Definitive Interconnection System Impact Study for Generation Interconnection Requests

(DISIS-2015-001-1)

December 2015

Generator Interconnection

Southwest Power Pool

Revision History

Date	Author	Change Description
07/30/2015	SPP	Report Issued (DISIS-2015-001). Group 2, 5, 6, and 7 Interconnection Request Results not included in this issue.
08/28/2015	SPP	Report Reissued (DISIS-2015-001) to include Group 2, 5, 6, and 7 Interconnection Requests Results
12/23/2015	SPP	Re-Study to account for withdrawn projects

Executive Summary

Pursuant to the Generator Interconnection Procedures (GIP) of the Southwest Power Pool (SPP) Open Access Transmission Tariff (OATT), SPP has conducted this Definitive Interconnection System Impact Study (DISIS). The Interconnection Customers' requests have been clustered together for the following System Impact Cluster Study window which closed March 31, 2015. The Interconnection Customers will be referred to in this study as the DISIS-2015-001 Interconnection Customers. This System Impact Study analyzes the interconnecting of multiple generation interconnection requests associated with new generation totaling approximately 2,937.8 MW of new generation which would be located within the transmission systems of American Electric Power – Western (AEPW), Kansas City Power and Light Company – Greater Missouri Operations Company (KCPL-GMO), Grand River Dam Authority (GRDA), Kansas City Power and Light Company (KPCL), Midwest Energy, Inc. (MIDW), Nebraska Public Power District (NPPD), Oklahoma Gas and Electric (OKGE), Southwestern Public Service (SPS), Sunflower Electric Power Corporation\Mid-Kansas Electric Company, LLC (SUNC\MKEC), Westar Energy, Inc. (WERE), and Western Farmers Electric Cooperative (WFEC). The various generation interconnection requests have differing proposed in-service dates[1]. The generation interconnection requests included in this System Impact Cluster Study are listed in Appendix A by their queue number, amount, requested interconnection service, area, requested interconnection point, proposed interconnection point, and the requested in-service date. This study represents the "Stand-Alone" analysis for remaining Interconnection Requests in the DISIS-2015-001 analysis.

Power flow analysis has indicated that for the power flow cases studied, 2,937.8 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 SPP stability and voltage recovery requirements including FERC Order #661A for wind farm interconnection requests. Those reactive requirements are listed for each interconnection request within this report. Dynamic stability analysis has determined that the transmission system will remain stable with the assigned Network Upgrades and necessary reactive compensation requirements. A short circuit analysis has been performed with available short circuit values given in the stability study for each group in the appendices of this report. A short circuit analysis has been performed with available short circuit values given in the stability study for each group in the appendices of this report.

In no way does this study guarantee operation for all periods of time. This interconnection study identifies and assigns transmission reinforcements for Energy Resource Interconnection Service (ERIS) interconnection injection constraints (defined as a 20% or greater distribution factor impact

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

for outage based constraints and 3% or greater distribution factor impact for system intact constraints) and Network Resource Interconnection Service (NRIS) constraints (defined as 3% or greater distribution factor impact), if requested by the Customer. These constraints are listed in Appendix G. This interconnection study does not assign transmission reinforcements for all potential transmission constraints. It should be noted that although this study analyzed many of the most probable contingencies, it is not an all-inclusive list and cannot account for every operational situation. Because of this, it is likely that the Interconnection Customer(s) may be required to reduce their generation output to 0 MW, also known as curtailment, under certain system conditions to allow system operators to maintain the reliability of the transmission network.

The total estimated minimum cost for interconnecting the DISIS-2015-001 Interconnection Customers is estimated at $233,963,833[2]. These costs determined at this time are shown in Appendix E and F. Interconnection Service to DISIS-2015-001 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 also do not include the Interconnection Customer Interconnection Facilities as defined by the SPP Open Access Transmission Tariff (OATT) or the additional SPP transmission network constraints identified through this study and shown in Appendix H.

Constraints listed in Appendix H do not require transmission reinforcement for Interconnection Service, but could require Interconnection Customer to reduce generation in operational conditions. These transmission constraints occur when this study's generation is dispatched into the SPP footprint for Energy Resource Interconnection Service (ERIS) or when this study's generation is dispatched into the interconnecting Transmission Owner's (T.O.) area for Network Resource Interconnection Service (NRIS).

It should be noted that the additional network constraints identified in Appendix H may also be identified by a Transmission Service Request (TSR) and may need to be verified by associated studies. With a defined source and sink in a TSR, the list of network constraints will be refined and expanded to account for all Network Upgrade requirements. The required interconnection costs listed in Appendix E and F do not include costs associated with the deliverability of the energy to load or other customers. These costs are determined by separate studies should the Customer decide to submit a Transmission Service Request through SPP's Open Access Same Time Information System (OASIS) as required by Attachment Z1 of the SPP OATT. Furthermore, this DISIS neither guarantees transmission service or deliverability of the requested resource.

[2] Does not include costs for ASGI-2015-001 Affected System Request

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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 System Impact Study window which closed March 31, 2015. The customers will be referred to in this study as the DISIS-2015-001 Interconnection Customers. This DISIS analyzes the interconnecting of multiple generation interconnection requests associated with new generation totaling 2,937.8 MW of new generation which would be located within the transmission systems of American Electric Power – Western (AEPW), Kansas City Power and Light Company – Greater Missouri Operations Company (KCPL-GMO), Grand River Dam Authority (GRDA), Kansas City Power and Light Company (KPCL), Midwest Energy, Inc. (MIDW), Nebraska Public Power District (NPPD), Oklahoma Gas and Electric (OKGE), Southwestern Public Service (SPS), Sunflower Electric Power Corporation\Mid-Kansas Electric Company, LLC (SUNC\MKEC), Westar Energy, Inc. (WERE), and Western Farmers Electric Cooperative (WFEC). The various generation interconnection requests have differing proposed in-service dates[3]. The generation interconnection requests included in this System Impact Study are listed in Appendix A by their queue number, amount, requested interconnection service, area, requested interconnection point, proposed interconnection point, and the requested in-service date. A separate analysis for each Interconnection Request for “Stand-Alone” operation has also been performed. This study represents the “Stand-Alone” analysis for remaining Interconnection Requests in the DISIS-2015-001 analysis

The primary objective of this DISIS is to identify the system constraints, transient instabilities, and over-dutied equipment associated with connecting the generation to the area transmission system. The Impact Study and other subsequent Interconnection Studies are designed to identify required Transmission Owner Interconnection Facilities, Network Upgrades and other Direct Assignment Facilities needed to inject power into the grid at each specific point of interconnection.

[3] The generation interconnection requests in-service dates may need to be deferred based on the required lead time for the Network Upgrades necessary. The Interconnection Customers that proceed to the Facility Study will be provided a new in-service date based on the completion of the Facility Study or as otherwise provided for in the GIP.

Model Development

Interconnection Requests Included in the Cluster

SPP included all interconnection requests that submitted a Definitive Interconnection System Impact Study Agreement no later than March 31, 2015 and were subsequently accepted by Southwest Power Pool under the terms of the Generator Interconnection Procedures (GIP) that were in effect at the time this study commenced on April 1, 2015. The interconnection requests that are included in this study are listed in Appendix A.

Affected System Interconnection Request

Also included in this Definitive Interconnection System Impact Study are three (3) Affected System Studies. The Affected System Interconnection Requests have been given the designations with the "ASGI" prefix. These requests are listed in Appendix A. Affected System Interconnection Requests were only studied in "cluster" scenarios.

Previously Queued Interconnection Requests

The previous queued requests included in this study are listed in Appendix B. In addition to the Base Case Upgrades, the previous queued requests and associated upgrades were assumed to be in-service and added to the Base Case models. These projects were dispatched as Energy Resources Interconnection Service (ERIS) with equal distribution across the SPP footprint. Prior queued projects that requested Network Resource Interconnection Service (NRIS) were also dispatched in separate NRIS scenarios into the balancing authority of the interconnecting transmission owner.

Development of Base Cases

Power Flow

The 2015 series Integrated Transmission Planning models (used in the 2016 ITPNT) including the 2016 summer peak and winter peak seasons, the 2017 spring season, the 2020 summer and winter peak seasons, and the 2025 summer peak season.

Dynamic Stability

The 2014 series SPP Model Development Working Group (MDWG) Models for the 2015 (summer and winter peak seasons), and 2025 (summer peak season) cases were used as starting points for this study.

Short Circuit

The 2025 summer peak stability case is used for this analysis.

Base Case Upgrades

The following facilities are part of the SPP Transmission Expansion Plan, the Balanced Portfolio or recently approved Priority Projects. These facilities have an approved Notification to Construct (NTC) 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-2015-001 Interconnection Customers have not been assigned advancement costs for the below listed projects. <u>The DISIS-2015-001 Interconnection Customers Generation Facilities in service dates may need to be delayed until the completion of</u>

the following upgrades. In some cases, the in-service date is beyond the allowable time a customer can delay. In this case, the Interconnection Customer may move forward with Limited Operation or remain in the DISIS Queue for additional study cycles. If for some reason, construction on these projects is discontinued, additional restudies will be needed to determine the interconnection needs of the DISIS Interconnection Customers.

- 2012 Integrated Transmission Plan (2012 ITP10) Projects
  - Woodward-Tatonga-Mathewson-Cimarron 345kV transmission line, scheduled for 2021 in-service[4]
  - Chisholm – Gracemont 345kV transmission line, and Chisholm 345/230kV transformer circuit #1, scheduled for 3/1/2018 in-service[5]
- 2015 Integrated Transmission Plan Near Term (2015 ITPNT) Projects
  - China Draw 115kV Reactive Power Support
    - 200Mvar Capacitive and 50Mvar Inductive Static Var Compensator (SVC)
  - Road Runner 115kV Reactive Power Support
    - 200Mvar Capacitive and 50Mvar Inductive Static Var Compensator (SVC)
  - Potash Junction – Intrepid – IMC #1 – Livingston Ridge 115kV rebuild
  - National Enrichment Plant – Targa – Cardinal 115kV circuit #1 rebuild
- Nebraska City – Mullin Creek – Sibley 345kV circuit #1 build, scheduled for 12/31/2016 in-service[6]
- Northwest 345/138/13.8 kV circuit #3 autotransformer, placed in-service in 2015[7]
- Hoskins – Neligh East 345/115 kV Project[8]
  - Neligh East 345/115 kV substation and transformer
  - Neligh East Area 115 kV upgrades to support new station
  - Hoskins – Neligh East 345 kV circuit #1
- High Priority Incremental Loads (HPILs) Projects[9]:
  - TUCO Interchange – Yoakum – Hobbs Interchange 345/230 kV Project
    - TUCO Interchange – Yoakum – Hobbs Interchange 345 kV circuit #1 and associated terminal equipment upgrades
    - Hobbs 345/230/13 kV transformer circuit #1
    - Yoakum 345/230/13 kV transformer circuit #1
  - Battle Axe – Road Runner 115 kV circuit #1
  - Chaves County – Price – CV Pines – Capitan 115 kV circuit #1
  - China Draw – Yeso Hills 115 kV circuit #1
  - Dollarhide – Toboso Flats 115 kV circuit #1
  - Hobbs Interchange – Kiowa 345 kV circuit #1

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[4] SPP Notification to Construct (NTC) 200223
[5] SPP Notification to Construct (NTC) 200240 and 200255
[6] SPP Notification to Construct (NTC) 20097 and 20098
[7] SPP Transmission Service Project identified in SPP 2009-AG2-AFS6. Per SPP NTC 20137 & 200194
[8] SPP Regional Reliability 2012 ITP 10 Project Per SPP-NTC-200220
[9] Per Network Upgrades assigned in High Priority Incremental Loads (HPILs) study, Including Direct Assigned Upgrades, Projects in SPP-NTC-200256 and SPP-NTC-200283.

- Kiowa – North Loving – China Draw 345/115 kV Projects
    - Kiowa – North Loving – China Draw circuit #1 and associated terminal equipment upgrades
    - China Draw 345/115/13 kV transformer circuit #1
    - North Loving 345/115/13 kV transformer circuit #1
- Kiowa – Road Runner 345/230/115 kV Projects
    - Kiowa 345/230 kV transformer circuit #1
    - Road Runner 345/115/13 kV transformer circuit #1
- Livingston Ridge – Sage Brush – Lagarto – Cardinal 115 kV circuit #1
- North Loving – South Loving 115 kV circuit #1
- Ponderosa – Ponderosa Tap 115 kV circuit #1
- Potash 230/115/13kV Transformer circuit #1 replacement

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-2015-001 study and are assumed to be in service. This list may not be all inclusive. The DISIS-2015-001 Interconnection 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 Generation Interconnection Agreement or withdraw from the interconnection queue. The DISIS-2015-001 Interconnection Customer Generation Facilities in-service dates may need to be delayed until the completion of the following upgrades.

- Upgrades assigned to DISIS-2010-002 Interconnection Customers:
    - Twin Church – Dixon County 230 kV circuit #1 rerate (320 MVA)
    - Buckner – Spearville 345 kV terminal equipment
- Upgrades assigned to DISIS-2011-001 Interconnection Customers:
    - Hoskins – Dixon County – Twin Church 230 kV circuit #1 conductor clearance increase
    - (NRIS only) Woodward District EHV Phase Shifting Transformer
- Upgrades assigned to DISIS-2012-002 Interconnection Customers:
    - Associated Electric Cooperatives Inc. (AECI) Fairfax 138/69 kV transformer replacement
    - Lake Creek – Lone Wolf 69 kV circuit #1 reset CT
    - Remington – Fairfax 138 kV circuit #1 conductor clearance increase
    - (NRIS only) Arkansas City – Paris –Creswell – Oak – Rainbow – City of Winfield 69kV circuit #1 rebuild
    - (NRIS only) Creswell 138/69/13kV Transformer circuit #1 and #2, replacements
- Upgrades assigned to DISIS-2013-002 Interconnection Customers:
    - Battle Creek – County Line – Neligh East 115kV circuit #1 rebuild
- Upgrades assigned to DISIS-2014-002 Interconnection Customers:
    - Arnold – Ransom 115kV circuit #1, terminal equipment replacement
    - Beaver County 345kV Reactive Power Support, build approximately 75Mvars of capacitive reactive power support
    - Carlisle 230/115/13kV Transformer circuit #1 replacement
    - Tolk – Plant X 230kV circuit #1 and circuit #2 re-conductor

- Crawfish Draw Substation 345/230kV
  - Build new 345/230kV substation along TUCO – Border 345kV and TUCO – Swisher 230kV. Tie in and Terminate TUCO 345kV, Border 345kV, TUCO 230kV, and Swisher 230kV at TUCO 2.
  - Build 345/230/13kV transformer
- Crawfish Draw – TUCO Interchange 230kV circuit #1 replace terminal equipment

Potential Upgrades Not in the Base Case

Any potential upgrades that do not have a Notification to Construct (NTC) and are not explicitly listed within this report 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 section.

Regional Groupings

The interconnection requests listed in Appendix A are grouped together into eight (8 active regional groups based on geographical and electrical impacts. These groupings are shown in Appendix C.

To determine interconnection impacts, eight (8) different generation dispatch scenarios of the spring, summer, and winter base case models are developed to accommodate the regional groupings.

Power Flow

For Variable Energy Resources (VER) (solar/wind) in each power flow case, Energy Resource Interconnection Service (ERIS), is evaluated for the generating plants within a geographical area of the interconnection request(s) for the VERs dispatched at 100% nameplate of maximum generation. The VERs in the remote areas are dispatched at 20% nameplate of maximum generation. These projects are dispatched across the SPP footprint using load factor ratios.

Peaking units are not dispatched in the 2017 spring, or in the “High VER” summer and winter peaks. To study peaking units’ impacts, the 2016 summer and winter peaks, 2020 summer and winter peaks, and 2025 summer peak models are developed with peaking units dispatched at 100% of the nameplate rating and VERs dispatched at 20% of the nameplate rating. Each interconnection request is also modeled separately at 100% nameplate for certain analyses.

All generators (VER and peaking) that requested Network Resource Interconnection Service (NRIS) are dispatched in an additional analysis into the interconnecting Transmission Owner’s (T.O.) area at 100% nameplate with Energy Resource Interconnection Service (ERIS) only requests at 80% nameplate. This method allows for identification of network constraints that are common between regional groupings to have affecting requests share the mitigating upgrade costs throughout the cluster.

Dynamic Stability

For each group, all interconnection requests are dispatched at 100% nameplate output while the other groups are dispatched at 20% output for VERs and 100% output for thermal requests.

Short Circuit
The dynamic stability models (2025 SP) are used for this analysis.

Identification of Network Constraints

Network constraints are found by using PSS/E AC Contingency Calculation (ACCC) analysis with PSS/E MUST First Contingency Incremental Transfer Capability (FCITC) analysis on the entire cluster grouping dispatched at the various levels previously mentioned. The ERIS constraints are then screened to determine which of the generation interconnection requests have at least a 20% Distribution Factor (DF) upon outage based constraints (n-1) and 3% DF upon system intact constraints (n-0) or on non-convergences case solutions during outage based constraints (n-1). In addition, stability issues are also considered for transmission reinforcement under ERIS. Interconnection Requests that requested Network Resource Interconnection Service (NRIS) are also studied in the NRIS analysis to determine if any constraint measured greater than or equal to a 3% DF. If so, these constraints are also considered for mitigation under NRIS.

Constraints that are identified and require transmission reinforcement are listed in Appendix G. These constraints met the criteria for analysis for Energy Resource Interconnection Service and Network Resource Interconnection Service (if requested).

Other network constraints not requiring transmission reinforcements are shown in Appendix H. With a defined source and sink in a Transmission Service Request, this list of network constraints can be refined and expanded to account for all Network Upgrade requirements for firm transmission service. Additional constraints identified by multi-element contingencies are listed in Appendix I.

In no way does the list of constraints in Appendix G identify all potential constraints that guarantee operation for all periods of time. It should be noted that although this study analyzed many of the most probable contingencies, it is not an all-inclusive list and cannot account for every operational situation. Because of this, it is likely that the Customer(s) may be required to reduce their generation output to 0 MW, also known as curtailment, under certain system conditions to allow system operators to maintain the reliability of the transmission network.

Determination of Cost Allocated Network Upgrades

Cost Allocated Network Upgrades of Variable Energy Resources (VER) (solar/wind) generation interconnection requests are determined using the 2017 spring model. Cost Allocated Network Upgrades of peaking units is determined using the 2020 summer peak model. A PSS/E and MUST sensitivity analysis is performed to determine the Distribution Factors (DF), a distribution factor with no contingency that each generation interconnection request has on each new upgrade. The impact each generation interconnection request has on each upgrade project is weighted by the size of each request. Finally the costs due by each request for a particular project are then determined by allocating the portion of each request's impact over the impact of all affecting requests.

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:

$$\text{Request X Impact Factor on Upgrade Project 1} = \text{PTDF(\%)(X)} * \text{MW(X)} = \text{X1}$$

$$\text{Request Y Impact Factor on Upgrade Project 1} = \text{PTDF(\%)(Y)} * \text{MW(Y)} = \text{Y1}$$

$$\text{Request Z Impact Factor on Upgrade Project 1} = \text{PTDF(\%)(Z)} * \text{MW(Z)} = \text{Z1}$$

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

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

- 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/Compensation for Amounts Advanced for Network Upgrades

Interconnection Customer shall be entitled to either credits or potentially Long Term Congestion Rights (LTCR), otherwise known as compensation, in accordance with Attachment Z2 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.

Required Interconnection Facilities

The requirement to interconnect the 2,937.8 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 an estimated $233,963,833, not including ASGI-2015-001 Affected System Interconnection Costs. Interconnection Facilities specific to each generation interconnection request are listed in Appendix E. A preliminary one-line drawing for each generation interconnection request are listed in Appendix D.

For an explanation of how required Network Upgrades and Interconnection Facilities were determined, refer to the section on "Identification of Network Constraints."

Facilities Analysis

The interconnecting Transmission Owner for each Interconnection Request has provided its preliminary analysis of required Transmission Owner Interconnection Facilities and the associated Network Upgrades, shown in Appendix D. This analysis was limited only to the expected facilities to be constructed by the Transmission Owner at the Point of Interconnection. These costs are included within one-line diagrams in Appendix D and also listed in Appendix E and F as combined "Interconnection Costs". If the one-lines and costs in Appendix D have been updated by the Transmission Owner's Interconnection Facilities Study, those costs will be noted in the appendix. These costs will be further refined by the Transmission Owner as part of the Interconnection Facilities Study. Any additional Network Upgrades identified by this DISIS beyond the Point of Interconnection are defined and estimated by either the Transmission Owner or by SPP. These additional Network Upgrade costs will also be refined further by the Transmission Owner within the Interconnection Facilities Study.

Power Flow Analysis

Power Flow Analysis Methodology

The ACCC function of PSS/E is used to simulate single element and special (i.e., breaker-to-breaker, multi-element, etc.) contingencies in portions or all of the modeled control areas of SPP, as well as, other control areas external to SPP and the resulting scenarios analyzed. Single element and multi-element contingencies are evaluated.

Power Flow Analysis

A power flow analysis is conducted for each Interconnection Customer's facility using modified versions of the 2016 summer and winter, 2017 spring , 2020 summer and winter, and 2025 summer peaks. The output of the Interconnection Customer's facility is 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 Interconnection Service request (ERIS). Certain requests that are also pursuing Network Resource Interconnection Service (NRIS) have an additional analysis conducted for displacing resources in the interconnecting Transmission Owner's balancing area.

Power Flow Results

Cluster Group 1 (Woodward Area)

In addition to the 4,216.5 MW of previously queued generation in the area, 161.0 MW of new interconnection service was studied. The system intact thermal violation of FPL Switch – Woodward 138kV will limit the Interconnection Service for the DISIS-2015-001 Interconnection Request. The FPL Switch – Woodward 138kV constraint will be relieved by the Woodward District EHV Phase Shifting Transformer which is currently assigned to DISIS-2011-001 Interconnection Requests and will need to be advanced by the DISIS-2015-001 Group 1 Interconnection Customer if the Interconnection Request anticipates having full Interconnection Service with their current proposed in-service date. The Mathewson-Tatonga 345kV overload is due to a modeling issue. The line should be rated at 1792MVA in the models. There were certain non-converged contingencies that were observed that were relieved with modeling corrections.

Cluster ERIS Constraints			
MONITORED ELEMENT	Limiting Rate A/B (MVA)	TC%LOADING (% MVA)	CONTINGENCY
FPL Switch – Woodward 138KV CKT 1	287	114.06	System intact

Cluster NRIS Constraints			
MONITORED ELEMENT	Limiting Rate A/B (MVA)	TC%LOADING (% MVA)	CONTINGENCY
No NRIS Interconnection Requests in Group 1			

Group 1 (Limited Operation)

Limited Operation results are listed below. While these results are based on the criteria listed in GIP 8.4.3, the Interconnection Customer may request additional scenarios for Limited Operation based on higher queued Interconnection Requests not being placed in service.

Limited Operation Analysis		
Interconnection Request	**MW**	**Constraint that most limits LOIS**
GEN-2015-029	0	FPL-Woodward 138kV

Cluster Group 2 (Hitchland Area)

All Interconnection Requests in Group 2 have withdrawn from the study. No additional analysis was performed for Group 2.

Cluster Group 3 (Spearville Area)

In addition to the 3,204.8 MW of previously queued generation in the area, 31.03 MW of new interconnection service was studied. The addition of the Group 3 Interconnection Requests caused thermal ERIS constraints on Crooked Creek – Cudahy – Kismet – Cimarron Tap 115kV circuit #1, FPL Switch – Woodward 138kV circuit #1, and Greenburg – Shooting Star Tap 115kV circuit #1 during system intact and contingency system conditions. Crooked Creek – Cudahy – Kismet 115kV and Greenburg – Shooting Start Tap 115kV will have to be rebuilt to mitigate the corresponding thermal overloads. The FPL Switch – Woodward 138kV constraint will be relieved by the Woodward District EHV Phase Shifting Transformer which is currently assigned to DISIS-2011-001 Interconnection Requests and will need to be advanced by the DISIS-2015-001 Group 3 Interconnection Customers if the Interconnection Request anticipates having full Interconnection Service with their current proposed in-service date.

Cluster ERIS Constraints			
MONITORED ELEMENT	**Limiting Rate A/B (MVA)**	**TC%LOADING (% MVA)**	**CONTINGENCY**
CIMARRON RIVER TAP - KISMET 115KV CKT 1	133.0	117.00	FINNEY SWITCHING STATION - WALKTAP 345KV CKT 1
Crooked Creek – Cudahy 115kV CKT 1	148.0	115.00	FINNEY SWITCHING STATION - WALKTAP 345KV CKT 1
Cudahy – Kismet 115kV CKT 1	135.0	117.00	FINNEY SWITCHING STATION - WALKTAP 345KV CKT 1
FPL Switch – Woodward 138kV CKT 1	153.0	108.00	System intact
Greenburg – Shooting Star Tap 115kV CKT1	148.0	105.00	System intact

Cluster NRIS Constraints			
MONITORED ELEMENT	**Limiting Rate A/B (MVA)**	**TC%LOADING (% MVA)**	**CONTINGENCY**
Currently, No NRIS constraints for Group 3 Interconnection Requests	-	-	N/A

Group 3 (Limited Operation)

Limited Operation results are listed below. While these results are based on the criteria listed in GIP 8.4.3, the Interconnection Customer may request additional scenarios for Limited Operation based on higher queued Interconnection Requests not being placed in service.

Limited Operation Analysis		
Interconnection Request	**MW**	**Constraint that most limits LOIS**
GEN-2015-021	0	FPL Switch – Woodward 138kV CKT 1
GEN-2015-027	0	Cimarron River Tap – Kismet 115kV CKT 1 Crooked Creek – Cudahy 115kV CKT 1 Cudahy – Kismet 115kV CKT 1 Greenburg – Shooting Star Tap 115kV CKT 1 FPL Switch – Woodward 138kV CKT 1

Cluster Group 4 (Northwest Kansas Area)

In addition to the 1,462.2 MW of previously queued generation in the area, 242.0 MW of new interconnection service was studied. Terminal equipment will need to be replaced to mitigate the ERIS thermal constraint on Beach Station – GEN-2010-048 Tap 115kV.

Cluster ERIS Constraints			
MONITORED ELEMENT	**Limiting Rate A/B (MVA)**	**TC%LOADING (% MVA)**	**CONTINGENCY**
Beach Station – GEN-2010-048 Tap 115kV CKT 1	80	102.0	POST ROCK (POSTROCK T1) 345/230/13.8KV TRANSFORMER CKT 1

Cluster NRIS Constraints			
MONITORED ELEMENT	**Limiting Rate A/B (MVA)**	**TC%LOADING (% MVA)**	**CONTINGENCY**
Currently, No NRIS constraints for Group 4 Interconnection Requests			

Group 4 (Limited Operation)

Limited Operation results are listed below. While these results are based on the criteria listed in GIP 8.4.3, the Interconnection Customer may request additional scenarios for Limited Operation based on higher queued Interconnection Requests not being placed in service.

Limited Operation Analysis		
Interconnection Request	**MW**	**Constraint that most limits LOIS**
GEN-2010-048	58	Beach Station – GEN-2010-048 Tap 115kV CKT 1
GEN-2015-017	172	None

Cluster Group 6 (South Texas Panhandle/New Mexico Area)

In addition to the 4,434.37 MW of previously queued generation in the area, 416.00 MW of new interconnection service was studied. Due to the addition of the new Interconnection Request(s), various potential voltage collapse(s) were observed for the entire southern portions of the Texas panhandle for outages as shown in the table below including all area tie lines. To mitigate potential voltage collapse(s), capacitive reactive power at Oklaunion is needed to mitigate the voltage collapse(s). In addition to the potential voltage collapse(s), mitigations for ERIS thermal constraints on the Elk City 230/138/13kV transformer, the Kress Interchange – Swisher 115kV line and Wheeler – Grapevine Interchange – Nichols Station 230kV. The Kress Interchange – Swisher 115kV line, Wheeler – Grapevine Interchange – Nichols Station 230kV will all require terminal upgrade(s). The Elk City 230/138kV transformer will require significant terminal and substation work to alleviate the overload.

NRIS constraints that require mitigation include the need for Carlisle – LP-Doug 115kV, Cox Interchange – Hale County 115kV, TUCO Interchange – Jones 230kV, Potter County Interchange 345/230kV Transformer, Wolfforth – Sundown 230kV, Wolfforth – Terry County 115kV and TUCO 230/115kV transformer.

The Hobbs – Yoakum – TUCO 345/230kV Project has been previously cost allocated for this study per SPP-NTC-200223 and 200309 from the 2012 SPP Integrated Transmission Plan 10-Year (2012 ITP 10) High Priority Incremental Loads (HPILs) Study with a current anticipated in-service date of June, 2020. The in-service date for this project is well beyond the in-service date of the Interconnection Request(s) in Group 2 and Group 6. In accordance with the SPP Generator Interconnection Procedure (GIP), Interconnection Request(s) can delay their in-service dates no more than three (3) years, therefore Group 6 requests will not be able to move forward into the Interconnection Facilities Study Queued unless they execute a Limited Operation Interconnection Facilities Study Agreement (Appendix 4A to the SPP GIP).

It should be noted that higher queued assigned network upgrades are considered in this analysis based on higher queued Interconnection Request(s) assignment. If higher queued Interconnection Request(s) withdraw from the SPP GI queue or terminate their Generator Interconnection Agreement (GIA), a restudy will be needed for this group to determine network upgrade need changes.

For Group 6 Cluster analysis cost allocation, please refer to Appendix E and F.

Cluster ERIS Constraints

MONITORED ELEMENT	Limiting Rate A/B (MVA)	TC%LOADING (% MVA)	CONTINGENCY
Non-Converged Contingency	N/A	N/A	BORDER 7345.00 - TUCO_2 345.00 345KV CKT 1
Non-Converged Contingency	N/A	N/A	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
Non-Converged Contingency	N/A	N/A	G14-074T 345.00 - OKLAUNION 345KV CKT 1
Elk City 230/138/13kV Transformer CKT 1	287	102	System Intact
Kress Interchange – Swisher County Interchange 115kV CKT 1	175	112	PALO DURO SUB - RANDALL COUNTY INTERCHANGE 115KV CKT 1
GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329	139	System Intact
GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	329	160.4	System Intact

Cluster NRIS Constraints			
MONITORED ELEMENT	Limiting Rate A/B (MVA)	TC%LOADING (% MVA)	CONTINGENCY
CARLISLE INTERCHANGE - LP-DOUD_TP 3115.00 115KV CKT 1	160	118.34	WOLFFORTH INTERCHANGE (WH 7001668) 230/115/13.2KV TRANSFORMER CKT 1
COX INTERCHANGE - HALE CO INTERCHANGE 115KV CKT 1	95.81	100.38	KRESS INTERCHANGE - KRESS_RURAL3115.00 115KV CKT 1
JONES STATION - TUCO INTERCHANGE 230KV CKT 1	343	114	GEN526331 1-JONES GEN #1 22 KV
POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	106.39	G14-074T 345.00 - TUCO INTERCHANGE 345KV CKT 1
SUNDOWN INTERCHANGE - WOLFFORTH INTERCHANGE 230KV CKT 1	350.6	100.77	TUCO INTERCHANGE - YOAKUM_345 345.00 345KV CKT 1
TERRY COUNTY INTERCHANGE - WOLFFORTH INTERCHANGE 115KV CKT 1	154	107.59	TUCO INTERCHANGE - YOAKUM_345 345.00 345KV CKT 1
TUCO INTERCHANGE (GE M102345) 230/115/13.2KV TRANSFORMER CKT 1	252	101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2

Group 6 (Limited Operation)

Limited Operation results are listed below. While these results are based on the criteria listed in GIP 8.4.3, the Interconnection Customer may request additional scenarios for Limited Operation based on higher queued Interconnection Requests not being placed in service.

Limited Operation Analysis		
Interconnection Request	MW	Constraint that most limits LOIS
ASGI-2015-002	0	BORDER 7345.00 - TUCO_2 345.00 345KV CKT 1 BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1 G14-074T 345.00 - OKLAUNION 345KV CKT 1 Tuco 345/230kV transformer
GEN-2014-074	0	BORDER 7345.00 - TUCO_2 345.00 345KV CKT 1 BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1 G14-074T 345.00 - OKLAUNION 345KV CKT 1 Tuco 345/230kV transformer
GEN-2015-014	0	BORDER 7345.00 - TUCO_2 345.00 345KV CKT 1 BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1 G14-074T 345.00 - OKLAUNION 345KV CKT 1 Tuco 345/230kV transformer
GEN-2015-022	0	BORDER 7345.00 - TUCO_2 345.00 345KV CKT 1 BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1 G14-074T 345.00 - OKLAUNION 345KV CKT 1 Tuco 345/230kV transformer

Cluster Group 7 (Southwestern Oklahoma Area)

In addition to the 1,751.00 MW of previously queued generation in the area, 172.90 MW of new interconnection service was studied. NRIS constraints were observed for the Mooreland – FPL Switch – Woodward 138kV line, and the Woodward 138/69kV transformer. Several constraints were found in the local area of GEN-2005-013. The GEN-2015-004 Interconnection Request, located at Border 345kV, has an impact on Group 6 Interconnection Requests and voltage performance at Oklaunion, for the loss of Border-Woodward 345kV. The reactive compensation at Oklaunion is necessary to mitigate the voltage collapse.

Cluster ERIS Constraints			
MONITORED ELEMENT	**Limiting Rate A/B (MVA)**	**TC%LOADING (% MVA)**	**CONTINGENCY**
ALTUS SW - NAVAJO 69KV CKT 1	36	120.0	SNYDER - SNYDER 138KV CKT 1
ANADARKO - SEQUOYAHJ4 138.00 138KV CKT 1	132	101.0	System Intact
CORN TAP - NAPLESTP 138.00 138KV CKT 1	132	114.0	System Intact
CORN TAP - SEQUOYAHJ4 138.00 138KV CKT 1	132	100.0	System Intact
NAPLESTP 138.00 - PAYNE 138.00 138KV CKT 1	132	111.0	System Intact
NAVAJO - SNYDER 69KV CKT 1	48	100.0	SNYDER - SNYDER 138KV CKT 1
Non-Converged Contingency	N/A	N/A	STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1
Non-Converged Contingency	N/A	N/A	STLN-DEMARC6 - SWEETWATER 230KV CKT 1
Non-Converged Contingency	N/A	N/A	BORDER – WOODWARD 345KV

Cluster NRIS Constraints			
MONITORED ELEMENT	**Limiting Rate A/B (MVA)**	**TC%LOADING (% MVA)**	**CONTINGENCY**
FPL Switch – Mooreland 138kV CKT 1	287	102.0	MATHWSN7 345.00 - TATONGA7 345.00 345KV CKT 1
FPL Switch – Woodward 138kV CKT 1	171	150.0	MATHWSN7 345.00 - TATONGA7 345.00 345KV CKT 1
Woodward 138/69/13kV Transformer CKT 1	134	101.0	FPL Switch – Mooreland 138kV

Group 7 (Limited Operation)

Limited Operation results are listed below. While these results are based on the criteria listed in GIP 8.4.3, the Interconnection Customer may request additional scenarios for Limited Operation based on higher queued Interconnection Requests not being placed in service.

Limited Operation Analysis		
Interconnection Request	**MW**	**Constraint that most limits LOIS**
GEN-2015-004	0	OKU reactive power
GEN-2015-013	0	FPL Switch – Woodward 138kV CKT 1

Cluster Group 8 (North Oklahoma/South Central Kansas Area)

In addition to the 4,188.20 MW of previously queued generation in the area, 1,54.06 MW of new interconnection service was studied. No new constraints were found in this area for ERIS service. The analysis for NRIS observed thermal overloads on Renfrow - Renfrow 138kV line for the outage of Mooreland – Rose Valley 138kV.

Cluster ERIS Constraints			
MONITORED ELEMENT	**Limiting Rate A/B (MVA)**	**TC%LOADING (% MVA)**	**CONTINGENCY**
Currently, No ERIS constraints for Group 8 Interconnection Requests			

Cluster NRIS Constraints			
MONITORED ELEMENT	**Limiting Rate A/B (MVA)**	**TC%LOADING (% MVA)**	**CONTINGENCY**
RENFROW4 138.00 - RENFROW4 138.00 138KV CKT 1	179	101.88	MOORELAND - ROSE_VALLEY 138.00 138KV CKT 1

Group 8 (Limited Operation)

Limited Operation results are listed below. While these results are based on the criteria listed in GIP 8.4.3, the Interconnection Customer may request additional scenarios for Limited Operation based on higher queued Interconnection Requests not being placed in service.

Limited Operation Analysis		
Interconnection Request	**MW**	**Constraint that most limits LOIS**
GEN-2015-001	200	None
GEN-2015-015	154.56 102 (NRIS)	None RENFROW4 138.00 - RENFROW4 138.00 138KV CKT 1
GEN-2015-016	200	None
GEN-2015-024	220	None
GEN-2015-025	220	None
GEN-2015-028	3	None
GEN-2015-030	200.1	None

Cluster Group 9 (Nebraska Area)

In addition to the 2,492.7 MW of previously queued generation in the area, 460.70 MW of new interconnection service was studied. No new constraints were found in this area for ERIS service in powerflow, but GEN-2015-023 was observed to require the GGS-Thedford-Holt County 345kV line for stability (see stability report for Group 9). The analysis for NRIS observed thermal overloads and non- converged on Grand Island – Grand Island LNX – Holt 345kV line for the outage of Grand Prairie LNX – Yankton 345kV. Mitigation for Grand Island – Grand Island LNX – Holt 345kV line would require the GGS – Thedford – Holt County 345kV ITP10 project per SPP NTC 200277, which has an in-serice date of 6/1/2018.

Cluster ERIS Constraints			
MONITORED ELEMENT	**Limiting Rate A/B (MVA)**	**TC%LOADING (% MVA)**	**CONTINGENCY**
Voltage Instability			Grand Prairie – Fort Thompson 345kV

Cluster NRIS Constraints			
MONITORED ELEMENT	**Limiting Rate A/B (MVA)**	**TC%LOADING (% MVA)**	**CONTINGENCY**
Non-Converged Contingency	720	-	GR ISLD-LNX3345.00 - GRAND ISLAND 345KV CKT Z
Non-Converged Contingency	720	-	GR ISLD-LNX3345.00 - HOLT.CO3 345.00 345KV CKT 1
GR ISLD-LNX3345.00 - GRAND ISLAND 345KV CKT Z	720	100.0	GRPRAR2-LNX3345.00 - YANKTON 345KV CKT Z
GR ISLD-LNX3345.00 - HOLT.CO3 345.00 345KV CKT 1	720	100.0	GRPRAR2-LNX3345.00 - YANKTON 345KV CKT Z

Group 9 (Limited Operation)

Limited Operation results are listed below. While these results are based on the criteria listed in GIP 8.4.3, the Interconnection Customer may request additional scenarios for Limited Operation based on higher queued Interconnection Requests not being placed in service.

Limited Operation Analysis		
Interconnection Request	**MW**	**Constraint that most limits LOIS**
GEN-2015-007	160	None
GEN-2015-023	0	Holt County – Grand Island 345kV

Cluster Group 10 (Southeast Oklahoma/Northeast Texas Area)

In addition to the 0.0 MW of previously queued generation in the area, 0.0 MW of new interconnection service was studied. No new constraints were found in this area.

Cluster Group 12 (Northwest Arkansas Area)

All Interconnection Requests in Group 2 have withdrawn from the study.

Cluster Group 13 (Northeast Kansas/Northwest Missouri Area)

In addition to the 434.6 MW of previously queued generation in the area, 200.1 MW of new interconnection service was studied. No new constraints were found in this area. SPP Interconnection Service for GEN-2015-005 would be dependent on the in-service of the Nebraska City – Mullins Creek - Sibley 345kV transmission circuit that is part of the SPP Priority Projects per SPP-NTC-20097 and SPP-NTC-20098, and the decommissioning of the GEN-2015-005 temporary Point of Interconnection (POI) at Associated Electric Cooperative, Inc.'s (AECI) Osborn 161kV. Currently, the Mid-Continent Independent System Operator is reviewing GEN-2015-005 for Affected System constraints.

Cluster ERIS Constraints			
MONITORED ELEMENT	**Limiting Rate A/B (MVA)**	**TC%LOADING (% MVA)**	**CONTINGENCY**
Currently, No ERIS Group 13 constraints			

Cluster NRIS Constraints			
MONITORED ELEMENT	**Limiting Rate A/B (MVA)**	**TC%LOADING (% MVA)**	**CONTINGENCY**
Currently, No NRIS Group 13 constraints			

Group 13 (Limited Operation)

Limited Operation results are listed below. While these results are based on the criteria listed in GIP 8.4.3, the Interconnection Customer may request additional scenarios for Limited Operation based on higher queued Interconnection Requests not being placed in service.

Limited Operation Analysis		
Interconnection Request	**MW**	**Constraint that most limits LOIS**
GEN-2015-005	200.1	None

Cluster Group 14 (South Central Oklahoma Area)
In addition to the 612.50 MW of previously queued generation in the area, 0.0 MW of new interconnection service was studied. No current studies, DISIS-2015-001 Interconnection Customers, are located in this geographical group.

Curtailment and System Reliability

In no way does this study guarantee operation for all periods of time. It should be noted that although this study analyzed many of the most probable contingencies, it is not an all-inclusive list and cannot account for every operational situation. Because of this, it is likely that the Customer(s) may be required to reduce their generation output to 0 MW, also known as curtailment, under certain system conditions to allow system operators to maintain the reliability of the transmission network.

Stability & Short Circuit Analysis

For this restudy, a stability and short circuit analysis was conducted for Groups 3, 6, 8, and 9 which had significant changes due to Interconnection Request withdrawals. For those groups, each Interconnection Request was studied using modified versions of the 2014 series SPP Model Development Working Group (MDWG) Models 2015 winter, 2015 summer, and 2025 summer peak dynamic cases[10]. The stability analysis is conducted with all upgrades in service that are identified in the power flow analysis unless otherwise noted in the individual group stability study. For each group, the interconnection requests are studied at 100% nameplate output while the other groups are dispatched at 20% output for Variable Energy Resource (VER) requests and 100% output for other requests. The output of the Interconnection Customer's facility is offset in each model by a reduction in output of existing online SPP generation. Each Interconnection Request is studied in a Stand Alone scenario in addition to the cluster scenario. A synopsis is included for each group. The entire stability study for each group can be found in the Appendices.

Short-circuit analysis is performed but verification of over-dutied equipment is performed by the Transmission Owner within the Interconnection Facilities Study. Results of that analysis may require additional costs to replace circuit breakers and associated equipment.

Cluster Group 1 (Woodward Area)

The Group 1 study was not performed again for this study. Power Factor requirements are listed in the table below. In addition, some Interconnection Requests may have requirements for reactors under low wind conditions as identified in the ABB Group 1 report from the original DISIS-2015-001 study.

Power Factor Requirements:

Request	Size (MW)	Generator Model	Point of Interconnection	Power Factor Requirement at POI*	
				Lagging (supplying)	Leading (absorbing)
GEN-2015-029**	161	G.E. 2.3MW	Tatonga 345kV	0.95	0.95

*As reactive power is required for all projects, the final requirement in the GIA will be the pro-forma 95% lagging to 95% leading at the point of interconnection.
** Requirement for reactors for low wind conditions

Cluster Group 2 (Hitchland Area)

No Interconnection Requests remained in Group 2.

[10] Short Circuit analysis performed only on the 2025 Summer Peak seasonal model. Group 6 Stability Analysis also includes 2020 Summer and Winter Peak seasons.

Cluster Group 3 (Spearville Area)

The Group 3 stability analysis for this area was performed by SPP Staff. Stability analysis has determined that with all previously assigned and currently assigned Network Upgrades placed in service the transmission system will remain stable and low voltage ride through requirements are satisfied for the probable contingencies studied. Power Factor requirements are listed in the table below. In addition, some Interconnection Requests may have requirements for reactors under low wind conditions as identified in the S&C Group 3 report from the original DISIS-2015-001 study.

Power Factor Requirements:

Request	Size (MW)	Generator Model	Point of Interconnection	Power Factor Requirement at POI*	
				Lagging (supplying)	Leading (absorbing)
GEN-2015-021	20	AE	Johnson Corner 115kV	0.95	0.95
GEN-2015-027	4.5	Siemens	Crooked Creek 115kV	0.95	0.95
ASGI-2015-001	4.27/ 6.13	GENSAL	Ninnescah 115kV	0.95	0.95

*As reactive power is required for all projects, the final requirement in the GIA will be the pro-forma 95% lagging to 95% leading at the point of interconnection.
** Requirement for reactors for low wind conditions

Cluster Group 4 (Northwest Kansas)

The Group 4 stability analysis was not performed again for this study. Power Factor requirements are listed in the table below. In addition, some Interconnection Requests may have requirements for reactors under low wind conditions as identified in the Power-tek Group 4 report from the original DISIS-2015-001 study.

Power Factor Requirements:

Request	Size (MW)	Generator Model	Point of Interconnection	Power Factor Requirement at POI*	
				Lagging (supplying)	Leading (absorbing)
GEN-2010-048	70	Nordex 2.5MW	Tap on Ross Beach – Redline 69kV	0.95	0.95
GEN-2015-017	155/ 172	GENROU	Mingo 115kV	0.95	0.95

*As reactive power is required for all projects, the final requirement in the GIA will be the pro-forma 95% lagging to 95% leading at the point of interconnection.
** Requirement for reactors for low wind conditions

Cluster Group 6 (South Texas Panhandle/New Mexico)

The Group 6 stability analysis for this area was performed by Mitsubishi Electric Power Products Inc. (MEPPI). The stability analysis has shown that for an outage of the G14-074 Tap to Tuco 345kV line GEN-2014-074 would trip offline due to high voltage. The mitigation for this outage is to add a 0/-30Mvar SVC at the G14-07Tap 345kV bus. With this 0/-30Mvar SVC and with all previously assigned and currently assigned Network Upgrades placed in service the transmission system will remain stable and low voltage ride through requirements are satisfied for the probable contingencies studied.

Power Factor requirements are listed in the table below. In addition, some Interconnection Requests may have requirements for reactors under low wind conditions as identified in the MEPPI Group 6 report. The power factor analysis showed that for an outage of the OKU to G14-074 Tap 345kV line that the voltage at Border 345kV collapsed. The mitigation for the outage is to increase the SVC at Border 345kV to 200Mvar and to install a 200Mvar capacitor at Border 345kV.

Power Factor Requirements:

Request	Size (MW)	Generator Model	Point of Interconnection	Power Factor Requirement at POI*	
				Lagging (supplying)	Leading (absorbing)
GEN-2014-074**	152.0	Vestas V110 2.0MW	Tap Tuco – OKU 345kV	0.95	0.95
GEN-2015-014	150.0	Vestas V110 2.0MW	Tap on Cochran – LG Plains 115kV	0.95	0.95
GEN-2015-022	112.0	GE LV5 4.0MW Inverters	Swisher 115kV	0.95	0.95
ASGI-2015-002	2.0	GE 2.0MW	Yuma Interchange 115/69kV	0.95	0.95

*As reactive power is required for all projects, the final requirement in the GIA will be the pro-forma 95% lagging to 95% leading at the point of interconnection.
** Requirement for reactors for low wind conditions

Cluster Group 7 (Southwest Oklahoma)

The Group 7 stability analysis was not performed again for this study. Power Factor requirements are listed in the table below. In addition, some Interconnection Requests may have requirements for reactors under low wind conditions as identified in the Burns and McDonnell Group 7 report from the original DISIS-2015-001 study.

Power Factor Requirements:

Request	Size (MW)	Generator Model	Point of Interconnection	Power Factor Requirement at POI*	
				Lagging (supplying)	Leading (absorbing)
GEN-2015-004**	52.9	Siemens 2.3MW	Border 345kV	0.95	0.95
GEN-2015-013	120	Eaton Power Xpert Solar Inverters 1.67MW	Snyder 138kV	0.95	0.95

*As reactive power is required for all projects, the final requirement in the GIA will be the pro-forma 95% lagging to 95% leading at the point of interconnection.
** Requirement for reactors for low wind conditions

Cluster Group 8 (South Central Kansas/North Oklahoma)

The Group 8 stability analysis for this area was performed by Mitsubishi Electric Power Products Inc. (MEPPI). Stability analysis has determined that with all previously assigned and currently assigned Network Upgrades placed in service the transmission system will remain stable and low voltage ride through requirements are satisfied for the probable contingencies studied. Power Factor requirements are listed in the table below. In addition, some Interconnection Requests may have requirements for reactors under low wind conditions as identified in the Group 8 report.

Power Factor Requirements:

Request	Size (MW)	Generator Model	Point of Interconnection	Power Factor Requirement at POI*	
				Lagging (supplying)	Leading (absorbing)
GEN-2015-001**	200	Vestas V126 3.0MW	Ranch Road 345kV	0.95	0.95
GEN-2015-015	154.5	Siemens 2.3MW with PowerBoost (2.415MW)	Tap Medford – Coyote 138kV	0.95	0.95
GEN-2015-016	200	Vestas V110 2.0MW	Tap Centerville – Marmaton 161kV	0.95	0.95
GEN-2015-024**	220	G.E. 2.0MW	Tap Wichita – Thistle 345kV	0.95	0.95
GEN-2015-025**	220	G.E. 2.0MW	Tap Wichita – Thistle 345kV	0.95	0.95
GEN-2015-028	3	Uprate from Siemens 2.3 to 2.415MW	Nardins 69kV	0.95	0.95
GEN-2015-030**	200.1	G.E. 2.3MW	Sooner 345kV	0.95	0.95
ASGI-2015-004	54.3/ 56.3	GENSAL	Coffeyville 69kV	0.95	0.95

*As reactive power is required for all projects, the final requirement in the GIA will be the pro-forma 95% lagging to 95% leading at the point of interconnection.
** Requirement for reactors for low wind conditions

Cluster Group 9 (Nebraska)

The Group 9 stability analysis for this area was performed by S&C Electric (S&C GEN-2015-023 exhibited instability for certain contingencies in the 2015 summer peak and the 2015 winter peak cases. If GEN-2015-023 requires service prior to the in-service date of the Gentleman – Cherry County/Thedford – Holt County 345kV Project (“R-Plan”) previously assigned in SPP 2012 Integrated Transmission Plan 10 Year Assessment (ITP10), per SPP-NTC-200220, the Interconnection Customer will need to request an advancement of this upgrade. Power Factor requirements are listed in the table below. In addition, some Interconnection Requests may have requirements for reactors under low wind conditions as identified in the Group 9 report.

Power Factor Requirements:

Request	Size (MW)	Generator Model	Point of Interconnection	Power Factor Requirement at POI*	
				Lagging (supplying)	Leading (absorbing)
GEN-2015-007	160	G.E.	Hoskins 345kV	0.95	0.95
GEN-2015-023	300.8	G.E.	Holt County 345kV	0.95	0.95

*As reactive power is required for all projects, the final requirement in the GIA will be the pro-forma 95% lagging to 95% leading at the point of interconnection.
** Requirement for reactors for low wind conditions

Cluster Group 10 (Southeast Oklahoma/Northeast Texas Area)

There were no customers requesting interconnection service in the southeast Oklahoma/northeast Texas area.

Cluster Group 12 (Northwest Arkansas Area)

No remaining Interconnection Requests in Group 12.

Cluster Group 13 (Northwest Missouri Area)

The Group 13 stability analysis was not performed again for this study. Power Factor requirements are listed in the table below. In addition, some Interconnection Requests may have requirements for reactors under low wind conditions as identified in the Power-tek report from the original DISIS-2015-001 study

Power Factor Requirements:

Request	Size (MW)	Generator Model	Point of Interconnection	Power Factor Requirement at POI*	
				Lagging (supplying)	Leading (absorbing)
GEN-2015-005**	200	G.E. 1.79MW	Tap Nebraska City – Mullens Creek 345kV	0.95	0.95

*As reactive power is required for all projects, the final requirement in the GIA will be the pro-forma 95% lagging to 95% leading at the point of interconnection.
** Requirement for reactors for low wind conditions

Cluster Group 14 (South Central Oklahoma)

There were no customers requesting Interconnection Service in the south central Oklahoma area.

Conclusion

The minimum cost of interconnecting 2,937.8 MW of new generation interconnection requests included in this Definitive Interconnection System Impact Study is estimated at $233,963,833, not including the ASGI-2015-001 Affected System Interconnection Costs for the Allocated Network Upgrades and Transmission Owner Interconnection Facilities listed in Appendix E and F. 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 any Network Upgrades that are identified as required through the short circuit analysis. Potential over-duty circuit breakers capability will be identified by the Transmission Owner in the Interconnection Facilities Study.

Further refinement of total estimated interconnection costs will be provided, should the Interconnection Customer meet the requirements for acceptance and choose to move into the Interconnection Facilities Study following the posting of this DISIS. The Interconnection Facilities Study may include additional study analysis, additional facility upgrades not yet identified by this DISIS, such as circuit breaker replacements and affected system facilities, and further refinement of existing cost estimates.

The required interconnection costs listed in Appendices E, and F, 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).

Appendices

A: Generation Interconnection Requests Considered for Impact Study

See next page.

A: Generation Interconnection Requests Considered for Study

Request	Amount	Service	Area	Requested Point of Interconnection	Proposed Point of Interconnection	Requested In-Service Date	In Service Date Delayed Until no earlier than*
ASGI-2015-001	6.13	ER	SUNCMKEC	Ninnescah 115kV	Ninnescah 115kV		TBD
ASGI-2015-002	2.00	ER	SPS	SP-Yuma 69kV	SP-Yuma 69kV		TBD
ASGI-2015-004	56.36	ER	GRDA	Coffeyville City 69kV	Coffeyville City 69kV		TBD
GEN-2010-048	70.00	ER	MIDW	Tap Beach Station - Redline 115kV	Tap Beach Station - Redline 115kV	12/30/2017	TBD
GEN-2014-074	152.00	ER/NR	SPS	Tap TUCO Interchange - Oklaunion 345kV	Tap TUCO Interchange - Oklaunion (GEN-2014-074 Tap) 345kV	10/31/2017	TBD
GEN-2015-001	200.00	ER	OKGE	Ranch Road 345kV	Ranch Road 345kV	12/31/2016	TBD
GEN-2015-004	52.90	ER	OKGE	Border 345kV	Border 345kV	5/15/2017	TBD
GEN-2015-005	200.10	ER	KCPL	Tap Nebraska City - Sibley 345kV	Tap Nebraska City - Sibley 345kV	12/31/2017	TBD
GEN-2015-007	160.00	ER	NPPD	Hoskins 345kV	Hoskins 345kV	12/31/2016	TBD
GEN-2015-013	120.00	ER/NR	WFEC	Synder 138kV	Synder 138kV	12/1/2016	TBD
GEN-2015-014	150.00	ER	SPS	Lehman 115kV	Tap Cochran - Lehman 115kV	12/1/2016	TBD
GEN-2015-015	154.60	ER/NR	OKGE	Tap Medford Tap - Coyote 138kV	Tap Medford Tap - Coyote 138kV	7/31/2016	TBD
GEN-2015-016	200.00	ER/NR	KCPL	Tap Marmaton - Centerville 161kV	Tap Marmaton - Centerville 161kV	12/31/2017	TBD
GEN-2015-017	172.00	ER/NR	SUNCMKEC	Mingo 115kV	Mingo 115kV	8/1/2018	TBD
GEN-2015-021	20.00	ER/NR	SUNCMKEC	Johnson Corner 115kV	Johnson Corner 115kV	12/31/2016	TBD
GEN-2015-022	112.00	ER/NR	SPS	Swisher 115kV	Swisher 115kV	12/1/2016	TBD
GEN-2015-023	300.70	ER/NR	NPPD	Holt County 345kV	Holt County 345kV	12/31/2019	TBD
GEN-2015-024	220.00	ER	WERE	Wichita 345kV	Tap Thistle - Wichita 345kV Dbl CKT	12/31/2016	TBD
GEN-2015-025	220.00	ER	WERE	Wichita 345kV	Tap Thistle - Wichita 345kV Dbl CKT	12/31/2016	TBD
GEN-2015-027	4.90	ER	SUNCMKEC	Crooked Creek 115kV	Crooked Creek 115kV	3/1/2016	TBD
GEN-2015-028	3.00	ER	OKGE	Nardins 69kV	Nardins 69kV	3/1/2016	TBD
GEN-2015-029	161.00	ER	OKGE	Tatonga 345kV	Tatonga 345kV	12/1/2016	TBD
GEN-2015-030	200.10	ER	OKGE	Sooner 345kV	Sooner 345kV	12/1/2017	TBD
Total:	**2,937.79**						

*In-Service Date for each request is to be determined after the Interconnection Facility Study is completed.

B: Prior Queued Interconnection Requests

See next page.

B: Prior Queued Interconnection Requests

Request	Amount	Area	Requested/Proposed Point of Interconnection	Status or In-Service Date
ASGI-2010-006	150.00	AECI	Remington 138kV	AECI queue Affected Study
ASGI-2010-010	42.20	SPS	Lovington 115kV	Lea County Affected Study
ASGI-2010-020	30.00	SPS	Tap LE-Tatum - LE-Crossroads 69kV	Lea County Affected Study
ASGI-2010-021	15.00	SPS	Tap LE-Saunders Tap - LE-Anderson 69kV	Lea County Affected Study
ASGI-2011-001	27.30	SPS	Lovington 115kV	On-Line
ASGI-2011-002	20.00	SPS	Herring 115kV	On-Line
ASGI-2011-003	10.00	SPS	Hendricks 69kV	On-Line
ASGI-2011-004	20.00	SPS	Pleasant Hill 69kV	Under Study (DISIS-2011-002)
ASGI-2012-002	18.15	SPS	FE-Clovis Interchange 115kV	Under Study (DISIS-2012-002)
ASGI-2012-006	22.50	SUNCMKEC	Tap Hugoton - Rolla 69kV	Under Study (DISIS-2012-001)
ASGI-2013-001	11.50	SPS	PanTex South 115kV	Under Study (DISIS-2013-001)
ASGI-2013-002	18.40	SPS	FE Tucumcari 115kV	Under Study (DISIS-2013-001)
ASGI-2013-003	18.40	SPS	FE Clovis 115kV	Under Study (DISIS-2013-001)
ASGI-2013-004	36.60	SUNCMKEC	Morris 115kV	Under Study (DISIS-2013-002)
ASGI-2013-005	1.65	SPS	FE Clovis 115kV	Under Study (DISIS-2013-002)
ASGI-2013-006	2.00	SPS	SP-Erskine 115kV	
ASGI-2014-001	2.50	SPS	SP-Erskine 115kV	Under Study (DISIS-2014-001)
ASGI-2014-002	49.60	SPS	Tap Tucumcari - Santa Rosa 115kV	Under Study (DISIS-2014-001)
ASGI-2014-005	10.00	SPS	Strata 69kV	Under Study (DISIS-2014-002)
ASGI-2014-008	10.00	SPS	South Loving 69kV	Under Study (DISIS-2014-002)
ASGI-2014-009	10.00	SPS	Wood Draw 115kV	Under Study (DISIS-2014-002)
ASGI-2014-010	10.00	SPS	Ochoa 115kV	Under Study (DISIS-2014-002)
ASGI-2014-012	10.00	SPS	Cooper Ranch 115kV	Under Study (DISIS-2014-002)
ASGI-2014-014	56.40	GRDA	Ferguson 69kV	Under Study (DISIS-2014-002)
GEN-2001-014	96.00	WFEC	Ft Supply 138kV	On-Line
GEN-2001-026	74.30	WFEC	Washita 138kV	On-Line
GEN-2001-033	180.00	SPS	San Juan Tap 230kV	On-Line at 120MW
GEN-2001-036	80.00	SPS	Norton 115kV	On-Line
GEN-2001-037	100.00	OKGE	FPL Moreland Tap 138kV	On-Line
GEN-2001-039A	105.00	SUNCMKEC	Shooting Star Tap 115kV	On-Line
GEN-2001-039M	100.00	SUNCMKEC	Central Plains Tap 115kV	On-Line
GEN-2002-004	200.00	WERE	Latham 345kV	On-Line at 150MW
GEN-2002-005	120.00	WFEC	Red Hills Tap 138kV	On-Line
GEN-2002-008	240.00	SPS	Hitchland 345kV	On-Line at 120MW
GEN-2002-009	80.00	SPS	Hansford 115kV	On-Line
GEN-2002-022	240.00	SPS	Bushland 230kV	On-Line
GEN-2002-023N	0.80	NPPD	Harmony 115kV	On-Line
GEN-2002-025A	150.00	SUNCMKEC	Spearville 230kV	On-Line
GEN-2003-004	100.00	WFEC	Washita 138kV	On-Line
GEN-2003-005	100.00	WFEC	Anadarko - Paradise (Blue Canyon) 138kV	On-Line
GEN-2003-006A	200.00	SUNCMKEC	Elm Creek 230kV	On-Line
GEN-2003-019	250.00	MIDW	Smoky Hills Tap 230kV	On-Line
GEN-2003-020	160.00	SPS	Martin 115kV	On-Line
GEN-2003-021N	75.00	NPPD	Ainsworth Wind Tap 115kV	On-Line
GEN-2003-022	120.00	AEPW	Weatherford 138kV	On-Line
GEN-2004-014	154.50	SUNCMKEC	Spearville 230kV	On-Line at 100MW
GEN-2004-020	27.00	AEPW	Weatherford 138kV	On-Line

Request	Amount	Area	Requested/Proposed Point of Interconnection	Status or In-Service Date
GEN-2004-023	20.60	WFEC	Washita 138kV	On-Line
GEN-2004-023N	75.00	NPPD	Columbus Co 115kV	On-Line
GEN-2005-003	30.60	WFEC	Washita 138kV	On-Line
GEN-2005-008	120.00	OKGE	Woodward 138kV	On-Line
GEN-2005-012	250.00	SUNCMKEC	Ironwood 345kV	On-Line at 160MW
GEN-2005-013	201.00	WERE	Caney River 345kV	On-Line
GEN-2006-002	101.00	AEPW	Sweetwater 230kV	On-Line
GEN-2006-018	170.00	SPS	TUCO Interchange 230kV	On-Line
GEN-2006-020N	42.00	NPPD	Bloomfield 115kV	On-Line
GEN-2006-020S	18.90	SPS	DWS Frisco 115kV	On-Line
GEN-2006-021	101.00	SUNCMKEC	Flat Ridge Tap 138kV	On-Line
GEN-2006-024S	19.80	WFEC	Buffalo Bear Tap 69kV	On-Line
GEN-2006-026	502.00	SPS	Hobbs 230kV & Hobbs 115kV	On-Line
GEN-2006-031	75.00	MIDW	Knoll 115kV	On-Line
GEN-2006-035	225.00	AEPW	Sweetwater 230kV	On-Line at 132MW
GEN-2006-037N1	75.00	NPPD	Broken Bow 115kV	On-Line
GEN-2006-038N005	80.00	NPPD	Broken Bow 115kV	On-Line
GEN-2006-038N019	80.00	NPPD	Petersburg North 115kV	On-Line
GEN-2006-043	99.00	AEPW	Sweetwater 230kV	On-Line
GEN-2006-044	370.00	SPS	Hitchland 345kV	On-Line at 120MW
GEN-2006-044N	40.50	NPPD	North Petersburg 115kV	On-Line
GEN-2006-046	131.00	OKGE	Dewey 138kV	On-Line
GEN-2007-011N08	81.00	NPPD	Bloomfield 115kV	On-Line
GEN-2007-017IS	166.00	WAPA	Ft Thompson-Grand Island 345kV	On Schedule
GEN-2007-018IS	234.00	WAPA	Ft Thompson-Grand Island 345kV	On Schedule
GEN-2007-021	201.00	OKGE	Tatonga 345kV	On-Line
GEN-2007-025	300.00	WERE	Viola 345kV	On-Line
GEN-2007-040	200.00	SUNCMKEC	Buckner 345kV	On-Line at 132MW
GEN-2007-043	200.00	OKGE	Minco 345kV	On-Line
GEN-2007-044	300.00	OKGE	Tatonga 345kV	On-Line at 199MW
GEN-2007-046	200.00	SPS	Hitchland 115kV	On Schedule for 2015
GEN-2007-050	170.00	OKGE	Woodward EHV 138kV	On-Line at 150MW
GEN-2007-052	150.00	WFEC	Anadarko 138kV	On-Line
GEN-2007-062	765.00	OKGE	Woodward EHV 345kV	On Schedule for 2016 and 2017
GEN-2008-003	101.00	OKGE	Woodward EHV 138kV	On-Line
GEN-2008-013	300.00	OKGE	Hunter 345kV	On-Line at 235MW
GEN-2008-018	250.00	SPS	Finney 345kV	On-Line
GEN-2008-021	42.00	WERE	Wolf Creek 345kV	On-Line
GEN-2008-022	300.00	SPS	Crossroads 345kV	On Schedule for 2015
GEN-2008-023	150.00	AEPW	Hobart Junction 138kV	On-Line
GEN-2008-037	101.00	WFEC	Slick Hills 138kV	On-Line
GEN-2008-044	197.80	OKGE	Tatonga 345kV	On-Line
GEN-2008-047	300.00	OKGE	Beaver County 345kV	On-Line
GEN-2008-051	322.00	SPS	Potter County 345kV	On-Line at 161MW
GEN-2008-079	99.20	SUNCMKEC	Crooked Creek 115kV	On-Line
GEN-2008-086N02	201.00	NPPD	Meadow Grove 230kV	On-Line
GEN-2008-092	200.60	MIDW	Post Rock 230kV	On-Line
GEN-2008-098	100.80	WERE	Waverly 345kV	On Schedule for 2015
GEN-2008-119O	60.00	OPPD	S1399 161kV	On-Line
GEN-2008-123N	89.70	NPPD	Tap Pauline - Hildreth (Rosemont) 115kV	On Schedule for 2015

Request	Amount	Area	Requested/Proposed Point of Interconnection	Status or In-Service Date
GEN-2008-124	200.10	SUNCMKEC	Ironwood 345kV	On Schedule for 2016
GEN-2008-129	80.00	KCPL	Pleasant Hill 161kV	On-Line
GEN-2009-008	199.50	MIDW	South Hays 230kV	On-Line
GEN-2009-020	48.30	MIDW	Walnut Creek 69kV	On Schedule for 2015
GEN-2009-025	59.80	OKGE	Nardins 69kV	On-Line
GEN-2009-040	73.80	WERE	Marshall 115kV	On Schedule for 2016
GEN-2010-001	300.00	OKGE	Beaver County 345kV	On-Line at 204 MW, On Schedule for 2015 (96 MW)
GEN-2010-003	100.80	WERE	Waverly 345kV	On-Line
GEN-2010-005	299.20	WERE	Viola 345kV	On-Line at 170MW
GEN-2010-006	205.00	SPS	Jones 230kV	On-Line
GEN-2010-009	165.60	SUNCMKEC	Buckner 345kV	On-Line
GEN-2010-011	29.70	OKGE	Tatonga 345kV	On-Line
GEN-2010-014	358.80	SPS	Hitchland 345kV	On Suspension
GEN-2010-036	4.60	WERE	6th Street 115kV	On-Line
GEN-2010-040	300.00	OKGE	Cimarron 345kV	On-Line
GEN-2010-041	10.50	OPPD	S1399 161kV	On Schedule for 2015
GEN-2010-045	197.80	SUNCMKEC	Buckner 345kV	On Schedule for 2017
GEN-2010-046	56.00	SPS	TUCO Interchange 230kV	On Schedule for 2016
GEN-2010-051	200.00	NPPD	Tap Hoskins - Twin Church (Dixon County) 230kV	On Suspension
GEN-2010-055	4.50	AEPW	Wekiwa 138kV	On-Line
GEN-2010-057	201.00	MIDW	Rice County 230kV	On-Line
GEN-2011-008	600.00	SUNCMKEC	Clark County 345kV	On Schedule for 2016
GEN-2011-010	100.80	OKGE	Minco 345kV	On-Line
GEN-2011-011	50.00	KCPL	Iatan 345kV	On-Line
GEN-2011-014	201.00	OKGE	Tap Hitchland - Woodward Dbl Ckt (GEN-2011-014 Tap) 345kV	On Schedule for 2016
GEN-2011-016	200.10	SUNCMKEC	Ironwood 345kV	Facility Study Stage
GEN-2011-018	73.60	NPPD	Steele City 115kV	On-Line
GEN-2011-019	299.00	OKGE	Woodward 345kV	On Suspension
GEN-2011-020	299.00	OKGE	Woodward 345kV	On Suspension
GEN-2011-022	299.00	SPS	Hitchland 345kV	On Suspension
GEN-2011-025	80.00	SPS	Tap Floyd County - Crosby County 115kV	On Schedule for 2016
GEN-2011-027	120.00	NPPD	Tap Hoskins - Twin Church (Dixon County) 230kV	On Suspension
GEN-2011-037	7.00	WFEC	Blue Canyon 5 138kV	On-Line
GEN-2011-040	111.00	OKGE	Carter County 138kV	On-Line
GEN-2011-045	205.00	SPS	Jones 230kV	On-Line
GEN-2011-046	27.00	SPS	Lopez 115kV	On-Line
GEN-2011-048	175.00	SPS	Mustang 230kV	On-Line
GEN-2011-049	250.70	OKGE	Border 345kV	On Schedule for 2016
GEN-2011-050	109.80	AEPW	Santa Fe Tap 138kV	On Schedule for 2016
GEN-2011-051	104.40	OKGE	Tap Woodward - Tatonga 345kV (GEN-2011-051 Tap)	On Suspension
GEN-2011-054	300.00	OKGE	Cimarron 345kV	On Schedule for 2015
GEN-2011-056	3.60	NPPD	Jeffrey 115kV	On-Line
GEN-2011-056A	3.60	NPPD	John 1 115kV	On-Line
GEN-2011-056B	4.50	NPPD	John 2 115kV	On-Line
GEN-2011-057	150.40	WERE	Creswell 138kV	On Schedule for 2015
GEN-2012-001	61.20	SPS	Cirrus Tap 230kV	On-Line
GEN-2012-004	41.40	OKGE	Carter County 138kV	On-Line
GEN-2012-007	120.00	SUNCMKEC	Rubart 115kV	On-Line

Request	Amount	Area	Requested/Proposed Point of Interconnection	Status or In-Service Date
GEN-2012-020	478.00	SPS	TUCO 230kV	On Schedule for 2016
GEN-2012-021	4.80	LES	Terry Bundy Generating Station 115kV	On-Line
GEN-2012-024	180.00	SUNCMKEC	Clark County 345kV	On Schedule for 2016
GEN-2012-027	136.00	AEPW	Shidler 138kV	On Suspension
GEN-2012-028	74.80	WFEC	Gotebo 69kV	On Schedule for 2015
GEN-2012-032	300.00	OKGE	Open Sky 345kV	On-Line
GEN-2012-033	98.80	OKGE	Tap and Tie South 4th - Bunch Creek & Enid Tap - Fairmont (GEN-2012-033T) 138kV	On Schedule for 2015
GEN-2012-034	7.00	SPS	Mustang 230kV	On-Line
GEN-2012-035	7.00	SPS	Mustang 230kV	On-Line
GEN-2012-036	7.00	SPS	Mustang 230kV	On-Line
GEN-2012-037	203.00	SPS	TUCO 345kV	On-Line
GEN-2012-040	76.50	WFEC	Tap Middlenton - Chilocco (GEN-2012-040 Tap) 138kV	On Suspension
GEN-2012-041	121.50	OKGE	Ranch Road 345kV	On-Line
GEN-2013-002	50.60	LES	Tap Sheldon - Folsom & Pleasant Hill (GEN-2013-002 Tap) 115kV CKT 2	On Schedule for 2016
GEN-2013-007	100.30	OKGE	Tap Prices Falls - Carter 138kV	On-Line
GEN-2013-008	1.20	NPPD	Steele City 115kV	On-Line
GEN-2013-010	99.00	SUNCMKEC	Tap Spearville - Post Rock (North of GEN-2011-017 Tap) 345kV	Facility Study
GEN-2013-011	30.00	AEPW	Turk 138kV	On-Line
GEN-2013-012	147.00	OKGE	Redbud 345kV	On-Line
GEN-2013-014	25.50	NPPD	Tap Pauline - Hildreth (Rosemont) 115kV	On Suspension
GEN-2013-016	203.00	SPS	TUCO 345kV	IA Pending
GEN-2013-019	73.60	LES	Tap Sheldon - Folsom & Pleasant Hill (GEN-2013-002 Tap) 115kV CKT 2	On Schedule for 2016
GEN-2013-022	25.00	SPS	Norton 115kV	On Schedule for 2016
GEN-2013-027	150.00	SPS	Tap Tolk - Yoakum 230kV	Facility Study
GEN-2013-028	559.50	GRDA	Tap N Tulsa - GRDA 1 345kV	On Schedule for 2017
GEN-2013-029	300.00	OKGE	Renfrow 345kV	On Schedule for 2016 (150MW) and 2016 (150MW)
GEN-2013-030	300.00	OKGE	Beaver County 345kV	On Schedule for 2016 (200MW) and 2017 (100MW)
GEN-2013-032	204.00	NPPD	Antelope 115kV	On Schedule for 2017
GEN-2013-033	28.00	MIDW	Knoll 115kV	On Schedule for 2016
GEN-2014-001	200.60	WERE	Tap Wichita - Emporia Energy Center (GEN-2014-001 Tap) 345kV	IA Pending
GEN-2014-002	10.50	OKGE	Tatonga 345kV (GEN-2007-021 POI)	Facility Study Stage
GEN-2014-003	15.80	OKGE	Tatonga 345kV (GEN-2007-044 POI)	Facility Study Stage
GEN-2014-004	4.00	NPPD	Steele City 115kV (GEN-2011-018 POI)	Facility Study Stage
GEN-2014-005	5.70	OKGE	Minco 345kV (GEN-2011-010 POI)	On-Line
GEN-2014-012	225.00	SPS	Tap Hobbs Interchange - Andrews 230kV	IA Pending
GEN-2014-013	73.50	NPPD	Meadow Grove (GEN-2008-086N2 Sub) 230kV	On Schedule for 2015
GEN-2014-020	100.00	AEPW	Tuttle 138kV	On Schedule for 2017
GEN-2014-021	300.00	KCPL	Tap Nebraska City - Mullin Creek 345kV	On Schedule for 2016
GEN-2014-025	2.40	MIDW	Walnut Creek 69kV	On Schedule for 2016
GEN-2014-026	150.00	OKGE	Beaver County 345kV	Facility Study
GEN-2014-028	35.00	EMDE	Riverton 161kV	Facility Study
GEN-2014-031	35.80	NPPD	Meadow Grove 230kV	On Schedule for 2016
GEN-2014-032	10.20	NPPD	Meadow Grove 230kV	Facility Study
GEN-2014-033	70.00	SPS	Chaves County 115kV	Facility Study
GEN-2014-034	70.00	SPS	Chaves County 115kV	Facility Study

