	540	541151	3
LAKE RD5	97.4	540	541255	4
HAW G5 1	563	541	542951	5
OSAWACT1	76	541	543078	1

Contingency FLT55-3PH was re-run for summer and winter load conditions. Four out of five equivalent machines for the previous queue project GEN-2005-016 were tripping for high frequency. This protection was dissabled for this contingency simulation.

Contingencies FLT21-3PH and FLT22-1PH for winter peak load conditions show oscillation without damping for the project GEN-2010-013 and for several previous queue requests projects in the neighborhood of Latham bus 345 kV. The same contingencies do not show this response for the summer peak load conditions.

Prior queued project GEN-2004-010 has a requirement to add two 30 MVAR capacitor bank at bus #574006 and #574009 which are not shown in the model provided by SPP. A sensitivity analysis for stability was carried out by adding these capacitors and an additional 90 MVAR bank to bus #574001 for the prior queued project GEN-2005-013, which has also a capacitor requirement. This analysis shows that the oscillation response for contingencies FLT21-3PH and FLT22-1PH for winter peak load conditions is eliminated with these additional capacitor banks.

Contingencies FLT13-3PH and FLT14-1PH show oscillations with poor damping for the project GEN-2008-098 and for a previous queued project GEN-2008-021. The same contingencies show similar responses for both, summer and winter peak load conditions. The sensitivity simulation with a Statcon device of 10 MVAR at bus #572092 show a damped response for those contingencies FLT13-3PH and FLT14-1PH for winter peak load conditions. Contingencies FLT13-3PH and FLT14-1PH show an acceptable response with a capacitor bank of 25 MVAR added at bus #572092 for summer peak load conditions.

For the five proposed projects, the stability simulations with sixty specified test disturbances did not show angular or voltage instability problems in the SPP system, except for the oscillating response that can be damped out by adding required capacitor banks to prior queued projects GEN-2004-010, GEN-2005-013 and a Statcon device for the study project GEN-2008-098.

Section 4. Conclusions

The findings of the impact study for the proposed interconnection projects under DISIS-2010-001 (Group 8), considered at 100% of their proposed installed capacities are as follows:

1. The results of the power factor analysis showed that with the MVAR capability of the five WTG's projects and without reactive compensation, each of the wind farms will not be able to keep the voltage schedule at their respective POI's consistent with the voltage schedule in the provided power flow cases for summer and winter. For each project, additional VAR compensating devices need to be installed in order to control the power factor at the POI to be within +/- 0.95 range.
2. For the five proposed projects, the stability simulations with sixty specified test disturbances did not show angular or voltage instability problems in the SPP system, except for the oscillating response that can be damped out by adding required capacitor banks to prior queued projects GEN-2004-010, GEN-2005-013 and a Statcon device for the study project GEN-2008-098.

Q: Stability Study for Group 9

SPP DISIS-2010-001 Group 9
Definitive Impact Study

Draft Report for

Southwest Power Pool

Prepared by:
Excel Engineering, Inc.

July 1, 2010

Principal Contributor:

William Quaintance, P.E.

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0. Certification

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the Laws of the State of **Nebraska**.

William Quaintance
Nebraska License Number: E13035

Excel Engineering, Inc.
Nebraska Authorization Number: CA1474

1. Background and Scope

The DISIS-2010-001 Group 9 Definitive Impact Study is a generation interconnection study performed by Excel Engineering, Inc. for its non-affiliated client, Southwest Power Pool (SPP). Its purpose is to study the impacts of interconnecting the projects shown in Table 1-1. The in-service date assumed for the generation addition was 2010. Both study projects are located in Madison County, Nebraska.

Table 1-1. Interconnection Requests to be Evaluated

Request	Size	Wind Turbine Model	Point of Interconnection
GEN-2006-044N02	100.5	GE 1.5MW (GEWTG1)	Madison County 230kV (570886), a new station in the Columbus (640133) – Ft Randall (652509) 230kV line.
GEN-2010-010	100.5	GE 1.5MW (GEWTG1)	Madison County 115kV (578001), a new station in the Petersburg (640318) – Madison (640263) 115kV line.

The previously-queued requests shown in Table 1-2 were included in this study and dispatched at 100% of rated capacity.

The study included stability analysis of each proposed interconnection request. Contingencies that resulted in a prior-queued project tripping off-line, if any, were re-run with the prior-queued project's voltage and frequency tripping disabled. A power factor analysis was performed for the wind farms in Table 1-1.

ATC (Available Transfer Capability) studies were not performed as part of this study. These studies will be required at the time transmission service is actually requested. Additional transmission upgrades may be required based on that analysis.

Study assumptions in general have been based on Excel's knowledge of the electric power system and on the specific information and data provided by SPP. The accuracy of the conclusions contained within this study is sensitive to the assumptions made with respect to generation additions and transmission improvements being contemplated. Changes in the assumptions of the timing of other generation additions or transmission improvements will affect this study's conclusions.

Table 1-2. Nearby Interconnection Requests Already in the Queue

Request	Size	Wind Turbine Model	Point of Interconnection
GEN-2006-020N	42	Vestas 3.0MW	Bloomfield 115kV (640084)
GEN-2006-038N019	79.5	GE 1.5MW (GEDFA)	Petersburg 115kV (640318)
GEN-2007-011N08	81	Vestas 3.0MW	Bloomfield 115kV (640084)
GEN-2006-037N1	75	GE 1.5MW (GEDFA)	Broken Bow 115kV (640089)
GEN-2003-021N	75	Vestas V82 1.65 MW	Ainsworth 115kV (640050)
GEN-2004-005N	30	GE 1.5MW (GEDFA)	St Francis 115kV (640351)
GEN-2006-038N005	80	CIMTR	Broken Bow (640089)
GEN-2006-044N	40.5	GE 1.5MW (GEWTG1)	Tap Neligh (640293) – Petersburg (640318) 115kV. (Bus 570644)
GEN-2007-011N06	75	GE 1.5MW (GEWTG1)	Petersburg 115kV (640318)
GEN-2007-011N09	75	GE 1.5MW (GEWTG1)	Bloomfield 115kV (640084)
GEN-2008-086N02	198	GE 1.5MW (GEWTG1)	Madison County 230kV (570886), a new station in the Columbus (640133) – Ft Randall (652509) 230kV line.

2. Executive Summary

The DISIS-2010-001 Group 9 Definitive Impact Study evaluated the impacts of interconnecting projects GEN-2006-044N02 and GEN-2010-010 to the SPP transmission system in Madison County, Nebraska.

As determined in the power flow study for these requests, the following transmission upgrades were included in the base cases for this stability study:

- Tap the Fort Randall – Columbus 230 kV line to create a new Madison County 230 kV bus.
- Add a 230/115 kV autotransformer and create a new Madison County 115 kV bus.
- Fold the Petersburg – Madison 115 kV line into the new Madison County 115 kV bus.
- Add a new Madison County – Norfolk 115 kV line.

The only stability issue found in this study was under-frequency tripping of prior-queued wind plant GEN-2008-086N02 for faults at Madison County 230. This bus is the POI for GEN-2008-086N02 and GEN-2006-044N02. When tripping was blocked, no further problems were found.

Power factor requirements were determined, and the study plants must install sufficient reactive power resources to meet the requirements listed in Table 4-2. These results indicate that GEN-2010-010 will need to add 5 Mvar of capacitors at its 34.5 kV substation bus, assuming they continue with the planned 0.95 power factor GE turbines. If GEN-2010-010 were to switch to 0.90 power factor GE turbines, no capacitors would be needed.

DISIS-2010-001 Group 9 should be able to reliably connect to the SPP transmission grid if the assumed transmission upgrades and reactive compensation requirements listed above are implemented.

3. Study Development and Assumptions

3.1 Simulation Tools

The Siemens Power Technologies, Inc. PSS/E power system simulation program Version 30.3.3 was used in this study.

3.2 Models Used

SPP provided its latest stability database cases for both summer and winter peak seasons. The study and prior-queued plant models were developed in a previous project and were included in the system models provided by SPP. A power flow one-line diagram of the study projects is shown in Figure 3-1. As the figure shows, each wind farm model includes explicit representation of the radial transmission line, if any; the substation transformer(s) from transmission voltage to 34.5 kV; and the substation reactive power device(s), if any. The remainder of each wind farm is represented by one or more lumped equivalents including a generator, a step-up transformer, and a collector system impedance. Steady-state and dynamic model data for the study plants are given in Appendix D.

To accommodate these projects, the Ft. Randall – Columbus 230 kV line and the Petersburg – Madison 115 kV line will be connected together with a new 230/115 kV autotransformer at the new Madison County 230/115 kV substation. A new 115 kV line will be built from this substation to Norfolk. Study project GEN-2006-044N02 and prior-queued project GEN-2008-086N02 will connect at the Madison County 230 kV bus. Study project GEN-2010-010 will connect at the Madison County 115 kV bus.

Project GEN-2006-044N02 was modeled with a 0.90 leading and lagging power factor capability at the generator terminals, while project GEN-2010-010 was modeled with 0.95 leading and lagging power factor at the generator terminals. Both plants will use GE 1.5 MW wind turbines. If these power factor capabilities change, this study would need to be repeated.

No special modeling is required of line relays in these cases, except for the special modeling related to the wind-turbine tripping.

3.3 Monitored Facilities

All generators and transmission buses in Areas 531, 534, 536, 540, 541, 640, 645, 650, and 652, were monitored.

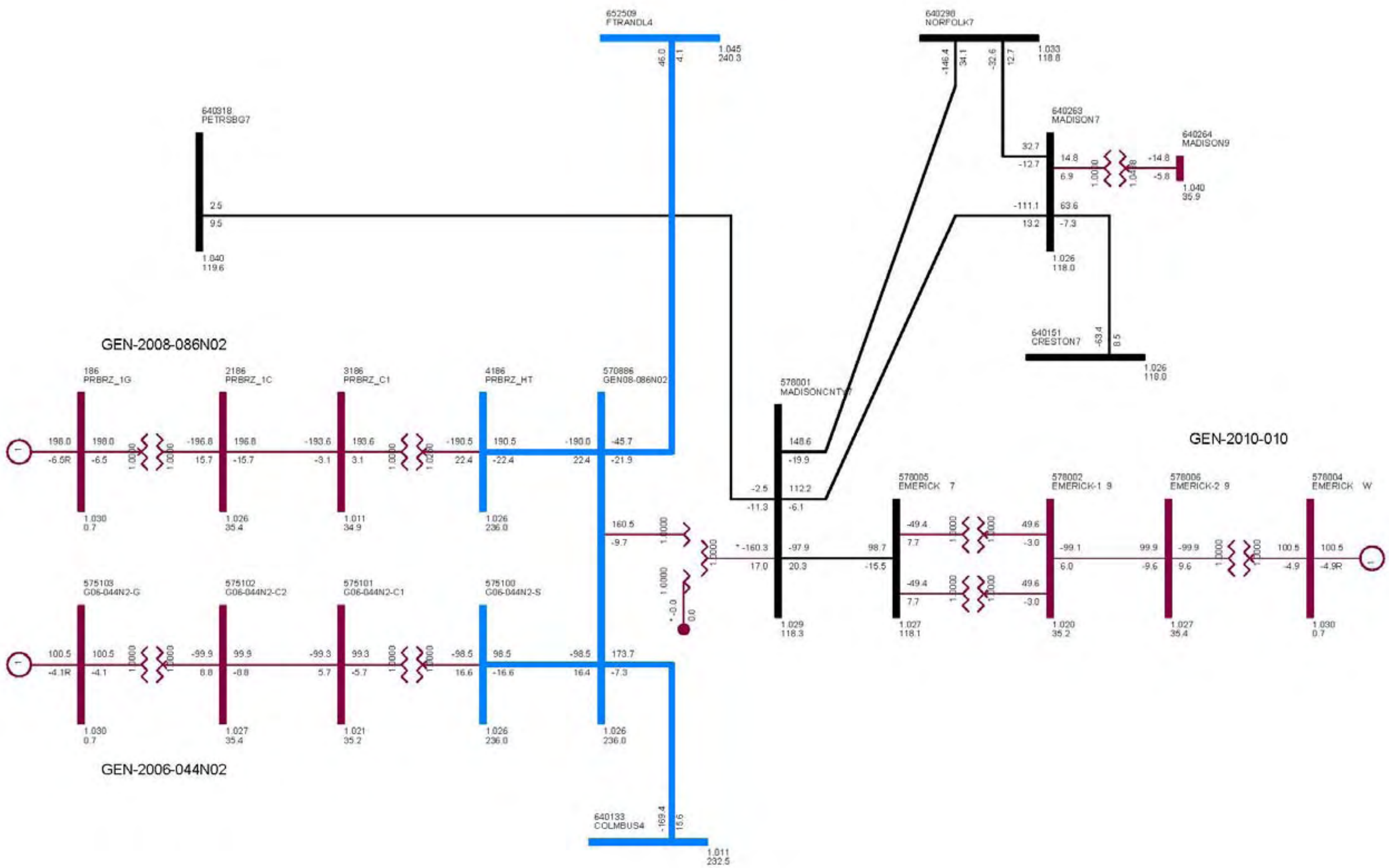

Figure 3-1. Power Flow One-line for GEN-2006-044N02 and GEN-2010-010

3.4 Performance Criteria

The wind generators must comply with FERC Order 661A on low voltage ride through for wind farms. Therefore, the wind generators should not trip off line for faults for under voltage relay actuation. If a wind generator trips off line, an appropriately sized SVC or STATCOM device may need to be specified to keep the wind generator on-line for the fault. SPP was consulted to determine if the addition of an SVC or STATCOM is warranted for the specific condition.

Contingencies that resulted in a prior-queued project tripping off-line, if any, were re-run with the prior-queued project's voltage and frequency tripping disabled to check for stability issues.

3.5 Performance Evaluation Methods

Since all of the interconnection requests are wind projects, a power factor analysis was performed. The power factor analysis consisted of modeling a var generator in each wind farm holding a voltage schedule at the POI. The voltage schedule was set equal to the higher of the voltage with the wind farm off-line or 1.0 per unit.

If the required power factor at the POI is beyond the capability of the studied wind turbines, then capacitor banks would be considered. Factors used in sizing capacitor banks would include two requirements of FERC Order 661A: the ability of the wind farm to ride through low voltage with and without capacitor banks and the ability of the wind farm to recover to pre-fault voltage. If a wind generator trips on high voltage, a leading power factor may be required.

ATC studies were not performed as part of this study. These studies will be required at the time transmission service is actually requested. Additional transmission facilities may be required based on subsequent ATC analysis.

Stability analysis was performed for each proposed interconnection request. Faults were simulated on transmission lines at the POIs and on other nearby transmission equipment. The faults in Table 3-1 were run for each case (three phase and single phase as noted).

Table 3-1. Fault Definitions for DISIS-2010-001 Group 9

Cont. No.	Cont. Name	Description
1	FLT01-3PH	3 phase fault on the GEN-2006-044N (570644) to Neligh (640293) 115kV line, near GEN-2006-044N. a. Apply fault at the GEN-2006-044N 115kVbus. b. Clear fault after 6.5 cycles by tripping the faulted line.
2	FLT02-3PH	3 phase fault on the GEN-2006-044N (570644) to Petersburg (640318) 115kV line, near GEN-2006-044N. a. Apply fault at the GEN-2006-044N 115kVbus. b. Clear fault after 6.5 cycles by tripping the faulted line.
3	FLT03-3PH	3 phase fault on the Albion (640054) to Petersburg (640318) 115kV line, near Petersburg. a. Apply fault at the Petersburg 115kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
4	FLT04-3PH	3 phase fault on the Albion (640054) to Genoa (640181) 115kV line, near Albion. a. Apply fault at the Albion 115kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
5	FLT05-3PH	3 phase fault on the Albion (640054) to Spalding (640347) 115kV line, near Albion. a. Apply fault at the Albion 115kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
6	FLT06-3PH	3 phase fault on the Clearwater (640113) to Neligh (640293) 115kV line, near Neligh. a. Apply fault at the Neligh 115kVbus. b. Clear fault after 6.5 cycles by tripping the faulted lines (Neligh-Clearwater-O’Neill 115 kV).
7	FLT07-3PH	3 phase fault on the County Line (640115) to Neligh (640293) 115kV line, near Neligh. a. Apply fault at the Neligh 115kVbus. b. Clear fault after 6.5 cycles by tripping the faulted lines (Neligh-CountyLine-BattleCreek-NorthNorfolk 115 kV).
8	FLT08-3PH	3 phase fault on the Creighton (640149) to Neligh (640293) 115kV line, near Neligh. a. Apply fault at the Neligh 115kVbus. b. Clear fault after 6.5 cycles by tripping the faulted line.
9	FLT09-3PH	3 phase fault on the O’Neill (640305) to Spencer (640349) 115kV line, near O’Neill. a. Apply fault at the O’Neill 115kVbus. b. Clear fault after 6.5 cycles by tripping the faulted lines (O’Neill-Spencer-Ft.Randall 115 kV).
10	FLT10-3PH	3 phase fault on the O’Neill (640305) to Emmett (640165) 115kV line, near O’Neill. a. Apply fault at the O’Neill 115kVbus. b. Clear fault after 6.5 cycles by tripping the faulted lines (O’Neill-Emmet-Atkinson-Stuart-Ainsworth 115 kV).
11	FLT11-3PH	3 phase fault on the Bloomfield (640084) to Gavins (652511) 115kV line, near Bloomfield. a. Apply fault at the Bloomfield 115kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
12	FLT12-3PH	3 phase fault on the Hartington (640212) to Gavins (652511) 115kV line, near Hartington. a. Apply fault at the Gavins Point 115kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.

Cont. No.	Cont. Name	Description
13	FLT13-3PH	3 phase fault on the Yankton Jct (660006) to Gavins (652511) 115kV line, near Yankton Jct a. Apply fault at the Yankton Jct 115kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
14	FLT14-3PH	3 phase fault on the Columbus (640133) to Shell Creek (640343) 230kV line, near Columbus a. Apply fault at the Columbus 230kV bus. b. Clear fault after 6.0 cycles by tripping the faulted line.
15	FLT15-3PH	3 phase fault on the Columbus (640133) to Columbus West (640131) 230kV line, near Columbus a. Apply fault at the Columbus 230kV bus. b. Clear fault after 6.0 cycles by tripping the faulted line.
16	FLT16-3PH	3 phase fault on the Columbus (640133) to East Columbus (640126) 230kV line, near Columbus a. Apply fault at the Columbus 230kV bus. b. Clear fault after 6.0 cycles by tripping the faulted line.
17	FLT17-3PH	3 phase fault on the GEN-2010-010 (570886) to Columbus (640133) 230kV line, near GEN-2010-010 a. Apply fault at the GEN-2010-010 230V bus. b. Clear fault after 6.0 cycles by tripping the faulted line.
18	FLT18-3PH	3 phase fault on the GEN-2010-010 (570886) to Fort Randall (652509) 230kV line, near GEN-2010-010 a. Apply fault at the GEN-2010-010 230V bus. b. Clear fault after 6.0 cycles by tripping the faulted line.
19	FLT19-3PH	3 phase fault on the Fort Randall (652509) to Fort Thompson (652507) 230kV line, near Fort Randall a. Apply fault at the Ft. Randall 230V bus. b. Clear fault after 6.0 cycles by tripping the faulted line.
20	FLT20-3PH	3 phase fault on the Fort Randall (652509) to Utica Jct (652526) 230kV line, near Fort Randall a. Apply fault at the Fort Randall 230V bus. b. Clear fault after 6.0 cycles by tripping the faulted line.
21	FLT21-3PH	3 phase fault on the Fort Randall (652509) to Lake Platt (652516) 230kV line, near Fort Randall a. Apply fault at the Fort Randal 230V bus. b. Clear fault after 6.0 cycles by tripping the faulted line.
22	FLT22-3PH	3 phase fault on the Fort Randall (652509) to Sioux City (652565) 230kV line, near Fort Randall a. Apply fault at the Fort Randal 230V bus. b. Clear fault after 6.0 cycles by tripping the faulted line.
23	FLT23-3PH	3 phase fault on the Kelly 230/115 kV auto at the 115kV (640134) a. Apply fault at the Kelly 115kV bus. b. Clear fault after 5.5 cycles by tripping autotransformer.

Cont. No.	Cont. Name	Description
24	FLT24-1PH	SLG fault on Bloomfield (640084) – Gavins Point (652511) 115 kV line, near Bloomfield. Stuck breaker at Gavins. a. Apply fault at Bloomfield 115 kV bus. b. Clear Bloomfield end of line at 5.5 cycles. Leave fault on end of open-ended line from Gavins Point. c. Clear Gavins Point 115 kV bus and fault at 18.0 cycles.
25	FLT25-1PH	SLG fault on Creighton (640149) – Neligh (640293) 115 kV line, near Creighton. Stuck breaker at Creighton. a. Apply fault at Creighton 115 kV bus. b. Clear Neligh end of line at 6.5 cycles. Leave fault on open-ended line from Creighton. c. Clear Creighton 115 kV bus and fault at 18.0 cycles.
26	FLT26-1PH	SLG fault on Gavins Point (652511) – Hartington (640212) 115 kV line, near Gavins Point. Stuck breaker at Gavins Point. a. Apply fault at Gavins Point 115 kV bus. b. Clear Hartington end of line at 6.5 cycles. Leave fault on open-ended line from Gavins Point. c. Clear Gavins Point 115 kV bus and fault at 18.0 cycles.
27	FLT27-1PH	SLG fault on Neligh (640293) - County Line (640115), near Neligh. Stuck PCB at Neligh. a. Apply fault at Neligh 115 kV bus. b. Clear North Norfolk end of Neligh-County Line-Battle Creek (640072)-North Norfolk (640296) 115 kV line at 6.5 cycles. Leave fault on open-ended line. c. Clear Neligh 115 kV bus and fault at 18.0 cycles.
28	FLT28-1PH	SLG fault on Albion (640054) – Genoa (640181) 115 kV line near Albion. Stuck PCB at Albion. a. Apply fault on Albion 115 kV bus. b. Clear Genoa end of Albion-Genoa 115 kV line at 6.5 cycles. Leave fault on open-ended line. c. Clear Albion 115 kV bus and fault at 18.0 cycles.
29	FLT29-1PH	SLG fault on Columbus (640133) – Columbus West (640131) 230 kV line. Stuck PCB at Columbus. a. Apply fault on Columbus 230 kV bus. b. Clear Columbus West end of line at 6.0 cycles. Leave fault on open-ended line. c. Clear Columbus 230 kV bus and fault at 14.5 cycles.
30	FLT30-3PH	3 phase fault on Gavins Point (652511) – Bloomfield (640084) 115 kV line with prior outage of Neligh (640293) – County Line (640115) 115 kV. a. Prior Outage: Neligh – County Line 115 kV b. Apply 3 phase fault on Bloomfield 115 kV bus. c. Clear fault after 6.5 cycles and trip faulted Gavins Point – Bloomfield 115 kV line.
31	FLT31-3PH	3 phase fault on Albion (640054) – Petersburg (640318) 115 kV line with prior outage of Neligh (640293) – County Line (640115) 115 kV. a. Prior Outage: Neligh – County Line 115 kV b. Apply 3 phase fault on Petersburg 115 kV bus. c. Clear fault after 6.5 cycles and trip faulted Albion – Petersburg 115 kV line.
32	FLT32-3PH	3 phase fault on the Hoskins 230/115 kV autotransformer at the 115kV (640228) a. Apply fault at the Hoskins 115kV bus. b. Clear fault after 5.5 cycles by tripping the autotransformer
33	FLT33-3PH	3 phase fault on the Hoskins 345/115 kV autotransformer at the 115kV (640228) a. Apply fault at the Hoskins 115kV bus. b. Clear fault after 5.5 cycles by tripping the autotransformer

Cont. No.	Cont. Name	Description
34	FLT34-3PH	3 phase fault on the Ft. Randall 230/115 kV autotransformer at the 115kV (652510) a. Apply fault at the Ft. Randall 115kV bus. b. Clear fault after 5.5 cycles by tripping the autotransformer
35	FLT35-3PH	3 phase fault on the Madison County 230/115 kV autotransformer at the 115kV (578001) a. Apply fault at the Madison County 115kV bus. b. Clear fault after 5.5 cycles by tripping the autotransformer
36	FLT36-3PH	3 phase fault on the Shell Creek (640342) to Hoskins (640226) 345kV line, near Hoskins. a. Apply fault at the Hoskins 345kV bus. b. Clear fault after 4.5 cycles by tripping the faulted line.
37	FLT37-3PH	3 phase fault on the Raun (635200) to Hoskins (640226) 345kV line, near Hoskins. a. Apply fault at the Hoskins 345kV bus. b. Clear fault after 4.5 cycles by tripping the faulted line.
38	FLT38-3PH	3 phase fault on the Belden (640080) to Bloomfield (640084) 115kV line, near Belden. a. Apply fault at the Belden 115kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
39	FLT39-3PH	3 phase fault on the Madison (640263) to Creston (640151) 115kV line, near Madison. a. Apply fault at the Madison 115kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
40	FLT40-3PH	3 phase fault on the Madison (640263) to Norfolk (640298) 115kV line, near Madison. a. Apply fault at the Madison 115kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
41	FLT41-3PH	3 phase fault on the Madison County (578001) to Petersburg (640318) 115kV line, near Madison County. a. Apply fault at the Madison County 115kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
42	FLT42-3PH	3 phase fault on the Madison County (578001) to Madison (640263) 115kV line, near Madison County. a. Apply fault at the Madison County 115kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
43	FLT43-3PH	3 phase fault on Columbus (640133) to Shell Creek (640343) 230kV line with prior outage of GEN-2010-010 (570886) to Fort Randall (652509) 230kV line. a. Prior Outage: GEN-2010-010 – Fort Randall 230 kV b. Apply fault at the Columbus 230kV bus. c. Clear fault after 6.0 cycles by tripping the faulted line.
44	FLT44-3PH	3 phase fault on Columbus (640133) to Columbus West (640131) 230kV line with prior outage of GEN-2010-010 (570886) to Fort Randall (652509) 230kV line. a. Prior Outage: GEN-2010-010 – Fort Randall 230 kV b. Apply fault at the Columbus 230kV bus. c. Clear fault after 6.0 cycles by tripping the faulted line.
45	FLT45-3PH	3 phase fault on Columbus (640133) to East Columbus (640126) 230kV line with prior outage of GEN-2010-010 (570886) to Fort Randall (652509) 230kV line. a. Prior Outage: GEN-2010-010 – Fort Randall 230 kV b. Apply fault at the Columbus 230kV bus. c. Clear fault after 6.0 cycles by tripping the faulted line.