Request	Amount	Area	Requested/Proposed Point of Interconnection	Status or In-Service Date
GEN-2014-035	30.00	SPS	Chaves County 115kV	Facility Study
GEN-2014-039	73.40	NPPD	Friend 115kV	IA Pending
GEN-2014-040	320.40	SPS	Castro 115kV	IA Pending
GEN-2014-041	120.80	SUNCMKEC	Arnold 115kV	Facility Study
GEN-2014-047	40.00	SPS	Crossroads 345kV	Facility Study
GEN-2014-053	80.00	SPS	Carlisle 230kV	Facility Study
GEN-2014-054	120.00	SPS	Carlisle 230kV	Facility Study
GEN-2014-056	250.00	OKGE	Minco 345kV	Facility Study
GEN-2014-057	250.00	AEPW	Tap Lawton - Sunnyside (Terry Road) 345kV	IA Pending
GEN-2014-064	248.40	OKGE	Otter 138kV	IA Pending
Gray County Wind (Montezuma)	110.00	SUNCMKEC	Gray County Tap 115kV	On-Line
Llano Estacado (White Deer)	80.00	SPS	Llano Wind 115kV	On-Line
NPPD Distributed (Broken Bow)	8.30	NPPD	Broken Bow 115kV	On-Line
NPPD Distributed (Buffalo County Solar)	10.00	NPPD	Kearney Northeast	On-Line
NPPD Distributed (Burt County Wind)	12.00	NPPD	Tekamah & Oakland 115kV	On-Line
NPPD Distributed (Burwell)	3.00	NPPD	Ord 115kV	On-Line
NPPD Distributed (Columbus Hydro)	45.00	NPPD	Columbus 115kV	On-Line
NPPD Distributed (North Platte - Lexington)	54.00	NPPD	Multiple: Jeffrey 115kV, John_1 115kV, John_2 115kV	On-Line
NPPD Distributed (Ord)	11.90	NPPD	Ord 115kV	On-Line
NPPD Distributed (Stuart)	2.10	NPPD	Ainsworth 115kV	On-Line
SPS Distributed (Dumas 19th St)	20.00	SPS	Dumas 19th Street 115kV	On-Line
SPS Distributed (Etter)	20.00	SPS	Etter 115kV	On-Line
SPS Distributed (Hopi)	10.00	SPS	Hopi 115kV	On-Line
SPS Distributed (Jal)	10.00	SPS	S Jal 115kV	On-Line
SPS Distributed (Lea Road)	10.00	SPS	Lea Road 115kV	On-Line
SPS Distributed (Monument)	10.00	SPS	Monument 115kV	On-Line
SPS Distributed (Moore E)	25.00	SPS	Moore East 115kV	On-Line
SPS Distributed (Ocotillo)	10.00	SPS	S_Jal 115kV	On-Line
SPS Distributed (Sherman)	20.00	SPS	Sherman 115kV	On-Line
SPS Distributed (Spearman)	10.00	SPS	Spearman 69kV	On-Line
SPS Distributed (TC-Texas County)	20.00	SPS	Texas County 115kV	On-Line
SPS Distributed (Yuma)	2.57	SPS	SP-Yuma 69kV	On-Line
Total:	**26,592.9**			

C: Study Groupings

See next page

C. Study Groups

GROUP 1: WOODWARD AREA Request	Capacity	Area	Proposed Point of Interconnection
GEN-2001-014	96.00	WFEC	Ft Supply 138kV
GEN-2001-037	100.00	OKGE	FPL Moreland Tap 138kV
GEN-2005-008	120.00	OKGE	Woodward 138kV
GEN-2006-024S	19.80	WFEC	Buffalo Bear Tap 69kV
GEN-2006-046	131.00	OKGE	Dewey 138kV
GEN-2007-021	201.00	OKGE	Tatonga 345kV
GEN-2007-043	200.00	OKGE	Minco 345kV
GEN-2007-044	300.00	OKGE	Tatonga 345kV
GEN-2007-050	170.00	OKGE	Woodward EHV 138kV
GEN-2007-062	765.00	OKGE	Woodward EHV 345kV
GEN-2008-003	101.00	OKGE	Woodward EHV 138kV
GEN-2008-044	197.80	OKGE	Tatonga 345kV
GEN-2010-011	29.70	OKGE	Tatonga 345kV
GEN-2010-040	300.00	OKGE	Cimarron 345kV
GEN-2011-010	100.80	OKGE	Minco 345kV
GEN-2011-019	299.00	OKGE	Woodward 345kV
GEN-2011-020	299.00	OKGE	Woodward 345kV
GEN-2011-051	104.40	OKGE	Tap Woodward - Tatonga 345kV (GEN-2011-051 Tap)
GEN-2011-054	300.00	OKGE	Cimarron 345kV
GEN-2014-002	10.50	OKGE	Tatonga 345kV (GEN-2007-021 POI)
GEN-2014-003	15.80	OKGE	Tatonga 345kV (GEN-2007-044 POI)
GEN-2014-005	5.70	OKGE	Minco 345kV (GEN-2011-010 POI)
GEN-2014-020	100.00	AEPW	Tuttle 138kV
GEN-2014-056	250.00	OKGE	Minco 345kV
PRIOR QUEUED SUBTOTAL	4,216.50		
GEN-2015-029	161.00	OKGE	Tatonga 345kV
CURRENT CLUSTER SUBTOTAL	161.00		
AREA TOTAL	4,377.50		

GROUP 2: HITCHLAND AREA

Request	Capacity	Area	Proposed Point of Interconnection
ASGI-2011-002	20.00	SPS	Herring 115kV
ASGI-2013-001	11.50	SPS	PanTex South 115kV
GEN-2002-008	240.00	SPS	Hitchland 345kV
GEN-2002-009	80.00	SPS	Hansford 115kV
GEN-2002-022	240.00	SPS	Bushland 230kV
GEN-2003-020	160.00	SPS	Martin 115kV
GEN-2006-020S	18.90	SPS	DWS Frisco 115kV
GEN-2006-044	370.00	SPS	Hitchland 345kV
GEN-2007-046	200.00	SPS	Hitchland 115kV
GEN-2008-047	300.00	OKGE	Beaver County 345kV
GEN-2008-051	322.00	SPS	Potter County 345kV
GEN-2010-001	300.00	OKGE	Beaver County 345kV
GEN-2010-014	358.80	SPS	Hitchland 345kV
GEN-2011-014	201.00	OKGE	Tap Hitchland - Woodward Dbl Ckt (GEN-2011-014 Tap) 345kV
GEN-2011-022	299.00	SPS	Hitchland 345kV
GEN-2013-030	300.00	OKGE	Beaver County 345kV
GEN-2014-026	150.00	OKGE	Beaver County 345kV
Llano Estacado (White Deer)	80.00	SPS	Llano Wind 115kV
SPS Distributed (Dumas 19th St)	20.00	SPS	Dumas 19th Street 115kV
SPS Distributed (Etter)	20.00	SPS	Etter 115kV
SPS Distributed (Moore E)	25.00	SPS	Moore East 115kV
SPS Distributed (Sherman)	20.00	SPS	Sherman 115kV
SPS Distributed (Spearman)	10.00	SPS	Spearman 69kV
SPS Distributed (TC-Texas County)	20.00	SPS	Texas County 115kV
PRIOR QUEUED SUBTOTAL	**3,766.20**		
AREA TOTAL	**3,766.20**		

GROUP 3: SPEARVILLE AREA

Request	Capacity	Area	Proposed Point of Interconnection
ASGI-2012-006	22.50	SUNCMKEC	Tap Hugoton - Rolla 69kV
GEN-2001-039A	105.00	SUNCMKEC	Shooting Star Tap 115kV
GEN-2002-025A	150.00	SUNCMKEC	Spearville 230kV
GEN-2004-014	154.50	SUNCMKEC	Spearville 230kV
GEN-2005-012	250.00	SUNCMKEC	Ironwood 345kV
GEN-2006-021	101.00	SUNCMKEC	Flat Ridge Tap 138kV
GEN-2007-040	200.00	SUNCMKEC	Buckner 345kV
GEN-2008-018	250.00	SPS	Finney 345kV
GEN-2008-079	99.20	SUNCMKEC	Crooked Creek 115kV
GEN-2008-124	200.10	SUNCMKEC	Ironwood 345kV
GEN-2010-009	165.60	SUNCMKEC	Buckner 345kV
GEN-2010-045	197.80	SUNCMKEC	Buckner 345kV
GEN-2011-008	600.00	SUNCMKEC	Clark County 345kV
GEN-2011-016	200.10	SUNCMKEC	Ironwood 345kV
GEN-2012-007	120.00	SUNCMKEC	Rubart 115kV
GEN-2012-024	180.00	SUNCMKEC	Clark County 345kV
GEN-2013-010	99.00	SUNCMKEC	Tap Spearville - Post Rock (North of GEN-2011-017 Tap) 345kV
Gray County Wind (Montezuma)	110.00	SUNCMKEC	Gray County Tap 115kV
PRIOR QUEUED SUBTOTAL	**3,204.80**		
ASGI-2015-001	6.13	SUNCMKEC	Ninnescah 115kV
GEN-2015-021	20.00	SUNCMKEC	Johnson Corner 115kV
GEN-2015-027	4.90	SUNCMKEC	Crooked Creek 115kV
CURRENT CLUSTER SUBTOTAL	**31.03**		
AREA TOTAL	**3,235.83**		

GROUP 4: NORTHWEST KANSAS AREA			
Request	**Capacity**	**Area**	**Proposed Point of Interconnection**
ASGI-2013-004	36.60	SUNCMKEC	Morris 115kV
GEN-2001-039M	100.00	SUNCMKEC	Central Plains Tap 115kV
GEN-2003-006A	200.00	SUNCMKEC	Elm Creek 230kV
GEN-2003-019	250.00	MIDW	Smoky Hills Tap 230kV
GEN-2006-031	75.00	MIDW	Knoll 115kV
GEN-2008-092	200.60	MIDW	Post Rock 230kV
GEN-2009-008	199.50	MIDW	South Hays 230kV
GEN-2009-020	48.30	MIDW	Walnut Creek 69kV
GEN-2010-057	201.00	MIDW	Rice County 230kV
GEN-2013-033	28.00	MIDW	Knoll 115kV
GEN-2014-025	2.40	MIDW	Walnut Creek 69kV
GEN-2014-041	120.80	SUNCMKEC	Arnold 115kV
PRIOR QUEUED SUBTOTAL	**1,462.20**		
GEN-2010-048	70.00	MIDW	Tap Beach Station - Redline 115kV
GEN-2015-017	172.00	SUNCMKEC	Mingo 115kV
CURRENT CLUSTER SUBTOTAL	**242.00**		
AREA TOTAL	**1,704.20**		

GROUP 6: SOUTH TEXAS PANHANDLE/NEW MEXICO AREA Request	Capacity	Area	Proposed Point of Interconnection
ASGI-2010-010	42.20	SPS	Lovington 115kV
ASGI-2010-020	30.00	SPS	Tap LE-Tatum - LE-Crossroads 69kV
ASGI-2010-021	15.00	SPS	Tap LE-Saunders Tap - LE-Anderson 69kV
ASGI-2011-001	27.30	SPS	Lovington 115kV
ASGI-2011-003	10.00	SPS	Hendricks 69kV
ASGI-2011-004	20.00	SPS	Pleasant Hill 69kV
ASGI-2012-002	18.15	SPS	FE-Clovis Interchange 115kV
ASGI-2013-002	18.40	SPS	FE Tucumcari 115kV
ASGI-2013-003	18.40	SPS	FE Clovis 115kV
ASGI-2013-005	1.65	SPS	FE Clovis 115kV
ASGI-2013-006	2.00	SPS	SP-Erskine 115kV
ASGI-2014-001	2.50	SPS	SP-Erskine 115kV
ASGI-2014-002	49.60	SPS	Tap Tucumcari - Santa Rosa 115kV
ASGI-2014-005	10.00	SPS	Strata 69kV
ASGI-2014-008	10.00	SPS	South Loving 69kV
ASGI-2014-009	10.00	SPS	Wood Draw 115kV
ASGI-2014-010	10.00	SPS	Ochoa 115kV
ASGI-2014-012	10.00	SPS	Cooper Ranch 115kV
GEN-2001-033	180.00	SPS	San Juan Tap 230kV
GEN-2001-036	80.00	SPS	Norton 115kV
GEN-2006-018	170.00	SPS	TUCO Interchange 230kV
GEN-2006-026	502.00	SPS	Hobbs 230kV & Hobbs 115kV
GEN-2008-022	300.00	SPS	Crossroads 345kV
GEN-2010-006	205.00	SPS	Jones 230kV
GEN-2010-046	56.00	SPS	TUCO Interchange 230kV
GEN-2011-025	80.00	SPS	Tap Floyd County - Crosby County 115kV
GEN-2011-045	205.00	SPS	Jones 230kV
GEN-2011-046	27.00	SPS	Lopez 115kV
GEN-2011-048	175.00	SPS	Mustang 230kV
GEN-2012-001	61.20	SPS	Cirrus Tap 230kV
GEN-2012-020	478.00	SPS	TUCO 230kV
GEN-2012-034	7.00	SPS	Mustang 230kV
GEN-2012-035	7.00	SPS	Mustang 230kV
GEN-2012-036	7.00	SPS	Mustang 230kV
GEN-2012-037	203.00	SPS	TUCO 345kV
GEN-2013-016	203.00	SPS	TUCO 345kV
GEN-2013-022	25.00	SPS	Norton 115kV
GEN-2013-027	150.00	SPS	Tap Tolk - Yoakum 230kV
GEN-2014-012	225.00	SPS	Tap Hobbs Interchange - Andrews 230kV
GEN-2014-033	70.00	SPS	Chaves County 115kV
GEN-2014-034	70.00	SPS	Chaves County 115kV
GEN-2014-035	30.00	SPS	Chaves County 115kV
GEN-2014-040	320.40	SPS	Castro 115kV
GEN-2014-047	40.00	SPS	Crossroads 345kV
GEN-2014-053	80.00	SPS	Carlisle 230kV
GEN-2014-054	120.00	SPS	Carlisle 230kV
SPS Distributed (Hopi)	10.00	SPS	Hopi 115kV
SPS Distributed (Jal)	10.00	SPS	S Jal 115kV
SPS Distributed (Lea Road)	10.00	SPS	Lea Road 115kV

SPS Distributed (Monument)	10.00	SPS	Monument 115kV
SPS Distributed (Ocotillo)	10.00	SPS	S_Jal 115kV
SPS Distributed (Yuma)	2.57	SPS	SP-Yuma 69kV
PRIOR QUEUED SUBTOTAL	**4,434.37**		
ASGI-2015-002	2.00	SPS	SP-Yuma 69kV
GEN-2014-074	152.00	SPS	Tap TUCO Interchange - Oklaunion (GEN-2014-074 Tap) 345kV
GEN-2015-014	150.00	SPS	Tap Cochran - Lehman 115kV
GEN-2015-022	112.00	SPS	Swisher 115kV
CURRENT CLUSTER SUBTOTAL	**416.00**		
AREA TOTAL	**4,850.37**		

GROUP 7: SOUTHWEST OKLAHOMA AREA

Request	Capacity	Area	Proposed Point of Interconnection
GEN-2001-026	74.30	WFEC	Washita 138kV
GEN-2002-005	120.00	WFEC	Red Hills Tap 138kV
GEN-2003-004	100.00	WFEC	Washita 138kV
GEN-2003-005	100.00	WFEC	Anadarko - Paradise (Blue Canyon) 138kV
GEN-2003-022	120.00	AEPW	Weatherford 138kV
GEN-2004-020	27.00	AEPW	Weatherford 138kV
GEN-2004-023	20.60	WFEC	Washita 138kV
GEN-2005-003	30.60	WFEC	Washita 138kV
GEN-2006-002	101.00	AEPW	Sweetwater 230kV
GEN-2006-035	225.00	AEPW	Sweetwater 230kV
GEN-2006-043	99.00	AEPW	Sweetwater 230kV
GEN-2007-052	150.00	WFEC	Anadarko 138kV
GEN-2008-023	150.00	AEPW	Hobart Junction 138kV
GEN-2008-037	101.00	WFEC	Slick Hills 138kV
GEN-2011-037	7.00	WFEC	Blue Canyon 5 138kV
GEN-2011-049	250.70	OKGE	Border 345kV
GEN-2012-028	74.80	WFEC	Gotebo 69kV
PRIOR QUEUED SUBTOTAL	**1,751.00**		
GEN-2015-004	52.90	OKGE	Border 345kV
GEN-2015-013	120.00	WFEC	Synder 138kV
CURRENT CLUSTER SUBTOTAL	**172.90**		
AREA TOTAL	**1,923.90**		

GROUP 8: NORTH OKLAHOMA/SOUTH CENTRAL KANSAS AREA

Request	Capacity	Area	Proposed Point of Interconnection
ASGI-2010-006	150.00	AECI	Remington 138kV
ASGI-2014-014	56.40	GRDA	Ferguson 69kV
GEN-2002-004	200.00	WERE	Latham 345kV
GEN-2005-013	201.00	WERE	Caney River 345kV
GEN-2007-025	300.00	WERE	Viola 345kV
GEN-2008-013	300.00	OKGE	Hunter 345kV
GEN-2008-021	42.00	WERE	Wolf Creek 345kV
GEN-2008-098	100.80	WERE	Waverly 345kV
GEN-2009-025	59.80	OKGE	Nardins 69kV
GEN-2010-003	100.80	WERE	Waverly 345kV
GEN-2010-005	299.20	WERE	Viola 345kV
GEN-2010-055	4.50	AEPW	Wekiwa 138kV
GEN-2011-057	150.40	WERE	Creswell 138kV
GEN-2012-027	136.00	AEPW	Shidler 138kV
GEN-2012-032	300.00	OKGE	Open Sky 345kV
GEN-2012-033	98.80	OKGE	Tap and Tie South 4th - Bunch Creek & Enid Tap - Fairmont (GEN-2012-033T) 138kV
GEN-2012-040	76.50	WFEC	Tap Middlenton - Chilocco (GEN-2012-040 Tap) 138kV
GEN-2012-041	121.50	OKGE	Ranch Road 345kV
GEN-2013-012	147.00	OKGE	Redbud 345kV
GEN-2013-028	559.50	GRDA	Tap N Tulsa - GRDA 1 345kV
GEN-2013-029	300.00	OKGE	Renfrow 345kV
GEN-2014-001	200.60	WERE	Tap Wichita - Emporia Energy Center (GEN-2014-001 Tap) 345kV
GEN-2014-028	35.00	EMDE	Riverton 161kV
GEN-2014-064	248.40	OKGE	Otter 138kV
PRIOR QUEUED SUBTOTAL	**4,188.20**		
ASGI-2015-004	56.36	GRDA	Coffeyville City 69kV
GEN-2015-001	200.00	OKGE	Ranch Road 345kV
GEN-2015-015	154.60	OKGE	Tap Medford Tap - Coyote 138kV
GEN-2015-016	200.00	KCPL	Tap Marmaton - Centerville 161kV
GEN-2015-024	220.00	WERE	Tap Thistle - Wichita 345kV Dbl CKT
GEN-2015-025	220.00	WERE	Tap Thistle - Wichita 345kV Dbl CKT
GEN-2015-028	3.00	OKGE	Nardins 69kV
GEN-2015-030	200.10	OKGE	Sooner 345kV
CURRENT CLUSTER SUBTOTAL	**1,254.06**		
AREA TOTAL	**5,442.26**		

GROUP 9: NEBRASKA AREA

Request	Capacity	Area	Proposed Point of Interconnection
GEN-2002-023N	0.80	NPPD	Harmony 115kV
GEN-2003-021N	75.00	NPPD	Ainsworth Wind Tap 115kV
GEN-2004-023N	75.00	NPPD	Columbus Co 115kV
GEN-2006-020N	42.00	NPPD	Bloomfield 115kV
GEN-2006-037N1	75.00	NPPD	Broken Bow 115kV
GEN-2006-038N005	80.00	NPPD	Broken Bow 115kV
GEN-2006-038N019	80.00	NPPD	Petersburg North 115kV
GEN-2006-044N	40.50	NPPD	North Petersburg 115kV
GEN-2007-011N08	81.00	NPPD	Bloomfield 115kV
GEN-2007-017IS	166.00	WAPA	Ft Thompson-Grand Island 345kV
GEN-2007-018IS	234.00	WAPA	Ft Thompson-Grand Island 345kV
GEN-2008-086N02	201.00	NPPD	Meadow Grove 230kV
GEN-2008-119O	60.00	OPPD	S1399 161kV
GEN-2008-123N	89.70	NPPD	Tap Pauline - Hildreth (Rosemont) 115kV
GEN-2009-040	73.80	WERE	Marshall 115kV
GEN-2010-041	10.50	OPPD	S1399 161kV
GEN-2010-051	200.00	NPPD	Tap Hoskins - Twin Church (Dixon County) 230kV
GEN-2011-018	73.60	NPPD	Steele City 115kV
GEN-2011-027	120.00	NPPD	Tap Hoskins - Twin Church (Dixon County) 230kV
GEN-2011-056	3.60	NPPD	Jeffrey 115kV
GEN-2011-056A	3.60	NPPD	John 1 115kV
GEN-2011-056B	4.50	NPPD	John 2 115kV
GEN-2012-021	4.80	LES	Terry Bundy Generating Station 115kV
GEN-2013-002	50.60	LES	Tap Sheldon - Folsom & Pleasant Hill (GEN-2013-002 Tap) 115kV CKT 2
GEN-2013-008	1.20	NPPD	Steele City 115kV
GEN-2013-014	25.50	NPPD	Tap Pauline - Hildreth (Rosemont) 115kV
GEN-2013-019	73.60	LES	Tap Sheldon - Folsom & Pleasant Hill (GEN-2013-002 Tap) 115kV CKT 2
GEN-2013-032	204.00	NPPD	Antelope 115kV
GEN-2014-004	4.00	NPPD	Steele City 115kV (GEN-2011-018 POI)
GEN-2014-013	73.50	NPPD	Meadow Grove (GEN-2008-086N2 Sub) 230kV
GEN-2014-031	35.80	NPPD	Meadow Grove 230kV
GEN-2014-032	10.20	NPPD	Meadow Grove 230kV
GEN-2014-039	73.40	NPPD	Friend 115kV
NPPD Distributed (Broken Bow)	8.30	NPPD	Broken Bow 115kV
NPPD Distributed (Buffalo County Solar)	10.00	NPPD	Kearney Northeast
NPPD Distributed (Burt County Wind)	12.00	NPPD	Tekamah & Oakland 115kV
NPPD Distributed (Burwell)	3.00	NPPD	Ord 115kV
NPPD Distributed (Columbus Hydro)	45.00	NPPD	Columbus 115kV
NPPD Distributed (North Platte - Lexington)	54.00	NPPD	Multiple: Jeffrey 115kV, John_1 115kV, John_2 115kV
NPPD Distributed (Ord)	11.90	NPPD	Ord 115kV
NPPD Distributed (Stuart)	2.10	NPPD	Ainsworth 115kV
PRIOR QUEUED SUBTOTAL	**2,492.50**		
GEN-2015-007	160.00	NPPD	Hoskins 345kV
GEN-2015-023	300.70	NPPD	Holt County 345kV
CURRENT CLUSTER SUBTOTAL	**460.70**		
AREA TOTAL	**2,953.20**		

GROUP 10: SOUTHEAST OKLAHOMA/NORTHEAST TEXAS AREA

Request	Capacity	Area	Proposed Point of Interconnection
AREA TOTAL	0.00		

GROUP 12: NORTHWEST ARKANSAS AREA

Request	Capacity	Area	Proposed Point of Interconnection
GEN-2013-011	30.00	AEPW	Turk 138kV
PRIOR QUEUED SUBTOTAL	30.00		
AREA TOTAL	30.00		

GROUP 13: NORTHWEST MISSOURI AREA

Request	Capacity	Area	Proposed Point of Interconnection
GEN-2008-129	80.00	KCPL	Pleasant Hill 161kV
GEN-2010-036	4.60	WERE	6th Street 115kV
GEN-2011-011	50.00	KCPL	Iatan 345kV
GEN-2014-021	300.00	KCPL	Tap Nebraska City - Mullin Creek 345kV
PRIOR QUEUED SUBTOTAL	434.60		
GEN-2015-005	200.10	KCPL	Tap Nebraska City - Sibley 345kV
CURRENT CLUSTER SUBTOTAL	200.10		
AREA TOTAL	634.70		

GROUP 14: SOUTH CENTRAL OKLAHOMA AREA

Request	Capacity	Area	Proposed Point of Interconnection
GEN-2011-040	111.00	OKGE	Carter County 138kV
GEN-2011-050	109.80	AEPW	Santa Fe Tap 138kV
GEN-2012-004	41.40	OKGE	Carter County 138kV
GEN-2013-007	100.30	OKGE	Tap Prices Falls - Carter 138kV
GEN-2014-057	250.00	AEPW	Tap Lawton - Sunnyside (Terry Road) 345kV
PRIOR QUEUED SUBTOTAL	612.50		
AREA TOTAL	612.50		

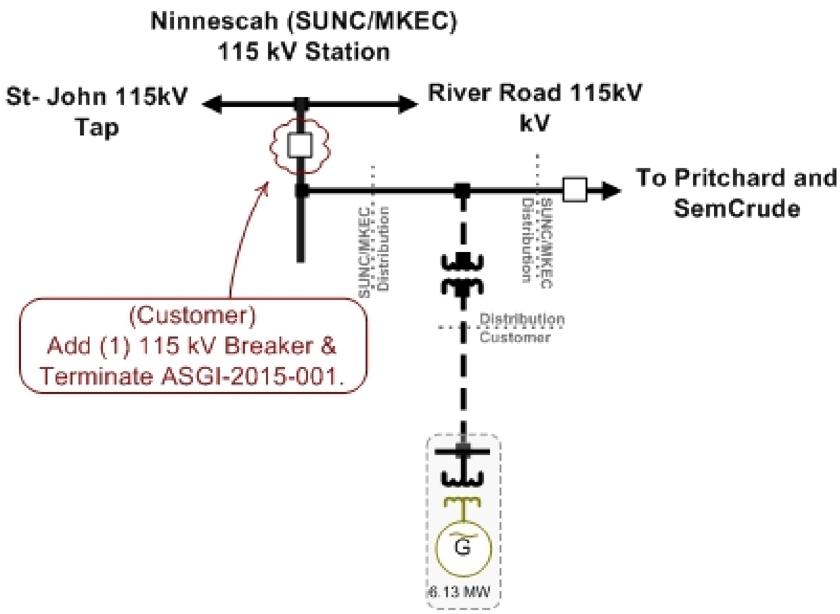
CLUSTER TOTAL (CURRENT STUDY)	2,937.8	MW
PQ TOTAL (PRIOR QUEUED)	26,592.9	MW
CLUSTER TOTAL (INCLUDING PRIOR QUEUED)	29,530.7	MW

D: Proposed Point of Interconnection One Line Diagrams

See next page

*Note: If not denoted otherwise for Affected System Generator Interconnection Requests (ASGI) interconnection cost estimate could include distribution system or third party system network upgrades and costs estimates.

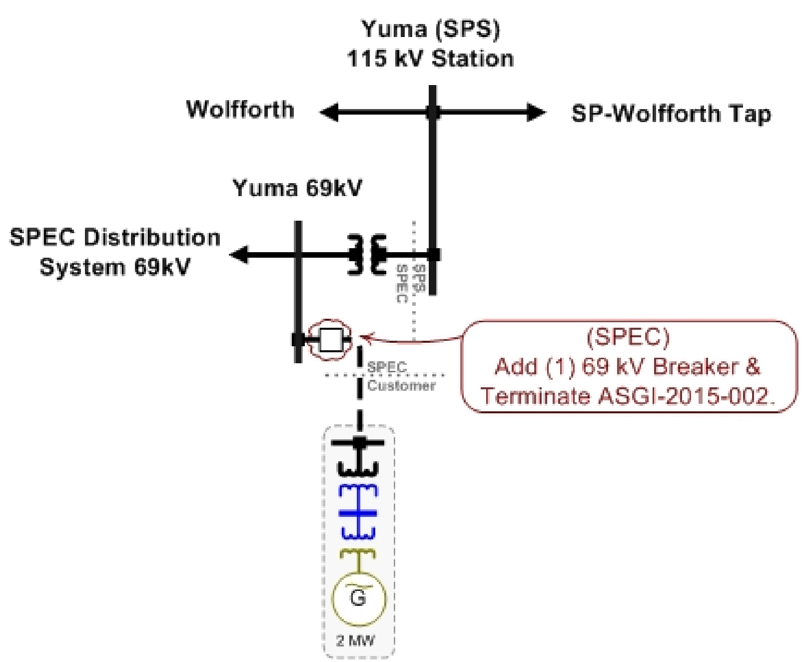
ASGI-2015-001
Estimated Cluster Analysis Interconnection Cost: $3,188,259
Estimated Stand Alone Analysis Interconnection Cost: $3,188,259



ASGI-2015-001

*** Interconnection Cost Estimate(s) only include Affected System Interconnection costs**

ASGI-2015-002
Estimated Cluster Analysis Interconnection Cost: $0*
Estimated Stand Alone Analysis Interconnection Cost: $0*



ASGI-2015-002

*** Interconnection Cost Estimate(s) only include Affected System Interconnection costs**

ASGI-2015-004
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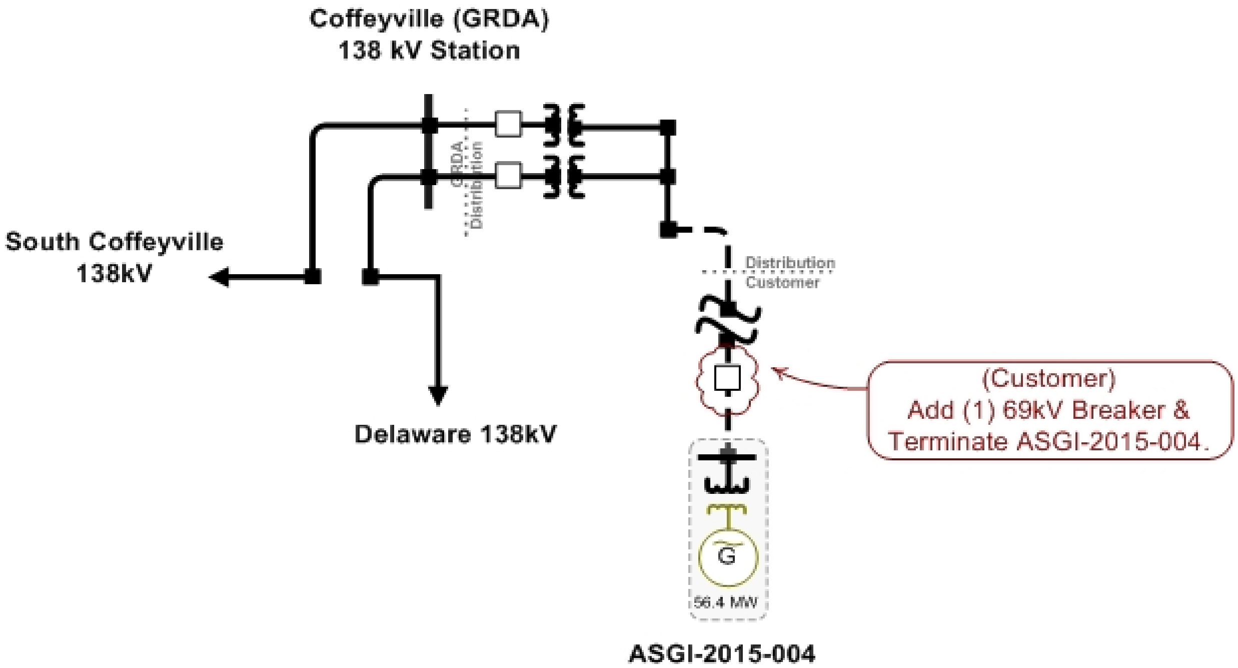
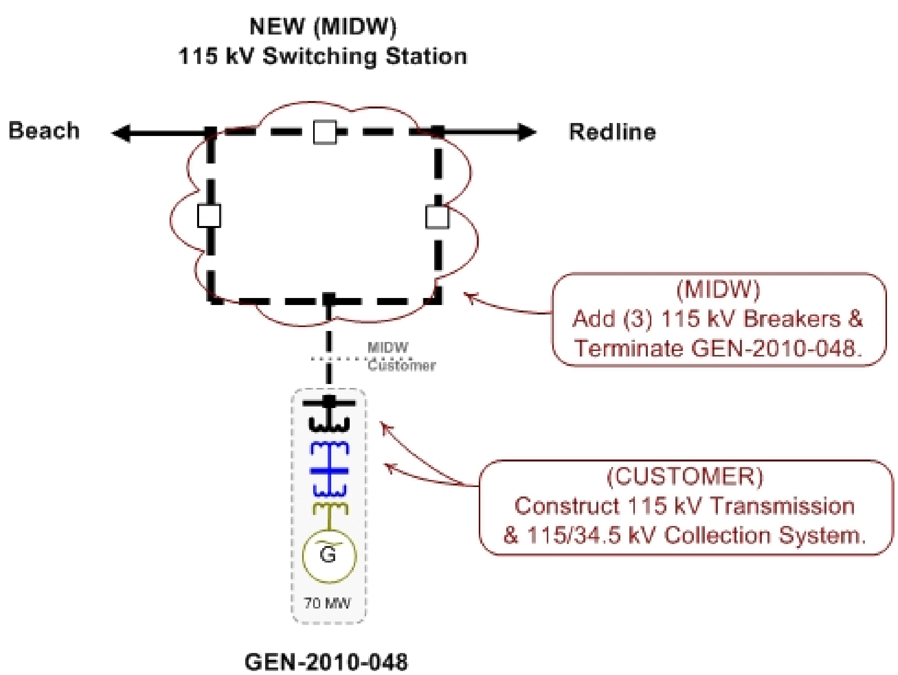
Estimated Stand Alone Analysis Interconnection Cost: $ 0*

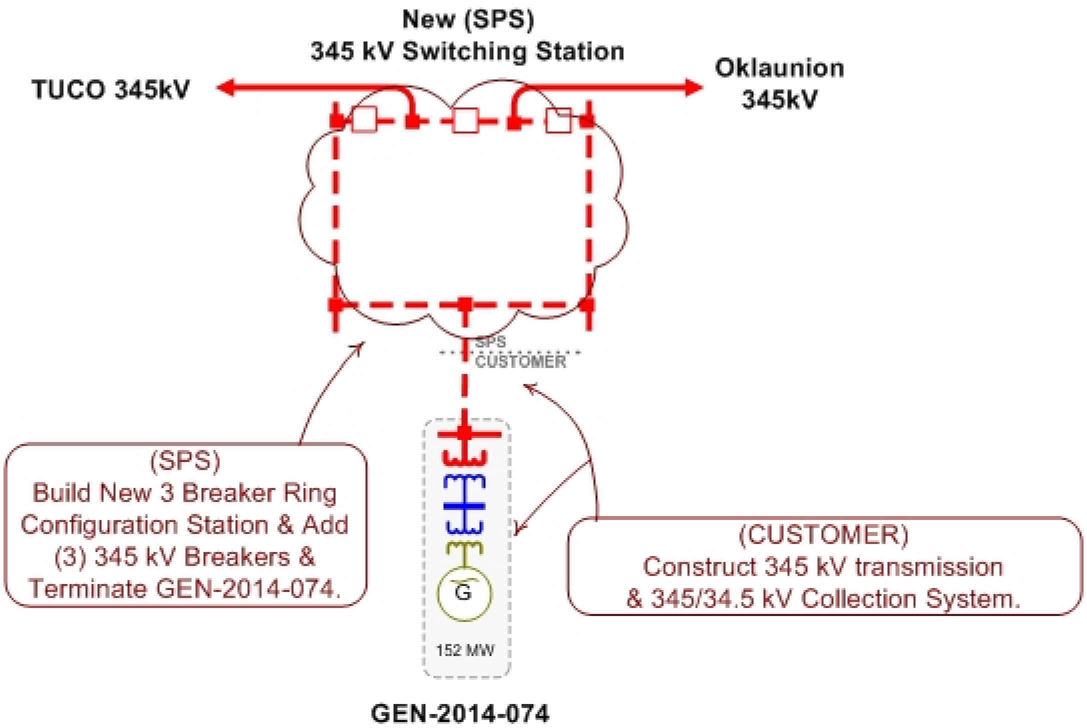


*** Interconnection Cost Estimate(s) only include Affected System Interconnection costs**

GEN-2010-048
Estimated Cluster Analysis Interconnection Cost: $4,000,000
Estimated Stand Alone Analysis Interconnection Cost: $4,000,000



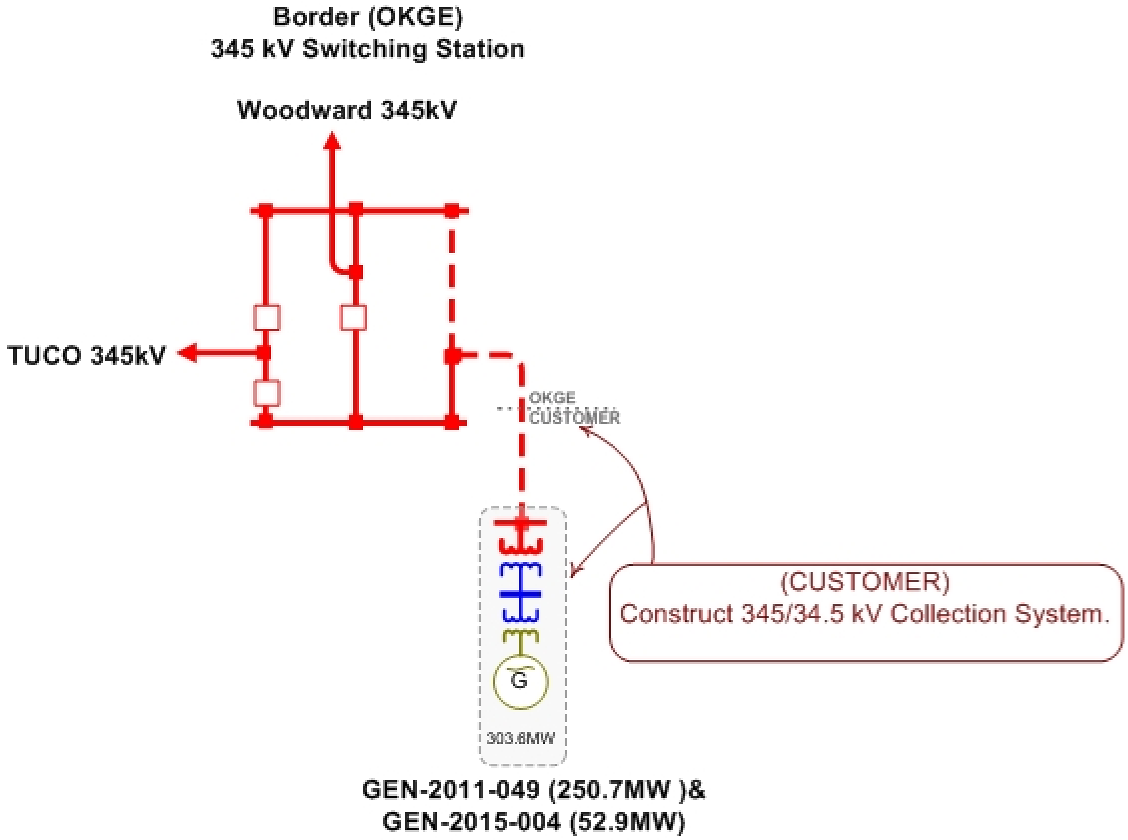
GEN-2014-074
Estimated Cluster Analysis Interconnection Cost: $13,519,992
Estimated Stand Alone Analysis Interconnection Cost: $13,519,992



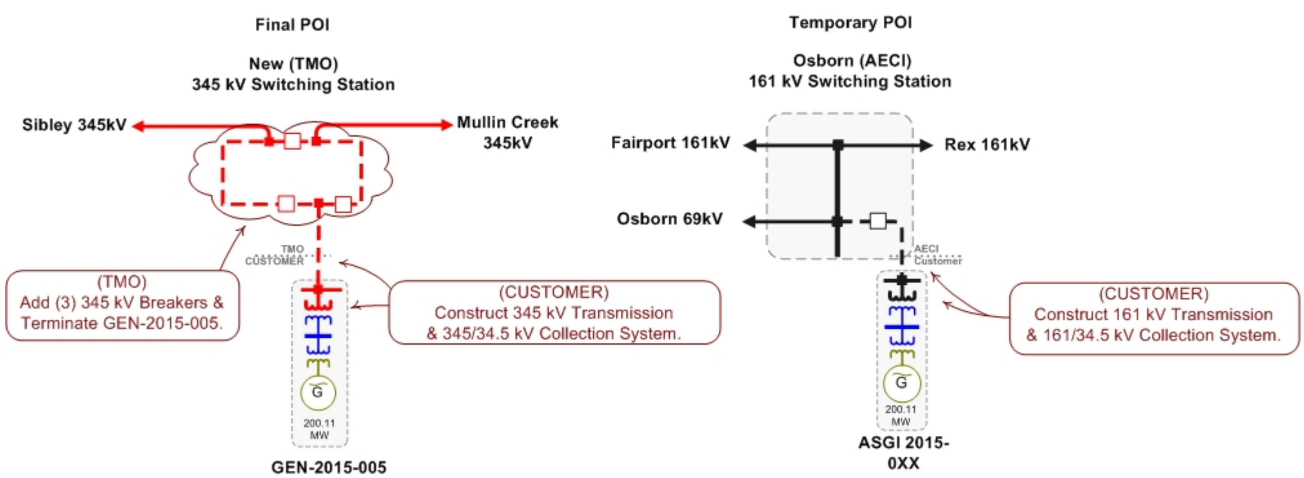
GEN-2015-001

See Posted Interconnection Facilties Study for GEN-2015-001

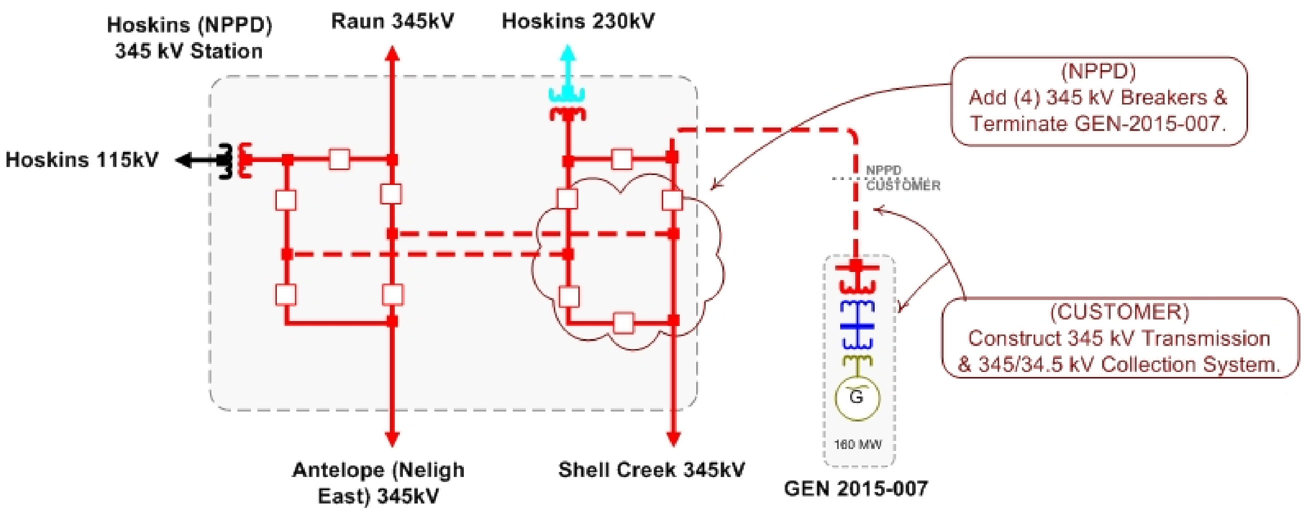
GEN-2015-004
Estimated Cluster Analysis Interconnection Cost: $0
Estimated Stand Alone Analysis Interconnection Cost: $0



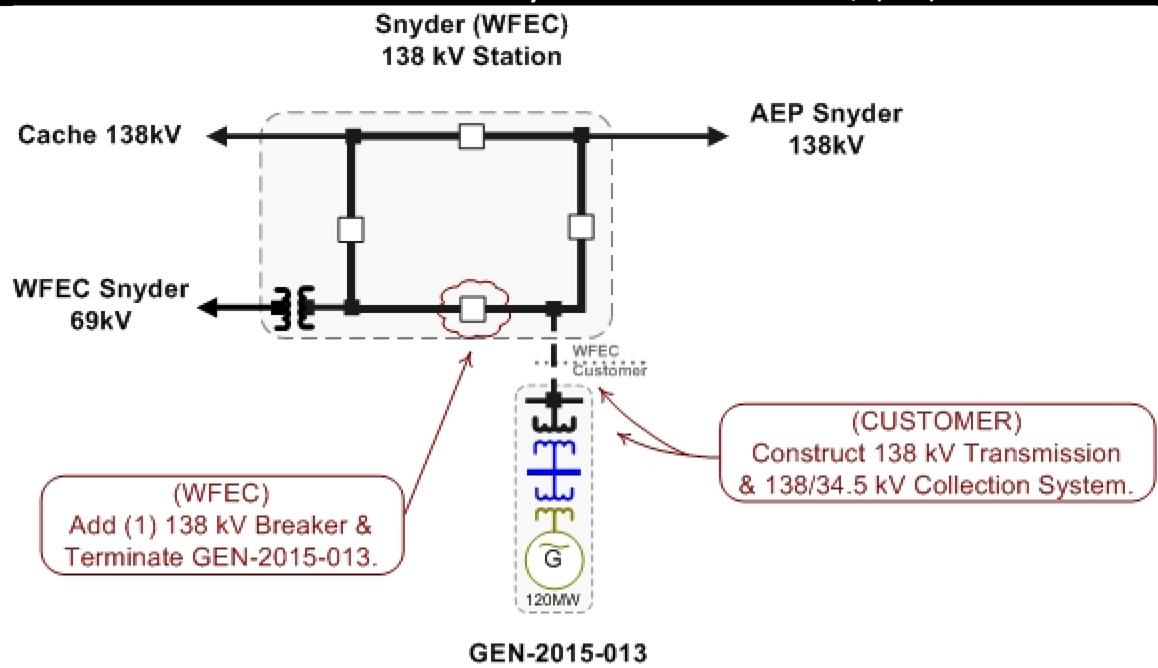
GEN-2015-005
Estimated Cluster Analysis Interconnection Cost: $18,262,000
Estimated Stand Alone Analysis Interconnection Cost: $18,262,000



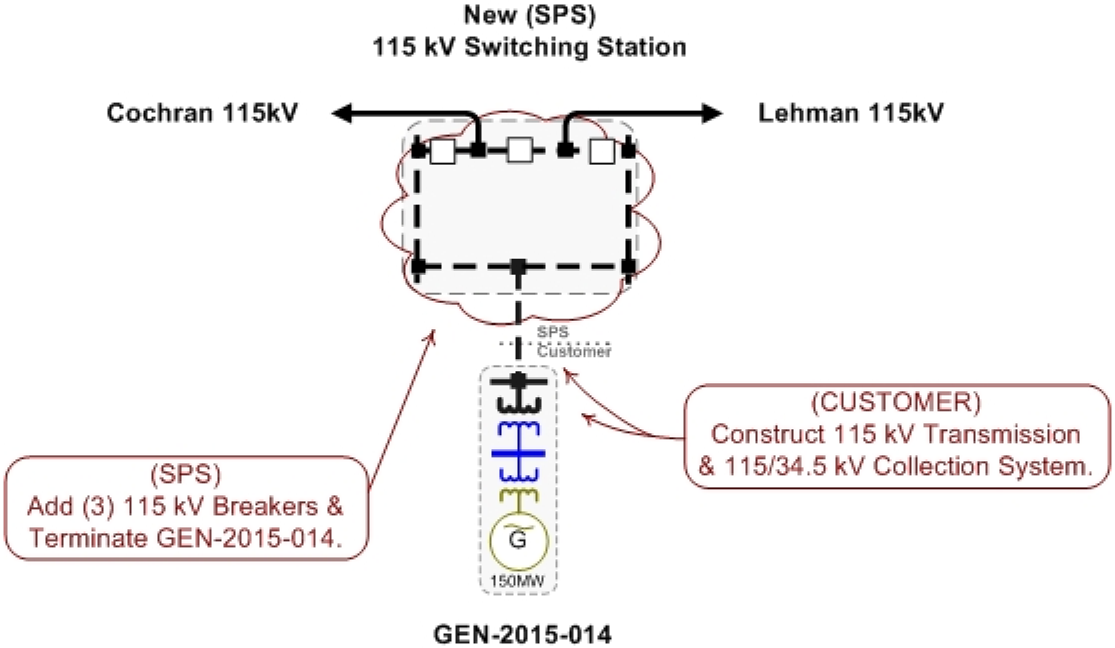
GEN-2015-007
Estimated Cluster Analysis Interconnection Cost: $5,300,000
Estimated Stand Alone Analysis Interconnection Cost: $5,300,000



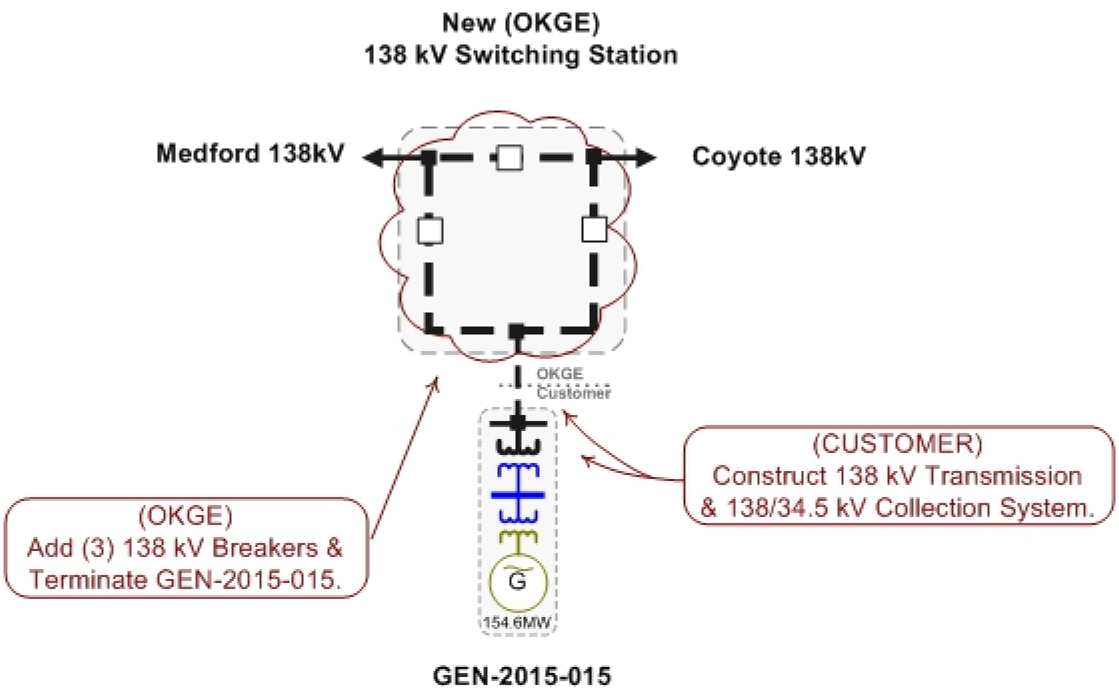
GEN-2015-013
Estimated Cluster Analysis Interconnection Cost: $1,000,000
Estimated Stand Alone Analysis Interconnection Cost: $1,000,000



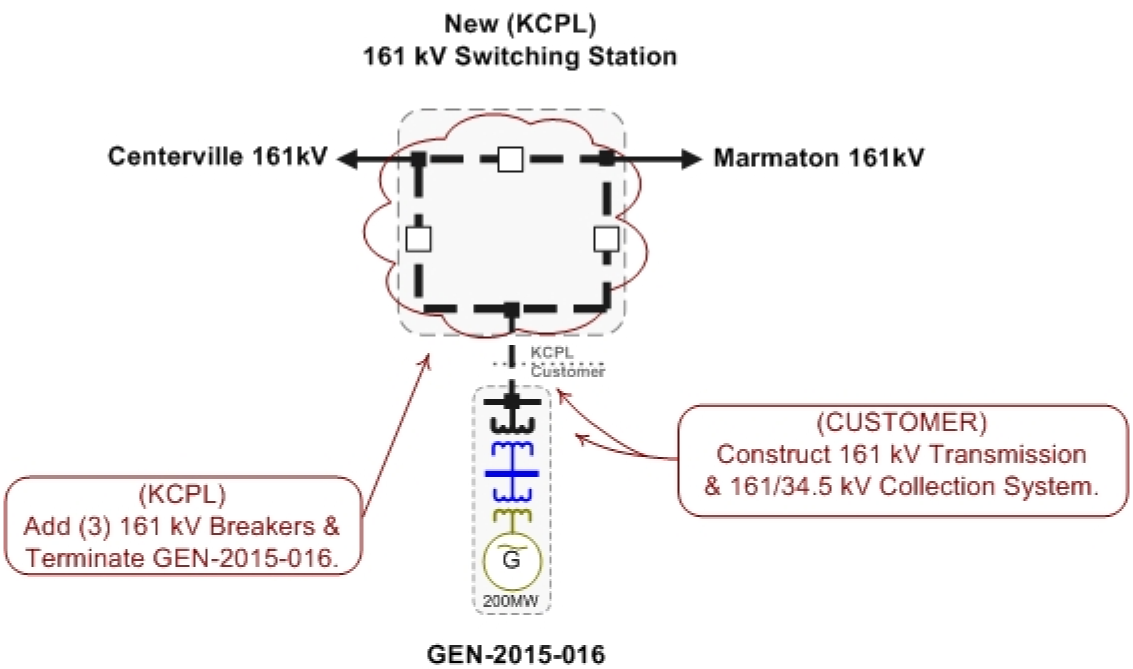
GEN-2015-014
Estimated Cluster Analysis Interconnection Cost: $4,773,333
Estimated Stand Alone Analysis Interconnection Cost: $4,773,333



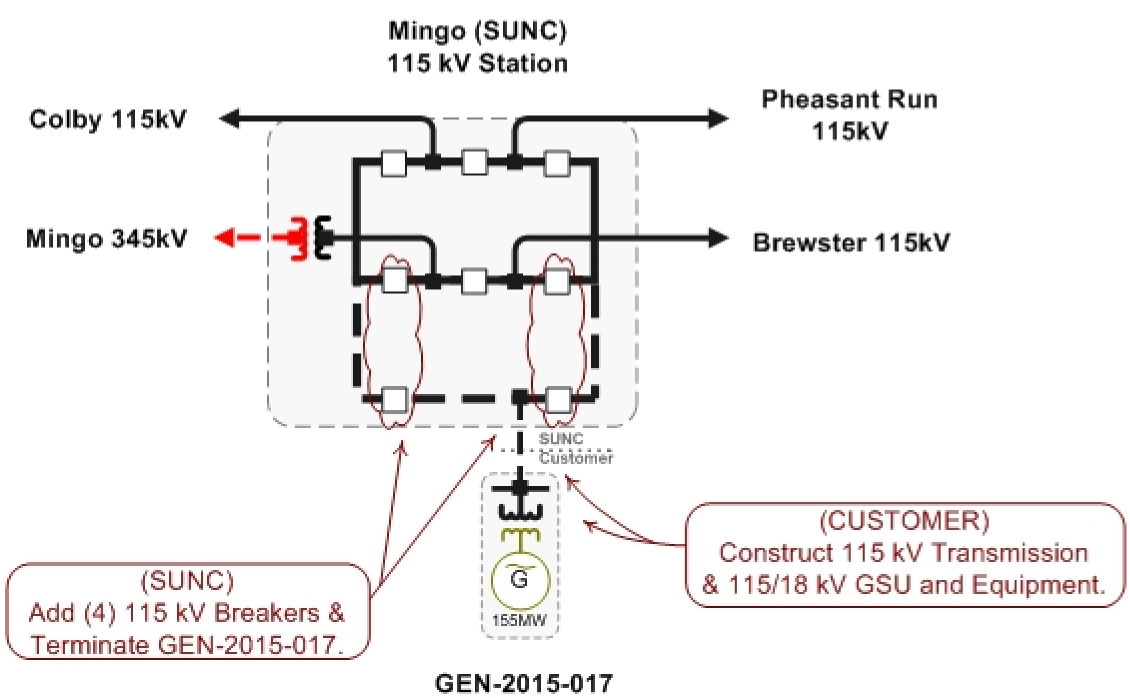
GEN-2015-015
Estimated Cluster Analysis Interconnection Cost: $3,041,661
Estimated Stand Alone Analysis Interconnection Cost: $3,041,661



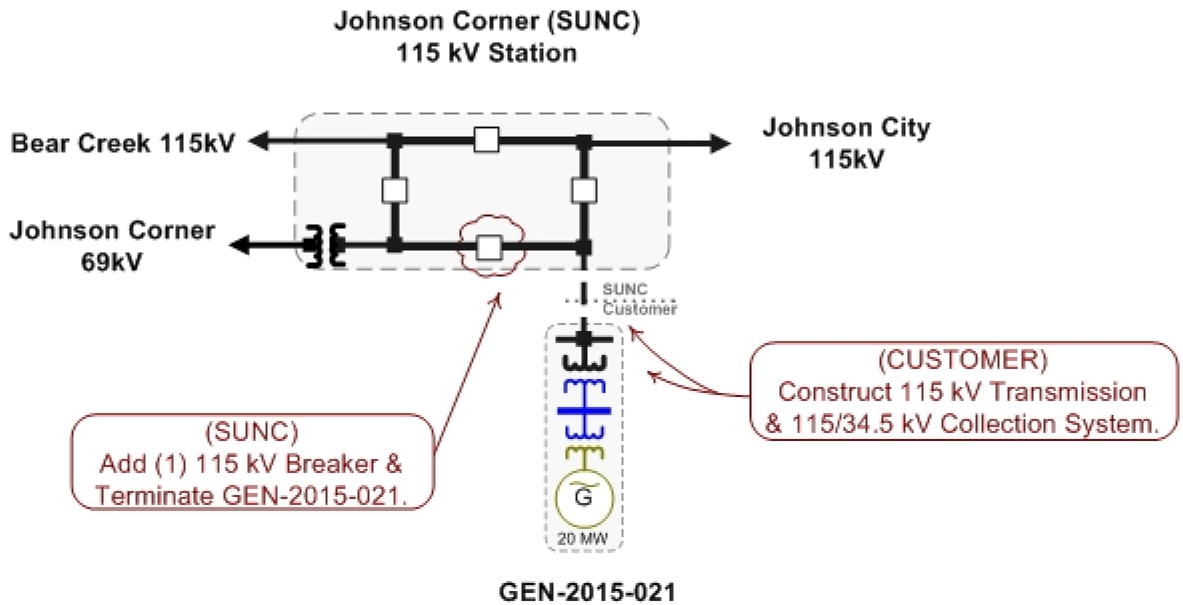
GEN-2015-016
Estimated Cluster Analysis Interconnection Cost: $8,110,000
Estimated Stand Alone Analysis Interconnection Cost: $8,110,000



GEN-2015-017
Estimated Cluster Analysis Interconnection Cost: $3,459,098
Estimated Stand Alone Analysis Interconnection Cost: $3,459,098



GEN-2015-021
Estimated Cluster Analysis Interconnection Cost: $1,438,309
Estimated Stand Alone Analysis Interconnection Cost: $1,438,309



GEN-2015-022
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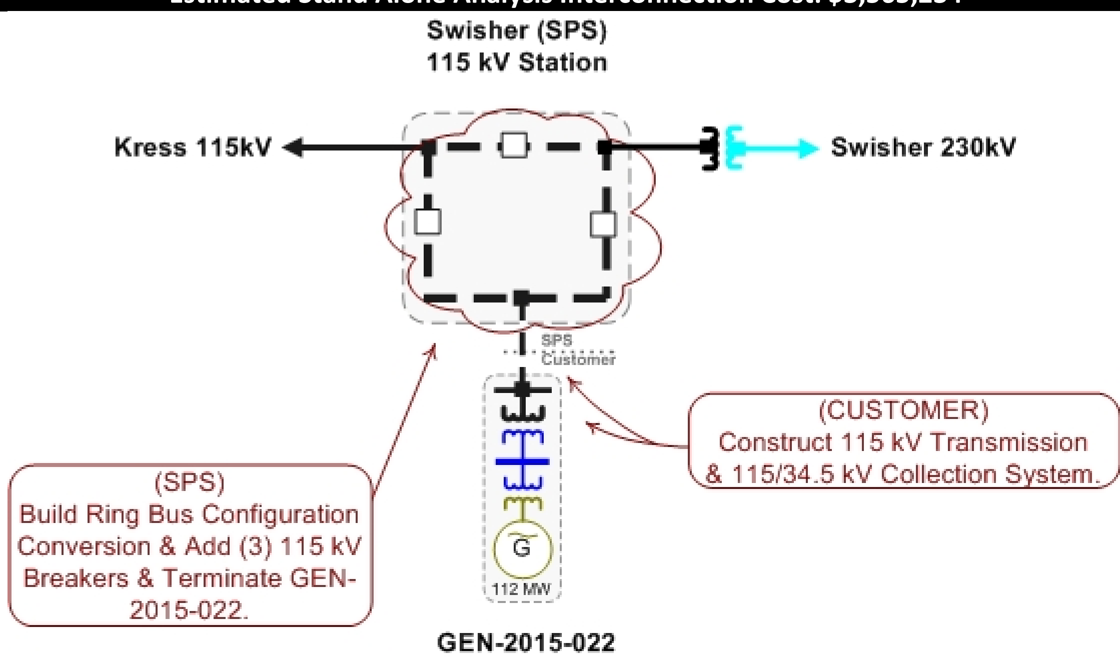
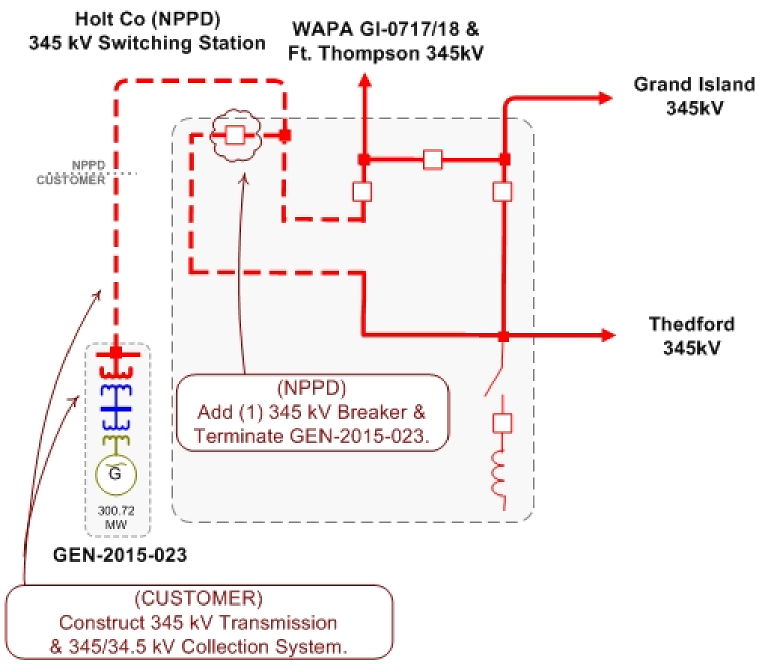
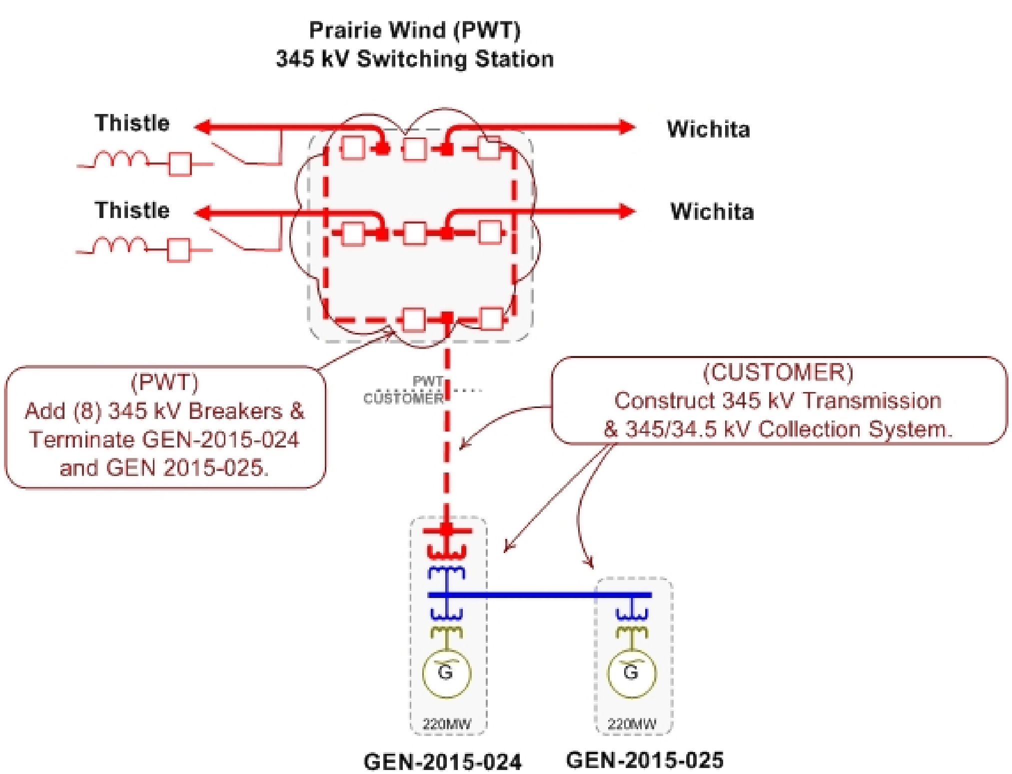
Estimated Stand Alone Analysis Interconnection Cost: $3,565,234



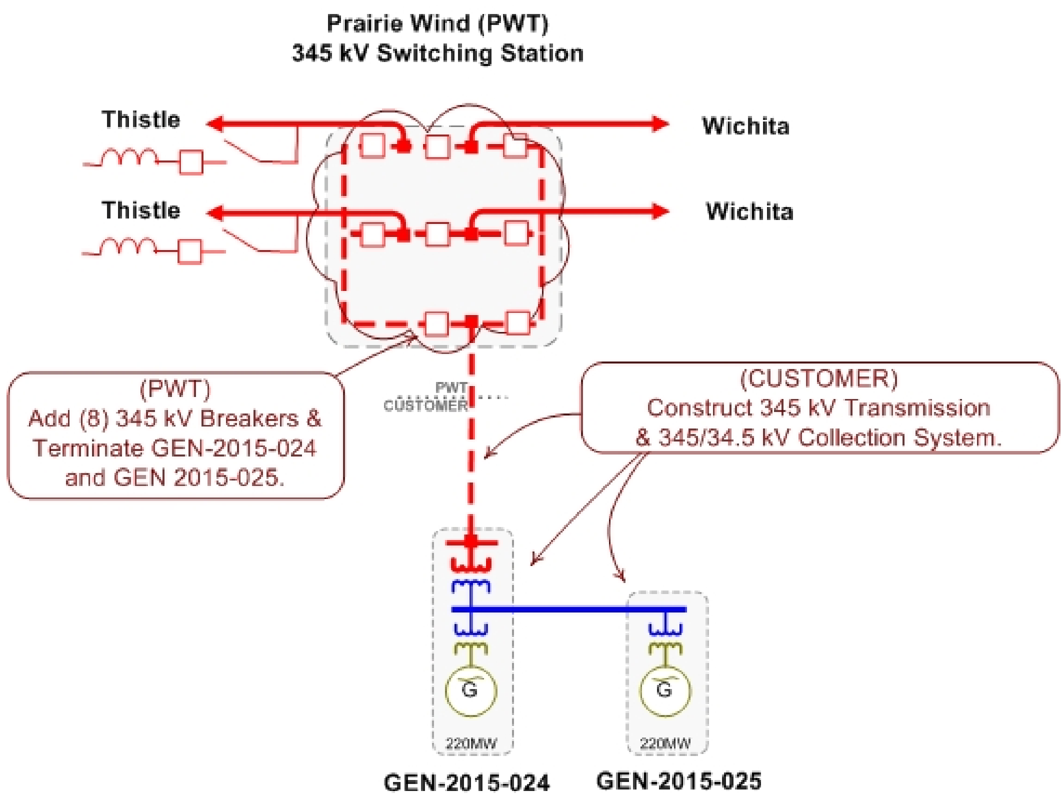
GEN-2015-023
Estimated Cluster Analysis Interconnection Cost: $4,800,000
Estimated Stand Alone Analysis Interconnection Cost: $4,800,000



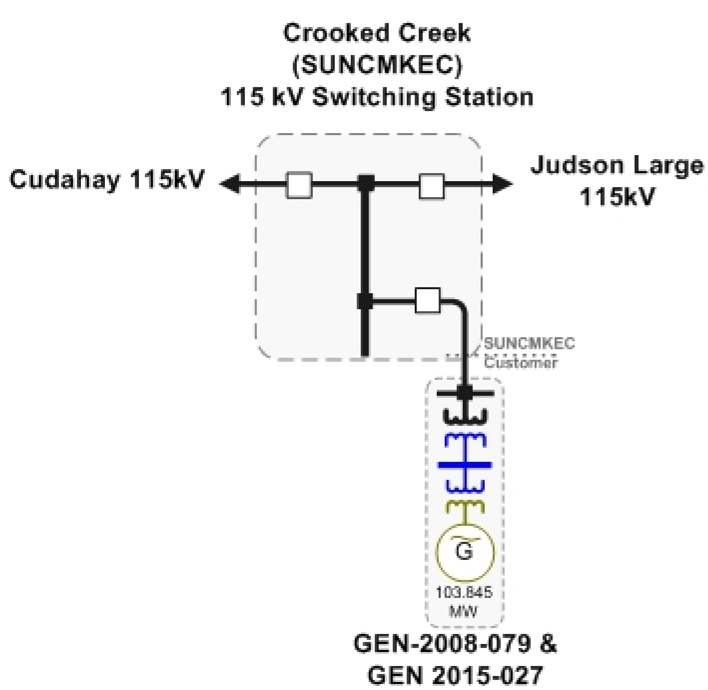
GEN-2015-024
Estimated Cluster Analysis Interconnection Cost: $32,704,640
Estimated Stand Alone Analysis Interconnection Cost: $32,704,640



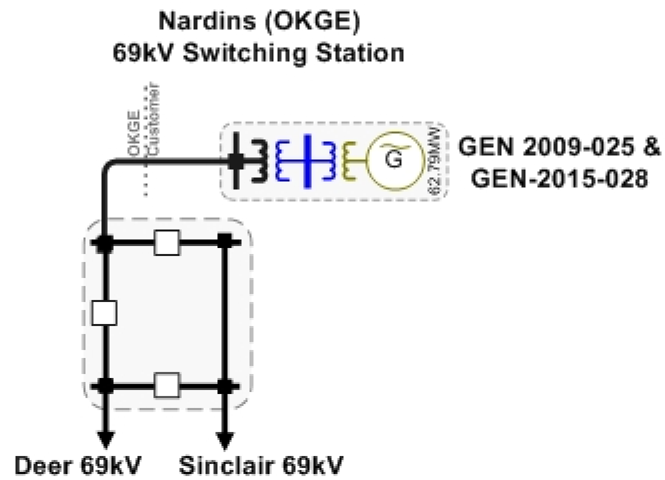
GEN-2015-025
Estimated Cluster Analysis Interconnection Cost: $0
Estimated Stand Alone Analysis Interconnection Cost: $32,704,640



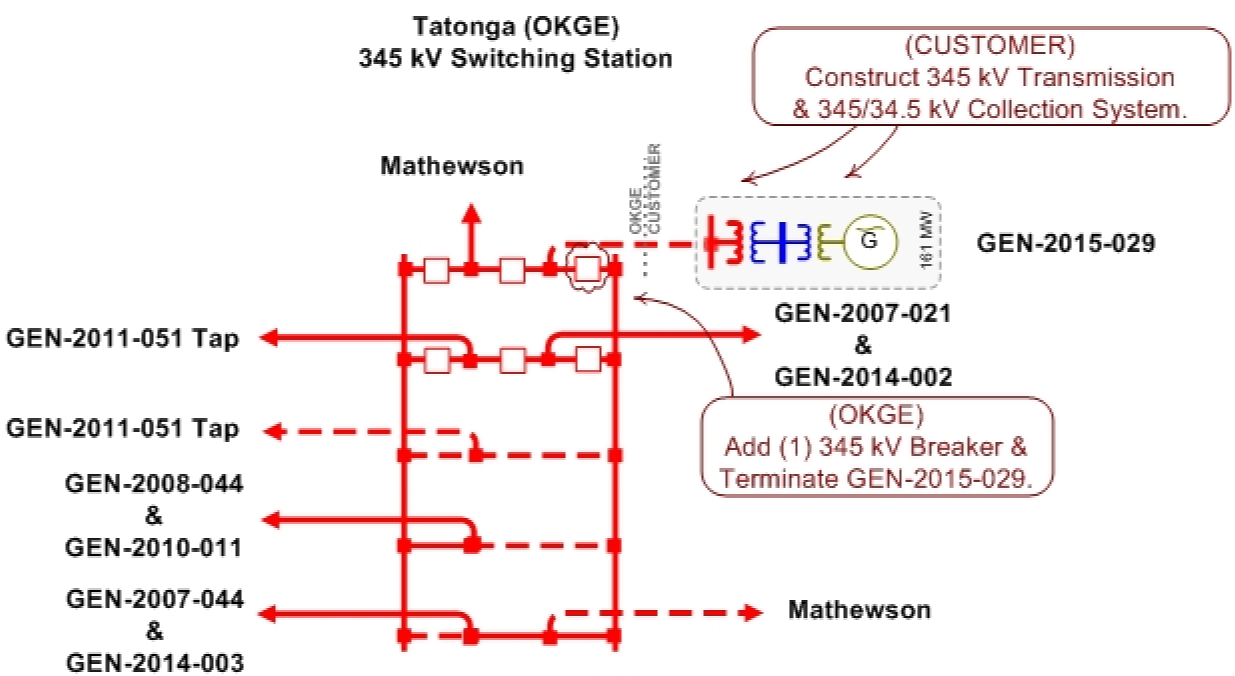
GEN-2015-027
Estimated Cluster Analysis Interconnection Cost: $150,000
Estimated Stand Alone Analysis Interconnection Cost: $150,000



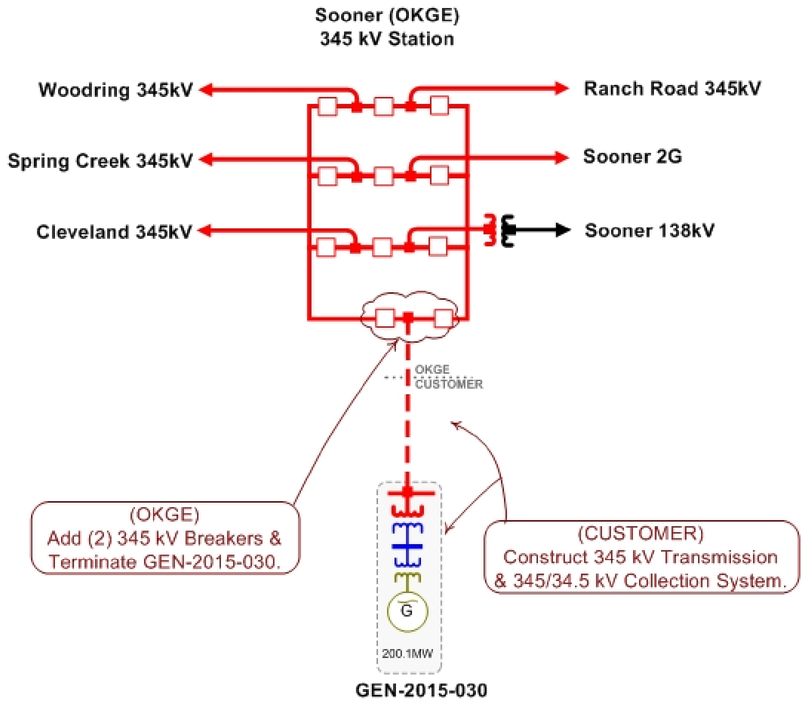
GEN-2015-028
Estimated Cluster Analysis Interconnection Cost: $0
Estimated Stand Alone Analysis Interconnection Cost: $0



GEN-2015-029
Estimated Cluster Analysis Interconnection Cost: $2,270,100
Estimated Stand Alone Analysis Interconnection Cost: $2,270,100



GEN-2015-030
Estimated Cluster Analysis Interconnection Cost: $3,369,366
Estimated Stand Alone Analysis Interconnection Cost: $3,369,366



E: Cost Allocation per Interconnection Request (Including Prior Queued Upgrades)

Important Note:

****WITHDRAWAL OF HIGHER QUEUED PROJECTS WILL CAUSE A RESTUDY AND MAY RESULT IN HIGHER INTERCONNECTION COSTS****

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 an 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.