Cont. No.	Cont. Name	Description
46	FLT46-3PH	3 phase fault on Fort Randall (652509) to Fort Thompson (652507) 230kV line with prior outage of GEN-2010-010 (570886) to Columbus (640133) 230kV line. a. Prior Outage: GEN-2010-010 – Columbus 230 kV b. Apply fault at the Fort Randall 230kV bus. c. Clear fault after 6.0 cycles by tripping the faulted line.
47	FLT47-3PH	3 phase fault on Fort Randall (652509) to Utica Jct (652526) 230kV line with prior outage of GEN-2010-010 (570886) to Columbus (640133) 230kV line. a. Prior Outage: GEN-2010-010 – Columbus 230 kV b. Apply fault at the Fort Randall 230kV bus. c. Clear fault after 6.0 cycles by tripping the faulted line.
48	FLT48-3PH	3 phase fault on Fort Randall (652509) to Lake Platt (652516) 230kV line with prior outage of GEN-2010-010 (570886) to Columbus (640133) 230kV line. a. Prior Outage: GEN-2010-010 – Columbus 230 kV b. Apply fault at the Fort Randall 230kV bus. c. Clear fault after 6.0 cycles by tripping the faulted line.
49	FLT49-3PH	3 phase fault on Fort Randall (652509) to Sioux City (652565) 230kV line with prior outage of GEN-2010-010 (570886) to Columbus (640133) 230kV line. a. Prior Outage: GEN-2010-010 – Columbus 230 kV b. Apply fault at the Fort Randall 230kV bus. c. Clear fault after 6.0 cycles by tripping the faulted line.
50	FLT50-3PH	3 phase fault on Fort Randall 115 (652510) to 230 (652509) autotransformer with prior outage of GEN-2010-010 (570886) to Columbus (640133) 230kV line. a. Prior Outage: GEN-2010-010 – Columbus 230 kV b. Apply fault at the Fort Randall 115kV bus. c. Clear fault after 5.5 cycles by tripping the autotransformer.
51	FLT51-3PH	3 phase fault on the Madison County 230/115 kV autotransformer at the 230kV (570886) a. Apply fault at the Madison County 230kV bus. b. Clear fault after 5.5 cycles by tripping the autotransformer
52	FLT52-3PH	3 phase fault on the Madison County (578001) to Norfolk (640298) 115kV line, near Madison County. a. Apply fault at the Madison County 115kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.

4. Results and Observations

4.1 Stability Analysis Results

All faults were run for both summer and winter peak conditions. If a previously-queued generator tripped for any of these faults, the voltage and frequency tripping was disabled, and the fault was re-run to check for system stability.

Table 4-1 summarizes the overall results for all faults. Figure 4-1 through Figure 4-2 show representative summer peak season plots for a fault at the POI of each of the study projects. Complete sets of plots for both summer and winter peak seasons for each fault and each project are included in Appendices A and B.

The only issue seen in this Group 9 study is that GEN-2008-086N02 trips following faults 17, 18, and 51 in Summer and Winter peak cases. As an example, Figure 4-3 shows this tripping for fault 17 in the Summer peak case. All three of these disturbances are three-phase faults at the Madison County 230 kV bus, which is the POI for GEN-2008-086N02 and GEN-2006-044N02. The GEN-2008-086N02 under-frequency protection relay is the cause of this tripping. Figure 4-4 shows the bus frequencies within the GEN-2008-086N02 wind farm. The frequency dips as low as -0.13 per unit (52 Hz) after fault clearing before recovering in about 0.1 s.

All three of the Madison County plants GEN-2008-086N02, GEN-2006-044N02, and GEN-2010-010 are using GE 1.5 MW wind turbines with the GEWTG1 dynamic model. However, of these plants, only the GEN-2008-086N02 model includes the frequency tripping model FRQTPA, and this is the only plant that trips during the frequency dip.

When these faults were rerun with tripping of GEN-2008-086N02 disabled, no problems were found.

Table 4-1. Summary of Results

Cont. No.	Cont. Name	Description	Summer Peak Results	Winter Peak Results
1	FLT01-3PH	3 phase fault on the GEN-2006-044N to Neligh 115kV line, near GEN-2006-044N.	OK	OK
2	FLT02-3PH	3 phase fault on the GEN-2006-044N to Petersburg 115kV line, near GEN-2006-044N.	OK	OK
3	FLT03-3PH	3 phase fault on the Albion to Petersburg 115kV line, near Petersburg.	OK	OK
4	FLT04-3PH	3 phase fault on the Albion to Genoa 115kV line, near Albion.	OK	OK
5	FLT05-3PH	3 phase fault on the Albion to Spalding 115kV line, near Albion.	OK	OK
6	FLT06-3PH	3 phase fault on the Clearwater to Neligh 115kV line, near Neligh.	OK	OK
7	FLT07-3PH	3 phase fault on the County Line to Neligh 115kV line, near Neligh.	OK	OK
8	FLT08-3PH	3 phase fault on the Creighton to Neligh 115kV line, near Neligh.	OK	OK
9	FLT09-3PH	3 phase fault on the O'Neill to Spencer 115kV line, near O'Neill.	OK	OK
10	FLT10-3PH	3 phase fault on the O'Neill to Emmett 115kV line, near O'Neill.	OK	OK
11	FLT11-3PH	3 phase fault on the Bloomfield to Gavins 115kV line, near Bloomfield.	OK	OK
12	FLT12-3PH	3 phase fault on the Hartington to Gavins 115kV line, near Hartington.	OK	OK
13	FLT13-3PH	3 phase fault on the Yankton Jct to Gavins 115kV line, near Yankton Jct	OK	OK
14	FLT14-3PH	3 phase fault on the Columbus to Shell Creek 230kV line, near Columbus	OK	OK
15	FLT15-3PH	3 phase fault on the Columbus to Columbus West 230kV line, near Columbus	OK	OK
16	FLT16-3PH	3 phase fault on the Columbus to East Columbus 230kV line, near Columbus	OK	OK
17	FLT17-3PH	3 phase fault on the GEN-2010-010 to Columbus 230kV line, near GEN-2010-010	**G08-86N02 trips**	**G08-86N02 trips**
17-nt	FLT17-3PH-nt	3 phase fault on the GEN-2010-010 to Columbus 230kV line, near GEN-2010-010. Tripping disabled.	**OK**	**OK**
18	FLT18-3PH	3 phase fault on the GEN-2010-010 to Fort Randall 230kV line, near GEN-2010-010	**G08-86N02 trips**	**G08-86N02 trips**
18-nt	FLT18-3PH-nt	3 phase fault on the GEN-2010-010 to Fort Randall 230kV line, near GEN-2010-010 Tripping disabled.	**OK**	**OK**
19	FLT19-3PH	3 phase fault on the Fort Randall to Fort Thompson 230kV line, near Fort Randall	OK	OK
20	FLT20-3PH	3 phase fault on the Fort Randall to Utica Jct 230kV line, near Fort Randall	OK	OK

Cont. No.	Cont. Name	Description	Summer Peak Results	Winter Peak Results
21	FLT21-3PH	3 phase fault on the Fort Randall to Lake Platt 230kV line, near Fort Randall	OK	OK
22	FLT22-3PH	3 phase fault on the Fort Randall to Sioux City 230kV line, near Fort Randall	OK	OK
23	FLT23-3PH	3 phase fault on the Kelly 230/115 kV auto at the 115kV	OK	OK
24	FLT24-1PH	SLG fault on Bloomfield – Gavins Point 115 kV line, near Bloomfield. Stuck breaker at Gavins.	OK	OK
25	FLT25-1PH	SLG fault on Creighton – Neligh 115 kV line, near Creighton. Stuck breaker at Creighton.	OK	OK
26	FLT26-1PH	SLG fault on Gavins Point – Hartington 115 kV line, near Gavins Point. Stuck breaker at Gavins Point.	OK	OK
27	FLT27-1PH	SLG fault on Neligh - County Line, near Neligh. Stuck PCB at Neligh.	OK	OK
28	FLT28-1PH	SLG fault on Albion – Genoa 115 kV line near Albion. Stuck PCB at Albion.	OK	OK
29	FLT29-1PH	SLG fault on Columbus – Columbus West 230 kV line. Stuck PCB at Columbus.	OK	OK
30	FLT30-3PH	3 phase fault on Gavins Point – Bloomfield 115 kV line with prior outage of Neligh – County Line 115 kV.	OK	OK
31	FLT31-3PH	3 phase fault on Albion – Petersburg 115 kV line with prior outage of Neligh – County Line 115 kV.	OK	OK
32	FLT32-3PH	3 phase fault on the Hoskins 230/115 kV autotransformer at the 115kV	OK	OK
33	FLT33-3PH	3 phase fault on the Hoskins 345/115 kV autotransformer at the 115kV	OK	OK
34	FLT34-3PH	3 phase fault on the Ft. Randall 230/115 kV autotransformer at the 115kV	OK	OK
35	FLT35-3PH	3 phase fault on the Madison County 230/115 kV autotransformer at the 115kV	OK	OK
36	FLT36-3PH	3 phase fault on the Shell Creek to Hoskins 345kV line, near Hoskins.	OK	OK
37	FLT37-3PH	3 phase fault on the Raun to Hoskins 345kV line, near Hoskins.	OK	OK
38	FLT38-3PH	3 phase fault on the Belden to Bloomfield 115kV line, near Belden.	OK	OK
39	FLT39-3PH	3 phase fault on the Madison to Creston 115kV line, near Madison.	OK	OK
40	FLT40-3PH	3 phase fault on the Madison to Norfolk 115kV line, near Madison.	OK	OK
41	FLT41-3PH	3 phase fault on the Madison County to Petersburg 115kV line, near Madison County.	OK	OK
42	FLT42-3PH	3 phase fault on the Madison County to Madison 115kV line, near Madison County.	OK	OK

Cont. No.	Cont. Name	Description	Summer Peak Results	Winter Peak Results
43	FLT43-3PH	3 phase fault on Columbus to Shell Creek 230kV line with prior outage of GEN-2010-010 to Fort Randall 230kV line.	OK	OK
44	FLT44-3PH	3 phase fault on Columbus to Columbus West 230kV line with prior outage of GEN-2010-010 to Fort Randall 230kV line.	OK	OK
45	FLT45-3PH	3 phase fault on Columbus to East Columbus 230kV line with prior outage of GEN-2010-010 to Fort Randall 230kV line.	OK	OK
46	FLT46-3PH	3 phase fault on Fort Randall to Fort Thompson 230kV line with prior outage of GEN-2010-010 to Columbus 230kV line.	OK	OK
47	FLT47-3PH	3 phase fault on Fort Randall to Utica Jct 230kV line with prior outage of GEN-2010-010 to Columbus 230kV line.	OK	OK
48	FLT48-3PH	3 phase fault on Fort Randall to Lake Platt 230kV line with prior outage of GEN-2010-010 to Columbus 230kV line.	OK	OK
49	FLT49-3PH	3 phase fault on Fort Randall to Sioux City 230kV line with prior outage of GEN-2010-010 to Columbus 230kV line.	OK	OK
50	FLT50-3PH	3 phase fault on Fort Randall 115 to 230 autotransformer with prior outage of GEN-2010-010 to Columbus 230kV line.	OK	OK
51	FLT51-3PH	3 phase fault on the Madison County 230/115 kV autotransformer at the 230kV	**G08-86N02 trips**	**G08-86N02 trips**
51-nt	FLT51-3PH-nt	3 phase fault on the Madison County 230/115 kV autotransformer at the 230kV. Tripping disabled.	**OK**	**OK**
52	FLT52-3PH	3 phase fault on the Madison County to Norfolk 115kV line, near Madison County.	OK	OK

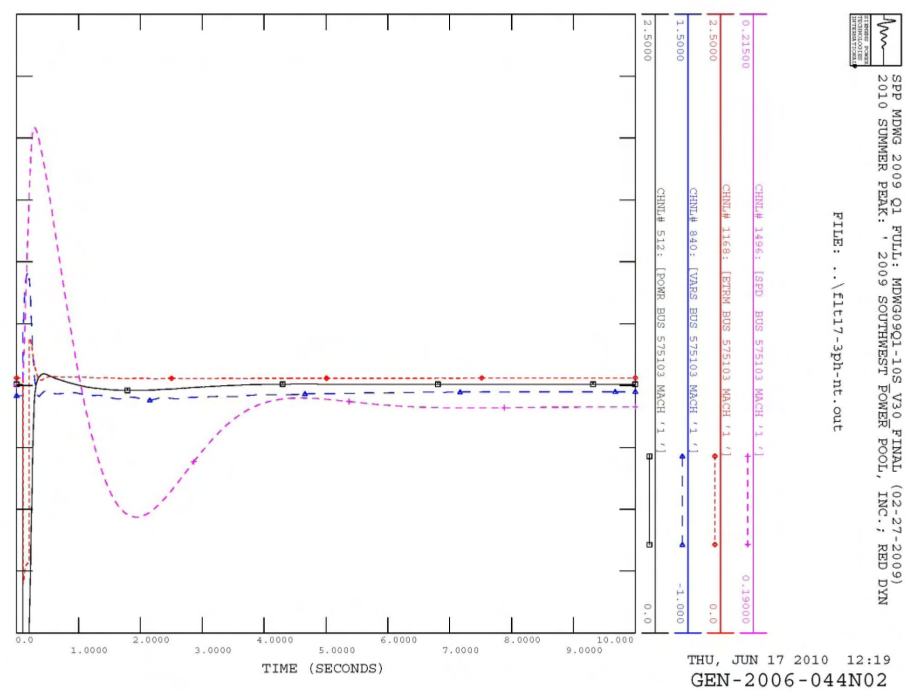

Figure 4-1. GEN-2006-044N02 Plot for Fault 17-nt – 3 phase fault on the Madison County to Columbus 230kV line, near Madison County

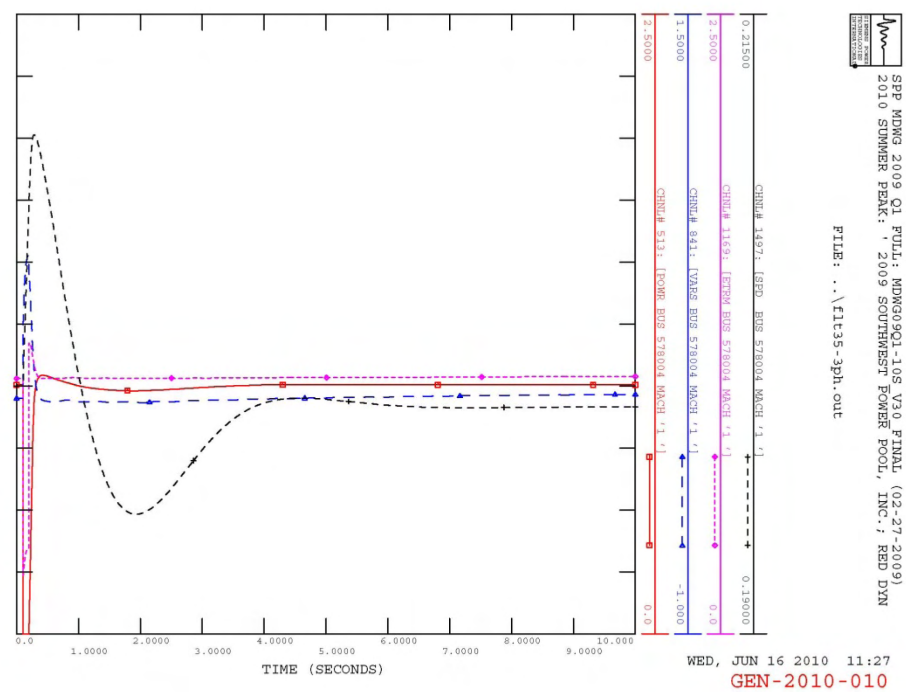

Figure 4-2. GEN-2010-010 Plot for Fault 35 – 3 phase fault on the Madison County 230/115 kV autotransformer at the 115kV side

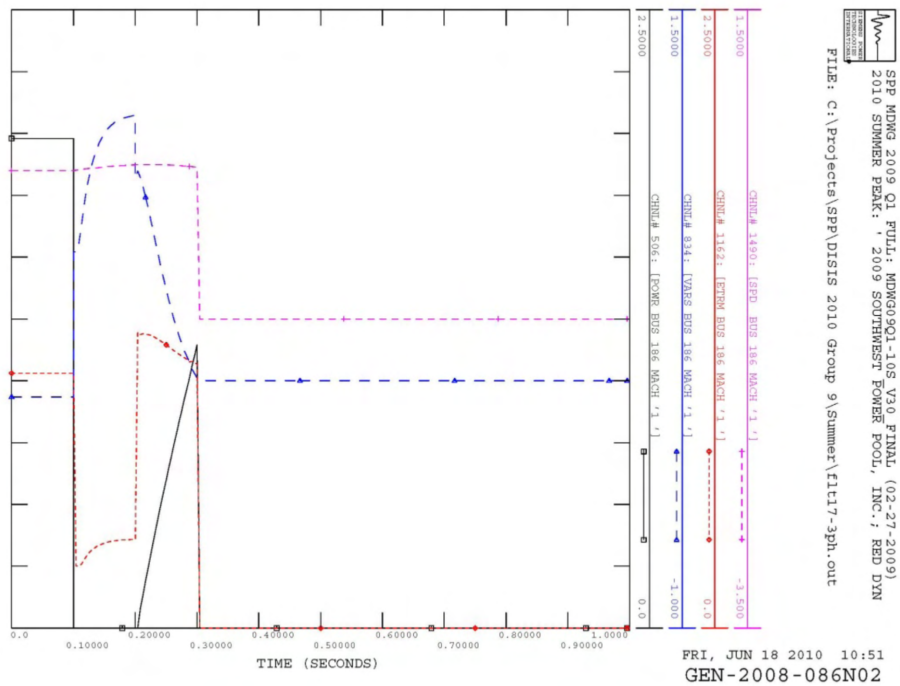

Figure 4-3. **GEN-2008-086N02 Plot for Fault 17 – 3 phase fault on the Madison County to Columbus 230kV line, near Madison County**

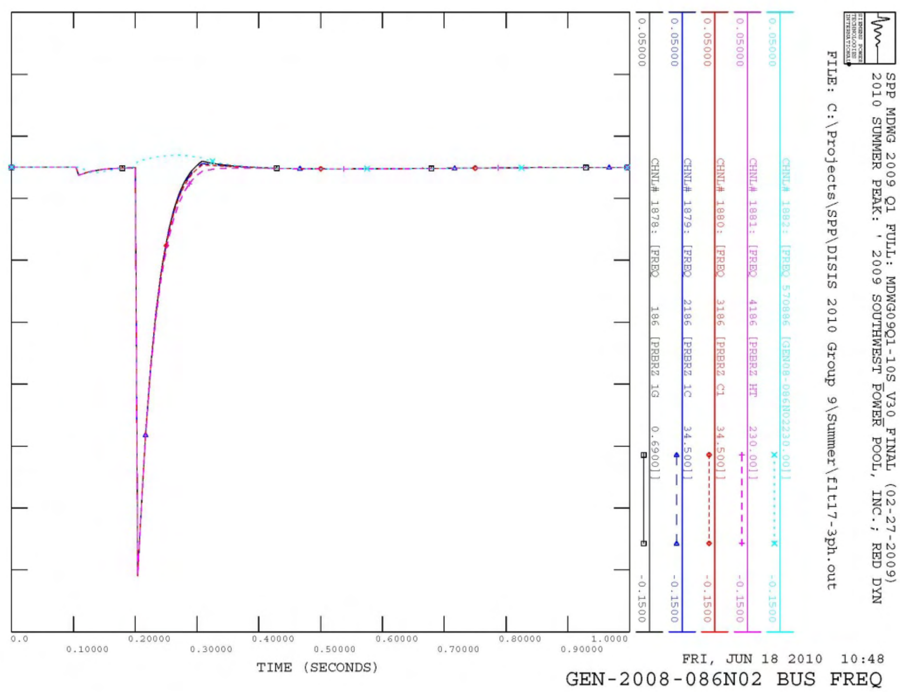

Figure 4-4. **GEN-2008-086N02 Bus Frequencies for Fault 17 – 3 phase fault on the Madison County to Columbus 230kV line, near Madison County**

4.2 Power Factor Requirements

All stability faults were tested as power flow contingencies to determine the power factor requirements for the wind farm study projects to maintain scheduled voltage at their respective points of interconnection (POI). The voltage schedules are set equal to the voltages at the POIs before the projects are added, with a minimum of 1.0 per unit. Fictitious reactive power sources were added to the study projects to maintain scheduled voltage during all studied contingencies. The MW and Mvar injections from the study projects at the POIs were recorded and the resulting power factors were calculated for all contingencies for summer peak and winter peak cases. The most leading and most lagging power factors determine the minimum power factor range capability that the study projects must install before commercial operation.

If more than one study project shared a single POI (none in this case), the projects were grouped together and a common power factor requirement was determined for those study projects. This ensures that none of the study projects is required to provide more or less than its fair share of the reactive power requirements at a single POI. *Prior-queued* projects at the same POI, if any, were not grouped with the study projects because their interconnection requirements were determined in previous studies. The voltages schedules of prior-queued and study projects at the same POI were coordinated.

Per FERC and SPP Tariff requirements, if the power factor needed to maintain scheduled voltage were less than 0.95 lagging, then the requirement would be set to 0.95 lagging. This limit was not reached for any study project. The limit for leading power factor requirement is also 0.95, and this limit was not reached for any study project. If the project never operated leading under any contingency, then the leading requirement is set to 1.0. Similar for lagging.

The final power factor requirements are shown in Table 4-2 below. These are only the minimum power factor ranges based on steady-state analysis. A project developer may install more capability than this if desired.

Based on the chosen 0.95 power factor capability for the GE wind turbines, GEN-2010-010 will need at least 5 Mvar of capacitors at the 34.5 kV substation bus to meet the lagging requirement at the POI. If the GE wind turbines were upgrade to the 0.90 power factor option, capacitors would not be needed.

The full details for each contingency in summer and winter peak cases are given in Appendix C.

Table 4-2. Power Factor Requirements [1]

Project	MW	Turbine	POI	Final PF Requirement	
				Lagging [2]	Leading [3]
GEN-2006-044N02	100.5	GE 1.5MW	Madison County 230kV	1.0	0.982
GEN-2010-010	100.5	GE 1.5MW	Madison County 115kV	0.976	0.987

Notes:

1. For each plant, the table shows the minimum required power factor capability at the point of interconnection that must be designed and installed with the plant. The power factor capability at the POI includes the net effect of the generators, transformers, line impedances, and any reactive compensation devices installed on the plant side of the meter. Installing more capability than the minimum requirement is acceptable.
2. Lagging is when the generating plant is supplying reactive power to the transmission grid. In this situation, the alternating current sinusoid "lags" behind the alternating voltage sinusoid, meaning that the current peaks shortly after the voltage.
3. Leading is when the generating plant is taking reactive power from the transmission grid. In this situation, the alternating current sinusoid "leads" the alternating voltage sinusoid, meaning that the current peaks shortly before the voltage.

5. Conclusions

The DISIS-2010-001 Group 9 Definitive Impact Study evaluated the impacts of interconnecting each of the projects shown below.

Table 5-1. Interconnection Requests Evaluated in this Study

Request	Size	Wind Turbine Model	Point of Interconnection
GEN-2006-044N02	100.5	GE 1.5MW (GEWTG1)	Madison County 230kV (570886), a new station in the Columbus (640133) – Ft Randall (652509) 230kV line.
GEN-2010-010	100.5	GE 1.5MW (GEWTG1)	Madison County 115kV (578001), a new station in the Petersburg (640318) – Madison (640263) 115kV line.

The only issue found was under-frequency tripping of prior-queued wind plant GEN-2008-086N02 for faults at Madison County 230. This bus is the POI for GEN-2008-086N02 and GEN-2006-044N02. When tripping was blocked, no further problems were found.

Power factor requirements were determined, and the study plants must install sufficient reactive power resources to meet the requirements listed in Table 4-2. These results indicate that GEN-2010-010 will need to add at least 5 Mvar of capacitors at its 34.5 kV substation bus, assuming they continue with the planned 0.95 power factor GE turbines. If GEN-2010-010 were to switch to 0.90 power factor GE turbines, no capacitors would be needed.

DISIS-2010-001 Group 9 should be able to reliably connect to the SPP transmission grid if the assumed transmission upgrades and reactive compensation requirements listed above are implemented.

Appendix A – Summer Peak Plots

See attachment.

Appendix B – Winter Peak Plots

See attachment.

Appendix C – Power Factor Details

See attachment.

Appendix D – Project Model Data

See attachment.

R: Stability Study for Group 10

No requests in Group 10

S: Stability Study for Group 11

Pterra Consulting

Technical Report R142-10

Impact Study for Generation Interconnection Request GEN-2010-001 Group 11 (Draft)

Submitted to

Southwest Power Pool

July 2010

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Contents

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Executive Summary

This report presents the results of impact study comprising of power factor and stability analyses of the proposed interconnection projects under DISIS-2010-001 Group 11 (the "Project") as described in the following table:

Request	Size (MW)	Wind Turbine Model	Point of Interconnection
GEN-2009-008	199.5	GE 1.5 MW	South Hays (530582) 230kV
GEN-2009-020	48.6	Vestas V90 1.8 MW	Balzine (530585) – Nekoma (530564) 69kV (Bus 575041)
GEN-2009-040	73.8	Vestas V90 1.8 MW	Smittyville (533338) – Knob Hill (533332) 115kV (Bus 560287)

The analysis was conducted through the Southwest Power Pool ("SPP") Tariff. Power factor analysis and transient stability simulations were conducted with all three projects in service at their full output.

Two base cases, summer 2010 and winter 2009 conditions, each comprising of a power flow and corresponding dynamics database, were provided by SPP. The three plants are already modeled in the base cases.

Power Factor Test

The results of the Power Factor analysis showed that with the MVar capability of the three WTG's and without reactive compensation, the wind farm will not be able to keep the voltage schedule at the POI consistent with the voltage schedule in the provided power flow cases for summer and winter.

For projects Gen-2009-008 and Gen-2009-040 involving the contingency Gen_2009_020-Nekoma 69 kV line, a fixed shunt capacitor needs to be added at the 34.5 kV bus of Gen_2009_020 in order to prevent voltage collapse. The capacitor sizes are 7 and 9 MVar for summer and winter cases, respectively.

Stability Simulations

Fifty-one (51) disturbances were considered for the transient stability simulations which include 3-phase faults as well as 1-phase to ground faults at the locations defined by SPP.

For contingency Gen_2009_020-Nekoma 69 kV line, the simulations showed oscillations in the voltage, power and frequency of the plant Gen_2009_020 in both the summer and winter cases. Addition of a 15 MVar SVC placed at the 34.5 kV bus of Gen_2009_020 plant was needed to eliminate these oscilations.

There are no impacts on the stability performance of the SPP system for the rest of the contingencies tested on the supplied base cases.

Section 1. Introduction

1.1. Project Overview

This report presents the results of impact study comprising of power factor and stability analyses of the proposed interconnection projects under DISIS-2010-001 Group 11 (the "Project") as described in Table 1-1:

Table 1-1 Projects Included Under DISIS-2010-001 (Group 11)

Request	Size (MW)	Wind Turbine Model	Point of Interconnection
GEN-2009-008	199.5	GE 1.5 MW	South Hays 230kV
GEN-2009-020	48.6	Vestas V90 1.8 MW	Balzine-Nekoma 69 kV line
GEN-2009-040	73.8	Vestas V90 1.8 MW	Smittyville-Knob Hill 115 kV line

Figures 1-1, 1-2, and 1-3 show the interconnection diagrams of the Project to SPP's system as modeled in the power flow cases.

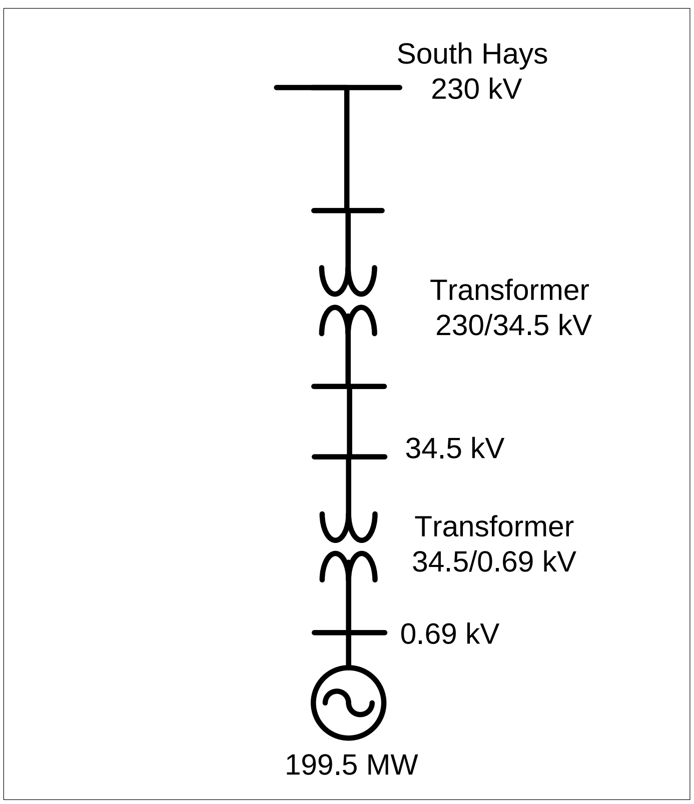


Figure 1-1 Power Flow Model for Gen-2009-008

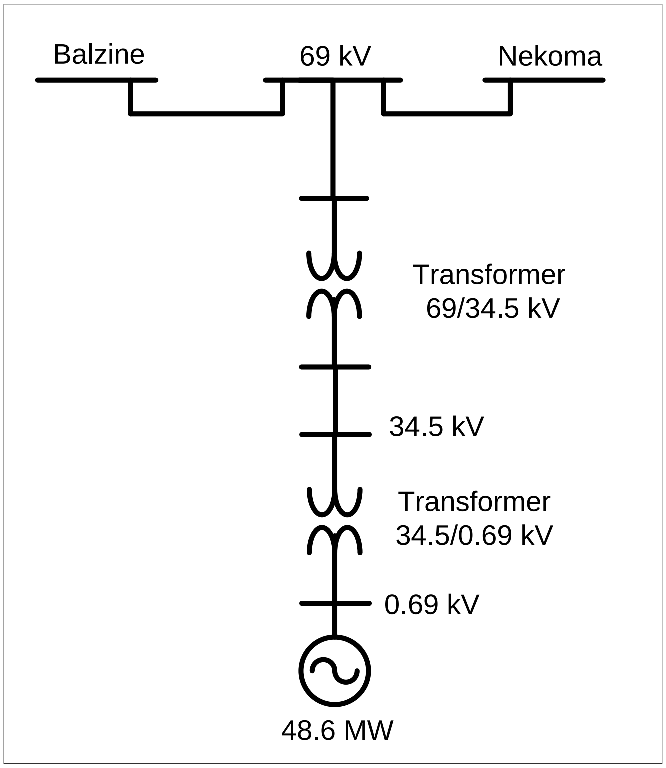


Figure 1-2 Power Flow Model for Gen-2009-020

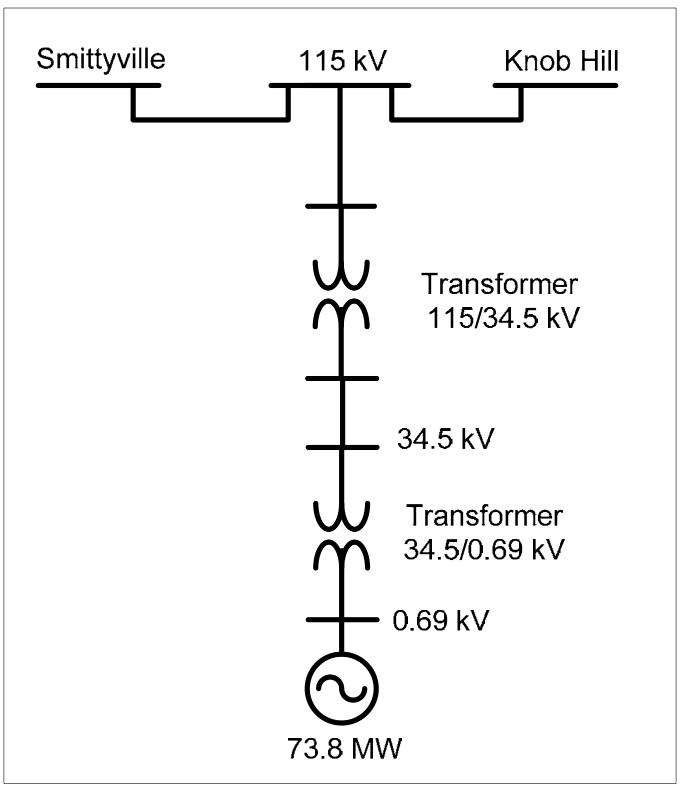


Figure 1-3 Power Flow Model for Gen-2009-040

Table 1-2 shows the list of prior queued projects modeled in the base case.

Table 1-2 List of Prior Queued Projects

Request	Size (MW)	Wind Turbine Model	Point of Interconnection
GEN-2003-006A	200	Vestas V90 3.0MW	Elm Creek 230kV (539639)
GEN-2003-019	250	GE 1.5MW	Smoky Hills 230kV (530592)
GEN-2006-031	75	Gas	Knoll 115kV (530561)
GEN-2006-032	200	Gamesa 2.0MW	South Hays 230kV (530582)
GEN-2008-092	200	GE 1.5MW	Knoll 230kV (530558)
GEN-2009-011	50	Gamesa 2.0MW	Tap Plainville (539686) – Phillipsburg (539685) 115kV. (Bus 570911)

1.2. Objectives

The objectives of the study are to conduct power factor analysis and to determine the impact on system stability of interconnecting the proposed wind farms to SPP's transmission system.

Section 2. Power Factor Analysis

2.1. Methodology

Power factor analysis was conducted for the Project using a methodology which is summarized as follows:

1. Model a VAR generator at the Project's 230, 115, or 69 kV bus, whichever is applicable. The VAR generator is set to hold a voltage schedule at the POI consistent with the voltage schedule in the provided power flow cases for summer and winter or 1.0 pu voltage, whichever is higher.

2. Steady state contingency analysis is conducted to determine the power factor necessary at the POI for each contingency.

3. According to the contingency analysis results, determine whether capacitors are required for the Project or not.

4. If the required power factor at the POI is beyond the capability of the studied wind turbines, capacitor banks are considered. The preference is to locate the capacitance banks on the 34.5 kV customer side. Factors to sizing capacitor banks include:

    4.1. The ability of the wind farm to meet FERC Order 661A (low voltage ride through) with and without capacitor banks.

    4.2. The ability of the wind farm to meet FERC Order 661A (wind farm recovery to pre-fault voltage).

    4.3. If wind farms trips on high voltage, power factor lower than unity may be required.

2.2. Analysis

Analysis was performed for each proposed project with all three projects in service. A var generator was modeled at each point of interconnection and was set to hold a voltage schedule at the POI consistent with the voltage schedule in the provided power flow cases. These voltages are summarized in the Table 2-1.

Table 2-1 Pre-contingency Voltages at POI

Request	Point of Interconnection	Size (MW)	Base Case Voltage (p.u.)	
			Summer Peak	Winter Peak
GEN-2009-008	South Hays (530582) 230kV	199.5	1.007	1.015
GEN-2009-020	Balzine (530585) – Nekoma (530564) 69kV (Bus 575041)	48.6	1.011	1.014
GEN-2009-040	Smittyville (533338) – Knob Hill (533332) 115kV (Bus 560287)	73.8	1.008	1.009

A. Gen-2009-008
POI: South Hays 230 kV

The var generator either supplies or absorbs reactive power at different contingencies as summarized in Table 2-2. The highest values obtained are as follows:

1. For the summer case, the var generator supplies 52.41 MVar for the outage of Knoll-Gen_2010_016 345 kV line and absorbs 6.28 MVar for the loss of Knoll-Saline 115 kV line. Power factors are 0.97 and near-unity, respectively.
2. For the winter case, the var generator supplies 49.99 MVar for the outage of Knoll-Gen_2010_016 345 kV line and absorbs 6.56 MVar for the loss of Mullergren 230/115 kV transformer. Power factors are 0.97 and near-unity, respectively.

For contingency Gen_2009_020-Nekoma 69 kV line, a fixed shunt capacitor has to be added at Gen_2009_020 34.5 kV bus in order to prevent voltage collapse. The capacitor sizes are 7 and 9 MVar for summer and winter cases, respectively.

Table 2-2 VAR Generator Output in Summer and Winter Peak Cases for GEN-2009-008

CASE	CONTINGENCY	PF @ POI	PF	MW @ POI	MVAR @ POI
SP	BASE CASE	1.00	Lag	194	0.80
	SETAB 345KV (531465) - 115KV (531464) XFMER	1.00	Lag	194	0.51
	KELLY (533217) 115KV – KELLY (532913) 161KV XFMER	1.00	Lag	194	0.74
	CONCORDIA (539657) 115KV – CONCORDIA (532658) 230KV XFMER	1.00	Lag	194	2.54
	MINGO 345KV (531451) - 115KV (531429) XFMER	1.00	Lag	194	0.35
	MULLERGREN (539678) 230KV – MULLERGREN (539679) 115KV XFMER	1.00	Lag	194	1.00
	KNOLL 230KV (530558) - 115KV (530561) XFMER	1.00	Lag	194	3.36
	NEKOMA (530564) 69KV – NEKOMA (530608) 115KV XFMER	1.00	Lag	194	0.82
	HEIZER (530563) 69KV – HEIZER (530601) 115KV XFMER	1.00	Lag	194	0.59
	HEIZER (530601) 115KV – MULLERGREN (539679) 230KV XFMER	1.00	Lag	194	5.63
	KNOLL 230KV (530558) - 345KV (560004) XFMER	0.99	Lead	194	20.59
	S. HAYS (530582) 230KV – S. HAYS (530553) 115KV XFMER	1.00	Lag	194	5.45
	MINGO (531451) - RED WILLOW (640325) 345KV LINE	1.00	Lead	194	10.96
	HOLCOMB (531449) - GEN-2007-040 (531000) 345KV LINE	1.00	Lag	194	1.23
	KNOLL (560004) - GEN-2010-016 (576704) 345KV LINE	0.97	Lead	194	52.41
	KNOLL (530558) - SMOKY HILLS (530592) 230KV LINE	1.00	Lead	194	12.10
	KNOLL (530558) - SOUTH HAYS (530582) 230KV LINE	0.97	Lead	194	47.14
	KNOLL (530561) - SALINE (530551) 115KV LINE	1.00	Lag	194	6.28
	KNOLL (530561) - REDLINE (530605) 115KV LINE	1.00	Lead	194	1.22
	SOUTH HAYS (530582) - MULLERGREN (539679) 230KV LINE	0.99	Lead	194	31.17
	KNOLL (530561) - N HAYS (530581) 115KV LINE	1.00	Lead	194	3.17
	PIONEER TAP (539642) - MULLERGREN (539678) 115KV LINE	1.00	Lag	194	0.86
	GEN-2009-040 (560287) - SMITTYVILLLE (533338) 115KV LINE	1.00	Lead	194	0.46
	GEN-2009-040 (560287) - KNOB HILL (533332) 115KV LINE	1.00	Lag	194	0.91
	GEN-2009-020 (575040) - BALZINE (530585) 69KV LINE	1.00	Lead	194	1.04
	GEN-2009-020 (575040) - NEKOMA (530564) 69KV LINE	1.00	Lead	194	2.75
	SENECA (533337) - KELLY (533217) 115KV LINE	1.00	Lag	194	0.58
	KNOB HILL (533332) - GREEN LEAF (539665) 115KV LINE	1.00	Lead	194	2.35

CASE	CONTINGENCY	PF @ POI	PF	MW @ POI	MVAR @ POI
	HANSTN (530566) - KINSLY (530578) 69KV LINE	1.00	Lag	194	0.03
	HANSTN (530566) - JETMOR (530579) 69KV LINE	1.00	Lag	194	0.96
	MULLERGREN (539679) – CIRCLE (532871) 230KV LINE	1.00	Lag	194	1.68
	MULLERGREN (539679) – SPEARVILLE (539695) 230KV LINE	0.99	Lead	194	23.36
WP	BASE CASE	1.00	Lag	194.0	0.28
	SETAB 345KV (531465) - 115KV (531464) XFMER	1.00	Lead	194.0	0.31
	KELLY (533217) 115KV – KELLY (532913) 161KV XFMER	1.00	Lag	194.0	0.07
	CONCORDIA (539657) 115KV – CONCORDIA (532658) 230KV XFMER	1.00	Lag	194.0	5.39
	MINGO 345KV (531451) - 115KV (531429) XFMER	1.00	Lead	194.0	0.57
	MULLERGREN (539678) 230KV – MULLERGREN (539679) 115KV XFMER	1.00	Lag	194.0	6.56
	KNOLL 230KV (530558) - 115KV (530561) XFMER	1.00	Lag	194.0	1.57
	NEKOMA (530564) 69KV – NEKOMA (530608) 115KV XFMER	1.00	Lag	194.0	0.28
	HEIZER (530563) 69KV – HEIZER (530601) 115KV XFMER	1.00	Lag	194.0	0.16
	HEIZER (530601) 115KV – MULLERGREN (539679) 230KV XFMER	1.00	Lag	194.0	1.82
	KNOLL 230KV (530558) - 345KV (560004) XFMER	0.99	Lead	194.0	19.77
	S. HAYS (530582) 230KV – S. HAYS (530553) 115KV XFMER	1.00	Lag	194.0	5.00
	MINGO (531451) - RED WILLOW (640325) 345KV LINE	1.00	Lead	194.0	10.75
	HOLCOMB (531449) - GEN-2007-040 (531000) 345KV LINE	1.00	Lag	194.0	2.17
	KNOLL (560004) - GEN-2010-016 (576704) 345KV LINE	0.97	Lead	194.0	49.99
	KNOLL (530558) - SMOKY HILLS (530592) 230KV LINE	1.00	Lead	194.0	10.95
	KNOLL (530558) - SOUTH HAYS (530582) 230KV LINE	0.98	Lead	194.0	36.60
	KNOLL (530561) - SALINE (530551) 115KV LINE	1.00	Lag	194.0	2.50
	KNOLL (530561) - REDLINE (530605) 115KV LINE	1.00	Lead	194.0	2.79
	SOUTH HAYS (530582) - MULLERGREN (539679) 230KV LINE	0.99	Lead	194.0	25.54
	KNOLL (530561) - N HAYS (530581) 115KV LINE	1.00	Lead	194.0	0.46
	PIONEER TAP (539642) - MULLERGREN (539678) 115KV LINE	1.00	Lead	194.0	0.21
	GEN-2009-040 (560287) - SMITTYVILLLE (533338) 115KV LINE	1.00	Lead	194.0	1.26
	GEN-2009-040 (560287) - KNOB HILL (533332) 115KV LINE	1.00	Lag	194.0	0.21
	GEN-2009-020 (575040) - BALZINE (530585) 69KV LINE	1.00	Lead	194.0	1.65
	GEN-2009-020 (575040) - NEKOMA (530564) 69KV LINE	1.00	Lead	194.0	10.48
	SENECA (533337) - KELLY (533217) 115KV LINE	1.00	Lag	194.0	0.22
	KNOB HILL (533332) - GREEN LEAF (539665) 115KV LINE	1.00	Lead	194.0	2.65
	HANSTN (530566) - KINSLY (530578) 69KV LINE	1.00	Lead	194.0	0.77
	HANSTN (530566) - JETMOR (530579) 69KV LINE	1.00	Lag	194.0	0.30
	MULLERGREN (539679) – CIRCLE (532871) 230KV LINE	1.00	Lag	194.0	3.95
	MULLERGREN (539679) – SPEARVILLE (539695) 230KV LINE	0.99	Lead	194.0	28.74

B. Gen-2009-020
POI: Balzine-Nekoma 69 kV Line

The VAR generator either supplies or absorbs reactive power at different contingencies as summarized in Table 2-3. The highest values obtained are as follows:

1. For the summer case, the var generator supplies 9.31 MVar for the outage of Gen_2009_020-Nekoma 69 kV line and absorbs 3.77 MVar for the loss of Gen_2009_020-Balzine 69 kV line . Power factors are 0.98 and near-unity, respectively.
2. For the winter case, the var generator supplies 8.58 MVar for the outage of Gen_2009_020-Nekoma 69 kV line and absorbs 1.18 MVar for the loss of Gen_2009_020-Balzine 69 kV line . Power factors are 0.98 and near-unity, respectively.

Table 2-3 VAR Generator Output in Summer and Winter Peak Cases for GEN-2009-020

CASE	CONTINGENCY	PF @ POI	PF	MW @ POI	MVAR @ POI
SP	BASE CASE	1.00	Lead	47.9	0.10
	SETAB 345KV (531465) - 115KV (531464) XFMER	1.00	Lead	47.9	1.18
	KELLY (533217) 115KV – KELLY (532913) 161KV XFMER	1.00	Lag	47.9	0.03
	CONCORDIA (539657) 115KV – CONCORDIA (532658) 230KV XFMER	1.00	Lag	47.9	0.12
	MINGO 345KV (531451) - 115KV (531429) XFMER	1.00	Lead	47.9	0.51
	MULLERGREN (539678) 230KV – MULLERGREN (539679) 115KV XFMER	1.00	Lag	47.9	0.05
	KNOLL 230KV (530558) - 115KV (530561) XFMER	1.00	Lag	47.9	0.14
	NEKOMA (530564) 69KV – NEKOMA (530608) 115KV XFMER	1.00	Lag	47.9	0.03
	HEIZER (530563) 69KV – HEIZER (530601) 115KV XFMER	1.00	Lead	47.9	0.09
	HEIZER (530601) 115KV – MULLERGREN (539679) 230KV XFMER	1.00	Lead	47.9	4.51
	KNOLL 230KV (530558) - 345KV (560004) XFMER	1.00	Lead	47.9	0.42
	S. HAYS (530582) 230KV – S. HAYS (530553) 115KV XFMER	1.00	Lag	47.9	0.10
	MINGO (531451) - RED WILLOW (640325) 345KV LINE	1.00	Lead	47.9	1.30
	HOLCOMB (531449) - GEN-2007-040 (531000) 345KV LINE	1.00	Lead	47.9	0.81
	KNOLL (560004) - GEN-2010-016 (576704) 345KV LINE	1.00	Lead	47.9	1.01
	KNOLL (530558) - SMOKY HILLS (530592) 230KV LINE	1.00	Lead	47.9	0.33
	KNOLL (530558) - SOUTH HAYS (530582) 230KV LINE	1.00	Lead	47.9	0.50
	KNOLL (530561) - SALINE (530551) 115KV LINE	1.00	Lag	47.9	0.13
	KNOLL (530561) - REDLINE (530605) 115KV LINE	1.00	Lead	47.9	0.06
	SOUTH HAYS (530582) - MULLERGREN (539679) 230KV LINE	1.00	Lead	47.9	0.25
	KNOLL (530561) - N HAYS (530581) 115KV LINE	1.00	Lead	47.9	0.04
	PIONEER TAP (539642) - MULLERGREN (539678) 115KV LINE	1.00	Lag	47.9	0.39
	GEN-2009-040 (560287) - SMITTYVILLLE (533338) 115KV LINE	1.00	Lead	47.9	0.07
	GEN-2009-040 (560287) - KNOB HILL (533332) 115KV LINE	1.00	Lag	47.9	0.04
	GEN-2009-020 (575040) - BALZINE (530585) 69KV LINE	1.00	Lag	47.9	3.77
	GEN-2009-020 (575040) - NEKOMA (530564) 69KV LINE	0.98	Lead	47.9	9.31
	SENECA (533337) - KELLY (533217) 115KV LINE	1.00	Lag	47.9	0.01
	KNOB HILL (533332) - GREEN LEAF (539665) 115KV LINE	1.00	Lead	47.9	0.11
	HANSTN (530566) - KINSLY (530578) 69KV LINE	1.00	Lag	47.9	0.38
	HANSTN (530566) - JETMOR (530579) 69KV LINE	1.00	Lag	47.9	0.65
	MULLERGREN (539679) – CIRCLE (532871) 230KV LINE	1.00	Lag	47.9	0.34
	MULLERGREN (539679) – SPEARVILLE (539695) 230KV LINE	1.00	Lead	47.9	1.30

CASE	CONTINGENCY	PF @ POI	PF	MW @ POI	MVAR @ POI
WP	BASE CASE	1.00	Lead	48.0	0.10
	SETAB 345KV (531465) - 115KV (531464) XFMER	1.00	Lead	48.0	1.12
	KELLY (533217) 115KV – KELLY (532913) 161KV XFMER	1.00	Lead	48.0	0.11
	CONCORDIA (539657) 115KV – CONCORDIA (532658) 230KV XFMER	1.00	Lag	48.0	0.28
	MINGO 345KV (531451) - 115KV (531429) XFMER	1.00	Lead	48.0	0.03
	MULLERGREN (539678) 230KV – MULLERGREN (539679) 115KV XFMER	1.00	Lead	48.0	1.88
	KNOLL 230KV (530558) - 115KV (530561) XFMER	1.00	Lead	48.0	0.08
	NEKOMA (530564) 69KV – NEKOMA (530608) 115KV XFMER	1.00	Lead	48.0	0.10
	HEIZER (530563) 69KV – HEIZER (530601) 115KV XFMER	1.00	Lead	48.0	0.11
	HEIZER (530601) 115KV – MULLERGREN (539679) 230KV XFMER	1.00	Lead	48.0	2.89
	KNOLL 230KV (530558) - 345KV (560004) XFMER	1.00	Lead	48.0	0.70
	S. HAYS (530582) 230KV – S. HAYS (530553) 115KV XFMER	1.00	Lead	48.0	0.00
	MINGO (531451) - RED WILLOW (640325) 345KV LINE	1.00	Lead	48.0	1.55
	HOLCOMB (531449) - GEN-2007-040 (531000) 345KV LINE	1.00	Lead	48.0	0.58
	KNOLL (560004) - GEN-2010-016 (576704) 345KV LINE	1.00	Lead	48.0	0.94
	KNOLL (530558) - SMOKY HILLS (530592) 230KV LINE	1.00	Lead	48.0	0.83
	KNOLL (530558) - SOUTH HAYS (530582) 230KV LINE	1.00	Lead	48.0	0.71
	KNOLL (530561) - SALINE (530551) 115KV LINE	1.00	Lead	48.0	0.06
	KNOLL (530561) - REDLINE (530605) 115KV LINE	1.00	Lead	48.0	0.19
	SOUTH HAYS (530582) - MULLERGREN (539679) 230KV LINE	1.00	Lead	48.0	1.24
	KNOLL (530561) - N HAYS (530581) 115KV LINE	1.00	Lead	48.0	0.12
	PIONEER TAP (539642) - MULLERGREN (539678) 115KV LINE	1.00	Lag	48.0	0.01
	GEN-2009-040 (560287) - SMITTYVILLLE (533338) 115KV LINE	1.00	Lead	48.0	0.25
	GEN-2009-040 (560287) - KNOB HILL (533332) 115KV LINE	1.00	Lead	48.0	0.11
	GEN-2009-020 (575040) - BALZINE (530585) 69KV LINE	1.00	Lag	48.0	1.18
	GEN-2009-020 (575040) - NEKOMA (530564) 69KV LINE	0.98	Lead	48.0	8.58
	SENECA (533337) - KELLY (533217) 115KV LINE	1.00	Lead	48.0	0.11
	KNOB HILL (533332) - GREEN LEAF (539665) 115KV LINE	1.00	Lead	48.0	0.29
	HANSTN (530566) - KINSLY (530578) 69KV LINE	1.00	Lead	48.0	0.15
	HANSTN (530566) - JETMOR (530579) 69KV LINE	1.00	Lag	48.0	0.11
	MULLERGREN (539679) – CIRCLE (532871) 230KV LINE	1.00	Lag	48.0	0.35
	MULLERGREN (539679) – SPEARVILLE (539695) 230KV LINE	1.00	Lead	48.0	0.47

C. Gen-2009-040
POI: Smittyville-Knob Hill 115 kV Line

The var generator either supplies or absorbs reactive power at different contingencies as summarized in Table 2-4. The highest values obtained are as follows:

1. For the summer case, the var generator supplies 15.75 MVar for the outage of Kelly 161/115 kV transformer and absorbs 9.92 MVar for the loss of Knob Hill-Green Leaf 115 kV line. Power factors are 0.98 and 0.99, respectively.