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

Appendix E. Cost Allocation Per Request

(Including Previously Allocated Network Upgrades*)

Interconnection Request and Upgrades	Upgrade Type	Allocated Cost	Upgrade Cost
ASGI-2015-001			
ASGI-2015-001 Interconnection Costs See One-Line Diagram.	Current Study	$TBD	$TBD
	Current Study Total	$TBD	
ASGI-2015-002			
ASGI-2015-002 Interconnection Costs See One-Line Diagram.	Current Study	$0	$0
Elk City 230/138/13kV Transformer CKT 1 Replace terminal equipment for Elk City Transformer to achieve transformer limit of 450MVA.	Current Study	$74,536	$15,000,000
Grapevine - Nichols 230kV CKT 1 Replace terminal equipment	Current Study	$1,993	$400,000
Grapevine - Wheeler 230kV CKT 1 Replace terminal equipment	Current Study	$1,988	$400,000
Oklaunion 345kV Reactive Power Install (2)-130Mvar Capacitor Bank(s) at Oklaunion.	Current Study	$36,925	$10,000,000
Amoco Wasson - Oxy Tap 230kV CKT 1 Replace line traps at both terminals	Previously Allocated		$200,000
China Draw 115kV Reactive Power Support Build China Draw SVC (+200Mvar/-50Mvar) per 2015 ITPNT SPP-NTC-200324.	Previously Allocated		$20,064,549
National Enrichment Plant-Targa 115kV CKT 1 Rebuild approximately 4 miles of 115kV from National Enrichment Plant to Targa per 2015 ITPNT.	Previously Allocated		$2,909,669
Potash Junction 230kV Reactive Power Support Build Potash Junction 100Mvar Capacitor bank per 2015 ITPNT.	Previously Allocated		$6,465,875
Targa-Cardinal 115kV CKT 1 Rebuild approximately 3 miles of 115kV from Targa to Cardinal per 2015 ITPNT.	Previously Allocated		$2,049,062
Tolk - Plant X 230kV CKT 1 & 2 Rebuild circuit 1 and 2 betweek Tolk - Plant X 230kV to 1200 amps each.	Previously Allocated		$9,921,693
TUCO 2 (Crawfish Draw) Substation Upgrade 345/230kV Tap Border-TUCO approximately 2 miles from TUCO and build TUCO 2 (Crawfish Draw) 345kV substation and add 345/230/13.2kV transformer and tie on TUCO-Swisher 230kV.	Previously Allocated		$24,764,205

* Withdrawal of higher queued projects will cause a restudy and may result in higher costs

Interconnection Request and Upgrades	Upgrade Type	Allocated Cost	Upgrade Cost
Woodward EHV Phase Shifting Transformer CKT 1 Install one phase shifting transformer at Woodward	Previously Allocated		$7,200,000
	Current Study Total	$115,441	

ASGI-2015-004

Interconnection Request and Upgrades	Upgrade Type	Allocated Cost	Upgrade Cost
ASGI-2015-004 Interconnection Costs See One-Line Diagram.	Current Study	$0	$0
	Current Study Total	$0	

GEN-2010-048

Interconnection Request and Upgrades	Upgrade Type	Allocated Cost	Upgrade Cost
Beach - GEN-2010-048 Tap CKT 1 Replace terminal equipment	Current Study	$250,000	$250,000
GEN-2010-048 Interconnection Costs See One-Line Diagram.	Current Study	$4,000,000	$4,000,000
Arnold - Ransom 115kV CKT 1 Replace terminal equipment and relay panels at Ransom Substation	Previously Allocated		$268,321
Bucker - Spearville 345V CKT 1 Replace Terminal equipment	Previously Allocated		$1,480,238
Mingo 345/115kV Transformer CKT 2 Build second 345/115/13.8kV transformer at Mingo per 2015 NT SPP-NTC-200325 (Total Project E&C Cost Shown)..	Previously Allocated		$10,696,692
	Current Study Total	$4,250,000	

GEN-2014-074

Interconnection Request and Upgrades	Upgrade Type	Allocated Cost	Upgrade Cost
Carlisle - LP-Doug 115kV CKT 1 NRIS only required upgrade: Replace line traps	Current Study	$400,000	$400,000
Elk City 230/138/13kV Transformer CKT 1 Replace terminal equipment for Elk City Transformer to achieve transformer limit of 450MVA.	Current Study	$3,390,860	$15,000,000
GEN-2014-074 Interconnection Costs See One-Line Diagram.	Current Study	$13,519,992	$13,519,992
Grapevine - Nichols 230kV CKT 1 Replace terminal equipment	Current Study	$89,443	$400,000
Grapevine - Wheeler 230kV CKT 1 Replace terminal equipment	Current Study	$90,327	$400,000
Kress Interchange - Swisher 115kV CKT 1 Replace terminal equipment	Current Study	$3,516	$500,000

* Withdrawal of higher queued projects will cause a restudy and may result in higher costs

Interconnection Request and Upgrades	Upgrade Type	Allocated Cost	Upgrade Cost
Oklaunion 345kV Reactive Power Install (2)-130Mvar Capacitor Bank(s) at Oklaunion.	Current Study	$2,677,672	$10,000,000
Potter County Interchange 345/230/13kV Transformer CKT 2 NRIS only required upgrade: Build second 345/230/13kV transformer at Potter County	Current Study	$15,000,000	$15,000,000
TUCO Interchange - Jones 230kV CKT 1 NRIS only required upgrade: Replace line traps at both terminals	Current Study	$277,071	$400,000
Wolfforth - Sundown 230kV CKT 1 NRIS only required upgrade: Replace line traps at both terminals	Current Study	$303,054	$400,000
Wolfforth - Terry County 115kV CKT 1 NRIS only required upgrade: Replace terminal equipment to achieving conductor limit	Current Study	$663,252	$1,000,000
Carlisle 230/115/13kV Transformer CKT 1 Replace existing Carlisle 230/115/13kV Transformer circuit #1 with 250 MVA.	Previously Allocated		$4,192,913
China Draw 115kV Reactive Power Support Build China Draw SVC (+200Mvar/-50Mvar) per 2015 ITPNT SPP-NTC-200324.	Previously Allocated		$20,064,549
Potash Junction 230kV Reactive Power Support Build Potash Junction 100Mvar Capacitor bank per 2015 ITPNT.	Previously Allocated		$6,465,875
Tolk - Plant X 230kV CKT 1 & 2 Rebuild circuit 1 and 2 betweek Tolk - Plant X 230kV to 1200 amps each.	Previously Allocated		$9,921,693
TUCO 230/115kV CKT 1 Transformer NRIS only required upgrade: Replace TUCO 230/115kV transformer per SPP-2012-AG3-AFS9 SPP-NTC-200297	Previously Allocated		$3,800,415
Woodward EHV Phase Shifting Transformer CKT 1 Install one phase shifting transformer at Woodward	Previously Allocated		$7,200,000
	Current Study Total	$36,415,186	

GEN-2015-001

Interconnection Request and Upgrades	Upgrade Type	Allocated Cost	Upgrade Cost
GEN-2015-001 Interconnection Costs See Interconnection Facilities Study One-Line Diagram.	Current Study	$2,250,100	$2,250,100
	Current Study Total	$2,250,100	

GEN-2015-004

Interconnection Request and Upgrades	Upgrade Type	Allocated Cost	Upgrade Cost
GEN-2015-004 Interconnection Costs See One-Line Diagram.	Current Study	$0	$0
Oklaunion 345kV Reactive Power Install (2)-130Mvar Capacitor Bank(s) at Oklaunion.	Current Study	$3,198,477	$10,000,000

* Withdrawal of higher queued projects will cause a restudy and may result in higher costs

Interconnection Request and Upgrades	Upgrade Type	Allocated Cost	Upgrade Cost
	Current Study Total	$3,198,477	
GEN-2015-005			
GEN-2015-005 Interconnection Costs See One-Line Diagram.	Current Study	$18,262,000	$18,262,000
Nebraska City - Sibley 345kV CKT 1 Priority Project: Nebraska City - Mullin Creek - Sibley 345kV circuit 1 per SPP-NTC-20097 and SPP-NTC-20098 (Total Project E&C Cost Shown).	Previously Allocated		$336,433,874
	Current Study Total	$18,262,000	
GEN-2015-007			
GEN-2015-007 Interconnection Costs See One-Line Diagram.	Current Study	$5,300,000	$5,300,000
Gentleman - Thedford 345kV CKT 1 Build approximately 76 Miles of 345kV from Gentleman to Thedford per SPP-NTC-200220 (Total Project E&C Cost Shown).	Previously Allocated		$311,717,040
Thedford - Holt County 345kV CKT 1 Build approximately 146 Miles of 345kV from Thedford to Holt County per SPP-NTC-200220 (Total Project E&C Cost Shown).	Previously Allocated		$311,717,040
Thedford 345/115kV Transformer CKT 1 Install Thedford 345/115kV transformer per SPP-NTC-200277 (Total Project E&C Cost Shown).	Previously Allocated		$311,717,040
Twin Church - Dixon County 230kV Increase conductor clearances to accommodate 320MVA facility rating	Previously Allocated		$100,000
	Current Study Total	$5,300,000	
GEN-2015-013			
Altus SW - Navajo 69kV CKT 1 Rebuild approximately 2.5 miles of 69kV from Atlus SW to Navajo	Current Study	$1,250,000	$1,250,000
Anadarko - Sequoyah 138KV CKT 1 Rebuild approximately 1 mile of 138kV from Anadarko to Sequoyah	Current Study	$700,000	$700,000
Cornville Tap - Naples Tap 138kV CKT 1 Rebuild approximately 11 miles of 138kV from Cornville Tap to Naples Tap	Current Study	$7,700,000	$7,700,000
GEN-2015-013 Interconnection Costs See One-Line Diagram.	Current Study	$1,000,000	$1,000,000
Naples Tap - Payne 138kV CKT 1 Rebuild approximately 8 miles of 138kV from Naples Tap to Payne	Current Study	$5,600,000	$5,600,000
Navajo - Snyder 69kV CKT 1 Rebuild approximately 15 miles of 69kV from Navajo to Snyder	Current Study	$7,500,000	$7,500,000

* Withdrawal of higher queued projects will cause a restudy and may result in higher costs

Interconnection Request and Upgrades	Upgrade Type	Allocated Cost	Upgrade Cost
Sequoyah - Cornville Tap 138kV CKT 1 Rebuild approximately 20 miles of 138kV from Sequoyah to Cornville Tap	Current Study	$1,000,000	$1,000,000
Stateline - Sweetwater 230kV CKT 1 Replace terminal equipment	Current Study	$1,000,000	$1,000,000
Woodward EHV Phase Shifting Transformer CKT 1 NRIS only required upgrade: Install one phase shifting transformer at Woodward	Previously Allocated		$7,200,000
	Current Study Total	$25,750,000	
GEN-2015-014			
Elk City 230/138/13kV Transformer CKT 1 Replace terminal equipment for Elk City Transformer to achieve transformer limit of 450MVA.	Current Study	$6,211,520	$15,000,000
GEN-2015-014 Interconnection Costs See One-Line Diagram.	Current Study	$4,773,333	$4,773,333
Grapevine - Nichols 230kV CKT 1 Replace terminal equipment	Current Study	$166,241	$400,000
Grapevine - Wheeler 230kV CKT 1 Replace terminal equipment	Current Study	$165,697	$400,000
Oklaunion 345kV Reactive Power Install (2)-130Mvar Capacitor Bank(s) at Oklaunion.	Current Study	$2,490,757	$10,000,000
Amoco Wasson - Oxy Tap 230kV CKT 1 Replace line traps at both terminals	Previously Allocated		$200,000
National Enrichment Plant-Targa 115kV CKT 1 Rebuild approximately 4 miles of 115kV from National Enrichment Plant to Targa per 2015 ITPNT.	Previously Allocated		$2,909,669
Potash Junction 230kV Reactive Power Support Build Potash Junction 100Mvar Capacitor bank per 2015 ITPNT.	Previously Allocated		$6,465,875
Targa-Cardinal 115kV CKT 1 Rebuild approximately 3 miles of 115kV from Targa to Cardinal per 2015 ITPNT.	Previously Allocated		$2,049,062
Tolk - Plant X 230kV CKT 1 & 2 Rebuild circuit 1 and 2 betweek Tolk - Plant X 230kV to 1200 amps each.	Previously Allocated		$9,921,693
TUCO 2 (Crawfish Draw) Substation Upgrade 345/230kV Tap Border-TUCO approximately 2 miles from TUCO and build TUCO 2 (Crawfish Draw) 345kV substation and add 345/230/13.2kV transformer and tie on TUCO-Swisher 230kV.	Previously Allocated		$24,764,205
Woodward EHV Phase Shifting Transformer CKT 1 Install one phase shifting transformer at Woodward	Previously Allocated		$7,200,000

* Withdrawal of higher queued projects will cause a restudy and may result in higher costs

Interconnection Request and Upgrades	Upgrade Type	Allocated Cost	Upgrade Cost
	Current Study Total	$13,807,549	
GEN-2015-015			
GEN-2015-015 Interconnection Costs See One-Line Diagram.	Current Study	$3,041,661	$3,041,661
Renfrow - Renfrow 138kV CKT 1 NRIS only required upgrade: Rebuild approximately 2 miles of 138kV from Renfrow to Renfrow.	Current Study	$1,400,000	$1,400,000
Clearwater - Viola 138kV CKT 1 SPP 2013 ITP NT assigneg upgrade per SPP-NTC-200288 for 6/1/2019 in-service.	Previously Allocated		$37,815,044
Viola 345/138 kV Transformer CKT 1 SPP 2013 ITP NT assigned upgrade per SPP-NTC-200288 for 6/1/2019 in-service.	Previously Allocated		$19,339,327
	Current Study Total	$4,441,661	
GEN-2015-016			
GEN-2015-016 Interconnection Costs See One-Line Diagram.	Current Study	$8,110,000	$8,110,000
	Current Study Total	$8,110,000	
GEN-2015-017			
GEN-2015-017 Interconnection Costs See One-Line Diagram.	Current Study	$3,459,098	$3,459,098
Arnold - Ransom 115kV CKT 1 Replace terminal equipment and relay panels at Ransom Substation	Previously Allocated		$268,321
Bucker - Spearville 345V CKT 1 Replace Terminal equipment	Previously Allocated		$1,480,238
	Current Study Total	$3,459,098	
GEN-2015-021			
GEN-2015-021 Interconnection Costs See One-Line Diagram.	Current Study	$1,438,309	$1,438,309
Bucker - Spearville 345V CKT 1 Replace Terminal equipment	Previously Allocated		$1,480,238
Walkemeyer Tap - Walkemeyer 345/115kV Project Per SPP-NTC-200343 and SPP-NTC-200344 (Total Project E&C Cost Shown).	Previously Allocated		$17,838,846
Woodward EHV Phase Shifting Transformer CKT 1 Install one phase shifting transformer at Woodward	Previously Allocated		$7,200,000

* Withdrawal of higher queued projects will cause a restudy and may result in higher costs

Interconnection Request and Upgrades	Upgrade Type	Allocated Cost	Upgrade Cost
	Current Study Total	$1,438,309	

GEN-2015-022

Cox Interchange - Hale County 115kV CKT 1 NRIS only required upgrade: Rebuild approximately 20 miles of 115kV from Hale Co to Cox Co	Current Study	$15,000,000	$15,000,000
Elk City 230/138/13kV Transformer CKT 1 Replace terminal equipment for Elk City Transformer to achieve transformer limit of 450MVA.	Current Study	$5,323,084	$15,000,000
GEN-2015-022 Interconnection Costs See One-Line Diagram.	Current Study	$3,565,234	$3,565,234
Grapevine - Nichols 230kV CKT 1 Replace terminal equipment	Current Study	$142,323	$400,000
Grapevine - Wheeler 230kV CKT 1 Replace terminal equipment	Current Study	$141,988	$400,000
Kress Interchange - Swisher 115kV CKT 1 Replace terminal equipment	Current Study	$496,484	$500,000
Oklaunion 345kV Reactive Power Install (2)-130Mvar Capacitor Bank(s) at Oklaunion.	Current Study	$1,596,168	$10,000,000
TUCO Interchange - Jones 230kV CKT 1 NRIS only required upgrade: Replace line traps at both terminals	Current Study	$122,929	$400,000
Wolfforth - Sundown 230kV CKT 1 NRIS only required upgrade: Replace line traps at both terminals	Current Study	$96,946	$400,000
Wolfforth - Terry County 115kV CKT 1 NRIS only required upgrade: Replace terminal equipment to achieving conductor limit	Current Study	$336,748	$1,000,000
Potash Junction 230/115 kV Ckt 1 Per HPILs SPP-NTC-200282 (Total Project E&C Cost Shown)	Previously Allocated		$3,508,346
TUCO 2 (Crawfish Draw) Substation Upgrade 345/230kV Tap Border-TUCO approximately 2 miles from TUCO and build TUCO 2 (Crawfish Draw) 345kV substation and add 345/230/13.2kV transformer and tie on TUCO-Swisher 230kV.	Previously Allocated		$24,764,205
Woodward EHV Phase Shifting Transformer CKT 1 Install one phase shifting transformer at Woodward	Previously Allocated		$7,200,000
	Current Study Total	$26,821,905	

GEN-2015-023

GEN-2015-023 Interconnection Costs See One-Line Diagram.	Current Study	$4,800,000	$4,800,000

* Withdrawal of higher queued projects will cause a restudy and may result in higher costs

Interconnection Request and Upgrades	Upgrade Type	Allocated Cost	Upgrade Cost
Battle Creek-County Line 115kV CKT 1 Rebuild approximately 11 miles of 115kV from Battle Creek to County Line.	Previously Allocated		$4,000,000
County Line-Neligh East 115kV CKT 1 Rebuild approximately 12 miles of 115kV from County Line to Neligh East.	Previously Allocated		$8,050,000
Gentleman - Thedford 345kV CKT 1 Build approximately 76 Miles of 345kV from Gentleman to Thedford per SPP-NTC-200220 (Total Project E&C Cost Shown).	Previously Allocated		$311,717,040
Hoskins - Neligh 345/115kV Projects Per SPP 2014 ITP NT and NTC 200253 for 6/1/2016 in-service.	Previously Allocated		$98,697,720
Thedford - Holt County 345kV CKT 1 Build approximately 146 Miles of 345kV from Thedford to Holt County per SPP-NTC-200220 (Total Project E&C Cost Shown).	Previously Allocated		$311,717,040
Thedford 345/115kV Transformer CKT 1 Install Thedford 345/115kV transformer per SPP-NTC-200277 (Total Project E&C Cost Shown).	Previously Allocated		$311,717,040
Twin Church - Dixon County 230kV Increase conductor clearances to accommodate 320MVA facility rating	Previously Allocated		$100,000
	Current Study Total	$4,800,000	
GEN-2015-024			
GEN-2015-024 Interconnection Costs See One-Line Diagram.	Current Study	$32,704,640	$32,704,640
	Current Study Total	$32,704,640	
GEN-2015-025			
GEN-2015-025 Interconnection Costs See One-Line Diagram.	Current Study	$0	$0
	Current Study Total	$0	
GEN-2015-027			
Cimarron River Tap - Kismet CKT 1 Rebuild approximately 3.4 miles of 115kV from Cudahy - Kismet.	Current Study	$2,400,000	$2,400,000
Crooked Creek - Cudahy 115kV CKT 1 Rebuild approximately 10 miles of 115kV from Crooked Creek - Cudahy.	Current Study	$7,000,000	$7,000,000
Cudahy - Kismet 115kV CKT 1 Rebuild approximately 32 miles of 115kV from Cudahy - Kismet.	Current Study	$22,400,000	$22,400,000
GEN-2015-027 Interconnection Costs See One-Line Diagram.	Current Study	$150,000	$150,000

* Withdrawal of higher queued projects will cause a restudy and may result in higher costs

Interconnection Request and Upgrades	Upgrade Type	Allocated Cost	Upgrade Cost
Greenburg - Shooting Star 115kV CKT 1 Rebuild approximately 8 miles of 115kV from Greenburg - Shooting Star.	Current Study	$5,250,000	$5,250,000
Walkemeyer Tap - Walkemeyer 345/115kV Project Per SPP-NTC-200343 and SPP-NTC-200344 (Total Project E&C Cost Shown).	Previously Allocated		$17,838,846
Woodward EHV Phase Shifting Transformer CKT 1 Install one phase shifting transformer at Woodward	Previously Allocated		$7,200,000
	Current Study Total	$37,200,000	
GEN-2015-028			
GEN-2015-028 Interconnection Costs See One-Line Diagram.	Current Study	$0	$0
Clearwater - Viola 138kV CKT 1 SPP 2013 ITP NT assigneg upgrade per SPP-NTC-200288 for 6/1/2019 in-service.	Previously Allocated		$37,815,044
Viola 345/138 kV Transformer CKT 1 SPP 2013 ITP NT assigned upgrade per SPP-NTC-200288 for 6/1/2019 in-service.	Previously Allocated		$19,339,327
	Current Study Total	$0	
GEN-2015-029			
GEN-2015-029 Interconnection Costs See One-Line Diagram.	Current Study	$2,270,100	$2,270,100
	Current Study Total	$2,270,100	
GEN-2015-030			
GEN-2015-030 Interconnection Costs See One-Line Diagram.	Current Study	$3,369,366	$3,369,366
Clearwater - Viola 138kV CKT 1 SPP 2013 ITP NT assigneg upgrade per SPP-NTC-200288 for 6/1/2019 in-service.	Previously Allocated		$37,815,044
Viola 345/138 kV Transformer CKT 1 SPP 2013 ITP NT assigned upgrade per SPP-NTC-200288 for 6/1/2019 in-service.	Previously Allocated		$19,339,327
	Current Study Total	$3,369,366	
	TOTAL CURRENT STUDY COSTS:	**$233,963,833***	

* Does not include ASGI-2015-001 Affected System Interconnection Costs.

* Withdrawal of higher queued projects will cause a restudy and may result in higher costs

F: Cost Allocation per Proposed Study Network Upgrade

Important Note:

****WITHDRAWAL OF HIGHER QUEUED PROJECTS WILL CAUSE A RESTUDY AND MAY RESULT IN HIGHER INTERCONNECTION COSTS****

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 by Upgrade

Altus SW - Navajo 69kV CKT 1		**$1,250,000**
Rebuild approximately 2.5 miles of 69kV from Atlus SW to Navajo		
GEN-2015-013	$1,250,000	
Total Allocated Costs	**$1,250,000**	
Anadarko - Sequoyah 138KV CKT 1		**$700,000**
Rebuild approximately 1 mile of 138kV from Anadarko to Sequoyah		
GEN-2015-013	$700,000	
Total Allocated Costs	**$700,000**	
ASGI-2015-001 Interconnection Costs		**$TBD**
See One-Line Diagram.		
ASGI-2015-001	$TBD	
Total Allocated Costs	**$TBD**	
ASGI-2015-002 Interconnection Costs		**$0**
See One-Line Diagram.		
ASGI-2015-002	$0	
Total Allocated Costs	**$0**	
ASGI-2015-004 Interconnection Costs		**$0**
See One-Line Diagram.		
ASGI-2015-004	$0	
Total Allocated Costs	**$0**	
Beach - GEN-2010-048 Tap CKT 1		**$250,000**
Replace terminal equipment		
GEN-2010-048	$250,000	
Total Allocated Costs	**$250,000**	
Carlisle - LP-Doug 115kV CKT 1		**$400,000**
NRIS only required upgrade: Replace line traps		
GEN-2014-074	$400,000	
Total Allocated Costs	**$400,000**	

* Withdrawal of higher queued projects will cause a restudy and may result in higher costs

Cimarron River Tap - Kismet CKT 1			$2,400,000
Rebuild approximately 3.4 miles of 115kV from Cudahy - Kismet.			
	GEN-2015-027	$2,400,000	
	Total Allocated Costs	**$2,400,000**	

Cornville Tap - Naples Tap 138kV CKT 1			$7,700,000
Rebuild approximately 11 miles of 138kV from Cornville Tap to Naples Tap			
	GEN-2015-013	$7,700,000	
	Total Allocated Costs	**$7,700,000**	

Cox Interchange - Hale County 115kV CKT 1			$15,000,000
NRIS only required upgrade: Rebuild approximately 20 miles of 115kV from Hale Co to Cox Co			
	GEN-2015-022	$15,000,000	
	Total Allocated Costs	**$15,000,000**	

Crooked Creek - Cudahy 115kV CKT 1			$7,000,000
Rebuild approximately 10 miles of 115kV from Crooked Creek - Cudahy.			
	GEN-2015-027	$7,000,000	
	Total Allocated Costs	**$7,000,000**	

Cudahy - Kismet 115kV CKT 1			$22,400,000
Rebuild approximately 32 miles of 115kV from Cudahy - Kismet.			
	GEN-2015-027	$22,400,000	
	Total Allocated Costs	**$22,400,000**	

Elk City 230/138/13kV Transformer CKT 1			$15,000,000
Replace terminal equipment for Elk City Transformer to achieve transformer limit of 450MVA.			
	ASGI-2015-002	$74,536	
	GEN-2014-074	$3,390,860	
	GEN-2015-014	$6,211,520	
	GEN-2015-022	$5,323,084	
	Total Allocated Costs	**$15,000,000**	

GEN-2010-048 Interconnection Costs			$4,000,000
See One-Line Diagram.			
	GEN-2010-048	$4,000,000	
	Total Allocated Costs	**$4,000,000**	

* Withdrawal of higher queued projects will cause a restudy and may result in higher costs

GEN-2014-074 Interconnection Costs			$13,519,992
See One-Line Diagram.			
	GEN-2014-074	$13,519,992	
	Total Allocated Costs	**$13,519,992**	
GEN-2015-001 Interconnection Costs			**$2,250,100**
See Interconnection Facilities Study One-Line Diagram.			
	GEN-2015-001	$2,250,100	
	Total Allocated Costs	**$2,250,100**	
GEN-2015-004 Interconnection Costs			**$0**
See One-Line Diagram.			
	GEN-2015-004	$0	
	Total Allocated Costs	**$0**	
GEN-2015-005 Interconnection Costs			**$18,262,000**
See One-Line Diagram.			
	GEN-2015-005	$18,262,000	
	Total Allocated Costs	**$18,262,000**	
GEN-2015-007 Interconnection Costs			**$5,300,000**
See One-Line Diagram.			
	GEN-2015-007	$5,300,000	
	Total Allocated Costs	**$5,300,000**	
GEN-2015-013 Interconnection Costs			**$1,000,000**
See One-Line Diagram.			
	GEN-2015-013	$1,000,000	
	Total Allocated Costs	**$1,000,000**	
GEN-2015-014 Interconnection Costs			**$4,773,333**
See One-Line Diagram.			
	GEN-2015-014	$4,773,333	
	Total Allocated Costs	**$4,773,333**	
GEN-2015-015 Interconnection Costs			**$3,041,661**
See One-Line Diagram.			
	GEN-2015-015	$3,041,661	
	Total Allocated Costs	**$3,041,661**	

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GEN-2015-016 Interconnection Costs			**$8,110,000**
See One-Line Diagram.			
	GEN-2015-016	$8,110,000	
	Total Allocated Costs	**$8,110,000**	
GEN-2015-017 Interconnection Costs			**$3,459,098**
See One-Line Diagram.			
	GEN-2015-017	$3,459,098	
	Total Allocated Costs	**$3,459,098**	
GEN-2015-021 Interconnection Costs			**$1,438,309**
See One-Line Diagram.			
	GEN-2015-021	$1,438,309	
	Total Allocated Costs	**$1,438,309**	
GEN-2015-022 Interconnection Costs			**$3,565,234**
See One-Line Diagram.			
	GEN-2015-022	$3,565,234	
	Total Allocated Costs	**$3,565,234**	
GEN-2015-023 Interconnection Costs			**$4,800,000**
See One-Line Diagram.			
	GEN-2015-023	$4,800,000	
	Total Allocated Costs	**$4,800,000**	
GEN-2015-024 Interconnection Costs			**$32,704,640**
See One-Line Diagram.			
	GEN-2015-024	$32,704,640	
	Total Allocated Costs	**$32,704,640**	
GEN-2015-025 Interconnection Costs			**$0**
See One-Line Diagram.			
	GEN-2015-025	$0	
	Total Allocated Costs	**$0**	
GEN-2015-027 Interconnection Costs			**$150,000**
See One-Line Diagram.			
	GEN-2015-027	$150,000	
	Total Allocated Costs	**$150,000**	

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GEN-2015-028 Interconnection Costs			**$0**
See One-Line Diagram.			
	GEN-2015-028	$0	
	Total Allocated Costs	**$0**	
GEN-2015-029 Interconnection Costs			**$2,270,100**
See One-Line Diagram.			
	GEN-2015-029	$2,270,100	
	Total Allocated Costs	**$2,270,100**	
GEN-2015-030 Interconnection Costs			**$3,369,366**
See One-Line Diagram.			
	GEN-2015-030	$3,369,366	
	Total Allocated Costs	**$3,369,366**	
Grapevine - Nichols 230kV CKT 1			**$400,000**
Replace terminal equipment			
	ASGI-2015-002	$1,993	
	GEN-2014-074	$89,443	
	GEN-2015-014	$166,241	
	GEN-2015-022	$142,323	
	Total Allocated Costs	**$400,000**	
Grapevine - Wheeler 230kV CKT 1			**$400,000**
Replace terminal equipment			
	ASGI-2015-002	$1,988	
	GEN-2014-074	$90,327	
	GEN-2015-014	$165,697	
	GEN-2015-022	$141,988	
	Total Allocated Costs	**$400,000**	
Greenburg - Shooting Star 115kV CKT 1			**$5,250,000**
Rebuild approximately 8 miles of 115kV from Greenburg - Shooting Star.			
	GEN-2015-027	$5,250,000	
	Total Allocated Costs	**$5,250,000**	

* Withdrawal of higher queued projects will cause a restudy and may result in higher costs

Kress Interchange - Swisher 115kV CKT 1			**$500,000**
Replace terminal equipment			
	GEN-2014-074	$3,516	
	GEN-2015-022	$496,484	
	Total Allocated Costs	**$500,000**	
Naples Tap - Payne 138kV CKT 1			**$5,600,000**
Rebuild approximately 8 miles of 138kV from Naples Tap to Payne			
	GEN-2015-013	$5,600,000	
	Total Allocated Costs	**$5,600,000**	
Navajo - Snyder 69kV CKT 1			**$7,500,000**
Rebuild approximately 15 miles of 69kV from Navajo to Snyder			
	GEN-2015-013	$7,500,000	
	Total Allocated Costs	**$7,500,000**	
Oklaunion 345kV Reactive Power			**$10,000,000**
Install (2)-130Mvar Capacitor Bank(s) at Oklaunion.			
	ASGI-2015-002	$36,925	
	GEN-2014-074	$2,677,672	
	GEN-2015-004	$3,198,477	
	GEN-2015-014	$2,490,757	
	GEN-2015-022	$1,596,168	
	Total Allocated Costs	**$10,000,000**	
Potter County Interchange 345/230/13kV Transformer CKT 2			**$15,000,000**
NRIS only required upgrade: Build second 345/230/13kV transformer at Potter County			
	GEN-2014-074	$15,000,000	
	Total Allocated Costs	**$15,000,000**	
Renfrow - Renfrow 138kV CKT 1			**$1,400,000**
NRIS only required upgrade: Rebuild approximately 2 miles of 138kV from Renfrow to Renfrow.			
	GEN-2015-015	$1,400,000	
	Total Allocated Costs	**$1,400,000**	
Sequoyah - Cornville Tap 138kV CKT 1			**$1,000,000**
Rebuild approximately 20 miles of 138kV from Sequoyah to Cornville Tap			
	GEN-2015-013	$1,000,000	
	Total Allocated Costs	**$1,000,000**	

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Stateline - Sweetwater 230kV CKT 1 **$1,000,000**

Replace terminal equipment

GEN-2015-013	$1,000,000
Total Allocated Costs	**$1,000,000**

TUCO Interchange - Jones 230kV CKT 1 **$400,000**

NRIS only required upgrade: Replace line traps at both terminals

GEN-2014-074	$277,071
GEN-2015-022	$122,929
Total Allocated Costs	**$400,000**

Wolfforth - Sundown 230kV CKT 1 **$400,000**

NRIS only required upgrade: Replace line traps at both terminals

GEN-2014-074	$303,054
GEN-2015-022	$96,946
Total Allocated Costs	**$400,000**

Wolfforth - Terry County 115kV CKT 1 **$1,000,000**

NRIS only required upgrade: Replace terminal equipment to achieving conductor limit

GEN-2014-074	$663,252
GEN-2015-022	$336,748
Total Allocated Costs	**$1,000,000**

* Withdrawal of higher queued projects will cause a restudy and may result in higher costs

G: Power Flow Analysis (Constraints Requiring Transmission Reinforcement)

See next page.

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNS	06ALL	0	17G	ASGI_15_02	FROM->TO	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	316	0.06796	102	BASE CASE
FDNS	06ALL	0	17G	ASGI_15_02	FROM->TO	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	316	0.06796	102	BASE CASE
FDNS	06ALL	0	20WP	ASGI_15_02	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329	360	0.07173	118	BASE CASE
FDNS	06ALL	0	20WP	ASGI_15_02	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	329	360	0.07435	102	BASE CASE
FDNSLock-Blown up	06ALL	0	16WP	ASGI_15_02	-	Non-Converged Contingency	1022	1124	0.2908	-	G14-074T 345.00 - OKLAUNION 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	ASGI_15_02	-	Non-Converged Contingency	1792	1792	0.22151	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	17G	ASGI_15_02	-	Non-Converged Contingency	1022	1124	0.28475	-	G14-074T 345.00 - OKLAUNION 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	ASGI_15_02	-	Non-Converged Contingency	1022	1124	0.27526	-	G14-074T 345.00 - OKLAUNION 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	ASGI_15_02	-	Non-Converged Contingency	1792	1972	0.2159	-	BORDER 7345.00 - TUCO_2 345.00 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	ASGI_15_02	-	Non-Converged Contingency	1792	1792	0.2159	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNS	06ALL	2	17G	ASGI_15_02	FROM->TO	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	316	0.06798	100	BASE CASE
FDNS	06ALL	2	17G	ASGI_15_02	FROM->TO	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	316	0.06798	100	BASE CASE
FDNS	06ALL	2	20WP	ASGI_15_02	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329	360	0.07176	115	BASE CASE
FDNSLock-Blown up	06ALL	2	17G	ASGI_15_02	-	Non-Converged Contingency	1022	1124	0.28481	-	G14-074T 345.00 - OKLAUNION 345KV CKT 1
FDNSLock-Blown up	06ALL	2	20WP	ASGI_15_02	-	Non-Converged Contingency	1022	1124	0.27535	-	G14-074T 345.00 - OKLAUNION 345KV CKT 1
FDNS	06ALL	3	20WP	ASGI_15_02	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329	360	0.07176	113	BASE CASE
FDNS	04ALL	0	25SP	G10_048	TO->FROM	BEACH STATION - G10-48T 115.00 115KV CKT 1	80	80	0.51406	102	POST ROCK (POSTROCK T1) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	04ALL	0	25SP	G10_048	TO->FROM	BEACH STATION - G10-48T 115.00 115KV CKT 1	80	80	0.51406	102	POST ROCK (POSTROCK T1) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	04ALL	0	16SP	G10_048	TO->FROM	BEACH STATION - G10-48T 115.00 115KV CKT 1	80	80	0.40985	101	MINGO (MINGO) 345/115/13.8KV TRANSFORMER CKT 1
FDNS	04ALL	0	16SP	G10_048	TO->FROM	BEACH STATION - G10-48T 115.00 115KV CKT 1	80	80	0.40985	101	MINGO (MINGO) 345/115/13.8KV TRANSFORMER CKT 1
FDNS	04ALL	0	16SP	G10_048	TO->FROM	BEACH STATION - G10-48T 115.00 115KV CKT 1	80	80	0.40985	101	MINGO (MINGO) 345/115/13.8KV TRANSFORMER CKT 1
FDNS	04ALL	0	16SP	G10_048	TO->FROM	BEACH STATION - G10-48T 115.00 115KV CKT 1	80	80	0.40985	101	MINGO (MINGO) 345/115/13.8KV TRANSFORMER CKT 1
FDNS	04ALL	0	25SP	G10_048	TO->FROM	BEACH STATION - G10-48T 115.00 115KV CKT 1	80	80	0.47769	101	KNOLL - SALINE RIVER 115KV CKT 1
FDNS	04ALL	0	25SP	G10_048	TO->FROM	BEACH STATION - G10-48T 115.00 115KV CKT 1	80	80	0.47769	101	KNOLL - SALINE RIVER 115KV CKT 1
FDNS	04ALL	2	25SP	G10_048	TO->FROM	BEACH STATION - G10-48T 115.00 115KV CKT 1	80	80	0.51406	102	POST ROCK (POSTROCK T1) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	04ALL	2	25SP	G10_048	TO->FROM	BEACH STATION - G10-48T 115.00 115KV CKT 1	80	80	0.51406	102	POST ROCK (POSTROCK T1) 345/230/13.8KV TRANSFORMER CKT 1
FDNS	04ALL	2	25SP	G10_048	TO->FROM	BEACH STATION - G10-48T 115.00 115KV CKT 1	80	80	0.47769	101	KNOLL - SALINE RIVER 115KV CKT 1
FDNS	04ALL	2	25SP	G10_048	TO->FROM	BEACH STATION - G10-48T 115.00 115KV CKT 1	80	80	0.47769	101	KNOLL - SALINE RIVER 115KV CKT 1
FDNS	00NR	0	25SP	G14_074	FROM->TO	CARLISLE INTERCHANGE - LP-DOUD_TP 3115.00 115KV CKT 1	159	160	0.0322	118.3363	WOLFFORTH INTERCHANGE (WH 7001668) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	25SP	G14_074	FROM->TO	CARLISLE INTERCHANGE - LP-DOUD_TP 3115.00 115KV CKT 1	159	160	0.0322	118.3363	WOLFFORTH INTERCHANGE (WH 7001668) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	17G	G14_074	FROM->TO	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	316	0.04085	102	BASE CASE
FDNS	06ALL	0	17G	G14_074	FROM->TO	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	316	0.04085	102	BASE CASE
FDNS	06ALL	0	20WP	G14_074	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329	360	0.04279	118	BASE CASE
FDNS	06ALL	0	20WP	G14_074	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	329	360	0.04449	102	BASE CASE
FDNS	00NR	0	16SP	G14_074	TO->FROM	JONES STATION - TUCO INTERCHANGE 230KV CKT 1	343	343	0.19036	114	GEN526331 1-JONES GEN #1 22 KV
FDNS	00NR	0	16SP	G14_074	TO->FROM	JONES STATION - TUCO INTERCHANGE 230KV CKT 1	343	343	0.19036	114	GEN526331 1-JONES GEN #1 22 KV
FDNS	00NR	0	25SP	G14_074	TO->FROM	JONES STATION - TUCO INTERCHANGE 230KV CKT 1	343.79	343.79	0.16773	105.3128	CARLISLE INTERCHANGE - TUCO INTERCHANGE 230KV CKT 1
FDNS	00NR	0	25SP	G14_074	TO->FROM	JONES STATION - TUCO INTERCHANGE 230KV CKT 1	343.79	343.79	0.16773	105.3128	CARLISLE INTERCHANGE - TUCO INTERCHANGE 230KV CKT 1
FDNS	00NR	0	16SP	G14_074	TO->FROM	JONES STATION - TUCO INTERCHANGE 230KV CKT 1	343	343	0.19036	102	GEN526332 1-JONES GEN #2 21 KV
FDNS	00NR	0	16SP	G14_074	TO->FROM	JONES STATION - TUCO INTERCHANGE 230KV CKT 1	343	343	0.19036	102	GEN526332 1-JONES GEN #2 21 KV
FDNS	00NR	0	16SP	G14_074	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.04243	110	NEWHART 230 - SWISHER COUNTY INTERCHANGE 230KV CKT 1
FDNS	00NR	0	16SP	G14_074	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.04243	110	NEWHART 230 - SWISHER COUNTY INTERCHANGE 230KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G14_074	-	Non-Converged Contingency	1022	1124	0.43219	-	G14-074T 345.00 - OKLAUNION 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G14_074	-	Non-Converged Contingency	1792	1792	0.21156	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	17G	G14_074	-	Non-Converged Contingency	1022	1124	0.42559	-	G14-074T 345.00 - OKLAUNION 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G14_074	-	Non-Converged Contingency	1022	1124	0.41148	-	G14-074T 345.00 - OKLAUNION 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G14_074	-	Non-Converged Contingency	1792	1972	0.19797	-	BORDER 7345.00 - TUCO_2 345.00 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G14_074	-	Non-Converged Contingency	1792	1792	0.19797	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNS	00NR	0	25SP	G14_074	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.23907	106.3884	G14-074T 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	00NR	0	25SP	G14_074	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.23907	103.9545	G14-074T 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	00NR	0	25SP	G14_074	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.0659	103.5502	BORDER 7345.00 - TUCO_2 345.00 345KV CKT 1
FDNS	00NR	0	25SP	G14_074	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.0659	101.4757	BORDER 7345.00 - TUCO_2 345.00 345KV CKT 1
FDNS	00NR	0	25SP	G14_074	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.08612	101.1767	HITCHLAND INTERCHANGE - MOORE COUNTY INTERCHANGE 230KV CKT 1
FDNS	00NR	0	25SP	G14_074	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.08612	101.1767	HITCHLAND INTERCHANGE - MOORE COUNTY INTERCHANGE 230KV CKT 1
FDNS	00NR	0	25SP	G14_074	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.07323	100.7965	GEN525562 1-TOLK GEN #2 24 KV
FDNS	00NR	0	25SP	G14_074	FROM->TO	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1	560	560	0.0659	100.5948	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNS	00NR	0	25SP	G14_074	TO->FROM	SUNDOWN INTERCHANGE - WOLFFORTH INTERCHANGE 230KV CKT 1	318.7	350.57	0.15429	100.769	TUCO INTERCHANGE - YOAKUM_345 345.00 345KV CKT 1
FDNS	00NR	0	25SP	G14_074	TO->FROM	TERRY COUNTY INTERCHANGE - WOLFFORTH INTERCHANGE 115KV CKT 1	119.51	153.97	0.06441	107.5928	TUCO INTERCHANGE - YOAKUM_345 345.00 345KV CKT 1
FDNS	00NR	0	25SP	G14_074	FROM->TO	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 1	250	288	0.06464	116.7712	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	0	25SP	G14_074	FROM->TO	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 1	250	288	0.06464	116.7712	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	0	25SP	G14_074	FROM->TO	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 1	250	288	0.06464	109.3113	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	0	25SP	G14_074	FROM->TO	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 1	250	288	0.06464	109.3113	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	0	25SP	G14_074	FROM->TO	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2	250	288	0.06464	116.7712	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	25SP	G14_074	FROM->TO	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2	250	288	0.06464	116.7712	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	25SP	G14_074	FROM->TO	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2	250	288	0.06464	109.3113	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	25SP	G14_074	FROM->TO	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2	250	288	0.06464	109.3113	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	16SP	G14_074	FROM->TO	TUCO INTERCHANGE (GE M102345) 230/115/13.2KV TRANSFORMER CKT 1	242	252	0.0978	101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	0	16SP	G14_074	FROM->TO	TUCO INTERCHANGE (GE M102345) 230/115/13.2KV TRANSFORMER CKT 1	242	252	0.0978	101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNS	00NR	0	16SP	G14_074	FROM->TO	TUCO INTERCHANGE (GE M102345) 230/115/13.2KV TRANSFORMER CKT 1	242	252	0.0978	101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	0	16SP	G14_074	FROM->TO	TUCO INTERCHANGE (GE M102345) 230/115/13.2KV TRANSFORMER CKT 1	242	252	0.0978	101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	0	16SP	G14_074	FROM->TO	TUCO INTERCHANGE (GE M102345) 230/115/13.2KV TRANSFORMER CKT 1	242	252	0.0978	100	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	0	16SP	G14_074	FROM->TO	TUCO INTERCHANGE (GE M102345) 230/115/13.2KV TRANSFORMER CKT 1	242	252	0.0978	100	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	0	16SP	G14_074	FROM->TO	TUCO INTERCHANGE (GE M102345) 230/115/13.2KV TRANSFORMER CKT 1	242	252	0.0978	100	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	0	16SP	G14_074	FROM->TO	TUCO INTERCHANGE (GE M102345) 230/115/13.2KV TRANSFORMER CKT 1	242	252	0.0978	100	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	2	17G	G14_074	FROM->TO	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	316	0.04086	100	BASE CASE
FDNS	06ALL	2	17G	G14_074	FROM->TO	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	316	0.04086	100	BASE CASE
FDNS	06ALL	2	20WP	G14_074	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329	360	0.04282	115	BASE CASE
FDNSLock-Blown up	06ALL	2	17G	G14_074	-	Non-Converged Contingency	1022	1124	0.42565	-	G14-074T 345.00 - OKLAUNION 345KV CKT 1
FDNSLock-Blown up	06ALL	2	20WP	G14_074	-	Non-Converged Contingency	1022	1124	0.41157	-	G14-074T 345.00 - OKLAUNION 345KV CKT 1
FDNS	06ALL	3	20WP	G14_074	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329	360	0.04283	113	BASE CASE
FDNS	00NR	4	16SP	G14_074	TO->FROM	JONES STATION - TUCO INTERCHANGE 230KV CKT 1	343	343	0.19036	114	GEN526331 1-JONES GEN #1 22 KV
FDNS	00NR	4	16SP	G14_074	TO->FROM	JONES STATION - TUCO INTERCHANGE 230KV CKT 1	343	343	0.19036	114	GEN526331 1-JONES GEN #1 22 KV
FDNS	00NR	4	16SP	G14_074	TO->FROM	JONES STATION - TUCO INTERCHANGE 230KV CKT 1	343	343	0.19036	102	GEN526332 1-JONES GEN #2 21 KV
FDNS	00NR	4	16SP	G14_074	TO->FROM	JONES STATION - TUCO INTERCHANGE 230KV CKT 1	343	343	0.19036	102	GEN526332 1-JONES GEN #2 21 KV
FDNS	00NR	4	16SP	G14_074	FROM->TO	TUCO INTERCHANGE (GE M102345) 230/115/13.2KV TRANSFORMER CKT 1	242	252	0.0978	101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	4	16SP	G14_074	FROM->TO	TUCO INTERCHANGE (GE M102345) 230/115/13.2KV TRANSFORMER CKT 1	242	252	0.0978	101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	4	16SP	G14_074	FROM->TO	TUCO INTERCHANGE (GE M102345) 230/115/13.2KV TRANSFORMER CKT 1	242	252	0.0978	101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	4	16SP	G14_074	FROM->TO	TUCO INTERCHANGE (GE M102345) 230/115/13.2KV TRANSFORMER CKT 1	242	252	0.0978	101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	4	16SP	G14_074	FROM->TO	TUCO INTERCHANGE (GE M102345) 230/115/13.2KV TRANSFORMER CKT 1	242	252	0.0978	100	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	4	16SP	G14_074	FROM->TO	TUCO INTERCHANGE (GE M102345) 230/115/13.2KV TRANSFORMER CKT 1	242	252	0.0978	100	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	4	16SP	G14_074	FROM->TO	TUCO INTERCHANGE (GE M102345) 230/115/13.2KV TRANSFORMER CKT 1	242	252	0.0978	100	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	4	16SP	G14_074	FROM->TO	TUCO INTERCHANGE (GE M102345) 230/115/13.2KV TRANSFORMER CKT 1	242	252	0.0978	100	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	07ALL	0	25SP	G15_013	TO->FROM	ALTUS SW - NAVAJO 69KV CKT 1	36	36	0.19987	120	SNYDER - SNYDER 138KV CKT 1
FDNS	07ALL	0	25SP	G15_013	TO->FROM	ALTUS SW - NAVAJO 69KV CKT 1	36	36	0.19987	120	SNYDER - SNYDER 138KV CKT 1
FDNS	07ALL	0	25SP	G15_013	TO->FROM	ALTUS SW - NAVAJO 69KV CKT 1	36	36	0.19987	120	SNYDER - SNYDER 138KV CKT 1
FDNS	07ALL	0	25SP	G15_013	TO->FROM	ALTUS SW - NAVAJO 69KV CKT 1	36	36	0.19987	120	SNYDER - SNYDER 138KV CKT 1
FDNS	00NR	0	25SP	G15_013	TO->FROM	ALTUS SW - NAVAJO 69KV CKT 1	36	36	0.19635	118.3161	SNYDER - SNYDER 138KV CKT 1
FDNS	00NR	0	25SP	G15_013	TO->FROM	ALTUS SW - NAVAJO 69KV CKT 1	36	36	0.19635	118.3161	SNYDER - SNYDER 138KV CKT 1
FDNS	07ALL	0	20SP	G15_013	TO->FROM	ALTUS SW - NAVAJO 69KV CKT 1	36	36	0.2	100	SNYDER - SNYDER 138KV CKT 1
FDNS	07ALL	0	20SP	G15_013	TO->FROM	ALTUS SW - NAVAJO 69KV CKT 1	36	36	0.2	100	SNYDER - SNYDER 138KV CKT 1
FDNS	07ALL	0	20SP	G15_013	TO->FROM	ALTUS SW - NAVAJO 69KV CKT 1	36	36	0.2	100	SNYDER - SNYDER 138KV CKT 1
FDNS	07ALL	0	20SP	G15_013	TO->FROM	ALTUS SW - NAVAJO 69KV CKT 1	36	36	0.2	100	SNYDER - SNYDER 138KV CKT 1
FDNS	07ALL	0	20SP	G15_013	FROM->TO	ANADARKO - SEQUOYAHJ4 138.00 138KV CKT 1	132	163	0.03996	101	BASE CASE
FDNS	00NR	0	20WP	G15_013	FROM->TO	CORN TAP - NAPLESTP 138.00 138KV CKT 1	132	143	0.03168	115	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	00NR	0	20WP	G15_013	FROM->TO	CORN TAP - NAPLESTP 138.00 138KV CKT 1	132	143	0.03168	115	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	00NR	0	16WP	G15_013	FROM->TO	CORN TAP - NAPLESTP 138.00 138KV CKT 1	132	143	0.03109	114	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	00NR	0	16WP	G15_013	FROM->TO	CORN TAP - NAPLESTP 138.00 138KV CKT 1	132	143	0.03109	114	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	07ALL	0	20WP	G15_013	FROM->TO	CORN TAP - NAPLESTP 138.00 138KV CKT 1	132	143	0.04201	114	BASE CASE
FDNS	00NR	0	20WP	G15_013	FROM->TO	CORN TAP - NAPLESTP 138.00 138KV CKT 1	132	143	0.03168	113	G14-057T 345.00 - LAWTON EASTSIDE 345KV CKT 1
FDNS	00NR	0	20WP	G15_013	FROM->TO	CORN TAP - NAPLESTP 138.00 138KV CKT 1	132	143	0.03168	113	G14-057T 345.00 - LAWTON EASTSIDE 345KV CKT 1
FDNS	00NR	0	16WP	G15_013	FROM->TO	CORN TAP - NAPLESTP 138.00 138KV CKT 1	132	143	0.03109	111	G14-057T 345.00 - LAWTON EASTSIDE 345KV CKT 1
FDNS	00NR	0	16WP	G15_013	FROM->TO	CORN TAP - NAPLESTP 138.00 138KV CKT 1	132	143	0.03109	111	G14-057T 345.00 - LAWTON EASTSIDE 345KV CKT 1
FDNS	07ALL	0	16WP	G15_013	FROM->TO	CORN TAP - NAPLESTP 138.00 138KV CKT 1	132	143	0.04207	110	BASE CASE
FDNS	07ALL	0	20SP	G15_013	FROM->TO	CORN TAP - NAPLESTP 138.00 138KV CKT 1	132	143	0.04273	106	BASE CASE
FDNS	00NR	0	20WP	G15_013	FROM->TO	CORN TAP - NAPLESTP 138.00 138KV CKT 1	132	143	0.03057	106	CIMARRON - MINCO 345KV CKT 1
FDNS	00NR	0	20WP	G15_013	FROM->TO	CORN TAP - NAPLESTP 138.00 138KV CKT 1	132	143	0.03057	106	CIMARRON - MINCO 345KV CKT 1
FDNS	00NR	0	16WP	G15_013	FROM->TO	CORN TAP - NAPLESTP 138.00 138KV CKT 1	132	143	0.02976	102	CIMARRON - MINCO 345KV CKT 1
FDNS	00NR	0	16WP	G15_013	FROM->TO	CORN TAP - NAPLESTP 138.00 138KV CKT 1	132	143	0.02976	102	CIMARRON - MINCO 345KV CKT 1
FDNS	07ALL	0	16SP	G15_013	FROM->TO	CORN TAP - NAPLESTP 138.00 138KV CKT 1	132	143	0.04253	101	BASE CASE
FDNS	00NR	0	20WP	G15_013	FROM->TO	CORN TAP - NAPLESTP 138.00 138KV CKT 1	132	143	0.03057	101	GRACEMONT - MINCO 345KV CKT 1
FDNS	00NR	0	20WP	G15_013	FROM->TO	CORN TAP - NAPLESTP 138.00 138KV CKT 1	132	143	0.03057	101	GRACEMONT - MINCO 345KV CKT 1
FDNS	07ALL	0	20SP	G15_013	TO->FROM	CORN TAP - SEQUOYAHJ4 138.00 138KV CKT 1	132	143	0.03996	100	BASE CASE
FDNS	00NR	0	20WP	G15_013	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	287	0.083	102	MATHWSN7 345.00 - TATONGA7 345.00 345KV CKT 1
FDNS	00NR	0	20WP	G15_013	FROM->TO	FPL SWITCH - MOORELAND 138KV CKT 1	287	287	0.083	102	MATHWSN7 345.00 - TATONGA7 345.00 345KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.083	150	MATHWSN7 345.00 - TATONGA7 345.00 345KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.083	150	MATHWSN7 345.00 - TATONGA7 345.00 345KV CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08198	140	MATHWSN7 345.00 - TATONGA7 345.00 345KV CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08198	140	MATHWSN7 345.00 - TATONGA7 345.00 345KV CKT 1
FDNSLock	00NR	0	16WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08181	139	MATHWSN7 345.00 - TATONGA7 345.00 345KV CKT 1
FDNSLock	00NR	0	16WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08181	139	MATHWSN7 345.00 - TATONGA7 345.00 345KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.083	136	G11_051T 345.00 - TATONGA7 345.00 345KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.083	136	G11_051T 345.00 - TATONGA7 345.00 345KV CKT 1
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.083	135	MATHWSN7 345.00 - TATONGA7 345.00 345KV CKT 1
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.083	135	MATHWSN7 345.00 - TATONGA7 345.00 345KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08686	133	DBL-G1524-WI
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08686	133	DBL-G1524-WI

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08686	130	DBL-THIS-G15
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08686	130	DBL-THIS-G15
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08626	130	DBL-THIS-WWR
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08626	130	DBL-THIS-WWR
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.083	129	G11_051T 345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.083	129	G11_051T 345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNS	00NR	0	16WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08181	126	G11_051T 345.00 - TATONGA7 345.00 345KV CKT 1
FDNS	00NR	0	16WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08181	126	G11_051T 345.00 - TATONGA7 345.00 345KV CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08198	125	G11_051T 345.00 - TATONGA7 345.00 345KV CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08198	125	G11_051T 345.00 - TATONGA7 345.00 345KV CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.0915	123	WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.0915	123	WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08537	123	DBL-G1524-WI
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08537	123	DBL-G1524-WI
FDNS	00NR	0	16WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08516	123	DBL-G1524-WI
FDNS	00NR	0	16WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08516	123	DBL-G1524-WI
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.09333	123	WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.09333	123	WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	16WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08472	121	DBL-THIS-WWR
FDNS	00NR	0	16WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08472	121	DBL-THIS-WWR
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08537	119	DBL-THIS-G15
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08537	119	DBL-THIS-G15
FDNS	00NR	0	16WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08516	119	DBL-THIS-G15
FDNS	00NR	0	16WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08516	119	DBL-THIS-G15
FDNS	00NR	0	16WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08181	119	G11_051T 345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNS	00NR	0	16WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08181	119	G11_051T 345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08686	119	DBL-G1524-WI
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08686	119	DBL-G1524-WI
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.083	119	G11_051T 345.00 - TATONGA7 345.00 345KV CKT 1
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.083	119	G11_051T 345.00 - TATONGA7 345.00 345KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08903	118	IODINE - WOODWARD EHV 138KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08903	118	IODINE - WOODWARD EHV 138KV CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08198	117	G11_051T 345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08198	117	G11_051T 345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08903	117	DEWEY - IODINE 138KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08903	117	DEWEY - IODINE 138KV CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08486	116	DBL-THIS-WWR
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08486	116	DBL-THIS-WWR
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08686	116	DBL-THIS-G15
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08686	116	DBL-THIS-G15
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08526	115	GEN520998 1-MORLND3
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08526	115	GEN520998 1-MORLND3
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.087	114	GEN520998 1-MORLND3
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.087	114	GEN520998 1-MORLND3
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08526	113	GEN520997 1-MORLND2
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08526	113	GEN520997 1-MORLND2
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08626	113	DBL-THIS-WWR
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08626	113	DBL-THIS-WWR
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08802	112	IODINE - WOODWARD EHV 138KV CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08802	112	IODINE - WOODWARD EHV 138KV CKT 1
FDNS	00NR	0	16WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.09116	112	WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	16WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.09116	112	WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.087	112	GEN520997 1-MORLND2
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.087	112	GEN520997 1-MORLND2
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08802	111	DEWEY - IODINE 138KV CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08802	111	DEWEY - IODINE 138KV CKT 1
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08903	111	IODINE - WOODWARD EHV 138KV CKT 1
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08903	111	IODINE - WOODWARD EHV 138KV CKT 1
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.083	111	G11_051T 345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.083	111	G11_051T 345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.0848	111	G14-074T 345.00 - OKLAUNION 345KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.0848	111	G14-074T 345.00 - OKLAUNION 345KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08143	111	P12:230:AEPW:ELKCITY6:SWEETWT6
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08143	111	P12:230:AEPW:ELKCITY6:SWEETWT6
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08903	110	DEWEY - IODINE 138KV CKT 1
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08903	110	DEWEY - IODINE 138KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.09333	110	WOODWARD - WOODWARD 69KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.09333	110	WOODWARD - WOODWARD 69KV CKT 1

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08601	109	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08601	109	CHISHOLM6 230.00 - SWEETWATER 230KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.09186	108	RENFROW4 138.00 - RENFROW4 138.00 138KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.09186	108	RENFROW4 138.00 - RENFROW4 138.00 138KV CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08998	107	RENFROW4 138.00 - RENFROW4 138.00 138KV CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08998	107	RENFROW4 138.00 - RENFROW4 138.00 138KV CKT 1
FDNS	00NR	0	16WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08698	107	IODINE - WOODWARD EHV 138KV CKT 1
FDNS	00NR	0	16WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08698	107	IODINE - WOODWARD EHV 138KV CKT 1
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.09186	107	RENFROW4 138.00 - RENFROW4 138.00 138KV CKT 1
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.09186	107	RENFROW4 138.00 - RENFROW4 138.00 138KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.09186	107	RENFROW4 138.00 - WAKITAS4 138.00 138KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.09186	107	RENFROW4 138.00 - WAKITAS4 138.00 138KV CKT 1
FDNS	00NR	0	16WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08698	106	DEWEY - IODINE 138KV CKT 1
FDNS	00NR	0	16WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08698	106	DEWEY - IODINE 138KV CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08998	105	RENFROW4 138.00 - WAKITAS4 138.00 138KV CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08998	105	RENFROW4 138.00 - WAKITAS4 138.00 138KV CKT 1
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.09186	105	RENFROW4 138.00 - WAKITAS4 138.00 138KV CKT 1
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.09186	105	RENFROW4 138.00 - WAKITAS4 138.00 138KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.09158	105	WAKITA4 138.00 - WAKITAS4 138.00 138KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.09158	105	WAKITA4 138.00 - WAKITAS4 138.00 138KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08681	105	THISTLE7 345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08681	105	THISTLE7 345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08681	105	THISTLE7 345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08681	105	THISTLE7 345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08681	105	THISTLE7 345.00 - WOODWARD DISTRICT EHV 345KV CKT 2
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08681	105	THISTLE7 345.00 - WOODWARD DISTRICT EHV 345KV CKT 2
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08681	105	THISTLE7 345.00 - WOODWARD DISTRICT EHV 345KV CKT 2
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08681	105	THISTLE7 345.00 - WOODWARD DISTRICT EHV 345KV CKT 2
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.0915	104	WOODWARD - WOODWARD 69KV CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.0915	104	WOODWARD - WOODWARD 69KV CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08526	104	BASE CASE
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.09158	104	SANDY_CN_138138.00 - WAKITA4 138.00 138KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.09158	104	SANDY_CN_138138.00 - WAKITA4 138.00 138KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.087	104	BASE CASE
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08601	104	P12:230:AEPW-SPS:SWEETWT6:WHEELER 6
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08601	104	P12:230:AEPW-SPS:SWEETWT6:WHEELER 6
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08601	104	STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08601	104	STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08601	104	STLN-DEMARC6 - SWEETWATER 230KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08601	104	STLN-DEMARC6 - SWEETWATER 230KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08517	104	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08517	104	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08517	104	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08517	104	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.0848	104	G14-074T 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.0848	104	G14-074T 345.00 - TUCO INTERCHANGE 345KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08132	104	CHISHOLM6 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08132	104	CHISHOLM6 230.00 - ELK CITY 230KV 230KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08132	104	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08132	104	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08972	103	WAKITA4 138.00 - WAKITAS4 138.00 138KV CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08972	103	WAKITA4 138.00 - WAKITAS4 138.00 138KV CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08359	103	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08359	103	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08359	103	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08359	103	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08098	103	ELK CITY 230KV - SWEETWATER 230KV CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08098	103	ELK CITY 230KV - SWEETWATER 230KV CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08098	103	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08098	103	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08098	103	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08098	103	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	00NR	0	16WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.085	103	GEN520998 1-MORLND3
FDNS	00NR	0	16WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.085	103	GEN520998 1-MORLND3
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.09333	103	WOODWARD - WOODWARD 69KV CKT 1
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.09333	103	WOODWARD - WOODWARD 69KV CKT 1
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.09159	103	WAKITA4 138.00 - WAKITAS4 138.00 138KV CKT 1
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.09159	103	WAKITA4 138.00 - WAKITAS4 138.00 138KV CKT 1

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.087	103	BASE CASE
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08698	103	G1524G1525 345.00 - THISTLE7 345.00 345KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08698	103	G1524G1525 345.00 - THISTLE7 345.00 345KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08698	103	G1524G1525 345.00 - THISTLE7 345.00 345KV CKT 2
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08698	103	G1524G1525 345.00 - THISTLE7 345.00 345KV CKT 2
FDNSLock	00NR	0	16WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08075	103	ELK CITY 230KV - SWEETWATER 230KV CKT 1
FDNSLock	00NR	0	16WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08075	103	ELK CITY 230KV - SWEETWATER 230KV CKT 1
FDNSLock	00NR	0	16WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08075	103	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNSLock	00NR	0	16WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08075	103	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNSLock	00NR	0	16WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08075	103	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNSLock	00NR	0	16WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08075	103	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08629	102	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08629	102	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08629	102	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.08629	102	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08972	101	SANDY_CN_138138.00 - WAKITA4 138.00 138KV CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08972	101	SANDY_CN_138138.00 - WAKITA4 138.00 138KV CKT 1
FDNS	00NR	0	16WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.085	101	GEN520997 1-MORLND2
FDNS	00NR	0	16WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.085	101	GEN520997 1-MORLND2
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.09159	101	SANDY_CN_138138.00 - WAKITA4 138.00 138KV CKT 1
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.09159	101	SANDY_CN_138138.00 - WAKITA4 138.00 138KV CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08667	100	WOODRING (WOODRNG2) 345/138/13.8KV TRANSFORMER CKT 1
FDNS	00NR	0	16SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08667	100	WOODRING (WOODRNG2) 345/138/13.8KV TRANSFORMER CKT 1
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.0848	100	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.0848	100	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.0848	100	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.0848	100	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08143	100	P12:230:AEPW:ELKCITY6:SWEETWT6
FDNS	00NR	0	20SP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.08143	100	P12:230:AEPW:ELKCITY6:SWEETWT6
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.09675	100	DEWEY - TALOGA 138KV CKT 1
FDNS	00NR	0	20WP	G15_013	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.09675	100	DEWEY - TALOGA 138KV CKT 1
FDNS	00NR	0	20WP	G15_013	FROM->TO	NAPLESTP 138.00 - PAYNE 138.00 138KV CKT 1	132	143	0.03168	112	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	00NR	0	20WP	G15_013	FROM->TO	NAPLESTP 138.00 - PAYNE 138.00 138KV CKT 1	132	143	0.03168	112	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	00NR	0	16WP	G15_013	FROM->TO	NAPLESTP 138.00 - PAYNE 138.00 138KV CKT 1	132	143	0.03109	111	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	00NR	0	16WP	G15_013	FROM->TO	NAPLESTP 138.00 - PAYNE 138.00 138KV CKT 1	132	143	0.03109	111	G14-057T 345.00 - SUNNYSIDE 345KV CKT 1
FDNS	07ALL	0	20WP	G15_013	FROM->TO	NAPLESTP 138.00 - PAYNE 138.00 138KV CKT 1	132	143	0.04201	111	BASE CASE
FDNS	00NR	0	20WP	G15_013	FROM->TO	NAPLESTP 138.00 - PAYNE 138.00 138KV CKT 1	132	143	0.03168	110	G14-057T 345.00 - LAWTON EASTSIDE 345KV CKT 1
FDNS	00NR	0	20WP	G15_013	FROM->TO	NAPLESTP 138.00 - PAYNE 138.00 138KV CKT 1	132	143	0.03168	110	G14-057T 345.00 - LAWTON EASTSIDE 345KV CKT 1
FDNS	00NR	0	16WP	G15_013	FROM->TO	NAPLESTP 138.00 - PAYNE 138.00 138KV CKT 1	132	143	0.03109	108	G14-057T 345.00 - LAWTON EASTSIDE 345KV CKT 1
FDNS	00NR	0	16WP	G15_013	FROM->TO	NAPLESTP 138.00 - PAYNE 138.00 138KV CKT 1	132	143	0.03109	108	G14-057T 345.00 - LAWTON EASTSIDE 345KV CKT 1
FDNS	07ALL	0	16WP	G15_013	FROM->TO	NAPLESTP 138.00 - PAYNE 138.00 138KV CKT 1	132	143	0.04207	107	BASE CASE
FDNS	07ALL	0	20SP	G15_013	FROM->TO	NAPLESTP 138.00 - PAYNE 138.00 138KV CKT 1	132	143	0.04273	103	BASE CASE
FDNS	00NR	0	20WP	G15_013	FROM->TO	NAPLESTP 138.00 - PAYNE 138.00 138KV CKT 1	132	143	0.03057	103	CIMARRON - MINCO 345KV CKT 1
FDNS	00NR	0	20WP	G15_013	FROM->TO	NAPLESTP 138.00 - PAYNE 138.00 138KV CKT 1	132	143	0.03057	103	CIMARRON - MINCO 345KV CKT 1
FDNS	07ALL	0	25SP	G15_013	TO->FROM	NAVAJO - SNYDER 69KV CKT 1	48	48	0.19987	100	SNYDER - SNYDER 138KV CKT 1
FDNS	07ALL	0	25SP	G15_013	TO->FROM	NAVAJO - SNYDER 69KV CKT 1	48	48	0.19987	100	SNYDER - SNYDER 138KV CKT 1
FDNS	07ALL	0	25SP	G15_013	TO->FROM	NAVAJO - SNYDER 69KV CKT 1	48	48	0.19987	100	SNYDER - SNYDER 138KV CKT 1
FDNS	07ALL	0	25SP	G15_013	TO->FROM	NAVAJO - SNYDER 69KV CKT 1	48	48	0.19987	100	SNYDER - SNYDER 138KV CKT 1
FDNSLock-Blown up	07ALL	0	17G	G15_013	-	Non-Converged Contingency	0	0	0.10691	-	P12:230:AEPW-SPS:SWEETWT6:WHEELER 6
FDNSLock-Blown up	07ALL	0	17G	G15_013	-	Non-Converged Contingency	348	381	0.05346	-	STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1
FDNSLock-Blown up	07ALL	0	17G	G15_013	-	Non-Converged Contingency	353	353	0.05346	-	STLN-DEMARC6 - SWEETWATER 230KV CKT 1
FDNS	07ALL	0	25SP	G15_013	TO->FROM	STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1	348	381	0.03557	107	BASE CASE
FDNS	07ALL	0	25SP	G15_013	TO->FROM	STLN-DEMARC6 - SWEETWATER 230KV CKT 1	353	353	0.03557	106	BASE CASE
FDNS	00NR	0	20WP	G15_013	FROM->TO	WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1	123	134	0.03164	101	FPL SWITCH - MOORELAND 138KV CKT 1
FDNS	00NR	0	20WP	G15_013	FROM->TO	WOODWARD (WOODWRD2) 138/69/13.2KV TRANSFORMER CKT 1	123	134	0.03164	101	FPL SWITCH - MOORELAND 138KV CKT 1
FDNS	07ALL	2	25SP	G15_013	TO->FROM	STATELINE INTERCHANGE - STLN-DEMARC6 230KV CKT 1	348	381	0.03552	108	BASE CASE
FDNS	07ALL	2	25SP	G15_013	TO->FROM	STLN-DEMARC6 - SWEETWATER 230KV CKT 1	353	353	0.03552	106	BASE CASE
FDNS	06ALL	0	17G	G15_014	FROM->TO	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	316	0.07554	102	BASE CASE
FDNS	06ALL	0	17G	G15_014	FROM->TO	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	316	0.07554	102	BASE CASE
FDNS	06ALL	0	20WP	G15_014	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329	360	0.07585	118	BASE CASE
FDNS	06ALL	0	20WP	G15_014	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	329	360	0.07862	102	BASE CASE
FDNSLock-Blown up	06ALL	0	16WP	G15_014	-	Non-Converged Contingency	1022	1124	0.269	-	G14-074T 345.00 - OKLAUNION 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_014	-	Non-Converged Contingency	1792	1792	0.19969	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	17G	G15_014	-	Non-Converged Contingency	1022	1124	0.26294	-	G14-074T 345.00 - OKLAUNION 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_014	-	Non-Converged Contingency	1022	1124	0.26439	-	G14-074T 345.00 - OKLAUNION 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_014	-	Non-Converged Contingency	1792	1972	0.20513	-	BORDER 7345.00 - TUCO_2 345.00 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_014	-	Non-Converged Contingency	1792	1792	0.20513	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNS	06ALL	2	17G	G15_014	FROM->TO	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	316	0.07556	100	BASE CASE

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNS	06ALL	2	17G	G15_014	FROM->TO	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	316	0.07556	100	BASE CASE
FDNS	06ALL	2	20WP	G15_014	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329	360	0.07588	115	BASE CASE
FDNSLock-Blown up	06ALL	2	17G	G15_014	-	Non-Converged Contingency	1022	1124	0.263	-	G14-074T 345.00 - OKLAUNION 345KV CKT 1
FDNSLock-Blown up	06ALL	2	20WP	G15_014	-	Non-Converged Contingency	1022	1124	0.26448	-	G14-074T 345.00 - OKLAUNION 345KV CKT 1
FDNS	06ALL	3	20WP	G15_014	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329	360	0.07589	113	BASE CASE
FDNS	00NR	0	25SP	G15_015	TO->FROM	RENFROW4 138.00 - RENFROW4 138.00 138KV CKT 1	179	179	0.04356	101.8796	MOORELAND - ROSE_VALLEY 138.00 138KV CKT 1
FDNS	00NR	0	20SP	G15_015	TO->FROM	RENFROW4 138.00 - RENFROW4 138.00 138KV CKT 1	179	179	0.04345	100	MOORELAND - ROSE_VALLEY 138.00 138KV CKT 1
FDNS	00NR	0	20SP	G15_015	TO->FROM	RENFROW4 138.00 - RENFROW4 138.00 138KV CKT 1	179	179	0.04345	100	MOORELAND - ROSE_VALLEY 138.00 138KV CKT 1
FDNS	03ALL	0	16SP	G15_021	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.0343	108	BASE CASE
FDNS	03ALL	0	20SP	G15_021	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.03651	107	BASE CASE
FDNS	03ALL	0	17G	G15_021	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.03552	105	BASE CASE
FDNS	03ALL	2	16SP	G15_021	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.03693	108	BASE CASE
FDNS	03ALL	2	20SP	G15_021	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.03754	107	BASE CASE
FDNS	03ALL	2	17G	G15_021	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.03813	106	BASE CASE
FDNS	03ALL	3	16SP	G15_021	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.03693	108	BASE CASE
FDNS	03ALL	3	20SP	G15_021	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.03754	107	BASE CASE
FDNS	03ALL	3	17G	G15_021	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.03813	106	BASE CASE
FDNS	03ALL	4	16SP	G15_021	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.03694	108	BASE CASE
FDNS	03ALL	4	20SP	G15_021	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.03756	107	BASE CASE
FDNS	03ALL	4	17G	G15_021	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.03814	105	BASE CASE
FDNS	03ALL	5	16SP	G15_021	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.03694	108	BASE CASE
FDNS	03ALL	5	20SP	G15_021	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.03755	107	BASE CASE
FDNS	03ALL	5	17G	G15_021	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.03814	105	BASE CASE
FDNS	00NR	0	25SP	G15_022	TO->FROM	COX INTERCHANGE - HALE CO INTERCHANGE 115KV CKT 1	95.81	95.81	0.03544	100.3805	KRESS INTERCHANGE - KRESS_RURAL3115.00 115KV CKT 1
FDNS	06ALL	0	17G	G15_022	FROM->TO	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	316	0.08671	102	BASE CASE
FDNS	06ALL	0	17G	G15_022	FROM->TO	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	316	0.08671	102	BASE CASE
FDNS	06ALL	0	20WP	G15_022	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329	360	0.09382	118	BASE CASE
FDNS	06ALL	0	20WP	G15_022	FROM->TO	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1	329	360	0.09732	102	BASE CASE
FDNS	00NR	0	16SP	G15_022	TO->FROM	JONES STATION - TUCO INTERCHANGE 230KV CKT 1	343	343	0.10758	114	GEN526331 1-JONES GEN #1 22 KV
FDNS	00NR	0	16SP	G15_022	TO->FROM	JONES STATION - TUCO INTERCHANGE 230KV CKT 1	343	343	0.10758	114	GEN526331 1-JONES GEN #1 22 KV
FDNS	00NR	0	25SP	G15_022	TO->FROM	JONES STATION - TUCO INTERCHANGE 230KV CKT 1	343.79	343.79	0.09946	105.3128	CARLISLE INTERCHANGE - TUCO INTERCHANGE 230KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	JONES STATION - TUCO INTERCHANGE 230KV CKT 1	343.79	343.79	0.09946	105.3128	CARLISLE INTERCHANGE - TUCO INTERCHANGE 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	JONES STATION - TUCO INTERCHANGE 230KV CKT 1	343	343	0.10758	102	GEN526332 1-JONES GEN #2 21 KV
FDNS	00NR	0	16SP	G15_022	TO->FROM	JONES STATION - TUCO INTERCHANGE 230KV CKT 1	343	343	0.10758	102	GEN526332 1-JONES GEN #2 21 KV
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.45636	133.3133	PALO DURO SUB - RANDALL COUNTY INTERCHANGE 115KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.45636	131.4571	P12:115:SPS:T66.1.RNDALL.HAPPY
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.45636	131.2866	HAPPY INTERCHANGE - PALO DURO SUB 115KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.46729	128	NEWHART 230 (WAUK WT01105) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.46729	128	NEWHART 230 (WAUK WT01105) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.46729	128	NEWHART 230 (WAUK WT01105) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.46729	128	NEWHART 230 (WAUK WT01105) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.54762	126.7582	NEWHART 230 - SWISHER COUNTY INTERCHANGE 230KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.49988	125.4927	BASE CASE
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.44813	123	PALO DURO SUB - RANDALL COUNTY INTERCHANGE 115KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.44813	123	PALO DURO SUB - RANDALL COUNTY INTERCHANGE 115KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.44813	122	P12:115:SPS:T66.1.RNDALL.HAPPY
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.44813	122	P12:115:SPS:T66.1.RNDALL.HAPPY
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.49465	121.6206	PLANT X STATION (WH ALM20171) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.49465	121.6206	PLANT X STATION (WH ALM20171) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.49486	121.5728	FLOYD COUNTY INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.49486	121.5728	FLOYD COUNTY INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.44813	121	HAPPY INTERCHANGE - PALO DURO SUB 115KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.44813	121	HAPPY INTERCHANGE - PALO DURO SUB 115KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.49349	120.9451	NEWHART 230 (UPDATE LATER) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.49349	120.9451	NEWHART 230 (UPDATE LATER) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.49349	120.9451	NEWHART 230 (WAUK WT01105) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.49349	120.9451	NEWHART 230 (WAUK WT01105) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.45636	120.5871	HAPPY INTERCHANGE - TULIA TAP 115KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.50233	120.5321	TUCO INTERCHANGE - YOAKUM_345 345.00 345KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.47976	120.3717	HALE CO INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.47976	120.3717	HALE CO INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.49814	120.3101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.49814	120.3101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.49814	120.3101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.49814	120.3101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.41053	119.7818	KRESS INTERCHANGE - NEWHART 115KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.41053	119.7818	KRESS INTERCHANGE - NEWHART 115KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.50007	119.5019	BUSHLAND INTERCHANGE - DEAF SMITH COUNTY INTERCHANGE 230KV CKT 1

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.50007	119.5019	BUSHLAND INTERCHANGE - DEAF SMITH COUNTY INTERCHANGE 230KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.50766	119.0724	TUCO INTERCHANGE - TUCO_2 230.00 230KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.45636	118.7998	P12:115:SPS:T67.1.HAPPY.KRESS
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.49988	118.7226	GEN525562 1-TOLK GEN #2 24 KV
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.45636	118.5946	KRESS INTERCHANGE - TULIA TAP 115KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.49937	118.327	LAMB COUNTY INTERCHANGE - TOLK STATION WEST 230KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.49937	118.3186	LAMB COUNTY INTERCHANGE (WH ALM20172) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.49937	118.3186	LAMB COUNTY INTERCHANGE (WH ALM20172) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.49937	118.3186	P12:230:SPS:K37.1.TOLK.LAMB
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.49988	118.3166	GEN525561 1-TOLK GEN #1 24 KV
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49541	118	BASE CASE
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48632	118	PLANT X STATION (WH ALM20171) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48632	118	PLANT X STATION (WH ALM20171) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48632	118	PLANT X STATION (WH ALM20171) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48632	118	PLANT X STATION (WH ALM20171) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.51007	117.8839	NEWHART 230 - PLANT X STATION 230KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.50077	117.8307	HART INDUSTRIAL - NEWHART 115KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.49625	117.7316	CROSBY COUNTY INTERCHANGE - LUBBOCK EAST INTERCHANGE 115KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.49625	117.7316	CROSBY COUNTY INTERCHANGE - LUBBOCK EAST INTERCHANGE 115KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.5018	117.4662	JONES STATION - TUCO INTERCHANGE 230KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.5018	117.4662	JONES STATION - TUCO INTERCHANGE 230KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.50092	117.3621	CARLISLE INTERCHANGE - TUCO INTERCHANGE 230KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.50092	117.3621	CARLISLE INTERCHANGE - TUCO INTERCHANGE 230KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.49987	117.1605	BUSHLAND INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.49987	117.1605	BUSHLAND INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.45592	117	PALO DURO SUB - RANDALL COUNTY INTERCHANGE 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.45592	117	PALO DURO SUB - RANDALL COUNTY INTERCHANGE 115KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.50077	116.8816	HART INDUSTRIAL - LAMTON INTERCHANGE 115KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.49988	116.6371	GEN562550 1-G14_040_3 0.6900
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.49972	116.4241	JONES STATION - LUBBOCK EAST INTERCHANGE 230KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.49972	116.4241	JONES STATION - LUBBOCK EAST INTERCHANGE 230KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.45592	116	HAPPY INTERCHANGE - PALO DURO SUB 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.45592	116	HAPPY INTERCHANGE - PALO DURO SUB 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.45592	116	P12:115:SPS:T66.1.RNDALL.HAPPY
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.45592	116	P12:115:SPS:T66.1.RNDALL.HAPPY
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50024	114	BASE CASE
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49541	113	GEN525561 1-TOLK GEN #1 24 KV
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49541	113	GEN525561 1-TOLK GEN #1 24 KV
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49541	113	GEN525562 1-TOLK GEN #2 24 KV
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49541	113	GEN525562 1-TOLK GEN #2 24 KV
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49054	113	FLOYD COUNTY INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49054	113	FLOYD COUNTY INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49054	113	FLOYD COUNTY INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49054	113	FLOYD COUNTY INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.50157	112.448	NEWHART 230 - POTTER COUNTY INTERCHANGE 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49923	112	JONES STATION - TUCO INTERCHANGE 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49923	112	JONES STATION - TUCO INTERCHANGE 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49923	112	JONES STATION - TUCO INTERCHANGE 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49923	112	JONES STATION - TUCO INTERCHANGE 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49477	112	LAMB COUNTY INTERCHANGE - TOLK STATION WEST 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49477	112	LAMB COUNTY INTERCHANGE - TOLK STATION WEST 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49477	112	LAMB COUNTY INTERCHANGE (WH ALM20172) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49477	112	LAMB COUNTY INTERCHANGE (WH ALM20172) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49477	112	LAMB COUNTY INTERCHANGE (WH ALM20172) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49477	112	LAMB COUNTY INTERCHANGE (WH ALM20172) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49477	112	P12:230:SPS:K37.1.TOLK.LAMB
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49477	112	P12:230:SPS:K37.1.TOLK.LAMB
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4941	112	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4941	112	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4941	112	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4941	112	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49401	112	TUCO INTERCHANGE (GE M102345) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49401	112	TUCO INTERCHANGE (GE M102345) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49401	112	TUCO INTERCHANGE (GE M102345) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49401	112	TUCO INTERCHANGE (GE M102345) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	0	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.43956	112	PALO DURO SUB - RANDALL COUNTY INTERCHANGE 115KV CKT 1
FDNS	0	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.43956	112	PALO DURO SUB - RANDALL COUNTY INTERCHANGE 115KV CKT 1
FDNS	0	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.43948	112	PALO DURO SUB - RANDALL COUNTY INTERCHANGE 115KV CKT 1

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNS	0	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.43948	112	PALO DURO SUB - RANDALL COUNTY INTERCHANGE 115KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.55491	111.7452	SWISHER COUNTY INTERCHANGE - TUCO_2 230.00 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50356	111	TUCO INTERCHANGE - TUCO_2 230.00 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50356	111	TUCO INTERCHANGE - TUCO_2 230.00 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49568	111	BUSHLAND INTERCHANGE - DEAF SMITH COUNTY INTERCHANGE 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49568	111	BUSHLAND INTERCHANGE - DEAF SMITH COUNTY INTERCHANGE 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49568	111	BUSHLAND INTERCHANGE - DEAF SMITH COUNTY INTERCHANGE 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49568	111	BUSHLAND INTERCHANGE - DEAF SMITH COUNTY INTERCHANGE 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.47502	111	HALE CO INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.47502	111	HALE CO INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.47502	111	HALE CO INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.47502	111	HALE CO INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.44813	111	HAPPY INTERCHANGE - TULIA TAP 115KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.44813	111	HAPPY INTERCHANGE - TULIA TAP 115KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.54985	110	NEWHART 230 - SWISHER COUNTY INTERCHANGE 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.54985	110	NEWHART 230 - SWISHER COUNTY INTERCHANGE 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.54494	110	SWISHER COUNTY INTERCHANGE - TUCO_2 230.00 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.54494	110	SWISHER COUNTY INTERCHANGE - TUCO_2 230.00 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49541	110	GEN526331 1-JONES GEN #1 22 KV
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49541	110	GEN526331 1-JONES GEN #1 22 KV
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49541	110	GEN562550 1-G14_040_3 0.6900
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49541	110	GEN562550 1-G14_040_3 0.6900
FDNS	0	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.43956	110	HAPPY INTERCHANGE - PALO DURO SUB 115KV CKT 1
FDNS	0	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.43956	110	HAPPY INTERCHANGE - PALO DURO SUB 115KV CKT 1
FDNS	0	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.43956	110	P12:115:SPS:T66.1.RNDALL.HAPPY
FDNS	0	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.43956	110	P12:115:SPS:T66.1.RNDALL.HAPPY
FDNS	0	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.43948	110	HAPPY INTERCHANGE - PALO DURO SUB 115KV CKT 1
FDNS	0	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.43948	110	HAPPY INTERCHANGE - PALO DURO SUB 115KV CKT 1
FDNS	0	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.43948	110	P12:115:SPS:T66.1.RNDALL.HAPPY
FDNS	0	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.43948	110	P12:115:SPS:T66.1.RNDALL.HAPPY
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4963	109	CARLISLE INTERCHANGE - TUCO INTERCHANGE 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4963	109	CARLISLE INTERCHANGE - TUCO INTERCHANGE 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4963	109	CARLISLE INTERCHANGE - TUCO INTERCHANGE 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4963	109	CARLISLE INTERCHANGE - TUCO INTERCHANGE 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49604	109	CARLISLE INTERCHANGE (CARLISLE_XF) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49604	109	CARLISLE INTERCHANGE (CARLISLE_XF) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49604	109	CARLISLE INTERCHANGE (CARLISLE_XF) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49604	109	CARLISLE INTERCHANGE (CARLISLE_XF) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49543	109	BUSHLAND INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49543	109	BUSHLAND INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49543	109	BUSHLAND INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49543	109	BUSHLAND INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49541	109	GEN527166 1-MUSTANG_6 118.000
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49541	109	GEN527166 1-MUSTANG_6 118.000
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49541	109	GEN527882 1-CUNNINGHAM GEN #2 20 KV
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49541	109	GEN527882 1-CUNNINGHAM GEN #2 20 KV
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49541	109	GEN527903 1-HOBBS PLANT #3 (ST)
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49541	109	GEN527903 1-HOBBS PLANT #3 (ST)
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49157	109	CROSBY COUNTY INTERCHANGE - LUBBOCK EAST INTERCHANGE 115KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49157	109	CROSBY COUNTY INTERCHANGE - LUBBOCK EAST INTERCHANGE 115KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49157	109	CROSBY COUNTY INTERCHANGE - LUBBOCK EAST INTERCHANGE 115KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49157	109	CROSBY COUNTY INTERCHANGE - LUBBOCK EAST INTERCHANGE 115KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.44813	109	KRESS INTERCHANGE - TULIA TAP 115KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.44813	109	KRESS INTERCHANGE - TULIA TAP 115KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.44813	109	P12:115:SPS:T67.1.HAPPY.KRESS
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.44813	109	P12:115:SPS:T67.1.HAPPY.KRESS
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49527	109	FLOYD COUNTY INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49527	109	FLOYD COUNTY INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49527	109	FLOYD COUNTY INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49527	109	FLOYD COUNTY INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4106	109	KRESS INTERCHANGE - NEWHART 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4106	109	KRESS INTERCHANGE - NEWHART 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4106	109	KRESS INTERCHANGE - NEWHART 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4106	109	KRESS INTERCHANGE - NEWHART 115KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.47418	108.0533	COX INTERCHANGE - KISER 3115.00 115KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.47418	108.0533	COX INTERCHANGE - KISER 3115.00 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.55337	108	SWISHER COUNTY INTERCHANGE - TUCO_2 230.00 230KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.55337	108	SWISHER COUNTY INTERCHANGE - TUCO_2 230.00 230KV CKT 1

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49845	108	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49845	108	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49845	108	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49845	108	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49845	108	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49845	108	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49845	108	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49845	108	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49564	108	PLANT X STATION (WH ALM20171) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49564	108	PLANT X STATION (WH ALM20171) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49564	108	PLANT X STATION (WH ALM20171) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49564	108	PLANT X STATION (WH ALM20171) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4939	108	NEWHART 230 (UPDATE LATER) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4939	108	NEWHART 230 (UPDATE LATER) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4939	108	NEWHART 230 (UPDATE LATER) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4939	108	NEWHART 230 (UPDATE LATER) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4939	108	NEWHART 230 (WAUK WT01105) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4939	108	NEWHART 230 (WAUK WT01105) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4939	108	NEWHART 230 (WAUK WT01105) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4939	108	NEWHART 230 (WAUK WT01105) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.40384	108	KRESS INTERCHANGE - NEWHART 115KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.40384	108	KRESS INTERCHANGE - NEWHART 115KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.40384	108	KRESS INTERCHANGE - NEWHART 115KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.40384	108	KRESS INTERCHANGE - NEWHART 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50754	107	TUCO INTERCHANGE - TUCO_2 230.00 230KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50754	107	TUCO INTERCHANGE - TUCO_2 230.00 230KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50024	107	GEN525561 1-TOLK GEN #1 24 KV
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50024	107	GEN525561 1-TOLK GEN #1 24 KV
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50024	107	GEN525562 1-TOLK GEN #2 24 KV
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50024	107	GEN525562 1-TOLK GEN #2 24 KV
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50273	106	TUCO INTERCHANGE - YOAKUM_345 345.00 345KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50273	106	TUCO INTERCHANGE - YOAKUM_345 345.00 345KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50181	106	JONES STATION - TUCO INTERCHANGE 230KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50181	106	JONES STATION - TUCO INTERCHANGE 230KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50181	106	JONES STATION - TUCO INTERCHANGE 230KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50181	106	JONES STATION - TUCO INTERCHANGE 230KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50116	106	CARLISLE INTERCHANGE - TUCO INTERCHANGE 230KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50116	106	CARLISLE INTERCHANGE - TUCO INTERCHANGE 230KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50116	106	CARLISLE INTERCHANGE - TUCO INTERCHANGE 230KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50116	106	CARLISLE INTERCHANGE - TUCO INTERCHANGE 230KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50031	106	BUSHLAND INTERCHANGE - DEAF SMITH COUNTY INTERCHANGE 230KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50031	106	BUSHLAND INTERCHANGE - DEAF SMITH COUNTY INTERCHANGE 230KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50031	106	BUSHLAND INTERCHANGE - DEAF SMITH COUNTY INTERCHANGE 230KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50031	106	BUSHLAND INTERCHANGE - DEAF SMITH COUNTY INTERCHANGE 230KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50024	106	GEN525493 1-PLANT X GEN #3
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50024	106	GEN525493 1-PLANT X GEN #3
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49977	106	LAMB COUNTY INTERCHANGE - TOLK STATION WEST 230KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49977	106	LAMB COUNTY INTERCHANGE - TOLK STATION WEST 230KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49977	106	LAMB COUNTY INTERCHANGE (WH ALM20172) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49977	106	LAMB COUNTY INTERCHANGE (WH ALM20172) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49977	106	LAMB COUNTY INTERCHANGE (WH ALM20172) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49977	106	LAMB COUNTY INTERCHANGE (WH ALM20172) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49977	106	P12:230:SPS:K37.1.TOLK.LAMB
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49977	106	P12:230:SPS:K37.1.TOLK.LAMB
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4968	106	CROSBY COUNTY INTERCHANGE - LUBBOCK EAST INTERCHANGE 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4968	106	CROSBY COUNTY INTERCHANGE - LUBBOCK EAST INTERCHANGE 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4968	106	CROSBY COUNTY INTERCHANGE - LUBBOCK EAST INTERCHANGE 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4968	106	CROSBY COUNTY INTERCHANGE - LUBBOCK EAST INTERCHANGE 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49516	106	PLANT X STATION - SPGLAKE_TP3 115.00 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49516	106	PLANT X STATION - SPGLAKE_TP3 115.00 115KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49079	106	BASE CASE
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49825	105	NEWHART 230 - POTTER COUNTY INTERCHANGE 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49825	105	NEWHART 230 - POTTER COUNTY INTERCHANGE 230KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49052	105	CASTRO COUNTY INTERCHANGE - NEWHART 115KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49052	105	CASTRO COUNTY INTERCHANGE - NEWHART 115KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49052	105	CASTRO COUNTY INTERCHANGE - NEWHART 115KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49052	105	CASTRO COUNTY INTERCHANGE - NEWHART 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50115	105	HART INDUSTRIAL - LAMTON INTERCHANGE 115KV CKT 1

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50115	105	HART INDUSTRIAL - LAMTON INTERCHANGE 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50115	105	HART INDUSTRIAL - NEWHART 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50115	105	HART INDUSTRIAL - NEWHART 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50024	105	GEN562550 1-G14_040_3 0.6900
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.50024	105	GEN562550 1-G14_040_3 0.6900
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49516	105	LAMB COUNTY REC-SOUTH OLTON - SPGLAKE_TP3 115.00 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49516	105	LAMB COUNTY REC-SOUTH OLTON - SPGLAKE_TP3 115.00 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49223	105	HALE CO INTERCHANGE - PLANT X STATION 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49223	105	HALE CO INTERCHANGE - PLANT X STATION 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49223	105	HALE CO INTERCHANGE - PLANT X STATION 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49223	105	HALE CO INTERCHANGE - PLANT X STATION 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.45592	105	HAPPY INTERCHANGE - TULIA TAP 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.45592	105	HAPPY INTERCHANGE - TULIA TAP 115KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49541	104	P12:115:SPS:V12.1.PLANTX.BAILEY
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49541	104	P12:115:SPS:V12.1.PLANTX.BAILEY
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49541	104	P12:115:SPS:V12A.1.PLANTX.BAILEY
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49541	104	P12:115:SPS:V12A.1.PLANTX.BAILEY
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49079	104	GEN562550 1-G14_040_3 0.6900
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49079	104	GEN562550 1-G14_040_3 0.6900
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.47098	104	HALE CO INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.47098	104	HALE CO INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.47098	104	HALE CO INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.47098	104	HALE CO INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	06ALL	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.52524	103	AMARILLO SOUTH INTERCHANGE - SWISHER COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.52524	103	AMARILLO SOUTH INTERCHANGE - SWISHER COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.52524	103	AMARILLO SOUTH INTERCHANGE - SWISHER COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.52524	103	AMARILLO SOUTH INTERCHANGE - SWISHER COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48721	103	PLANT X STATION (WH ALM20171) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48721	103	PLANT X STATION (WH ALM20171) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48721	103	PLANT X STATION (WH ALM20171) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48721	103	PLANT X STATION (WH ALM20171) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.47448	103	COX INTERCHANGE - FLOYD COUNTY INTERCHANGE 115KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.47448	103	COX INTERCHANGE - FLOYD COUNTY INTERCHANGE 115KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.47448	103	COX INTERCHANGE - FLOYD COUNTY INTERCHANGE 115KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.47448	103	COX INTERCHANGE - FLOYD COUNTY INTERCHANGE 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48302	102	COX INTERCHANGE - FLOYD COUNTY INTERCHANGE 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48302	102	COX INTERCHANGE - FLOYD COUNTY INTERCHANGE 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48302	102	COX INTERCHANGE - FLOYD COUNTY INTERCHANGE 115KV CKT 1
FDNS	00NR	0	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48302	102	COX INTERCHANGE - FLOYD COUNTY INTERCHANGE 115KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159.35	175.28	0.47418	101.8241	KISER 3115.00 - N_PLAINVEW 3115.00 115KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.46984	101	COX INTERCHANGE - KISER 3115.00 115KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.46984	101	COX INTERCHANGE - KISER 3115.00 115KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.46984	101	COX INTERCHANGE - KISER 3115.00 115KV CKT 1
FDNS	00NR	0	16SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.46984	101	COX INTERCHANGE - KISER 3115.00 115KV CKT 1
FDNS	0	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.53053	101	NEWHART 230 - SWISHER COUNTY INTERCHANGE 230KV CKT 1
FDNS	0	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.53053	101	NEWHART 230 - SWISHER COUNTY INTERCHANGE 230KV CKT 1
FDNS	0	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.53029	101	NEWHART 230 - SWISHER COUNTY INTERCHANGE 230KV CKT 1
FDNS	0	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.53029	101	NEWHART 230 - SWISHER COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.52523	101	AMARILLO SOUTH INTERCHANGE - SWISHER COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.52523	101	AMARILLO SOUTH INTERCHANGE - SWISHER COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.52523	101	AMARILLO SOUTH INTERCHANGE - SWISHER COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.52523	101	AMARILLO SOUTH INTERCHANGE - SWISHER COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48804	101	BLANCO 3115.00 - FLOYD COUNTY INTERCHANGE 115KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48804	101	BLANCO 3115.00 - FLOYD COUNTY INTERCHANGE 115KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48804	101	BLANCO 3115.00 - FLOYD COUNTY INTERCHANGE 115KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48804	101	BLANCO 3115.00 - FLOYD COUNTY INTERCHANGE 115KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48798	101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48798	101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48798	101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48798	101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48798	101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48798	101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48798	101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48798	101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48548	101	FLOYD COUNTY INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48548	101	FLOYD COUNTY INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48548	101	FLOYD COUNTY INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48548	101	FLOYD COUNTY INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49103	100	HART INDUSTRIAL - NEWHART 115KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49103	100	HART INDUSTRIAL - NEWHART 115KV CKT 1
FDNS	0	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49098	100	BASE CASE
FDNS	0	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49087	100	BASE CASE
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49079	100	GEN562007 1-G11_025_3 0.6900
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49079	100	GEN562007 1-G11_025_3 0.6900
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49051	100	LAMB COUNTY INTERCHANGE - TOLK STATION WEST 230KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49051	100	LAMB COUNTY INTERCHANGE - TOLK STATION WEST 230KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49051	100	LAMB COUNTY INTERCHANGE (WH ALM20172) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49051	100	LAMB COUNTY INTERCHANGE (WH ALM20172) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49051	100	LAMB COUNTY INTERCHANGE (WH ALM20172) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49051	100	LAMB COUNTY INTERCHANGE (WH ALM20172) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49051	100	P12:230:SPS:K37.1.TOLK.LAMB
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49051	100	P12:230:SPS:K37.1.TOLK.LAMB
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49015	100	TUCO INTERCHANGE - YOAKUM_345 345.00 345KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49015	100	TUCO INTERCHANGE - YOAKUM_345 345.00 345KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48727	100	PLANT X STATION - SPGLAKE_TP3 115.00 115KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48727	100	PLANT X STATION - SPGLAKE_TP3 115.00 115KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4836	100	NEWHART 230 (UPDATE LATER) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4836	100	NEWHART 230 (UPDATE LATER) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4836	100	NEWHART 230 (UPDATE LATER) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4836	100	NEWHART 230 (UPDATE LATER) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4836	100	NEWHART 230 (WAUK WT01105) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4836	100	NEWHART 230 (WAUK WT01105) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4836	100	NEWHART 230 (WAUK WT01105) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4836	100	NEWHART 230 (WAUK WT01105) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.43933	100	PALO DURO SUB - RANDALL COUNTY INTERCHANGE 115KV CKT 1
FDNS	06ALL	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.43933	100	PALO DURO SUB - RANDALL COUNTY INTERCHANGE 115KV CKT 1
FDNS	0	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.40398	100	KRESS INTERCHANGE - NEWHART 115KV CKT 1
FDNS	0	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.40398	100	KRESS INTERCHANGE - NEWHART 115KV CKT 1
FDNS	0	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.40398	100	KRESS INTERCHANGE - NEWHART 115KV CKT 1
FDNS	0	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.40398	100	KRESS INTERCHANGE - NEWHART 115KV CKT 1
FDNS	0	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.40388	100	KRESS INTERCHANGE - NEWHART 115KV CKT 1
FDNS	0	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.40388	100	KRESS INTERCHANGE - NEWHART 115KV CKT 1
FDNS	0	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.40388	100	KRESS INTERCHANGE - NEWHART 115KV CKT 1
FDNS	0	0	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.40388	100	KRESS INTERCHANGE - NEWHART 115KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_022	-	Non-Converged Contingency	1022	1124	0.24098	-	G14-074T 345.00 - OKLAUNION 345KV CKT 1
FDNSLock-Blown up	06ALL	0	16WP	G15_022	-	Non-Converged Contingency	1792	1792	0.17204	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNSLock-Blown up	06ALL	0	17G	G15_022	-	Non-Converged Contingency	1022	1124	0.23495	-	G14-074T 345.00 - OKLAUNION 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_022	-	Non-Converged Contingency	1022	1124	0.22072	-	G14-074T 345.00 - OKLAUNION 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_022	-	Non-Converged Contingency	1792	1972	0.16384	-	BORDER 7345.00 - TUCO_2 345.00 345KV CKT 1
FDNSLock-Blown up	06ALL	0	20WP	G15_022	-	Non-Converged Contingency	1792	1792	0.16384	-	BORDER 7345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	SUNDOWN INTERCHANGE - WOLFFORTH INTERCHANGE 230KV CKT 1	318.7	350.57	0.07569	100.769	TUCO INTERCHANGE - YOAKUM_345 345.00 345KV CKT 1
FDNS	00NR	0	25SP	G15_022	TO->FROM	TERRY COUNTY INTERCHANGE - WOLFFORTH INTERCHANGE 115KV CKT 1	119.51	153.97	0.04567	107.5928	TUCO INTERCHANGE - YOAKUM_345 345.00 345KV CKT 1
FDNS	06ALL	2	17G	G15_022	FROM->TO	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	316	0.08673	100	BASE CASE
FDNS	06ALL	2	17G	G15_022	FROM->TO	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	316	0.08673	100	BASE CASE
FDNS	06ALL	2	20WP	G15_022	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329	360	0.09385	115	BASE CASE
FDNSLock-Blown up	06ALL	2	17G	G15_022	-	Non-Converged Contingency	1022	1124	0.23501	-	G14-074T 345.00 - OKLAUNION 345KV CKT 1
FDNSLock-Blown up	06ALL	2	20WP	G15_022	-	Non-Converged Contingency	1022	1124	0.22081	-	G14-074T 345.00 - OKLAUNION 345KV CKT 1
FDNS	06ALL	3	20WP	G15_022	TO->FROM	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	329	360	0.09385	113	BASE CASE
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.40384	108	KRESS INTERCHANGE - NEWHART 115KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.40384	108	KRESS INTERCHANGE - NEWHART 115KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.40384	108	KRESS INTERCHANGE - NEWHART 115KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.40384	108	KRESS INTERCHANGE - NEWHART 115KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49079	106	BASE CASE
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49079	104	GEN562550 1-G14_040_3 0.6900
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49079	104	GEN562550 1-G14_040_3 0.6900
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.47098	104	HALE CO INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.47098	104	HALE CO INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.47098	104	HALE CO INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.47098	104	HALE CO INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48721	103	PLANT X STATION (WH ALM20171) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48721	103	PLANT X STATION (WH ALM20171) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48721	103	PLANT X STATION (WH ALM20171) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48721	103	PLANT X STATION (WH ALM20171) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.47448	103	COX INTERCHANGE - FLOYD COUNTY INTERCHANGE 115KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.47448	103	COX INTERCHANGE - FLOYD COUNTY INTERCHANGE 115KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.47448	103	COX INTERCHANGE - FLOYD COUNTY INTERCHANGE 115KV CKT 1

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.47448	103	COX INTERCHANGE - FLOYD COUNTY INTERCHANGE 115KV CKT 1
FDNS	06ALL	3	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.52524	102	AMARILLO SOUTH INTERCHANGE - SWISHER COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	3	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.52524	102	AMARILLO SOUTH INTERCHANGE - SWISHER COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	3	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.52524	102	AMARILLO SOUTH INTERCHANGE - SWISHER COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	3	20SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.52524	102	AMARILLO SOUTH INTERCHANGE - SWISHER COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.52523	101	AMARILLO SOUTH INTERCHANGE - SWISHER COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.52523	101	AMARILLO SOUTH INTERCHANGE - SWISHER COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.52523	101	AMARILLO SOUTH INTERCHANGE - SWISHER COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.52523	101	AMARILLO SOUTH INTERCHANGE - SWISHER COUNTY INTERCHANGE 230KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48804	101	BLANCO 3115.00 - FLOYD COUNTY INTERCHANGE 115KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48804	101	BLANCO 3115.00 - FLOYD COUNTY INTERCHANGE 115KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48804	101	BLANCO 3115.00 - FLOYD COUNTY INTERCHANGE 115KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48804	101	BLANCO 3115.00 - FLOYD COUNTY INTERCHANGE 115KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48798	101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48798	101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48798	101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48798	101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48798	101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48798	101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48798	101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48798	101	TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48548	101	FLOYD COUNTY INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48548	101	FLOYD COUNTY INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48548	101	FLOYD COUNTY INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48548	101	FLOYD COUNTY INTERCHANGE - TUCO INTERCHANGE 115KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49103	100	HART INDUSTRIAL - NEWHART 115KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49103	100	HART INDUSTRIAL - NEWHART 115KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49079	100	GEN562007 1-G11_025_3 0.6900
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49079	100	GEN562007 1-G11_025_3 0.6900
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49051	100	LAMB COUNTY INTERCHANGE - TOLK STATION WEST 230KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49051	100	LAMB COUNTY INTERCHANGE - TOLK STATION WEST 230KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49051	100	LAMB COUNTY INTERCHANGE (WH ALM20172) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49051	100	LAMB COUNTY INTERCHANGE (WH ALM20172) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49051	100	LAMB COUNTY INTERCHANGE (WH ALM20172) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49051	100	LAMB COUNTY INTERCHANGE (WH ALM20172) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49051	100	P12:230:SPS:K37.1.TOLK.LAMB
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49051	100	P12:230:SPS:K37.1.TOLK.LAMB
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49015	100	TUCO INTERCHANGE - YOAKUM_345 345.00 345KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.49015	100	TUCO INTERCHANGE - YOAKUM_345 345.00 345KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48727	100	PLANT X STATION - SPGLAKE_TP3 115.00 115KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.48727	100	PLANT X STATION - SPGLAKE_TP3 115.00 115KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4836	100	NEWHART 230 (UPDATE LATER) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4836	100	NEWHART 230 (UPDATE LATER) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4836	100	NEWHART 230 (UPDATE LATER) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4836	100	NEWHART 230 (UPDATE LATER) 230/115/13.2KV TRANSFORMER CKT 2
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4836	100	NEWHART 230 (WAUK WT01105) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4836	100	NEWHART 230 (WAUK WT01105) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4836	100	NEWHART 230 (WAUK WT01105) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.4836	100	NEWHART 230 (WAUK WT01105) 230/115/13.2KV TRANSFORMER CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.43933	100	PALO DURO SUB - RANDALL COUNTY INTERCHANGE 115KV CKT 1
FDNS	06ALL	3	25SP	G15_022	TO->FROM	KRESS INTERCHANGE - SWISHER COUNTY INTERCHANGE 115KV CKT 1	159	175	0.43933	100	PALO DURO SUB - RANDALL COUNTY INTERCHANGE 115KV CKT 1
FDNS	00NR	4	16SP	G15_022	TO->FROM	JONES STATION - TUCO INTERCHANGE 230KV CKT 1	343	343	0.10758	114	GEN526331 1-JONES GEN #1 22 KV
FDNS	00NR	4	16SP	G15_022	TO->FROM	JONES STATION - TUCO INTERCHANGE 230KV CKT 1	343	343	0.10758	114	GEN526331 1-JONES GEN #1 22 KV
FDNS	00NR	4	16SP	G15_022	TO->FROM	JONES STATION - TUCO INTERCHANGE 230KV CKT 1	343	343	0.10758	102	GEN526332 1-JONES GEN #2 21 KV
FDNS	00NR	4	16SP	G15_022	TO->FROM	JONES STATION - TUCO INTERCHANGE 230KV CKT 1	343	343	0.10758	102	GEN526332 1-JONES GEN #2 21 KV
FDNS	00NR	0	16SP	G15_023	FROM->TO	GR ISLD-LNX3345.00 - GRAND ISLAND 345KV CKT Z	720	720	1	100	GRPRAR2-LNX3345.00 - YANKTON 345KV CKT Z
FDNS	00NR	0	16SP	G15_023	FROM->TO	GR ISLD-LNX3345.00 - GRAND ISLAND 345KV CKT Z	720	720	1	100	GRPRAR2-LNX3345.00 - YANKTON 345KV CKT Z
FDNS	00NR	0	16SP	G15_023	TO->FROM	GR ISLD-LNX3345.00 - HOLT.CO3 345.00 345KV CKT 1	720	720	1	100	GRPRAR2-LNX3345.00 - YANKTON 345KV CKT Z
FDNS	00NR	0	16SP	G15_023	TO->FROM	GR ISLD-LNX3345.00 - HOLT.CO3 345.00 345KV CKT 1	720	720	1	100	GRPRAR2-LNX3345.00 - YANKTON 345KV CKT Z
FDNSLock-Blown up	00NR	0	16SP	G15_023	-	Non-Converged Contingency	720	720	0.70689	-	GR ISLD-LNX3345.00 - GRAND ISLAND 345KV CKT Z
FDNSLock-Blown up	00NR	0	16SP	G15_023	-	Non-Converged Contingency	720	720	0.70689	-	GR ISLD-LNX3345.00 - HOLT.CO3 345.00 345KV CKT 1
FDNSLock-Blown up	00NR	0	16WP	G15_023	-	Non-Converged Contingency	720	720	0.7042	-	GR ISLD-LNX3345.00 - GRAND ISLAND 345KV CKT Z
FDNSLock-Blown up	00NR	0	16WP	G15_023	-	Non-Converged Contingency	720	720	0.7042	-	GR ISLD-LNX3345.00 - HOLT.CO3 345.00 345KV CKT 1
FDNS	03ALL	0	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.37665	114	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	0	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.37665	114	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	0	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.37665	114	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	0	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.37665	114	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	0	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.3777	110	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNS	03ALL	0	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.3777	110	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	0	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.3777	110	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	0	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.3777	110	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	0	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.37665	113	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	0	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.37665	113	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	0	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.37665	113	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	0	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.37665	113	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	0	16WP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.29263	112	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	0	16WP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.29263	112	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	0	16WP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.29263	112	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	0	16WP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.29263	112	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	0	16WP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.23269	112	HOLCOMB - PLYMELL 115KV CKT 1
FDNS	03ALL	0	16WP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.23269	112	HOLCOMB - PLYMELL 115KV CKT 1
FDNS	03ALL	0	16WP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.29057	108	BASE CASE
FDNS	03ALL	0	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.3777	108	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	0	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.3777	108	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	0	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.3777	108	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	0	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.3777	108	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	0	16WP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.23269	101	P12:115:SUNC:HOLCOMB-PIONEERTAP::
FDNS	03ALL	0	16WP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.23269	101	P12:115:SUNC:HOLCOMB-PIONEERTAP::
FDNS	03ALL	0	16WP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.23269	101	PIONEER TAP - PLYMELL 115KV CKT 1
FDNS	03ALL	0	16WP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.23269	101	PIONEER TAP - PLYMELL 115KV CKT 1
FDNS	03ALL	0	25SP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	135	0.37665	114	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	0	25SP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	135	0.37665	114	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	0	25SP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	135	0.37665	114	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	0	25SP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	135	0.37665	114	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	0	25SP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	135	0.3777	110	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	0	25SP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	135	0.3777	110	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	0	25SP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	135	0.3777	110	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	0	25SP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	135	0.3777	110	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	0	16WP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	148	0.29263	107	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	0	16WP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	148	0.29263	107	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	0	16WP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	148	0.29263	107	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	0	16WP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	148	0.29263	107	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	0	16WP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	148	0.23269	106	HOLCOMB - PLYMELL 115KV CKT 1
FDNS	03ALL	0	16WP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	148	0.23269	106	HOLCOMB - PLYMELL 115KV CKT 1
FDNS	03ALL	0	16WP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	148	0.29057	102	BASE CASE
FDNS	03ALL	0	16SP	G15_027	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.03371	108	BASE CASE
FDNS	03ALL	0	20SP	G15_027	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.03576	107	BASE CASE
FDNS	03ALL	0	17G	G15_027	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.03496	105	BASE CASE
FDNS	03ALL	0	20WP	G15_027	TO->FROM	GREENSBURG - SSTARTP3 115.00 115KV CKT 1	119	148	0.0854	105	BASE CASE
FDNS	03ALL	0	25SP	G15_027	TO->FROM	GREENSBURG - SSTARTP3 115.00 115KV CKT 1	119	135	0.08592	105	BASE CASE
FDNS	03ALL	0	20SP	G15_027	TO->FROM	GREENSBURG - SSTARTP3 115.00 115KV CKT 1	119	135	0.08584	103	BASE CASE
FDNS	03ALL	2	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.38054	117	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	2	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.38054	117	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	2	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.38054	117	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	2	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.38054	117	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	2	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.38166	116	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	2	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.38166	116	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	2	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.38166	116	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	2	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.38166	116	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	2	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.38054	115	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	2	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.38054	115	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	2	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.38054	115	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	2	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.38054	115	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	2	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.38166	114	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	2	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.38166	114	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	2	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.38166	114	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	2	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.38166	114	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	2	16WP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.35297	105	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	2	16WP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.35297	105	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	2	16WP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.35297	105	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	2	16WP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.35297	105	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	2	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.38017	102	BASE CASE
FDNS	03ALL	2	16WP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.35114	101	BASE CASE
FDNS	03ALL	2	25SP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	135	0.38054	117	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	2	25SP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	135	0.38054	117	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	2	25SP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	135	0.38054	117	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNS	03ALL	2	25SP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	135	0.38054	117	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	2	25SP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	135	0.38166	116	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	2	25SP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	135	0.38166	116	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	2	25SP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	135	0.38166	116	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	2	25SP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	135	0.38166	116	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	2	16WP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	148	0.35297	100	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	2	16WP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	148	0.35297	100	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	2	16WP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	148	0.35297	100	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	2	16WP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	148	0.35297	100	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	2	16SP	G15_027	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.03586	108	BASE CASE
FDNS	03ALL	2	20SP	G15_027	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.03674	107	BASE CASE
FDNS	03ALL	2	17G	G15_027	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.0371	106	BASE CASE
FDNS	03ALL	2	20WP	G15_027	TO->FROM	GREENSBURG - SSTARTP3 115.00 115KV CKT 1	119	148	0.08445	105	BASE CASE
FDNS	03ALL	2	25SP	G15_027	TO->FROM	GREENSBURG - SSTARTP3 115.00 115KV CKT 1	119	135	0.08497	104	BASE CASE
FDNS	03ALL	2	20SP	G15_027	TO->FROM	GREENSBURG - SSTARTP3 115.00 115KV CKT 1	119	135	0.0849	103	BASE CASE
FDNS	03ALL	3	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.38054	117	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	3	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.38054	117	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	3	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.38054	117	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	3	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.38054	117	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	3	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.38166	116	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	3	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.38166	116	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	3	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.38166	116	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	3	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.38166	116	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	3	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.38054	115	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	3	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.38054	115	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	3	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.38054	115	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	3	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.38054	115	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	3	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.38166	114	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	3	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.38166	114	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	3	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.38166	114	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	3	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.38166	114	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	3	16WP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.35297	105	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	3	16WP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.35297	105	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	3	16WP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.35297	105	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	3	16WP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.35297	105	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	3	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.38017	102	BASE CASE
FDNS	03ALL	3	16WP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.35114	101	BASE CASE
FDNS	03ALL	3	25SP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	135	0.38054	117	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	3	25SP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	135	0.38054	117	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	3	25SP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	135	0.38054	117	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	3	25SP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	135	0.38054	117	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	3	25SP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	135	0.38166	116	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	3	25SP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	135	0.38166	116	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	3	25SP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	135	0.38166	116	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	3	25SP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	135	0.38166	116	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	3	16WP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	148	0.35297	100	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	3	16WP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	148	0.35297	100	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	3	16WP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	148	0.35297	100	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	3	16WP	G15_027	FROM->TO	CUDAHY - KISMET 3 115.00 115KV CKT 1	119	148	0.35297	100	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	3	16SP	G15_027	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.03586	108	BASE CASE
FDNS	03ALL	3	20SP	G15_027	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.03674	107	BASE CASE
FDNS	03ALL	3	17G	G15_027	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.0371	106	BASE CASE
FDNS	03ALL	4	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.36583	102	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	4	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.36583	102	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	4	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.36583	102	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	4	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.36583	102	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	4	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.36427	102	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	4	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.36427	102	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	4	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.36427	102	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	4	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.36427	102	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	4	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.36583	100	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	4	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.36583	100	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	4	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.36583	100	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	4	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.36583	100	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	4	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.36427	100	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	4	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.36427	100	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	4	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.36427	100	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	4	25SP	G15_027	FROM->TO	CRKCK 3 115.00 - CUDAHY 115KV CKT 1	119	148	0.36427	100	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1

SOLUTION	GROUP	SCENARIO	SEASON	SOURCE	DIRECTION	MONITORED ELEMENT	RATEA (MVA)	RATEB(MVA)	TDF	TC%LOADING (% MVA)	CONTINGENCY
FDNS	03ALL	4	16SP	G15_027	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.03575	108	BASE CASE
FDNS	03ALL	4	20SP	G15_027	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.03659	107	BASE CASE
FDNS	03ALL	4	17G	G15_027	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.03699	105	BASE CASE
FDNS	03ALL	5	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.37095	101	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	5	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.37095	101	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	5	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.37095	101	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	5	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.37095	101	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
FDNS	03ALL	5	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.36952	100	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	5	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.36952	100	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	5	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.36952	100	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	5	25SP	G15_027	TO->FROM	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1	133	133	0.36952	100	FINNEY SWITCHING STATION - WALKTAP7 345.00 345KV CKT 1
FDNS	03ALL	5	16SP	G15_027	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.03578	108	BASE CASE
FDNS	03ALL	5	20SP	G15_027	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.03663	107	BASE CASE
FDNS	03ALL	5	17G	G15_027	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.03702	105	BASE CASE
FDNS	01ALL	0	16SP	G15_029	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.04189	119	BASE CASE
FDNS	01ALL	0	17G	G15_029	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.04394	117	BASE CASE
FDNS	01ALL	0	20SP	G15_029	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.04201	117	BASE CASE
FDNS	01ALL	0	20WP	G15_029	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	171	185	0.043	105	BASE CASE
FDNS	01ALL	0	20WP	G15_029	TO->FROM	MATHWSN7 345.00 - TATONGA7 345.00 345KV CKT 1	1195	1195	0.56276	102	THISTLE7 345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNS	01ALL	0	20WP	G15_029	TO->FROM	MATHWSN7 345.00 - TATONGA7 345.00 345KV CKT 1	1195	1195	0.56276	102	THISTLE7 345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNS	01ALL	0	20WP	G15_029	TO->FROM	MATHWSN7 345.00 - TATONGA7 345.00 345KV CKT 1	1195	1195	0.56276	102	THISTLE7 345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNS	01ALL	0	20WP	G15_029	TO->FROM	MATHWSN7 345.00 - TATONGA7 345.00 345KV CKT 1	1195	1195	0.56276	102	THISTLE7 345.00 - WOODWARD DISTRICT EHV 345KV CKT 1
FDNS	01ALL	0	20WP	G15_029	TO->FROM	MATHWSN7 345.00 - TATONGA7 345.00 345KV CKT 1	1195	1195	0.56276	102	THISTLE7 345.00 - WOODWARD DISTRICT EHV 345KV CKT 2
FDNS	01ALL	0	20WP	G15_029	TO->FROM	MATHWSN7 345.00 - TATONGA7 345.00 345KV CKT 1	1195	1195	0.56276	102	THISTLE7 345.00 - WOODWARD DISTRICT EHV 345KV CKT 2
FDNS	01ALL	0	20WP	G15_029	TO->FROM	MATHWSN7 345.00 - TATONGA7 345.00 345KV CKT 1	1195	1195	0.56276	102	THISTLE7 345.00 - WOODWARD DISTRICT EHV 345KV CKT 2
FDNS	01ALL	0	20WP	G15_029	TO->FROM	MATHWSN7 345.00 - TATONGA7 345.00 345KV CKT 1	1195	1195	0.56276	102	THISTLE7 345.00 - WOODWARD DISTRICT EHV 345KV CKT 2

H: Power Flow Analysis (Other Constraints Not Requiring Transmission Reinforcement)

Available upon request. Contact SPP Generation Interconnection Studies for details.

I: Power Flow Analysis (Constraints from Multi-Contingencies)

Available upon request. Contact SPP Generation Interconnection Studies for details.

J: Group 6 Dynamic Stability Analysis Report

See MEPPI report next page

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Southwest Power Pool, Inc. (SPP)

DISIS-2015-001-1 (Group 06)
Definitive Impact Study

Final Report

PXE-1164
Revision #00

December 2015

Submitted By:
Mitsubishi Electric Power Products, Inc. (MEPPI)
Power Systems Engineering Services Department
Warrendale, PA

Title: **DISIS-2015-001-1 (Group 6) Definitive Impact Study: Final Report PXE-1164**
Date: December 2015

Author: Nicholas W. Tenza; Engineer II, Power Systems Engineering Dept. *Nicholas W. Tenza*
Approved: Elizabeth M. Cook; Section Manager, Power Systems Engineering Dept. *Elizabeth M. Cook*

EXECUTIVE SUMMARY

SPP requested a Definitive Interconnection System Impact Study (DISIS). The DISIS required a Stability Analysis, Short Circuit Analysis, Power Factor Analysis, and Low Wind/No Wind Analysis detailing the impacts of the interconnecting projects as shown in Table ES-1.

Table ES-1
Interconnection Projects Evaluated

Request	Size (MW)	Generator Model	Point of Interconnection
GEN-2014-074	152.0	Vestas V110 2.0MW (584443)	Tap Tuco – OKU 345kV (560027)
GEN-2015-014	150.0	Vestas V110 2.0MW (584563)	Tap on Cochran – LG Plains 115kV (560030)
GEN-2015-022	112.0	GE LV5 4.0MW Inverters (584643)	Swisher 115kV (525212)
ASGI-2015-002	2.0	GE 2.0MW (584723)	Yuma Interchange 115/69kV (526469)

SUMMARY OF STABILITY ANALYSIS

The Stability Analysis determined that there were no contingencies that resulted in system instability or generation tripping offline for the 2015 Summer Peak, 2015 Winter Peak, 2020 Summer Peak, 2020 Winter Peak, and 2025 Summer Peak conditions when all generation interconnection requests were at 100% output. However, it was observed that the post-contingency voltages at the O.K.U. 345 kV and GEN-2014-074 Tap 345 kV bus did not recover to above 0.90 p.u. in the 2015 Summer Peak, 2015 Winter Peak, and 2020 Winter Peak cases. After discussing this voltage violation with SPP, it was determined that a minimum of 2 x 130 Mvar capacitor banks will be installed at the O.K.U. 345 kV bus (in addition to the existing 3 x 30 Mvar capacitor banks). After the addition of the 2 x 130 Mvar capacitor banks, all voltages recovered to above 0.90 p.u. for all years and seasons.

SUMMARY OF THE SHORT CIRCUIT ANALYSIS

The short circuit analysis was performed on the 2025 Summer Peak power flow for all study projects. Refer to Table ES-2 for a list of maximum fault currents observed for each study project.

Table ES-2
List of Maximum Fault Currents Observed for Each Study Project

Study Project	Fault Current at POI (kA)	Maximum Fault Current (kA)	Fault Location	Bus Voltage (kV)
GEN-2014-074	6.45	35.12	LP-COOK	69
GEN-2015-014	6.44	27.76	PLANT_X	230
GEN-2015-022	10.33	35.12	LP-COOK	69
ASGI-2015-002	3.07	27.76	PLANT_X	230

SUMMARY OF POWER FACTOR ANALYSIS

For all the generators that follow, the power factor is measured at the point of interconnection (POI).

Study Generator GEN-2014-074

The Power Factor Analysis shows that GEN-2014-074 has a power factor range of 0.413 lagging (supplying) to 0.971 leading (absorbing) for the 2015 Summer Peak conditions, a power factor range of 0.499 lagging (supplying) to 0.958 leading (absorbing) for the 2015 Winter Peak conditions, a power factor range of 0.651 lagging (supplying) to 0.970 leading (absorbing) for the 2020 Summer Peak conditions, a power factor range of 0.574 lagging (supplying) to 0.966 leading (absorbing) for the 2020 Winter Peak conditions, and a power factor range of 0.852 lagging (supplying) to 0.969 leading (absorbing) for the 2025 Summer Peak conditions.

Study Generator GEN-2015-014

The Power Factor Analysis shows that GEN-2015-014 has a power factor range of 0.999 lagging (supplying) to 0.978 leading (absorbing) for the 2015 Summer Peak conditions, a power factor range of 0.974 to 0.999 leading (absorbing) for the 2015 Winter Peak conditions, a power factor range of 0.955 to 0.999 leading (absorbing) for the 2020 Summer Peak conditions, a power factor range of 0.970 to 0.997 leading (absorbing) for the 2020 Winter Peak conditions, and a power factor range of 0.937 to 0.999 leading (absorbing) for the 2025 Summer Peak conditions.

Study Generator GEN-2015-022

The Power Factor Analysis shows that GEN-2015-022 has a power factor range of 0.916 lagging (supplying) to 0.878 leading (absorbing) for the 2015 Summer Peak conditions, a power factor range of 0.978 lagging (supplying) to 0.961 leading (absorbing) for the 2015 Winter Peak conditions, a power factor range of 0.918 lagging (supplying) to 0.817 leading (absorbing) for the 2020 Summer Peak conditions, a power factor range of 0.957 lagging (supplying) to 0.979 leading (absorbing) for the 2020 Winter Peak conditions, and a power factor range of 0.886 lagging (supplying) to 0.835 leading (absorbing) for the 2025 Summer Peak conditions.

Study Generator ASGI-2015-002

The Power Factor Analysis shows that ASGI-2015-002 has a power factor range of 0.704 lagging (supplying) to 0.683 leading (absorbing) for the 2015 Summer Peak conditions, a power factor range of 0.609 lagging (supplying) to 0.795 leading (absorbing) for the 2015 Winter Peak conditions, a power factor range of 0.652 lagging (supplying) to 0.693 leading (absorbing) for the 2020 Summer Peak conditions, a power factor range of 0.944 lagging (supplying) to 0.873 leading (absorbing) for the 2020 Winter Peak conditions, and a power factor range of 0.873 lagging (supplying) to 0.337 leading (absorbing) for the 2025 Summer Peak conditions.

SUMMARY OF LOW WIND/NO WIND ANALYSIS

The amount of reactive power injected into the transmission network was recorded at the point of interconnection for GEN-2014-074 for each season. The reactance needed for zero Mvar flow at the POI was 8.9 Mvar.

Table of Contents

SECTION 1: OBJECTIVES

The objective of this report is to provide Southwest Power Pool, Inc. (SPP) with the deliverables for the "DISIS-2015-001-1 (Group 06) Definitive Impact Study." SPP requested an Interconnection System Impact Study for four (4) generation interconnections for 2015 Summer Peak, 2015 Winter Peak, 2020 Summer Peak, 2020 Winter Peak, and 2025 Summer Peak, which requires a Stability Analysis, Short Circuit Analysis, Power Factor Analysis, Low Wind/No Wind Analysis, and an Impact Study Report.

SECTION 2: BACKGROUND

The Siemens Power Technologies, Inc. PSS/E power system simulation program Version 32.2.0 was used for this study. SPP provided the stability database cases for 2015 Summer Peak, 2015 Winter Peak, 2020 Summer Peak, 2020 Winter Peak, and 2025 Summer Peak conditions and a list of contingencies to be examined. The model includes the study projects shown in Table 2-1 and the previously queued projects listed in Table 2-2. Refer to Appendix A for the steady-state and dynamic model data for the study projects. A power flow one-line diagram for each generation interconnection project is shown in Figures 2-1 through 2-11. Note that the one-line diagrams represent the 2015 Summer Peak case.

The Stability Analysis determined the impacts of the new interconnecting projects on the stability and voltage recovery of the nearby system and the ability of the interconnecting projects to meet FERC Order 661A. If problems with stability or voltage recovery are identified, the need for reactive compensation or system upgrades will be investigated. Three-phase faults and single line-to-ground faults will be examined as listed in Table 2-3. Note that all contingencies listed were examined for the cluster scenario, and specified contingencies (indicated by an X) were examined for each Stand Alone generator as listed in Table 2-4.

A Short Circuit Analysis was performed on the 2025 Summer Peak study year for each study generator in the Cluster Scenario. The study was performed five buses out from the study generator's point of interconnection and results were documented.

The Power Factor Analysis determined the power factor at the point of interconnection for the wind or solar interconnection projects for pre-contingency and post-contingency conditions. Table 2-3 lists the contingencies developed from the three-phase fault definitions provided in the group's interconnection impact study request.

The Low Wind/No Wind Analysis was completed for wind farm interconnections that interconnect to a 345 kV or 230 kV bus. This analysis determined if reactive support is needed to have an Mvar flow of approximately zero at the point of interconnection (POI).

Table 2-1
Interconnection Projects Evaluated

Request	Size (MW)	Generator Model	Point of Interconnection
GEN-2014-074	152.0	Vestas V110 2.0MW (584443)	Tap Tuco – OKU 345kV (560027)
GEN-2015-014	150.0	Vestas V110 2.0MW (584563)	Tap on Cochran – LG Plains 115kV (560030)
GEN-2015-022	112.0	GE LV5 4.0MW Inverters (584643)	Swisher 115kV (525212)
ASGI-2015-002	2.0	GE 2.0MW (584723)	Yuma Interchange 115/69kV (526469)

Table 2-2
Previously Queued Nearby Interconnection Projects Included

Request	Size (MW)	Generator Model	Point of Interconnection
GEN-2001-033	180	Mitsubishi 1000	San Juan Mesa 230kV (524885)
GEN-2001-036	80	Mitsubishi 1000	Norton 115kV (524502)
GEN-2006-018	170	GENSAL	Tuco 230kV (525830)
GEN-2006-026	502	GENROU (527901, 527902, 527903)	Hobbs 115kV(527891) Hobbs 230kV (527894)
GEN-2008-022	300	GE 2.5MW	Tap on Eddy County – Tolk 345kV line (G08-022-POI, 560007)
GEN-2010-006	180 Summer 205 Winter	GENROU	Jones_bus2 230kV(526337)
ASGI-2010-010	42	GENSAL	Lovington 115kV (528334)
ASGI-2010-020	30	Nordex 2.5MW	Tap LE-Tatum to LE-Crsroads 69kV (AS10-020-POI, 560360)
ASGI-2010-021	15	Mitsubishi MPS-1000A 1.0MW	Tap LE-Saundrtp to LE-Anderson 69kV (ASGI-021-POI, 560364)
GEN-2010-046	56	GENSAL	Tuco 230kV (525830)
ASGI-2011-001	27.3	Suzlon 2.1MW	Lovington 115kV (528334)
ASGI-2011-003	10	Sany 2.0MW	Hendricks 69kV (525943)
ASGI-2011-004	19.8	Sany 1.8MW	Crosby 69kV (525915)
GEN-2011-025	80	GE 1.6MW	Tap on Floyd County - Crosby County 115kV line (G11-025-POI, 562004)
GEN-2011-045	180 Summer 205 Winter	GENROU	Jones_bus2 230kV (526337)
GEN-2011-046	23 Summer 27 Winter	GENROU	Quay County 115kV (524472)
GEN-2011-048	165 Summer 175 Winter	GENROU	Mustang 230kV (527151)
GEN-2012-001	61.2	CCWE 3.6MW (WT4)	Tap Grassland to Borden 230kV (526679)
ASGI-2012-002	18	Vestas 1.65MW V82	Clovis 115kV (524808)
GEN-2012-009	15 MW increase (Pgen=165MW)	GENROU	Mustang 230kV (527151)
GEN-2012-010	15 MW increase (Pgen=165MW)	GENROU	Mustang 230kV (527151)
GEN-2012-020	478	GE 1.68MW	Tuco 230kV (525830)
GEN-2012-034	7 MW increase (Pgen=172MW)	GENROU	Mustang 230kV (527151)
GEN-2012-035	7 MW increase (Pgen=172MW)	GENROU	Mustang 230kV (527151)
GEN-2012-036	7 MW increase (Pgen=172MW Summer/185MW Winter)	GENROU	Mustang 230kV (527151)
GEN-2012-037	196 Summer 203 Winter	GENROU	Tuco 345kV (525832)

Table 2-2 (Continued)
Previously Queued Nearby Interconnection Projects Included

Request	Size (MW)	Generator Model	Point of Interconnection
ASGI-2012-002	18	Vestas 1.65MW V82	Clovis 115kV (524808)
GEN-2013-016	191 Summer 203 Winter	GENROU (583456)	Tuco 345kV (525832)
ASGI-2013-002	18.4	Siemens 2.3MW VS (583613)	Tucumcari 115kV (524509)
ASGI-2013-003	18.4	Siemens 2.3MW VS (583623)	Clovis 115kV (524808)
ASGI-2013-005	19.8	Vestas V82 1.65MW (583283)	FE-Clovis 115kV (524808)
ASGI-2013-006	2	Gamesa G114 2MW (583813)	Erskine 115kV (526109)
GEN-2013-022	25	Solaron 500kW (583313)	Caprock 115kV (524486)
GEN-2013-027	150	Siemens 2.3/2.415	Tap on Yoakum to Tolk 230 kV (562480)
GEN-2014-012	186 Summer 225 Winter	GENROU (528607)	Tap Hobbs to Andrews 230kV in 2015 Tap Hobbs to Andrews 345kV in 2025
ASGI-2014-001	2.3	GE 107m 2.3MW (583816)	Erskine 69kV (526109)
GEN-2014-033	70	SC 500HE/CP 0.5MVA inverter	Chaves County 115kV
GEN-2014-034	70	SC 500HE/CP 0.5MVA inverter	Chaves County 115kV
GEN-2014-035	30	SC 500HE/CP 0.5MVA inverter	Chaves County 115kV
GEN-2014-047	40	AE 500NX 0.5 MW PV inverters	Tap Tolk - Eddy County (Crossroads) 345kV
GEN-2014-053	80	GE 2.0MW WTG	Carlisle 230kV
GEN-2014-054	120	GE 2.0MW WTG	Carlisle 230kV
GEN-2014-066	30	AE 1000NX 1.0MW PV inverter	Norton 115kV
ASGI-2014-002	49.6	SMA 1.6MVA 630CP-US inverters	Santa Rosa tap - Tucumcari 69kV line
ASGI-2014-005	10	Solar PV inverter	Strata 69 kV - bus 528046
ASGI-2014-008	10	Solar PV inverter	South Loving 69 kV - bus 528218
ASGI-2014-009	10	Solar PV inverter	Wood Draw 115 kV - bus 528228
ASGI-2014-010	10	Solar PV inverter	Ochoa 115 kV - bus 528232
ASGI-2014-012	10	Solar PV inverter	Cooper Ranch 115 kV - bus 528554

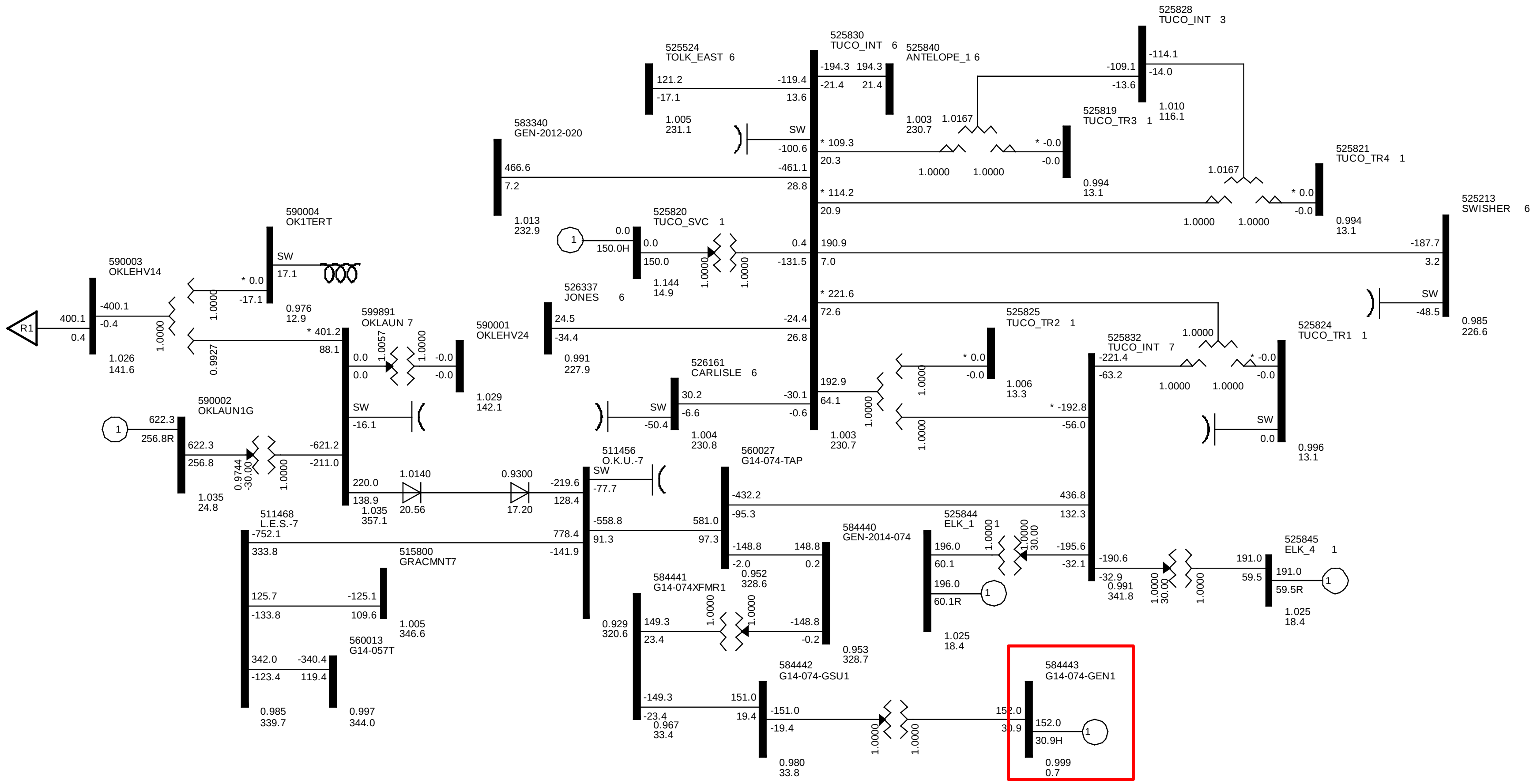

Figure 2-1. Power flow one-line diagram for interconnection project at the Tuco – OKU 345 kV POI (GEN-2014-074)

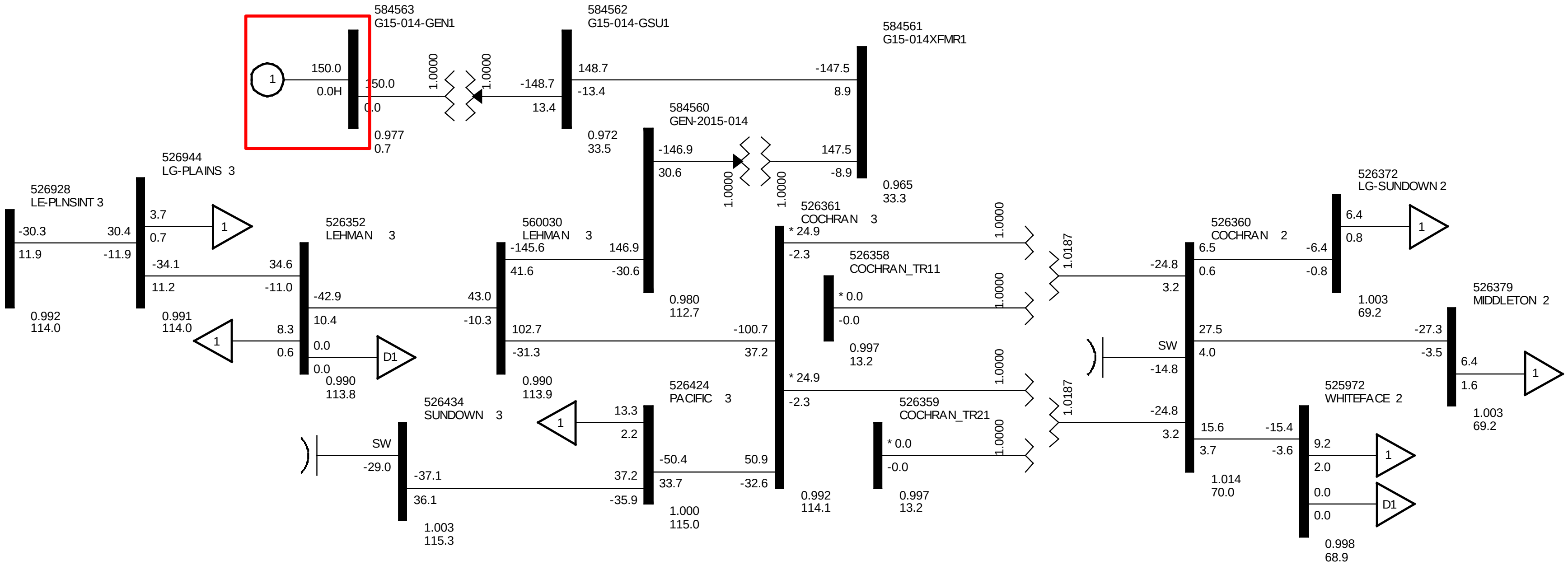

Figure 2-2. Power flow one-line diagram for interconnection project at the Cochran – LG Plains 115 kV POI (GEN-2015-014)

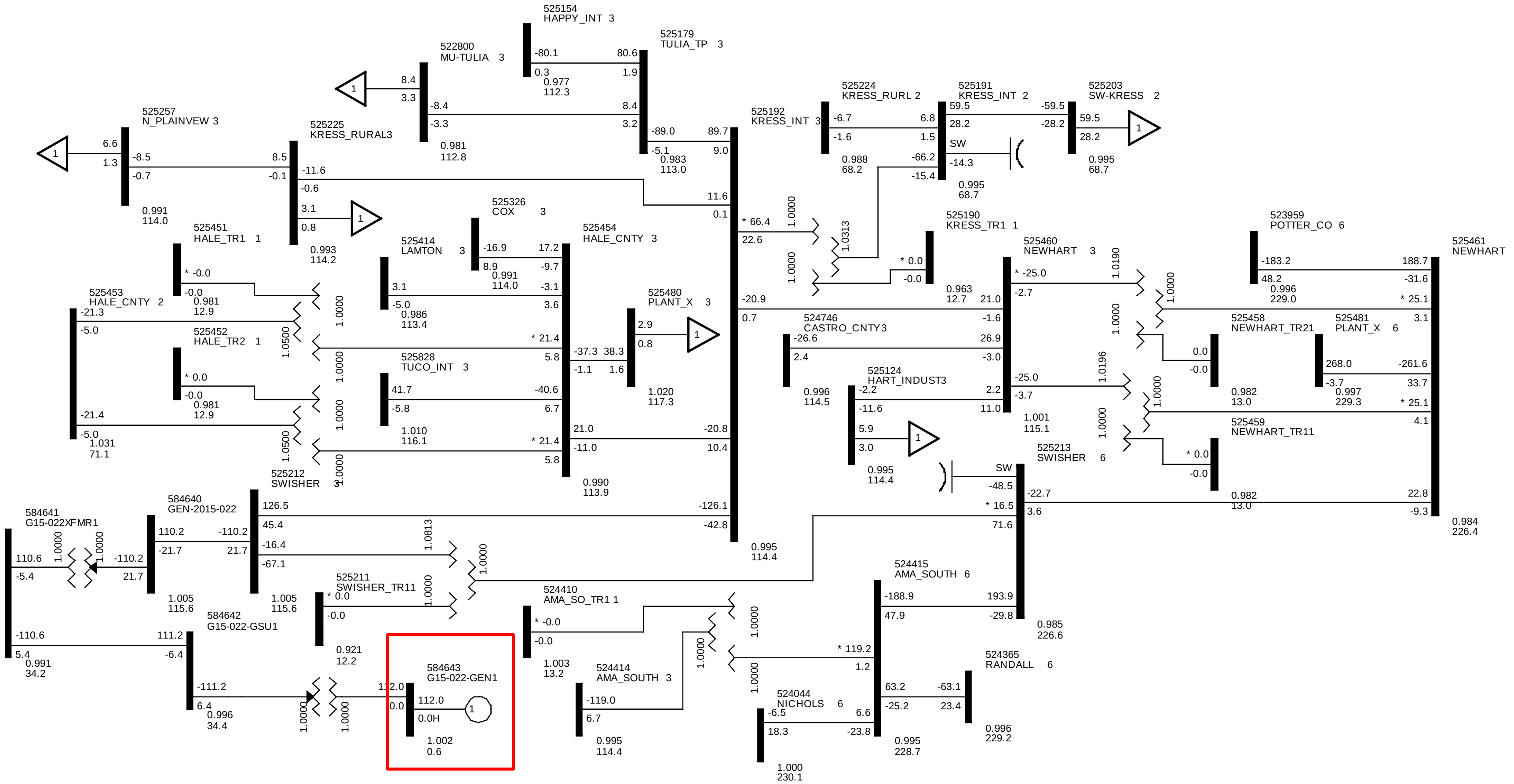

Figure 2-3. Power flow one-line diagram for interconnection project at Swisher 115 kV POI (GEN-2015-022)

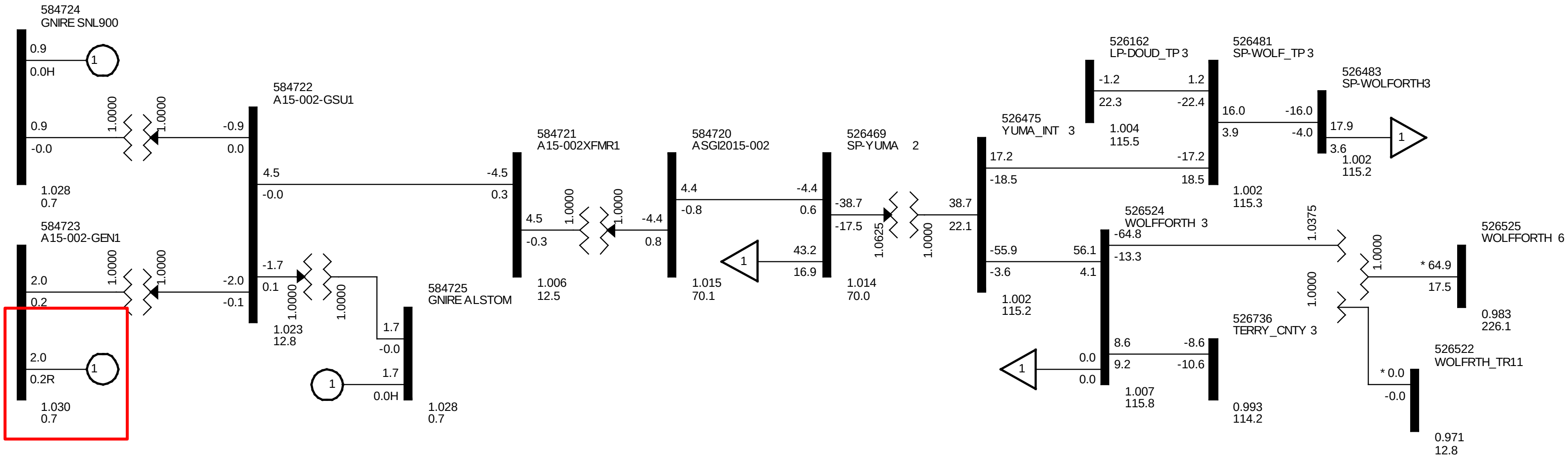

Figure 2-4. Power flow one-line diagram for interconnection project at Yuma Interchange 115/69 kV POI (ASGI-2015-002)

Table 2-3
Case List with Contingency Description

Cont. No.	Cont. Name	Description
1	FLT50-3PH	**3 phase fault on the Tolk Tap 230 kV (525543) to Tolk 345kV (525549) to Tolk 13.2 kV (525537) XFMR Ckt 1, near Tolk Tap 230 kV.**
		a. Apply fault at the Tolk Tap 230 kV bus.
		b. Clear fault after 5 cycles and trip the faulted transformer.
2	FLT51-3PH	**3 phase fault on the GEN-2013-027 (562480) to Tolk West (525531) 230 kV line, near GEN-2013-027.**
		a. Apply fault at the GEN-2013-027 230 kV 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.
3	FLT52-SB	**Single phase fault with stuck breaker on the Tolk West (525531) to GEN-2013-027 (562480) 230 kV line, near Tolk West.**
		a. Apply fault at the Tolk West 230 kV bus.
		b. Run 5 cycles, and then open GEN-2013-027 end of the faulted line.
		c. Run 10 cycles, and then clear the fault and disconnect Tolk West 230kV bus (525531).
4	FLT53-3PH	**3 phase fault on the GEN-2013-027 (562480) to Yoakum (526935) 230 kV line, near GEN-2013-027.**
		a. Apply fault at the GEN-2013-027 230 kV 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	FLT54-SB	**Single phase fault with stuck breaker on the Yoakum (526935) to GEN-2013-027 (562480) 230 kV line, near Yoakum.**
		a. Apply fault at the Yoakum 230kV bus.
		b. Run 5 cycles, and then open GEN-2013-027 end of the faulted line.
		c. Run 10 cycles, and then clear the fault and open Yoakum end of the line in (b) and trip Yoakum (526935) to Yoakum 115 (526934)/13.2 kV (526931) transformer circuit #1.
6	FLT55-3PH	**3 phase fault on the Yoakum (526935) to Amoco-SS (526460) 230 kV line, near Yoakum.**
		a. Apply fault at the Yoakum 230 kV 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.
7	FLT56-3PH	**3 phase fault on the Yoakum (526935) to OxyBru Tap (527010) 230 kV line, near Yoakum.**
		a. Apply fault at the Yoakum 230 kV 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	FLT57-3PH	**3 phase fault on the Yoakum (526935) to Mustang (527149) 230 kV line, near Yoakum.**
		a. Apply fault at the Yoakum 230 kV 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	FLT58-3PH	**3 phase fault on the Yoakum (526935) to Hobbs (527894) 230 kV line, near Yoakum.**
		a. Apply fault at the Yoakum 230 kV 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	FLT59-3PH	**3 phase fault on the Yoakum 230 kV (526935) to Yoakum 115 kV (526934)/13.2 kV (526934) transformer circuit #1, near Yoakum.**
		a. Apply fault at the Yoakum 230 kV bus.
		b. Clear fault after 5 cycles by tripping the faulted transformer and remove fault.