2. For the winter case, the var generator supplies 17.38 MVar for the outage of Seneca-Kelly 115 kV line and absorbs 9.79 MVar for the loss of Knob Hill-Green Leaf 115 kV line. Power factors are 0.97 and 0.99, respectively.

For contingency Gen_2009_020-Nekoma 69 kV line, a fixed shunt capacitor has to be added at Gen_2009_020 34.5 kV bus in order to prevent voltage collapse. The capacitor sizes are 7 and 9 MVar for summer and winter cases, respectively.

Table 2-4 VAR Generator Output in Summer and Winter Peak Cases for GEN-2009-040

CASE	CONTINGENCY	PF @ POI	PF	MW @ POI	MVAR @ POI
SP	BASE CASE	1.00	Lead	71.5	0.00
	SETAB 345KV (531465) - 115KV (531464) XFMER	1.00	Lag	71.5	0.00
	KELLY (533217) 115KV – KELLY (532913) 161KV XFMER	0.98	Lead	71.5	15.75
	CONCORDIA (539657) 115KV – CONCORDIA (532658) 230KV XFMER	1.00	Lag	71.5	6.83
	MINGO 345KV (531451) - 115KV (531429) XFMER	1.00	Lag	71.5	0.09
	MULLERGREN (539678) 230KV – MULLERGREN (539679) 115KV XFMER	1.00	Lag	71.5	0.99
	KNOLL 230KV (530558) - 115KV (530561) XFMER	1.00	Lead	71.5	0.00
	NEKOMA (530564) 69KV – NEKOMA (530608) 115KV XFMER	1.00	Lead	71.5	0.00
	HEIZER (530563) 69KV – HEIZER (530601) 115KV XFMER	1.00	Lead	71.5	0.00
	HEIZER (530601) 115KV – MULLERGREN (539679) 230KV XFMER	1.00	Lead	71.5	0.01
	KNOLL 230KV (530558) - 345KV (560004) XFMER	1.00	Lead	71.5	0.32
	S. HAYS (530582) 230KV – S. HAYS (530553) 115KV XFMER	1.00	Lag	71.5	0.05
	MINGO (531451) - RED WILLOW (640325) 345KV LINE	1.00	Lead	71.5	1.40
	HOLCOMB (531449) - GEN-2007-040 (531000) 345KV LINE	1.00	Lag	71.5	0.16
	KNOLL (560004) - GEN-2010-016 (576704) 345KV LINE	1.00	Lead	71.5	0.24
	KNOLL (530558) - SMOKY HILLS (530592) 230KV LINE	1.00	Lag	71.5	0.07
	KNOLL (530558) - SOUTH HAYS (530582) 230KV LINE	1.00	Lead	71.5	0.33
	KNOLL (530561) - SALINE (530551) 115KV LINE	1.00	Lag	71.5	1.09
	KNOLL (530561) - REDLINE (530605) 115KV LINE	1.00	Lag	71.5	0.11
	SOUTH HAYS (530582) - MULLERGREN (539679) 230KV LINE	1.00	Lag	71.5	0.22
	KNOLL (530561) - N HAYS (530581) 115KV LINE	1.00	Lead	71.5	0.01
	PIONEER TAP (539642) - MULLERGREN (539678) 115KV LINE	1.00	Lag	71.5	0.81
	GEN-2009-040 (560287) - SMITTYVILLLE (533338) 115KV LINE	1.00	Lead	71.5	5.26
	GEN-2009-040 (560287) - KNOB HILL (533332) 115KV LINE	1.00	Lag	71.5	5.26
	GEN-2009-020 (575040) - BALZINE (530585) 69KV LINE	1.00	Lag	71.5	0.01
	GEN-2009-020 (575040) - NEKOMA (530564) 69KV LINE	1.00	Lead	71.5	0.10
	SENECA (533337) - KELLY (533217) 115KV LINE	0.98	Lead	71.5	14.64
	KNOB HILL (533332) - GREEN LEAF (539665) 115KV LINE	0.99	Lag	71.5	9.92
	HANSTN (530566) - KINSLY (530578) 69KV LINE	1.00	Lag	71.5	0.01
	HANSTN (530566) - JETMOR (530579) 69KV LINE	1.00	Lead	71.5	0.01
	MULLERGREN (539679) – CIRCLE (532871) 230KV LINE	1.00	Lead	71.5	0.28
	MULLERGREN (539679) – SPEARVILLE (539695) 230KV LINE	1.00	Lag	71.5	0.22
WP	BASE CASE	1.00	Lag	71.5	1.78
	SETAB 345KV (531465) - 115KV (531464) XFMER	1.00	Lag	71.5	0.16
	KELLY (533217) 115KV – KELLY (532913) 161KV XFMER	0.99	Lead	71.5	12.40
	CONCORDIA (539657) 115KV – CONCORDIA (532658) 230KV XFMER	0.99	Lag	71.5	9.29
	MINGO 345KV (531451) - 115KV (531429) XFMER	1.00	Lead	71.5	0.03
	MULLERGREN (539678) 230KV – MULLERGREN (539679) 115KV XFMER	1.00	Lag	71.5	1.17
	KNOLL 230KV (530558) - 115KV (530561) XFMER	1.00	Lag	71.5	0.07
	NEKOMA (530564) 69KV – NEKOMA (530608) 115KV XFMER	1.00	Lag	71.5	0.18

CASE	CONTINGENCY	PF @ POI	PF	MW @ POI	MVAR @ POI
	HEIZER (530563) 69KV – HEIZER (530601) 115KV XFMER	1.00	Lag	71.5	0.18
	HEIZER (530601) 115KV – MULLERGREN (539679) 230KV XFMER	1.00	Lag	71.5	0.18
	KNOLL 230KV (530558) - 345KV (560004) XFMER	1.00	Lead	71.5	0.44
	S. HAYS (530582) 230KV – S. HAYS (530553) 115KV XFMER	1.00	Lag	71.5	0.22
	MINGO (531451) - RED WILLOW (640325) 345KV LINE	1.00	Lead	71.5	1.60
	HOLCOMB (531449) - GEN-2007-040 (531000) 345KV LINE	1.00	Lag	71.5	0.33
	KNOLL (560004) - GEN-2010-016 (576704) 345KV LINE	1.00	Lead	71.5	0.28
	KNOLL (530558) - SMOKY HILLS (530592) 230KV LINE	1.00	Lag	71.5	0.12
	KNOLL (530558) - SOUTH HAYS (530582) 230KV LINE	1.00	Lead	71.5	0.35
	KNOLL (530561) - SALINE (530551) 115KV LINE	1.00	Lag	71.5	0.93
	KNOLL (530561) - REDLINE (530605) 115KV LINE	1.00	Lag	71.5	0.28
	SOUTH HAYS (530582) - MULLERGREN (539679) 230KV LINE	1.00	Lag	71.5	0.19
	KNOLL (530561) - N HAYS (530581) 115KV LINE	1.00	Lag	71.5	0.17
	PIONEER TAP (539642) - MULLERGREN (539678) 115KV LINE	1.00	Lag	71.5	0.04
	GEN-2009-040 (560287) - SMITTYVILLLE (533338) 115KV LINE	1.00	Lead	71.5	4.92
	GEN-2009-040 (560287) - KNOB HILL (533332) 115KV LINE	1.00	Lag	71.5	3.63
	GEN-2009-020 (575040) - BALZINE (530585) 69KV LINE	1.00	Lag	71.5	0.17
	GEN-2009-020 (575040) - NEKOMA (530564) 69KV LINE	1.00	Lead	71.5	0.22
	SENECA (533337) - KELLY (533217) 115KV LINE	0.97	Lead	71.5	17.38
	KNOB HILL (533332) - GREEN LEAF (539665) 115KV LINE	0.99	Lag	71.5	9.79
	HANSTN (530566) - KINSLY (530578) 69KV LINE	1.00	Lag	71.5	0.19
	HANSTN (530566) - JETMOR (530579) 69KV LINE	1.00	Lag	71.5	0.17
	MULLERGREN (539679) – CIRCLE (532871) 230KV LINE	1.00	Lead	71.5	0.37
	MULLERGREN (539679) – SPEARVILLE (539695) 230KV LINE	1.00	Lag	71.5	0.11

2.3. Conclusions

In order to hold a voltage schedule at the POI's of the three projects consistent with the voltage schedule in the provided power flow cases, the wind farm should control the power factor at the POI to be within the ± 0.95 range.

For projects Gen-2009-008 and Gen-2009-040 involving the contingency Gen_2009_020-Nekoma 69 kV line, fixed shunt capacitor needs to be added at the 34.5 kV bus of Gen_2009_020 in order to prevent voltage collapse. The capacitor sizes are 7 and 9 MVar for summer and winter cases, respectively.

3.1. Assumptions

The following assumptions were adopted for the dynamic simulations:

1. Constant maximum and uniform wind speed for the entire period of study.
2. Wind turbine control models with their default values.
3. Under/over voltage/frequency protection use manufacturer settings.

3.2. Faults Simulated

Fifty-one (51) faults were considered for the transient stability simulations which included three phase faults, as well as single phase line faults, at the locations defined by SPP. Single-phase line faults were simulated by applying a fault impedance to the positive sequence network at the fault location to represent the effect of the negative and zero sequence networks on the positive sequence network. The fault impedance was computed to give a positive sequence voltage at the specified fault location of approximately 60% of pre-fault voltage. This method is in agreement with SPP current practice. Prior queued projects shown in Table 1-2 and units in areas 520, 524, 525, 526, 531, 534, 536, 640, 645, and 650 were monitored in the simulations.

Table 3-1 shows the list of simulated contingencies. It also shows the fault clearing time and the time delay before re-closing for all the study contingencies.

Table 3-1 List of Simulated Faults

No.	Cont. Name	Description
1	FLT01-3PH	3 phase fault on the Setab 345kV (531465) to 115kV (531464) transformer, near the 345 kV bus. a. Apply fault at the Setab 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
2	FLT02-3PH	3 phase fault on the Mingo (531451) to Red Willow (640325) 345kV line, near Mingo. a. Apply fault at the Mingo 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
3	FLT03-1PH	Single phase fault on the line in previous fault. a. Apply fault. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
4	FLT04-3PH	3 phase fault on the Mingo 345kV (531451) to 115kV (531429) transformer, near the 345 kV bus. a. Apply fault at the Mingo 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
5	FLT05-3PH	3 phase fault on the Holcomb (531449) to GEN-2007-040 (531000) 345kV line, near Holcomb. a. Apply fault at the Holcomb 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
6	FLT06-1PH	Single phase fault on the line in previous fault. a. Apply fault. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.

No.	Cont. Name	Description
7	FLT07-3PH	3 phase fault on the Knoll (560004) to Gen-2010-016 (576704) 345kV line, near Knoll. a. Apply fault at the Knoll 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
8	FLT08-1PH	Single phase fault on the line in previous fault. a. Apply fault. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
9	FLT11-3PH	3 phase fault on the Knoll (530558) to Smoky Hills (530592) 230kV line, near Smoky Hills.. a. Apply fault at the Smoky Hills 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
10	FLT12-1PH	Single phase fault and sequence like previous
11	FLT13-3PH	3 phase fault on the Knoll (530558) to South Hays (530582) 230kV line, near Knoll. a. Apply fault at the Knoll 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
12	FLT14-1PH	Single phase fault and sequence like previous
13	FLT15-3PH	3 phase fault on the Knoll 230kV (530558) to 345kV (560004) transformer, near the 230kV bus. a. Apply fault at the Knoll 230kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
14	FLT16-3PH	3 phase fault on one circuit of the Knoll 230kV (530558) to 115kV (530561) transformer, near the 230kV bus. a. Apply fault at the Knoll 230kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
15	FLT17-3PH	3 phase fault on the Knoll (530561) to Saline (530551) 115kV line, near Knoll. a. Apply fault at the Knoll 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
16	FLT18-1PH	Single phase fault and sequence like previous
17	FLT19-3PH	3 phase fault on the Knoll (530561) to Redline (530605) 115kV line, near Knoll. a. Apply fault at the Knoll 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
18	FLT20-1PH	Single phase fault and sequence like previous
19	FLT21-3PH	3 phase fault on the South Hays (530582) to Mullergren (539679) 230kV line, near South Hays. a. Apply fault at the South Hays 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
20	FLT22-1PH	Single phase fault and sequence like previous
21	FLT23-3PH	3 phase fault on the Knoll (530561) to N Hays (530581) 115kV line, near Knoll. a. Apply fault at the Knoll 115kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
22	FLT24-1PH	Single phase fault and sequence like previous

No.	Cont. Name	Description
23	FLT25-3PH	3 phase fault on the Pioneer Tap (539642) to Mullergren (539678) 115kV line, near Pioneer Tap. a. Apply fault at the Pioneer Tap 115kV bus b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
24	FLT26-1PH	Single phase fault and sequence like previous
25	FLT28-3PH	3 phase fault on the GEN-2009-040 (560287) to Smittyvillle (533338) 115kV line, near GEN-2009-040. a. Apply fault at the GEN-2009-040 115kV bus b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
26	FLT29-1PH	Single phase fault and sequence like previous
27	FLT30-3PH	3 phase fault on the GEN-2009-040 (560287) to Knob Hill (533332) 115kV line, near GEN-2009-040. a. Apply fault at the GEN-2009-040 115kV bus b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
28	FLT31-1PH	Single phase fault and sequence like previous
29	FLT32-3PH	3 phase fault on the GEN-2009-020 (575040) to Balzine (530585) 69kV line, near GEN-2009-020. a. Apply fault at the GEN-2009-020 69kV bus b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
30	FLT33-1PH	Single phase fault and sequence like previous
31	FLT34-3PH	3 phase fault on the GEN-2009-020 (575040) to Nekoma (530564) 69kV line, near GEN-2009-020. a. Apply fault at the GEN-2009-020 69kV bus b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
32	FLT35-1PH	Single phase fault and sequence like previous
33	FLT36-3PH	3 phase fault on the Nekoma (530564) 69kV – Nekoma (530608) 115kV autotransformer on the 115kV bus a. Apply fault at the Nekoma 115 kV bus b. Clear fault after 5 cycles by tripping the faulted line.
34	FLT37-3PH	3 phase fault on the Heizer (530563) 69kV – Heizer (530601) 115kV transformer on the 115kV bus a. Apply fault at the Heizer 115 kV bus b. Clear fault after 5 cycles by tripping the faulted line.
35	FLT38-3PH	3 phase fault on one circuit of the Heizer (530601) 115kV – Mullergren (539679) 230kV transformer on the 115kV bus a. Apply fault at the Heizer 115 kV bus b. Clear fault after 5 cycles by tripping the faulted line.
36	FLT39-3PH	3 phase fault on the Mullergren (539679) 230kV – Mullergren (539679) 115kV transformer on the 230kV bus a. Apply fault at the Mullergren 115 kV bus b. Clear fault after 5 cycles by tripping the faulted line.
37	FLT40-3PH	3 phase fault on the S. Hays (530582) 230kV – S. Hays (530553) 115kV transformer on the 115kV bus a. Apply fault at the S. Hays 115 kV bus b. Clear fault after 5 cycles by tripping the faulted line.

No.	Cont. Name	Description
38	FLT41-3PH	3 phase fault on the Kelly (533217) 115kV – Kelly (532913) 161kV transformer on the 115kV bus a. Apply fault at the Kelly 115 kV bus b. Clear fault after 5 cycles by tripping the faulted line.
39	FLT42-3PH	3 phase fault on the Concordia (539657) 115kV – Concordia (532658) 230kV transformer on the 230kV bus a. Apply fault at the Concordia 230kV bus b. Clear fault after 5 cycles by tripping the faulted line.
40	FLT43-3PH	3 phase fault on the Seneca (533337) to Kelly (533217) 115kV line, near Kelly. a. Apply fault at the Kelly 115kV bus b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
41	FLT44-1PH	Single phase fault and sequence like previous
42	FLT47-3PH	3 phase fault on the Knob Hill (533332) to Green Leaf (539665) 115kV line, near Green Leaf. a. Apply fault at the Green Leaf 115kV bus b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
43	FLT48-1PH	Single phase fault and sequence like previous
44	FLT49-3PH	3 phase fault on the Hanstn (530566) to Kinsly (530578) 69kV line, near Hanstn. a. Apply fault at the Hanstn 69kV bus b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
45	FLT50-1PH	Single phase fault and sequence like previous
46	FLT51-3PH	3 phase fault on the Hanstn (530566) to Jetmor (530579) 69kV line, near Hanstn. a. Apply fault at the Hanstn 69kV bus b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
47	FLT52-1PH	Single phase fault and sequence like previous
48	FLT53-3PH	3 phase fault on the Mullergren (539679) – Circle (532871) 230kV line, near Mullergren. a. Apply fault at the Mullergren 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
49	FLT54-1PH	Single phase fault and sequence like previous
50	FLT55-3PH	3 phase fault on the Mullergren (539679) – Spearville (539695) 230kV line, near Mullergren. a. Apply fault at the Mullergren 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
51	FLT56-1PH	Single phase fault and sequence like previous

Table 3-2 shows the contingencies from the list provided by SPP which are not found in the power flow case provided.

Table 3-2 List of Faults Not Simulated

No.	Cont. Name	Description
1	FLT09-3PH	3 phase fault on the Knoll (530558) to Axtell (640065) 345kV line, near Knoll. a. Apply fault at the Knoll 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
2	FLT10-1PH	Single phase fault on the line in previous fault. a. Apply fault. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
3	FLT27-3PH	3 phase fault on the Smoky Hills 345/230kV autotransformer on the 230kV bus (530592) a. Apply fault at the Smoky Hills 230kV bus b. Clear fault after 5 cycles by tripping the faulted line.
4	FLT45-3PH	3 phase fault on the Knob Hill (533332) to Beatrice (640074) 115kV line, near Knob Hill. a. Apply fault at the Knob Hill 115kV bus b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
5	FLT46-1PH	Single phase fault and sequence like previous

Simulations were performed with a 0.1-second steady-state run followed by the appropriate disturbance as described in Table 3-1. Simulations were run for a minimum 10-second duration to confirm proper machine damping.

3.3. Simulation Results

For contingency Gen_2009_020-Nekoma 69 kV line, the stability simulations showed oscillations in the voltage, power and frequency of the plant Gen_2009_020. Addition of a 15 MVar SVC placed at the 34.5 kV bus of Gen_2009_020 plant was needed to eliminate these oscilations.

There are no impacts on the stability performance of the SPP system for the rest of the contingencies tested on the supplied base cases.

Section 4. Conclusions

The findings of the impact study for the proposed interconnection projects under DISIS-2010-001 (Group 11), namely Gen-2009-008, Gen-2009-020, and Gen-2009-040, considered at 100% of their proposed installed capacities are as follows:

1. The results of the power factor analysis showed that with the MVar capability of the project WTG's and without reactive compensation, each of the three wind farms will not be able to keep the voltage schedule at their respective POI's consistent with the voltage schedule in the provided power flow cases for summer and winter. For each project, additional VAR compensating devices need to be installed in order to control the power factor at their POI's to be within ±0.95 range.

   For projects Gen-2009-008 and Gen-2009-040 involving the contingency Gen_2009_020-Nekoma 69 kV line, fixed shunt capacitor needs to be added at the 34.5 kV bus Gen_2009_020 in order to prevent voltage collapse. The capacitor sizes are 7 and 9 MVar for the summer and winter cases, respectively.

2. The stability simulations showed oscillations in the voltage, power and frequency of the plant Gen_2009_020 for contingency Gen_2009_020-Nekoma 69 kV line in both the summer and winter cases. Addition of a 15 MVar SVC placed at the 34.5 kV bus of Gen_2009_020 plant was needed to eliminate these oscilations.

   There are no impacts on the stability performance of the SPP system for the rest of the contingencies tested on the supplied base cases.

T: Stability Study for Group 12

No requests in Group 12

U: Stability Study for Group 13

No requests in Group 13

V: Stability Study for Group 14

System Impact Study

DISIS-2010-001 (Group 14)

Southwest Power Pool (SPP)
July 26, 2010

By

BLACK & VEATCH

Table of Contents

EXECUTIVE SUMMARY

A transient stability study has been performed for Southwest Power Pool (SPP) Definitive Impact Study Interconnection Study Group 14 (DISIS-2010-001 Group 14) projects.

The DISIS-2010-001 Group 14 has two Interconnection Requests, GEN-2008-046 and GEN-2009-032S. The Interconnection Queue Position GEN-2008-046 is a wind farm of 200 MW capacity interconnected at Sunnyside 345 kV substation and the Interconnection Queue Position GEN-2009-032S is an installation of conventional generators with an aggregate capacity of 6.4 MW connected to Foster 138 kV substation.

The 2010 summer load flow case and 2009 winter load flow case together with the SPP SDDWG 2006 stability model were used as the basis for the transient stability analysis. The study was performed using Siemens PTI’s PSS/E program, which is an industry-wide accepted power system simulation program.

The power factor analysis indicated that the Gen-2008-046 wind farm will be required to maintain at least 0.944 power factor at the point of interconnection.

The study has not indicated any transient stability issues and the wind farm was found to stay connected during the contingencies that were studied.

Should any previously queued projects that were included in this study drop out then this System Impact Study may have to be revised to determine the impacts of this Interconnection Customer’s project on transmission facilities.

1. Introduction

This report discusses the results of a transient stability study performed for Southwest Power Pool (SPP) Definitive Impact Study Interconnection Customers Group 14 (DISIS-2010-001 Group 14).

Group 14 has two Interconnection Requests, Gen-2008-046 and GEN-2009-032S. The Interconnection Queue Position GEN-2008-046 is a wind farm with a capacity of 200 MW. This wind farm is proposed to be interconnected on the Sunnyside 345 kV bus. The Interconnection Queue Position GEN-2008-032S consists of conventional generators with an aggregate capacity of 6.4 MW. These generators are proposed to be interconnected with the Foster 138 kV bus. The system one line diagram of the area near the Queue Position GEN-2008-046 is shown in Figure 1.

The Customer has requested to study Vestas V90 1.8 MW wind turbine generators for GEN-2008-046. Transient Stability studies were conducted with the full outputs (100%) for Gen-2008-046 and GEN-2009-032S.

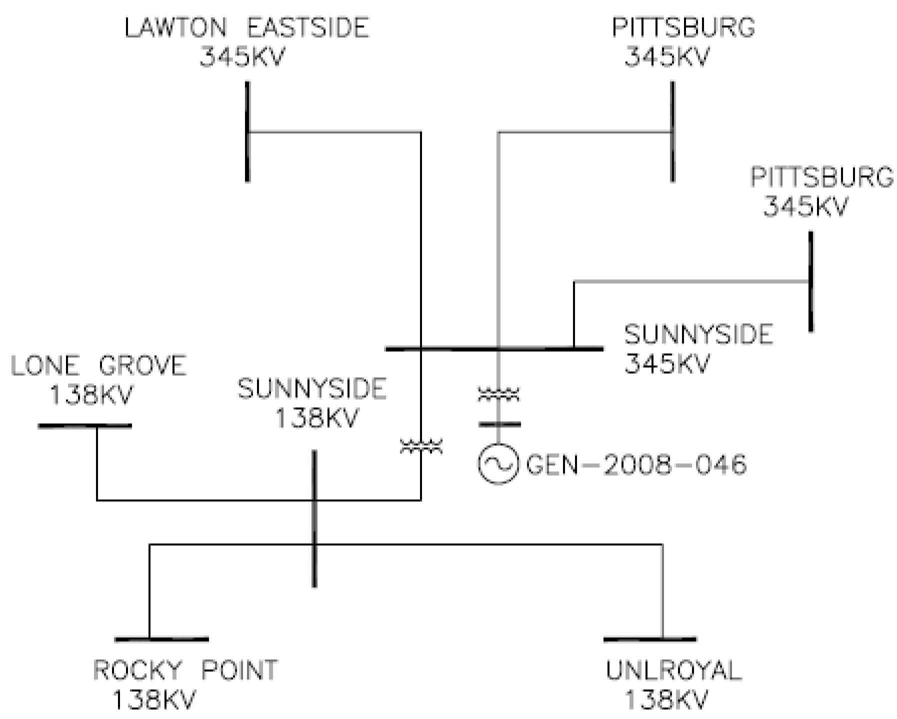


Figure 1: System One Line Diagram near GEN-2008-046

2. Stability Study Criteria

The 2010 summer load flow and 2009 winter load flow cases together with the SPP SDDWG 2006 stability model were used as the base case for the transient stability analysis. These models were provided by SPP.

Using Planning Standards approved by NERC, the following stability definition was applied in the Transient Stability Analysis:

"Power system stability is defined as that condition in which the difference of the angular positions of synchronous machine rotor becomes constant following an aperiodic system disturbance."

Disturbances such as three phase and single phase line faults were simulated for a specified duration and the synchronous machine rotor angles were monitored for their synchronism following the fault removal.

The ability of the wind generators to stay connected to the grid during the disturbances and during the fault recovery was also monitored.

3. Simulation Cases

Transient Stability studies were conducted for (i) 2010 summer and (ii) 2009 winter load flow cases.

Table 1 indicates the contingencies that were studied for each of the two cases.

Table 1: Study Cases

Cont. No.	Cont. Name	Description
1	FLT01-3PH	3 phase fault on the Foster (514959) to Discovery (514962) 138kV line, near Discovery. a. Apply fault at the Discovery 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
2	FLT02-1PH	*Single phase fault and sequence like previous*
3	FLT03-3PH	3 phase fault on the Foster (514959) to Newdomi (515387) 138kV line, near Newdomi. a. Apply fault at the Newdomi 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
4	FLT04-1PH	*Single phase fault and sequence like previous*
5	FLT05-3PH	3 phase fault on the Oak Creek (514960) to Santa Fe (514926) 138kV line, near Oak Creek. a. Apply fault at the Oak Creek 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
6	FLT06-1PH	*Single phase fault and sequence like previous*

Cont. No.	Cont. Name	Description
7	FLT07-3PH	3 phase fault on the Oak Creek (514960) to Moore (514955) 138kV line, near Moore. a. Apply fault at the Moore 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
8	FLT08-1PH	*Single phase fault and sequence like previous*
9	FLT09-3PH	3 phase fault on the Oak Creek (514960) to Wild Mry (514984) 138kV line, near Wild Mry. a. Apply fault at the Wild Mry 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
10	FLT10-1PH	*Single phase fault and sequence like previous*
11	FLT11-3PH	3 phase fault on the Trosper (514963) to Lighting Creek (514923) 138kV line, near Trosper. a. Apply fault at the Trosper 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
12	FLT12-1PH	*Single phase fault and sequence like previous*
13	FLT13-3PH	3 phase fault on one circuit of the Draper (514933) 138 kV to Draper (514934) 345kV transformer, on the 138kV bus. a. Apply fault at the Draper 138kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
14	FLT14-3PH	3 phase fault on the Sunnyside 345/138kV autotransformer on the 345kV bus (515136). a. Apply fault at Sunnyside 345kV. b. Clear fault after 5 cycles by tripping the faulted line.
15	FLT15-3PH	3 phase fault on the Sunnyside (515135) to Rocky Point (515164) 138kV line, near Sunnyside. a. Apply fault at the Sunnyside 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
16	FLT16-1PH	*Single phase fault and sequence like previous*
17	FLT17-3PH	3 phase fault on the Sunnyside (515135) to Lone Grove (515144) 138kV line, near Sunnyside. a. Apply fault at the Sunnyside 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
18	FLT18-1PH	*Single phase fault and sequence like previous*
19	FLT19-3PH	3 phase fault on the Sunnyside (515135) to Pooleville (515130) 138kV line, near Sunnyside. a. Apply fault at the Sunnyside 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
20	FLT20-1PH	*Single phase fault and sequence like previous*
21	FLT21-3PH	3 phase fault on the Sunnyside (515135) to Uniroyal (515137) 138kV line, near Uniroyal. a. Apply fault at the Uniroyal 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.

Cont. No.	Cont. Name	Description
22	FLT22-1PH	*Single phase fault and sequence like previous*
23	FLT23-3PH	3 phase fault on the Sunnyside (515136) to Pittsburgh (510907) 345kV line, near Sunnyside. a. Apply fault at the Sunnyside 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
24	FLT24-1PH	*Single phase fault and sequence like previous*
25	FLT25-3PH	3 phase fault on the Sunnyside (515136) to Lawton Eastside (511468) 345kV line, near Sunnyside. a. Apply fault at the Sunnyside 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
26	FLT26-1PH	*Single phase fault and sequence like previous*
27	FLT27-3PH	3 phase fault on the Sunnyside (515136) to Hugo (521157) 345kV line, near Sunnyside. a. Apply fault at the Sunnyside 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
28	FLT28-1PH	*Single phase fault and sequence like previous*
29	FLT29-3PH	3 phase fault on the Anadarko (511541) to Lawton Eastside (511468) 345kV line, near Lawton Eastside. a. Apply fault at the Lawton Eastside 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
30	FLT30-1PH	*Single phase fault and sequence like previous*
31	FLT31-3PH	3 phase fault on the Oklaunion (511456) to Lawton Eastside (511468) 345kV line, near Lawton Eastside. a. Apply fault at the Lawton Eastside 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
32	FLT32-1PH	*Single phase fault and sequence like previous*
33	FLT33-3PH	3 phase fault on the Hugo (521157) to Valiant (510911) 345kV line, near Hugo. a. Apply fault at the Hugo 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
34	FLT34-1PH	*Single phase fault and sequence like previous*
35	FLT35-3PH	3 phase fault on the Hugo (520948) 138kV to Hugo (521157) 345kV transformer, on the 138kV bus. a. Apply fault at the Hugo 138kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.

Cont. No.	Cont. Name	Description
36	FLT36-3PH	3 phase fault on the Pittsburg (510907) – Valiant (510911) 345kV line, near Pittsburg. a. Apply fault at the Pittsburg 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
37	FLT37-1PH	*Single phase fault and sequence like previous*
38	FLT38-3PH	3 phase fault on the Pittsburg (510907) – Kiowa (510925) 345kV line, near Kiowa. a. Apply fault at the Kiowa 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
39	FLT39-1PH	*Single phase fault and sequence like previous*
40	FLT40-3PH	3 phase fault on the Pittsburg (510907) – Seminole (515045) 345kV line, near Seminole. a. Apply fault at the Seminole 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
41	FLT41-1PH	*Single phase fault and sequence like previous*
42	FLT42-3PH	3 phase fault on the Pittsburg (510907) – Muskogee (515224) 345kV line, near Muskogee. a. Apply fault at the Muskogee 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
43	FLT43-1PH	*Single phase fault and sequence like previous*

4. System Modeling

The power flow and the dynamic data provided by SPP had already contained the models of GEN-2008-046 and GEN-2009-032S.

5. Power Factor Analysis

A power factor analysis was performed by modeling a VAR generator at high voltage bus of Gen-2008-046. The VAR generator was set to hold a voltage schedule of 1.0368 per unit at the POI, i.e., at Sunnyside 345 kV and all the contingencies listed in Table 1 were studied. Table 2 shows the calculated power factors that need to be maintained at the POI for each of the contingencies that were studied. The lowest power factor that would be required is 0.944 under the FLT14-3PH contingency.

Table 2: Required Power Factor

	Required power factor at POI	
Fault Case	**Summer Case**	**Winter Case**
FLT01-3PH	0.997 lead	0.997 lead
FLT03-3PH	0.997 lead	0.997 lead
FLT05-3PH	0.997 lead	0.997 lead
FLT07-3PH	0.997 lead	0.997 lead
FLT09-3PH	0.997 lead	0.997 lead
FLT11-3PH	0.997 lead	0.997 lead
FLT13-3PH	0.997 lead	0.997 lead
FLT14-3PH	0.977 lead	0.944 lead
FLT15-3PH	0.989 lead	0.998 lead
FLT17-3PH	0.998 lead	0.998 lead
FLT19-3PH	0.997 lead	0.997 lead
FLT21-3PH	0.986 lead	0.995 lead
FLT23-3PH	0.999 lag	0.995 lag
FLT25-3PH	0.985 lead	0.989 lead
FLT27-3PH	0.997 lag	0.993 lag
FLT29-3PH	0.998 lead	0.998 lead
FLT31-3PH	0.997 lead	0.995 lead
FLT33-3PH	0.994 lead	0.995 lead
FLT35-3PH	0.985 lead	0.987 lead
FLT36-3PH	1.000	1.000
FLT38-3PH	0.997 lead	0.997 lead
FLT40-3PH	0.978 lead	0.980 lead
FLT42-3PH	0.998 lead	0.998 lead

6. Simulation Results

Initial simulation was carried out without any disturbance to verify the numerical stability of the model and was confirmed to be stable. Table 3 provides the summary of the study results for the contingencies that were studied.

Table 3: Stability Study Results Summary

Fault Case	Summer Case	Winter Case
FLT01-3PH	- -	- -
FLT02-1PH	- -	- -
FLT03-3PH	- -	- -
FLT04-1PH	- -	- -
FLT05-3PH	- -	- -
FLT06-1PH	- -	- -
FLT07-3PH	- -	- -
FLT08-1PH	- -	- -
FLT09-3PH	- -	- -

Fault Case	**Summer Case**	**Winter Case**
FLT10-1PH	- -	- -
FLT11-3PH	- -	- -
FLT12-1PH	- -	- -
FLT13-3PH	- -	- -
FLT14-3PH	- -	- -
FLT15-3PH	- -	- -
FLT16-1PH	- -	- -
FLT17-3PH	- -	- -
FLT18-1PH	- -	- -
FLT19-3PH	- -	- -
FLT20-1PH	- -	- -
FLT21-3PH	- -	- -
FLT22-1PH	- -	- -
FLT23-3PH	- -	- -
FLT24-1PH	- -	- -
FLT25-3PH	- -	- -
FLT26-1PH	- -	- -
FLT27-3PH	- -	- -
FLT28-1PH	- -	- -
FLT29-3PH	- -	- -
FLT30-1PH	- -	- -
FLT31-3PH	- -	- -
FLT32-1PH	- -	- -
FLT33-3PH	- -	- -
FLT34-1PH	- -	- -
FLT35-3PH	- -	- -
FLT36-3PH	- -	- -
FLT37-1PH	- -	- -
FLT38-3PH	- -	- -
FLT39-1PH	- -	- -
FLT40-3PH	- -	- -
FLT41-1PH	- -	- -
FLT42-3PH	- -	- -
FLT43-1PH	- -	- -

T : Gen-2008-046 tripped due to angle deviation
UV : Gen-2009-032S tripped due to under voltage
PT : Post-Transient voltage issues encountered
S : Stability issues encountered

PQ : Prior queued project tripped
- - : Wind Farm did not trip

Figure 2 shows the system response for FLT01-3PH from the summer case.

7. Summary

A transient stability analysis was conducted for Southwest Power Pool (SPP) Definitive Impact Study Interconnection Customers Group 14 (DISIS-2010-001 Group 14). The study was conducted for two different power flow scenarios, i.e., one for summer peak and one for winter peak.

The power factor analysis indicated that the Gen-2008-046 wind farm will be required to maintain at least 0.944 power factor at the point of interconnection.

The study has not indicated any stability issues and the wind farm was found to be stayed connected to the grid during the contingencies studied.

Disclaimer

If any previously queued projects that were included in this study drop out, then this System Impact Study may have to be revised to determine the impacts of this Interconnection Customer's project on transmission facilities. Since this is also a preliminary System Impact Study, not all previously queued projects were assumed to be in service in this System Impact Study. If any of those projects are constructed, then this System Impact Study may have to be revised to determine the impacts of this Interconnection Customer's project on transmission facilities. In accordance with FERC and SPP procedures, the study cost for restudy shall be borne by the Interconnection Customer.

Figure 2: System Responses for FLT01-3PH

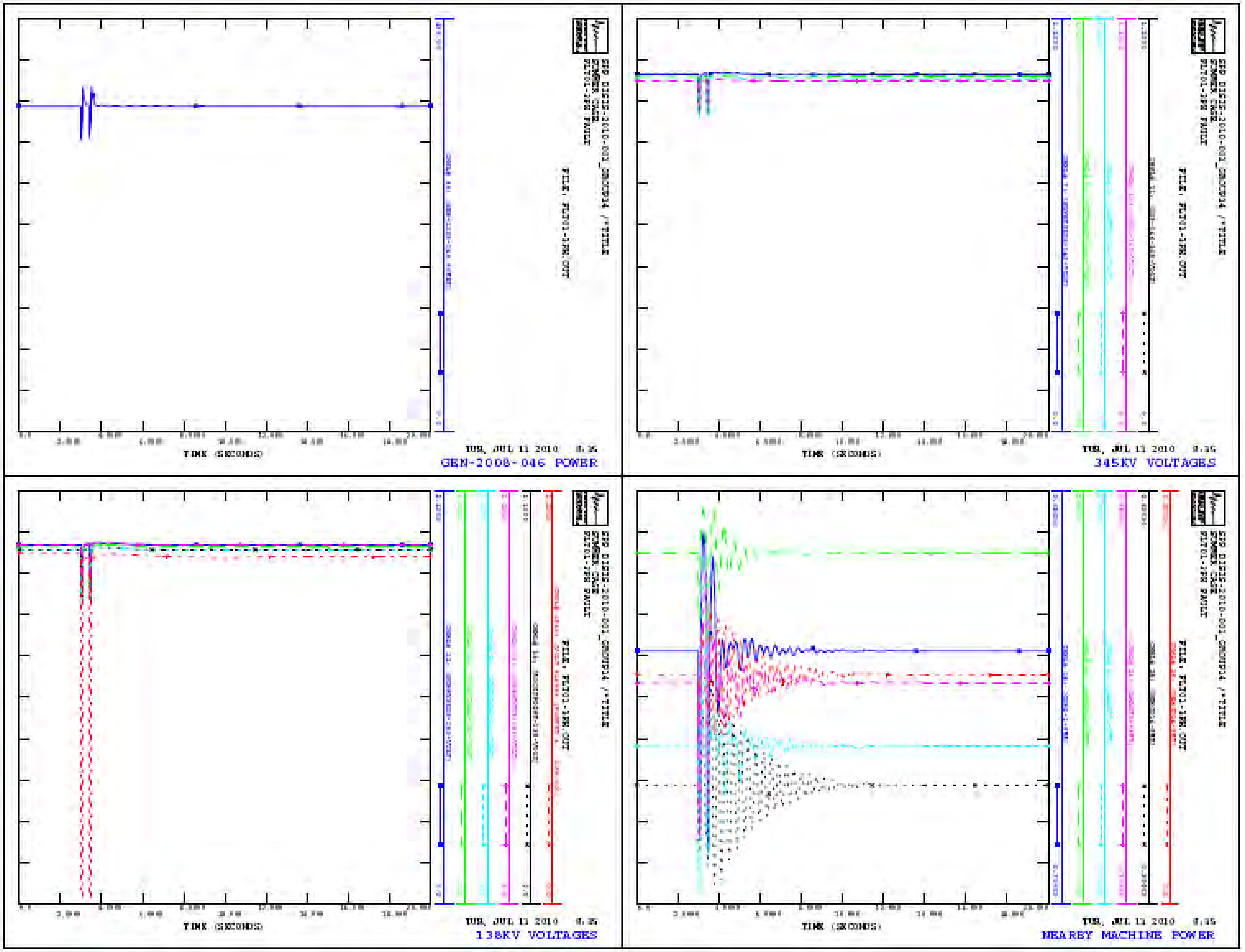
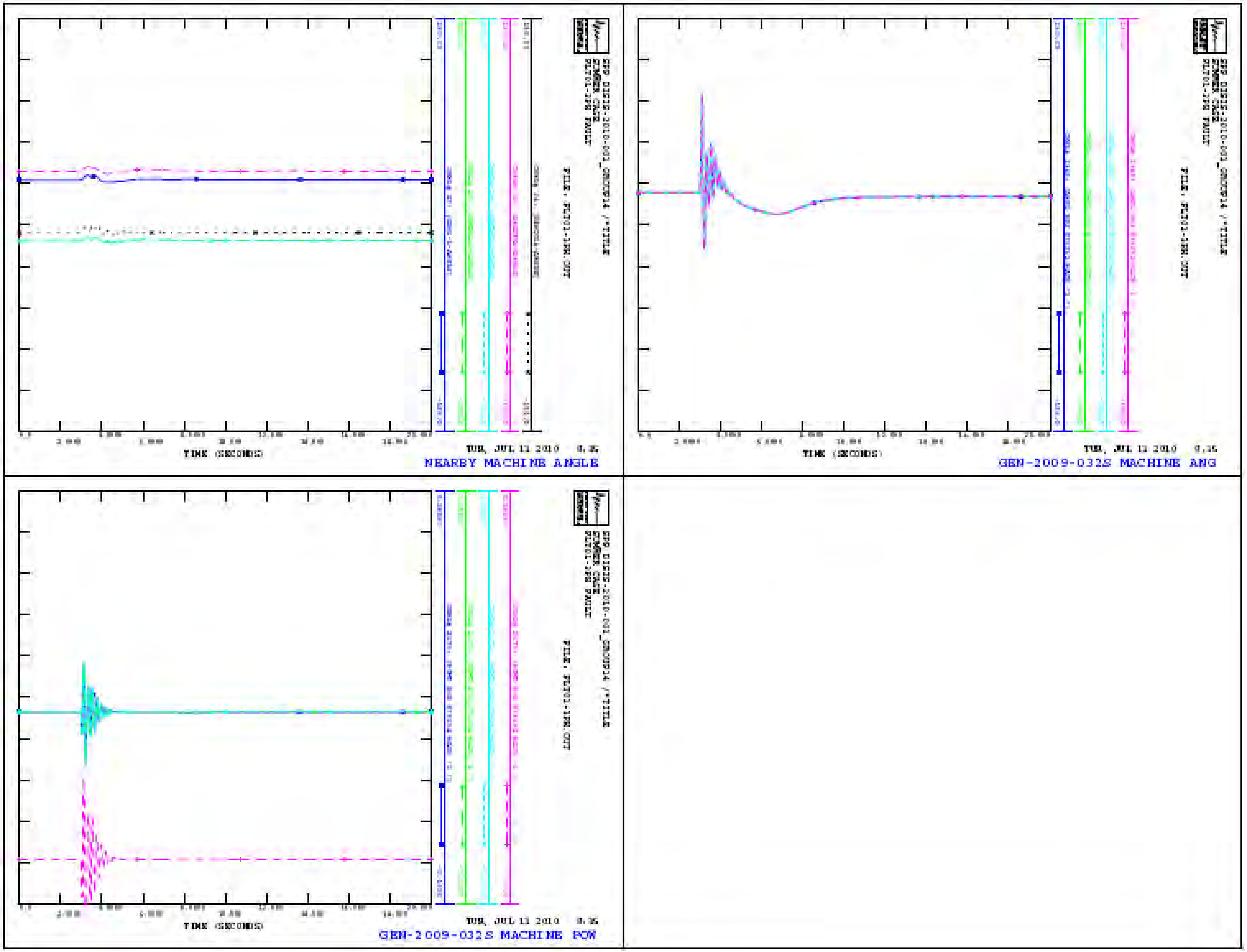


Figure 2: System Responses for FLT01-3PH (cont'd)



W: Stability Study for Group 15

Group 15
2010-001 Definitive Interconnection System Impact Study

July 10, 2010





Submitted To:
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EXECUTIVE SUMMARY

The Southwest Power Pool (SPP), on behalf of generation interconnection customers, desires a definitive interconnection system impact study for a generator grouping in South Nebraska collectively referred to as Group 15. Group 15 consists of only one generator:

- GEN-2008-123N. 89.7 MW wind farm (39 Siemens SWT 2.3 MW turbines) connected to the NPPD Pauline – Guide Rock 115kV line.

There are thirteen (13) previously queued generation interconnection requests in Group 15:

- Sheldon Unit #1 (121 MW of turbine at the NPPD Sheldon 13.8 kV bus #640019.)
- Sheldon Unit #2 (136 MW of turbine at the NPPD Sheldon 13.8 kV bus #640020.)
- Hallam CT #1 (52 MW of combustion turbine at NPPD Sheldon 13.8 kV bus #640021.)
- Cooper Unit #1 (874.4 MW of turbine at NPPD Cooper 22 kV bus #640009.)
- Beatrice Power Station Unit #1 (80 MW of turbine at the NPPD Beatrice Power Station 13.8 kV bus #640022.)
- Beatrice Power Station Unit #2 (80 MW of turbine at the NPPD Beatrice Power Station 13.8 kV bus #640023.)
- Beatrice Power Station Unit #3 (90 MW of turbine at the NPPD Beatrice Power Station 13.8 kV bus #640024.)
- Hebron CT #1 (52 MW of combustion turbine at the NPPD Hebron 13.8 kV bus #640012.)
- Fairbury #1 (11 MW of turbine at the NPPD Fairbury 34.5 kV bus #6400170.)
- Fairbury #2 (4.3 MW of turbine at the NPPD Fairbury 34.5 kV bus #6400170.)
- Energy Center Unit #1 (84 MW of turbine at the NPPD Energy Center 13.8 kV bus #641086.)
- Platte Generation Station Unit #1 (108.4 MW of turbine at the NPPD Platte 13.8 kV bus #642067.)

SPP requested a stability analysis and a power factor analysis for the queued generator projects in Group 15. SPP did not request an Available Transfer Capability (ATC) study as part of this study.

Transient stability analysis shows no new problems with the dynamic response of study generation in the region of interest.

All generators in the monitored area remain stable during disturbances.

All wind turbine generators have the capability of pre-contingency voltage recovery.

Low Voltage Ride Through (LVRT) analysis shows no generators tripping due to low voltage.

Power factor analysis indicates no susceptibility to low voltage generator tripping or voltage collapse. No reactive compensation is required to maintain post contingency voltage at or above 1.0 PU at the POI for all off the specified faults.

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1. INTRODUCTION

The Southwest Power Pool (hereafter referred to as SPP) commissioned AMEC Earth and Environmental (hereafter referred to as AMEC) to study the impact of a group of generators in the SPP interconnection queue referred to as Group 15. The site studied is in south Nebraska, within approximately 100 miles of Lincoln.

The site studied was:

1. GEN-2008-123N. 89.7 MW wind generation (39 x 2.3 MW Siemens SWT 2.3MW wind turbines) connected to the NPPD Pauline – Guide Rock 115kV line.

SPP did not request an Available Transfer Capability (ATC) study. The ATC study will be required when the generation companies request transmission service.

SPP requested a stability analysis and a power factor analysis. Given SPP's list of faults, AMEC performed a dynamics study and a power factor study to:

a. Determine the amount of reactive compensation required at the wind farm facility on the customer side of the collector substation transformer to meet the specified post contingency voltage requirements.

b. Determine the ability of the wind farm to meet FERC Order 661A (low voltage ride through and wind farm recovery to pre-fault voltage) with and without additional reactive power support.

c. Determine the ability of the generators to remain in synchronism following three-phase and single-line-to-ground faults.

2. STUDY METHODOLOGY

SPP provided 2010 summer peak and 2009 winter peak load flow cases in PSS/E format. Table 1 below shows the total demand and generation in the monitored areas.

Table 1: Description of Study Areas

Area No.	Area Name	2010 Summer Peak		2009 Winter Peak	
		Load (MW)	Generation (MW)	Load (MW)	Generation (MW)
531	MIDW	354.8	320.7	203.7	320.1
534	SUNC	535.8	1009.4	440.4	938.9
536	WERE	6060.2	5813.3	3989.1	4130.1
540	MIPU	2008.4	1898.5	1520.3	1701.8
541	KACP	3557.1	3864.2	2617.9	2325.2
640	NPPD	3641.2	3420.6	2778.8	3134.8
645	OPPD	2919.7	3018.2	2049.4	2482.8
650	LES	819.8	449.7	571.0	449.7
652	WAPA	3628.5	5309.3	3677.6	5017.2

- **POWER FACTOR ANALYSIS**

A VAr generator with large capacity was placed at the wind farm POI. The VAr generator was set to hold a voltage schedule at the POI consistent with the voltage schedule in the base case or 1.0 pu, whichever is higher. A list of contingencies shown in Table 2 was simulated. If the required reactive support to maintain an acceptable power factor (+/-0.95) at the POI is beyond the capability of the wind farm, the additional reactive compensation at the wind farm customer side was considered.

Table 2: Steady-State Contingency Descriptions

Cont No.	Description
FLT01	Outage of Pauline (640312) – Moore (640277) 345 kV line
FLT03	Outage of Moore (640277) – Cooper (640139) 345 kV line
FLT04	Outage of Moore (640277) – McCool (640271) 345 kV line
FLT05	Outage of Moore (640277) – NW68HOL3 (650114) 345 kV line
FLT06	Outage of Moore (640277) – 103ROK (650189) 345 kV line
FLT07	Outage of Moore (640277) 345/115 kV autotransformer

Cont No.	Description
FLT08	Outage of Pauline (640312) 345/115 kV autotransformer
FLT09	Outage of Pauline (640312) – Axtell (640065) 345 kV line
FLT10	Outage of Pauline (640313) – GEN-2008-123N (572050) 115 kV line
FLT11	Outage of Guide Rock (640206) – GEN-2008-123N (572050) 115 kV line
FLT12	Outage of Pauline (640313) – Hastings (640215) 115 kV line Ckt 1
FLT13	Outage of Pauline (640313) – Hildreth (640222) 115 kV line
FLT14	Outage of North Hebron (640218) – Carlton Jct (640105) 115 kV line
FLT15	Outage of North Hebron (640218) – Fairbury (640169) 115 kV line
FLT17	Outage of N. Hebron (640218) – Carleton Junction (640105) 115 kV line and Prior Outage of GEN-2008-123N (572050) – Pauline (640313) 115 kV line
FLT18	Outage of BPS (640088) – Sheldon (640278) 115 kV line
FLT19	Outage of Beatrice (640076) – Harbine (640208) 115 kV line
FLT20	Outage of BPS (640088) – Sheldon (640278) 115 kV line and Prior Outage of BPS (640088) – Clatonia (640111) 115 kV line
FLT27	Outage of Energy Center (641087) – Sutton (640372) 115 kV line
FLT28	Outage of Energy Center (641087) – Hastings City (641088) 115 kV line
FLT29	Outage of Moore (640277) - McCool (640271) 345 kV line and Moore (640277) – NW68th & Holdrege (650114) 345 kV line
FLT30	Outage of Moore (640277) - McCool (640271) 345kV line and Moore (640277) – 103rd & Rokeby (650189) 345 kV line
FLT31	Outage of Moore (640277) - Cooper (640271) 345 kV line and Moore 345/115 kV transformer
FLT35	Outage of Beatrice (640076) – Harbine (640208) 115 kV line, Beatrice – BPS 115 kV line ckt 1 and Beatrice – Beatrice South 115 kV line
FLT36	Outage of Holdredge (640224) – Axtell (640066) 115 kV line
FLT37	Outage of Holdredge (640224) – Johnson (640242) 115 kV line
FLT38	Outage of Axtell (640066) 115 kV – Axtell (640065) 345 kV transformer
FLT39	Outage of Hastings (640215) 115 kV – Hastings (640214) 230 kV transformer

Tables 3 and 4 contain the results of the powerflow analysis for each of the fault conditions specified in Table 2 for the summer and winter conditions respectively. The tables contain bus voltage at the POI, the real and reactive output of the Interconnection Customer and the resultant power factor, the real and reactive flows at the POI, and the resultant power factor.