Table 2-3 (Continued)
Case List with Contingency Description

Cont. No.	Cont. Name	Description
11	FLT60-PO	**(Prior Outage) Yoakum (526935) – Amoco-SS (526460) 230 kV out of service then 3 phase fault on the Yoakum 230 kV (526935) to Yoakum 115 kV (526934)/13.2 kV (526934) transformer circuit #1, near Yoakum.**
		Switch Yoakum (526935) – Amoco-SS (526460) out of service then solve.
		a. Apply fault at the Yoakum 230 kV bus.
		b. Clear fault after 5 cycles by tripping the faulted transformer and remove fault.
12	FLT61-SB	**Single phase fault with stuck breaker on the Yoakum (526935) to Amoco-SS (526460) 230 kV line, near Yoakum.**
		a. Apply fault at the Yoakum 230kV bus.
		b. Run 5 cycles, and then open Amoco-SS end of the faulted line.
		c. Run 10 cycles, and then clear the fault and trip Yoakum 230 kV (526935) bus.
13	FLT64-3PH	**3 phase fault on the Tolk West (525531) to Plant X (525481) 230kV circuit #1 line, near Tolk West.**
		a. Apply fault at the Tolk West 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.
14	FLT65-SB	**Single phase fault with stuck breaker on the Tolk West (525531) to Plant X (525481) 230kV circuit #1 line, near Tolk West.**
		a. Apply fault at the Tolk West 230kV bus.
		b. Run 5 cycles, and then open Plant X end of the faulted line.
		c. Run 10 cycles, and then clear the fault and disconnect Tolk West 230kV bus (525531).
15	FLT67-3PH	**3 phase fault on the Tolk West (525531) to Lamb Co (525637) 230kV line, near Tolk West.**
		a. Apply fault at the Tolk West 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.
16	FLT68-SB	**Single phase fault with stuck breaker on the Tolk West (525531) to Lamb Co (525637) 230kV line, near Tolk West.**
		a. Apply fault at the Tolk West 230kV bus.
		b. Run 5 cycles, and then open Lamb Co end of the faulted line.
		c. Run 10 cycles, and then clear the fault and disconnect Tolk West 230kV bus (525531).
17	FLT73-3PH	**3 phase fault on the Tuco (525828) to Hale County (525454) 115kV line circuit 1, near Tuco.**
		a. Apply fault at the Tuco 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	FLT74-3PH	**3 phase fault on the Tuco (525828) to Floyd County (525780) 115kV line circuit 1, near Tuco.**
		a. Apply fault at the Tuco 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.

Table 2-3 (Continued)
Case List with Contingency Description

Cont. No.	Cont. Name	Description
19	FLT75-3PH	**3 phase fault on the Tuco (525828) to Stanton West (526076) 115kV line circuit 1, near Tuco.**
		a. Apply fault at the Tuco 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.
20	FLT76-3PH	**3 phase fault on the Tuco (525828) to Lubbock West (526298) 115kV line circuit 1, near Tuco.**
		a. Apply fault at the Tuco 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.
21	FLT77-3PH	**3 phase fault on the Carlisle (526160) to LP-Doud Tap (526162) 115kV line circuit 1, near Carlisle.**
		a. Apply fault at the Carlisle 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	FLT78-3PH	**3 phase fault on the Carlisle (526160) to Murphy (526192) 115kV line circuit 1, near Carlisle.**
		a. Apply fault at the Carlisle 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.
23	FLT79-3PH	**3 phase fault on the Carlisle (526161) to LP-Milwaukee (522823) 230kV line circuit 1, near Carlisle.**
		a. Apply fault at the Carlisle 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	FLT80-3PH	**3 phase fault on the Carlisle (526161) to Tuco (525830) 230kV line circuit 1, near Carlisle.**
		a. Apply fault at the Carlisle 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.
25	FLT81-3PH	**3 phase fault on the Carlisle (526160) 115kV to Carlisle (526161) 230kV/(526157) 13.2kV ckt 1 transformer at the 115kV bus.**
		a. Apply fault at the Carlisle 115kV bus.
		b. Clear fault after 5 cycles by tripping the transformer
26	FLT82-3PH	**3 phase fault on the Tuco (525828) 115kV to Tuco (525830) 230kV/(525821) 13.2kV ckt 1 transformer at the 115kV bus.**
		a. Apply fault at the Tuco 115kV bus.
		b. Clear fault after 5 cycles by tripping the transformer
27	FLT88-3PH	**3 phase fault on the Tuco (525832) 345kV to Tuco (525830) 230kV/(525824) 13.2kV ckt 1 transformer at the 345kV bus.**
		a. Apply fault at the Tuco 345kV bus.
		b. Clear fault after 5 cycles by tripping the transformer

Table 2-3 (Continued)
Case List with Contingency Description

Cont. No.	Cont. Name	Description
28	FLT90-3PH	**3 phase fault on the Tuco (525830) to Tolk East (525524) 230kV line circuit 1, 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 (b) back into the fault.
		d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
29	FLT91-3PH	**3 phase fault on the Tuco (525830) to Jones (526337) 230kV line circuit 1, 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 (b) back into the fault.
		d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
30	FLT93-3PH	**3 phase fault on the Jones (526337) to LP-Holly (522870) 230kV line circuit 1, near Jones.**
		a. Apply fault at the Jones 230kV bus.
		b. Clear fault after 5 cycles by tripping the faulted line.
31	FLT94-3PH	**3 phase fault on the Jones (526337) to Lubbock South (526269) 230kV line circuit 2, near Jones.**
		a. Apply fault at the Jones 230kV bus.
		b. Clear fault after 5 cycles by tripping the faulted line.
32	FLT95-3PH	**3 phase fault on the Jones (526337) to Lubbock East (526299) 230kV line circuit 1, near Jones.**
		a. Apply fault at the Jones 230kV bus.
		b. Clear fault after 5 cycles by tripping the faulted line.
33	FLT96-3PH	**3 phase fault on the Jones (526337) to Grassland (526677) 230kV line circuit 1, near Jones.**
		a. Apply fault at the Jones 230kV bus.
		b. Clear fault after 5 cycles by tripping the faulted line.
34	FLT97-3PH	**3 phase fault on the Swisher (525213) to Amarillo South (524415) 230kV line circuit 1, near Swisher.**
		a. Apply fault at the Swisher 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.
35	FLT117-3PH (2020WP&SP and 2025SP)	**3 phase fault on the Tuco (525832) to Yoakam (526936) 345kV line circuit 1, near Tuco.**
		a. Apply fault at the Tuco (525832) 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	FLT123-3PH	**3 phase fault on the Tolk (525549) to Potter County (523961) 345 kV line, near Tolk.**
		a. Apply fault at the Tolk 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.

Table 2-3 (Continued)
Case List with Contingency Description

Cont. No.	Cont. Name	Description
37	FLT125-3PH	**3 phase fault on the Potter County (523961) to Hitchland (523097) 345 kV line, near Potter County.**
		a. Apply fault at the Potter County 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.
38	FLT126-3PH	**3 phase fault on the Potter County 345kV (523961) to 230kV (523959) to 13.2kV (523957) transformer, near Potter County 345kV.**
		a. Apply fault at the Potter County 345kV bus.
		b. Clear fault after 5 cycles by tripping the faulted transformer.
39	FLT132-3PH	**3 phase fault on the Yuma (526475) to SP-Wolforth Tap (526481) 115kV line circuit 1, near Yuma.**
		a. Apply fault at the Yuma 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.
40	FLT133-3PH	**3 phase fault on the Yuma (526475) to Wolfforth (526524) 115kV line circuit 1, near Yuma.**
		a. Apply fault at the Yuma 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	FLT134-3PH	**3 phase fault on the SP-Wolfforth (526481) to LP-Doud Tap (526162) 115kV line circuit 1, near SP-Wolfforth.**
		a. Apply fault at the SP-Wolfforth 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.
42	FLT135-3PH	**3 phase fault on the Carlisle (526160) 115kV to Carlisle (526159) 69kV/(526158) 13.2kV transformer, near Carlisle 115kV.**
		a. Apply fault at the Carlisle 115kV bus.
		b. Clear fault after 5 cycles by tripping the faulted transformer.
43	FLT136-3PH	**3 phase fault on the Carlisle (526161) to Wolfforth (526525) 230kV line circuit 1, near Carlisle.**
		a. Apply fault at the Carlisle 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.
44	FLT137-3PH	**3 phase fault on the Lubbock South (526268) to SP-Woodrow (526602) 115kV line circuit 1, near Lubbock South.**
		a. Apply fault at the Lubbock South 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	FLT138-3PH	**3 phase fault on the Lubbock South (526268) 115kV to Lubbock South (526267) 69kV/(526266) 13.2kV transformer, near Lubbock South 115kV.**
		a. Apply fault at the Lubbock South 115kV bus.
		b. Clear fault after 5 cycles by tripping the faulted transformer.

Table 2-3 (Continued)
Case List with Contingency Description

Cont. No.	Cont. Name	Description
46	FLT139-3PH	**3 phase fault on the Lubbock South (526268) 115kV to Lubbock South (526269) 230kV/(526265) 13.2kV transformer, near Lubbock South 115kV.**
		a. Apply fault at the Lubbock South 115kV bus.
		b. Clear fault after 5 cycles by tripping the faulted transformer.
47	FLT140-3PH	**3 phase fault on the LP-Wolforth (526524) to Terry County (526736) 115kV line circuit 1, near LP-Wolforth.**
		a. Apply fault at the LP-Wolforth 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.
48	FLT141-3PH	**3 phase fault on the LP-Wolforth (526524) 115kV to Wolforth (526525) 230kV/(526522) 13.2kV transformer, near LP-Wolforth 115kV.**
		a. Apply fault at the LP-Wolforth 115kV bus.
		b. Clear fault after 5 cycles by tripping the faulted transformer.
49	FLT142-3PH	**3 phase fault on the Wolforth (526525) to Lubbock South (526269) 230kV line circuit 1, near Wolforth.**
		a. Apply fault at the Wolforth 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.
50	FLT143-3PH	**3 phase fault on the Wolforth (526525) to Sundown (526435) 230kV line circuit 1, near Wolforth.**
		a. Apply fault at the Wolforth 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	FLT144-3PH	**3 phase fault on the Terry County (526736) to LG-Clauene (526491) 115kV line circuit 1, near Terry County.**
		a. Apply fault at the Terry County 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	FLT145-3PH	**3 phase fault on the Terry County (526736) to Prentice (526792) 115kV line circuit 1, near Terry County.**
		a. Apply fault at the Terry County 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	FLT146-3PH	**3 phase fault on the Terry County (526736) to Denver North (527130) 115kV line circuit 1, near Terry County.**
		a. Apply fault at the Terry County 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.

Table 2-3 (Continued)
Case List with Contingency Description

Cont. No.	Cont. Name	Description
54	FLT147-3PH	**3 phase fault on the Terry County (526736) to Sulphur (527262) 115kV line circuit 1, near Terry County.**
		a. Apply fault at the Terry County 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	FLT148-3PH	**3 phase fault on the Terry County (526736) 115kV to Terry County (526735) 69kV/(526733) 13.2kV transformer, near Terry County 115kV.**
		a. Apply fault at the Terry County 115kV bus.
		b. Clear fault after 5 cycles by tripping the faulted transformer.
56	FLT172-3PH	**3 phase fault on the Tolk East (525524) to Plant X (525481) 230kV line circuit 2, near Tolk East.**
		a. Apply fault at the Tolk East 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.
57	FLT174-3PH	**3 phase fault on the Swisher (525212) to Kress Int (525192) 115kV line circuit 1, near Swisher.**
		a. Apply fault at the Swisher 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.
58	FLT175-3PH	**3 phase fault on the Swisher (525212) 115kV to Swisher (525213) 230kV/(525211) 13.2kV transformer, near Swisher 115kV.**
		a. Apply fault at the Swisher 115kV bus.
		b. Clear fault after 5 cycles by tripping the faulted transformer.
59	FLT176-3PH	**3 phase fault on the Kress Int (525192) to Tulia Tap (525179) 115kV line circuit 1, near Kress Int.**
		a. Apply fault at the Kress Int 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.
60	FLT177-3PH	**3 phase fault on the Kress Int (525192) to Kress Rural (525225) 115kV line circuit 1, near Kress Int.**
		a. Apply fault at the Kress Int 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	FLT178-3PH	**3 phase fault on the Kress Int (525192) to Hale Conty (525454) 115kV line circuit 1, near Kress Int.**
		a. Apply fault at the Kress Int 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.

Table 2-3 (Continued)
Case List with Contingency Description

Cont. No.	Cont. Name	Description
62	FLT179-3PH	**3 phase fault on the Kress Int (525192) to Newhart (525460) 115kV line circuit 1, near Kress Int.**
		a. Apply fault at the Kress Int 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.
63	FLT180-3PH	**3 phase fault on the Randal (524364) to Manhattan (524224) 115kV line circuit 1, near Randal.**
		a. Apply fault at the Randal 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.
64	FLT181-3PH	**3 phase fault on the Randal (524364) to Georgia (524322) 115kV line circuit 1, near Randal.**
		a. Apply fault at the Randal 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.
65	FLT182-3PH	**3 phase fault on the Randal (524364) to Southeast (524338) 115kV line circuit 1, near Randal.**
		a. Apply fault at the Randal 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.
66	FLT183-3PH	**3 phase fault on the Randal (524364) to Canyon Tap (524522) 115kV line circuit 1, near Randal.**
		a. Apply fault at the Randal 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.
67	FLT184-3PH	**3 phase fault on the Randal (524364) to Palo Duro (524530) 115kV line circuit 1, near Randal.**
		a. Apply fault at the Randal 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.
68	FLT185-3PH	**3 phase fault on the Randal (524364) 115kV to Randal (524365) 230kV/(524361) 13.2kV transformer, near Randal 115kV.**
		a. Apply fault at the Randal 115kV bus.
		b. Clear fault after 5 cycles by tripping the faulted transformer.
69	FLT186-3PH	**3 phase fault on the Hale County (525454) to Cox (525326) 115kV line circuit 1, near Hale County.**
		a. Apply fault at the Hale County 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.

Table 2-3 (Continued)
Case List with Contingency Description

Cont. No.	Cont. Name	Description
70	FLT187-3PH	**3 phase fault on the Hale County (525454) to Lamton (525414) 115kV line circuit 1, near Hale County.**
		a. Apply fault at the Hale County 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.
71	FLT188-3PH	**3 phase fault on the Hale County (525454) to Plant X (525480) 115kV line circuit 1, near Hale County.**
		a. Apply fault at the Hale County 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.
72	FLT189-3PH	**3 phase fault on the Hale County (525454) 115kV to Hale County (525453) 69kV/(525451) 13.2kV transformer, near Hale County 115kV.**
		a. Apply fault at the Hale County 115kV bus.
		b. Clear fault after 5 cycles by tripping the faulted transformer.
73	FLT190-3PH	**3 phase fault on the Cox (525326) to Kiser (525272) 115kV line circuit 1, near Cox.**
		a. Apply fault at the Cox 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.
74	FLT191-3PH	**3 phase fault on the Cox (525326) to Floyd County (525780) 115kV line circuit 1, near Cox.**
		a. Apply fault at the Cox 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.
75	FLT192-3PH	**3 phase fault on the Newhart (525460) to Castro County (524746) 115kV line circuit 1, near Newhart.**
		a. Apply fault at the Newhart 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.
76	FLT193-3PH	**3 phase fault on the Newhart (525460) to Hart Industry (525124) 115kV line circuit 1, near Newhart.**
		a. Apply fault at the Newhart 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.
77	FLT194-3PH	**3 phase fault on the Newhart (525460) 115kV to Newhart (525461) 230kV/(525459) 13.2kV transformer, near Newhart 115kV.**
		a. Apply fault at the Newhart 115kV bus.
		b. Clear fault after 5 cycles by tripping the faulted transformer.
78	FLT195-3PH	**3 phase fault on the Swisher (525213) to Amarillo (524415) 230kV line circuit 1, near Swisher.**
		a. Apply fault at the Swisher 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.

Table 2-3 (Continued)
Case List with Contingency Description

Cont. No.	Cont. Name	Description
79	FLT196-3PH	**3 phase fault on the Swisher (525213) to Newhart (525461) 230kV line circuit 1, near Swisher.**
		a. Apply fault at the Swisher 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.
80	FLT197-3PH	**3 phase fault on the Swisher (525213) to Tuco2 (525830) 230kV line circuit 1, near Swisher.**
		a. Apply fault at the Swisher 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.
81	FLT198-3PH	**3 phase fault on the G15-014 Tap (560030) to Lehman (526352) 115kV line circuit 1, near G15-014 Tap.**
		a. Apply fault at the G15-014 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.
82	FLT199-3PH	**3 phase fault on the G15-014 Tap (560030) to Cochran (526361) 115kV line circuit 1, near G15-014 Tap.**
		a. Apply fault at the G15-014 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.
83	FLT200-3PH	**3 phase fault on the Lehman (526352) to LG-Plains (526944) 115kV line circuit 1, near Lehman.**
		a. Apply fault at the Lehman 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.
84	FLT201-3PH	**3 phase fault on the LE-PLNSINT (526928) to Yoakum (526934) 115kV line circuit 1, near LE-PLNSINT.**
		a. Apply fault at the LE-PLNSINT 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.
85	FLT202-3PH	**3 phase fault on the LE-PLNSINT (526928) to LG-Plains (526944) 115kV line circuit 1, near LE-PLNSINT.**
		a. Apply fault at the LE-PLNSINT 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.
86	FLT203-3PH	**3 phase fault on the LE-PLNSINT (526928) 115kV to LE-PLNSINT (528626) 69kV two winding transformer circuit 1, near LE-PLNSINT.**
		a. Apply fault at the LE-PLNSINT 115kV bus.
		b. Clear fault after 5 cycles by tripping the faulted transformer.

Table 2-3 (Continued)
Case List with Contingency Description

Cont. No.	Cont. Name	Description
87	FLT204-3PH	**3 phase fault on the Cochran (526361) to Pacific (526424) 115kV line circuit 1, near Cochran.**
		a. Apply fault at the Cochran 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.
88	FLT205-3PH	**3 phase fault on the Cochran (526361) 115kV to Cochran (526360) 69kV/(526358) 13.2kV transformer, near Cochran 115kV.**
		a. Apply fault at the Cochran 115kV bus.
		b. Clear fault after 5 cycles by tripping the faulted transformer.
89	FLT206-3PH	**3 phase fault on the Sundown (526434) to LC-OPDYKE (526036) 115kV line circuit 1, near Sundown.**
		a. Apply fault at the Sundown 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.
90	FLT207-3PH	**3 phase fault on the Sundown (526434) to Amoco Tap (526445) 115kV line circuit 1, near Sundown.**
		a. Apply fault at the Sundown 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.
91	FLT208-3PH	**3 phase fault on the Sundown (526434) 115kV to Sundown (526435) 230kV/(526432) 13.2kV transformer, near Sundown 115kV.**
		a. Apply fault at the Sundown 115kV bus.
		b. Clear fault after 5 cycles by tripping the faulted transformer.
92	FLT209-3PH	**3 phase fault on the Sundown (526435) to Plant X (525481) 230kV line circuit 1, near Sundown.**
		a. Apply fault at the Sundown 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.
93	FLT210-3PH	**3 phase fault on the Sundown (526435) to Amoco (526460) 230kV line circuit 1, near Sundown.**
		a. Apply fault at the Sundown 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.
94	FLT211-3PH	**3 phase fault on the Yoakum (526934) to Prentice (526792) 115kV line circuit 1, near Yoakum.**
		a. Apply fault at the Yoakum 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.
95	FLT212-3PH	**3 phase fault on the Yoakum (526934) to Arco Tap (527041) 115kV line circuit 1, near Yoakum.**
		a. Apply fault at the Yoakum 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.

Table 2-3 (Continued)
Case List with Contingency Description

Cont. No.	Cont. Name	Description
96	FLT213-3PH	**3 phase fault on the Yoakum (526934) to Pleasant Hill (527194) 115kV line circuit 1, near Yoakum.**
		a. Apply fault at the Yoakum 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.
97	FLT214-3PH	**3 phase fault on the G14-074 Tap (560027) to OKU (511456) 345kV line circuit 1, near G14-074.**
		a. Apply fault at the G14-074 Tap 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.
98	FLT215-3PH	**3 phase fault on the G14-074 Tap (560027) to Tuco Int (525832) 345kV line circuit 1, near G14-074.**
		a. Apply fault at the G14-074 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.
99	FLT216-3PH	**3 phase fault on the OKU (511456) to LES (511468) 345kV line circuit 1, near OKU.**
		a. Apply fault at the OKU 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.
100	FLT217-3PH	**3 phase fault on the LES (511468) to Gracemont (515800) 345kV line circuit 1, near LES.**
		a. Apply fault at the LES 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.
101	FLT218-3PH	**3 phase fault on the LES (511468) to G14-057T (560013) 345kV line circuit 1, near LES.**
		a. Apply fault at the LES 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.
102	FLT219-3PH	**3 phase fault on the LES (511468) 345kV to LES (511467) 138kV/(511411) 13.8kV transformer CKT 2, near LES 345kV.**
		a. Apply fault at the LES 115kV bus.
		b. Clear fault after 5 cycles by tripping the faulted transformer.
103	FLT221-3PH	**3 phase fault on the Woodward (515375) – Border (515458) 345kV circuit #1, 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.

Table 2-3 (Continued)
Case List with Contingency Description

Cont. No.	Cont. Name	Description
104	FLT224-3PH (2015SP&WP and 2020WP)	**3 phase fault on the Chisholm (511553) – Gracemont (515800) 345kV circuit #1, near Chisholm.**
		a. Apply fault at the Chisholm 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.
105	FLT225-3PH (2015SP&WP and 2020WP)	**3 phase fault on the Chisholm (511553) 345kV to Chisholm (511557) 230kV/(511558) 13.2kV transformer, near Chisholm 345kV.**
		a. Apply fault at the Chisholm 345kV bus.
		b. Clear fault after 5 cycles by tripping the faulted transformer.
106	FLT229-3PH	**3 Phase fault on the Tuco (525832) to Border (515458) 345 kV circuit #1, 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.

SECTION 3: STABILITY ANALYSIS

The objective of the Stability Analysis was to determine the impacts of the generator interconnections on the stability and voltage recovery on the SPP transmission system. If problems with stability or voltage recovery were identified the need for reactive compensation or system upgrades was investigated.

3.1 Approach

SPP provided MEPPI with the following five power flow cases:

- MDWG14-15SP_DIS15011_G06
- MDWG14-15WP_DIS15011_G06
- MDWG14-20SP_DIS15011_G06
- MDWG14-20WP_DIS15011_G06
- MDWG14-25SP_DIS15011_G06

Each case was examined prior to the Stability Analysis to ensure the case contained the proposed study projects and any previously queued projects listed in Tables 2-1 and 2-2 respectively. There was no suspect power flow data in the study area. The dynamic datasets were also verified and stable initial system conditions (i.e., “flat lines”) were achieved. Three-phase and single phase-to-ground faults listed in Table 2-3 were examined. Single-phase fault impedances were calculated for each season to result in a voltage of approximately 60% of the pre-fault voltage.

Refer to Table 3-1 for a list of the calculated single-phase fault impedances used for this analysis.

Table 3-1
Calculated Single-Phase Fault Impedances for this Analysis

Cont. No.*	Cont. Name	Single-Phase Fault Impedance (MVA)				
		2015 Summer	2015 Winter	2020 Summer	2020 Winter	2025 Summer
3	FLT52-SB	-6468.8	-6062.5	-6875.0	-6875.0	-7687.5
5	FLT54-SB	-3625.0	-2812.5	-4437.5	-4031.3	-4437.5
12	FLT61-SB	-3625.0	-2812.5	-4437.5	-4031.3	-4437.5
14	FLT65-SB	-6468.8	-6062.5	-6875.0	-6875.0	-7687.5
16	FLT68-SB	-6468.8	-6062.5	-6875.0	-6875.0	-7687.5

*Refer to Table 2-3 for a description of the contingency

Bus voltages, machine rotor angles, and previously queued generation in the study area were monitored in addition to bus voltages and machine rotor angles in the following areas:

- 520 AEPW
- 524 OKGE
- 525 WFEC
- 526 SPS
- 531 MIDW
- 534 SUNC
- 536 WERE

Requested and previously queued generation outside the above study area was also monitored.

The results of the analysis determined if reactive compensation or system upgrades were required to obtain acceptable system performance. If additional reactive compensation was required, the size, type, and location were determined. The proposed reactive reinforcements would ensure the wind or solar farm meets FERC Order 661A low voltage requirements and return the wind or solar farm to its pre-disturbance operating voltage. If the results indicated the need for fast responding reactive support, dynamic support such as an SVC or STATCOM was investigated. If tripping of the prior queued projects was observed during the stability analysis (for under/over voltage or under/over frequency) the simulations were re-ran with the prior queued project's voltage and frequency tripping disabled.

3.2 Stability Analysis Results

The Stability Analysis determined that there were no contingencies that resulted in system instability or generation tripping offline for the 2015 Summer Peak, 2015 Winter Peak, and 2025 Summer peak conditions when all generation interconnection requests were at 100% output.

However, it was determined that two contingencies, FLT221-3PH resulting in the loss of the Woodward to Border 345 kV line and FLT229-3PH resulting in the loss of the Border to Tuco 345 kV line, resulted in post-contingency voltages not recovering to above 0.90 p.u. at the O.K.U. 345 kV bus and GEN-2014-074 Tap 345 kV bus. After discussion with SPP, it was determined that a minimum of 2 x 130 Mvar capacitor banks will be installed at the O.K.U. 345 kV bus, in addition to the existing 3 x 30 Mvar capacitor banks. The total reactive support at the O.K.U. 345 kV bus will be 350 Mvar. With the additional 2 x 130 Mvar capacitor banks at O.K.U. 345 kV, all voltages recovered within SPP criteria.

Refer to Table 3-2 for a summary of the Stability Analysis results for the contingencies listed in Table 2-3. Table 3-2 is a summary of the stability results for the 2015 Summer Peak, 2015 Winter Peak, and 2025 Summer Peak conditions and states whether the system remained stable or generation tripped offline and if acceptable voltage recovery was observed after the fault was cleared. Voltage recovery criteria includes ensuring that the transient voltage recovery is between 0.7 p.u. and 1.2 p.u. and determining if the post-contingency voltage recovered to above 0.90 p.u.

Refer to Appendix B, Appendix C, Appendix D, Appendix E, and Appendix F for a complete set of plots for all contingencies for 2015 Summer Peak, 2015 Winter Peak, 2020 Summer Peak, 2020 Winter Peak, and 2025 Summer Peak conditions, respectively.

Table 3-2
Stability Analysis Summary of Results for 2015 Summer, 2015 Winter, 2020 Summer, 2020 Winter, and 2025 Summer Peak Conditions

Cont. No.	Cont. Name	2015 Summer Peak			2015 Winter Peak			2020 Summer Peak			2020 Winter Peak			2025 Summer Peak		
		Voltage Recovery			Voltage Recovery			Voltage Recovery			Voltage Recovery			Voltage Recovery		
		Less than .70 p.u.	Greater than 1.20 p.u.	Stable?	Less than .70 p.u.	Greater than 1.20 p.u.	Stable?	Less than .70 p.u.	Greater than 1.20 p.u.	Stable?	Less than .70 p.u.	Greater than 1.20 p.u.	Stable?	Less than .70 p.u.	Greater than 1.20 p.u.	Stable?
1	FLT50-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
2	FLT51-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
3	FLT52-SB	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
4	FLT53-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
5	FLT54-SB	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
6	FLT55-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
7	FLT56-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
8	FLT57-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
9	FLT58-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
10	FLT59-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
11	FLT60-PO	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
12	FLT61-SB	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
13	FLT64-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
14	FLT65-SB	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
15	FLT67-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
16	FLT68-SB	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
17	FLT73-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
18	FLT74-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
19	FLT75-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
20	FLT76-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
21	FLT77-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
22	FLT78-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
23	FLT79-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
24	FLT80-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
25	FLT81-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
26	FLT82-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
27	FLT88-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
28	FLT90-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
29	FLT91-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
30	FLT93-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
31	FLT94-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
32	FLT95-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
33	FLT96-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
34	FLT97-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
35	FLT117-3PH		N/A			N/A		No	No	Yes	No	No	Yes	No	No	Yes
36	FLT123-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
37	FLT125-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
38	FLT126-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
39	FLT132-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
40	FLT133-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
41	FLT134-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
42	FLT135-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
43	FLT136-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
44	FLT137-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes

Table 3-2 (Continued)
Stability Analysis Summary of Results for 2015 Summer, 2015 Winter, 2020 Summer, 2020 Winter, and 2025 Summer Peak Conditions

Cont. No.	Cont. Name	2015 Summer Peak			2015 Winter Peak			2020 Summer Peak			2020 Winter Peak			2025 Summer Peak		
		Voltage Recovery			Voltage Recovery			Voltage Recovery			Voltage Recovery			Voltage Recovery		
		Less than .70 p.u.	Greater than 1.20 p.u.	Stable?	Less than .70 p.u.	Greater than 1.20 p.u.	Stable?	Less than .70 p.u.	Greater than 1.20 p.u.	Stable?	Less than .70 p.u.	Greater than 1.20 p.u.	Stable?	Less than .70 p.u.	Greater than 1.20 p.u.	Stable?
45	FLT138-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
46	FLT139-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
47	FLT140-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
48	FLT141-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
49	FLT142-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
50	FLT143-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
51	FLT144-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
52	FLT145-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
53	FLT146-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
54	FLT147-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
55	FLT148-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
56	FLT172-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
57	FLT174-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
58	FLT175-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
59	FLT176-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
60	FLT177-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
61	FLT178-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
62	FLT179-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
63	FLT180-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
64	FLT181-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
65	FLT182-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
66	FLT183-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
67	FLT184-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
68	FLT185-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
69	FLT186-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
70	FLT187-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
71	FLT188-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
72	FLT189-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
73	FLT190-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
74	FLT191-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
75	FLT192-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
76	FLT193-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
77	FLT194-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
78	FLT195-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
79	FLT196-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
80	FLT197-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
81	FLT198-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
82	FLT199-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
83	FLT200-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
84	FLT201-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
85	FLT202-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
86	FLT203-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
87	FLT204-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
88	FLT205-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes

Table 3-2 (Continued)
Stability Analysis Summary of Results for 2015 Summer, 2015 Winter, 2020 Summer, 2020 Winter, and 2025 Summer Peak Conditions

Cont. No.	Cont. Name	2015 Summer Peak			2015 Winter Peak			2020 Summer Peak			2020 Winter Peak			2025 Summer Peak		
		Voltage Recovery		Stable?	Voltage Recovery		Stable?	Voltage Recovery		Stable?	Voltage Recovery		Stable?	Voltage Recovery		Stable?
		Less than .70 p.u.	Greater than 1.20 p.u.		Less than .70 p.u.	Greater than 1.20 p.u.		Less than .70 p.u.	Greater than 1.20 p.u.		Less than .70 p.u.	Greater than 1.20 p.u.		Less than .70 p.u.	Greater than 1.20 p.u.	
89	FLT206-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
90	FLT207-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
91	FLT208-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
92	FLT209-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
93	FLT210-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
94	FLT211-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
95	FLT212-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
96	FLT213-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
97	FLT214-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	Yes	Yes	No	No	Yes
98	FLT215-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	Yes	Yes	No	No	Yes
99	FLT216-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	Yes	Yes	No	No	Yes
100	FLT217-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
101	FLT218-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
102	FLT219-3PH	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
103	FLT221-3PH	No*	No	Yes	No*	No	Yes	No	No	Yes	No*	No	Yes	No	No	Yes
104	FLT224-3PH	No	No	Yes	No	No	Yes	N/A			No	No	Yes	N/A		
105	FLT225-3PH	No	No	Yes	No	No	Yes	N/A			No	No	Yes	N/A		
106	FLT229-3PH	No*	No	Yes	No*	No	Yes	No	No	Yes	No*	No	Yes	No	No	Yes

*Note: Voltage at O.K.U. 345 kV and GEN-2014-074 Tap 345 kV does not recover to above 0.9 p.u.

The limiting fault for the voltage violation observed at the O.K.U. 345 kV bus was FLT221-3PH, loss of the Woodward to Border 345 kV line, during the 2015 Summer Peak case. Refer to Figure 3-1 for a comparison plot of the voltage at O.K.U 345 kV for the 2015 Summer Peak case with and without system upgrades.

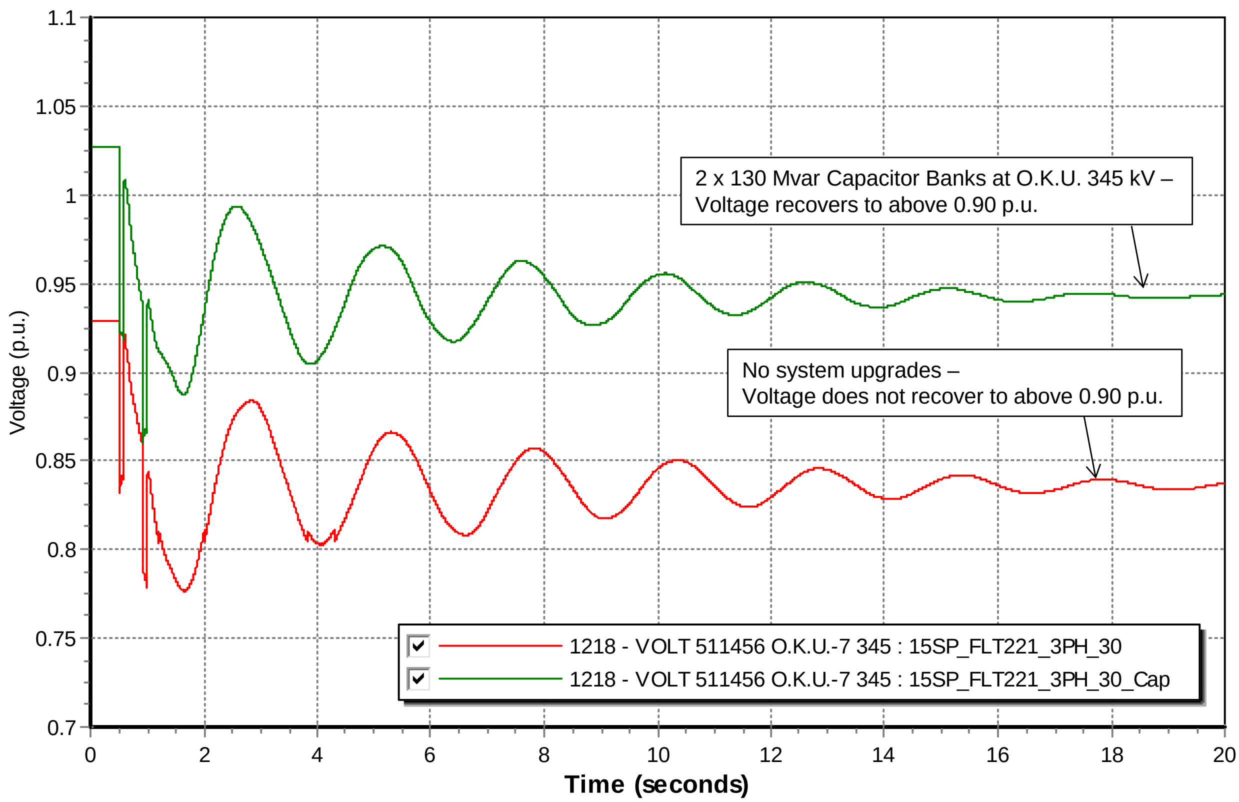

Figure 3-1. Plot of the O.K.U. 345 kV bus voltage for FLT221-3PH for the 2015 Summer Peak case with and without system upgrades.

After the 2 x 130 Mvar capacitor banks were added at the O.K.U. 345 kV bus, it was determined that all voltages recovered within SPP criteria.

SECTION 4: SHORT CIRCUIT ANALYSIS

The objective of this task is to quantify the three-phase to ground fault currents for the 2025 Summer Peak season for each interconnecting generator.

4.1 Approach

The short-circuit analysis will assess breaker adequacy and fault duties for the generator interconnection bus and five buses away from the point of interconnection. MEPPI will assume no outages to find maximum short-circuit currents that flow through the breaker. The Automatic Sequencing Fault Calculation (ASCC) function in PSS/E was utilized to perform this task. FLAT conditions were applied to pre-fault conditions and the following adjustments were utilized:

- All synchronous and asynchronous machine P and Q output was set to zero
- All transformer tap ratios were set to 1.0 p.u. and all phase shift angles were set to zero
- All generator reactance's were fixed to the subtransient reactance
- All line charging was set to zero
- All shunts were set to zero
- All loads were set to zero
- All pre-fault bus voltages were set to 1.0 p.u. and a phase shift angle of zero

Note upgrades found to be necessary for the Stability Analysis were included in the Short-Circuit Analysis.

4.2 Short Circuit Analysis Results

The maximum fault current for each bus is provided for the 2025 Summer Peak condition. The following tables show the short circuit results for the study generators:

- Table 4-1: Short Circuit Analysis for GEN-2014-074
- Table 4-2: Short Circuit Analysis for GEN-2015-014
- Table 4-3: Short Circuit Analysis for GEN-2015-022
- Table 4-4: Short Circuit Analysis for ASGI-2015-002

Table 4-1
Short Circuit Analysis for Study Project GEN-2014-074

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
511422	FLETCHR4	138	7.79	524415	AMA_SOUTH 6	230	13.40	526679	CIRRUS_WND 6	230	5.08
511423	FLE TAP4	138	8.51	524623	DEAFSMITH 6	230	8.06	526784	AMOCOWASSON6	230	13.83
511431	LWS S4	138	10.76	524909	ROSEVELT_N 6	230	8.98	526792	PRENTICE 3	115	5.86
511436	COMANC-2	69	9.64	524911	ROSEVELT_S 6	230	8.98	526928	LE-PLNSINT 3	115	9.50
511437	COMANC-4	138	17.52	524915	SW_4K33 6	230	8.98	526934	YOAKUM 3	115	16.49
511439	LWSTAP 4	138	11.20	525192	KRESS_INT 3	115	11.22	526935	YOAKUM 6	230	17.52
511456	O.K.U.-7	345	5.13	525212	SWISHER 3	115	10.33	526936	YOAKUM_345	345	8.93
511466	L.E.S.-2	69	16.33	525213	SWISHER 6	230	10.24	527010	OXYBRU_TP 6	230	13.91
511467	L.E.S.-4	138	23.39	525326	COX 3	115	6.05	527041	ARCO_TP 3	115	12.95
511468	L.E.S.-7	345	11.94	525414	LAMTON 3	115	7.97	527146	MUSTANG 3	115	22.21
511469	LGORE-N2	69	7.94	525453	HALE_CNTY 2	69	6.97	527149	MUSTANG 6	230	15.58
511470	LGORE-S2	69	6.89	525454	HALE_CNTY 3	115	10.35	527151	GS-MUSTANG 6	230	15.58
511474	SHERID4	138	11.95	525460	NEWHART 3	115	15.24	527194	LG-PLSHILL 3	115	7.50
511477	S.W.S.-4	138	33.49	525461	NEWHART 6	230	10.97	527276	SEMINOLE 6	230	7.25
511486	ELGINJT4	138	9.89	525480	PLANT_X 3	115	26.24	527865	CUNNINHAM 6	230	17.00
511487	ELGINJT2	69	8.46	525481	PLANT_X 6	230	27.76	527891	HOBBS_INT 3	115	32.23
511488	112GORE4	138	12.28	525524	TOLK_EAST 6	230	28.60	527894	HOBBS_INT 6	230	18.67
511494	COMMTAP4	138	20.60	525531	TOLK_WEST 6	230	28.60	527896	HOBBS_INT 7	345	8.39
511512	RPPAPER4	138	11.59	525543	TOLK_TAP 6	230	28.60	527962	POTASH_JCT 3	115	14.98
511537	ARTVLTP4	138	11.38	525549	TOLK 7	345	7.09	527965	KIOWA 7	345	5.71
511553	CHISHOLM7	345	5.35	525731	SP-ABERNTHY2	69	3.02	528027	RDRUNNER 7	345	3.82
511557	CHISHOLM6	230	8.26	525738	HALECENTER 2	69	2.46	528185	NLOV_PLT 7	345	4.50
514785	WOODWRD4	138	20.66	525779	FLOYD_CNTY 2	69	5.57	528611	GAINESGENTP6	230	8.77
514796	IODINE-4	138	7.08	525780	FLOYD_CNTY 3	115	6.66	529304	OMDUNCN4	138	6.55
514801	MINCO 7	345	15.92	525816	TUCO_INT2 2	69	4.67	539800	CLARKCOUNTY7	345	12.17
514809	JOHNCO 7	345	8.79	525826	TUCO_INT 2	69	7.92	539801	THISTLE7	345	15.83
514901	CIMARON7	345	29.92	525828	TUCO_INT 3	115	20.04	539804	THISTLE4	138	16.43
515135	SUNNYSD4	138	16.49	525830	TUCO_INT 6	230	22.29	560000	G11-14-TAP	345	13.59
515136	SUNNYSD7	345	9.69	525832	TUCO_INT 7	345	11.98	560013	G14-057T	345	9.03
515375	WWRDEHV7	345	20.06	525840	ANTELOPE_1 6	230	22.12	560027	G14-074-TAP	345	6.45
515376	WWRDEHV4	138	25.35	525853	LH-WIL&ELLN2	69	2.58	560033	G1524&G1525T	345	19.49
515394	KEENAN 4	138	9.03	525885	SP-NEWDEAL 2	69	3.39	562004	G11-025-TAP	115	5.92
515398	OUSPRT 4	138	9.59	525926	CROSBY 3	115	5.18	562075	G11-051-TAP	345	16.59
515407	TATONGA7	345	16.34	526076	STANTON_W 3	115	9.31	562480	G13-027-TAP	230	9.35
515444	MCNOWND7	345	15.87	526109	SP-ERSKINE 3	115	11.55	579351	GEN-2007-062	345	8.54
515458	BORDER 7	345	5.10	526146	INDIANA 3	115	9.73	579358	G07-062-HV-2	345	6.52
515549	MNCWND37	345	11.05	526159	CARLISLE 2	69	2.57	581112	GEN-2011-014	345	10.14
515554	BVRCNTY7	345	14.68	526160	CARLISLE 3	115	13.54	582019	GEN-2011-019	345	20.06
515800	GRACMNT7	345	14.43	526161	CARLISLE 6	230	13.83	582020	GEN-2011-020	345	20.06
515802	GRACMNT4	138	27.92	526162	LP-DOUD_TP 3	115	11.89	583090	G1149&G1504	345	4.66
520814	ANADARK4	138	32.31	526192	MURPHY 3	115	10.81	583110	GEN-2011-051	345	16.59
521089	WASHITA4	138	27.50	526268	LUBBCK_STH 3	115	19.21	583340	GEN-2012-020	230	9.11
521157	HUGO 7	345	10.72	526269	LUBBCK_STH 6	230	19.15	583840	GEN-2013-027	230	8.29
522823	LP-MILWAKEE6	230	13.38	526297	LUBBCK_EST 2	69	8.08	583990	GEN-2014-049	345	7.85
522828	LP-MILWAKEE2	69	8.41	526298	LUBBCK_EST 3	115	15.52	584030	G14053&14054	230	8.30
522861	LP-SOUTHEST6	230	17.22	526299	LUBBCK_EST 6	230	13.54	584070	GEN-2014-057	345	6.13
522866	LP-COOK 2	69	35.12	526337	JONES 6	230	21.14	584440	GEN-2014-074	345	6.08
522870	LP-HOLLY 6	230	16.99	526435	SUNDOWN 6	230	11.18	584640	GEN-2015-022	115	10.33
522888	LP-WADSWRTH6	230	12.63	526460	AMOCO_SS 6	230	9.79	590001	OKLEHV24	138	4.79
523959	POTTER_CO 6	230	20.41	526524	WOLFFORTH 3	115	11.65	590003	OKLEHV14	138	4.80
524044	NICHOLS 6	230	25.34	526525	WOLFFORTH 6	230	13.79	599891	OKLAUN 7	345	4.04
524365	RANDALL 6	230	14.22	526676	GRASSLAND 3	115	6.17	599955	PNM-DC6	230	8.98
524414	AMA_SOUTH 3	115	16.58	526677	GRASSLAND 6	230	6.54				

Table 4-2
Short Circuit Analysis for Study Project GEN-2015-014

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
525481	PLANT_X 6	230	27.76	526435	SUNDOWN 6	230	11.18
525958	MORTON 2	69	1.65	526445	AMOCO_TP 3	115	10.38
525965	LC-WHTEFACE2	69	2.37	526452	AMOCO_CRYO 3	115	6.44
525972	WHITEFACE 2	69	3.41	526460	AMOCO_SS 6	230	9.79
526020	HOCKLEY 3	115	5.59	526484	LG-LEVELAND3	115	9.30
526030	LC-PETTIT 2	69	1.89	526525	WOLFFORTH 6	230	13.79
526036	LC-OPDYKE 3	115	5.86	526792	PRENTICE 3	115	5.86
526042	COBLE 2	69	2.28	526928	LE-PLNSINT 3	115	9.50
526352	LEHMAN 3	115	6.03	526934	YOAKUM 3	115	16.49
526360	COCHRAN 2	69	5.81	526935	YOAKUM 6	230	17.52
526361	COCHRAN 3	115	6.89	526944	LG-PLAINS 3	115	7.73
526372	LG-SUNDOWN 2	69	2.37	527041	ARCO_TP 3	115	12.95
526379	MIDDLETON 2	69	3.54	527194	LG-PLSHILL 3	115	7.50
526386	MALLET 2	69	2.98	528626	LE-PLNSINT 2	69	3.60
526395	TEXACO 2	69	2.60	528740	LE-PLANS_TP2	69	2.76
526424	PACIFIC 3	115	9.47	560030	LEHMAN 3	115	6.44
526434	SUNDOWN 3	115	11.11	584560	GEN-2015-014	115	5.06

Table 4-3
Short Circuit Analysis for Study Project GEN-2015-022

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
511456	O.K.U.-7	345	5.13	524522	CANYON E_TP3	115	5.11	525524	TOLK_EAST 6	230	28.60
515375	WWRDEHV7	345	20.06	524530	PALO_DURO 3	115	6.55	525531	TOLK_WEST 6	230	28.60
515458	BORDER 7	345	5.10	524544	SPRING_DRW 3	115	6.36	525543	TOLK_TAP 6	230	28.60
522800	MU-TULIA 3	115	5.10	524622	DEAFSMITH 3	115	11.97	525549	TOLK 7	345	7.09
522823	LP-MILWAKEE6	230	13.38	524623	DEAFSMITH 6	230	8.06	525614	W_LITLFLDTP3	115	8.26
522828	LP-MILWAKEE2	69	8.41	524694	DS-#22 3	115	4.97	525615	W_LITTLFLD 3	115	7.72
522861	LP-SOUTHEST6	230	17.22	524714	CASTRO_TP 2	69	3.66	525636	LAMB_CNTY 3	115	9.72
522866	LP-COOK 2	69	35.12	524721	DS-#15&#19 2	69	3.68	525637	LAMB_CNTY 6	230	5.61
522870	LP-HOLLY 6	230	16.99	524728	DS-CASTRO 2	69	4.46	525731	SP-ABERNTHY2	69	3.02
522888	LP-WADSWRTH6	230	12.63	524734	DS-#21 3	115	10.84	525738	HALECENTER 2	69	2.46
523095	HITCHLAND 6	230	14.40	524745	CASTRO_CNTY2	69	9.61	525745	LH-HALECTR 2	69	2.44
523097	HITCHLAND 7	345	15.30	524746	CASTRO_CNTY3	115	11.67	525779	FLOYD_CNTY 2	69	5.57
523221	XIT_INTG 6	230	2.58	524909	ROSEVELT_N 6	230	8.98	525780	FLOYD_CNTY 3	115	6.66
523267	PRINGLE 6	230	4.48	524911	ROSEVELT_S 6	230	8.98	525816	TUCO_INT2 2	69	4.67
523308	MOORE_E 3	115	10.63	524915	SW_4K33 6	230	8.98	525826	TUCO_INT 2	69	7.92
523309	MOORE_CNTY 6	230	6.62	525018	EMULESH&VLY3	115	5.86	525828	TUCO_INT 3	115	20.04
523339	FAIN 3	115	5.26	525019	EMU&VLY_TP 3	115	6.43	525830	TUCO_INT 6	230	22.29
523410	CRMWA_#4 3	115	9.70	525028	BAILEYCO 3	115	6.37	525832	TUCO_INT 7	345	11.98
523544	HUTCH_N 3	115	15.54	525056	BC-EARTH 3	115	9.12	525840	ANTELOPE_1 6	230	22.12
523546	HUTCH_S 3	115	15.54	525124	HART_INDUST3	115	7.64	525853	LH-WIL&ELLN2	69	2.58
523551	HUTCHISON 6	230	7.18	525132	LC-N_OLTON 2	69	3.11	525885	SP-NEWDEAL 2	69	3.39
523770	GRAPEVINE 3	115	8.25	525143	HAPPY_CTYTP2	69	3.25	525926	CROSBY 3	115	5.18
523771	GRAPEVINE 6	230	5.70	525153	HAPPY_INT 2	69	3.53	526076	STANTON_W 3	115	9.31
523777	WHEELER 6	230	5.80	525154	HAPPY_INT 3	115	5.36	526109	SP-ERSKINE 3	115	11.55
523817	MIDSTRM_TP 3	115	6.71	525179	TULIA_TP 3	115	6.30	526146	INDIANA 3	115	9.73
523869	CHAN/TASCOS6	230	3.79	525191	KRESS_INT 2	69	4.44	526159	CARLISLE 2	69	2.57
523959	POTTER_CO 6	230	20.41	525192	KRESS_INT 3	115	11.22	526160	CARLISLE 3	115	13.54
523961	POTTER_CO 7	345	7.68	525203	SW-KRESS 2	69	4.44	526161	CARLISLE 6	230	13.83
523977	HARRNG_WST 6	230	26.09	525212	SWISHER 3	115	10.33	526162	LP-DOUD_TP 3	115	11.89
523978	HARRNG_MID 6	230	26.09	525213	SWISHER 6	230	10.24	526192	MURPHY 3	115	10.81
523979	HARRNG_EST 6	230	26.09	525224	KRESS_RURL 2	69	2.51	526268	LUBBCK_STH 3	115	19.21
524007	ROLLHILLS 3	115	19.31	525225	KRESS_RURAL3	115	6.29	526269	LUBBCK_STH 6	230	19.15
524010	ROLLHILLS 6	230	19.35	525249	LH-PLW&FNY 2	69	1.59	526297	LUBBCK_EST 2	69	8.08
524016	ASARCO 3	115	26.39	525256	SW_9848 2	69	3.10	526298	LUBBCK_EST 3	115	15.52
524018	ASARCO_TP 3	115	28.51	525257	N_PLAINVEW 3	115	5.15	526299	LUBBCK_EST 6	230	13.54
524043	NICHOLS 3	115	30.49	525271	KISER 2	69	3.48	526337	JONES 6	230	21.14
524044	NICHOLS 6	230	25.34	525272	KISER 3	115	5.16	526434	SUNDOWN 3	115	11.11
524058	WHITAKER 3	115	21.86	525284	WESTRIDGE 2	69	4.29	526435	SUNDOWN 6	230	11.18
524079	CONWAY 3	115	5.02	525291	PLAINVW_TP 2	69	6.54	526460	AMOCO_SS 6	230	9.79
524163	EAST_PLANT 6	230	13.67	525298	S_PLAINVEW 2	69	2.59	526524	WOLFFORTH 3	115	11.65
524224	MANHATTAN 3	115	18.38	525307	E_PLAINVEW 2	69	2.46	526525	WOLFFORTH 6	230	13.79
524266	BUSHLAND 3	115	9.35	525316	LH-PROVDNCE2	69	3.39	526676	GRASSLAND 3	115	6.17
524267	BUSHLAND 6	230	9.73	525325	COX 2	69	3.39	526677	GRASSLAND 6	230	6.54
524290	WILDOR2_JUS6	230	6.64	525326	COX 3	115	6.05	526679	CIRRUS_WND 6	230	5.08
524296	SPNSPUR_WND7	345	4.74	525339	AIKEN_RURL 2	69	2.46	526935	YOAKUM 6	230	17.52
524322	GEORGIA 3	115	16.35	525404	LC-OLTON 2	69	4.56	526936	YOAKUM_345	345	8.93
524338	SOUTHEAST 3	115	10.98	525413	LAMTON 2	69	5.27	527896	HOBBS_INT 7	345	8.39
524345	OSAGE 3	115	13.73	525414	LAMTON 3	115	7.97	560027	G14-074-TAP	345	6.45
524364	RANDALL 3	115	20.84	525425	CORNER 2	69	3.65	562004	G11-025-TAP	115	5.92
524365	RANDALL 6	230	14.22	525432	SP-HALFWAY 2	69	5.91	562480	G13-027-TAP	230	9.35
524377	FARMERS 3	115	15.07	525440	LC-S_OLTON 3	115	7.66	583090	G1149&G1504	345	4.66
524388	CROUSE_HIND3	115	15.07	525453	HALE_CNTY 2	69	6.97	583340	GEN-2012-020	230	9.11
524397	ARROWHEAD 3	115	13.56	525454	HALE_CNTY 3	115	10.35	584030	G14053&14054	230	8.30
524404	OWENSCORN 3	115	14.78	525460	NEWHART 3	115	15.24	584220	GEN-2014-040	115	10.31
524414	AMA_SOUTH 3	115	16.58	525461	NEWHART 6	230	10.97	584440	GEN-2014-074	345	6.08
524415	AMA_SOUTH 6	230	13.40	525480	PLANT_X 3	115	26.24	584640	GEN-2015-022	115	10.33
524425	ESTACADO_TP3	115	13.19	525481	PLANT_X 6	230	27.76	599955	PNM-DC6	230	8.98

Table 4-4
Short Circuit Analysis for Study Project ASGI-2015-002

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
522823	LP-MILWAKEE6	230	13.38	526491	LG-CLAUENE 3	115	7.91
522861	LP-SOUTHEST6	230	17.22	526506	LG-DOCWEBR 2	69	4.92
525481	PLANT_X 6	230	27.76	526524	WOLFFORTH 3	115	11.65
525830	TUCO_INT 6	230	22.29	526525	WOLFFORTH 6	230	13.79
526109	SP-ERSKINE 3	115	11.55	526735	TERRY_CNTY 2	69	6.91
526159	CARLISLE 2	69	2.57	526736	TERRY_CNTY 3	115	10.23
526160	CARLISLE 3	115	13.54	526747	LG-BROWNFLD2	69	3.55
526161	CARLISLE 6	230	13.83	526792	PRENTICE 3	115	5.86
526162	LP-DOUD_TP 3	115	11.89	526934	YOAKUM 3	115	16.49
526176	LP-DOUD 3	115	9.20	527080	EL_PASO 3	115	15.51
526192	MURPHY 3	115	10.81	527125	DENVER_CTY 2	69	8.60
526268	LUBBCK_STH 3	115	19.21	527130	DENVER_N 3	115	20.62
526269	LUBBCK_STH 6	230	19.15	527136	DENVER_S 3	115	20.62
526337	JONES 6	230	21.14	527146	MUSTANG 3	115	22.21
526434	SUNDOWN 3	115	11.11	527202	SEAGRAVES 3	115	8.50
526435	SUNDOWN 6	230	11.18	527212	DIAMONDBACK3	115	3.03
526460	AMOCO_SS 6	230	9.79	527261	SULPHUR 2	69	3.35
526469	SP-YUMA 2	69	3.07	527262	SULPHUR 3	115	5.64
526475	YUMA_INT 3	115	11.17	527286	XTO_RUSSEL 3	115	10.00
526481	SP-WOLF_TP 3	115	11.37	583810	ASGI2013-006	115	8.79
526483	SP-WOLFORTH3	115	8.79	584030	G14053&14054	230	8.30
526484	LG-LEVELAND3	115	9.30	584720	ASGI2015-002	69	2.15

SECTION 5: POWER FACTOR ANALYSIS

The objective of this task is to quantify the power factor at the point of interconnection for the wind farms during base case and system contingencies. SPP transmission planning practice requires interconnecting generation projects to maintain the power factor (pf) at the Point of Interconnection (POI) within +/- 0.95 pf for system intact conditions and for post-contingency conditions. This is analyzed by having the wind farm maintain a prescribed voltage schedule at the point of interconnection of 1.0 p.u. voltage.

The 2015 Summer Peak, 2015 Winter Peak, 2020 Summer Peak, 2020 Winter Peak, and 2025 Summer Peak power flows provided by SPP were examined prior to the Power Factor Analysis to ensure they contained the proposed study project modeled at 100% of the nameplate rating and any previously queued projects listed in Table 2-2. There was no suspect power flow data in the study area. The proposed study project and any previously queued projects at the same point of interconnection were turned off during the power factor analysis. The wind farm(s) were then replaced by a generator modeled at the high side bus with the same real power (MW) capability as the wind farm(s) and open limits for the reactive power set points (Mvar). The generator was set to hold the POI scheduled bus voltage. All N-1, three-phase fault contingencies from Table 2-3 were then applied and the reactive power required to maintain the bus voltage was recorded.

5.1 Approach

GEN-2014-074 was disabled and a generator was placed at the study project's high voltage bus. The generator was modeled with PGEN = 152.0 MW, QMin = -9999 Mvar, and QMax = 9999 Mvar. All buses and transformers connected from the study project's high voltage bus to GEN-2014-074 were disabled. The scheduled voltage was set to 1.00 p.u. for all study years.

GEN-2015-014 was disabled and a generator was placed at the study project's high voltage bus. The generator was modeled with PGEN = 150.0 MW, QMin = -9999 Mvar, and QMax = 9999 Mvar. All buses and transformers connected from the study project's high voltage bus to GEN-2015-014 were disabled. The scheduled voltage was set to 1.00 p.u. for 2015 Summer Peak conditions, 1.001 for the 2015 Winter Peak conditions, 1.009 p.u. for the 2020 Summer Peak conditions, 1.004 for the 2020 Winter Peak conditions, and 1.02 for the 2025 Summer Peak conditions.

GEN-2015-022 was disabled and a generator was placed at the study project's high voltage bus. The generator was modeled with PGEN = 112.0 MW, QMin = -9999 Mvar, and QMax = 9999 Mvar. All buses and transformers connected from the study project's high voltage bus to GEN-2015-022 were disabled. The scheduled voltage was set to 1.005 p.u. for 2015 Summer Peak conditions, 1.007 for the 2015 Winter Peak conditions, 1.011 p.u. for the 2020 Summer Peak conditions, 1.002 for the 2020 Winter Peak conditions, and 1.005 for the 2025 Summer Peak conditions.

ASGI-2015-002, GNIRE SNL, and GNIRE ALSTOM were disabled and the generators were placed at the study project's high voltage bus. The generators were modeled with PGEN = 2.0 MW for ASGI-2015-002, PGEN = 0.9 MW for GNIRE SNL, PGEN = 1.67 MW for GNIRE ALSTOM, QMin = -9999 Mvar, and QMax = 9999 Mvar for all generators. All buses and transformers connected from the study project's high voltage bus to the generators were disabled. The scheduled voltage was set to 1.014 p.u. for 2015 Summer Peak conditions, 1.015 for the 2015 Winter Peak conditions, 1.015 p.u. for the 2020 Summer Peak conditions, 1.018 for the 2020 Winter Peak conditions, and 1.032 for the 2025 Summer Peak conditions.

5.2 Power Factor Analysis Results

The power factor was calculated for the 2015 Summer Peak, 2015 Winter Peak, 2020 Summer Peak, 2020 Winter Peak, and 2025 Summer Peak condition. The following tables show the power factor results for the study generators:

- Table 5-2: Power Factor Analysis for GEN-2014-074
- Table 5-3: Power Factor Analysis for GEN-2015-014
- Table 5-4: Power Factor Analysis for GEN-2015-022
- Table 5-5: Power Factor Analysis for ASGI-2015-002

Note that a positive Q (Mvar) output illustrates that the generator is absorbing reactive power from the system, implying a leading power factor; a negative Q (Mvar) illustrates that the generator is supplying reactive power to the system, implying a lagging power factor.