Table 3: Voltage at POI and P.F. at POI and Wind Farm without VAR Generator, Summer Peak

Cont. No.	Voltage @ POI (pu)	Power Factor of Wind Generator GEN-2008-123N					Power Factor @ POI				
		P	Q	MVA	PF	Lead/ Lag	P	Q	MVA	PF	Lead/ Lag
Base Case	1.042	89.7	-8	90.06	0.996	Lead	86.8	-27.4	91.02	0.954	Lead
FLT01-3PH	1.043	89.7	-8	90.06	0.996	Lead	87.1	-26.7	91.1	0.956	Lead
FLT03-3PH	1.0394	89.7	-6	89.9	0.998	Lead	87.1	-24.7	90.53	0.962	Lead
FLT04-3PH	1.038	89.7	-5.6	89.87	0.998	Lead	87.1	-24.1	90.37	0.964	Lead
FLT05-3PH	1.04	89.7	-6.1	89.91	0.998	Lead	87.1	-25.2	90.67	0.961	Lead
FLT06-3PH	1.04	89.7	-6.5	89.94	0.997	Lead	87.1	-25.1	90.64	0.961	Lead
FLT07-3PH	1.041	89.7	-7	89.97	0.997	Lead	87.1	-25.6	90.78	0.959	Lead
FLT08-3PH	1.036	89.7	-4.3	89.8	0.999	Lead	87.1	-22.8	90.03	0.967	Lead
FLT09-3PH	1.035	89.7	-3.9	89.78	0.999	Lead	87.1	-22.4	89.93	0.969	Lead
FLT10-3PH	1.032	89.7	-2.4	89.73	1.000	Lead	87.1	-20.9	89.57	0.972	Lead
FLT11-3PH	1.039	89.7	-6.2	89.91	0.998	Lead	87.1	-24.8	90.56	0.962	Lead
FLT12-3PH	1.04	89.7	-6.2	89.91	0.998	Lead	87.1	-24.8	90.56	0.962	Lead
FLT13-3PH	1.04	89.7	-6.6	89.94	0.997	Lead	87.1	-25.2	90.67	0.961	Lead
FLT14-3PH	1.044	89.7	-8.4	90.09	0.996	Lead	87.1	-27.1	91.22	0.955	Lead
FLT15-3PH	1.041	89.7	-7	89.97	0.997	Lead	87.1	-25.6	90.78	0.959	Lead
FLT17-3PH	1.04	89.7	-6.5	89.94	0.997	Lead	87.1	-25.1	90.64	0.961	Lead
FLT18-3PH	1.04	89.7	-6.4	89.93	0.997	Lead	87.1	-25	90.62	0.961	Lead
FLT19-3PH	1.04	89.7	-6.4	89.93	0.997	Lead	87.1	-24.9	90.59	0.961	Lead
FLT20-3PH	1.048	89.7	-6.4	89.93	0.997	Lead	87.1	-25	90.62	0.961	Lead
FLT27-3PH	1.04	89.7	-6.2	89.91	0.998	Lead	87.1	-24.8	90.56	0.962	Lead

Table 4 continued: Voltage at POI and P.F. at POI and Wind Farm without VAR Generator, Summer Peak

Cont. No.	Voltage @ POI (pu)	Power Factor of Wind Generator GEN-2008-123N					Power Factor @ POI				
		P	Q	MVA	PF	Lead/ Lag	P	Q	MVA	PF	Lead/ Lag
FLT28-1PH	1.041	89.7	-6.7	89.95	0.997	Lead	87.1	-25.3	90.7	0.96	Lead
FLT29-1PH	1.039	89.7	-5.7	89.88	0.998	Lead	87.1	-24.2	90.4	0.963	Lead
FLT30-1PH	1.038	89.7	-5.6	89.87	0.998	Lead	87.1	-24.1	90.37	0.964	Lead
FLT31-1PH	1.039	89.7	-5.9	89.89	0.998	Lead	87.1	-24.4	90.45	0.963	Lead
FLT35-1PH	1.04	89.7	-6.3	89.92	0.998	Lead	87.1	-24.9	90.59	0.961	Lead
FLT36-3PH	1.039	89.7	-6	89.9	0.998	Lead	87.1	-24.5	90.48	0.963	Lead
FLT37-3PH	1.04	89.7	-6.3	89.92	0.998	Lead	87.1	-24.8	90.56	0.962	Lead
FLT38-3PH	1.04	89.7	-6.2	89.91	0.998	Lead	87.1	-24.8	90.56	0.962	Lead
FLT39-3PH	1.036	89.7	-4.2	89.8	0.999	Lead	87.1	-22.7	90.01	0.968	Lead

Table 5: Voltage at POI and P.F. at POI and Wind Farm without VAR Generator, Winter Peak

Cont. No.	Voltage @ POI (pu)	Power Factor of Wind Generator GEN-2008-123N					Power Factor @ POI				
		P	Q	MVA	PF	Lead/ Lag	P	Q	MVA	PF	Lead/ Lag
Base Case	1.042	89.7	-7.6	90.02	0.996	Lead	86.8	-27.5	91.05	0.953	Lead
FLT01-3PH	1.042	89.7	-7.7	90.03	0.996	Lead	87.1	-26.4	91.01	0.957	Lead
FLT03-3PH	1.042	89.7	-7.6	90.02	0.996	Lead	87.1	-26.3	90.98	0.957	Lead
FLT04-3PH	1.041	89.7	-7	89.97	0.997	Lead	87.1	-25.7	90.81	0.959	Lead
FLT05-3PH	1.04	89.7	-6.5	89.94	0.997	Lead	87.1	-25.1	90.64	0.961	Lead
FLT06-3PH	1.04	89.7	-6.5	89.94	0.997	Lead	87.1	-25.1	90.64	0.961	Lead
FLT07-3PH	1.041	89.7	-6.7	89.95	0.997	Lead	87.1	-25.3	90.7	0.96	Lead
FLT08-3PH	1.04	89.7	-6.4	89.93	0.997	Lead	87.1	-25	90.62	0.961	Lead
FLT09-3PH	1.036	89.7	-4.1	89.79	0.999	Lead	87.1	-22.5	89.96	0.968	Lead
FLT10-3PH	1.027	89.7	0.4	89.7	1.000	Lag	87.1	-17.9	88.92	0.98	Lead
FLT11-3PH	1.045	89.7	-8.9	90.14	0.995	Lead	87.1	-27.7	91.4	0.953	Lead
FLT12-3PH	1.04	89.7	-6.2	89.91	0.998	Lead	87.1	-24.9	90.59	0.961	Lead
FLT13-3PH	1.042	89.7	-7.4	90	0.997	Lead	87.1	-26.1	90.93	0.958	Lead
FLT14-3PH	1.043	89.7	-7.9	90.05	0.996	Lead	87.1	-26.5	91.04	0.957	Lead
FLT15-3PH	1.04	89.7	-6.3	89.92	0.998	Lead	87.1	-24.9	90.59	0.961	Lead
FLT17-3PH	1.03	89.7	-1.1	89.71	1	Lead	87.1	-19.5	89.26	0.976	Lead
FLT18-3PH	1.042	89.7	-7.5	90.01	0.997	Lead	-26.1	-25	36.14	-0.722	Lead
FLT19-3PH	1.04	89.7	-6.5	89.94	0.997	Lead	87.1	-25.1	90.64	0.961	Lead
FLT20-3PH	1.042	89.7	-7.5	90.01	0.997	Lead	87.1	-26.1	90.93	0.958	Lead

Table 6 continued: Voltage at POI and P.F. at POI and Wind Farm without VAR Generator, Winter Peak

Cont. No.	Voltage @ POI (pu)	Power Factor of Wind Generator GEN-2008-123N					Power Factor @ POI				
		P	Q	MVA	PF	Lead/ Lag	P	Q	MVA	PF	Lead/ Lag
FLT27-3PH	1.042	89.7	-7.5	90.01	0.997	Lead	87.1	-26.1	90.93	0.958	Lead
FLT28-1PH	1.041	89.7	-6.6	89.94	0.997	Lead	87.1	-25.2	90.67	0.961	Lead
FLT29-1PH	1.041	89.7	-6.9	89.96	0.997	Lead	87.1	-25.6	90.78	0.959	Lead
FLT30-1PH	1.041	89.7	-6.9	89.96	0.997	Lead	87.1	-25.5	90.76	0.96	Lead
FLT31-1PH	1.032	89.7	-7.3	90	0.997	Lead	87.1	-25.9	90.87	0.959	Lead
FLT35-1PH	1.04	89.7	-6.5	89.94	0.997	Lead	87.1	-25.1	90.64	0.961	Lead
FLT36-3PH	1.042	89.7	-7.4	90	0.997	Lead	87.1	-26.2	90.96	0.958	Lead
FLT37-3PH	1.04	89.7	-6.3	89.92	0.998	Lead	87.1	-24.9	90.59	0.961	Lead
FLT38-3PH	1.041	89.7	-7	89.97	0.997	Lead	87.1	-25.7	90.81	0.959	Lead
FLT39-3PH	1.038	89.7	-5.3	89.86	0.998	Lead	87.1	-23.8	90.29	0.965	Lead

- **DYNAMIC ANALYSIS**

The study areas are shown in Table 1. These areas are monitored in the dynamic analysis.

The transmission line and transformer faults were simulated and synchronous machine rotor angles and wind turbine generator speeds were monitored to check whether synchronism of the synchronous machines is maintained and whether the wind turbine generators trip offline during the disturbance.

Following is a summary of the faults simulated in this analysis.

Table 7: Fault Descriptions

Fault No.	Fault Name	Description
1	FLT01-3PH	3 phase fault on the Pauline (640312) – Moore (640277) 345 kV line near Pauline a. Apply fault at the Pauline 345 kV bus. b. Clear fault after 4.5 cycles by tripping the faulted line.
2	FLT03-3PH	3 phase fault on the Moore (640277) – Cooper (640139) 345 kV line near Moore a. Apply fault at the Moore 345 kV bus. b. Clear fault after 4.5 cycles by tripping the faulted line.
3	FLT04-3PH	3 phase fault on the Moore (640277) – McCool (640271) 345 kV line near Moore a. Apply fault at the Moore 345 kV bus. b. Clear fault after 4.5 cycles by tripping the faulted line.
4	FLT05-3PH	3 phase fault on the Moore (640277) – NW68HOL3 (650114) 345 kV line near Moore a. Apply fault at the Moore 345kV bus. b. Clear fault after 4.5 cycles by tripping the faulted line.
5	FLT06-3PH	3 phase fault on the Moore (640277) – 103ROK (650189) 345 kV line near Moore a. Apply fault at the Moore 345 kV bus. b. Clear fault after 4.5 cycles by tripping the faulted line.
6	FLT07-3PH	3 phase fault on the Moore (640277) 345/115 kV autotransformer near Moore a. Apply fault at the Moore 345 kV bus. b. Clear fault after 5.5 cycles by tripping the faulted line.
7	FLT08-3PH	3 phase fault on the Pauline (640312) 345/115 kV autotransformer near Pauline a. Apply fault at the Pauline 345 kV bus. b. Clear fault after 5.5 cycles by tripping the faulted line.
8	FLT09-3PH	3 phase fault on the Pauline (640312) – Axtell (640065) 345 kV line near Pauline a. Apply fault at the Pauline 345 kV bus. b. Clear fault after 4.5 cycles by tripping the faulted line.
9	FLT10-3PH	3 phase fault on the Pauline (640313) – GEN-2008-123N (572050) 115 kV line near GEN-2008-123N a. Apply fault at the GEN-2008-123N 115 kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
10	FLT11-3PH	3 phase fault on the Guide Rock (640206) – GEN-2008-123N (572050) 115 kV line near GEN-2008-123N a. Apply fault at the GEN-2008-123N 115kV bus.

Fault No.	Fault Name	Description
		b. Clear fault after 6.5 cycles by tripping the Gen-2008-123N – Guide Rock – Superior 115 kV line.
11	FLT12-3PH	3 phase fault on the Pauline (640313) – Hastings (640215) 115kV line Ckt 1 near Pauline a. Apply fault at the Pauline 115 kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
12	FLT13-3PH	3 phase fault on the Pauline (640313) – Hildreth (640222) 115kV line near Pauline a. Apply fault at the Pauline 115 kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
13	FLT14-3PH	3 phase fault on the North Hebron (640218) – Carlton Jct (640105) 115 kV line near North Hebron a. Apply fault at the North Hebron 115 kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
14	FLT15-3PH	3 phase fault on the North Hebron (640218) – Fairbury (640169) 115 kV line near North Hebron a. Apply fault at the North Hebron 115 kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
15	FLT17-3PH	3 phase fault on N. Hebron (640218) – Carleton Junction (640105) 115 kV with Prior Outage of GEN-2008-123N (572050) – Pauline (640313) 115 kV. a. Prior Outage: GEN-2008-123N – Pauline 115 kV line. b. 3 PH fault on N. Hebron – Carleton Junction 115 kV line at N. Hebron. c. Clear fault after 6.5 cycles by tripping faulted line.
16	FLT18-3PH	3 phase fault on BPS (640088) – Sheldon (640278) 115 kV line. a. 3 PH fault at BPS 115 kV (640088). b. Clear fault after 6.5 cycles by tripping faulted line.
17	FLT19-3PH	3 phase fault on Beatrice (640076) – Harbine (640208) 115 kV line. a. 3 PH fault at Beatrice (640076) 115 kV. b. Clear fault after 6.5 cycles by tripping faulted line.
18	FLT20-3PH	3 phase fault on BPS (640088) – Sheldon (640278) 115 kV with Prior Outage of BPS (640088) – Clatonia (640111) 115 kV line. a. Prior Outage: BPS – Clatonia 115 kV b. 3 PH fault at BPS 115 kV on BPS – Sheldon 115 kV. c. Clear fault after 6.5 cycles by tripping faulted line.
19	FLT27-3PH	3 phase fault on Energy Center (641087) – Sutton (640372) 115 kV line. a. Apply fault at Energy Center 115 kV. b. Clear fault after 6.5 cycles by tripping faulted line.
20	FLT28-1PH	3 phase fault on Energy Center (641087) – Hastings City (641088) 115 kV line. a. Apply fault at Energy Center 115 kV. b. Clear fault after 6.5 cycles by tripping faulted line.
21	FLT29-1PH	SLG fault on Moore (640277) - McCool (640271) 345 kV, stuck PCB, clear faulted line & Moore (640277) – NW68th & Holdrege (650114) 345 kV. a. Apply SLG fault at Moore. b. Clear McCool end of Moore – McCool 345 kV line at 4.5 cycles. c. Clear fault, Moore end of McCool – Moore 345 kV line and Moore – NW68th & Holdrege 345 kV at 12.5 cycles.
22	FLT30-1PH	SLG fault on Moore (640277) - McCool (640271) 345 kV, stuck PCB, clear faulted line & Moore (640277) – 103rd & Rokeby (650189) 345 kV. a. Apply SLG fault at Moore. b. Clear McCool end of Moore – McCool 345 kV line at 4.5 cycles. c. Clear fault, Moore end of McCool – Moore 345 kV line and Moore – 103rd & Rokeby 345 kV at 12.5 cycles.

Fault No.	Fault Name	Description
23	FLT31-1PH	SLG fault on Moore (640277) - Cooper (640271) 345 kV, stuck PCB, clear faulted line & Moore 345/115 kV transformer. a. Apply SLG fault at Moore. b. Clear Cooper end of Moore – Cooper 345 kV line at 4.5 cycles. c. Clear fault, Moore end of Cooper – Moore 345 kV line and Moore 345/115 kV transformer at 12.5 cycles.
24	FLT35-1PH	SLG fault on Beatrice (640076) – Harbine (640208) 115 kV, stuck PCB, clear faulted line & Beatrice – BPS 115 kV ckt 1 & Beatrice – Beatrice South 115 kV. a. Apply SLG fault at Beatrice. b. Clear Harbine end of Beatrice – Harbine 115 kV line at 6.5 cycles. c. Clear fault, Beatrice end of Beatrice – Harbine 115 kV, Beatrice – BPS 115 kV ckt 1, and Beatrice – Beatrice South 115 kV.
25	FLT36-3PH	3 phase fault on the Holdredge (640224) – Axtell (640066) 115 kV line near Holdredge a. Apply fault at the Holdredge 115kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
26	FLT37-3PH	3 phase fault on the Holdredge (640224) – Johnson (640242) 115 kV line near Johnson a. Apply fault at the Johnson 115 kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
27	FLT38-3PH	3 phase fault on Axtell (640066) 115 kV – Axtell (640065) 345kV transformer on the 115kV bus. a. Apply 3 PH fault at Axtell 115 kV bus. b. Clear fault after 6.5 cycles on the 115kV bus by tripping faulted transformer
28	FLT39-3PH	3 phase fault on Hastings (640215) 115 kV – Hastings (640214) 230 kV transformer on the 115 kV bus. a. Apply 3 PH fault at Hastings 115 kV bus. b. Clear fault after 6.5 cycles on the 115kV bus by tripping faulted transformer

In order to simulate 1PH faults, equivalent shunt MVAr[1] were determined to be applied at the faulted buses. Table 4 presents equivalent reactors used in the transient stability study.

[1] The equivalent shunt MVAr causes the voltage at the faulted bus dropped to 0.60 pu.

Table 8: Equivalent Shunt MVAr at Faulted Bus for Single-Line-to-Ground Faults

Fault No.	Faulted Bus No.	2010 Summer Peak (MVAr)	2009 Winter Peak (MVAr)
FLT29-1PH	640277	-8101.9	-7584.3
FLT30-1PH	640277	-8101.9	-7584.3
FLT31-1PH	640277	-8101.9	-7584.3
FLT35-1PH	640076	-1602.0	-1673.6

Another important aspect of the dynamic analysis was to check FERC Order 661A compliance. The turbine generators were monitored to determine whether they stayed connected to the grid (Low Voltage Ride Through - LVRT) following the faults defined in Table 3. The wind farm capability of post-fault voltage recovery at the POI was also checked.

3. PROJECT DESCRIPTION

Following is a table of the proposed wind farms in Group 15.

Table 9: Points of Interconnection for Group 15

Request	Size (MW)	Turbine Model	Point Of Interconnection		
			Common Name	Bus No.	Bus Name in Model
GEN-2008-123N	89.7	Siemens SWT 2.3 MW	Pauline – Guide Rock 115kV line	572050	GEN08-123N

The one-line diagram of GEN-2008-123N in Figure 1 uses the following color codes for nominal voltages:

Blue **115 kV**
Black **lower voltage levels**

All voltages and line flows are from the 2010 summer peak base case.

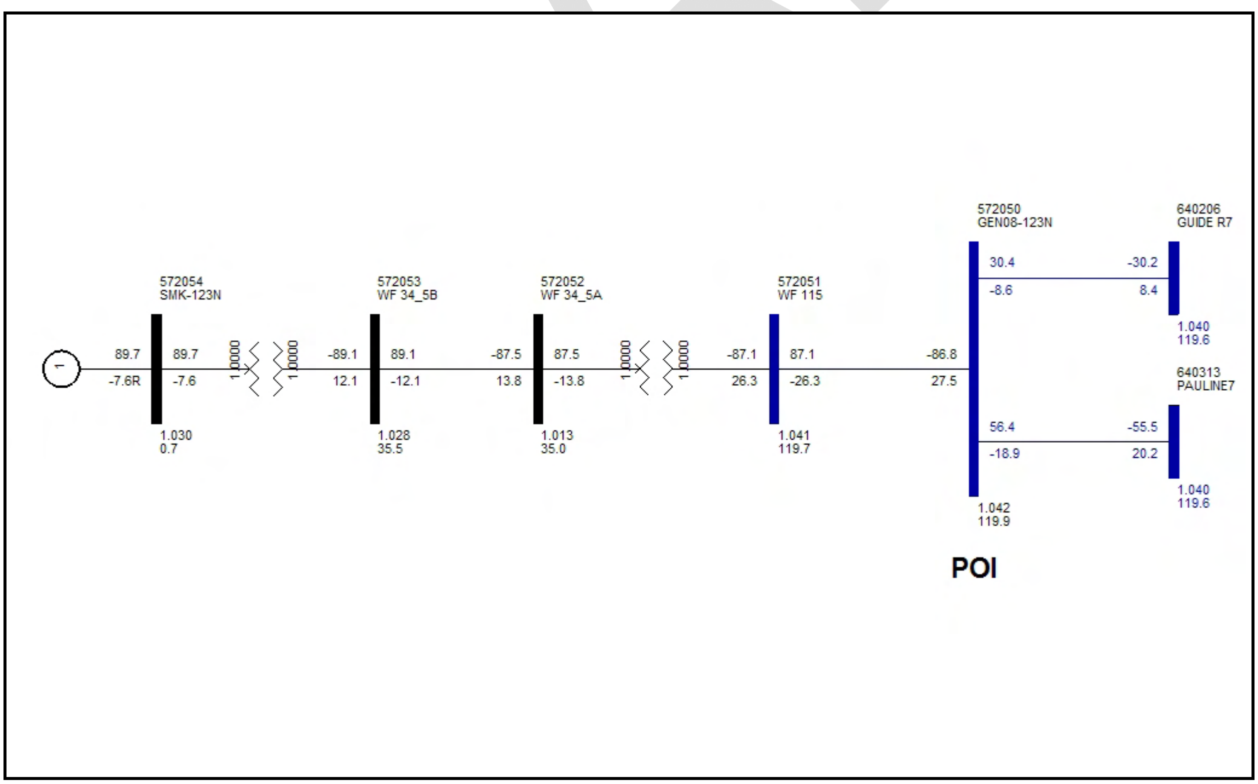

Figure 1: GEN-2008-123N Interconnection One-Line Diagram

As illustrated below, the site in Group 15 is within approximately 100 miles to the southwest of Lincoln, Nebraska.

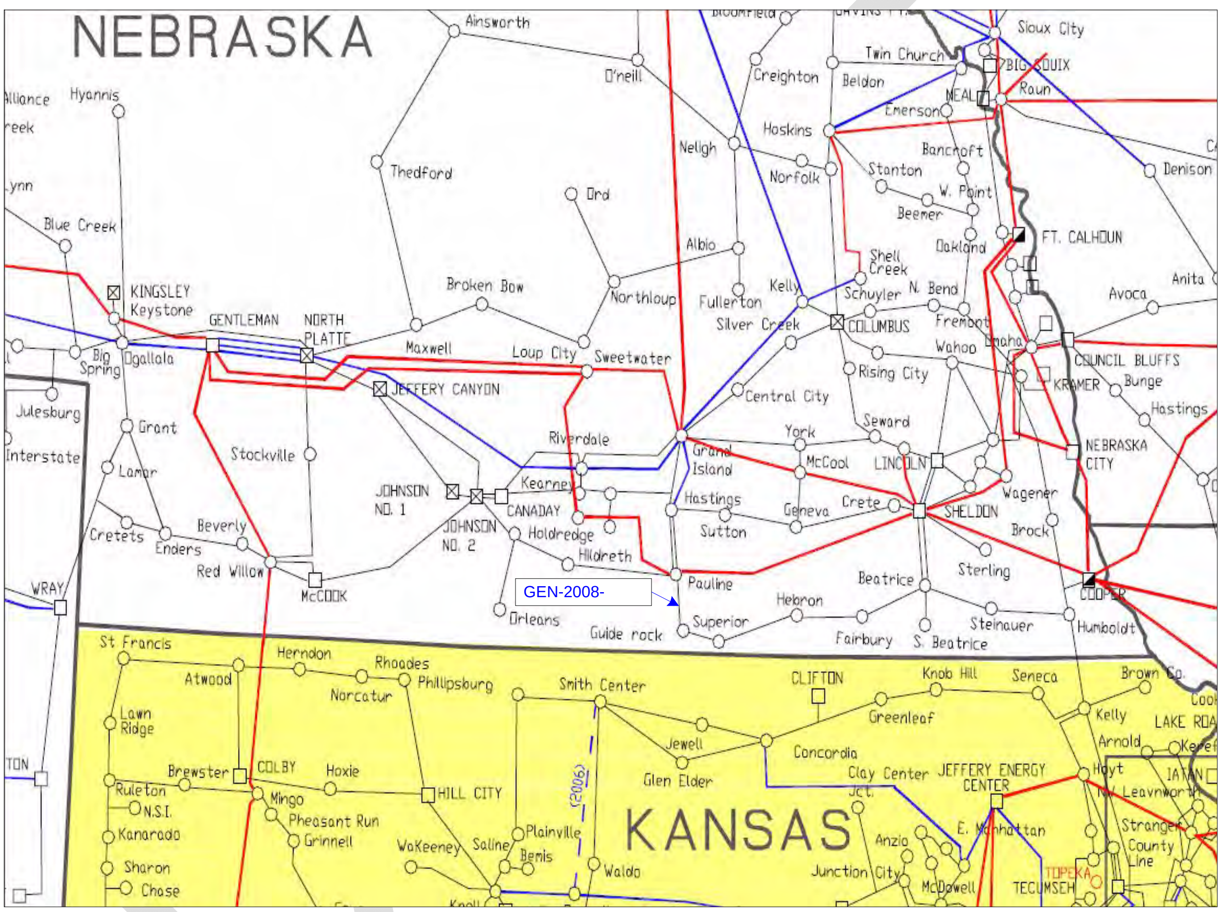

Figure 2: Geographical Location of Group 15 Project

The following is the detailed description of the wind projects in Group 15.

GEN-2008-123N

- Wind farm rating

  Active power capability: 89.7 MW

  Reactive power capability: 29.6 MVAR

- Interconnection:
    - Voltage: 115 kV
    - Location: Existing NPPD Pauline – Guide Rock 115kV bus
    - Transformer: One step-up transformer connecting to the 115 kV
        - MVA: Rate A - 61, Rate B -80, Rate C - 100
        - Voltage: 115/34.5 kV
        - R: 0.546%, X: 16.39% on 100 MVA

- Wind turbine:
    - Number: Thirty-nine (39)
    - Manufacturer: Siemens
    - Type: Doubly-fed induction generator (DFIG)

    - Machine terminal voltage: 690 V
    - Rated power: 1.5 MW
    - Frequency: 60Hz
    - Generator step-up transformer
        - MVA: 2.6
        - Voltage: 34.5/0.6kV
        - R: 0.84%, X: 5.92% on 100 MVA

- Generator protection
    - Undervoltage
        - Relay trips when $V_{bus} < 0.15$ pu for t = 0.65 s
          $V_{bus} < 0.50$ pu for t = 1.735 s
          $V_{bus} < 0.90$ pu for t = 3.0 s
    - Overvoltage
        - Relay trips when $V_{bus} > 1.10$ pu for t = 1.0 s
          $V_{bus} > 1.20$ pu for t = 0.2 s
    - Underfrequency
        - Relay trips when $F_{bus} < 56.4$ Hz for t = 0.1 s
          $F_{bus} < 57.0$ Hz for t = 10.0 s
    - Overfrequency
        - Relay trips when $F_{bus} > 62.4$ Hz for t = 0.1 s

4. POWER FACTOR RESULTS

The proposed GEN-2008-123N wind farm (89.7 MW) will be comprised of 39 Siemens SWT 2.3 MW wind turbine generators. These wind turbine generators are doubly fed induction generators (DFIG) with a reactive power capability of +/- 0.90 p.f. The wind turbine generators were modeled in voltage control mode. They were set to regulate its terminal bus voltage at 1.03 pu.

A contingency analysis was run using all faults described in Table 2. A continuously variable VAr generator was placed into the model at the Point of Interconnection (POI) for any contingencies in which the post contingent voltage at the POI was less than 1.0 pu. No higher voltage schedule was specified at the POI.

The results listed in Tables 3 and 4 indicate that no reactive compensation is required to maintain post contingency voltage at or above 1.0 PU at the POI for all off the specified faults. Therefore, no additional reactive compensation is indicated.

VOLTAGE RECOVERY RESULTS

Dynamic simulations were performed using each fault noted in Section 2. Voltage recovery as determined via dynamic simulation was checked against all contingencies. If the voltage recovers post-fault to a steady-state level consistent with the steady-state simulation, the generator interconnection is considered acceptable from a voltage recovery standpoint.

In these dynamic simulations, real loads are modeled as constant current and reactive loads are modeled as constant admittance; i.e. MW loads are proportional to voltage and MVAr loads are proportional to voltage squared. In contrast, loads are modeled as constant MW and constant MVAr in steady-state simulations. Therefore, due to differences in load modeling, minor differences in voltages are to be expected between dynamic and steady-state simulations.

The dynamic simulation showed all generators did not trip during any of the contingencies tested. That is, the wind farm GEN-2008-123N meets FERC Order 661A (low voltage ride through and wind farm recovery to pre-fault voltage). Table 6 lists the post-fault voltages at POI[2].

Table 10: Post-Fault Voltage Recovery by Dynamic Simulation

Fault No.	Voltage @ GEN-2008-123N POI (Pauline – Guide Rock 115kV line) (pu)

[2] The PTI utility tool PSSECHOP was used to retrieve the post-fault voltage at the POI from the dynamic simulation channel output files.

	Summer Peak	Winter Peak
FLT01-3PH	1.0447	1.0440
FLT03-3PH	1.0409	1.0423
FLT04-3PH	1.0395	1.0407
FLT05-3PH	1.0423	1.0407
FLT06-3PH	1.0421	1.0424
FLT07-3PH	1.0425	1.0438
FLT08-3PH	1.0356	1.0405
FLT09-3PH	1.0356	1.0339
FLT10-3PH	1.0253	1.0193
FLT11-3PH	1.0415	1.0441
FLT12-3PH	1.0414	1.0420
FLT13-3PH	1.0421	1.0415
FLT14-3PH	1.0480	1.0444
FLT15-3PH	1.0438	1.0417
FLT17-3PH	1.0480	1.0444
FLT18-3PH	1.0412	1.0419
FLT19-3PH	1.0385	1.0417
FLT20-3PH	1.0412	1.0419
FLT27-3PH	1.0411	1.0414
FLT28-1PH	1.0422	1.0423
FLT29-1PH	1.0368	1.0405
FLT30-1PH	1.0396	1.0404
FLT31-1PH	1.0395	1.0412
FLT35-1PH	1.0385	1.0416
FLT36-3PH	1.0306	1.0418
FLT37-3PH	1.0414	1.0423
FLT38-3PH	1.0414	1.0439
FLT39-3PH	1.0321	1.0364

The two (2) plots below show the highest post-fault voltage at the POI following the faults FLT14-3PH and FLT17-3PH and the lowest post-fault voltage at the POI following the faults in FLT10-3PH in both summer and winter peak cases.

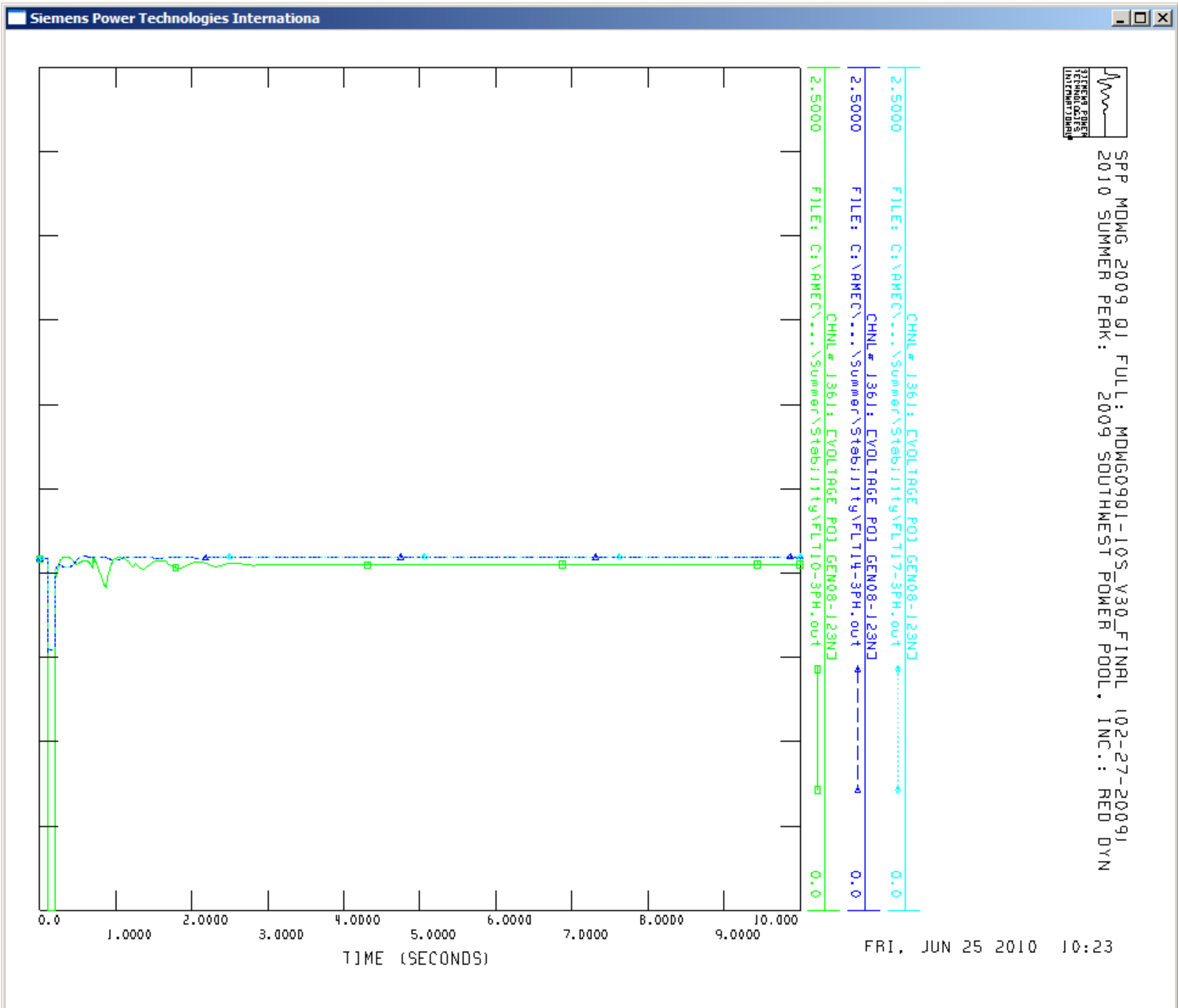

Figure 3: POI Voltage Recovery for FLT10-3PH, FLT14-3PH & FLT17-3PH, Summer Peak

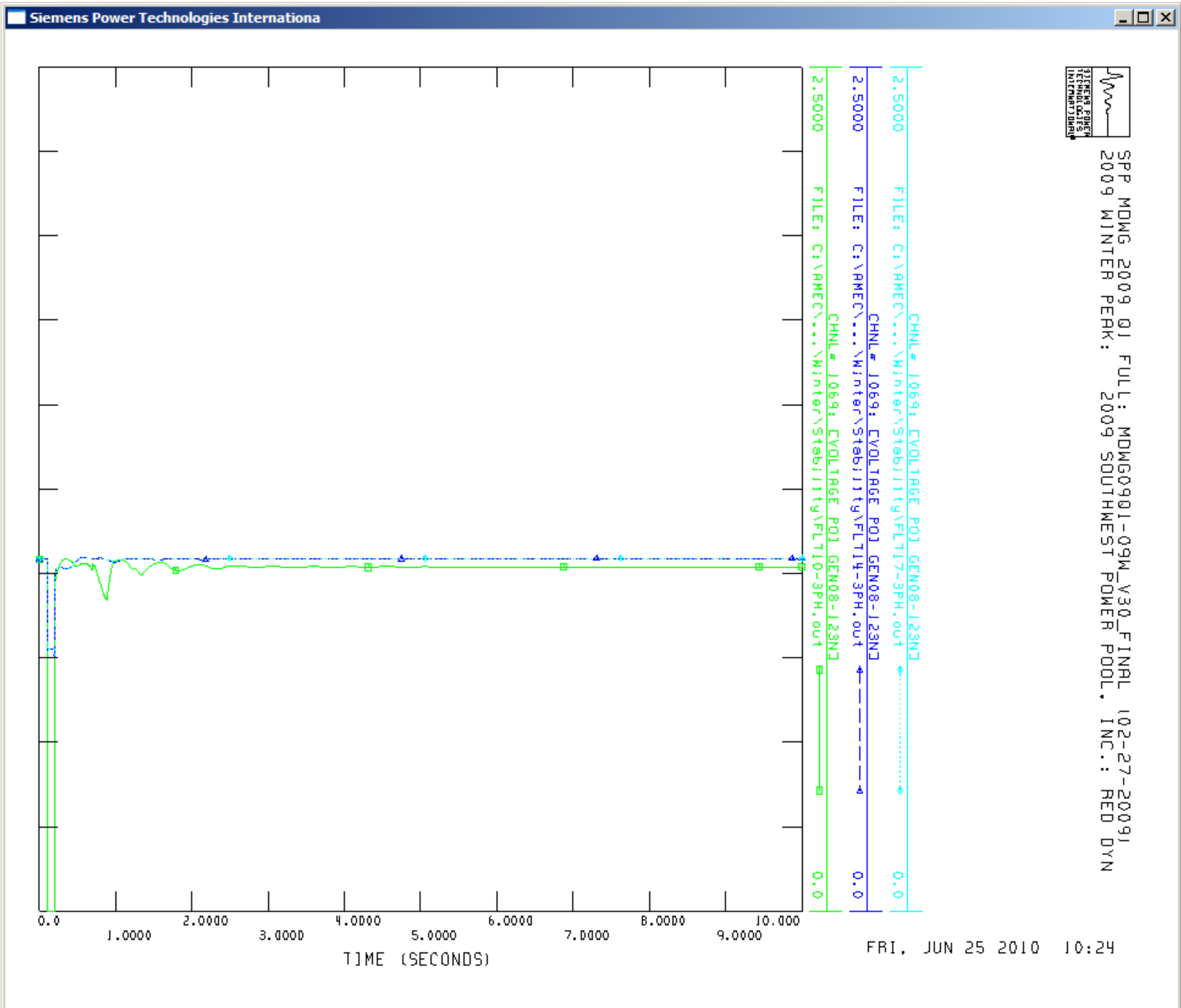

Figure 4: POI Voltage Recovery for FLT10-3PH, FLT14-3PH & FLT17-3PH, Winter Peak

5. TRANSIENT STABILITY RESULTS

Based on the dynamics results, GEN-2008-123N did not cause any new stability problems. For the faults studied, the three-phase faults are relatively severe than the corresponding single-line- to-ground faults. No synchronous generators pulled out of synchronism with the grid and no generators tripped.

Below are the worst-case faults[3] for the generator to be studied in Group 15, as determined by visual inspection of the rotor speed graphs from PSS/E dynamic analysis.

Table 11: Worst Faults for Dynamic Behavior within Group 15 (Summer Peak)

Generator	Worst Fault	Worst Fault Description
GEN-2008-123N	FLT11-3Φ	Guide Rock to GEN-2008-123N 115 kV, near GEN-2008-123N

Following are graphs of the rotor speeds for GEN-2008-123N after applying the faults to the summer peak case.

[3] Here the severity of the faults is measured by the oscillation amplitude of the wind turbine generator speed.

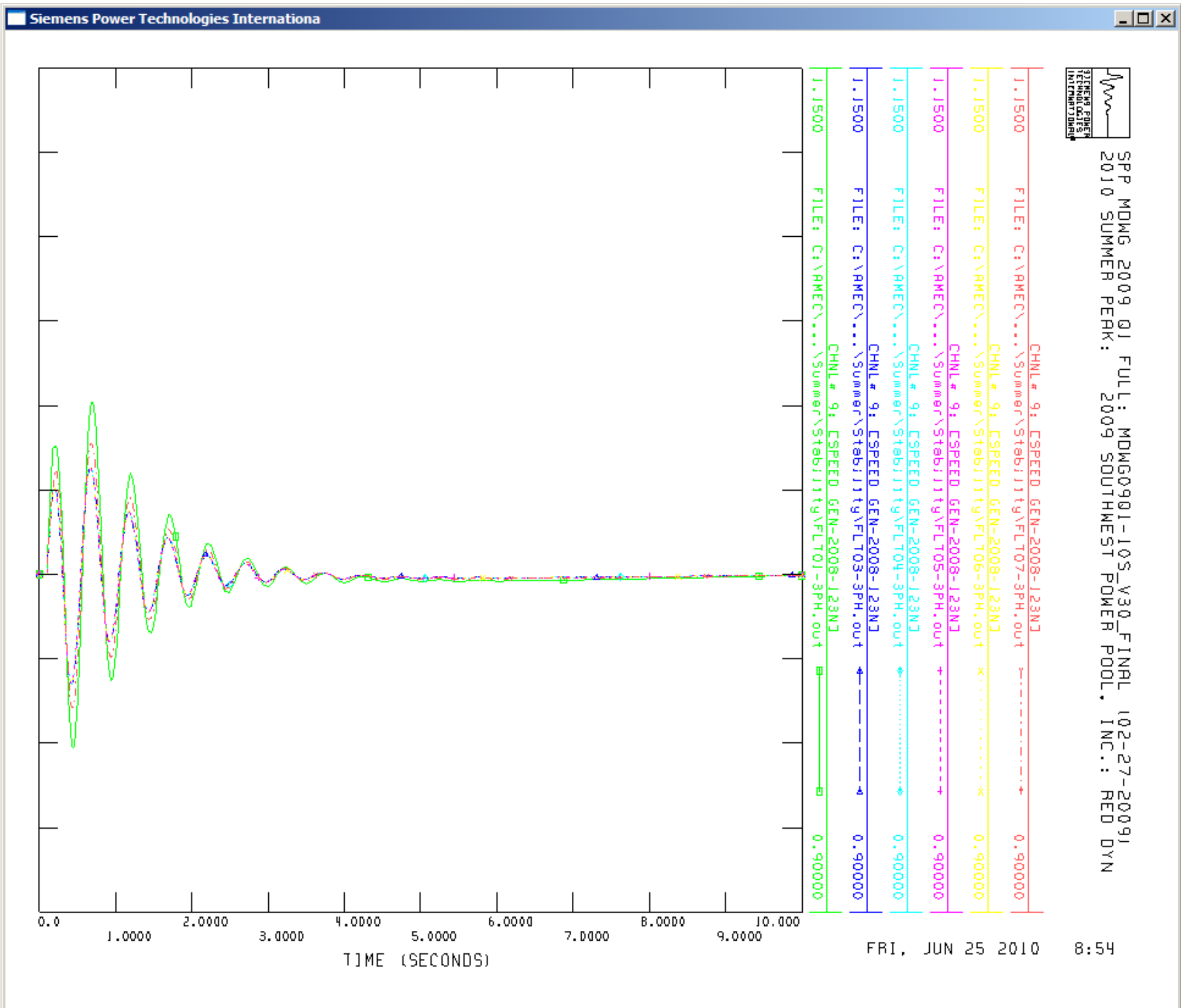

Figure 5: Response of GEN-2008-123N Wind Turbine Generator Speed to FLT01-3PH ~ FLT07-3PH, Summer Peak

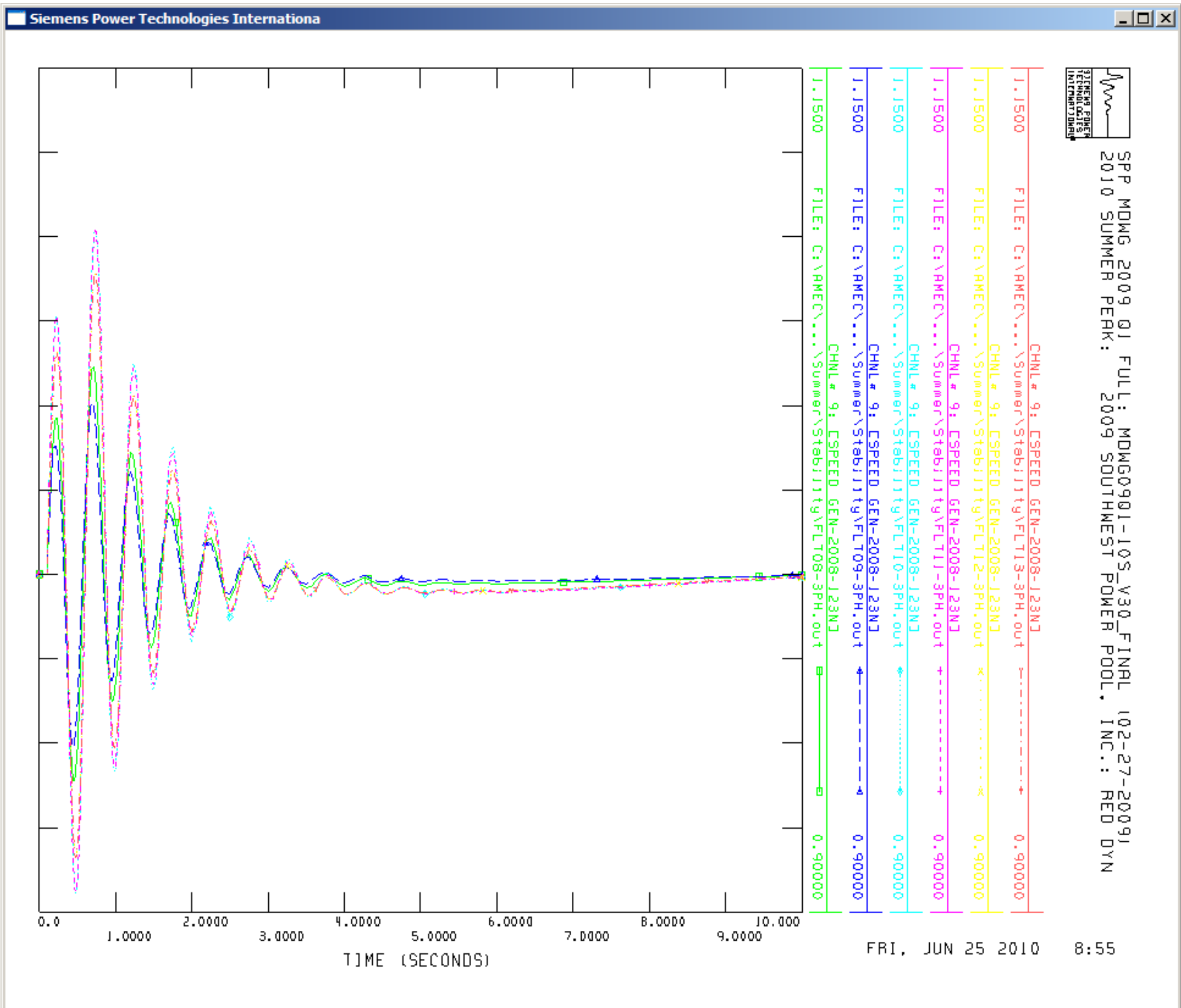

Figure 6: Response of GEN-2008-123N Wind Turbine Generator Speed to FLT08-3PH ~ FLT13-3PH, Summer Peak

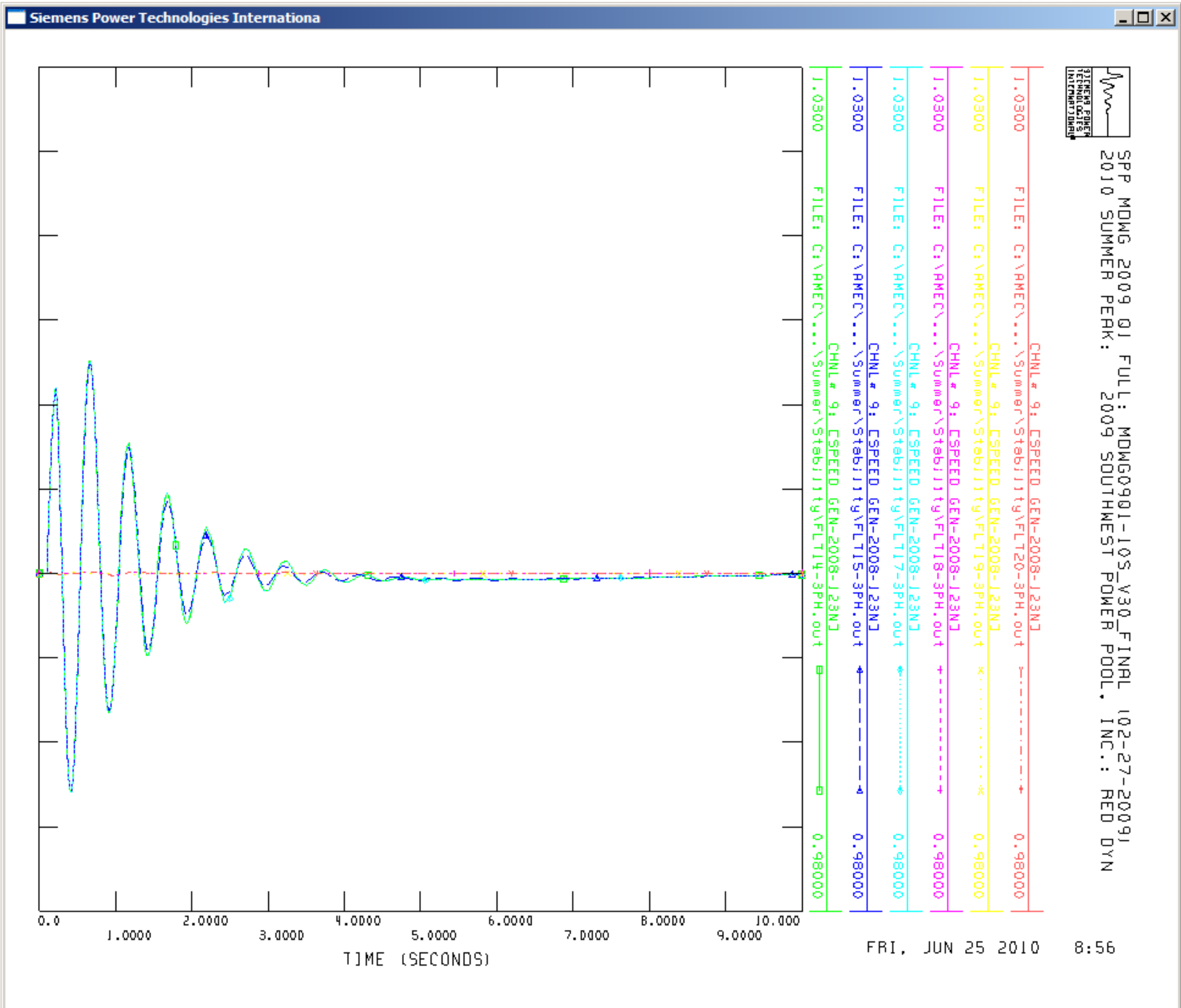

Figure 7: **Response of GEN-2008-123N Wind Turbine Generator Speed to FLT14-3PH ~ FLT20-3PH, Summer Peak**