Table 5-1
Power Factor Analysis: GEN-2014-074

Ref No.	Case	2015 Summer Peak			2015 Winter Peak			2020 Summer Peak			2020 Winter Peak			2025 Summer Peak		
		Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
0	Base	0.650	Lagging	-177.48	0.733	Lagging	-141.26	0.873	Lagging	-85.11	0.809	Lagging	-110.31	0.979	Lagging	-32.03
1	FLT51-3PH	0.649	Lagging	-178.06	0.734	Lagging	-140.75	0.870	Lagging	-86.19	0.810	Lagging	-110.22	0.979	Lagging	-31.97
2	FLT53-3PH	0.653	Lagging	-176.31	0.742	Lagging	-137.48	0.876	Lagging	-83.65	0.812	Lagging	-109.12	0.981	Lagging	-30.19
3	FLT55-3PH	0.653	Lagging	-176.30	0.731	Lagging	-141.71	0.871	Lagging	-85.75	0.806	Lagging	-111.71	0.979	Lagging	-32.00
4	FLT56-3PH	0.651	Lagging	-177.26	0.733	Lagging	-141.16	0.871	Lagging	-85.54	0.809	Lagging	-110.62	0.977	Lagging	-32.80
5	FLT57-3PH	0.651	Lagging	-177.26	0.733	Lagging	-141.24	0.871	Lagging	-85.72	0.808	Lagging	-110.78	0.977	Lagging	-32.92
6	FLT58-3PH	0.650	Lagging	-177.81	0.731	Lagging	-142.08	0.868	Lagging	-87.11	0.802	Lagging	-113.03	0.975	Lagging	-34.81
7	FLT59-3PH	0.650	Lagging	-177.48	0.733	Lagging	-141.26	0.873	Lagging	-85.11	0.809	Lagging	-110.31	0.979	Lagging	-32.03
8	FLT64-3PH	0.645	Lagging	-179.90	0.728	Lagging	-143.16	0.867	Lagging	-87.45	0.805	Lagging	-111.99	0.977	Lagging	-33.15
9	FLT67-3PH	0.651	Lagging	-177.01	0.732	Lagging	-141.44	0.869	Lagging	-86.59	0.809	Lagging	-110.46	0.978	Lagging	-32.58
10	FLT73-3PH	0.645	Lagging	-180.08	0.731	Lagging	-141.76	0.870	Lagging	-86.33	0.807	Lagging	-111.05	0.977	Lagging	-33.08
11	FLT74-3PH	0.649	Lagging	-178.39	0.733	Lagging	-141.00	0.871	Lagging	-85.75	0.809	Lagging	-110.44	0.978	Lagging	-32.59
12	FLT75-3PH	0.650	Lagging	-177.79	0.732	Lagging	-141.47	0.873	Lagging	-84.74	0.810	Lagging	-110.21	0.978	Lagging	-32.13
13	FLT76-3PH	0.651	Lagging	-177.44	0.732	Lagging	-141.40	0.872	Lagging	-85.48	0.804	Lagging	-112.29	0.978	Lagging	-32.06
14	FLT77-3PH	0.651	Lagging	-177.03	0.729	Lagging	-142.62	0.873	Lagging	-84.94	0.809	Lagging	-110.54	0.978	Lagging	-32.52
15	FLT78-3PH	0.650	Lagging	-177.59	0.733	Lagging	-141.16	0.876	Lagging	-83.54	0.809	Lagging	-110.41	0.979	Lagging	-31.95
16	FLT79-3PH	0.649	Lagging	-178.02	0.731	Lagging	-142.05	0.876	Lagging	-83.80	0.812	Lagging	-109.33	0.979	Lagging	-31.98
17	FLT80-3PH	0.651	Lagging	-177.26	0.733	Lagging	-141.22	0.875	Lagging	-83.98	0.813	Lagging	-108.79	0.977	Lagging	-33.18
18	FLT81-3PH	0.645	Lagging	-179.98	0.728	Lagging	-143.24	0.868	Lagging	-87.10	0.806	Lagging	-111.58	0.976	Lagging	-33.61
19	FLT82-3PH	0.644	Lagging	-180.41	0.730	Lagging	-142.25	0.866	Lagging	-87.80	0.807	Lagging	-111.11	0.977	Lagging	-33.07
20	FLT88-3PH	0.653	Lagging	-176.34	0.745	Lagging	-136.10	0.858	Lagging	-90.86	0.789	Lagging	-118.20	0.972	Lagging	-36.53
21	FLT90-3PH	0.672	Lagging	-167.33	0.744	Lagging	-136.44	0.889	Lagging	-78.27	0.820	Lagging	-106.00	0.984	Lagging	-27.84
22	FLT91-3PH	0.652	Lagging	-176.68	0.725	Lagging	-144.25	0.875	Lagging	-83.97	0.815	Lagging	-107.98	0.978	Lagging	-32.28
23	FLT93-3PH	0.651	Lagging	-177.42	0.730	Lagging	-142.31	0.873	Lagging	-84.98	0.809	Lagging	-110.33	0.979	Lagging	-31.92
24	FLT94-3PH	0.650	Lagging	-177.67	0.732	Lagging	-141.33	0.872	Lagging	-85.34	0.808	Lagging	-110.94	0.978	Lagging	-32.09
25	FLT95-3PH	0.648	Lagging	-178.49	0.728	Lagging	-143.18	0.860	Lagging	-90.17	0.806	Lagging	-111.70	0.975	Lagging	-34.93
26	FLT96-3PH	0.650	Lagging	-177.67	0.732	Lagging	-141.37	0.872	Lagging	-85.25	0.811	Lagging	-109.71	0.978	Lagging	-32.06
27	FLT97-3PH	0.601	Lagging	-202.26	0.701	Lagging	-154.84	0.831	Lagging	-101.94	0.763	Lagging	-128.61	0.964	Lagging	-41.94
28	FLT117-3PH	0.650	Lagging	-177.48	0.733	Lagging	-141.26	0.890	Lagging	-77.88	0.812	Lagging	-109.19	0.979	Lagging	-31.86
29	FLT123-3PH	0.650	Lagging	-177.48	0.733	Lagging	-141.26	0.873	Lagging	-85.11	0.809	Lagging	-110.31	0.979	Lagging	-32.03
30	FLT125-3PH	0.650	Lagging	-177.48	0.733	Lagging	-141.26	0.873	Lagging	-85.11	0.809	Lagging	-110.31	0.979	Lagging	-32.03
31	FLT126-3PH	0.602	Lagging	-201.47	0.682	Lagging	-163.11	0.838	Lagging	-98.92	0.761	Lagging	-129.71	0.972	Lagging	-36.96
32	FLT132-3PH	0.652	Lagging	-176.59	0.730	Lagging	-142.11	0.872	Lagging	-85.29	0.809	Lagging	-110.39	0.979	Lagging	-31.93
33	FLT133-3PH	0.653	Lagging	-176.32	0.731	Lagging	-141.74	0.871	Lagging	-85.92	0.809	Lagging	-110.58	0.979	Lagging	-31.85
34	FLT134-3PH	0.652	Lagging	-176.77	0.730	Lagging	-142.32	0.873	Lagging	-85.05	0.809	Lagging	-110.41	0.978	Lagging	-32.12
35	FLT135-3PH	0.644	Lagging	-180.46	0.730	Lagging	-142.26	0.865	Lagging	-88.17	0.807	Lagging	-111.37	0.976	Lagging	-33.98
36	FLT136-3PH	0.650	Lagging	-177.48	0.733	Lagging	-141.26	0.874	Lagging	-84.53	0.808	Lagging	-111.00	0.977	Lagging	-32.83
37	FLT137-3PH	0.651	Lagging	-177.46	0.733	Lagging	-141.18	0.873	Lagging	-84.82	0.810	Lagging	-110.07	0.978	Lagging	-32.22
38	FLT138-3PH	0.634	Lagging	-185.34	0.720	Lagging	-146.46	0.855	Lagging	-92.01	0.795	Lagging	-116.06	0.971	Lagging	-37.13
39	FLT139-3PH	0.650	Lagging	-177.48	0.733	Lagging	-141.26	0.873	Lagging	-85.11	0.809	Lagging	-110.31	0.979	Lagging	-32.03
40	FLT140-3PH	0.651	Lagging	-177.45	0.729	Lagging	-142.64	0.872	Lagging	-85.33	0.805	Lagging	-111.88	0.977	Lagging	-32.92
41	FLT141-3PH	0.650	Lagging	-177.51	0.732	Lagging	-141.57	0.867	Lagging	-87.41	0.806	Lagging	-111.52	0.976	Lagging	-33.67
42	FLT142-3PH	0.645	Lagging	-179.91	0.724	Lagging	-144.86	0.866	Lagging	-87.77	0.805	Lagging	-112.19	0.977	Lagging	-33.30
43	FLT143-3PH	0.651	Lagging	-177.05	0.727	Lagging	-143.53	0.870	Lagging	-86.28	0.796	Lagging	-115.75	0.976	Lagging	-34.00
44	FLT144-3PH	0.651	Lagging	-177.39	0.733	Lagging	-140.99	0.872	Lagging	-85.14	0.810	Lagging	-110.24	0.979	Lagging	-31.87
45	FLT145-3PH	0.651	Lagging	-177.11	0.732	Lagging	-141.35	0.872	Lagging	-85.14	0.809	Lagging	-110.51	0.978	Lagging	-32.07
46	FLT146-3PH	0.651	Lagging	-177.26	0.732	Lagging	-141.51	0.872	Lagging	-85.29	0.809	Lagging	-110.60	0.978	Lagging	-32.04
47	FLT147-3PH	0.650	Lagging	-177.49	0.732	Lagging	-141.37	0.872	Lagging	-85.19	0.809	Lagging	-110.61	0.978	Lagging	-32.16
48	FLT148-3PH	0.650	Lagging	-177.58	0.733	Lagging	-141.24	0.872	Lagging	-85.33	0.809	Lagging	-110.30	0.978	Lagging	-32.21
49	FLT172-3PH	0.646	Lagging	-179.73	0.728	Lagging	-143.03	0.867	Lagging	-87.26	0.805	Lagging	-111.87	0.977	Lagging	-33.07
50	FLT174-3PH	0.650	Lagging	-177.85	0.733	Lagging	-141.24	0.874	Lagging	-84.32	0.808	Lagging	-110.84	0.978	Lagging	-32.71
51	FLT175-3PH	0.649	Lagging	-178.33	0.733	Lagging	-141.15	0.876	Lagging	-83.76	0.809	Lagging	-110.33	0.977	Lagging	-33.11
52	FLT176-3PH	0.634	Lagging	-185.16	0.722	Lagging	-145.79	0.862	Lagging	-89.48	0.795	Lagging	-115.86	0.973	Lagging	-35.89
53	FLT177-3PH	0.651	Lagging	-177.10	0.733	Lagging	-140.95	0.873	Lagging	-84.84	0.810	Lagging	-110.12	0.979	Lagging	-31.55
54	FLT178-3PH	0.649	Lagging	-178.16	0.732	Lagging	-141.27	0.871	Lagging	-85.56	0.808	Lagging	-110.68	0.978	Lagging	-32.20
55	FLT179-3PH	0.651	Lagging	-177.31	0.732	Lagging	-141.31	0.872	Lagging	-85.44	0.809	Lagging	-110.50	0.979	Lagging	-31.97
56	FLT180-3PH	0.650	Lagging	-177.48	0.733	Lagging	-141.26	0.873	Lagging	-85.11	0.809	Lagging	-110.31	0.979	Lagging	-32.03
57	FLT181-3PH	0.649	Lagging	-178.20	0.732	Lagging	-141.64	0.871	Lagging	-85.70	0.808	Lagging	-110.72	0.978	Lagging	-32.78
58	FLT182-3PH	0.642	Lagging	-181.73	0.726	Lagging	-143.94	0.864	Lagging	-88.51	0.802	Lagging	-113.09	0.975	Lagging	-34.66
59	FLT183-3PH	0.650	Lagging	-177.48	0.733	Lagging	-141.26	0.873	Lagging	-85.11	0.809	Lagging	-110.31	0.979	Lagging	-32.03
60	FLT184-3PH	0.642	Lagging	-181.33	0.725	Lagging	-144.24	0.867	Lagging	-87.48	0.799	Lagging	-114.33	0.977	Lagging	-33.33
61	FLT185-3PH	0.651	Lagging	-177.24	0.733	Lagging	-141.08	0.873	Lagging	-84.87	0.810	Lagging	-110.06	0.979	Lagging	-32.01
62	FLT186-3PH	0.651	Lagging	-177.27	0.732	Lagging	-141.27	0.873	Lagging	-85.08	0.809	Lagging	-110.34	0.979	Lagging	-31.88
63	FLT187-3PH	0.651	Lagging	-177.39	0.733	Lagging	-141.25	0.873	Lagging	-84.80	0.809	Lagging	-110.38	0.979	Lagging	-31.88
64	FLT188-3PH	0.651	Lagging	-177.09	0.733	Lagging	-141.16	0.872	Lagging	-85.32	0.809	Lagging	-110.52	0.979	Lagging	-31.81
65	FLT189-3PH	0.650	Lagging	-177.62	0.732	Lagging	-141.29	0.872	Lagging	-85.33	0.809	Lagging	-110.36	0.978	Lagging	-32.16

Table 5-1 (Continued)
Power Factor Analysis: GEN-2014-074

Ref No.	Case	2015 Summer Peak			2015 Winter Peak			2020 Summer Peak			2020 Winter Peak			2025 Summer Peak		
		Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
66	FLT190-3PH	0.650	Lagging	-177.48	0.733	Lagging	-141.26	0.873	Lagging	-85.11	0.809	Lagging	-110.31	0.979	Lagging	-32.03
67	FLT191-3PH	0.646	Lagging	-179.38	0.730	Lagging	-142.33	0.870	Lagging	-86.20	0.806	Lagging	-111.73	0.978	Lagging	-32.79
68	FLT192-3PH	0.650	Lagging	-177.48	0.733	Lagging	-141.26	0.873	Lagging	-85.11	0.809	Lagging	-110.31	0.979	Lagging	-32.03
69	FLT193-3PH	0.651	Lagging	-177.47	0.732	Lagging	-141.29	0.873	Lagging	-84.74	0.809	Lagging	-110.50	0.979	Lagging	-31.95
70	FLT194-3PH	0.651	Lagging	-177.41	0.733	Lagging	-141.26	0.873	Lagging	-85.09	0.809	Lagging	-110.35	0.978	Lagging	-32.09
71	FLT195-3PH	0.601	Lagging	-202.26	0.701	Lagging	-154.84	0.831	Lagging	-101.94	0.763	Lagging	-128.61	0.964	Lagging	-41.94
72	FLT196-3PH	0.650	Lagging	-177.48	0.733	Lagging	-141.26	0.873	Lagging	-85.11	0.809	Lagging	-110.31	0.979	Lagging	-32.03
73	FLT197-3PH	0.650	Lagging	-177.48	0.733	Lagging	-141.26	0.873	Lagging	-85.11	0.809	Lagging	-110.31	0.979	Lagging	-32.03
74	FLT198-3PH	0.651	Lagging	-177.05	0.734	Lagging	-140.67	0.873	Lagging	-84.97	0.811	Lagging	-109.62	0.978	Lagging	-32.06
75	FLT199-3PH	0.661	Lagging	-172.78	0.738	Lagging	-139.00	0.872	Lagging	-85.46	0.811	Lagging	-109.68	0.977	Lagging	-33.14
76	FLT200-3PH	0.651	Lagging	-177.11	0.734	Lagging	-140.82	0.873	Lagging	-85.06	0.811	Lagging	-109.69	0.978	Lagging	-32.08
77	FLT201-3PH	0.650	Lagging	-177.63	0.732	Lagging	-141.27	0.870	Lagging	-86.29	0.811	Lagging	-109.67	0.977	Lagging	-32.97
78	FLT202-3PH	0.651	Lagging	-177.18	0.734	Lagging	-140.79	0.873	Lagging	-84.98	0.811	Lagging	-109.60	0.979	Lagging	-32.01
79	FLT203-3PH	0.627	Lagging	-188.92	0.716	Lagging	-148.03	0.847	Lagging	-95.38	0.791	Lagging	-117.45	0.968	Lagging	-39.31
80	FLT204-3PH	0.655	Lagging	-175.28	0.735	Lagging	-140.26	0.872	Lagging	-85.15	0.813	Lagging	-109.04	0.978	Lagging	-32.05
81	FLT205-3PH	0.650	Lagging	-177.53	0.733	Lagging	-141.26	0.872	Lagging	-85.23	0.809	Lagging	-110.38	0.978	Lagging	-32.13
82	FLT206-3PH	0.650	Lagging	-177.93	0.733	Lagging	-141.09	0.875	Lagging	-84.18	0.810	Lagging	-109.90	0.979	Lagging	-31.46
83	FLT207-3PH	0.652	Lagging	-176.84	0.733	Lagging	-140.92	0.872	Lagging	-85.33	0.809	Lagging	-110.36	0.978	Lagging	-32.18
84	FLT208-3PH	0.649	Lagging	-178.09	0.731	Lagging	-142.02	0.869	Lagging	-86.36	0.810	Lagging	-110.08	0.977	Lagging	-33.39
85	FLT209-3PH	0.656	Lagging	-174.85	0.745	Lagging	-136.28	0.878	Lagging	-83.01	0.819	Lagging	-106.61	0.983	Lagging	-28.67
86	FLT210-3PH	0.650	Lagging	-177.75	0.731	Lagging	-141.76	0.870	Lagging	-86.21	0.799	Lagging	-114.24	0.978	Lagging	-32.62
87	FLT211-3PH	0.651	Lagging	-177.22	0.732	Lagging	-141.32	0.872	Lagging	-85.33	0.809	Lagging	-110.41	0.979	Lagging	-31.98
88	FLT212-3PH	0.650	Lagging	-177.69	0.732	Lagging	-141.54	0.873	Lagging	-84.90	0.809	Lagging	-110.40	0.979	Lagging	-31.76
89	FLT213-3PH	0.651	Lagging	-177.43	0.733	Lagging	-141.25	0.872	Lagging	-85.14	0.809	Lagging	-110.31	0.979	Lagging	-31.97
90	FLT214-3PH	0.975	Lagging	-34.58	0.996	Lagging	-12.79	1.000	Lagging	-3.59	1.000	Lagging	-3.71	1.000	Leading	2.47
91	FLT215-3PH	0.972	Leading	37.09	0.958	Leading	45.49	0.971	Leading	37.59	0.966	Leading	40.78	0.969	Leading	38.44
92	FLT216-3PH	0.814	Lagging	-108.42	0.938	Lagging	-56.03	0.936	Lagging	-57.35	0.945	Lagging	-52.35	0.960	Lagging	-44.19
93	FLT217-3PH	0.634	Lagging	-185.25	0.739	Lagging	-138.55	0.856	Lagging	-91.73	0.809	Lagging	-110.39	0.971	Lagging	-37.67
94	FLT218-3PH	0.683	Lagging	-162.58	0.774	Lagging	-124.42	0.904	Lagging	-72.05	0.848	Lagging	-95.07	0.985	Lagging	-26.50
95	FLT219-3PH	0.650	Lagging	-177.60	0.733	Lagging	-141.15	0.876	Lagging	-83.75	0.811	Lagging	-109.76	0.982	Lagging	-29.13
96	FLT221-3PH	0.413	Lagging	-335.23	0.500	Lagging	-263.46	0.651	Lagging	-177.04	0.574	Lagging	-216.77	0.852	Lagging	-93.24
97	FLT224-3PH	0.650	Lagging	-177.48	0.733	Lagging	-141.26	0.856	Lagging	-91.99	0.772	Lagging	-125.01	0.975	Lagging	-34.29
98	FLT225-3PH	0.650	Lagging	-177.48	0.733	Lagging	-141.26	0.863	Lagging	-88.89	0.781	Lagging	-121.60	0.980	Lagging	-31.11
99	FLT229-3PH	0.444	Lagging	-306.61	0.532	Lagging	-242.15	0.691	Lagging	-158.88	0.615	Lagging	-194.78	0.884	Lagging	-80.31

Study Generator GEN-2014-074

The Power Factor Analysis shows that GEN-2014-074 has a power factor range of 0.413 lagging (supplying) to 0.971 leading (absorbing) for the 2015 Summer Peak conditions, a power factor range of 0.499 lagging (supplying) to 0.958 leading (absorbing) for the 2015 Winter Peak conditions, a power factor range of 0.651 lagging (supplying) to 0.970 leading (absorbing) for the 2020 Summer Peak conditions, a power factor range of 0.574 lagging (supplying) to 0.966 leading (absorbing) for the 2020 Winter Peak conditions, and a power factor range of 0.852 lagging (supplying) to 0.969 leading (absorbing) for the 2025 Summer Peak conditions.

Table 5-2
Power Factor Analysis: GEN-2015-014

Ref No.	Case	2015 Summer Peak			2015 Winter Peak			2020 Summer Peak			2020 Winter Peak			2025 Summer Peak		
		Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
0	Base	0.990	Leading	21.68	0.980	Leading	30.08	0.972	Leading	36.59	0.977	Leading	32.99	0.956	Leading	46.07
1	FLT51-3PH	0.991	Leading	20.18	0.982	Leading	28.90	0.972	Leading	35.93	0.978	Leading	32.08	0.956	Leading	45.76
2	FLT53-3PH	0.991	Leading	20.60	0.989	Leading	22.61	0.974	Leading	35.16	0.982	Leading	28.59	0.960	Leading	43.47
3	FLT55-3PH	0.993	Leading	18.17	0.983	Leading	28.19	0.974	Leading	34.87	0.977	Leading	32.39	0.959	Leading	44.52
4	FLT56-3PH	0.991	Leading	20.53	0.981	Leading	29.84	0.973	Leading	35.67	0.977	Leading	32.64	0.958	Leading	44.63
5	FLT57-3PH	0.991	Leading	20.28	0.981	Leading	29.62	0.973	Leading	35.47	0.977	Leading	32.49	0.959	Leading	44.46
6	FLT58-3PH	0.990	Leading	20.98	0.985	Leading	26.46	0.974	Leading	34.60	0.979	Leading	30.94	0.961	Leading	42.98
7	FLT59-3PH	0.990	Leading	21.68	0.980	Leading	30.08	0.972	Leading	36.59	0.977	Leading	32.99	0.956	Leading	46.07
8	FLT64-3PH	0.991	Leading	20.59	0.981	Leading	29.40	0.972	Leading	36.35	0.976	Leading	33.11	0.956	Leading	46.14
9	FLT67-3PH	0.994	Leading	16.77	0.984	Leading	27.51	0.982	Leading	28.67	0.978	Leading	32.36	0.972	Leading	36.25
10	FLT73-3PH	0.990	Leading	21.76	0.980	Leading	30.11	0.971	Leading	36.69	0.977	Leading	33.01	0.956	Leading	46.19
11	FLT74-3PH	0.990	Leading	21.68	0.980	Leading	30.07	0.972	Leading	36.60	0.977	Leading	32.95	0.956	Leading	46.10
12	FLT75-3PH	0.990	Leading	21.49	0.980	Leading	30.12	0.972	Leading	36.39	0.977	Leading	32.97	0.956	Leading	45.93
13	FLT76-3PH	0.990	Leading	21.70	0.981	Leading	30.01	0.972	Leading	36.57	0.977	Leading	32.92	0.956	Leading	46.07
14	FLT77-3PH	0.991	Leading	19.83	0.982	Leading	29.15	0.973	Leading	35.66	0.978	Leading	32.29	0.958	Leading	45.12
15	FLT78-3PH	0.989	Leading	22.69	0.980	Leading	30.70	0.970	Leading	37.58	0.977	Leading	32.90	0.953	Leading	47.67
16	FLT79-3PH	0.990	Leading	21.71	0.980	Leading	30.08	0.971	Leading	36.95	0.976	Leading	33.21	0.955	Leading	46.41
17	FLT80-3PH	0.990	Leading	21.69	0.981	Leading	29.88	0.972	Leading	36.23	0.977	Leading	32.41	0.958	Leading	45.12
18	FLT81-3PH	0.992	Leading	19.60	0.984	Leading	27.50	0.973	Leading	35.78	0.977	Leading	32.48	0.958	Leading	44.65
19	FLT82-3PH	0.990	Leading	21.50	0.980	Leading	30.15	0.972	Leading	36.49	0.977	Leading	33.03	0.956	Leading	46.05
20	FLT88-3PH	0.990	Leading	21.78	0.980	Leading	30.07	0.972	Leading	36.46	0.978	Leading	32.21	0.956	Leading	45.81
21	FLT90-3PH	0.991	Leading	20.78	0.981	Leading	29.87	0.972	Leading	36.09	0.977	Leading	32.68	0.957	Leading	45.42
22	FLT91-3PH	0.990	Leading	21.86	0.981	Leading	29.40	0.972	Leading	36.56	0.977	Leading	33.10	0.956	Leading	46.04
23	FLT93-3PH	0.990	Leading	21.55	0.981	Leading	29.91	0.972	Leading	36.57	0.977	Leading	32.97	0.956	Leading	46.04
24	FLT94-3PH	0.990	Leading	21.67	0.980	Leading	30.22	0.972	Leading	36.47	0.977	Leading	32.70	0.956	Leading	45.98
25	FLT95-3PH	0.990	Leading	21.26	0.981	Leading	29.75	0.972	Leading	36.19	0.977	Leading	32.84	0.957	Leading	45.25
26	FLT96-3PH	0.990	Leading	21.65	0.981	Leading	30.03	0.972	Leading	36.55	0.977	Leading	33.08	0.956	Leading	46.05
27	FLT97-3PH	0.990	Leading	21.49	0.981	Leading	30.00	0.972	Leading	36.45	0.977	Leading	32.78	0.956	Leading	46.06
28	FLT117-3PH	0.990	Leading	21.68	0.980	Leading	30.08	0.974	Leading	35.07	0.982	Leading	28.47	0.966	Leading	39.92
29	FLT123-3PH	0.990	Leading	21.68	0.980	Leading	30.08	0.972	Leading	36.59	0.977	Leading	32.99	0.956	Leading	46.07
30	FLT125-3PH	0.990	Leading	21.68	0.980	Leading	30.08	0.972	Leading	36.59	0.977	Leading	32.99	0.956	Leading	46.07
31	FLT126-3PH	0.990	Leading	21.50	0.981	Leading	30.00	0.972	Leading	36.36	0.977	Leading	32.59	0.956	Leading	45.98
32	FLT132-3PH	0.991	Leading	20.68	0.980	Leading	30.18	0.971	Leading	36.92	0.977	Leading	32.86	0.955	Leading	46.83
33	FLT133-3PH	0.988	Leading	23.02	0.978	Leading	32.32	0.970	Leading	37.78	0.976	Leading	33.43	0.952	Leading	48.04
34	FLT134-3PH	0.991	Leading	20.28	0.981	Leading	29.66	0.972	Leading	36.40	0.977	Leading	32.55	0.956	Leading	46.09
35	FLT135-3PH	0.990	Leading	21.39	0.980	Leading	30.11	0.972	Leading	36.31	0.977	Leading	33.00	0.956	Leading	45.81
36	FLT136-3PH	0.990	Leading	21.68	0.980	Leading	30.08	0.973	Leading	35.27	0.978	Leading	32.25	0.959	Leading	44.37
37	FLT137-3PH	0.990	Leading	21.68	0.981	Leading	30.02	0.971	Leading	36.67	0.976	Leading	33.14	0.956	Leading	46.27
38	FLT138-3PH	0.990	Leading	21.80	0.980	Leading	30.16	0.971	Leading	36.66	0.977	Leading	32.94	0.956	Leading	46.19
39	FLT139-3PH	0.990	Leading	21.68	0.980	Leading	30.08	0.972	Leading	36.59	0.977	Leading	32.99	0.956	Leading	46.07
40	FLT140-3PH	0.992	Leading	19.66	0.982	Leading	28.65	0.975	Leading	34.15	0.978	Leading	32.34	0.963	Leading	42.23
41	FLT141-3PH	0.990	Leading	20.98	0.981	Leading	29.28	0.974	Leading	34.88	0.978	Leading	32.31	0.961	Leading	43.25
42	FLT142-3PH	0.994	Leading	16.28	0.987	Leading	24.42	0.975	Leading	34.15	0.978	Leading	31.92	0.961	Leading	43.07
43	FLT143-3PH	0.992	Leading	19.58	0.984	Leading	27.15	0.978	Leading	31.97	0.981	Leading	29.51	0.964	Leading	41.14
44	FLT144-3PH	0.988	Leading	23.16	0.981	Leading	29.93	0.969	Leading	38.12	0.978	Leading	32.05	0.951	Leading	48.88
45	FLT145-3PH	0.990	Leading	21.25	0.981	Leading	29.64	0.972	Leading	36.31	0.977	Leading	32.70	0.956	Leading	45.78
46	FLT146-3PH	0.990	Leading	20.89	0.981	Leading	29.67	0.973	Leading	35.69	0.977	Leading	32.93	0.956	Leading	45.76
47	FLT147-3PH	0.990	Leading	21.82	0.981	Leading	29.47	0.971	Leading	36.82	0.978	Leading	32.34	0.955	Leading	46.36
48	FLT148-3PH	0.990	Leading	21.22	0.981	Leading	29.98	0.972	Leading	36.07	0.977	Leading	32.90	0.957	Leading	45.46
49	FLT172-3PH	0.991	Leading	20.67	0.981	Leading	29.44	0.972	Leading	36.38	0.976	Leading	33.11	0.956	Leading	46.13
50	FLT174-3PH	0.990	Leading	21.67	0.980	Leading	30.14	0.971	Leading	36.63	0.977	Leading	33.07	0.956	Leading	46.07
51	FLT175-3PH	0.990	Leading	21.66	0.981	Leading	30.05	0.972	Leading	36.60	0.977	Leading	32.95	0.956	Leading	46.00
52	FLT176-3PH	0.990	Leading	21.67	0.981	Leading	30.05	0.972	Leading	36.59	0.977	Leading	32.88	0.956	Leading	46.05
53	FLT177-3PH	0.990	Leading	21.67	0.980	Leading	30.08	0.972	Leading	36.56	0.977	Leading	33.00	0.956	Leading	46.04
54	FLT178-3PH	0.990	Leading	21.66	0.980	Leading	30.07	0.972	Leading	36.56	0.977	Leading	32.97	0.956	Leading	46.05
55	FLT179-3PH	0.990	Leading	21.67	0.980	Leading	30.08	0.972	Leading	36.55	0.977	Leading	32.98	0.956	Leading	46.03
56	FLT180-3PH	0.990	Leading	21.68	0.980	Leading	30.08	0.972	Leading	36.59	0.977	Leading	32.99	0.956	Leading	46.07
57	FLT181-3PH	0.990	Leading	21.67	0.980	Leading	30.07	0.972	Leading	36.59	0.977	Leading	32.98	0.956	Leading	46.07
58	FLT182-3PH	0.990	Leading	21.67	0.980	Leading	30.08	0.972	Leading	36.55	0.977	Leading	32.93	0.956	Leading	46.04
59	FLT183-3PH	0.990	Leading	21.68	0.980	Leading	30.08	0.972	Leading	36.59	0.977	Leading	32.99	0.956	Leading	46.07
60	FLT184-3PH	0.990	Leading	21.63	0.981	Leading	30.04	0.972	Leading	36.56	0.977	Leading	32.89	0.956	Leading	46.05
61	FLT185-3PH	0.990	Leading	21.69	0.980	Leading	30.08	0.972	Leading	36.60	0.977	Leading	33.00	0.956	Leading	46.07
62	FLT186-3PH	0.990	Leading	21.66	0.981	Leading	30.05	0.972	Leading	36.56	0.977	Leading	32.99	0.956	Leading	46.03
63	FLT187-3PH	0.990	Leading	21.68	0.980	Leading	30.07	0.972	Leading	36.60	0.977	Leading	32.97	0.956	Leading	46.06
64	FLT188-3PH	0.990	Leading	21.52	0.981	Leading	30.04	0.972	Leading	36.45	0.977	Leading	32.89	0.956	Leading	45.89
65	FLT189-3PH	0.990	Leading	21.68	0.980	Leading	30.08	0.972	Leading	36.58	0.977	Leading	32.99	0.956	Leading	46.07

Table 5-2 (Continued)
Power Factor Analysis: GEN-2015-014

Ref No.	Case	2015 Summer Peak			2015 Winter Peak			2020 Summer Peak			2020 Winter Peak			2025 Summer Peak		
		Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
66	FLT190-3PH	0.990	Leading	21.68	0.980	Leading	30.08	0.972	Leading	36.59	0.977	Leading	32.99	0.956	Leading	46.07
67	FLT191-3PH	0.990	Leading	21.74	0.980	Leading	30.08	0.971	Leading	36.67	0.977	Leading	33.01	0.956	Leading	46.15
68	FLT192-3PH	0.990	Leading	21.68	0.980	Leading	30.08	0.972	Leading	36.59	0.977	Leading	32.99	0.956	Leading	46.07
69	FLT193-3PH	0.990	Leading	21.69	0.981	Leading	30.05	0.972	Leading	36.60	0.977	Leading	32.97	0.956	Leading	46.07
70	FLT194-3PH	0.990	Leading	21.69	0.980	Leading	30.09	0.971	Leading	36.60	0.977	Leading	32.99	0.956	Leading	46.08
71	FLT195-3PH	0.990	Leading	21.49	0.981	Leading	30.00	0.972	Leading	36.45	0.977	Leading	32.78	0.956	Leading	46.06
72	FLT196-3PH	0.990	Leading	21.68	0.980	Leading	30.08	0.972	Leading	36.59	0.977	Leading	32.99	0.956	Leading	46.07
73	FLT197-3PH	0.990	Leading	21.68	0.980	Leading	30.08	0.972	Leading	36.59	0.977	Leading	32.99	0.956	Leading	46.07
74	FLT198-3PH	0.992	Leading	19.32	0.989	Leading	22.19	0.975	Leading	34.10	0.976	Leading	33.17	0.966	Leading	40.41
75	FLT199-3PH	0.999	Leading	7.83	0.999	Leading	7.02	0.999	Leading	6.92	0.998	Leading	10.25	0.999	Leading	7.64
76	FLT200-3PH	0.992	Leading	18.51	0.990	Leading	21.90	0.976	Leading	33.26	0.977	Leading	32.81	0.967	Leading	39.46
77	FLT201-3PH	1.000	Lagging	-4.16	0.994	Leading	16.70	0.999	Leading	7.04	0.993	Leading	17.35	0.998	Leading	8.61
78	FLT202-3PH	0.992	Leading	18.99	0.988	Leading	23.14	0.976	Leading	33.62	0.975	Leading	34.02	0.967	Leading	39.72
79	FLT203-3PH	0.983	Leading	28.00	0.976	Leading	33.60	0.960	Leading	43.84	0.972	Leading	36.25	0.939	Leading	54.97
80	FLT204-3PH	0.998	Leading	8.65	1.000	Leading	3.77	0.977	Leading	33.10	0.978	Leading	32.37	0.975	Leading	33.96
81	FLT205-3PH	0.991	Leading	20.52	0.981	Leading	29.65	0.973	Leading	35.28	0.977	Leading	32.51	0.959	Leading	44.54
82	FLT206-3PH	0.985	Leading	26.24	0.976	Leading	33.33	0.959	Leading	44.11	0.972	Leading	36.50	0.937	Leading	56.13
83	FLT207-3PH	0.978	Leading	31.90	0.974	Leading	35.20	0.955	Leading	46.65	0.970	Leading	37.48	0.937	Leading	56.15
84	FLT208-3PH	1.000	Leading	1.62	0.996	Leading	13.66	0.994	Leading	16.79	0.976	Leading	33.25	0.995	Leading	15.74
85	FLT209-3PH	0.994	Leading	16.26	0.990	Leading	21.20	0.979	Leading	31.20	0.985	Leading	26.37	0.968	Leading	38.80
86	FLT210-3PH	0.989	Leading	22.50	0.985	Leading	26.45	0.968	Leading	39.00	0.975	Leading	34.13	0.954	Leading	46.98
87	FLT211-3PH	0.990	Leading	20.88	0.981	Leading	29.90	0.972	Leading	35.98	0.977	Leading	32.86	0.957	Leading	45.54
88	FLT212-3PH	0.987	Leading	24.27	0.977	Leading	32.52	0.968	Leading	38.95	0.975	Leading	34.44	0.948	Leading	50.36
89	FLT213-3PH	0.990	Leading	21.57	0.981	Leading	29.52	0.971	Leading	36.65	0.977	Leading	32.59	0.955	Leading	46.66
90	FLT214-3PH	0.990	Leading	21.43	0.981	Leading	29.75	0.971	Leading	36.80	0.975	Leading	33.95	0.955	Leading	46.64
91	FLT215-3PH	0.990	Leading	21.69	0.981	Leading	29.92	0.971	Leading	36.99	0.975	Leading	33.92	0.955	Leading	46.44
92	FLT216-3PH	0.991	Leading	20.60	0.982	Leading	28.88	0.972	Leading	36.06	0.977	Leading	32.94	0.956	Leading	46.20
93	FLT217-3PH	0.990	Leading	21.67	0.980	Leading	30.08	0.972	Leading	36.54	0.977	Leading	33.01	0.956	Leading	46.08
94	FLT218-3PH	0.990	Leading	21.71	0.980	Leading	30.07	0.971	Leading	36.68	0.976	Leading	33.13	0.956	Leading	46.13
95	FLT219-3PH	0.990	Leading	21.69	0.980	Leading	30.08	0.971	Leading	36.60	0.977	Leading	32.98	0.956	Leading	46.09
96	FLT221-3PH	0.990	Leading	21.37	0.981	Leading	29.81	0.971	Leading	36.63	0.976	Leading	33.42	0.955	Leading	46.55
97	FLT224-3PH	0.990	Leading	21.68	0.980	Leading	30.08	0.972	Leading	36.53	0.977	Leading	32.80	0.956	Leading	46.06
98	FLT225-3PH	0.990	Leading	21.68	0.980	Leading	30.08	0.972	Leading	36.54	0.977	Leading	32.81	0.956	Leading	46.07
99	FLT229-3PH	0.990	Leading	21.45	0.981	Leading	29.91	0.971	Leading	36.67	0.976	Leading	33.33	0.955	Leading	46.45

Study Generator GEN-2015-014

The Power Factor Analysis shows that GEN-2015-014 has a power factor range of 0.999 lagging (supplying) to 0.978 leading (absorbing) for the 2015 Summer Peak conditions, a power factor range of 0.974 to 0.999 leading (absorbing) for the 2015 Winter Peak conditions, a power factor range of 0.955 to 0.999 leading (absorbing) for the 2020 Summer Peak conditions, a power factor range of 0.970 to 0.997 leading (absorbing) for the 2020 Winter Peak conditions, and a power factor range of 0.937 to 0.999 leading (absorbing) for the 2025 Summer Peak conditions.

Table 5-3
Power Factor Analysis: GEN-2015-022

Ref No.	Case	2015 Summer Peak			2015 Winter Peak			2020 Summer Peak			2020 Winter Peak			2025 Summer Peak		
		Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
0	Base	0.981	Leading	21.88	0.975	Leading	25.34	0.958	Leading	33.55	0.993	Leading	13.64	0.983	Leading	20.97
1	FLT51-3PH	0.982	Leading	21.84	0.975	Leading	25.27	0.958	Leading	33.55	0.993	Leading	13.41	0.983	Leading	20.87
2	FLT53-3PH	0.981	Leading	21.92	0.976	Leading	24.95	0.959	Leading	33.06	0.994	Leading	12.77	0.984	Leading	20.33
3	FLT55-3PH	0.982	Leading	21.37	0.976	Leading	25.17	0.958	Leading	33.55	0.993	Leading	12.99	0.983	Leading	20.85
4	FLT56-3PH	0.981	Leading	21.92	0.975	Leading	25.34	0.958	Leading	33.47	0.993	Leading	13.60	0.983	Leading	20.93
5	FLT57-3PH	0.981	Leading	21.90	0.975	Leading	25.32	0.958	Leading	33.45	0.993	Leading	13.58	0.983	Leading	20.91
6	FLT58-3PH	0.982	Leading	21.75	0.976	Leading	25.02	0.959	Leading	33.24	0.993	Leading	13.22	0.983	Leading	20.69
7	FLT59-3PH	0.981	Leading	21.88	0.975	Leading	25.34	0.958	Leading	33.55	0.993	Leading	13.64	0.983	Leading	20.97
8	FLT64-3PH	0.983	Leading	20.82	0.981	Leading	22.20	0.959	Leading	33.05	0.993	Leading	13.44	0.983	Leading	21.15
9	FLT67-3PH	0.981	Leading	22.19	0.978	Leading	23.63	0.957	Leading	34.13	0.992	Leading	14.39	0.982	Leading	21.51
10	FLT73-3PH	0.983	Leading	20.84	0.973	Leading	26.51	0.964	Leading	31.10	0.992	Leading	13.87	0.990	Leading	16.11
11	FLT74-3PH	0.983	Leading	21.01	0.972	Leading	27.19	0.959	Leading	33.14	0.992	Leading	14.11	0.985	Leading	19.59
12	FLT75-3PH	0.982	Leading	21.77	0.977	Leading	24.38	0.959	Leading	33.26	0.993	Leading	13.15	0.984	Leading	20.30
13	FLT76-3PH	0.982	Leading	21.66	0.977	Leading	24.61	0.959	Leading	33.20	0.994	Leading	12.21	0.984	Leading	20.52
14	FLT77-3PH	0.979	Leading	23.37	0.976	Leading	24.97	0.958	Leading	33.73	0.993	Leading	13.68	0.983	Leading	21.00
15	FLT78-3PH	0.979	Leading	23.04	0.975	Leading	25.58	0.956	Leading	34.18	0.993	Leading	13.58	0.982	Leading	21.34
16	FLT79-3PH	0.980	Leading	22.61	0.975	Leading	25.45	0.957	Leading	33.97	0.992	Leading	13.94	0.983	Leading	21.05
17	FLT80-3PH	0.983	Leading	21.18	0.976	Leading	24.93	0.957	Leading	33.85	0.991	Leading	14.84	0.983	Leading	20.96
18	FLT81-3PH	0.980	Leading	22.58	0.976	Leading	25.20	0.960	Leading	32.84	0.993	Leading	13.22	0.985	Leading	19.90
19	FLT82-3PH	0.983	Leading	20.97	0.973	Leading	26.63	0.956	Leading	34.57	0.992	Leading	14.36	0.980	Leading	22.64
20	FLT88-3PH	0.983	Leading	21.21	0.978	Leading	24.14	0.957	Leading	33.89	0.993	Leading	13.76	0.984	Leading	20.18
21	FLT90-3PH	0.980	Leading	22.82	0.976	Leading	24.91	0.958	Leading	33.40	0.993	Leading	13.07	0.985	Leading	19.93
22	FLT91-3PH	0.979	Leading	23.15	0.973	Leading	26.37	0.958	Leading	33.58	0.992	Leading	14.63	0.983	Leading	21.06
23	FLT93-3PH	0.982	Leading	21.56	0.976	Leading	25.05	0.958	Leading	33.57	0.993	Leading	13.63	0.983	Leading	21.01
24	FLT94-3PH	0.981	Leading	21.96	0.975	Leading	25.46	0.958	Leading	33.49	0.993	Leading	13.43	0.983	Leading	20.99
25	FLT95-3PH	0.985	Leading	19.80	0.978	Leading	24.09	0.960	Leading	32.54	0.993	Leading	13.20	0.987	Leading	18.16
26	FLT96-3PH	0.982	Leading	21.80	0.976	Leading	25.23	0.958	Leading	33.50	0.992	Leading	13.85	0.983	Leading	20.98
27	FLT97-3PH	0.991	Leading	14.74	0.974	Leading	25.87	0.972	Leading	26.87	0.994	Leading	12.82	0.989	Leading	17.06
28	FLT117-3PH	0.981	Leading	21.88	0.975	Leading	25.34	0.955	Leading	34.65	0.989	Leading	17.01	0.982	Leading	21.39
29	FLT123-3PH	0.981	Leading	21.88	0.975	Leading	25.34	0.958	Leading	33.55	0.993	Leading	13.64	0.983	Leading	20.97
30	FLT125-3PH	0.981	Leading	21.88	0.975	Leading	25.34	0.958	Leading	33.55	0.993	Leading	13.64	0.983	Leading	20.97
31	FLT126-3PH	0.979	Leading	23.13	0.972	Leading	26.95	0.956	Leading	34.40	0.991	Leading	14.90	0.982	Leading	21.27
32	FLT132-3PH	0.980	Leading	22.65	0.976	Leading	25.05	0.958	Leading	33.42	0.993	Leading	13.62	0.983	Leading	20.79
33	FLT133-3PH	0.982	Leading	21.27	0.976	Leading	24.96	0.959	Leading	33.05	0.993	Leading	13.44	0.984	Leading	20.52
34	FLT134-3PH	0.980	Leading	22.97	0.976	Leading	25.03	0.958	Leading	33.59	0.993	Leading	13.68	0.983	Leading	20.91
35	FLT135-3PH	0.983	Leading	20.75	0.976	Leading	25.21	0.960	Leading	32.76	0.993	Leading	13.44	0.984	Leading	20.43
36	FLT136-3PH	0.981	Leading	21.88	0.975	Leading	25.34	0.957	Leading	33.87	0.993	Leading	13.72	0.983	Leading	21.01
37	FLT137-3PH	0.982	Leading	21.74	0.976	Leading	25.22	0.958	Leading	33.62	0.992	Leading	13.83	0.983	Leading	21.08
38	FLT138-3PH	0.984	Leading	20.00	0.977	Leading	24.63	0.961	Leading	32.29	0.994	Leading	12.40	0.984	Leading	20.06
39	FLT139-3PH	0.981	Leading	21.88	0.975	Leading	25.34	0.958	Leading	33.55	0.993	Leading	13.64	0.983	Leading	20.97
40	FLT140-3PH	0.981	Leading	22.15	0.976	Leading	25.03	0.958	Leading	33.63	0.993	Leading	13.24	0.983	Leading	21.04
41	FLT141-3PH	0.983	Leading	21.14	0.976	Leading	25.13	0.959	Leading	32.88	0.993	Leading	13.31	0.984	Leading	20.17
42	FLT142-3PH	0.983	Leading	20.97	0.978	Leading	24.11	0.960	Leading	32.81	0.993	Leading	13.08	0.983	Leading	20.74
43	FLT143-3PH	0.982	Leading	21.77	0.977	Leading	24.64	0.958	Leading	33.55	0.994	Leading	12.55	0.983	Leading	21.00
44	FLT144-3PH	0.981	Leading	21.87	0.975	Leading	25.38	0.958	Leading	33.46	0.993	Leading	13.57	0.983	Leading	20.88
45	FLT145-3PH	0.981	Leading	21.98	0.975	Leading	25.36	0.958	Leading	33.58	0.993	Leading	13.60	0.983	Leading	20.98
46	FLT146-3PH	0.982	Leading	21.84	0.975	Leading	25.30	0.958	Leading	33.53	0.993	Leading	13.56	0.983	Leading	20.97
47	FLT147-3PH	0.981	Leading	21.91	0.975	Leading	25.31	0.958	Leading	33.57	0.993	Leading	13.53	0.983	Leading	20.98
48	FLT148-3PH	0.982	Leading	21.82	0.975	Leading	25.34	0.958	Leading	33.49	0.993	Leading	13.64	0.983	Leading	20.93
49	FLT172-3PH	0.983	Leading	20.99	0.981	Leading	22.42	0.959	Leading	33.11	0.993	Leading	13.46	0.983	Leading	21.14
50	FLT174-3PH	0.878	Leading	61.08	1.000	Leading	2.72	0.817	Leading	79.17	1.000	Leading	0.21	0.835	Leading	73.78
51	FLT175-3PH	0.933	Lagging	-43.28	0.973	Leading	26.48	0.918	Lagging	-48.42	0.988	Leading	17.43	0.886	Lagging	-58.62
52	FLT176-3PH	0.934	Leading	42.86	0.961	Leading	32.31	0.901	Leading	53.90	0.979	Leading	23.56	0.946	Leading	38.43
53	FLT177-3PH	0.979	Leading	23.20	0.981	Leading	22.36	0.951	Leading	36.55	0.994	Leading	11.88	0.975	Leading	25.43
54	FLT178-3PH	0.974	Leading	25.92	0.977	Leading	24.20	0.939	Leading	40.90	0.993	Leading	13.00	0.967	Leading	29.41
55	FLT179-3PH	0.985	Leading	19.48	0.983	Leading	21.16	0.978	Leading	23.67	0.995	Leading	10.68	0.995	Leading	11.06
56	FLT180-3PH	0.981	Leading	21.88	0.975	Leading	25.34	0.958	Leading	33.55	0.993	Leading	13.64	0.983	Leading	20.97
57	FLT181-3PH	0.979	Leading	23.35	0.974	Leading	26.20	0.954	Leading	35.19	0.992	Leading	14.59	0.977	Leading	24.26
58	FLT182-3PH	0.980	Leading	22.79	0.974	Leading	25.99	0.956	Leading	34.53	0.992	Leading	14.15	0.981	Leading	22.25
59	FLT183-3PH	0.981	Leading	21.88	0.975	Leading	25.34	0.958	Leading	33.55	0.993	Leading	13.64	0.983	Leading	20.97
60	FLT184-3PH	0.984	Leading	20.16	0.973	Leading	26.38	0.969	Leading	28.60	0.989	Leading	16.65	0.996	Leading	10.06
61	FLT185-3PH	0.982	Leading	21.33	0.976	Leading	25.19	0.959	Leading	32.94	0.993	Leading	13.69	0.986	Leading	19.02
62	FLT186-3PH	0.982	Leading	21.66	0.976	Leading	25.17	0.958	Leading	33.43	0.993	Leading	13.44	0.983	Leading	20.66
63	FLT187-3PH	0.980	Leading	22.48	0.977	Leading	24.48	0.956	Leading	34.43	0.994	Leading	12.70	0.981	Leading	22.11
64	FLT188-3PH	0.989	Leading	16.92	0.979	Leading	23.39	0.965	Leading	30.65	0.995	Leading	11.07	0.987	Leading	18.06
65	FLT189-3PH	0.982	Leading	21.44	0.976	Leading	25.22	0.959	Leading	33.01	0.993	Leading	13.50	0.984	Leading	20.31

Table 5-3 (Continued)
Power Factor Analysis: GEN-2015-022

Ref No.	Case	2015 Summer Peak			2015 Winter Peak			2020 Summer Peak			2020 Winter Peak			2025 Summer Peak		
		Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
66	FLT190-3PH	0.981	Leading	21.88	0.975	Leading	25.34	0.958	Leading	33.55	0.993	Leading	13.64	0.983	Leading	20.97
67	FLT191-3PH	0.991	Leading	15.38	0.982	Leading	21.73	0.975	Leading	25.47	0.995	Leading	10.72	0.995	Leading	11.59
68	FLT192-3PH	0.981	Leading	21.88	0.975	Leading	25.34	0.958	Leading	33.55	0.993	Leading	13.64	0.983	Leading	20.97
69	FLT193-3PH	0.979	Leading	23.08	0.975	Leading	25.26	0.952	Leading	35.95	0.993	Leading	13.65	0.978	Leading	23.72
70	FLT194-3PH	0.980	Leading	22.86	0.974	Leading	25.79	0.963	Leading	31.22	0.992	Leading	13.86	0.987	Leading	17.88
71	FLT195-3PH	0.991	Leading	14.74	0.974	Leading	25.87	0.972	Leading	26.87	0.994	Leading	12.82	0.989	Leading	17.06
72	FLT196-3PH	0.981	Leading	21.88	0.975	Leading	25.34	0.958	Leading	33.55	0.993	Leading	13.64	0.983	Leading	20.97
73	FLT197-3PH	0.981	Leading	21.88	0.975	Leading	25.34	0.958	Leading	33.55	0.993	Leading	13.64	0.983	Leading	20.97
74	FLT198-3PH	0.981	Leading	21.90	0.976	Leading	24.90	0.958	Leading	33.44	0.993	Leading	13.58	0.983	Leading	20.88
75	FLT199-3PH	0.980	Leading	22.95	0.975	Leading	25.54	0.957	Leading	34.00	0.992	Leading	14.10	0.982	Leading	21.27
76	FLT200-3PH	0.981	Leading	21.86	0.976	Leading	24.90	0.958	Leading	33.45	0.993	Leading	13.56	0.983	Leading	20.89
77	FLT201-3PH	0.982	Leading	21.46	0.976	Leading	24.85	0.959	Leading	33.26	0.993	Leading	13.63	0.983	Leading	20.69
78	FLT202-3PH	0.981	Leading	21.85	0.976	Leading	24.95	0.958	Leading	33.47	0.993	Leading	13.58	0.983	Leading	20.91
79	FLT203-3PH	0.986	Leading	18.95	0.977	Leading	24.47	0.962	Leading	31.57	0.994	Leading	12.15	0.985	Leading	19.44
80	FLT204-3PH	0.980	Leading	22.48	0.975	Leading	25.65	0.958	Leading	33.64	0.992	Leading	14.01	0.983	Leading	21.02
81	FLT205-3PH	0.981	Leading	21.85	0.975	Leading	25.33	0.958	Leading	33.52	0.993	Leading	13.62	0.983	Leading	20.95
82	FLT206-3PH	0.981	Leading	22.10	0.976	Leading	24.87	0.957	Leading	34.03	0.993	Leading	13.69	0.982	Leading	21.25
83	FLT207-3PH	0.982	Leading	21.83	0.975	Leading	25.64	0.959	Leading	33.26	0.993	Leading	13.42	0.983	Leading	20.66
84	FLT208-3PH	0.982	Leading	21.83	0.976	Leading	25.03	0.958	Leading	33.42	0.993	Leading	13.79	0.983	Leading	20.83
85	FLT209-3PH	0.981	Leading	22.15	0.972	Leading	27.26	0.959	Leading	32.98	0.993	Leading	13.48	0.984	Leading	20.02
86	FLT210-3PH	0.981	Leading	21.95	0.974	Leading	25.81	0.959	Leading	33.19	0.994	Leading	12.36	0.983	Leading	20.77
87	FLT211-3PH	0.982	Leading	21.82	0.975	Leading	25.30	0.958	Leading	33.50	0.993	Leading	13.59	0.983	Leading	20.93
88	FLT212-3PH	0.981	Leading	21.87	0.975	Leading	25.35	0.958	Leading	33.56	0.993	Leading	13.60	0.983	Leading	20.95
89	FLT213-3PH	0.981	Leading	21.87	0.975	Leading	25.32	0.958	Leading	33.53	0.993	Leading	13.64	0.983	Leading	20.95
90	FLT214-3PH	0.988	Lagging	-17.42	1.000	Lagging	-3.42	0.999	Leading	5.76	0.992	Lagging	-14.63	0.999	Leading	4.04
91	FLT215-3PH	1.000	Lagging	-2.71	0.998	Leading	6.57	0.989	Leading	16.69	0.999	Lagging	-3.87	0.995	Leading	11.34
92	FLT216-3PH	0.916	Lagging	-48.93	0.978	Lagging	-23.63	0.992	Lagging	-14.69	0.957	Lagging	-33.97	0.994	Lagging	-12.26
93	FLT217-3PH	0.985	Leading	19.57	0.977	Leading	24.44	0.961	Leading	32.25	0.994	Leading	12.49	0.984	Leading	20.54
94	FLT218-3PH	0.985	Leading	19.91	0.978	Leading	23.67	0.961	Leading	32.32	0.994	Leading	12.30	0.984	Leading	19.96
95	FLT219-3PH	0.982	Leading	21.45	0.976	Leading	25.12	0.958	Leading	33.37	0.993	Leading	13.30	0.983	Leading	20.81
96	FLT221-3PH	0.996	Lagging	-10.52	0.999	Leading	5.03	0.994	Leading	12.53	0.998	Lagging	-6.89	0.997	Leading	8.02
97	FLT224-3PH	0.981	Leading	21.88	0.975	Leading	25.34	0.957	Leading	33.90	0.992	Leading	14.22	0.983	Leading	21.00
98	FLT225-3PH	0.981	Leading	21.88	0.975	Leading	25.34	0.957	Leading	34.04	0.992	Leading	14.38	0.983	Leading	21.04
99	FLT229-3PH	0.999	Lagging	-5.71	0.998	Leading	7.72	0.989	Leading	16.79	0.999	Lagging	-3.93	0.995	Leading	11.08

Study Generator GEN-2015-022

The Power Factor Analysis shows that GEN-2015-022 has a power factor range of 0.916 lagging (supplying) to 0.878 leading (absorbing) for the 2015 Summer Peak conditions, a power factor range of 0.978 lagging (supplying) to 0.961 leading (absorbing) for the 2015 Winter Peak conditions, a power factor range of 0.918 lagging (supplying) to 0.817 leading (absorbing) for the 2020 Summer Peak conditions, a power factor range of 0.957 lagging (supplying) to 0.979 leading (absorbing) for the 2020 Winter Peak conditions, and a power factor range of 0.886 lagging (supplying) to 0.835 leading (absorbing) for the 2025 Summer Peak conditions.

Table 5-4
Power Factor Analysis: ASGI-2015-002

Ref No.	Case	2015 Summer Peak			2015 Winter Peak			2020 Summer Peak			2020 Winter Peak			2025 Summer Peak		
		Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
0	Base	0.983	Leading	0.37	0.976	Leading	0.45	0.969	Leading	0.51	0.898	Leading	0.98	0.534	Leading	3.16
1	FLT51-3PH	0.987	Leading	0.32	0.983	Leading	0.37	0.972	Leading	0.48	0.909	Leading	0.92	0.536	Leading	3.15
2	FLT53-3PH	0.983	Leading	0.37	1.000	Lagging	-0.04	0.978	Leading	0.43	0.945	Leading	0.69	0.552	Leading	3.02
3	FLT55-3PH	1.000	Leading	0.02	0.986	Leading	0.34	0.980	Leading	0.40	0.901	Leading	0.96	0.549	Leading	3.04
4	FLT56-3PH	0.984	Leading	0.36	0.977	Leading	0.43	0.973	Leading	0.48	0.901	Leading	0.96	0.539	Leading	3.12
5	FLT57-3PH	0.985	Leading	0.35	0.978	Leading	0.42	0.974	Leading	0.47	0.902	Leading	0.96	0.540	Leading	3.12
6	FLT58-3PH	0.988	Leading	0.31	0.989	Leading	0.30	0.979	Leading	0.42	0.914	Leading	0.89	0.549	Leading	3.05
7	FLT59-3PH	0.983	Leading	0.37	0.976	Leading	0.45	0.969	Leading	0.51	0.898	Leading	0.98	0.534	Leading	3.16
8	FLT64-3PH	0.990	Leading	0.28	0.979	Leading	0.42	0.971	Leading	0.49	0.897	Leading	0.99	0.533	Leading	3.18
9	FLT67-3PH	0.993	Leading	0.24	0.985	Leading	0.34	0.988	Leading	0.31	0.902	Leading	0.96	0.568	Leading	2.90
10	FLT73-3PH	0.985	Leading	0.35	0.979	Leading	0.41	0.969	Leading	0.51	0.902	Leading	0.96	0.530	Leading	3.20
11	FLT74-3PH	0.984	Leading	0.36	0.979	Leading	0.41	0.971	Leading	0.49	0.903	Leading	0.95	0.535	Leading	3.16
12	FLT75-3PH	0.997	Leading	0.15	0.962	Leading	0.57	0.988	Leading	0.31	0.916	Leading	0.88	0.543	Leading	3.09
13	FLT76-3PH	0.985	Leading	0.35	0.980	Leading	0.41	0.972	Leading	0.49	0.910	Leading	0.91	0.537	Leading	3.15
14	FLT77-3PH	0.704	Lagging	-2.02	0.971	Lagging	-0.49	0.888	Lagging	-1.04	0.946	Lagging	-0.68	0.803	Leading	1.48
15	FLT78-3PH	0.683	Leading	2.14	0.795	Leading	1.52	0.693	Leading	2.08	0.924	Leading	0.83	0.337	Leading	5.58
16	FLT79-3PH	0.955	Leading	0.62	0.955	Leading	0.62	0.938	Leading	0.74	0.873	Leading	1.12	0.510	Leading	3.37
17	FLT80-3PH	0.990	Leading	0.29	0.997	Leading	0.17	0.986	Leading	0.33	0.951	Leading	0.65	0.597	Leading	2.69
18	FLT81-3PH	0.728	Lagging	-1.88	0.609	Lagging	-2.61	0.807	Lagging	-1.46	0.944	Lagging	-0.70	0.997	Lagging	-0.14
19	FLT82-3PH	0.996	Leading	0.18	0.968	Leading	0.52	0.976	Leading	0.44	0.900	Leading	0.97	0.537	Leading	3.14
20	FLT88-3PH	0.973	Leading	0.48	0.976	Leading	0.45	0.960	Leading	0.58	0.889	Leading	1.03	0.536	Leading	3.15
21	FLT90-3PH	0.988	Leading	0.31	0.974	Leading	0.47	0.972	Leading	0.49	0.902	Leading	0.96	0.538	Leading	3.13
22	FLT91-3PH	0.972	Leading	0.48	0.992	Leading	0.25	0.970	Leading	0.51	0.888	Leading	1.04	0.535	Leading	3.16
23	FLT93-3PH	0.992	Leading	0.25	0.987	Leading	0.33	0.971	Leading	0.50	0.901	Leading	0.96	0.537	Leading	3.14
24	FLT94-3PH	0.983	Leading	0.37	0.971	Leading	0.49	0.975	Leading	0.46	0.921	Leading	0.85	0.539	Leading	3.13
25	FLT95-3PH	1.000	Lagging	-0.02	0.996	Leading	0.19	0.990	Leading	0.29	0.914	Leading	0.89	0.619	Leading	2.54
26	FLT96-3PH	0.985	Leading	0.35	0.980	Leading	0.40	0.972	Leading	0.48	0.884	Leading	1.06	0.536	Leading	3.15
27	FLT97-3PH	0.993	Leading	0.24	0.977	Leading	0.43	0.977	Leading	0.44	0.911	Leading	0.91	0.536	Leading	3.15
28	FLT117-3PH	0.983	Leading	0.37	0.976	Leading	0.45	0.971	Leading	0.50	0.938	Leading	0.74	0.576	Leading	2.84
29	FLT123-3PH	0.983	Leading	0.37	0.976	Leading	0.45	0.969	Leading	0.51	0.898	Leading	0.98	0.534	Leading	3.16
30	FLT125-3PH	0.983	Leading	0.37	0.976	Leading	0.45	0.969	Leading	0.51	0.898	Leading	0.98	0.534	Leading	3.16
31	FLT126-3PH	0.993	Leading	0.24	0.980	Leading	0.41	0.975	Leading	0.46	0.911	Leading	0.90	0.535	Leading	3.16
32	FLT132-3PH	0.901	Lagging	-0.96	0.953	Leading	0.64	0.865	Leading	1.16	0.972	Leading	0.48	0.442	Leading	4.06
33	FLT133-3PH	0.806	Lagging	-1.47	0.811	Lagging	-1.45	0.814	Lagging	-1.43	0.975	Leading	0.45	0.992	Leading	0.26
34	FLT134-3PH	0.752	Lagging	-1.75	1.000	Leading	0.05	0.995	Leading	0.21	0.997	Lagging	-0.14	0.567	Leading	2.91
35	FLT135-3PH	0.999	Lagging	-0.08	0.971	Leading	0.49	0.999	Leading	0.08	0.892	Leading	1.02	0.588	Leading	2.75
36	FLT136-3PH	0.983	Leading	0.37	0.976	Leading	0.45	0.981	Leading	0.40	0.917	Leading	0.87	0.554	Leading	3.01
37	FLT137-3PH	0.986	Leading	0.34	0.981	Leading	0.39	0.964	Leading	0.55	0.875	Leading	1.11	0.516	Leading	3.32
38	FLT138-3PH	0.981	Leading	0.39	0.972	Leading	0.48	0.964	Leading	0.55	0.898	Leading	0.98	0.526	Leading	3.23
39	FLT139-3PH	0.983	Leading	0.37	0.976	Leading	0.45	0.969	Leading	0.51	0.898	Leading	0.98	0.534	Leading	3.16
40	FLT140-3PH	0.909	Leading	0.92	0.963	Leading	0.56	0.881	Leading	1.07	0.883	Leading	1.06	0.453	Leading	3.94
41	FLT141-3PH	0.791	Lagging	-1.55	0.821	Lagging	-1.39	0.652	Lagging	-2.32	0.966	Lagging	-0.53	0.873	Lagging	-1.12
42	FLT142-3PH	0.983	Lagging	-0.37	0.918	Lagging	-0.87	0.997	Lagging	-0.17	0.959	Leading	0.59	0.648	Leading	2.35
43	FLT143-3PH	0.969	Leading	0.51	0.967	Leading	0.52	0.940	Leading	0.72	0.886	Leading	1.04	0.512	Leading	3.36
44	FLT144-3PH	0.989	Leading	0.30	0.987	Leading	0.32	0.981	Leading	0.39	0.906	Leading	0.94	0.565	Leading	2.92
45	FLT145-3PH	0.976	Leading	0.44	0.963	Leading	0.56	0.962	Leading	0.57	0.884	Leading	1.06	0.530	Leading	3.20
46	FLT146-3PH	0.989	Leading	0.30	0.972	Leading	0.48	0.980	Leading	0.41	0.889	Leading	1.03	0.537	Leading	3.14
47	FLT147-3PH	0.978	Leading	0.43	0.973	Leading	0.47	0.958	Leading	0.60	0.903	Leading	0.95	0.516	Leading	3.32
48	FLT148-3PH	0.987	Leading	0.32	0.977	Leading	0.44	0.976	Leading	0.45	0.900	Leading	0.97	0.543	Leading	3.10
49	FLT172-3PH	0.990	Leading	0.29	0.979	Leading	0.42	0.971	Leading	0.49	0.897	Leading	0.99	0.533	Leading	3.17
50	FLT174-3PH	0.986	Leading	0.34	0.972	Leading	0.49	0.976	Leading	0.44	0.895	Leading	1.00	0.545	Leading	3.07
51	FLT175-3PH	0.987	Leading	0.33	0.977	Leading	0.44	0.976	Leading	0.45	0.901	Leading	0.96	0.547	Leading	3.06
52	FLT176-3PH	0.983	Leading	0.37	0.977	Leading	0.43	0.967	Leading	0.53	0.903	Leading	0.95	0.533	Leading	3.17
53	FLT177-3PH	0.984	Leading	0.36	0.975	Leading	0.46	0.972	Leading	0.49	0.897	Leading	0.99	0.537	Leading	3.14
54	FLT178-3PH	0.985	Leading	0.35	0.976	Leading	0.45	0.973	Leading	0.48	0.899	Leading	0.97	0.537	Leading	3.14
55	FLT179-3PH	0.984	Leading	0.37	0.976	Leading	0.44	0.971	Leading	0.49	0.899	Leading	0.98	0.536	Leading	3.15
56	FLT180-3PH	0.983	Leading	0.37	0.976	Leading	0.45	0.969	Leading	0.51	0.898	Leading	0.98	0.534	Leading	3.16
57	FLT181-3PH	0.983	Leading	0.37	0.976	Leading	0.45	0.969	Leading	0.51	0.898	Leading	0.98	0.534	Leading	3.17
58	FLT182-3PH	0.984	Leading	0.36	0.976	Leading	0.45	0.970	Leading	0.50	0.900	Leading	0.97	0.535	Leading	3.16
59	FLT183-3PH	0.983	Leading	0.37	0.976	Leading	0.45	0.969	Leading	0.51	0.898	Leading	0.98	0.534	Leading	3.16
60	FLT184-3PH	0.986	Leading	0.34	0.977	Leading	0.43	0.972	Leading	0.49	0.904	Leading	0.95	0.537	Leading	3.14
61	FLT185-3PH	0.983	Leading	0.37	0.976	Leading	0.45	0.969	Leading	0.51	0.898	Leading	0.98	0.535	Leading	3.16
62	FLT186-3PH	0.984	Leading	0.37	0.976	Leading	0.45	0.970	Leading	0.50	0.899	Leading	0.98	0.535	Leading	3.16
63	FLT187-3PH	0.982	Leading	0.38	0.976	Leading	0.44	0.968	Leading	0.52	0.899	Leading	0.97	0.533	Leading	3.18
64	FLT188-3PH	0.986	Leading	0.34	0.976	Leading	0.45	0.971	Leading	0.50	0.900	Leading	0.97	0.534	Leading	3.17
65	FLT189-3PH	0.984	Leading	0.37	0.976	Leading	0.45	0.970	Leading	0.50	0.898	Leading	0.98	0.535	Leading	3.16

Table 5-4 (Continued)
Power Factor Analysis: ASGI-2015-002

Ref No.	Case	2015 Summer Peak			2015 Winter Peak			2020 Summer Peak			2020 Winter Peak			2025 Summer Peak		
		Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
66	FLT190-3PH	0.983	Leading	0.37	0.976	Leading	0.45	0.969	Leading	0.51	0.898	Leading	0.98	0.534	Leading	3.16
67	FLT191-3PH	0.982	Leading	0.38	0.978	Leading	0.43	0.967	Leading	0.53	0.903	Leading	0.95	0.531	Leading	3.19
68	FLT192-3PH	0.983	Leading	0.37	0.976	Leading	0.45	0.969	Leading	0.51	0.898	Leading	0.98	0.534	Leading	3.16
69	FLT193-3PH	0.984	Leading	0.37	0.976	Leading	0.45	0.971	Leading	0.49	0.899	Leading	0.97	0.537	Leading	3.15
70	FLT194-3PH	0.983	Leading	0.38	0.976	Leading	0.45	0.970	Leading	0.51	0.898	Leading	0.98	0.535	Leading	3.16
71	FLT195-3PH	0.993	Leading	0.24	0.977	Leading	0.43	0.977	Leading	0.44	0.911	Leading	0.91	0.536	Leading	3.15
72	FLT196-3PH	0.983	Leading	0.37	0.976	Leading	0.45	0.969	Leading	0.51	0.898	Leading	0.98	0.534	Leading	3.16
73	FLT197-3PH	0.983	Leading	0.37	0.976	Leading	0.45	0.969	Leading	0.51	0.898	Leading	0.98	0.534	Leading	3.16
74	FLT198-3PH	0.987	Leading	0.32	0.995	Leading	0.21	0.975	Leading	0.46	0.901	Leading	0.97	0.540	Leading	3.12
75	FLT199-3PH	0.985	Leading	0.36	0.996	Leading	0.17	0.969	Leading	0.51	0.895	Leading	1.00	0.544	Leading	3.09
76	FLT200-3PH	0.987	Leading	0.32	0.994	Leading	0.22	0.974	Leading	0.46	0.899	Leading	0.97	0.539	Leading	3.12
77	FLT201-3PH	0.993	Leading	0.24	0.991	Leading	0.26	0.986	Leading	0.34	0.895	Leading	1.00	0.571	Leading	2.87
78	FLT202-3PH	0.986	Leading	0.34	0.993	Leading	0.24	0.973	Leading	0.48	0.901	Leading	0.96	0.538	Leading	3.14
79	FLT203-3PH	0.981	Leading	0.40	0.964	Leading	0.55	0.959	Leading	0.59	0.890	Leading	1.02	0.515	Leading	3.33
80	FLT204-3PH	0.972	Leading	0.49	0.983	Leading	0.37	0.973	Leading	0.48	0.876	Leading	1.10	0.536	Leading	3.15
81	FLT205-3PH	0.984	Leading	0.36	0.976	Leading	0.44	0.971	Leading	0.49	0.899	Leading	0.97	0.537	Leading	3.14
82	FLT206-3PH	0.971	Leading	0.49	0.966	Leading	0.53	0.938	Leading	0.74	0.880	Leading	1.08	0.502	Leading	3.45
83	FLT207-3PH	1.000	Lagging	-0.06	0.999	Lagging	-0.06	1.000	Lagging	-0.04	0.962	Leading	0.57	0.632	Leading	2.45
84	FLT208-3PH	0.996	Leading	0.19	0.994	Leading	0.22	0.990	Leading	0.29	0.890	Leading	1.02	0.586	Leading	2.76
85	FLT209-3PH	0.999	Leading	0.09	0.994	Lagging	-0.22	0.996	Leading	0.18	0.950	Leading	0.66	0.592	Leading	2.72
86	FLT210-3PH	0.971	Leading	0.49	0.979	Leading	0.41	0.943	Leading	0.70	0.876	Leading	1.10	0.523	Leading	3.26
87	FLT211-3PH	0.994	Leading	0.22	0.983	Leading	0.37	0.984	Leading	0.36	0.918	Leading	0.87	0.561	Leading	2.95
88	FLT212-3PH	0.980	Leading	0.41	0.975	Leading	0.45	0.966	Leading	0.54	0.899	Leading	0.97	0.527	Leading	3.23
89	FLT213-3PH	0.986	Leading	0.34	0.979	Leading	0.42	0.975	Leading	0.46	0.902	Leading	0.96	0.544	Leading	3.09
90	FLT214-3PH	0.991	Leading	0.27	0.985	Leading	0.35	0.974	Leading	0.47	0.891	Leading	1.02	0.532	Leading	3.18
91	FLT215-3PH	0.976	Leading	0.45	0.982	Leading	0.38	0.966	Leading	0.54	0.881	Leading	1.07	0.533	Leading	3.18
92	FLT216-3PH	0.993	Lagging	-0.23	0.998	Lagging	-0.12	0.978	Leading	0.43	0.940	Leading	0.72	0.558	Leading	2.97
93	FLT217-3PH	0.986	Leading	0.33	0.976	Leading	0.45	0.972	Leading	0.49	0.899	Leading	0.97	0.534	Leading	3.16
94	FLT218-3PH	0.981	Leading	0.39	0.976	Leading	0.44	0.968	Leading	0.52	0.894	Leading	1.00	0.534	Leading	3.17
95	FLT219-3PH	0.983	Leading	0.37	0.976	Leading	0.45	0.969	Leading	0.51	0.899	Leading	0.97	0.534	Leading	3.16
96	FLT221-3PH	0.999	Leading	0.09	0.991	Leading	0.26	0.978	Leading	0.43	0.907	Leading	0.93	0.532	Leading	3.18
97	FLT224-3PH	0.983	Leading	0.37	0.976	Leading	0.45	0.971	Leading	0.49	0.906	Leading	0.94	0.534	Leading	3.16
98	FLT225-3PH	0.983	Leading	0.37	0.976	Leading	0.45	0.971	Leading	0.50	0.905	Leading	0.94	0.534	Leading	3.16
99	FLT229-3PH	0.998	Leading	0.14	0.988	Leading	0.31	0.976	Leading	0.44	0.907	Leading	0.93	0.533	Leading	3.18

Study Generator ASGI-2015-002

The Power Factor Analysis shows that ASGI-2015-002 has a power factor range of 0.704 lagging (supplying) to 0.683 leading (absorbing) for the 2015 Summer Peak conditions, a power factor range of 0.609 lagging (supplying) to 0.795 leading (absorbing) for the 2015 Winter Peak conditions, a power factor range of 0.652 lagging (supplying) to 0.693 leading (absorbing) for the 2020 Summer Peak conditions, a power factor range of 0.944 lagging (supplying) to 0.873 leading (absorbing) for the 2020 Winter Peak conditions, and a power factor range of 0.873 lagging (supplying) to 0.337 leading (absorbing) for the 2025 Summer Peak conditions

SECTION 6: LOW WIND/NO WIND ANALYSIS

The objective of this task is to determine the impact of low wind or no wind conditions on wind farms that interconnect to a 345 kV or 230 kV bus. The 2015 Summer Peak, 2015 Winter Peak, 2020 Summer Peak, 2020 Winter Peak, and 2025 Summer Peak power flows provided by SPP were examined for this analysis.

6.1 Approach

Low wind or no wind conditions were examined for all 345 kV or 230 kV wind farms. Generators were disabled (independently), but the collector systems remained in-service. In order to maintain generation and load balance in the SPP area, the generation was scaled after disabling the respective generator. The amount of reactive power injected into the transmission network was recorded at the respective point of interconnection. This reactive power comes from the capacitance of the project's transmission lines and collector cables. A shunt reactor was added at the high side bus to bring the Mvar flow into the POI down to approximately zero.

6.2 Low Wind/No Wind Analysis Results

The reactance needed to bring the Mvar flow into the point of interconnect to zero Mvar was recorded for each season for all 345 kV or 230 kV wind farms. Refer to Table 6-1 for the Low Wind/No Wind Analysis results. The table lists the generators examined and the amount of reactive power needed for zero Mvar flow into the POI for each season.

Table 6-1
Low Wind/No Wind Analysis

Request	Size (MW)	Point of Interconnection	Reactor Size (Mvar)				
			15SP	15WP	20SP	20WP	25SP
GEN-2014-074	152	Tap Tuco - OKU 345kV (560027)	8.9	8.9	8.9	8.9	8.9

SECTION 7: CONCLUSIONS

Summary of Stability Analysis

The Stability Analysis determined that there were no contingencies that resulted in system instability or generation tripping offline for the 2015 Summer Peak, 2015 Winter Peak, 2020 Summer Peak, 2020 Winter Peak, and 2025 Summer Peak conditions when all generation interconnection requests were at 100% output. However, it was observed that the post-contingency voltages at the O.K.U. 345 kV and GEN-2014-074 Tap 345 kV bus did not recover to above 0.90 p.u. in the 2015 Summer Peak, 2015 Winter Peak, and 2020 Winter Peak cases. After discussing this voltage violation with SPP, it was determined that a minimum of 2 x 130 Mvar capacitor banks will be installed at the O.K.U. 345 kV bus (in addition to the existing 3 x 30 Mvar capacitor banks). After the addition of the 2 x 130 Mvar capacitor banks, all voltages recovered to above 0.90 p.u. for all years and seasons.

Summary of the Short Circuit Analysis

The short circuit analysis was performed on the 2025 Summer Peak power flow for all study projects. Refer to Table 7-1 for a list of maximum fault currents observed for each study project.

Table 7-1
List of Maximum Fault Currents Observed for Each Study Project

Study Project	Fault Current at POI (kA)	Maximum Fault Current (kA)	Fault Location	Bus Voltage (kV)
GEN-2014-074	6.45	35.12	LP-COOK	69
GEN-2015-014	6.44	27.76	PLANT_X	230
GEN-2015-022	10.33	35.12	LP-COOK	69
ASGI-2015-002	3.07	27.76	PLANT_X	230

Summary of the Power Factor Analysis

For all the generators that follow, the power factor is measured at the point of interconnection (POI).

<u>Study Generator GEN-2014-074</u>

The Power Factor Analysis shows that GEN-2014-074 has a power factor range of 0.413 lagging (supplying) to 0.971 leading (absorbing) for the 2015 Summer Peak conditions, a power factor range of 0.499 lagging (supplying) to 0.958 leading (absorbing) for the 2015 Winter Peak conditions, a power factor range of 0.651 lagging (supplying) to 0.970 leading (absorbing) for the 2020 Summer Peak conditions, a power factor range of 0.574 lagging (supplying) to 0.966 leading (absorbing) for the 2020 Winter Peak conditions, and a power factor range of 0.852 lagging (supplying) to 0.969 leading (absorbing) for the 2025 Summer Peak conditions.

<u>Study Generator GEN-2015-014</u>

The Power Factor Analysis shows that GEN-2015-014 has a power factor range of 0.999 lagging (supplying) to 0.978 leading (absorbing) for the 2015 Summer Peak conditions, a power factor range of 0.974 to 0.999 leading (absorbing) for the 2015 Winter Peak conditions, a power factor range of 0.955 to 0.999 leading (absorbing) for the 2020 Summer Peak conditions, a power factor range of 0.970 to 0.997 leading (absorbing) for the 2020 Winter Peak conditions, and a power factor range of 0.937 to 0.999 leading (absorbing) for the 2025 Summer Peak conditions.

<u>Study Generator GEN-2015-022</u>

The Power Factor Analysis shows that GEN-2015-022 has a power factor range of 0.916 lagging (supplying) to 0.878 leading (absorbing) for the 2015 Summer Peak conditions, a power factor range of 0.978 lagging (supplying) to 0.961 leading (absorbing) for the 2015 Winter Peak conditions, a power factor range of 0.918 lagging (supplying) to 0.817 leading (absorbing) for the 2020 Summer Peak conditions, a power factor range of 0.957 lagging (supplying) to 0.979 leading (absorbing) for the 2020 Winter Peak conditions, and a power factor range of 0.886 lagging (supplying) to 0.835 leading (absorbing) for the 2025 Summer Peak conditions.

Study Generator ASGI-2015-002

The Power Factor Analysis shows that ASGI-2015-002 has a power factor range of 0.704 lagging (supplying) to 0.683 leading (absorbing) for the 2015 Summer Peak conditions, a power factor range of 0.609 lagging (supplying) to 0.795 leading (absorbing) for the 2015 Winter Peak conditions, a power factor range of 0.652 lagging (supplying) to 0.693 leading (absorbing) for the 2020 Summer Peak conditions, a power factor range of 0.944 lagging (supplying) to 0.873 leading (absorbing) for the 2020 Winter Peak conditions, and a power factor range of 0.873 lagging (supplying) to 0.337 leading (absorbing) for the 2025 Summer Peak conditions.