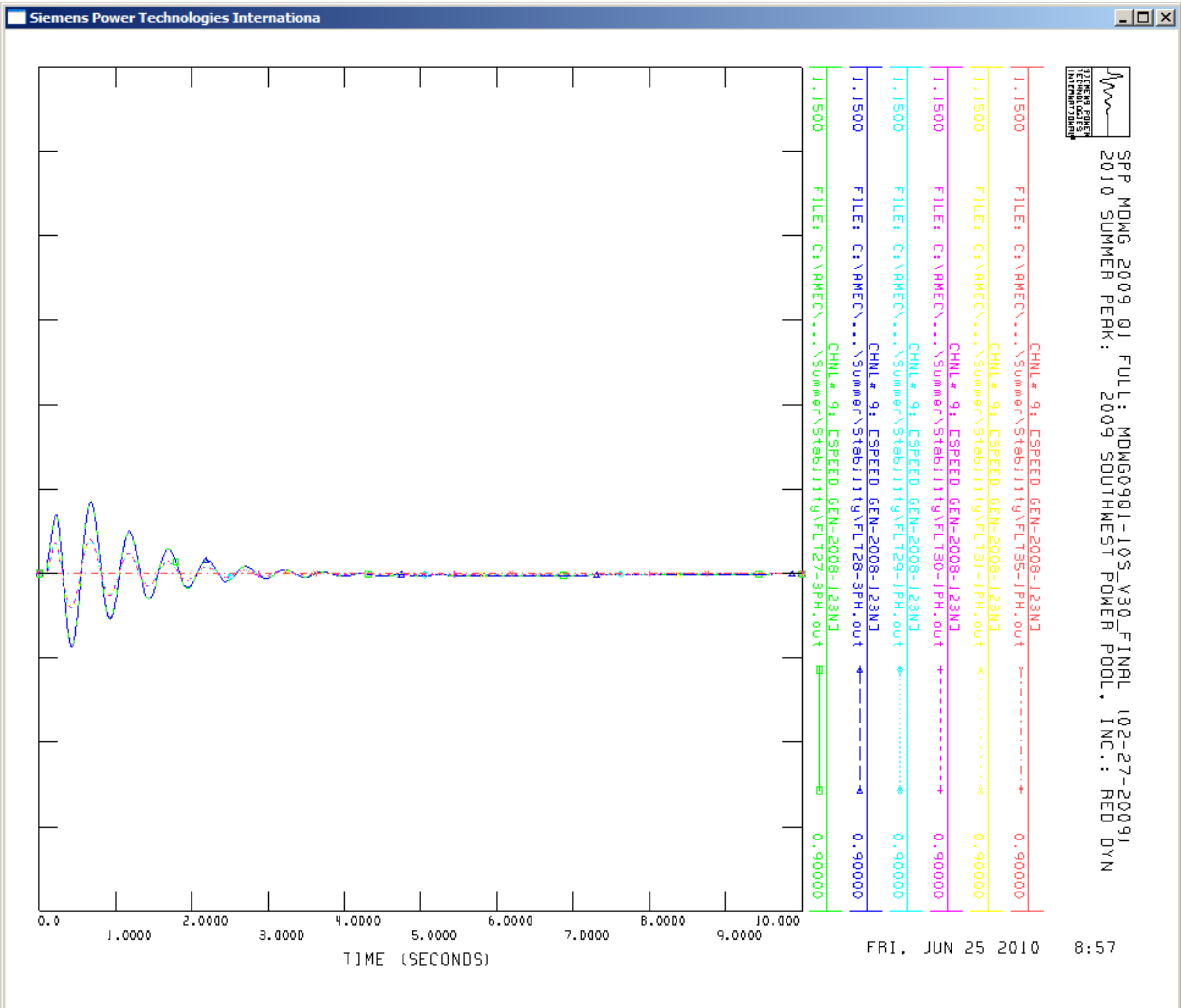

Figure 8: Response of GEN-2008-123N Wind Turbine Generator Speed to FLT27-3PH ~ FLT35-1PH, Summer Peak

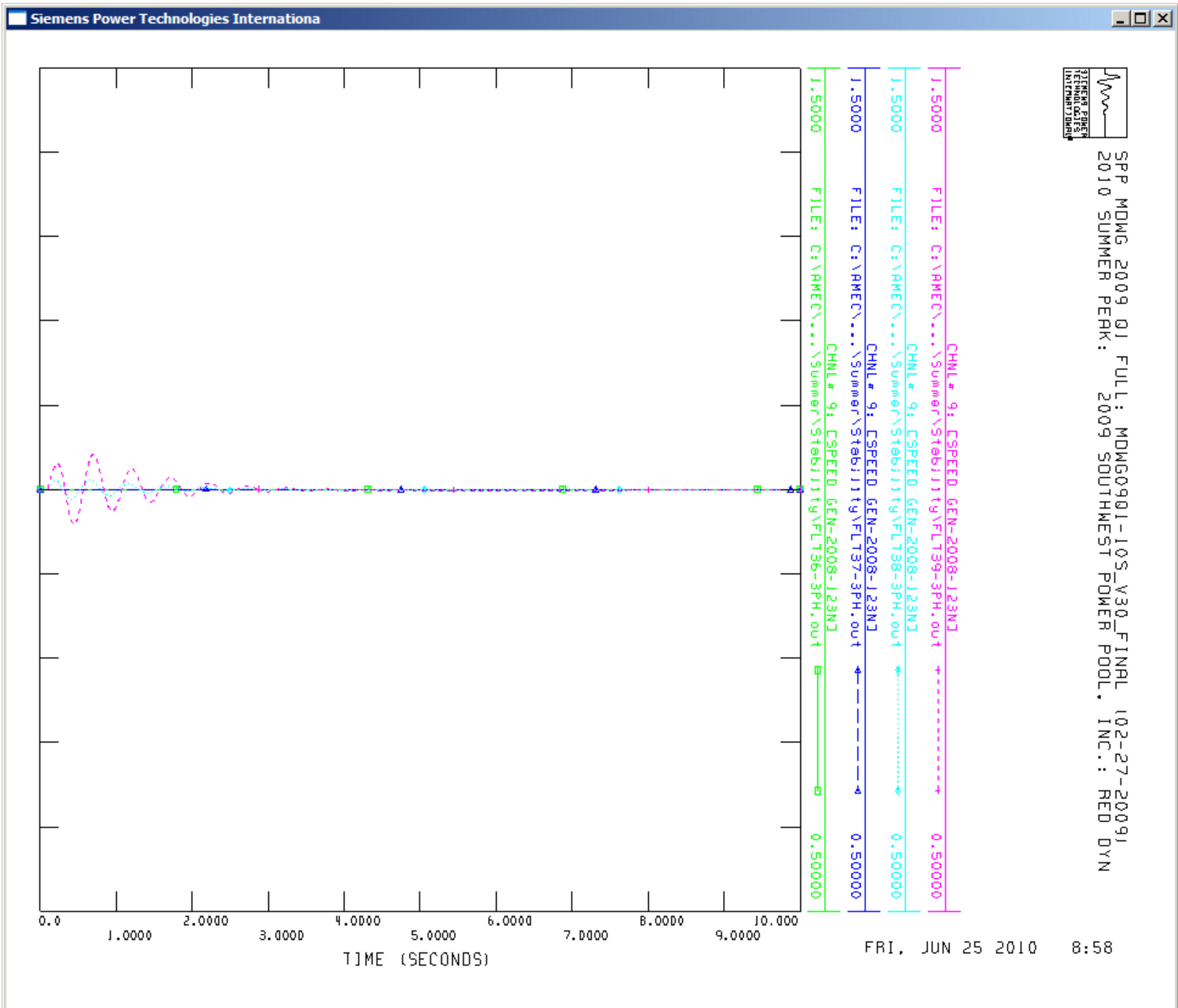

Figure 9: Response of GEN-2008-123N Wind Turbine Generator Speed to FLT36-3PH ~ FLT39-3PH, Summer Peak

Similar results were obtained in dynamic analysis of the winter peak case. The worst-case faults for the winter peak case are shown below. The worst-case faults are the same for the winter and summer peak cases for Group 15.

Table 8: Worst Faults for Dynamic Behavior within Group 15 (Winter Peak)

Generator	Worst Fault	Worst Fault Description
GEN-2008-123N	FLT11-3Φ	Guide Rock to GEN-2008-123N 115kV, near GEN-2008-123N

Following are graphs of the rotor speeds for GEN-2008-123N after applying the faults to the winter peak case.

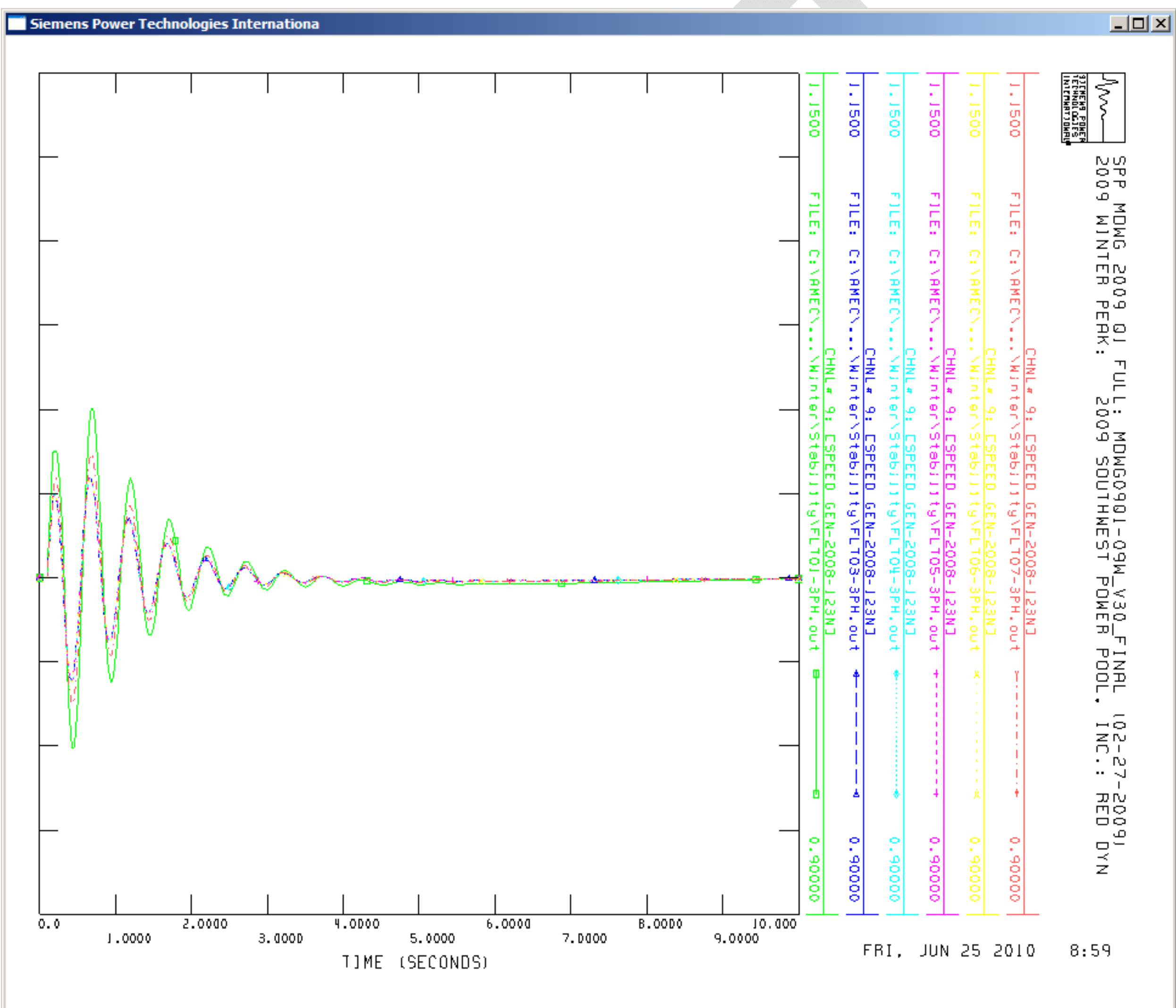

Figure 10: Response of GEN-2008-123N Wind Turbine Generator Speed to FLT01-3PH ~ FLT07-3PH, Winter Peak

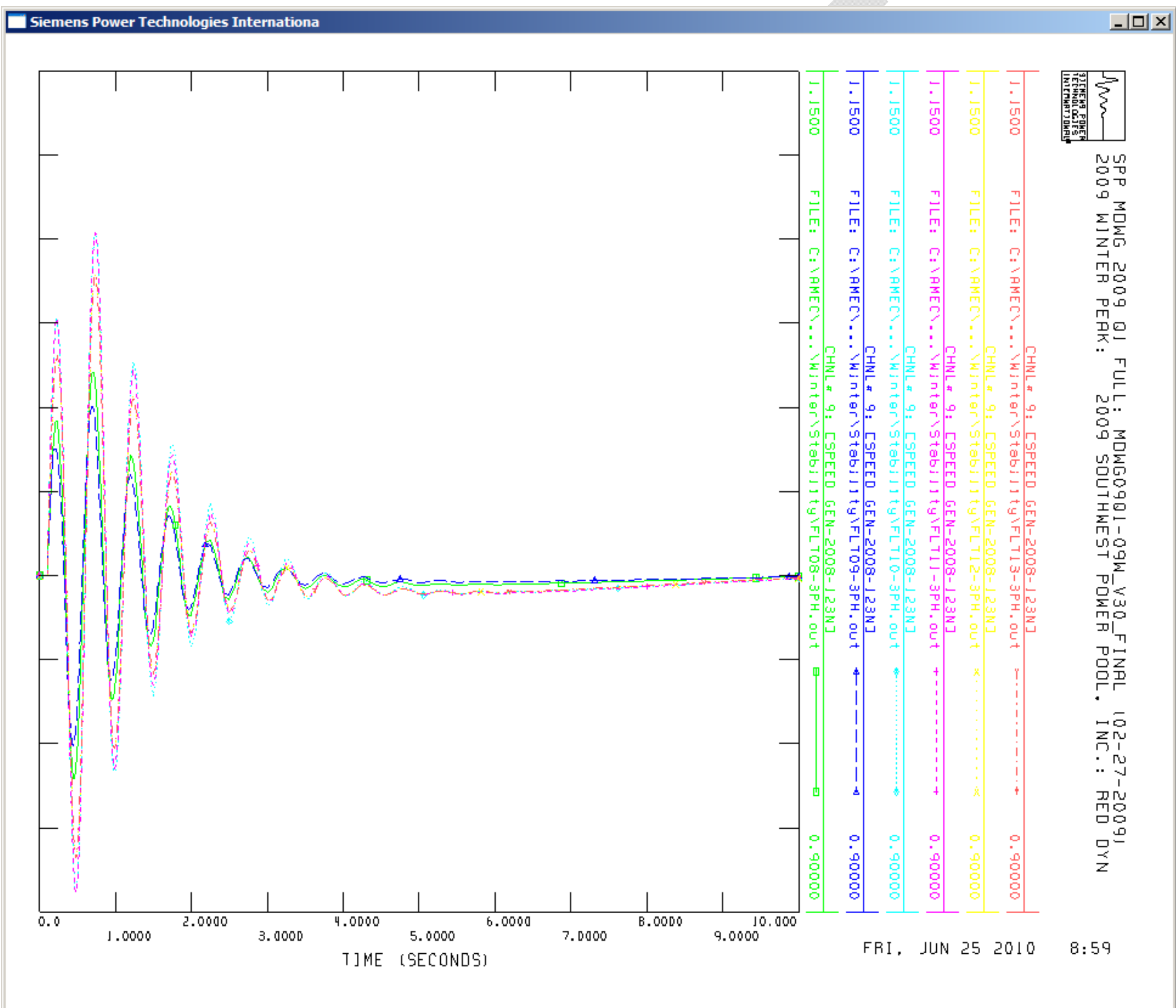

Figure 11: Response of GEN-2008-123N Wind Turbine Generator Speed to FLT08-3PH ~ FLT13-3PH, Winter Peak

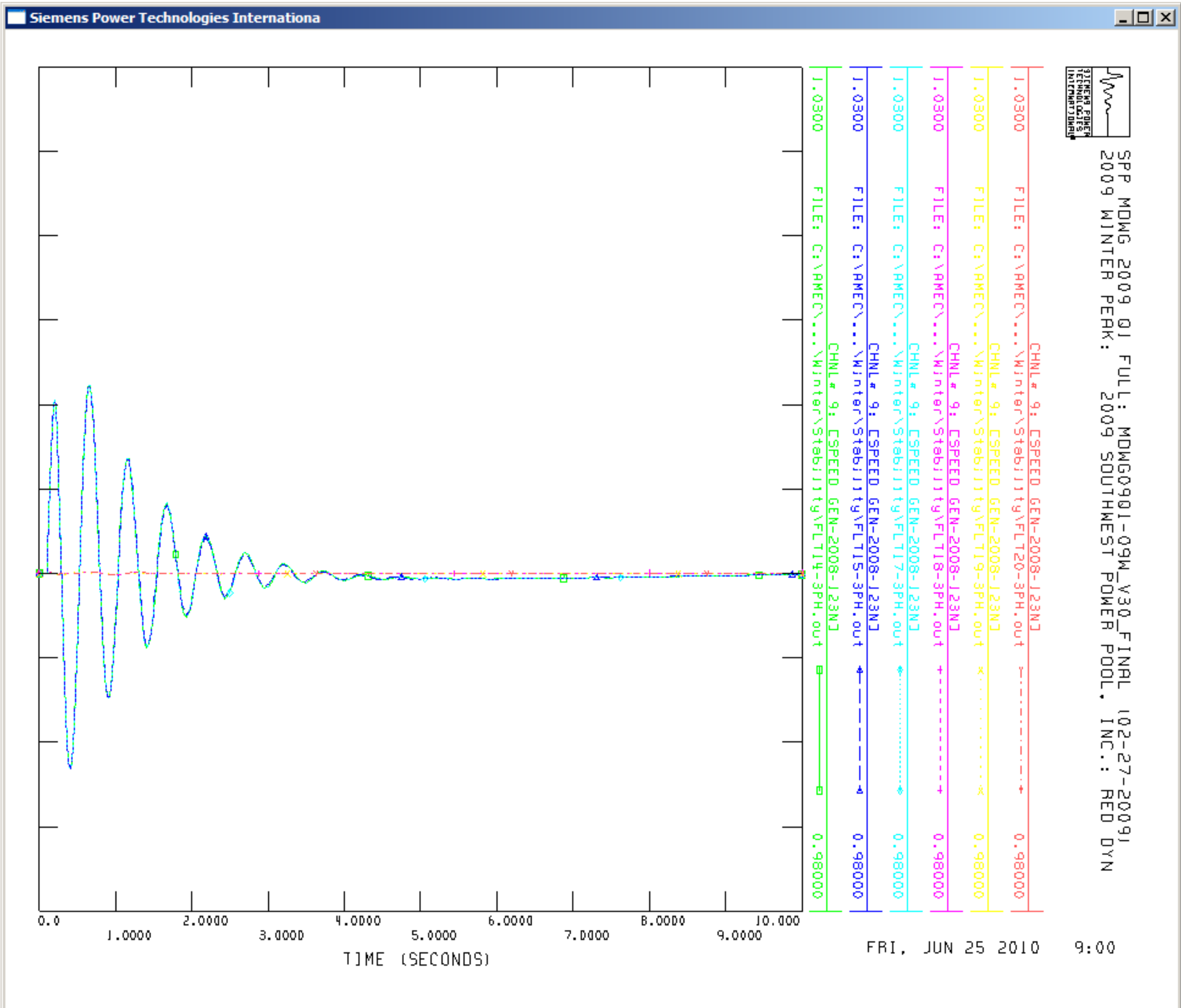

Figure 12: Response of GEN-2008-123N Wind Turbine Generator Speed to FLT14-3PH ~ FLT20-3PH, Winter Peak

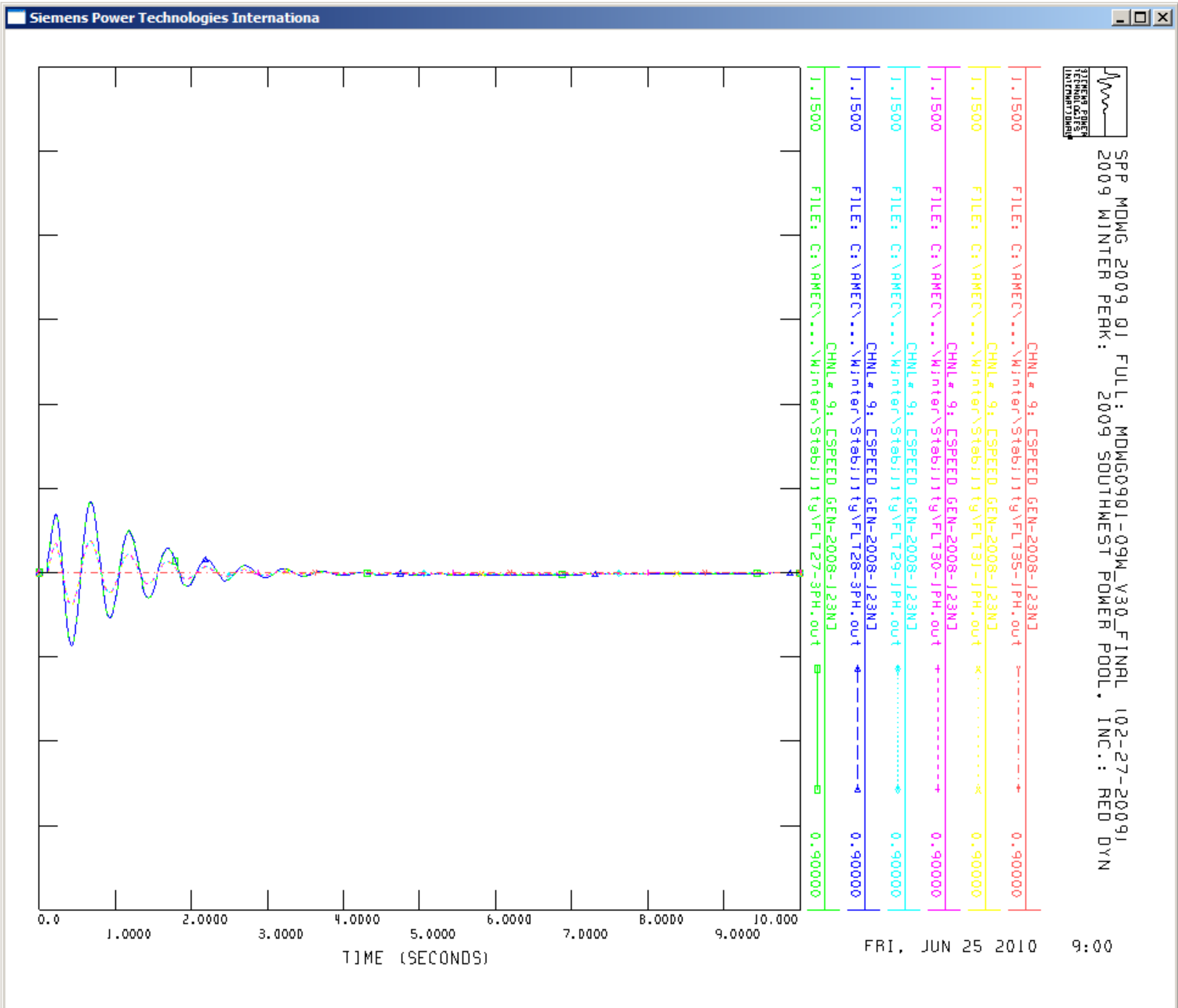

Figure 13: Response of GEN-2008-123N Wind Turbine Generator Speed to FLT27-3PH ~ FLT35-1PH, Winter Peak

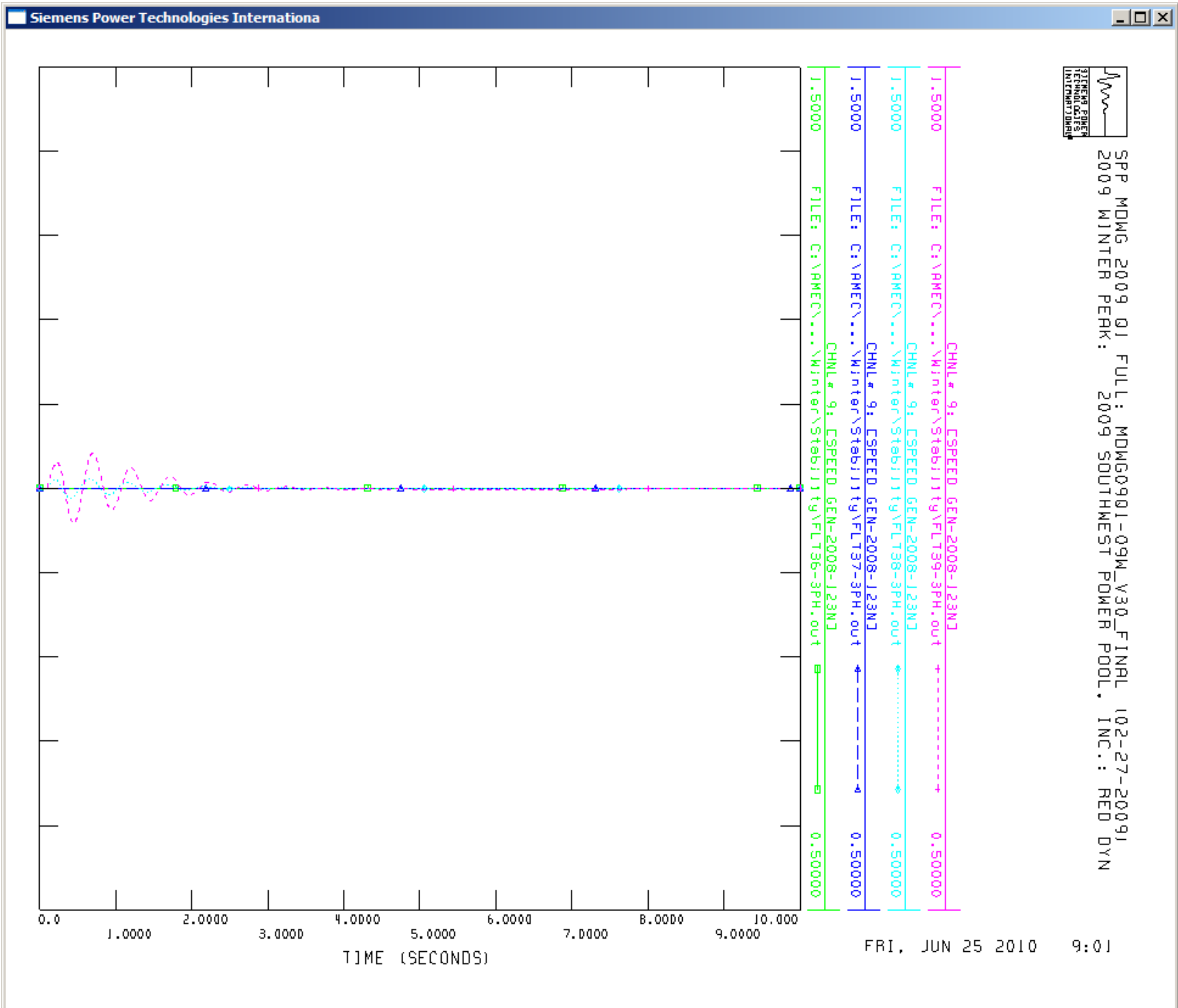

Figure 14: Response of GEN-2008-123N Wind Turbine Generator Speed to FLT36-3PH ~ FLT39-3PH, Winter Peak

6. CONCLUSIONS

Based on the results of Group 15 studies, the following findings had been observed:

- No additional reactive power support.
- All generators appeared capable of meeting LVRT requirements. No generators tripped off line under the fault conditions.
- All wind farms had the capability of recovering to the pre-contingency voltage following the fault disturbance.
- Neither the rotor angles of the synchronous machines in the studied areas suffered from instability nor the wind turbine generators in the studied areas tripped off-line under the fault disturbance.