Summary of the Low Wind/No Wind Analysis

The amount of reactive power injected into the transmission network was recorded at the point of interconnection for GEN-2014-074 for each season. The reactance needed for zero Mvar flow at the POI was 8.9 Mvar.

K: Group 8 Dynamic Stability Analysis Report

See MEPPI report next page

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Southwest Power Pool, Inc. (SPP)

DISIS-2015-001-1 (Group 08) Definitive Impact Study

Final Report

PXE-1137
Revision #00

October 2015

Submitted By:
Mitsubishi Electric Power Products, Inc. (MEPPI)
Power Systems Engineering Services Department
Warrendale, PA

Title:	**DISIS-2015-001-1 (Group 08) Definitive Impact Study: Final Report PXE-1137**
Date:	October 2015

Author: Nicholas W. Tenza; Engineer II, Power Systems Engineering Dept. *Nicholas W. Tenza*
Approved: Elizabeth M. Cook; Section Manager, Power Systems Engineering Dept. *Elizabeth M. Cook*

EXECUTIVE SUMMARY

SPP requested a Definitive Interconnection System Impact Study (DISIS). The DISIS required a Stability Analysis, Short Circuit Analysis, Power Factor Analysis, and Low Wind/No Wind Analysis detailing the impacts of the interconnecting projects as shown in Table ES-1.

Table ES-1
Interconnection Projects Evaluated

Request	Size (MW)	Generator Model	Point of Interconnection
GEN-2015-001	199.8	56 x Vestas V126 3.3MW and 5 x Vestas V126 3.0MW	Ranch Road 345kV
GEN-2015-015	154.6	Siemens 2.3MW with Power Boost (115kW => 2.415MW)	Tap Medford Tap – Coyote 138kV
GEN-2015-016	200	Vestas V110 2.0MW	Tap Centerville – Marmaton 161kV
GEN-2015-024	220	GE 2.0MW	Tap on Thistle to Wichita 345kV, ckt1&2 (560033)
GEN-2015-025	220	GE 2.0MW	Tap on Thistle to Wichita 345kV, ckt1&2 (560033)
GEN-2015-028	3.0 uprate to GEN-2009-025 for total 62.8MW	Siemens 2.3MW with Power Boost (115kW => 2.415MW)	Nardins 69kV
GEN-2015-030	200.1	GE 2.3MW	Sooner 345kV
ASGI-2015-004	54.300 Summer 56.364 Winter	GENSAL	Coffeyville Municipal Light & Power Northern Industrial Park Substation 69kV

SUMMARY OF STABILITY ANALYSIS

The Stability Analysis determined that there were no contingencies that resulted in system instability, generation tripping offline, or voltage violations for the 2015 Summer Peak, 2015

Winter Peak, and 2025 Summer Peak conditions when all generation interconnection requests were at 100% output. Thus, no mitigations or upgrades were required.

SUMMARY OF THE SHORT CIRCUIT ANALYSIS

The short circuit analysis was performed on the 2025 Summer Peak power flow for all study projects. Refer to Table ES-2 for a list of maximum fault currents observed for each study project.

Table ES-2
List of Maximum Fault Currents Observed for Each Study Project

Study Project	Fault Current at POI (kA)	Maximum Fault Current (kA)	Fault Location	Bus Voltage (kV)
GEN-2015-001	13	41.55	NORTWST4	138
GEN-2015-015	8.47	24.47	WICHITA7	345
GEN-2015-016	7.26	24.67	LACYGNE7	345
GEN-2015-024	19.49	41.38	EVANS S4	138
GEN-2015-025				
GEN-2015-028	5.51	15.65	WHEAGLE4	138
GEN-2015-030	22.77	57.59	SEMINOL4	138
ASGI-2015-004	8.59	26.11	ONETA--7	345

SUMMARY OF POWER FACTOR ANALYSIS

For all the generators that follow, the power factor is measured at the point of interconnection (POI).

<u>Study Generator GEN-2015-001</u>
The Power Factor Analysis shows that GEN-2015-001 has a power factor range of 0.999 lagging (supplying) to 0.991 leading (absorbing) for the 2015 Summer Peak conditions, a power factor range of 0.988 lagging (supplying) to 1.00 (unity) for the 2015 Winter Peak conditions, and a power factor range of 0.995 leading (absorbing) to 1.00 unity for the 2025 Summer Peak conditions.

<u>Study Generator GEN-2015-015</u>
The Power Factor Analysis shows that GEN-2015-015 has a power factor range of 0.994 lagging (supplying) to 0.994 leading (absorbing) for the 2015 Summer Peak conditions, a power factor range of 0.978 lagging (supplying) to 0.992 leading (absorbing) for the 2015 Winter Peak

conditions, and a power factor range of 0.995 lagging (supplying) to 0.992 leading (absorbing) for the 2025 Summer Peak conditions.

Study Generator GEN-2015-016

The Power Factor Analysis shows that GEN-2015-016 has a power factor range of 0.975 to 0.998 leading (absorbing) for the 2015 Summer Peak conditions, a power factor range of 0.973 to 0.997 leading (absorbing) for the 2015 Winter Peak conditions, and a power factor range of 0.979 to 0.998 leading (absorbing) for the 2025 Summer Peak conditions.

Study Generator GEN-2015-024 (Tap Wichita – Thistle circuit 1&2)

The Power Factor Analysis shows that GEN-2015-024 has a power factor range of 0.996 lagging (supplying) to 0.974 leading (absorbing) for the 2015 Summer Peak conditions, a power factor range of 0.0.951 to 1.00 (unity) for the 2015 Winter Peak conditions, and a power factor range of 0.998 lagging (supplying) to 0.972 leading (absorbing) for the 2025 Summer Peak conditions.

Study Generator GEN-2015-025 (Tap Wichita – Thistle circuit 1&2)

The Power Factor Analysis shows that GEN-2015-025 has a power factor range of 0.996 lagging (supplying) to 0.974 leading (absorbing) for the 2015 Summer Peak conditions, a power factor range of 0.0.951 to 1.00 (unity) for the 2015 Winter Peak conditions, and a power factor range of 0.998 lagging (supplying) to 0.972 leading (absorbing) for the 2025 Summer Peak conditions.

Study Generator GEN-2015-028

The Power Factor Analysis shows that GEN-2015-028 has a power factor range of 0.961 to 0.999 leading (supplying) for the 2015 Summer Peak conditions, a power factor range of 0.998 lagging (supplying) to 0.975 leading (absorbing) for the 2015 Winter Peak conditions, and a power factor range of 0.988 lagging (supplying) to 0.978 leading (absorbing) for the 2025 Summer Peak conditions.

Study Generator GEN-2015-030

The Power Factor Analysis shows that GEN-2015-030 has a power factor range of 0.935 to 0.999 lagging (supplying) for the 2015 Summer Peak conditions, a power factor range of 0.822 to 0.956 lagging (supplying) for the 2015 Winter Peak conditions, and a power factor range of 0.940 lagging (supplying) to 1.00 (unity) for the 2025 Summer Peak conditions.

SUMMARY OF LOW WIND/NO WIND ANALYSIS

The amount of reactive power injected into the transmission network was recorded at the point of interconnection for GEN-2015-001, GEN-2015-024, GEN-2015-025, and GEN-2015-030 for each season. The maximum reactance needed for zero Mvar flow was 34.8 Mvar for GEN-2015-024 (Tap Wichita – Thistle circuit 1&2). The minimum reactance needed for zero Mvar flow was 9.3 Mvar for GEN-2015-001 (Ranch Road 345 kV).

Table of Contents

SECTION 1: OBJECTIVES

The objective of this report is to provide Southwest Power Pool, Inc. (SPP) with the deliverables for the "DISIS-2015-001-1 (Group 8) Definitive Impact Study." SPP requested an Interconnection System Impact Study for eight (8) generation interconnections for 2015 Summer Peak, 2015 Winter Peak, and 2025 Summer Peak, which requires a Stability Analysis, Short Circuit Analysis, Power Factor Analysis, Low Wind/No Wind Analysis, and an Impact Study Report.

SECTION 2: BACKGROUND

The Siemens Power Technologies, Inc. PSS/E power system simulation program Version 32.2.0 was used for this study. SPP provided the stability database cases for 2015 Summer Peak, 2015 Winter Peak, and 2025 Summer Peak conditions and a list of contingencies to be examined. The model includes the study projects shown in Table 2-1 and the previously queued projects listed in Table 2-2. Refer to Appendix A for the steady-state and dynamic model data for the study projects. A power flow one-line diagram for each generation interconnection project is shown in Figures 2-1 through 2-7. Note that the one-line diagrams represent the 2015 Summer Peak case.

The Stability Analysis determined the impacts of the new interconnecting projects on the stability and voltage recovery of the nearby system and the ability of the interconnecting projects to meet FERC Order 661A. If problems with stability or voltage recovery are identified, the need for reactive compensation or system upgrades will be investigated. Three-phase faults and single line-to-ground faults will be examined as listed in Table 2-3. Note that all contingencies listed were examined for the cluster scenario, and specified contingencies (indicated by an X) were examined for each Stand Alone generator.

A Short Circuit Analysis was performed on the 2025 Summer Peak study year for each study generator in the Cluster Scenario. The study was performed five buses out from the study generator's point of interconnection and results were documented.

The Power Factor Analysis determined the power factor at the point of interconnection for the wind or solar interconnection projects for pre-contingency and post-contingency conditions. The N-1, three phase contingencies listed in Table 2-3 were used in the Power Factor analysis.

The Low Wind/No Wind Analysis was completed for wind or solar farm interconnections that interconnect to a 345 kV or 230 kV bus. This analysis determined if reactive support is needed to have an Mvar flow of approximately zero at the point of interconnection (POI).

Table 2-1
Interconnection Projects Evaluated

Request	Size (MW)	Generator Model	Point of Interconnection
GEN-2015-001	199.8	56 x Vestas V126 3.3MW and 5 x Vestas V126 3.0MW	Ranch Road 345kV
GEN-2015-015	154.6	Siemens 2.3MW with Power Boost (115kW => 2.415MW)	Tap Medford Tap – Coyote 138kV
GEN-2015-016	200	Vestas V110 2.0MW	Tap Centerville – Marmaton 161kV
GEN-2015-024	220	GE 2.0MW	Tap on Thistle to Wichita 345kV, ckt1&2 (560033)
GEN-2015-025	220	GE 2.0MW	Tap on Thistle to Wichita 345kV, ckt1&2 (560033)
GEN-2015-028	3.0 uprate to GEN-2009-025 for total 62.8MW	Siemens 2.3MW with Power Boost (115kW => 2.415MW)	Nardins 69kV
GEN-2015-030	200.1	GE 2.3MW	Sooner 345kV
ASGI-2015-004	54.300 Summer 56.364 Winter	GENSAL	Coffeyville Municipal Light & Power Northern Industrial Park Substation 69kV

Table 2-2
Previously Queued Nearby Interconnection Projects Included

Request	Size (MW)	Generator Model	Point of Interconnection
GEN-2002-004	199.5	GE.1.5MW	Latham 345kV (532800)
GEN-2005-013	199.8	Vestes V90 1.8MW	Caney River 345kV (532780)
GEN-2007-025	299.2	GE 1.6MW	Viola 345kV (532798)
GEN-2008-013	300	G.E. 1.68MW	Hunter 345kV (515476)
GEN-2008-021	1261 Summer 1283 Winter	GENROU	Wolf Creek 345kV (532797)
GEN-2008-098	100.8	Vestas V100 1.8MW	Tap on the Wolf Creek – LaCygne 345kV line (560004)
GEN-2009-025	59.8	Siemens 2.3MW	Tap on the Deerck – Sincblk 69KV line (515528)
GEN-2010-003	100.8	Vestas V100 1.8MW	Tap on the Wolf Creek – LaCygne 345kV line (560004)
GEN-2010-005	299.2	GE 1.6MW	Viola 345kV (532798)
ASGI-2010-006	150	GE1.5MW	Remington 138kV (301369)
GEN-2010-055	4.8	GENROU	Wekiwa 138kV (509757)
GEN-2011-057	150.4	GE 1.6MW	Creswell 138kV (532981)
GEN-2012-027	150.7	GE 1.62MW	Shidler 138kV (510403)
KCPL Distributed: Osawatomie	76	GENROU (543078)	Paola 161kV
GEN-2012-032	300	Vestas V112 3.0MW	Tap Rose Hill-Sooner 345kV (562318)
GEN-2012-033	98.8	GE 1.62MW	Tap Bunch Creek-South 4th 138kV(562303)
GEN-2012-040	76.5	GE 1.7MW	Chilocco 138kV (521198)
GEN-2012-041	85 Summer 121.5 Winter	GENROU	Tap Rose Hill-Sooner 345kV (562318)
GEN-2013-012	4 x 168.0MW Summer 4 x 215MW Winter	GENROU (514910) (514911) (514912)	Redbud 345kV (514909)

Table 2-2 (Continued)
Previously Queued Nearby Interconnection Projects Included

Request	Size (MW)	Generator Model	Point of Interconnection
GEN-2013-028	516.4 Summer 559.5 Winter	GENROU (583743, 583746)	Tap on Tulsa N to GRDA1 345kV (562423)
GEN-2013-029	300	Vestas V100 VCSS 2MW (583753, 583756)	Renfrow 345kV(515543)
GEN-2014-001	200.6	GE 1.7MW 100m (583853,583856)	Tap Wichita to Emporia Energy Center 345kV (562476)
GEN-2014-028	35 (Uprate) (Pgen=259W/ 256S)	GENROU	Riverton 161kV (547469)
GEN-2014-064	248.4	GE 2.3MW	Otter 138kV (514708)
ASGI-2014-014	54.3 Summer 56.4 Winter	GENROU	Ferguson 69kV (512664)

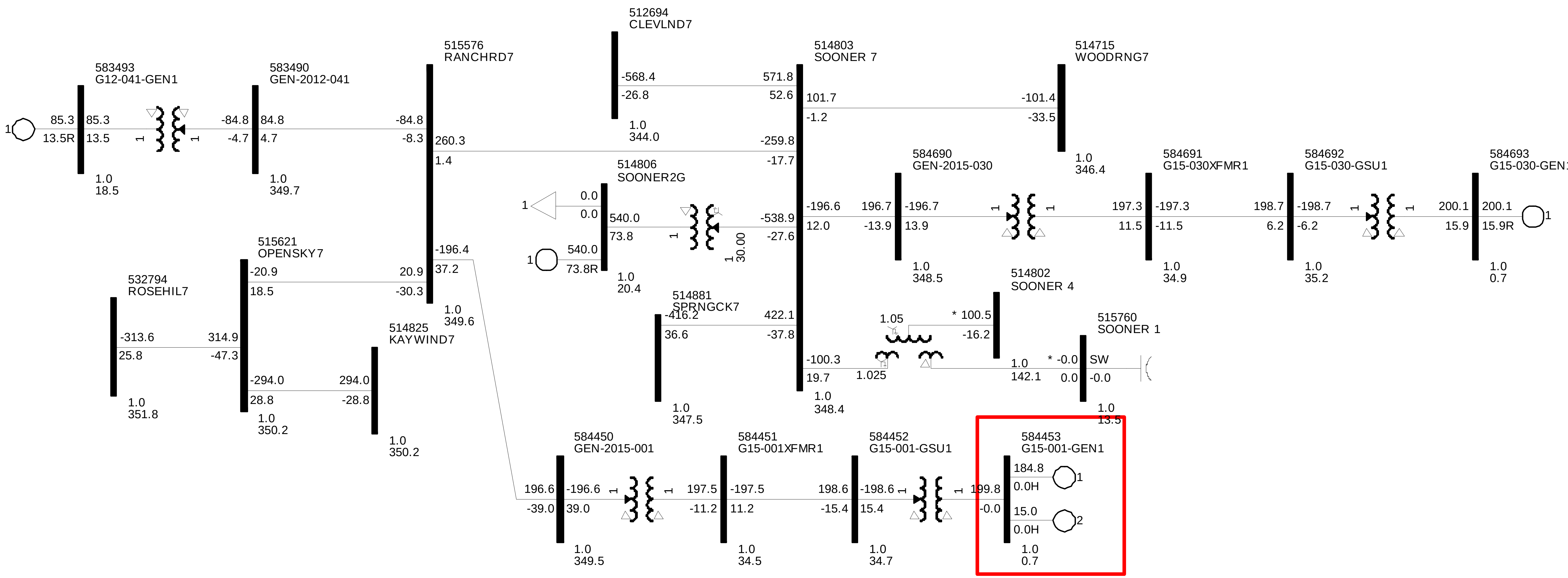

Figure 2-1. Power flow one-line diagram for interconnection project at the Ranch Road 345 kV POI (GEN-2015-001)

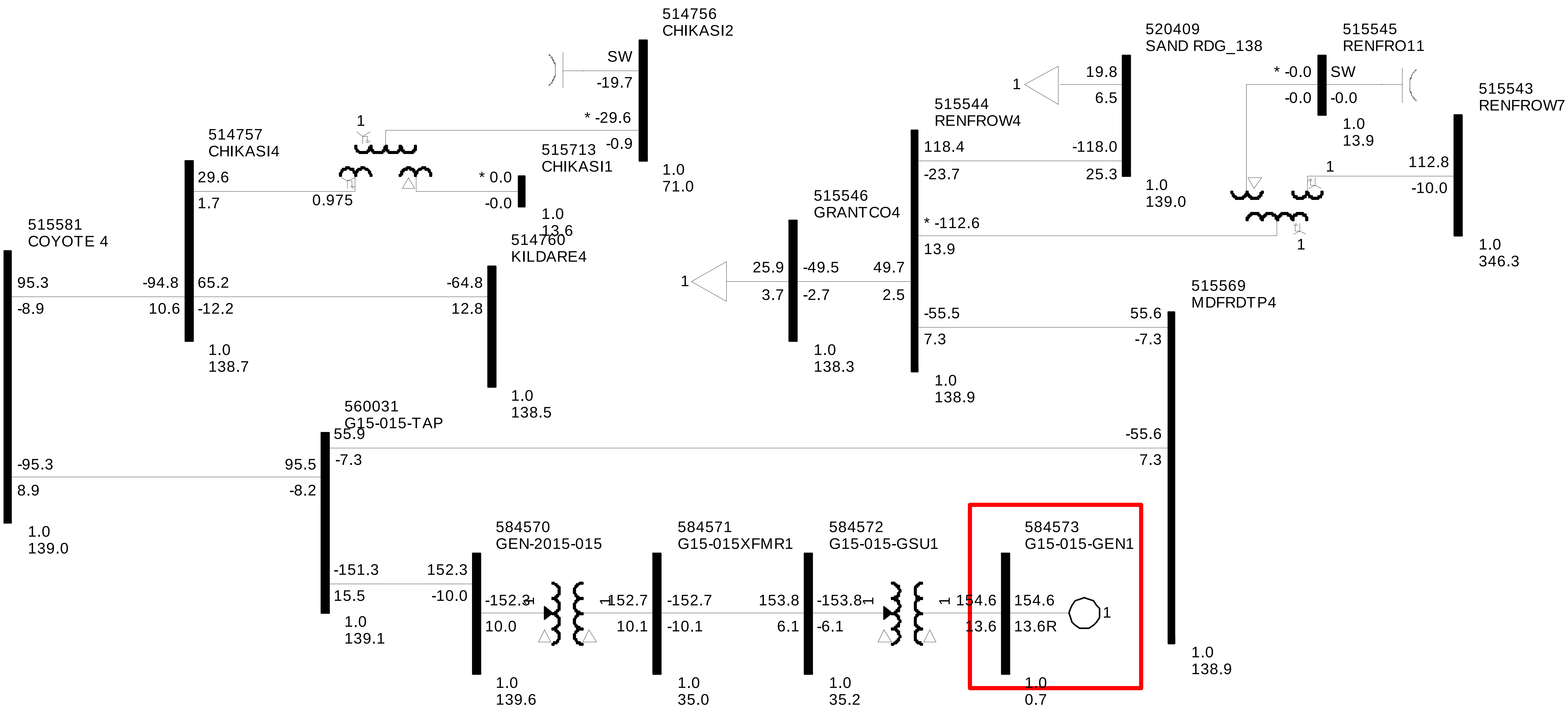

Figure 2-2. Power flow one-line diagram for interconnection project at the Tap along Medford to Coyote 138 kV line (GEN-2015-015)

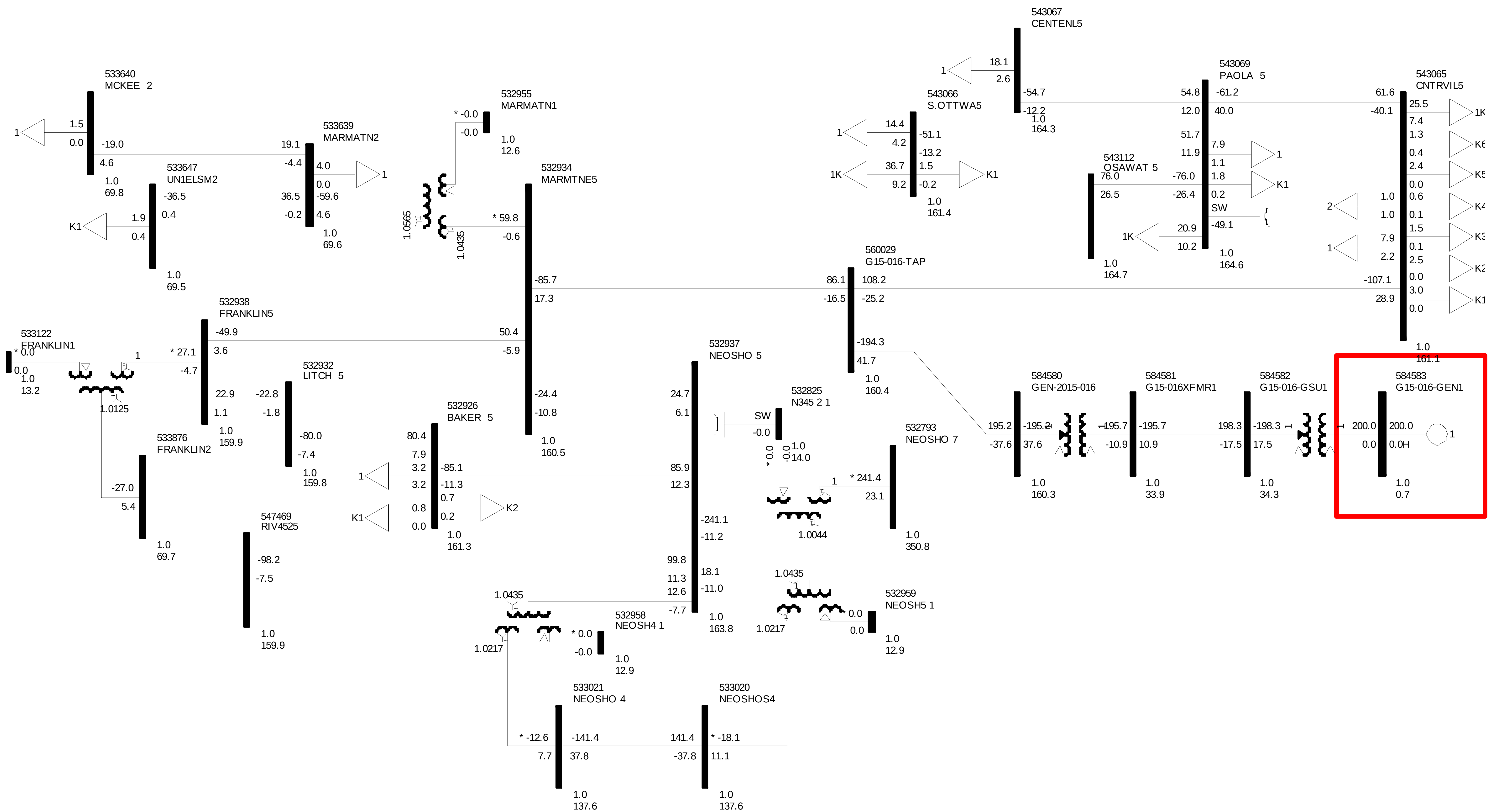

Figure 2-3. Power flow one-line diagram for interconnection project at the Tap along the Centerville to Marmaton 161 kV line (GEN-2015-016)

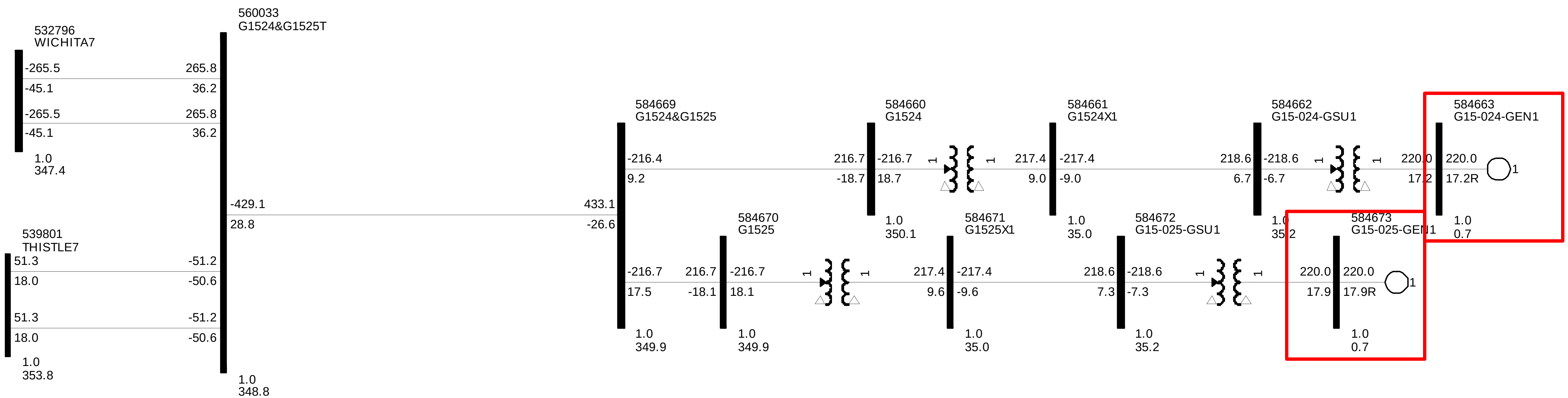

Figure 2-4. Power flow one-line diagram for interconnection project at the Tap along the Wichita – Thistle 345 kV lines (GEN-2015-024, GEN-2015-025)

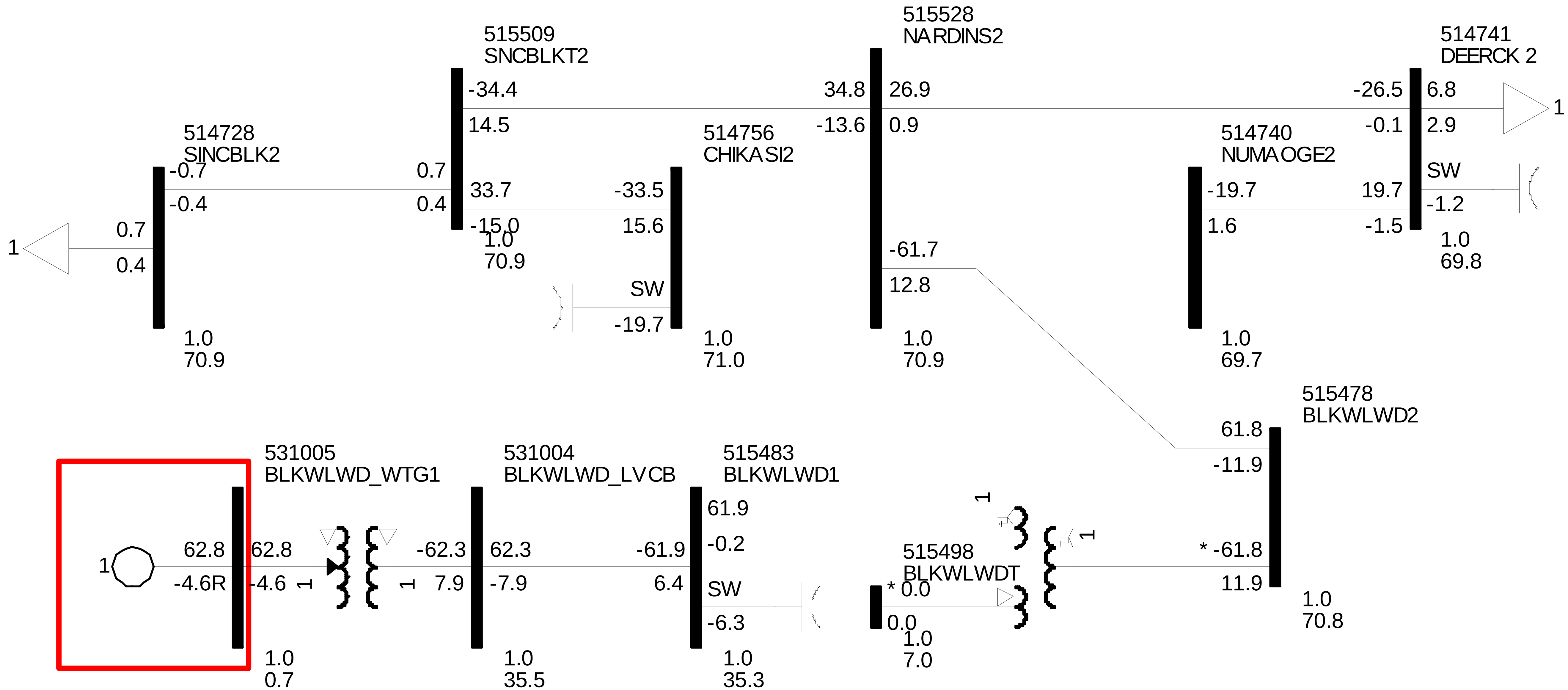

Figure 2-5. Power flow one-line diagram for interconnection project at the Nardins 69 kV POI (GEN-2015-028)

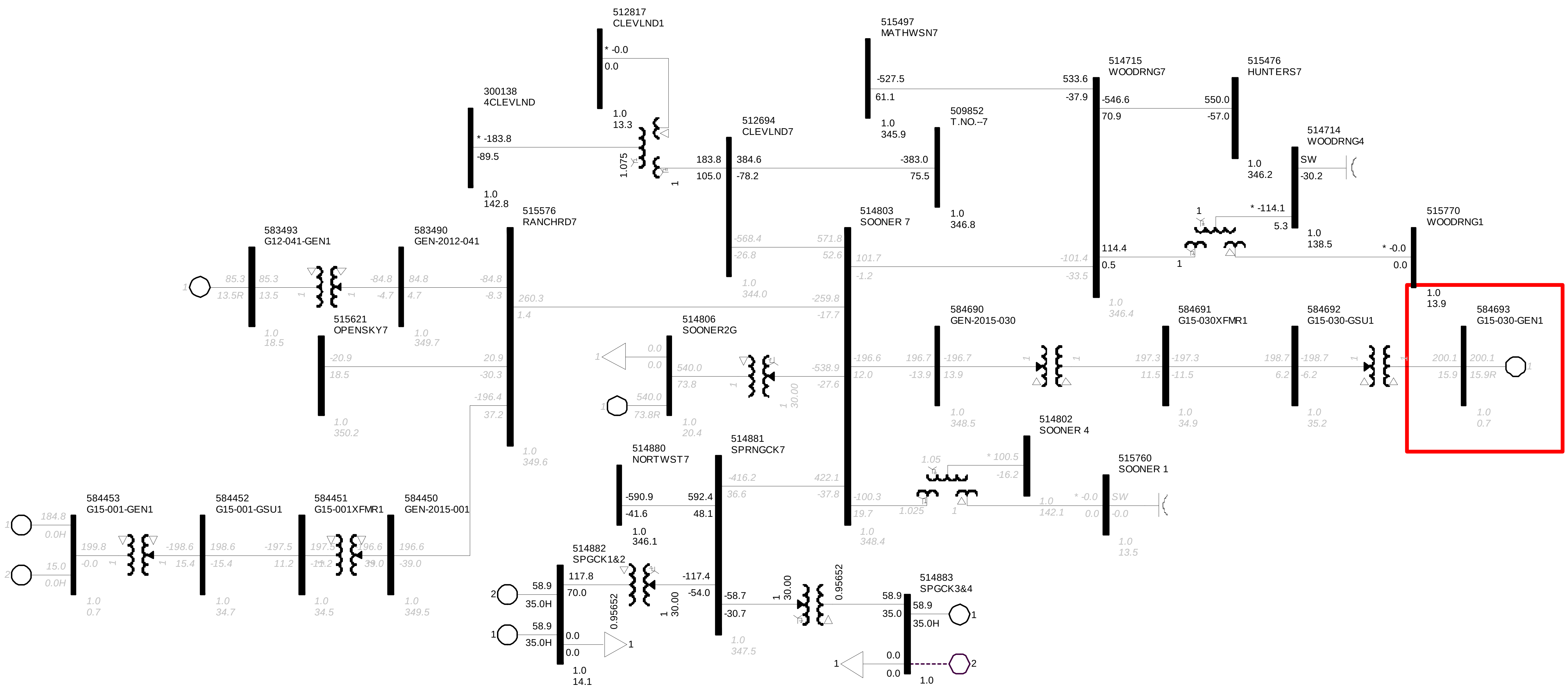

Figure 2-6. Power flow one-line diagram for interconnection project at the Sooner 345 kV POI (GEN-2015-030)

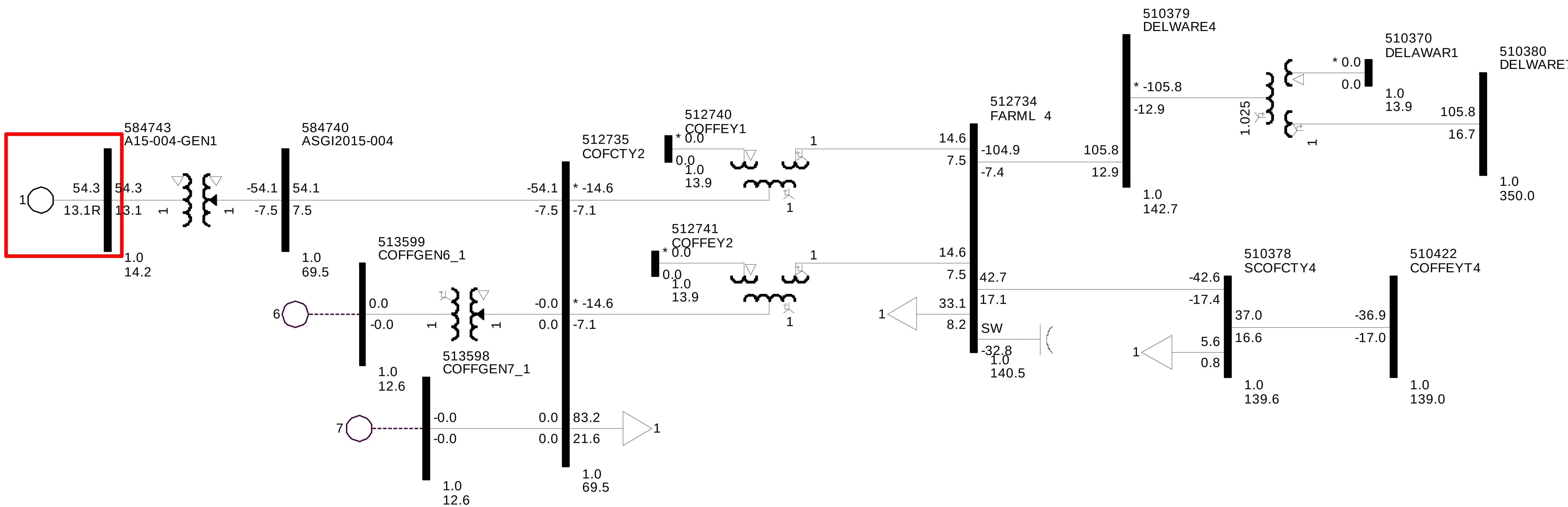

Figure 2-7. Power flow one-line diagram for interconnection project at the Coffeyville Municipal Light & Power Northern Industrial Park Substation 69 kV POI (ASGI-2015-004)

Table 2-3
Case List with Contingency Description

Cont. No.	Cont. Name	Description
1	FLT01-3PH	3 phase fault on the Open Sky (515621) to Ranch Road (515576) 345kV line, near Ranch Road. a. Apply fault at the Ranch Road 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	FLT02-3PH	3 phase fault on the Open Sky (515621) to Rosehill (532794) 345kV line, near Open Sky. a. Apply fault at the Open Sky 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.
3	FLT03-3PH	3 phase fault on the Ranch Road (515576) to Sooner (514803) 345kV line, near Ranch Road. a. Apply fault at the Ranch Road 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	FLT04-3PH	3 phase fault on the Rosehill (532794) to Benton (532791) 345kV line, near Rosehill. a. Apply fault at the Rosehill 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.
5	FLT05-3PH	3 phase fault on the Rosehill (532794) to Wolf Creek (532797) 345kV line, near Rosehill. a. Apply fault at the Rosehill 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	FLT06-3PH	3 phase fault on the Rosehill (532794) to Latham (532800) 345kV line, near Rosehill. a. Apply fault at the Rosehill 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.
7	FLT07-3PH	3 phase fault on the Sooner (514803) to Spring Creek (514881) 345kV line, near Sooner. a. Apply fault at the Sooner 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.
8	FLT08-3PH	3 phase fault on the Sooner (514803) to Cleveland (512694) 345kV line, near Sooner. a. Apply fault at the Sooner 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.
9	FLT09-3PH	3 phase fault on the Sooner (514803) to Woodring (514715) 345kV line, near Sooner. a. Apply fault at the Sooner 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	FLT10-3PH	3 phase fault on the Renfrow (515543) to Hunter (515476) 345kV line, near Renfrow. a. Apply fault at the Renfrow 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.

Table 2-3 (Continued)
Case List with Contingency Description

Cont. No.	Cont. Name	Description
11	FLT11-3PH	3 phase fault on the Renfrow (515543) to Viola (532798) 345kV line, near Renfro. a. Apply fault at the Renfro 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	FLT12-3PH	3 phase fault on the Viola (532798) to Wichita (532796) 345kV line, near Viola. a. Apply fault at the Viola 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	FLT13-3PH	3 phase fault on the Wichita (532796) to Benton (532791) 345kV line, near Wichita. a. Apply fault at the Wichita 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	FLT14-3PH	3 phase fault on the Wichita (532796) to G14-001 Tap (562476) 345kV line, near Wichita. a. Apply fault at the Wichita 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.
15	FLT15-3PH	3 phase fault on the Emporia EC (532768) to G14-001 Tap (562476) 345kV line, near G14-001. a. Apply fault at the G14-001 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.
16	FLT16-3PH	3 phase fault on the Wichita (532796) to G1524&G1525T (560033) 345kV line circuit 1, near Wichita. a. Apply fault at the Wichita 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
17	FLT17-3PH (2025SP Only)	3 phase fault on the Viola (532798) 345/(533075) 138/(532832) 13.8kV transformer, near Viola 345. a. Apply fault at the Viola 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
18	FLT18-3PH	3 phase fault on the Renfrow (515543) 345/(515544) 138/(515545) 13.8kV transformer, near Renfrow 345. a. Apply fault at the Renfrow 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
19	FLT19-3PH	3 phase fault on the G15-015 Tap (560031) to Medford Tap (515569) 138kV line, near G15-015. a. Apply fault at the G15-015 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	FLT20-3PH	3 phase fault on the G15-015 Tap (560031) to Coyote (5155581) 138kV line, near G15-015. a. Apply fault at the G15-015 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	FLT21-3PH	3 phase fault on the Kildare (514760) to NewkirkAT (514764) 138kV circuit 1 line, near Stateline. a. Apply fault at the Kildare 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.

Table 2-3 (Continued)
Case List with Contingency Description

Cont. No.	Cont. Name	Description
22	FLT22-3PH	3 phase fault on the Kildare (514760) to White Eagle (514761) 138kV circuit 1 line, near Stateline. a. Apply fault at the Kildare 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	FLT23-3PH	3 phase fault on the Renfrow (515544) to Sand Ridge (520409) 138kV circuit 1 line, near Renfrow. a. Apply fault at the Renfrow 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	FLT24-3PH	3 phase fault on the G15-016 Tap (560029) to Marmaton (532934) 161kV circuit 1 line, near G15-016. a. Apply fault at the G15-016 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	FLT25-3PH	3 phase fault on the G15-016 Tap (560029) to Centerville (543065) 161kV circuit 1 line, near G15-016. a. Apply fault at the G15-016 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	FLT26-3PH	3 phase fault on the Marmaton (532934) 161/(533639) 69/(532955) 13.2kV transformer, near Marmaton 161kV. a. Apply fault at the Marmaton 161kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
27	FLT27-3PH	3 phase fault on the Franklin (532938) to Litchfield (532932) 161kV circuit 1 line, near Franklin. a. Apply fault at the Franklin 161kV 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	FLT28-3PH	3 phase fault on the Franklin (532938) 161/(533876) 69/(533122) 13.2kV transformer, near Franklin 161kV. a. Apply fault at the Franklin 161kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
29	FLT29-3PH	3 phase fault on the Neosho (532937) to Marmaton (532934) 161kV circuit 1 line, near Neosho. a. Apply fault at the Neosho 161kV 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	FLT30-3PH	3 phase fault on the Neosho (532937) to Baker (532926) 161kV circuit 1 line, near Neosho. a. Apply fault at the Neosho 161kV 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	FLT31-3PH	3 phase fault on the Neosho (532793) to Lacygne (542981) 345kV circuit 1 line, near Neosho. a. Apply fault at the Neosho 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.

Table 2-3 (Continued)
Case List with Contingency Description

Cont. No.	Cont. Name	Description
32	FLT32-3PH	3 phase fault on the Centennial (543067) to Paola (543069) 161kV circuit 1 line, near Centerville. a. Apply fault at the Centennial 161kV 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	FLT33-3PH	3 phase fault on the Reno (532771) to Wichita (532796) 345kV circuit 1 line, near Wichita. a. Apply fault at the Wichita 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	FLT34-3PH	3 phase fault on the Wichita (532796) 345/Evans (533040) 138/(532829) 13.8kV transformer circuit 1, near Wichita 345kV. a. Apply fault at the Wichita 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
35	FLT35-3PH	3 phase fault on the Lang (532769) to Emporia EC (532768) 345kV circuit 1 line, near Emporia EC. a. Apply fault at the Emporia EC 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	FLT36-3PH	3 phase fault on the Morris (532770) to Emporia EC (532768) 345kV circuit 1 line, near Emporia EC. a. Apply fault at the Emporia EC 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	FLT37-3PH	3 phase fault on the Swissvale (532774) to Emporia EC (532768) 345kV circuit 1 line, near Emporia EC. a. Apply fault at the Emporia EC 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.
38	FLT38-3PH	3 phase fault on the Reno (532771) to Summit (532773) 345kV circuit 1 line, near Reno. a. Apply fault at the Reno 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	FLT39-3PH	3 phase fault on the Rosehill 345kV (532794) to Rosehill (533062) 138kV/(532831) 13.8kV transformer, near the 345kV bus. a. Apply fault at the Rosehill 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
40	FLT40-3PH	3 phase fault on the Nardins (515528) to Deer Creek (514741) 69kV circuit 1 line, near Nardins. a. Apply fault at the Nardins 69kV bus. b. Clear fault after 6.5 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 6.5 cycles, then trip the line in (b) and remove fault.
41	FLT41-3PH	3 phase fault on the Nardins (515528) to Sinclair Blackwell Tap (515509) 69kV circuit 1 line, near Nardins. a. Apply fault at the Nardins 69kV bus. b. Clear fault after 6.5 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 6.5 cycles, then trip the line in (b) and remove fault.

Table 2-3 (Continued)
Case List with Contingency Description

Cont. No.	Cont. Name	Description
42	FLT42-3PH	3 phase fault on the Grant Co (515547) to Clyde (514719) 69kV circuit 1 line, near Grant Co. a. Apply fault at the Grant Co 69kV bus. b. Clear fault after 6.5 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 6.5 cycles, then trip the line in (b) and remove fault.
43	FLT43-3PH	3 phase fault on the Grant Co (515546) 138/ (515547) 69/ (515548) 13.8kV circuit 1 transformer, near Grant Co 69kV. a. Apply fault at the Grant Co 69kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
44	FLT44-3PH	3 phase fault on the Chickaskia (514756) to Blackwell (514755) 69kV circuit 1 line, near Chikaskia. a. Apply fault at the Chikaskia 69kV bus. b. Clear fault after 6.5 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 6.5 cycles, then trip the line in (b) and remove fault.
45	FLT45-3PH	3 phase fault on the Chickaskia (514756) to Braman (514750) 69kV circuit 1 line, near Chikaskia. a. Apply fault at the Chikaskia 69kV bus. b. Clear fault after 6.5 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 6.5 cycles, then trip the line in (b) and remove fault.
46	FLT46-3PH	3 phase fault on the Chikaskia (514757) 138/ (514756) 69/ (515713) 13.8kV circuit 1 transformer, near Chikaskia 69kV. a. Apply fault at the Chikaskia 69kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
47	FLT47-3PH	3 phase fault on the Woodring (514715) to Mathewson (515797) 345kV circuit 1 line, near Woodring. a. Apply fault at the Woodring 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.
48	FLT48-3PH	3 phase fault on the Woodring (514715) 345/ (514714) 138/ (515770) 13.8kV circuit 1 transformer, near Woodring 345kV. a. Apply fault at the Woodring 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
49	FLT49-3PH	3 phase fault on the Sooner (514803) 345/ (514802) 138/ (515760) 13.8kV circuit 1 transformer, near Sooner 345kV. a. Apply fault at the Sooner 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
50	FLT50-3PH	3 phase fault on the Coffeyville Farmland (512734) 138/ Coffeyville City (512735) 69/ (512740) 13.8kV circuit 1 transformer, near Coffeyville City 69kV. a. Apply fault at the Coffeyville City 69kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
51	FLT51-3PH	3 phase fault on the Coffeyville Farmland (512734) to Delaware (510379) 138kV circuit 1 line, near Coffeyville Farmland. a. Apply fault at the Coffeyville Farmland 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.
52	FLT52-3PH	3 phase fault on the Coffeyville Farmland (512734) to South Coffeyville City (510378) 138kV circuit 1 line, near Coffeyville Farmland. a. Apply fault at the Coffeyville Farmland 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.

Table 2-3 (Continued)
Case List with Contingency Description

Cont. No.	Cont. Name	Description
53	FLT53-3PH	3 phase fault on the South Coffeyville Tap (510422) to Dearing (533002) 138kV circuit 1 line, near South Coffeyville Tap. a. Apply fault at the South Coffeyville Tap 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.
54	FLT54-3PH	3 phase fault on the South Coffeyville Tap (510422) to North Bartlesville (510386) 138kV circuit 1 line, near South Coffeyville Tap. a. Apply fault at the South Coffeyville Tap 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.
55	FLT55-3PH	3 phase fault on the Dearing (533002) to Montgomery (533004) 138kV circuit 1 line, near Dearing. a. Apply fault at the Dearing 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.
56	FLT56-3PH	3 phase fault on the Delaware (510380) to NES (510406) 345kV circuit 1 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.
57	FLT57-3PH	3 phase fault on the Delaware (510380) to Neosho (532793) 345kV circuit 1 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.
58	FLT58-3PH	**Prior outage on the Sooner (514803) – Cleveland (512694) 345kV line** 3 phase fault on the Sooner (514803) to Woodring (514715) 345kV line, near Sooner. a. Apply fault at the Sooner 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.
59	FLT59-3PH	**Prior outage on the Sooner (514803) – Spring Creek (514881) 345kV line** 3 phase fault on the Sooner (514803) to Woodring (514715) 345kV line, near Sooner. a. Apply fault at the Sooner 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.
60	FLT60-3PH	**Prior outage on the Rosehill (532794) – Wolf Creek (532797) 345kV line** 3 phase fault on the Rosehill (532794) to Benton (532791) 345kV line, near Rosehill. a. Apply fault at the Rosehill 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.
61	FLT61-3PH	**Prior outage on the Caney River (532780) – Neosho (532793) 345kV line** 3 phase fault on the Rosehill (532794) to Benton (532791) 345kV line, near Caney River. a. Apply fault at the Rosehill 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.

Table 2-3 (Continued)
Case List with Contingency Description

Cont. No.	Cont. Name	Description
62	FLT62-3PH	**Prior outage on the Caney River (532780) – Neosho (532793) 345kV line** 3 phase fault on the Wichita (532796) to Benton (532791) 345kV line, near Wichita. a. Apply fault at the Wichita 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.
63	FLT63-3PH	**Prior outage on the Renfrow (515543) 345/ (515544) 138/ (515545) 13.8kV transformer** 3 phase fault on the Renfrow (515543) to Viola (532798) 345kV line, near Renfrow. a. Apply fault at the Renfrow 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.
64	FLT64-3PH	**Prior outage on the Renfrow (515543) 345/ (515544) 138/ (515545) 13.8kV transformer** 3 phase fault on the Renfrow (515543) to Hunter (515476) 345kV line, near Renfrow. a. Apply fault at the Renfrow 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.
65	FLT65-3PH	**Prior outage on the Renfrow (515543) 345/ (515544) 138/ (515545) 13.8kV transformer** 3 phase fault on the Viola (532798) to Wichita (532798) 345kV line, near Viola. a. Apply fault at the Viola 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.
66	FLT66-3PH	**Prior outage on the Wichita (532796) – Benton (532791) 345kV line** 3 phase fault on the Hunter (515476) to Woodring (514715) 345kV line, near Hunter. a. Apply fault at the Hunter 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.
67	FLT67-3PH	**Prior outage on the Renfrow (515544) – Sand Ridge (520409) 138kV line** 3 phase fault on the Renfrow (515544) to Grant Co (515546) 138kV line, near Renfrow. a. Apply fault at the Renfrow 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.
68	FLT68-3PH	**Prior outage on the Chikaskia (514757) 138/ (514756) 69/ (515713) 13.2kV transformer** 3 phase fault on the Kildare (514760) to Chikaskia (514757) 138kV line, near Chikaskia. a. Apply fault at the Chikaskia 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.
69	FLT69-3PH	**Prior outage on the Marmaton (532934) 161/ (533639) 69/ (532955) 13.2kV transformer** 3 phase fault on the Marmaton (532934) to Franklin (532938) 161kV line, near Marmaton. a. Apply fault at the Marmaton 161kV 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.

Table 2-3 (Continued)
Case List with Contingency Description

Cont. No.	Cont. Name	Description
70	FLT70-3PH	**Prior outage on the Marmaton (532934) 161/ (533639) 69/ (532955) 13.2kV transformer** 3 phase fault on the Marmaton (532934) to Neosho (532937) 161kV line, near Marmaton. a. Apply fault at the Marmaton 161kV 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.
71	FLT71-3PH	**Prior outage on the S Ottawa (543066) – SE Ottawa (543055) 161kV line** 3 phase fault on the Paola (543069) to Centennial (543067) 161kV line, near Paola. a. Apply fault at the Paola 161kV 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.
72	FLT72-3PH	**Prior outage on the Neosho (532937) – Baker (532926) 161kV line** 3 phase fault on the Neosho (532937) to Riverton (547469) 161kV line, near Neosho. a. Apply fault at the Neosho 161kV 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.
73	FLT73-3PH	**Prior outage on the Wichita (532796) – Benton (532791) 345kV line** 3 phase fault on the G14-01 Tap (562476) to Emporia EC (532768) 345kV line, near G14-01. a. Apply fault at the G14-01 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.
74	FLT74-3PH	**Prior outage on the Wichita (532796) – Benton (532791) 345kV line** 3 phase fault on the Wichita (532796) to Viola (532798) 345kV line, near Wichita. a. Apply fault at the Wichita 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.
75	FLT75-3PH	**Prior outage on the Wichita (532796) – G1524&G1525T (560033) 345kV circuit 1 line** 3 phase fault on the Wichita (532796) to G1524&G1525T (560033) 345kV circuit 2 line, near Wichita. a. Apply fault at the Wichita 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
76	FLT76-3PH	**Prior outage on the Viola (532798) – Renfrow (515543) 345kV line** 3 phase fault on the Rosehill (532794) to Open Sky (515621) 345kV line, near Rosehill. a. Apply fault at the Rosehill 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.
77	FLT77-3PH	**Prior Outage on the Chikaskia (514757) 138/ (514756) 69/ (515713) 13.2kV transformer** 3 phase fault on the Chikaskia (514757) to Blackwell (514755) 69kV line, near Chikaskia. a. Apply fault at the Chikaskia 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.

Table 2-3 (Continued)
Case List with Contingency Description

Cont. No.	Cont. Name	Description
78	FLT78-3PH	**Prior Outage on the Grant Co (515546) 138/ (515547) 69/ (515548) 13.8kV transformer** 3 phase fault on the Grant Co (515547) to Clyde (514719) 69kV line, near Grant Co. a. Apply fault at the Grant Co 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.
79	FLT79-3PH	**Prior outage on the Woodring (514715) – Hunters (515476) 345kV line** 3 phase fault on the Woodring (514715) to Sooner (514803) 345kV line, near Woodring. a. Apply fault at the Woodring 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.
80	FLT80-3PH	**Prior outage on the Sooner (514803) – Cleveland (512694) 345kV line** 3 phase fault on the Sooner (514803) to Spring Creek (514881) 345kV line, near Sooner. a. Apply fault at the Sooner 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.
81	FLT81-3PH	**Prior outage on the Sooner (514803) – Cleveland (512694) 345kV line** 3 phase fault on the Sooner (514803) to Ranch Road (515576) 345kV line, near Sooner. a. Apply fault at the Sooner 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.
82	FLT82-3PH	**Prior outage on the Sooner (514803) – Woodring (514715) 345kV line** 3 phase fault on the Sooner (514803) to Spring Creek (514881) 345kV line, near Sooner. a. Apply fault at the Sooner 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.
83	FLT83-3PH	**Prior outage on the Coffeyville Farmland (512734) 138/ Coffeyville City (512735) 69/ (512740) 13.8kV circuit 1 transformer, near Coffeyville City 69kV.** 3 phase fault on the Coffeyville Farmland (512734) to South Coffeyville City (510378) 138kV line, near Coffeyville Farmland. a. Apply fault at the Coffeyville Farmland 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.
84	FLT84-3PH	**Prior outage on the Coffeyville Farmland (512734) 138/ Coffeyville City (512735) 69/ (512740) 13.8kV circuit 1 transformer, near Coffeyville City 69kV.** 3 phase fault on the Coffeyville Farmland (512734) to Delaware (510379) 138kV line, near Coffeyville Farmland. a. Apply fault at the Coffeyville Farmland 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.
85	FLT85-1PH	**Stuck Breaker on Riverton – Neosho 161kv line** a. Apply single-phase fault at Riverton (547469) 161kV bus on the Riverton – Neosho 161kV line b. After 20 cycles, trip the Riverton (547469) 161/69 (547541)/12.5 (547725) kV transformer c. Trip the Riverton (547469) to Neosho (532937) line, and remove the fault

Table 2-3 (Continued)
Case List with Contingency Description

Cont. No.	Cont. Name	Description
86	FLT86-1PH	**Ranch Road 345kV Single Phase Fault** a. Apply single-phase fault on the Ranch Road (515576) – Open Sky (515621) 345kV line, near Ranch Road. b. Clear fault after 5 cycles by tripping the line in (a). c. Wait 20 cycles, and then re-close the line in (a) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (a) and remove fault.
87	FLT87-1PH	**Ranch Road 345kV Single Phase Fault** a. Apply single-phase fault on the Ranch Road (515576) – Sooner (514803) 345kV line, near Ranch Road. b. Clear fault after 5 cycles by tripping the line in (a). c. Wait 20 cycles, and then re-close the line in (a) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (a) and remove fault.
88	FLT88-1PH	**Stuck Breaker on Renfrow – Viola 345kV circuit 1 line** a. Apply single-phase fault at Renfrow (515543) on the 345kV bus. b. After 20 cycles, trip the Renfrow 345/ (515544) 138/(515545) 13.8kV transformer c. Trip the Renfrow – Viola (532798) 345 kV circuit 1 line, and remove the fault
89	FLT89-1PH	**Stuck Breaker on Renfrow – Hunter 345kV circuit 1 line** a. Apply single-phase fault at Renfrow (515543) on the 345kV bus. b. After 20 cycles, trip the Renfrow 345/ (515544) 138/(515545) 13.8kV transformer c. Trip the Renfrow – Hunter (515476) 345 kV circuit 1 line, and remove the fault
90	FLT90-1PH	**G15-015 Tap 138kV Single Phase Fault** a. Apply single-phase fault on the G15-015 Tap (560031) – Coyote (515581) 138kV line, near G15-015 Tap. b. Clear fault after 6.5 cycles by tripping the line in (a). c. Wait 20 cycles, and then re-close the line in (a) back into the fault. d. Leave fault on for 6.5 cycles, then trip the line in (a) and remove fault.
91	FLT91-1PH	**G15-015 Tap 138kV Single Phase Fault** a. Apply single-phase fault on the G15-015 Tap (560031) – Medford Tap (515569) 138kV line, near G15-015 Tap. b. Clear fault after 6.5 cycles by tripping the line in (a). c. Wait 20 cycles, and then re-close the line in (a) back into the fault. d. Leave fault on for 6.5 cycles, then trip the line in (a) and remove fault.
92	FLT92-1PH	**G15-016 Tap 161kV Single Phase Fault** a. Apply single-phase fault on the G15-016 Tap (560029) – Centerville (543065) 161kV line, near G15-016 Tap. b. Clear fault after 6.5 cycles by tripping the line in (a). c. Wait 20 cycles, and then re-close the line in (a) back into the fault. d. Leave fault on for 6.5 cycles, then trip the line in (a) and remove fault.
93	FLT93-1PH	**G15-016 Tap 161kV Single Phase Fault** a. Apply single-phase fault on the G15-016 Tap (560029) – Marmaton (532934) line, near G15-016 Tap. b. Clear fault after 6.5 cycles by tripping the line in (a). c. Wait 20 cycles, and then re-close the line in (a) back into the fault. d. Leave fault on for 6.5 cycles, then trip the line in (a) and remove fault.
94	FLT94-1PH	**Stuck Breaker on Wichita – G1524&1525T 345kV circuit 2 line** a. Apply single-phase fault at Wichita (532796) on the 345kV bus. b. After 20 cycles, trip the Wichita 345/ (533040) 138/(532830) 13.8kV transformer circuit 1 c. Trip the Wichita – G1524&G1525T (560033) 345 kV circuit 2 line, and remove the fault
95	FLT95-1PH	**Stuck Breaker on Wichita – G1524&1525T 345kV circuit 1 line** a. Apply single-phase fault at Wichita (532796) on the 345kV bus. b. After 20 cycles, trip the Wichita - Viola (532798) 345kV line circuit 1 c. Trip the Wichita – G1524&G1525T (560033) 345 kV circuit 1 line, and remove the fault

Table 2-3 (Continued)
Case List with Contingency Description

Cont. No.	Cont. Name	Description
96	FLT96-1PH	**Stuck Breaker on Wichita – G14-001 Tap 345kV circuit 1 line** a. Apply single-phase fault at Wichita (532796) on the 345kV bus. b. After 20 cycles, trip the Wichita 345/ (533040) 138/(532829) 13.8kV transformer circuit 1 c. Trip the Wichita – G14-001 Tap (562476) 345 kV line, and remove the fault
97	FLT97-1PH	**Stuck Breaker on Wichita – Reno 345kV circuit 1 line** a. Apply single-phase fault at Wichita (532796) on the 345kV bus. b. After 20 cycles, trip the Wichita – Benton (532791) 345kV line circuit 1 c. Trip the Wichita – Reno (532771) 345 kV line, and remove the fault
98	FLT98-1PH	**Nardin 69kV Single Phase Fault** a. Apply single-phase fault on the Nardin (515528) – Sinclair Blackwell Tap (515509) line, near Nardin. b. Clear fault after 8 cycles by tripping the line in (a). c. Wait 20 cycles, and then re-close the line in (a) back into the fault. d. Leave fault on for 8 cycles, then trip the line in (a) and remove fault.
99	FLT99-1PH	**Nardin 69kV Single Phase Fault** a. Apply single-phase fault on the Nardin (515528) – Deer Creek (514741) line, near Nardin. b. Clear fault after 8 cycles by tripping the line in (a). c. Wait 20 cycles, and then re-close the line in (a) back into the fault. d. Leave fault on for 8 cycles, then trip the line in (a) and remove fault.
100	FLT100-1PH	**Stuck Breaker on Rosehill 345/138/13.8kV circuit 1 transformer** a. Apply single-phase fault at Rosehill (532794) on the 345kV bus. b. After 20 cycles, trip the Rosehill (532794) – Benton (532791) 345kV line c. Trip the Rosehill 345/(532794) 138/(532831) 13.8kV transformer circuit 1, and remove the fault
101	FLT101-1PH	**Stuck Breaker on Rosehill 345/138/13.8kV circuit 3 transformer** a. Apply single-phase fault at Rosehill (532794) on the 345kV bus. b. After 20 cycles, trip the Rosehill (532794) – Wolf Creek (532797) 345kV line c. Trip the Rosehill 345/(533062) 138/(532827) 13.8kV transformer circuit 3, and remove the fault
102	FLT102-1PH	**Stuck Breaker on Sooner – Ranch Road 345kV line** a. Apply single-phase fault at Sooner (514803) 345kV bus on the Sooner – Ranch Road 345kV line b. After 20 cycles, trip the Sooner (514803) – Woodring 345kV line c. Trip the Sooner– Ranch Road (515576) line, and remove the fault
103	FLT103-1PH	**Stuck Breaker on Sooner – Cleveland 345kV line** a. Apply single-phase fault at Sooner (514803) 345kV bus on the Sooner – Cleveland 345kV line b. After 20 cycles, trip the Sooner (514803) 345/ (514802) 138/ (515760) 13.8kV transformer c. Trip the Sooner– Cleveland (512694) line, and remove the fault
104	FLT104-1PH	**Stuck Breaker on Coffeyville Farmland – South Coffeyville City 138kV line** a. Apply single-phase fault at Coffeyville Farmland (512734) 138kV bus on the Coffeyville Farmland – South Coffeyville City 138kV line b. After 20 cycles, trip the Coffeyville Farmland (512734) 138/ Coffeyville City (512735) 69/ (512740) 13.8kV transformer c. Trip the Coffeyville Farmland – South Coffeyville City (510378) line, and remove the fault
105	FLT105-1PH	**Stuck Breaker on Coffeyville Farmland – Delaware 138kV line** a. Apply single-phase fault at Coffeyville Farmland (512734) 138kV bus on the Coffeyville Farmland – Delaware138kV line b. After 20 cycles, trip the Coffeyville Farmland (512734) 138/ Coffeyville City (512735) 69/ (512740) 13.8kV transformer c. Trip the Coffeyville Farmland – Delaware (510379) line, and remove the fault

SECTION 3: STABILITY ANALYSIS

The objective of the Stability Analysis was to determine the impacts of the generator interconnections on the stability and voltage recovery on the SPP transmission system. If problems with stability or voltage recovery were identified the need for reactive compensation or system upgrades were investigated.

3.1 Approach

SPP provided MEPPI with the following three power flow cases from the DISIS-2015-001 Group 8 study:

- 2015 Summer Peak
- 2015 Winter Peak
- 2025 Summer Peak

For this analysis, DISIS-2015-001-1 Group 8, SPP supplied updates to GEN-2015-001, GEN-2015-024, and GEN-2015-025. The aggregate representation of GEN-2015-001 was changed from 100 Vestas V110 2.0 MW turbines to 56 Vestas V126 3.3 MW turbines and 5 Vestas V126 3.0 MW turbines for a total generation interconnection of 199.8 MW. GEN-2015-024 and GEN-2015-025 were separated in to two separate facilities that share a portion of the transmission lead to the POI. GEN-2015-003 was withdrawn from the queue and was sub sequentially switched off in the power flow case, including all elements up to the POI. To maintain generation and load balance, generation was re-dispatched according to the scaling subsystem provided by SPP. Once these updates were applied to each year and season, each case was examined prior to the Stability Analysis to ensure the case contained the proposed study projects and any previously queued projects listed in Tables 2-2 and 2-3, respectively. There was no suspect power flow data in the study area. The dynamic datasets were also verified and stable initial system conditions (i.e., “flat lines”) were achieved. Three-phase and single phase-to-ground faults listed in Table 2-3 were examined. Single-phase fault impedances were calculated for each season to result in a voltage of approximately 60% of the pre-fault voltage. Refer to Table 3-1 for a list of the calculated single-phase fault impedances used for this analysis.

Table 3-1
Calculated Single-Phase Fault Impedances for the Stability Analysis

Cont. No.*	Cont. Name	Single-Phase Fault Impedance (MVA)		
		2015 Summer	2015 Winter	2025 Summer
85	FLT85-1PH	-4234.4	-4031.3	-4234.4
86	FLT86-1PH	-5250.0	-4843.8	-5250.0
87	FLT87-1PH	-5250.0	-4843.8	-5250.0
88	FLT88-1PH	-4437.5	-4031.3	-4843.8
89	FLT89-1PH	-4437.5	-4031.3	-4843.8
90	FLT90-1PH	-1375.0	-1375.0	-1375.0
91	FLT91-1PH	-1375.0	-1375.0	-1375.0
92	FLT92-1PH	-1375.0	-1375.0	-1375.0
93	FLT93-1PH	-1375.0	-1375.0	-1375.0
94	FLT94-1PH	-9312.5	-7687.5	-10125.0
95	FLT95-1PH	-9312.5	-7687.5	-10125.0
96	FLT96-1PH	-9312.5	-7687.5	-10125.0
97	FLT97-1PH	-9312.5	-7687.5	-10125.0
98	FLT98-1PH	-500.0	-468.8	-468.8
99	FLT99-1PH	-500.0	-468.8	-468.8
100	FLT100-1PH	-7281.3	-6468.8	-7281.3
101	FLT101-1PH	-7281.3	-6468.8	-7281.3
102	FLT102-1PH	-8906.3	-8500.0	-9312.5
103	FLT103-1PH	-8906.3	-8500.0	-9312.5
104	FLT104-1PH	-1250.0	-1250.0	-1250.0
105	FLT105-1PH	-1250.0	-1250.0	-1250.0

*Refer to Table 2-3 for a description of the contingency scenerio

Bus voltages, machine rotor angles, and previously queued generation in the study area were monitored in addition to bus voltages and machine rotor angles in the following areas:

- 520 AEPW
- 524 OKGE
- 525 WFEC
- 526 SPS
- 531 MIDW
- 534 SUNC
- 536 WERE
- 540 GMO
- 541 ETEC

Requested and previously queued generation outside the above study area was also monitored.

The results of the analysis determined if reactive compensation or system upgrades were required to obtain acceptable system performance. If additional reactive compensation was required, the size, type, and location were determined. The proposed reactive reinforcements would ensure the wind or solar farm meets FERC Order 661A low voltage requirements and return the wind or solar farm to its pre-disturbance operating voltage. If the results indicated the need for fast responding reactive support, dynamic support such as an SVC or STATCOM was investigated. If tripping of the prior queued projects was observed during the stability analysis (for under/over voltage or under/over frequency) the simulations were re-ran with the prior queued project's voltage and frequency tripping disabled.

3.2 Stability Analysis Results

The Stability Analysis determined that there were no contingencies that resulted in system instability, generation tripping offline, or voltage violations for the 2015 Summer Peak, 2015 Winter Peak, and 2025 Summer peak conditions when all generation interconnection requests were at 100% output.

Refer to Table 3-2 for a summary of the Stability Analysis results for the contingencies listed in Table 2-3. Table 3-2 is a summary of the stability results for the 2015 Summer Peak, 2015 Winter Peak, and 2025 Summer Peak conditions and states whether the system remained stable or generation tripped offline and if acceptable voltage recovery was observed after the fault was cleared. Voltage recovery criteria includes ensuring that the transient voltage recovery is between 0.7 p.u. and 1.2 p.u. and ending in a steady-state voltage (for N-1 contingencies) at the pre-contingent level or at least 0.9 p.u. If high or low voltages were observed the number of buses failing the voltage criteria was listed.

Refer to Appendix B, Appendix C, and Appendix D for a complete set of plots for all contingencies for 2015 Summer Peak, 2015 Winter Peak, and 2025 Summer Peak conditions, respectively.

Table 3-2
Stability Analysis Summary of Results for 2015 Summer, 2015 Winter, and 2025 Summer Peak Conditions

Cont. No.	Cont. Name	2015 Summer Peak			2015 Winter Peak			2025 Summer Peak		
		Recovers between 0.70 and 1.20 p.u.		Stable?	Recovers between 0.70 and 1.20 p.u.?		Stable?	Recovers between 0.70 and 1.20 p.u.?		Stable?
		Less than 0.70 p.u.	Greater than 1.20 p.u.		Less than 0.70 p.u.	Greater than 1.20 p.u.		Less than 0.70 p.u.	Greater than 1.20 p.u.	
1	FLT01-3PH	No	No	Yes	No	No	Yes	No	No	Yes
2	FLT02-3PH	No	No	Yes	No	No	Yes	No	No	Yes
3	FLT03-3PH	No	No	Yes	No	No	Yes	No	No	Yes
4	FLT04-3PH	No	No	Yes	No	No	Yes	No	No	Yes
5	FLT05-3PH	No	No	Yes	No	No	Yes	No	No	Yes
6	FLT06-3PH	No	No	Yes	No	No	Yes	No	No	Yes
7	FLT07-3PH	No	No	Yes	No	No	Yes	No	No	Yes
8	FLT08-3PH	No	No	Yes	No	No	Yes	No	No	Yes
9	FLT09-3PH	No	No	Yes	No	No	Yes	No	No	Yes
10	FLT10-3PH	No	No	Yes	No	No	Yes	No	No	Yes
11	FLT11-3PH	No	No	Yes	No	No	Yes	No	No	Yes
12	FLT12-3PH	No	No	Yes	No	No	Yes	No	No	Yes
13	FLT13-3PH	No	No	Yes	No	No	Yes	No	No	Yes
14	FLT14-3PH	No	No	Yes	No	No	Yes	No	No	Yes
15	FLT15-3PH	No	No	Yes	No	No	Yes	No	No	Yes
16	FLT16-3PH	No	No	Yes	No	No	Yes	No	No	Yes
17	FLT17-3PH	N/A			N/A			No	No	Yes
18	FLT18-3PH	No	No	Yes	No	No	Yes	No	No	Yes
19	FLT19-3PH	No	No	Yes	No	No	Yes	No	No	Yes
20	FLT20-3PH	No	No	Yes	No	No	Yes	No	No	Yes
21	FLT21-3PH	No	No	Yes	No	No	Yes	No	No	Yes
22	FLT22-3PH	No	No	Yes	No	No	Yes	No	No	Yes
23	FLT23-3PH	No	No	Yes	No	No	Yes	No	No	Yes
24	FLT24-3PH	No	No	Yes	No	No	Yes	No	No	Yes
25	FLT25-3PH	No	No	Yes	No	No	Yes	No	No	Yes
26	FLT26-3PH	No	No	Yes	No	No	Yes	No	No	Yes
27	FLT27-3PH	No	No	Yes	No	No	Yes	No	No	Yes
28	FLT28-3PH	No	No	Yes	No	No	Yes	No	No	Yes
29	FLT29-3PH	No	No	Yes	No	No	Yes	No	No	Yes
30	FLT30-3PH	No	No	Yes	No	No	Yes	No	No	Yes
31	FLT31-3PH	No	No	Yes	No	No	Yes	No	No	Yes
32	FLT32-3PH	No	No	Yes	No	No	Yes	No	No	Yes
33	FLT33-3PH	No	No	Yes	No	No	Yes	No	No	Yes
34	FLT34-3PH	No	No	Yes	No	No	Yes	No	No	Yes
35	FLT35-3PH	No	No	Yes	No	No	Yes	No	No	Yes
36	FLT36-3PH	No	No	Yes	No	No	Yes	No	No	Yes
37	FLT37-3PH	No	No	Yes	No	No	Yes	No	No	Yes
38	FLT38-3PH	No	No	Yes	No	No	Yes	No	No	Yes
39	FLT39-3PH	No	No	Yes	No	No	Yes	No	No	Yes
40	FLT40-3PH	No	No	Yes	No	No	Yes	No	No	Yes
41	FLT41-3PH	No	No	Yes	No	No	Yes	No	No	Yes
42	FLT42-3PH	No	No	Yes	No	No	Yes	No	No	Yes
43	FLT43-3PH	No	No	Yes	No	No	Yes	No	No	Yes
44	FLT44-3PH	No	No	Yes	No	No	Yes	No	No	Yes
45	FLT45-3PH	No	No	Yes	No	No	Yes	No	No	Yes
46	FLT46-3PH	No	No	Yes	No	No	Yes	No	No	Yes
47	FLT47-3PH	No	No	Yes	No	No	Yes	No	No	Yes
48	FLT48-3PH	No	No	Yes	No	No	Yes	No	No	Yes
49	FLT49-3PH	No	No	Yes	No	No	Yes	No	No	Yes
50	FLT50-3PH	No	No	Yes	No	No	Yes	No	No	Yes
51	FLT51-3PH	No	No	Yes	No	No	Yes	No	No	Yes
52	FLT52-3PH	No	No	Yes	No	No	Yes	No	No	Yes
53	FLT53-3PH	No	No	Yes	No	No	Yes	No	No	Yes

Table 3-2 (Continued)
Stability Analysis Summary of Results for 2015 Winter, 2015 Summer, and 2025 Summer Peak Conditions

Cont. No.	Cont. Name	2015 Summer Peak			2015 Winter Peak			2025 Summer Peak		
		Recovers between 0.70 and 1.20 p.u.		Stable?	Recovers between 0.70 and 1.20 p.u.?		Stable?	Recovers between 0.70 and 1.20 p.u.?		Stable?
		Less than 0.70 p.u.	Greater than 1.20 p.u.		Less than 0.70 p.u.	Greater than 1.20 p.u.		Less than 0.70 p.u.	Greater than 1.20 p.u.	
54	FLT54-3PH	No	No	Yes	No	No	Yes	No	No	Yes
55	FLT55-3PH	No	No	Yes	No	No	Yes	No	No	Yes
56	FLT56-3PH	No	No	Yes	No	No	Yes	No	No	Yes
57	FLT57-3PH	No	No	Yes	No	No	Yes	No	No	Yes
58	FLT58-3PH	No	No	Yes	No	No	Yes	No	No	Yes
59	FLT59-3PH	No	No	Yes	No	No	Yes	No	No	Yes
60	FLT60-3PH	No	No	Yes	No	No	Yes	No	No	Yes
61	FLT61-3PH	No	No	Yes	No	No	Yes	No	No	Yes
62	FLT62-3PH	No	No	Yes	No	No	Yes	No	No	Yes
63	FLT63-3PH	No	No	Yes	No	No	Yes	No	No	Yes
64	FLT64-3PH	No	No	Yes	No	No	Yes	No	No	Yes
65	FLT65-3Ph	No	No	Yes	No	No	Yes	No	No	Yes
66	FLT66-3PH	No	No	Yes	No	No	Yes	No	No	Yes
67	FLT67-3PH	No	No	Yes	No	No	Yes	No	No	Yes
68	FLT68-3PH	No	No	Yes	No	No	Yes	No	No	Yes
69	FLT69-3PH	No	No	Yes	No	No	Yes	No	No	Yes
70	FLT70-3PH	No	No	Yes	No	No	Yes	No	No	Yes
71	FLT71-3PH	No	No	Yes	No	No	Yes	No	No	Yes
72	FLT72-3PH	No	No	Yes	No	No	Yes	No	No	Yes
73	FLT73-3PH	No	No	Yes	No	No	Yes	No	No	Yes
74	FLT74-3PH	No	No	Yes	No	No	Yes	No	No	Yes
75	FLT75-3PH	No	No	Yes	No	No	Yes	No	No	Yes
76	FLT76-3PH	No	No	Yes	No	No	Yes	No	No	Yes
77	FLT77-3PH	No	No	Yes	No	No	Yes	No	No	Yes
78	FLT78-3PH	No	No	Yes	No	No	Yes	No	No	Yes
79	FLT79-3PH	No	No	Yes	No	No	Yes	No	No	Yes
80	FLT80-3PH	No	No	Yes	No	No	Yes	No	No	Yes
81	FLT81-3PH	No	No	Yes	No	No	Yes	No	No	Yes
82	FLT82-3PH	No	No	Yes	No	No	Yes	No	No	Yes
83	FLT83-3PH	No	No	Yes	No	No	Yes	No	No	Yes
84	FLT84-3PH	No	No	Yes	No	No	Yes	No	No	Yes
85	FLT85-1PH	No	No	Yes	No	No	Yes	No	No	Yes
86	FLT86-1PH	No	No	Yes	No	No	Yes	No	No	Yes
87	FLT87-1PH	No	No	Yes	No	No	Yes	No	No	Yes
88	FLT88-1PH	No	No	Yes	No	No	Yes	No	No	Yes
89	FLT89-1PH	No	No	Yes	No	No	Yes	No	No	Yes
90	FLT90-1PH	No	No	Yes	No	No	Yes	No	No	Yes
91	FLT91-1PH	No	No	Yes	No	No	Yes	No	No	Yes
92	FLT92-1PH	No	No	Yes	No	No	Yes	No	No	Yes
93	FLT93-1PH	No	No	Yes	No	No	Yes	No	No	Yes
94	FLT94-1PH	No	No	Yes	No	No	Yes	No	No	Yes
95	FLT95-1PH	No	No	Yes	No	No	Yes	No	No	Yes
96	FLT96-1PH	No	No	Yes	No	No	Yes	No	No	Yes
97	FLT97-1PH	No	No	Yes	No	No	Yes	No	No	Yes
98	FLT98-1PH	No	No	Yes	No	No	Yes	No	No	Yes
99	FLT99-1PH	No	No	Yes	No	No	Yes	No	No	Yes
100	FLT100-1PH	No	No	Yes	No	No	Yes	No	No	Yes
101	FLT101-1PH	No	No	Yes	No	No	Yes	No	No	Yes
102	FLT102-1PH	No	No	Yes	No	No	Yes	No	No	Yes
103	FLT103-1PH	No	No	Yes	No	No	Yes	No	No	Yes
104	FLT104-1PH	No	No	Yes	No	No	Yes	No	No	Yes
105	FLT105-1PH	No	No	Yes	No	No	Yes	No	No	Yes

SECTION 4: SHORT CIRCUIT ANALYSIS

The objective of this task is to quantify the three-phase to ground fault currents for the 2025 Summer Peak season for each interconnecting generator.

4.1 Approach

The short-circuit analysis will assess breaker adequacy and fault duties for the generator interconnection bus and five buses away from the point of interconnection. MEPPI will assume no outages to find maximum short-circuit currents that flow through the breaker. The Automatic Sequencing Fault Calculation (ASCC) function in PSS/E was utilized to perform this task. FLAT conditions were applied to pre-fault conditions and the following adjustments were utilized:

- All synchronous and asynchronous machine P and Q output was set to zero
- All transformer tap ratios were set to 1.0 p.u. and all phase shift angles were set to zero
- All generator reactance's were fixed to the subtransient reactance
- All line charging was set to zero
- All shunts were set to zero
- All loads were set to zero
- All pre-fault bus voltages were set to 1.0 p.u. and a phase shift angle of zero

4.2 Short Circuit Results

The maximum fault current for each bus is provided for the 2025 Summer Peak condition. The following tables show the short circuit results for the study generators:

- Table 4-1: Short Circuit Analysis for GEN-2015-001
- Table 4-2: Short Circuit Analysis for GEN-2015-015
- Table 4-3: Short Circuit Analysis for GEN-2015-016
- Table 4-4: Short Circuit Analysis for the GEN-2015-024 and GEN-2015-025
- Table 4-5: Short Circuit Analysis for GEN-2015-028
- Table 4-6: Short Circuit Analysis for GEN-2015-030
- Table 4-7: Short Circuit Analysis for ASGI-2015-004

Table 4-1
Short Circuit Analysis for Study Project GEN-2015-001

Study Generator GEN-2015-001											
Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
300131	4FISHERTP	138	14.45	514770	MARLNDT4	138	10.80	532794	ROSEHIL7	345	18.28
300137	4BRISTOW	138	7.16	514798	SNRPMPT4	138	20.28	532796	WICHITA7	345	24.47
300138	4CLEVLND	138	16.44	514799	SNRPMP 4	138	11.22	532797	WOLFCRK7	345	15.97
300139	4FAIRFAX	138	7.49	514801	MINCO 7	345	15.96	532798	VIOLA 7	345	13.38
300140	4SILVCTY	138	15.55	514802	SOONER 4	138	31.28	532799	WAVERLY7	345	14.77
300141	4STILWTR	138	11.51	514803	SOONER 7	345	22.77	532800	LATHAMS7	345	10.37
300943	2SILVCTY	69	10.12	514825	KAYWIND7	345	11.61	532801	ELKRVR17	345	9.17
300996	4JAVINE	138	6.52	514827	CTNWOOD4	138	16.18	532986	BENTON 4	138	28.09
301339	4SFORKKTP	138	6.81	514828	KETCHTP4	138	25.46	532988	BELAIRE4	138	18.63
301425	4GLENCOE	138	9.20	514854	BRADEN 4	138	30.06	532990	MIDIAN 4	138	10.17
301429	4CLEVLNDXFMR	138	16.44	514873	LNEOAK 4	138	25.95	532991	WEAVER 4	138	21.89
301430	2CLEVLNDXFMR	69	9.72	514879	NORTWST4	138	41.55	532993	TALLGRS4	138	10.03
509755	WEKIWA-7	345	18.41	514880	NORTWST7	345	29.41	533024	29TH 4	138	19.40
509757	WEKIWA-4	138	31.10	514881	SPRNGCK7	345	21.34	533026	ANDOVER4	138	17.63
509807	ONETA--7	345	26.11	514898	CIMARON4	138	40.87	533029	59TH ST4	138	18.58
509817	T.NO.--4	138	34.16	514901	CIMARON7	345	30.01	533030	BOEING 4	138	17.08
509852	T.NO.--7	345	23.17	514907	ARCADIA4	138	40.29	533032	BU11PON4	138	14.99
509870	SAPLPRD7	345	20.74	514908	ARCADIA7	345	24.98	533035	CHISHLM4	138	22.32
509895	T.NO.2-4	138	34.10	514909	REDBUD 7	345	24.17	533039	ELPASO 4	138	25.01
510376	WEBBTAP4	138	8.05	514934	DRAPER 7	345	20.97	533040	EVANS N4	138	41.38
510380	DELWARE7	345	11.37	515006	MORRISN4	138	13.33	533042	FARBER 4	138	15.98
510406	N.E.S.-7	345	18.42	515011	STILWTR4	138	12.45	533062	ROSEHIL4	138	30.99
512650	GRDA1 7	345	26.28	515045	SEMINOL7	345	28.11	533066	64TH 4	138	14.24
512694	CLEVLND7	345	14.51	515181	UNVRSTY4	138	12.43	533067	SPRNGDL4	138	14.38
512726	SILVCTYGR4	138	15.40	515400	DMANCRK4	138	8.03	533068	STEARMN4	138	19.67
512749	PAWNSW4	138	9.73	515407	TATONGA7	345	16.41	533604	WEAVER 2	69	11.63
514703	FAIRMNT4	138	10.52	515412	DMNCRKT4	138	13.67	533626	BURLJCT2	69	4.90
514704	MILLERT4	138	20.23	515447	MORISNT4	138	13.35	533629	CC2SHAR2	69	4.58
514705	COWCRK 2	69	4.04	515448	CRSRDSW7	345	11.57	533653	WOLFCRK2	69	5.91
514706	COWCRK 4	138	11.14	515471	NW164TH4	138	34.19	533793	ELPASO 2	69	11.81
514707	PERRY 4	138	10.86	515476	HUNTERS7	345	12.25	542981	LACYGNE7	345	24.67
514708	OTTER 4	138	9.39	515477	CHSHLMV7	345	12.23	560033	G1524&G1525T	345	19.49
514709	FRMNTAP4	138	16.39	515497	MATHWSN7	345	28.56	562075	G11-051-TAP	345	16.70
514710	WAUKOMI4	138	9.33	515512	SPVALLY4	138	8.37	562423	G13-028-TAP	345	25.84
514711	WAUKOTP4	138	14.50	515543	RENFROW7	345	12.16	562476	G14-001-TAP	345	10.52
514713	WRVALLY4	138	8.59	515544	RENFROW4	138	13.79	572091	GEN-2008-098	345	12.59
514714	WOODRNG4	138	17.71	515576	RANCHRD7	345	13.00	579253	G07-21&14-02	345	13.58
514715	WOODRNG7	345	16.51	515610	FSHRTAP7	345	15.93	579268	G07-44&14-03	345	9.13
514731	SO4TH 4	138	14.08	515621	OPENSKY7	345	11.64	583490	GEN-2012-041	345	11.49
514733	MARSHL 4	138	7.69	521006	MARSHAL4	138	7.65	583740	GEN-2013-028	345	25.84
514737	OTOE 4	138	16.16	532771	RENO 7	345	12.20	583750	GEN-2013-029	345	10.77
514742	OSGE 2	69	17.56	532780	CANEYRV7	345	9.82	584170	GEN-2014-064	138	9.32
514743	OSAGE 4	138	16.55	532781	CANEYWF7	345	9.56	584450	GEN-2015-001	345	10.51
514758	STDBEAR4	138	13.85	532791	BENTON 7	345	18.98	584690	GEN-2015-030	345	17.66
514761	WHEAGLE4	138	15.65	532793	NEOSHO 7	345	16.22	584700	GEN-2015-029	345	9.77

Table 4-2
Short Circuit Analysis for Study Project GEN-2015-015

Study Generator GEN-2015-015											
Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
514715	WOODRNG7	345	16.51	514761	WHEAGLE4	138	15.65	520204	SANDY_CN_138	138	5.43
514719	CLYDE 2	69	4.58	514764	NWKRKAT4	138	10.43	520205	WAKITA_138	138	5.51
514728	SINCBLK2	69	7.17	515412	DMNCRKT4	138	13.67	520409	SAND RDG_138	138	10.07
514739	MEDFORD2	69	5.44	515476	HUNTERS7	345	12.25	520871	BRAMAN 2	69	8.94
514743	OSAGE 4	138	16.55	515477	CHSHLMV7	345	12.23	521085	WAKITA 2	69	5.20
514748	CONTEMP4	138	13.46	515509	SNCBLKT2	69	7.18	529255	OMBLKWL2	69	8.21
514750	BRMAN 2	69	8.94	515528	NARDINS2	69	5.51	532792	FR2EAST7	345	6.36
514751	NEWKRKT2	69	5.58	515543	RENFROW7	345	12.16	532796	WICHITA7	345	24.47
514754	KAYCOOP2	69	5.83	515544	RENFROW4	138	13.79	532798	VIOLA 7	345	13.38
514755	BLACKWL2	69	8.51	515546	GRANTCO4	138	6.74	533075	VIOLA 4	138	20.54
514756	CHIKASI2	69	10.20	515547	GRANTCO2	69	7.51	560031	G15-015-TAP	138	8.47
514757	CHIKASI4	138	9.11	515569	MDFRDTP4	138	11.52	583750	GEN-2013-029	345	10.77
514759	NEWKIRK4	138	8.93	515581	COYOTE 4	138	8.34	584570	GEN-2015-015	138	5.86
514760	KILDARE4	138	10.76								

Table 4-3
Short Circuit Analysis for Study Projects GEN-2015-016

Study Generator GEN-2015-016											
Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
300739	7BLACKBERRY	345	12.25	533645	SE9HIAT2	69	3.73	543112	OSAWAT 5	161	9.34
300740	7SPORTSMAN	345	23.74	533647	UN1ELSM2	69	7.45	547467	ORO110 5	161	19.04
300949	7JASPER	345	10.65	533650	UN8HUMB2	69	4.07	547469	RIV4525	161	23.37
510379	DELWARE4	138	10.88	533654	ZILAJCT2	69	5.63	547470	JOP145 5	161	17.23
510380	DELWARE7	345	11.37	533696	LABETTS2	69	7.04	547476	ASB349 5	161	12.93
510406	N.E.S.-7	345	18.42	533703	ORDNJCT2	69	8.73	547477	CJ 366 5	161	12.62
512631	MIAMI 5	161	9.10	533756	AQUARS 2	69	7.66	547483	JOP389 5	161	19.47
532780	CANEYRV7	345	9.82	533758	CRAWFOR2	69	6.71	547486	HOC404 4	138	6.42
532781	CANEYWF7	345	9.56	533765	LITCH 2	69	12.65	547487	HOC404 5	161	12.83
532793	NEOSHO 7	345	16.22	533767	MULBERY2	69	7.09	547490	FIR417 5	161	14.28
532799	WAVERLY7	345	14.77	533768	NEOSHO 2	69	18.72	547491	PUR421 5	161	9.82
532800	LATHAMS7	345	10.37	533769	PITNAC 2	69	11.05	547494	OAK432 5	161	17.21
532926	BAKER 5	161	8.43	533771	ROUSE 2	69	9.04	547498	STL439 5	161	24.04
532932	LITCH 5	161	11.09	533773	SE8CLEM2	69	4.44	547501	RIV453 5	161	22.17
532934	MARMTNE5	161	7.94	533774	SHEFFLD2	69	4.52	547502	RIV167 5	161	21.69
532937	NEOSHO 5	161	22.10	533876	FRANKLIN2	69	8.58	547503	RIV452T 5	161	22.97
532938	FRANKLIN5	161	8.62	542965	W.GRDNR7	345	23.99	547523	JOP 59 TX	69	9.60
533003	LIBERTY4	138	7.14	542968	STILWEL7	345	23.66	547530	COL 94 2	69	6.31
533005	NEPARSN4	138	11.95	542981	LACYGNE7	345	24.67	547534	ORO110 2	69	17.47
533008	TV1MNDV4	138	6.82	543055	SEOTTWA5	161	6.52	547541	RIV167 2	69	17.91
533020	NEOSHOS4	138	23.17	543057	BUCYRUS5	161	18.93	547555	GAL278 2	69	15.82
533021	NEOSHO 4	138	23.17	543065	CNTRVIL5	161	6.09	547601	HOC404 2	69	9.38
533022	NEOSHON4	138	23.17	543066	S.OTTWA5	161	6.43	547602	RIV406 2	69	15.78
533621	ALLEN 2	69	5.67	543067	CENTENL5	161	9.72	547690	GLF339 2	69	8.97
533639	MARMATN2	69	8.34	543068	WAGSTAF5	161	13.20	560029	G15-016-TAP	161	7.26
533640	MCKEE 2	69	4.16	543069	PAOLA 5	161	9.71	584580	GEN-2015-016	161	6.43
533644	SE4DEVO2	69	3.67	543077	PLSTVAL5	161	9.17				

Table 4-4
Short Circuit Analysis for Study Project GEN-2015-024 and GEN-2015-025
(Tap Wichita – Thistle circuit 1&2)

Study Generators GEN-2015-024, GEN-2015-025

Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
514715	WOODRNG7	345	16.51	532984	SUMNER 4	138	9.89	533796	GILL W 2	69	33.29
514782	WODWRD 2	69	11.94	532986	BENTON 4	138	28.09	539631	FLATRWD3	138	9.76
514785	WOODWRD4	138	20.72	532987	BUTLER 4	138	10.00	539638	FLATRDG3	138	14.80
514787	DEWEY 4	138	6.59	532988	BELAIRE4	138	18.63	539639	ELMCREK6	230	8.21
514796	IODINE-4	138	7.09	532990	MIDIAN 4	138	10.17	539668	HARPER 4	138	5.56
514825	KAYWIND7	345	11.61	532991	WEAVER 4	138	21.89	539674	BARBER 4	138	8.02
515363	CENT 4	138	3.94	532992	TIMBJCT4	138	5.61	539675	MILANTP4	138	6.54
515375	WWRDEHV7	345	20.31	533012	HALSTDS4	138	9.46	539679	GRTBEND6	230	8.39
515376	WWRDEHV4	138	25.46	533013	MOUND 4	138	7.94	539694	SPEARVL3	115	10.50
515394	KEENAN 4	138	9.05	533015	BENTLEY4	138	12.28	539695	SPEARVL6	230	12.81
515398	OUSPRT 4	138	9.60	533016	WWUPLNT4	138	8.96	539753	SPEARVLE-EVB	230	12.81
515407	TATONGA7	345	16.41	533024	29TH 4	138	19.40	539759	SPRVL 3	115	11.71
515448	CRSRDSW7	345	11.57	533029	59TH ST4	138	18.58	539760	BARBER 3	115	7.89
515458	BORDER 7	345	5.11	533031	BURNSTP4	138	4.49	539771	NFTDODG3	115	12.63
515476	HUNTERS7	345	12.25	533035	CHISHLM4	138	22.32	539800	CLARKCOUNTY7	345	12.54
515477	CHSHLMV7	345	12.23	533036	CLEARWT4	138	17.04	539801	THISTLE7	345	15.96
515497	MATHWSN7	345	28.56	533037	COMOTAR4	138	18.34	539803	IRONWOOD7	345	13.92
515543	RENFROW7	345	12.16	533038	COWSKIN4	138	19.49	539804	THISTLE4	138	16.48
515544	RENFROW4	138	13.79	533039	ELPASO 4	138	25.01	539805	ELMCREEK7	345	5.72
515546	GRANTCO4	138	6.74	533040	EVANS N4	138	41.38	539809	IRONWOOD 1 7	345	13.92
515554	BVRCNTY7	345	16.00	533041	EVANS S4	138	41.38	542965	W.GRDNR7	345	23.99
515569	MDFRDTP4	138	11.52	533045	GILL W 4	138	27.09	542981	LACYGNE7	345	24.67
515576	RANCHRD7	345	13.00	533046	GILL S 4	138	27.09	560000	G11-14-TAP	345	14.39
515621	OPENSKY7	345	11.64	533049	HOOVERN4	138	18.83	560010	G14-037-TAP	345	16.65
515785	WINDFRM4	138	18.70	533053	LAKERDG4	138	19.02	560027	G14-074-TAP	345	6.46
520409	SAND RDG_138	138	10.07	533054	MAIZE 4	138	23.25	560033	G1524&G1525T	345	19.49
525830	TUCO_INT 6	230	22.36	533060	NOEASTE4	138	20.12	560242	G11-017-TAP	345	10.15
525832	TUCO_INT 7	345	12.04	533062	ROSEHIL4	138	30.99	562075	G11-051-TAP	345	16.70
526936	YOAKUM_345	345	9.40	533063	SC10BEL4	138	9.56	562334	G13-010-TAP	345	7.77
530592	SMOKYHL6	230	6.97	533064	17TH 4	138	17.90	562476	G14-001-TAP	345	10.52
531449	HOLCOMB7	345	12.20	533065	SG12COL4	138	22.60	562701	GEN-2006-006	345	14.41
531469	SPERVIL7	345	14.41	533068	STEARMN4	138	19.67	572091	GEN-2008-098	345	12.59
531501	BUCKNER7	345	10.70	533074	45TH ST4	138	28.02	573501	GEN-2008-047	345	13.36
531502	CIMRRN 7	345	8.35	533075	VIOLA 4	138	20.54	578542	GEN-2010-001	345	13.05
531504	CPV_CIMRRN 7	345	10.70	533304	LANG 3	115	14.37	579253	G07-21&14-02	345	13.58
532766	JEC N 7	345	23.67	533336	GEARY 3	115	17.16	579268	G07-44&14-03	345	9.13
532767	GEARY 7	345	9.84	533372	PHILIPS3	115	12.65	579351	GEN-2007-062	345	8.58
532768	EMPEC 7	345	16.79	533380	SPRGCRK3	115	3.92	579358	G07-062-HV-2	345	6.54
532769	LANG 7	345	16.59	533381	SUMMIT 3	115	17.66	579480	GEN-2008-124	230	20.12
532770	MORRIS 7	345	12.54	533390	MAIZEW 4	138	27.64	580049	GEN-2010-045	345	7.33
532771	RENO 7	345	12.20	533391	MAIZEE 4	138	21.78	581112	GEN-2011-014	345	10.56
532773	SUMMIT 7	345	11.00	533412	ARKVALJ3	115	10.17	582008	GEN-2011-008	345	10.05
532774	SWISVAL7	345	16.10	533413	CIRCLE 3	115	29.30	582016	GEN-2011-016	345	7.72
532780	CANEYRV7	345	9.82	533414	CITIES 3	115	9.10	582017	GEN-2011-017	345	9.40
532791	BENTON 7	345	18.98	533415	DAVIS 3	115	9.15	582019	GEN-2011-019	345	20.31
532792	FR2EAST7	345	6.36	533416	RENO 3	115	29.74	582020	GEN-2011-020	345	20.31
532794	ROSEHIL7	345	18.28	533419	HEC 3	115	26.74	582708	G-2011-008-1	345	9.00
532795	FR2WEST7	345	5.13	533421	HEC GT 3	115	28.40	582908	G-2011-008-2	345	7.56
532796	WICHITA7	345	24.47	533422	HEC U4 3	115	27.58	583090	G1149&G1504	345	4.67
532797	WOLFCRK7	345	15.97	533426	MANVILE3	115	11.77	583110	GEN-2011-051	345	16.70
532798	VIOLA 7	345	13.38	533428	MCPHER 3	115	15.87	583370	GEN-2012-024	345	9.95
532799	WAVERLY7	345	14.77	533429	MOUNDRG3	115	9.75	583750	GEN-2013-029	345	10.77
532800	LATHAMS7	345	10.37	533438	WMCPHER3	115	15.91	583760	GEN-2013-030	345	12.10
532801	ELKRVR17	345	9.17	533439	WHEATLD3	115	8.96	583850	GEN-2014-001	345	7.02
532856	SWISVAL6	230	21.38	533506	DAVIS 2	69	7.70	583990	GEN-2014-049	345	7.87
532863	MORRIS 6	230	13.36	533597	MIDIAN 2	69	12.34	584500	GEN-2015-006	345	11.07
532871	CIRCLE 6	230	10.64	533626	BURLJCT2	69	4.90	584660	G1524	345	4.95
532872	EMCPHER6	230	9.46	533629	CC2SHAR2	69	4.58	584669	G1524&G1525	345	6.12
532873	SUMMIT 6	230	13.61	533653	WOLFCRK2	69	5.91	584670	G1525	345	6.02
532874	UNIONRG6	230	7.32	533786	CHISHLM2	69	17.72	584700	GEN-2015-029	345	9.77
532982	OXFORD 4	138	9.02	533795	GILL E 2	69	33.29				

Table 4-5
Short Circuit Analysis for Study Project GEN-2015-028

Study Generators GEN-2015-028											
Bus Number	**Bus Name**	**Bus Voltage (kV)**	**Fault Current 3-LG (kA)**	**Bus Number**	**Bus Name**	**Bus Voltage (kV)**	**Fault Current 3-LG (kA)**	**Bus Number**	**Bus Name**	**Bus Voltage (kV)**	**Fault Current 3-LG (kA)**
514719	CLYDE 2	69	4.58	514755	BLACKWL2	69	8.51	515546	GRANTCO4	138	6.74
514728	SINCBLK2	69	7.17	514756	CHIKASI2	69	10.20	515547	GRANTCO2	69	7.51
514739	MEDFORD2	69	5.44	514757	CHIKASI4	138	9.11	515581	COYOTE 4	138	8.34
514740	NUMAOGE2	69	4.57	514760	KILDARE4	138	10.76	520837	BLACKWE2	69	5.82
514741	DEERCK 2	69	4.53	514761	WHEAGLE4	138	15.65	520871	BRAMAN 2	69	8.94
514744	CHILOCO2	69	11.15	514764	NWKRKAT4	138	10.43	521012	NEWKIRK2	69	5.58
514750	BRMAN 2	69	8.94	515478	BLKWLWD2	69	4.88	521013	NUMA 2	69	4.57
514751	NEWKRKT2	69	5.58	515509	SNCBLKT2	69	7.18	529255	OMBLKWL2	69	8.21
514752	TONKAWA2	69	4.86	515528	NARDINS2	69	5.51	560031	G15-015-TAP	138	8.47
514754	KAYCOOP2	69	5.83								

Table 4-6
Short Circuit Analysis for Study Project GEN-2015-030

Study Generator GEN-2015-030											
Bus Number	**Bus Name**	**Bus Voltage (kV)**	**Fault Current 3-LG (kA)**	**Bus Number**	**Bus Name**	**Bus Voltage (kV)**	**Fault Current 3-LG (kA)**	**Bus Number**	**Bus Name**	**Bus Voltage (kV)**	**Fault Current 3-LG (kA)**
300131	4FISHERTP	138	14.45	514706	COWCRK 4	138	11.14	515377	CRESENT4	138	7.06
300137	4BRISTOW	138	7.16	514707	PERRY 4	138	10.86	515400	DMANCRK4	138	8.03
300138	4CLEVLND	138	16.44	514708	OTTER 4	138	9.39	515402	CONBLKT2	69	15.57
300139	4FAIRFAX	138	7.49	514709	FRMNTAP4	138	16.39	515407	TATONGA7	345	16.41
300140	4SILVCTY	138	15.55	514710	WAUKOMI4	138	9.33	515412	DMNCRKT4	138	13.67
300141	4STILWTR	138	11.51	514711	WAUKOTP4	138	14.50	515444	MCNOWND7	345	15.92
300145	4FISHER	138	12.23	514712	FAIRMON4	138	8.20	515447	MORISNT4	138	13.35
300146	4SKIAETP	138	6.90	514713	WRVALLY4	138	8.59	515448	CRSRDSW7	345	11.57
300165	4SFORKK	138	4.34	514714	WOODRNG4	138	17.71	515461	RNDBARN4	138	38.34
300686	4WOODY	138	7.61	514715	WOODRNG7	345	16.51	515465	LGARBER4	138	20.77
300740	7SPORTSMAN	345	23.74	514730	SO4TH 2	69	13.09	515466	MITCHSB4	138	20.70
300844	4RAMSEY	138	9.64	514731	SO4TH 4	138	14.08	515471	NW164TH4	138	34.19
300889	2BRIISTOW	69	9.36	514733	MARSHL 4	138	7.69	515476	HUNTERS7	345	12.25
300927	2CLEVLND	69	9.72	514737	OTOE 4	138	16.16	515477	CHSHLMV7	345	12.23
300928	2DIXIE	69	5.35	514742	OSGE 2	69	17.56	515497	MATHWSN7	345	28.56
300929	2FAIRFAX	69	4.84	514743	OSAGE 4	138	16.55	515512	SPVALLY4	138	8.37
300936	2MANFORD	69	6.21	514748	CONTEMP4	138	13.46	515514	KNIPE 4	138	4.92
300943	2SILVCTY	69	10.12	514753	CONORTH4	138	13.51	515542	CWBOYHT4	138	7.83
300945	2YALE	69	5.14	514758	STDBEAR4	138	13.85	515543	RENFROW7	345	12.16
300996	4JAVINE	138	6.52	514760	KILDARE4	138	10.76	515544	RENFROW4	138	13.79
301339	4SFORKKTP	138	6.81	514761	WHEAGLE4	138	15.65	515546	GRANTCO4	138	6.74
301369	4REMNGTON	138	7.86	514768	WF KAY 2	69	2.95	515549	MNCWND37	345	11.08
301413	2WILLIAMS	69	11.60	514770	MARLNDT4	138	10.80	515569	MDFRDTP4	138	11.52
301425	4GLENCOE	138	9.20	514774	HENESEY4	138	7.15	515576	RANCHRD7	345	13.00
301429	4CLEVLNDXFMR	138	16.44	514790	IMO 4	138	10.71	515600	KNGFSHR7	345	11.01
301430	2CLEVLNDXFMR	69	9.72	514798	SNRPMPT4	138	20.28	515605	CANADN7	345	11.31
505610	KEYSTON4	138	21.27	514799	SNRPMP 4	138	11.22	515610	FSHRTAP7	345	15.93
509745	CLARKSV7	345	19.71	514801	MINCO 7	345	15.96	515621	OPENSKY7	345	11.64
509755	WEKIWA-7	345	18.41	514802	SOONER 4	138	31.28	515800	GRACMNT7	345	14.47
509757	WEKIWA-4	138	31.10	514803	SOONER 7	345	22.77	520409	SAND RDG_138	138	10.07
509782	R.S.S.-7	345	29.75	514815	BRECKNR4	138	9.95	521006	MARSHAL4	138	7.65
509806	ONETA--4	138	46.96	514819	EL-RENO4	138	15.07	521100	WARREN 4	138	8.59
509807	ONETA--7	345	26.11	514820	JENSENT4	138	14.92	529241	OMMORANT	69	12.32
509812	SHEFFD-4	138	25.22	514825	KAYWIND7	345	11.61	529249	OMWW	69	13.34
509817	T.NO.--4	138	34.16	514827	CTNWOOD4	138	16.18	532780	CANEYRV7	345	9.82
509823	WED-TAP4	138	18.86	514828	KETCHTP4	138	25.46	532791	BENTON 7	345	18.98
509836	OEC 7	345	25.82	514829	PINE ST4	138	11.49	532792	FR2EAST7	345	6.36
509837	46ST--E4	138	14.00	514834	KETCH 4	138	25.89	532793	NEOSHO 7	345	16.22
509839	CDC-ET 4	138	18.48	514851	QUAILCK4	138	28.12	532794	ROSEHIL7	345	18.28
509842	CDC-WT 4	138	19.20	514852	SLVRLAK4	138	31.13	532796	WICHITA7	345	24.47
509844	OWASOTP4	138	14.89	514854	BRADEN 4	138	30.06	532797	WOLFCRK7	345	15.97
509851	P&P WTP4	138	14.89	514863	HAYMAKR4	138	25.29	532798	VIOLA 7	345	13.38
509852	T.NO.--7	345	23.17	514864	PIEDMNT4	138	21.69	532799	WAVERLY7	345	14.77
509863	PPTAP 4	138	10.27	514873	LNEOAK 4	138	25.95	532800	LATHAMS7	345	10.37
509870	SAPLPRD7	345	20.74	514879	NORTWST4	138	41.55	532801	ELKRVR17	345	9.17
509871	SAPLPRD4	138	32.03	514880	NORTWST7	345	29.41	532986	BENTON 4	138	28.09
509884	SKIATOK4	138	10.41	514881	SPRNGCK7	345	21.34	532991	WEAVER 4	138	21.89
509895	T.NO.2-4	138	34.10	514894	CZECHAL4	138	25.97	533039	ELPASO 4	138	25.01

Table 4-6 (Continued)
Short Circuit Analysis for Study Project GEN-2015-030

Study Generator GEN-2015-030											
Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
510376	WEBBTAP4	138	8.05	514895	SARA 4	138	18.41	533062	ROSEHIL4	138	30.99
510377	FAIRFXT4	138	8.10	514898	CIMARON4	138	40.87	533068	STEARMN4	138	19.67
510379	DELWARE4	138	10.88	514901	CIMARON7	345	30.01	533075	VIOLA 4	138	20.54
510380	DELWARE7	345	11.37	514906	JNSKAMO4	138	20.14	533653	WOLFCRK2	69	5.91
510396	N.E.S.-4	138	35.42	514907	ARCADIA4	138	40.29	560389	GEN-2010-055	138	31.10
510406	N.E.S.-7	345	18.42	514908	ARCADIA7	345	24.98	562075	G11-051-TAP	345	16.70
510432	SHIDWFC4	138	5.62	514909	REDBUD 7	345	24.17	562423	G13-028-TAP	345	25.84
510907	PITTSB-7	345	13.21	514933	DRAPER 4	138	39.12	579253	G07-21&14-02	345	13.58
511425	TUTCONT4	138	10.63	514934	DRAPER 7	345	20.97	579268	G07-44&14-03	345	9.13
512650	GRDA1 7	345	26.28	515006	MORRISN4	138	13.33	579272	G0744&1403HV	345	9.13
512656	GRDA1 5	161	41.53	515009	MCELROY4	138	12.46	583110	GEN-2011-051	345	16.70
512694	CLEVLND7	345	14.51	515011	STILWTR4	138	12.45	583490	GEN-2012-041	345	11.49
512726	SILVCTYGR4	138	15.40	515039	PAYNESB4	138	7.42	583740	GEN-2013-028	345	25.84
512731	NORTHTP4	138	9.89	515044	SEMINOL4	138	57.59	583750	GEN-2013-029	345	10.77
512749	PAWNSW4	138	9.73	515045	SEMINOL7	345	28.11	584170	GEN-2014-064	138	9.32
512750	TONECE7	345	15.86	515181	UNVRSTY4	138	12.43	584450	GEN-2015-001	345	10.51
514703	FAIRMNT4	138	10.52	515224	MUSKOGE7	345	28.51	584690	GEN-2015-030	345	17.66
514704	MILLERT4	138	20.23	515373	LBRTYLK4	138	13.33	584700	GEN-2015-029	345	9.77
514705	COWCRK 2	69	4.04	515375	WWRDEHV7	345	20.31	515375	WWRDEHV7	345	20.32

Table 4-7
Short Circuit Analysis for Study Project ASGI-2015-004

Study Generator ASGI-2015-004											
Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)	Bus Number	Bus Name	Bus Voltage (kV)	Fault Current 3-LG (kA)
300739	7BLACKBERRY	345	12.25	510391	BV-SE--4	138	12.02	532937	NEOSHO 5	161	22.10
509807	ONETA--7	345	26.11	510406	N.E.S.-7	345	18.42	533002	DEARING4	138	8.98
509852	T.NO.--7	345	23.17	510422	COFFEYT4	138	9.63	533003	LIBERTY4	138	7.14
510378	SCOFCTY4	138	8.35	512734	FARML 4	138	7.98	533004	MONTGOM4	138	6.65
510379	DELWARE4	138	10.88	512735	COFCTY2	69	8.59	533021	NEOSHO 4	138	23.17
510380	DELWARE7	345	11.37	532780	CANEYRV7	345	9.82	533688	DEARING2	69	7.38
510386	NBVILLE4	138	9.22	532793	NEOSHO 7	345	16.22	542981	LACYGNE7	345	24.67

SECTION 5: POWER FACTOR ANALYSIS

The objective of this task is to quantify the power factor at the point of interconnection for the wind farms during base case and system contingencies. SPP transmission planning practice requires interconnecting generation projects to maintain the power factor (pf) at the Point of Interconnection (POI) within +/- 0.95 pf for system intact conditions and for post-contingency conditions. This is analyzed by having the wind farm maintain a prescribed voltage schedule at the point of interconnection of 1.0 p.u. voltage, or if the pre-project voltage is higher than 1.0 p.u., to maintain the pre-project voltage schedule.

The 2015 Summer Peak, 2015 Winter Peak, and 2025 Summer Peak power flows provided by SPP, including any updates, were examined prior to the Power Factor Analysis to ensure they contained the proposed study project modeled at 100% of the nameplate rating and any previously queued projects listed in Table 2-2. There was no suspect power flow data in the study area. The proposed study project and any previously queued projects at the same point of interconnection were turned off during the power factor analysis. The wind farm(s) were then replaced by a generator modeled at the high side bus with the same real power (MW) capability as the wind farm(s) and open limits for the reactive power set points (Mvar). The generator was set to hold the POI scheduled bus voltage or 1.0 p.u., whichever was greater. All N-1, three-phase fault contingencies from Table 2-3 were then applied and the reactive power required to maintain the bus voltage was recorded.

5.1 Approach

GEN-2015-001 and GEN-2012-041 were disabled and the generators were placed at their respective high voltage bus. The generators were modeled with PGEN = 199.8 MW for GEN-2015-001, PGEN = 85.269 MW for GEN-2012-041 during Summer Peak conditions, and PGEN=121.488 MW for GEN-2012-041 during Winter Peak conditions. QMin = -9999 Mvar and QMax = 9999 Mvar for both generators and both conditions. All buses and transformers connected from the study project's POI bus to the generators on the high voltage bus were disabled. The scheduled voltage was set to 1.013 p.u. for 2015 Summer Peak conditions, 1.006 p.u. for 2015 Winter Peak conditions, and 1.011 p.u. for 2025 Summer Peak conditions.

GEN-2015-015 was disabled and a generator was placed at the study project's high voltage bus. The generator was modeled with PGEN = 154.6 MW, QMin = -9999 Mvar, and QMax = 9999 Mvar. All buses and transformers connected from the study project's high voltage bus to GEN-2015-015 were disabled. The scheduled voltage was set to 1.008 p.u. for 2015 Summer Peak conditions, 1.000 p.u. for 2015 Winter Peak conditions, and 1.005 p.u. for 2025 Summer Peak conditions.

GEN-2015-016 was disabled and a generator was placed at the study project's high voltage bus. The generator was modeled with PGEN = 200.0 MW, QMin = -9999 Mvar, and QMax = 9999 Mvar. All buses and transformers connected from the study project's high voltage bus to GEN-2015-016 were disabled. The scheduled voltage was set to 1.00 p.u. for all study years.

GEN-2015-024 and GEN-2015-025 were disabled and the generators were placed at their respective study project's high voltage bus. The generators were modeled with PGEN=220.0 MW, QMin = -9999 Mvar, and QMax = 9999 Mvar. All buses and transformers connected from the study project's high voltage bus to the generators were disabled. The scheduled voltage was set to 1.011 p.u. for 2015 Summer Peak conditions, 1.00 p.u. for 2015 Winter Peak conditions, and 1.012 p.u. for 2025 Summer Peak conditions.

GEN-2015-028 was disabled and a generator was placed at the study project's high voltage bus. The generator was modeled with PGEN = 62.8 MW, QMin = -9999 Mvar, and QMax = 9999 Mvar. All buses and transformers connected from the study project's high voltage bus to GEN-

2015-028 were disabled. The scheduled voltage was set to 1.027 p.u. for 2015 Summer Peak conditions, 1.019 p.u. for 2015 Winter Peak conditions, and 1.018 p.u. for 2025 Summer Peak conditions.

GEN-2015-030 was disabled and the generator was placed at the study project's high voltage bus. The generator was modeled with PGEN = 200.1 MW, QMin = -9999 Mvar, and QMax = 9999 Mvar. All buses and transformers connected from the study project's high voltage bus to GEN-2015-030 were disabled. The scheduled voltage was set to 1.01 p.u. for all study years.

5.2 Power Factor Analysis Results

The power factor was calculated for the 2015 Summer Peak, 2015 Winter Peak, and 2025 Summer Peak condition. The following tables show the power factor results for the study generators:

- Table 5-1: Power Factor Analysis for GEN-2015-001
- Table 5-2: Power Factor Analysis for GEN-2015-015
- Table 5-3: Power Factor Analysis for GEN-2015-016
- Table 5-4: Power Factor Analysis for GEN-2015-024
- Table 5-5: Power Factor Analysis for GEN-2015-025
- Table 5-6: Power Factor Analysis for GEN-2015-028
- Table 5-7: Power Factor Analysis for GEN-2015-030

Note that a positive Q (Mvar) output illustrates that the generator is absorbing reactive power from the system, implying a leading power factor; a negative Q (Mvar) illustrates that the generator is supplying reactive power to the system, implying a lagging power factor.

Table 5-1
Power Factor Analysis: GEN-2015-001

Cont. No.	Case	2015 Summer Peak			2015 Winter Peak			2025 Summer Peak		
		Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
0	Base	0.996	Leading	17.19	0.994	Lagging	-21.92	0.997	Leading	16.41
1	FLT01-3PH	1.000	Leading	2.28	1.000	Leading	2.53	0.999	Leading	10.72
2	FLT02-3PH	0.999	Lagging	-7.49	0.999	Lagging	-7.96	1.000	Leading	2.52
3	FLT03-3PH	0.996	Leading	17.19	0.994	Lagging	-21.92	0.997	Leading	16.41
4	FLT04-3PH	0.994	Leading	21.51	0.998	Lagging	-11.76	0.996	Leading	17.45
5	FLT05-3PH	0.998	Leading	13.33	0.988	Lagging	-31.84	0.999	Leading	10.58
6	FLT06-3PH	0.996	Leading	17.28	0.992	Lagging	-25.76	0.997	Leading	15.27
7	FLT07-3PH	0.996	Leading	17.19	0.994	Lagging	-21.92	0.997	Leading	16.41
8	FLT08-3PH	0.999	Leading	10.79	0.991	Lagging	-27.61	0.999	Leading	10.62
9	FLT09-3PH	0.997	Leading	16.61	0.994	Lagging	-22.55	0.997	Leading	15.85
10	FLT10-3PH	0.997	Leading	16.33	0.993	Lagging	-23.88	0.997	Leading	15.77
11	FLT11-3PH	0.997	Leading	16.69	0.993	Lagging	-23.86	0.997	Leading	16.12
12	FLT12-3PH	0.998	Leading	12.63	0.990	Lagging	-28.47	0.997	Leading	15.88
13	FLT13-3PH	0.991	Leading	26.90	0.994	Lagging	-22.10	0.997	Leading	15.95
14	FLT14-3PH	0.997	Leading	16.07	0.993	Lagging	-23.30	0.997	Leading	15.31
15	FLT15-3PH	0.997	Leading	16.06	0.993	Lagging	-23.41	0.997	Leading	15.47
16	FLT16-3PH	0.997	Leading	16.39	0.993	Lagging	-22.98	0.997	Leading	15.71
17	FLT17-3PH	N/A	N/A	N/A	N/A	N/A	N/A	0.998	Leading	13.48
18	FLT18-3PH	0.996	Leading	16.95	0.994	Lagging	-22.06	0.997	Leading	16.38
19	FLT19-3PH	0.996	Leading	17.13	0.994	Lagging	-22.05	0.997	Leading	16.34
20	FLT20-3PH	0.996	Leading	16.92	0.994	Lagging	-22.02	0.997	Leading	16.26
21	FLT21-3PH	0.997	Leading	16.53	0.994	Lagging	-22.49	0.997	Leading	16.33
22	FLT22-3PH	0.996	Leading	16.86	0.994	Lagging	-22.53	0.997	Leading	16.21
23	FLT23-3PH	0.996	Leading	16.91	0.994	Lagging	-22.28	0.997	Leading	16.28
24	FLT24-3PH	0.996	Leading	16.91	0.994	Lagging	-22.11	0.997	Leading	16.01
25	FLT25-3PH	0.996	Leading	17.03	0.994	Lagging	-22.23	0.997	Leading	16.28
26	FLT26-3PH	0.996	Leading	16.92	0.994	Lagging	-21.81	0.997	Leading	16.22
27	FLT27-3PH	0.996	Leading	17.20	0.994	Lagging	-21.94	0.997	Leading	16.41
28	FLT28-3PH	0.996	Leading	17.17	0.994	Lagging	-21.92	0.997	Leading	16.38
29	FLT29-3PH	0.996	Leading	17.27	0.994	Lagging	-21.84	0.997	Leading	16.50
30	FLT30-3PH	0.996	Leading	17.55	0.994	Lagging	-21.68	0.996	Leading	16.77
31	FLT31-3PH	0.997	Leading	15.51	0.993	Lagging	-23.34	0.998	Leading	13.87
32	FLT32-3PH	0.996	Leading	17.30	0.994	Lagging	-21.82	0.997	Leading	16.51
33	FLT33-3PH	0.997	Leading	16.06	0.993	Lagging	-24.09	0.998	Leading	13.63
34	FLT34-3PH	0.995	Leading	19.58	0.995	Lagging	-20.06	0.995	Leading	19.23
35	FLT35-3PH	0.996	Leading	17.13	0.994	Lagging	-21.73	0.997	Leading	16.38
36	FLT36-3PH	0.996	Leading	17.07	0.994	Lagging	-22.19	0.997	Leading	16.29
37	FLT37-3PH	0.996	Leading	17.54	0.994	Lagging	-21.37	0.997	Leading	16.63
38	FLT38-3PH	0.997	Leading	16.40	0.993	Lagging	-23.12	0.997	Leading	16.00
39	FLT39-3PH	0.997	Leading	15.98	0.995	Lagging	-20.56	0.997	Leading	15.77
40	FLT40-3PH	0.996	Leading	17.15	0.994	Lagging	-21.97	0.997	Leading	16.35
41	FLT41-3PH	0.996	Leading	17.15	0.994	Lagging	-21.94	0.997	Leading	16.36
42	FLT42-3PH	0.996	Leading	17.21	0.994	Lagging	-21.93	0.997	Leading	16.43
43	FLT43-3PH	0.996	Leading	17.19	0.994	Lagging	-21.91	0.997	Leading	16.43
44	FLT44-3PH	0.996	Leading	17.23	0.994	Lagging	-21.90	0.997	Leading	16.44
45	FLT45-3PH	0.996	Leading	17.20	0.994	Lagging	-21.93	0.997	Leading	16.42
46	FLT46-3PH	0.996	Leading	17.23	0.994	Lagging	-21.82	0.997	Leading	16.53
47	FLT47-3PH	0.997	Leading	15.91	0.993	Lagging	-23.31	0.997	Leading	15.44

Table 5-1 (Continued)
Power Factor Analysis: GEN-2015-001

Cont. No.	Case	2015 Summer Peak			2015 Winter Peak			2025 Summer Peak		
		Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
48	FLT48-3PH	0.996	Leading	17.08	0.994	Lagging	-21.98	0.997	Leading	16.37
49	FLT49-3PH	0.996	Leading	17.44	0.994	Lagging	-21.75	0.997	Leading	16.58
50	FLT50-3PH	0.996	Leading	17.21	0.994	Lagging	-21.90	0.997	Leading	16.45
51	FLT51-3PH	0.996	Leading	16.90	0.994	Lagging	-22.04	0.997	Leading	16.16
52	FLT52-3PH	0.996	Leading	16.94	0.994	Lagging	-22.32	0.997	Leading	16.28
53	FLT53-3PH	0.997	Leading	16.12	0.993	Lagging	-22.93	0.997	Leading	15.62
54	FLT54-3PH	0.996	Leading	16.91	0.994	Lagging	-22.20	0.997	Leading	16.11
55	FLT55-3PH	0.996	Leading	16.80	0.994	Lagging	-22.25	0.997	Leading	16.10
56	FLT56-3PH	0.997	Leading	15.63	0.993	Lagging	-23.35	0.997	Leading	15.85
57	FLT57-3PH	0.997	Leading	16.05	0.993	Lagging	-23.46	0.997	Leading	16.09

Table 5-2
Power Factor Analysis: GEN-2015-015

Cont. No.	Case	2015 Summer Peak			2015 Winter Peak			2025 Summer Peak		
		Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
0	Base	0.998	Leading	10.07	0.999	Leading	4.89	0.999	Leading	7.73
1	FLT01-3PH	0.998	Leading	10.21	1.000	Leading	4.49	0.999	Leading	7.74
2	FLT02-3PH	0.999	Leading	8.21	1.000	Leading	1.87	0.999	Leading	5.59
3	FLT03-3PH	0.998	Leading	10.07	0.999	Leading	4.89	0.999	Leading	7.73
4	FLT04-3PH	0.998	Leading	9.71	1.000	Leading	4.44	0.999	Leading	7.49
5	FLT05-3PH	0.998	Leading	9.50	1.000	Leading	3.50	0.999	Leading	6.90
6	FLT06-3PH	0.998	Leading	10.07	1.000	Leading	4.38	0.999	Leading	7.63
7	FLT07-3PH	0.998	Leading	10.07	0.999	Leading	4.89	0.999	Leading	7.73
8	FLT08-3PH	0.999	Leading	7.78	1.000	Leading	2.39	0.999	Leading	5.35
9	FLT09-3PH	0.999	Leading	7.11	1.000	Leading	0.50	0.999	Leading	5.96
10	FLT10-3PH	1.000	Leading	2.60	0.996	Lagging	-13.53	1.000	Leading	1.67
11	FLT11-3PH	0.998	Leading	9.75	0.992	Leading	19.87	0.999	Leading	5.13
12	FLT12-3PH	0.994	Lagging	-17.39	0.978	Lagging	-33.20	1.000	Lagging	-1.14
13	FLT13-3PH	0.999	Leading	8.08	1.000	Leading	4.48	0.999	Leading	7.15
14	FLT14-3PH	0.998	Leading	9.15	1.000	Leading	3.72	0.999	Leading	6.98
15	FLT15-3PH	0.998	Leading	8.99	1.000	Leading	3.53	0.999	Leading	7.03
16	FLT16-3PH	0.998	Leading	9.54	1.000	Leading	4.13	0.999	Leading	7.30
17	FLT17-3PH	N/A	N/A	N/A	N/A	N/A	N/A	0.999	Leading	6.61
18	FLT18-3PH	1.000	Leading	3.67	0.996	Leading	14.17	0.995	Lagging	-14.77
19	FLT19-3PH	0.999	Leading	7.66	0.998	Leading	9.16	1.000	Leading	4.84
20	FLT20-3PH	0.999	Leading	6.22	1.000	Lagging	-1.20	0.999	Leading	7.67
21	FLT21-3PH	0.994	Leading	17.22	0.997	Leading	11.04	0.998	Leading	9.00
22	FLT22-3PH	1.000	Lagging	-1.86	0.997	Lagging	-11.97	1.000	Lagging	-2.28
23	FLT23-3PH	1.000	Leading	2.89	0.999	Lagging	-5.35	0.999	Leading	5.35
24	FLT24-3PH	0.998	Leading	10.03	0.999	Leading	4.90	0.999	Leading	7.71
25	FLT25-3PH	0.998	Leading	10.03	1.000	Leading	4.77	0.999	Leading	7.66
26	FLT26-3PH	0.998	Leading	10.00	0.999	Leading	4.91	0.999	Leading	7.68
27	FLT27-3PH	0.998	Leading	10.08	0.999	Leading	4.90	0.999	Leading	7.74
28	FLT28-3PH	0.998	Leading	10.07	0.999	Leading	4.89	0.999	Leading	7.73
29	FLT29-3PH	0.998	Leading	10.08	0.999	Leading	4.90	0.999	Leading	7.74
30	FLT30-3PH	0.998	Leading	10.12	0.999	Leading	4.92	0.999	Leading	7.78
31	FLT31-3PH	0.998	Leading	9.85	1.000	Leading	4.72	0.999	Leading	7.51
32	FLT32-3PH	0.998	Leading	10.09	0.999	Leading	4.89	0.999	Leading	7.74
33	FLT33-3PH	0.998	Leading	9.14	1.000	Leading	3.16	0.999	Leading	5.82
34	FLT34-3PH	0.997	Leading	12.11	0.999	Leading	6.55	0.998	Leading	9.66
35	FLT35-3PH	0.998	Leading	10.07	0.999	Leading	5.04	0.999	Leading	7.73
36	FLT36-3PH	0.998	Leading	9.99	1.000	Leading	4.69	0.999	Leading	7.66
37	FLT37-3PH	0.998	Leading	10.10	0.999	Leading	5.13	0.999	Leading	7.83
38	FLT38-3PH	0.998	Leading	9.42	1.000	Leading	3.93	0.999	Leading	7.42
39	FLT39-3PH	0.998	Leading	9.94	1.000	Leading	4.15	0.999	Leading	7.48
40	FLT40-3PH	0.998	Leading	8.71	1.000	Leading	3.41	0.999	Leading	5.96
41	FLT41-3PH	0.998	Leading	8.71	1.000	Leading	2.54	0.999	Leading	5.15
42	FLT42-3PH	0.997	Leading	11.37	1.000	Leading	4.86	0.998	Leading	9.23
43	FLT43-3PH	0.998	Leading	9.77	0.999	Leading	5.07	0.999	Leading	8.08
44	FLT44-3PH	0.996	Leading	13.93	0.999	Leading	6.99	0.997	Leading	11.11
45	FLT45-3PH	0.997	Leading	11.27	1.000	Leading	4.64	0.998	Leading	8.74
46	FLT46-3PH	0.996	Leading	13.79	0.997	Leading	12.67	0.992	Leading	19.66
47	FLT47-3PH	0.998	Leading	9.58	1.000	Leading	4.00	0.999	Leading	5.98

Table 5-2 (Continued)
Power Factor Analysis: GEN-2015-015

Cont. No.	Case	2015 Summer Peak			2015 Winter Peak			2025 Summer Peak		
		Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
48	FLT48-3PH	0.998	Leading	10.12	0.999	Leading	5.02	0.999	Leading	7.85
49	FLT49-3PH	0.998	Leading	8.73	1.000	Leading	2.37	0.999	Leading	6.22
50	FLT50-3PH	0.998	Leading	10.08	0.999	Leading	4.90	0.999	Leading	7.75
51	FLT51-3PH	0.998	Leading	9.97	1.000	Leading	4.84	0.999	Leading	7.64
52	FLT52-3PH	0.998	Leading	9.97	1.000	Leading	4.68	0.999	Leading	7.65
53	FLT53-3PH	0.998	Leading	9.84	1.000	Leading	4.69	0.999	Leading	7.51
54	FLT54-3PH	0.998	Leading	9.90	1.000	Leading	4.78	0.999	Leading	7.50
55	FLT55-3PH	0.998	Leading	9.99	1.000	Leading	4.82	0.999	Leading	7.66
56	FLT56-3PH	0.998	Leading	9.81	1.000	Leading	4.59	0.999	Leading	7.55
57	FLT57-3PH	0.998	Leading	9.88	1.000	Leading	4.59	0.999	Leading	7.64

Table 5-3
Power Factor Analysis: GEN-2015-016

Cont. No.	Case	2015 Summer Peak			2015 Winter Peak			2025 Summer Peak		
		Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
0	Base	0.987	Leading	32.05	0.985	Leading	34.99	0.989	Leading	30.00
1	FLT01-3PH	0.987	Leading	32.31	0.985	Leading	34.80	0.989	Leading	29.97
2	FLT02-3PH	0.986	Leading	33.44	0.985	Leading	35.22	0.988	Leading	31.18
3	FLT03-3PH	0.987	Leading	32.05	0.985	Leading	34.99	0.989	Leading	30.00
4	FLT04-3PH	0.987	Leading	32.33	0.985	Leading	35.31	0.989	Leading	29.98
5	FLT05-3PH	0.988	Leading	31.00	0.986	Leading	34.35	0.990	Leading	28.55
6	FLT06-3PH	0.988	Leading	31.35	0.984	Leading	36.15	0.989	Leading	29.95
7	FLT07-3PH	0.987	Leading	32.05	0.985	Leading	34.99	0.989	Leading	30.00
8	FLT08-3PH	0.988	Leading	30.70	0.986	Leading	34.25	0.990	Leading	28.12
9	FLT09-3PH	0.987	Leading	31.93	0.985	Leading	34.85	0.989	Leading	29.92
10	FLT10-3PH	0.988	Leading	31.66	0.985	Leading	34.69	0.989	Leading	29.62
11	FLT11-3PH	0.988	Leading	31.89	0.985	Leading	34.78	0.989	Leading	29.97
12	FLT12-3PH	0.987	Leading	32.31	0.985	Leading	34.81	0.989	Leading	30.08
13	FLT13-3PH	0.985	Leading	34.45	0.985	Leading	35.36	0.988	Leading	30.91
14	FLT14-3PH	0.988	Leading	31.32	0.986	Leading	34.15	0.989	Leading	29.82
15	FLT15-3PH	0.989	Leading	29.65	0.987	Leading	32.51	0.990	Leading	28.64
16	FLT16-3PH	0.987	Leading	32.07	0.985	Leading	34.96	0.989	Leading	30.00
17	FLT17-3PH	N/A	N/A	N/A	N/A	N/A	N/A	0.989	Leading	30.17
18	FLT18-3PH	0.987	Leading	32.02	0.985	Leading	35.01	0.989	Leading	29.94
19	FLT19-3PH	0.987	Leading	32.01	0.985	Leading	34.93	0.989	Leading	29.99
20	FLT20-3PH	0.987	Leading	32.08	0.985	Leading	35.05	0.989	Leading	30.00
21	FLT21-3PH	0.987	Leading	32.00	0.985	Leading	34.94	0.989	Leading	29.99
22	FLT22-3PH	0.987	Leading	31.94	0.985	Leading	34.90	0.989	Leading	29.92
23	FLT23-3PH	0.987	Leading	31.93	0.985	Leading	34.90	0.989	Leading	29.87
24	FLT24-3PH	0.998	Leading	11.75	0.996	Leading	18.67	0.998	Leading	12.71
25	FLT25-3PH	0.996	Leading	18.28	0.997	Leading	14.39	0.998	Leading	13.37
26	FLT26-3PH	0.985	Leading	35.35	0.974	Leading	46.95	0.984	Leading	36.08
27	FLT27-3PH	0.984	Leading	36.01	0.985	Leading	35.49	0.985	Leading	35.11
28	FLT28-3PH	0.988	Leading	31.28	0.985	Leading	34.71	0.990	Leading	29.15
29	FLT29-3PH	0.993	Leading	23.78	0.992	Leading	24.95	0.995	Leading	20.22
30	FLT30-3PH	0.991	Leading	27.15	0.988	Leading	31.44	0.992	Leading	25.02
31	FLT31-3PH	0.989	Leading	29.79	0.987	Leading	32.44	0.991	Leading	27.42
32	FLT32-3PH	0.975	Leading	45.37	0.973	Leading	47.42	0.979	Leading	41.58
33	FLT33-3PH	0.989	Leading	29.80	0.987	Leading	33.10	0.990	Leading	28.52
34	FLT34-3PH	0.987	Leading	32.47	0.985	Leading	35.38	0.989	Leading	30.38
35	FLT35-3PH	0.987	Leading	31.93	0.985	Leading	35.15	0.989	Leading	29.91
36	FLT36-3PH	0.988	Leading	31.76	0.985	Leading	34.77	0.989	Leading	29.79
37	FLT37-3PH	0.990	Leading	28.53	0.986	Leading	33.27	0.991	Leading	26.94
38	FLT38-3PH	0.988	Leading	31.31	0.986	Leading	34.34	0.989	Leading	29.29
39	FLT39-3PH	0.988	Leading	31.91	0.985	Leading	34.95	0.989	Leading	29.87
40	FLT40-3PH	0.987	Leading	32.04	0.985	Leading	34.98	0.989	Leading	29.99
41	FLT41-3PH	0.987	Leading	32.07	0.985	Leading	35.02	0.989	Leading	30.01
42	FLT42-3PH	0.987	Leading	32.03	0.985	Leading	34.98	0.989	Leading	29.98
43	FLT43-3PH	0.987	Leading	32.04	0.985	Leading	34.99	0.989	Leading	29.99
44	FLT44-3PH	0.987	Leading	32.05	0.985	Leading	34.99	0.989	Leading	30.00
45	FLT45-3PH	0.987	Leading	32.04	0.985	Leading	34.99	0.989	Leading	30.00
46	FLT46-3PH	0.987	Leading	32.04	0.985	Leading	34.99	0.989	Leading	30.00
47	FLT47-3PH	0.988	Leading	31.25	0.986	Leading	34.27	0.989	Leading	29.31

Table 5-3 (Continued)
Power Factor Analysis: GEN-2015-016

Cont. No.	Case	2015 Summer Peak			2015 Winter Peak			2025 Summer Peak		
		Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
48	FLT48-3PH	0.987	Leading	32.01	0.985	Leading	34.99	0.989	Leading	29.95
49	FLT49-3PH	0.987	Leading	32.07	0.985	Leading	35.00	0.989	Leading	30.03
50	FLT50-3PH	0.987	Leading	32.15	0.985	Leading	35.07	0.989	Leading	30.20
51	FLT51-3PH	0.989	Leading	30.23	0.986	Leading	34.14	0.990	Leading	28.44
52	FLT52-3PH	0.989	Leading	30.48	0.987	Leading	32.52	0.990	Leading	29.06
53	FLT53-3PH	0.990	Leading	28.37	0.988	Leading	30.90	0.991	Leading	27.24
54	FLT54-3PH	0.987	Leading	32.26	0.985	Leading	34.51	0.989	Leading	29.89
55	FLT55-3PH	0.989	Leading	30.09	0.986	Leading	33.29	0.990	Leading	28.58
56	FLT56-3PH	0.986	Leading	33.80	0.985	Leading	34.89	0.988	Leading	31.50
57	FLT57-3PH	0.987	Leading	32.41	0.987	Leading	33.17	0.989	Leading	30.26

Table 5-4
Power Factor Analysis: GEN-2015-024

Cont. No.	Case	2015 Summer Peak			2015 Winter Peak			2025 Summer Peak		
		Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
0	Base	0.997	Leading	17.80	0.981	Lagging	-43.20	0.996	Leading	18.80
1	FLT01-3PH	0.996	Leading	19.28	0.979	Lagging	-46.17	0.996	Leading	18.74
2	FLT02-3PH	0.999	Leading	11.23	0.967	Lagging	-58.12	0.998	Leading	13.04
3	FLT03-3PH	0.997	Leading	17.80	0.981	Lagging	-43.20	0.996	Leading	18.80
4	FLT04-3PH	0.999	Leading	8.78	0.968	Lagging	-57.29	0.998	Leading	13.98
5	FLT05-3PH	0.998	Leading	12.58	0.971	Lagging	-54.65	0.999	Leading	10.83
6	FLT06-3PH	0.997	Leading	17.90	0.978	Lagging	-47.34	0.997	Leading	17.57
7	FLT07-3PH	0.997	Leading	17.80	0.981	Lagging	-43.20	0.996	Leading	18.80
8	FLT08-3PH	0.999	Leading	10.40	0.973	Lagging	-51.72	0.998	Leading	12.48
9	FLT09-3PH	0.997	Leading	16.77	0.980	Lagging	-45.08	0.997	Leading	18.42
10	FLT10-3PH	1.000	Leading	1.27	0.951	Lagging	-71.54	0.999	Leading	8.98
11	FLT11-3PH	0.999	Leading	7.97	0.952	Lagging	-70.77	0.997	Leading	16.27
12	FLT12-3PH	0.992	Leading	28.52	0.998	Lagging	-15.30	0.993	Leading	25.58
13	FLT13-3PH	0.996	Lagging	-20.54	0.983	Lagging	-40.85	0.998	Leading	12.53
14	FLT14-3PH	1.000	Leading	3.57	0.964	Lagging	-60.98	1.000	Leading	4.88
15	FLT15-3PH	1.000	Leading	4.00	0.962	Lagging	-62.12	1.000	Leading	6.11
16	FLT16-3PH	0.993	Leading	25.70	0.998	Lagging	-13.16	0.993	Leading	26.19
17	FLT17-3PH	N/A	N/A	N/A	N/A	N/A	N/A	0.999	Leading	8.79
18	FLT18-3PH	0.998	Leading	14.36	0.978	Lagging	-47.41	0.997	Leading	17.90
19	FLT19-3PH	0.996	Leading	18.74	0.982	Lagging	-42.50	0.996	Leading	19.46
20	FLT20-3PH	0.998	Leading	14.66	0.979	Lagging	-46.28	0.997	Leading	17.24
21	FLT21-3PH	0.997	Leading	16.99	0.981	Lagging	-43.89	0.996	Leading	18.66
22	FLT22-3PH	0.997	Leading	16.49	0.979	Lagging	-45.25	0.997	Leading	17.71
23	FLT23-3PH	0.998	Leading	15.33	0.978	Lagging	-46.59	0.997	Leading	16.90
24	FLT24-3PH	0.997	Leading	17.83	0.982	Lagging	-42.90	0.997	Leading	18.44
25	FLT25-3PH	0.997	Leading	16.93	0.980	Lagging	-44.62	0.997	Leading	18.34
26	FLT26-3PH	0.997	Leading	17.47	0.981	Lagging	-42.99	0.996	Leading	18.56
27	FLT27-3PH	0.997	Leading	17.86	0.981	Lagging	-43.15	0.996	Leading	18.83
28	FLT28-3PH	0.997	Leading	17.77	0.981	Lagging	-43.21	0.996	Leading	18.77
29	FLT29-3PH	0.997	Leading	17.82	0.981	Lagging	-43.19	0.996	Leading	18.86
30	FLT30-3PH	0.997	Leading	18.18	0.981	Lagging	-42.97	0.996	Leading	19.17
31	FLT31-3PH	0.997	Leading	16.56	0.980	Lagging	-44.25	0.997	Leading	16.11
32	FLT32-3PH	0.997	Leading	17.82	0.981	Lagging	-43.39	0.996	Leading	18.86
33	FLT33-3PH	1.000	Leading	6.93	0.955	Lagging	-68.66	0.998	Lagging	-14.97
34	FLT34-3PH	0.974	Leading	50.66	1.000	Lagging	-6.59	0.972	Leading	53.60
35	FLT35-3PH	0.997	Leading	17.98	0.984	Lagging	-40.40	0.996	Leading	19.16
36	FLT36-3PH	0.997	Leading	16.55	0.978	Lagging	-46.64	0.997	Leading	17.47
37	FLT37-3PH	0.995	Leading	22.04	0.985	Lagging	-37.97	0.996	Leading	20.43
38	FLT38-3PH	0.999	Leading	7.50	0.966	Lagging	-59.12	0.998	Leading	12.87
39	FLT39-3PH	0.997	Leading	16.08	0.981	Lagging	-43.73	0.997	Leading	17.46
40	FLT40-3PH	0.997	Leading	17.55	0.981	Lagging	-43.52	0.997	Leading	18.43
41	FLT41-3PH	0.997	Leading	16.94	0.980	Lagging	-44.16	0.997	Leading	18.23
42	FLT42-3PH	0.997	Leading	17.79	0.981	Lagging	-43.43	0.996	Leading	18.85
43	FLT43-3PH	0.997	Leading	17.69	0.981	Lagging	-43.20	0.996	Leading	18.93
44	FLT44-3PH	0.997	Leading	17.91	0.981	Lagging	-43.22	0.996	Leading	18.91
45	FLT45-3PH	0.997	Leading	17.76	0.981	Lagging	-43.36	0.996	Leading	18.79
46	FLT46-3PH	0.997	Leading	17.88	0.981	Lagging	-42.93	0.996	Leading	19.19
47	FLT47-3PH	0.999	Leading	11.30	0.973	Lagging	-52.45	0.998	Leading	12.29

Table 5-4 (Continued)
Power Factor Analysis: GEN-2015-024

Cont. No.	Case	2015 Summer Peak			2015 Winter Peak			2025 Summer Peak		
		Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
48	FLT48-3PH	0.997	Leading	17.47	0.981	Lagging	-43.84	0.996	Leading	18.74
49	FLT49-3PH	0.997	Leading	17.50	0.981	Lagging	-43.87	0.996	Leading	18.62
50	FLT50-3PH	0.997	Leading	17.83	0.981	Lagging	-43.18	0.996	Leading	18.85
51	FLT51-3PH	0.997	Leading	17.34	0.981	Lagging	-43.43	0.997	Leading	18.39
52	FLT52-3PH	0.997	Leading	17.44	0.981	Lagging	-43.81	0.996	Leading	18.59
53	FLT53-3PH	0.997	Leading	16.11	0.980	Lagging	-44.93	0.997	Leading	17.64
54	FLT54-3PH	0.997	Leading	17.27	0.981	Lagging	-43.77	0.997	Leading	18.34
55	FLT55-3PH	0.997	Leading	17.15	0.981	Lagging	-43.79	0.997	Leading	18.29
56	FLT56-3PH	0.998	Leading	15.13	0.979	Lagging	-45.92	0.997	Leading	18.08
57	FLT57-3PH	0.997	Leading	15.96	0.979	Lagging	-45.70	0.997	Leading	18.40

Table 5-5
Power Factor Analysis: GEN-2015-025

Cont. No.	Case	2015 Summer Peak			2015 Winter Peak			2025 Summer Peak		
		Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
0	Base	0.997	Leading	17.80	0.981	Lagging	-43.20	0.996	Leading	18.80
1	FLT01-3PH	0.996	Leading	19.28	0.979	Lagging	-46.17	0.996	Leading	18.74
2	FLT02-3PH	0.999	Leading	11.23	0.967	Lagging	-58.12	0.998	Leading	13.04
3	FLT03-3PH	0.997	Leading	17.80	0.981	Lagging	-43.20	0.996	Leading	18.80
4	FLT04-3PH	0.999	Leading	8.78	0.968	Lagging	-57.29	0.998	Leading	13.98
5	FLT05-3PH	0.998	Leading	12.58	0.971	Lagging	-54.65	0.999	Leading	10.83
6	FLT06-3PH	0.997	Leading	17.90	0.978	Lagging	-47.34	0.997	Leading	17.57
7	FLT07-3PH	0.997	Leading	17.80	0.981	Lagging	-43.20	0.996	Leading	18.80
8	FLT08-3PH	0.999	Leading	10.40	0.973	Lagging	-51.72	0.998	Leading	12.48
9	FLT09-3PH	0.997	Leading	16.77	0.980	Lagging	-45.08	0.997	Leading	18.42
10	FLT10-3PH	1.000	Leading	1.27	0.951	Lagging	-71.54	0.999	Leading	8.98
11	FLT11-3PH	0.999	Leading	7.97	0.952	Lagging	-70.77	0.997	Leading	16.27
12	FLT12-3PH	0.992	Leading	28.52	0.998	Lagging	-15.30	0.993	Leading	25.58
13	FLT13-3PH	0.996	Lagging	-20.54	0.983	Lagging	-40.85	0.998	Leading	12.53
14	FLT14-3PH	1.000	Leading	3.57	0.964	Lagging	-60.98	1.000	Leading	4.88
15	FLT15-3PH	1.000	Leading	4.00	0.962	Lagging	-62.12	1.000	Leading	6.11
16	FLT16-3PH	0.993	Leading	25.70	0.998	Lagging	-13.16	0.993	Leading	26.19
17	FLT17-3PH	N/A	N/A	N/A	N/A	N/A	N/A	0.999	Leading	8.79
18	FLT18-3PH	0.998	Leading	14.36	0.978	Lagging	-47.41	0.997	Leading	17.90
19	FLT19-3PH	0.996	Leading	18.74	0.982	Lagging	-42.50	0.996	Leading	19.46
20	FLT20-3PH	0.998	Leading	14.66	0.979	Lagging	-46.28	0.997	Leading	17.24
21	FLT21-3PH	0.997	Leading	16.99	0.981	Lagging	-43.89	0.996	Leading	18.66
22	FLT22-3PH	0.997	Leading	16.49	0.979	Lagging	-45.25	0.997	Leading	17.71
23	FLT23-3PH	0.998	Leading	15.33	0.978	Lagging	-46.59	0.997	Leading	16.90
24	FLT24-3PH	0.997	Leading	17.83	0.982	Lagging	-42.90	0.997	Leading	18.44
25	FLT25-3PH	0.997	Leading	16.93	0.980	Lagging	-44.62	0.997	Leading	18.34
26	FLT26-3PH	0.997	Leading	17.47	0.981	Lagging	-42.99	0.996	Leading	18.56
27	FLT27-3PH	0.997	Leading	17.86	0.981	Lagging	-43.15	0.996	Leading	18.83
28	FLT28-3PH	0.997	Leading	17.77	0.981	Lagging	-43.21	0.996	Leading	18.77
29	FLT29-3PH	0.997	Leading	17.82	0.981	Lagging	-43.19	0.996	Leading	18.86
30	FLT30-3PH	0.997	Leading	18.18	0.981	Lagging	-42.97	0.996	Leading	19.17
31	FLT31-3PH	0.997	Leading	16.56	0.980	Lagging	-44.25	0.997	Leading	16.11
32	FLT32-3PH	0.997	Leading	17.82	0.981	Lagging	-43.39	0.996	Leading	18.86
33	FLT33-3PH	1.000	Leading	6.93	0.955	Lagging	-68.66	0.998	Lagging	-14.97
34	FLT34-3PH	0.974	Leading	50.66	1.000	Lagging	-6.59	0.972	Leading	53.60
35	FLT35-3PH	0.997	Leading	17.98	0.984	Lagging	-40.40	0.996	Leading	19.16
36	FLT36-3PH	0.997	Leading	16.55	0.978	Lagging	-46.64	0.997	Leading	17.47
37	FLT37-3PH	0.995	Leading	22.04	0.985	Lagging	-37.97	0.996	Leading	20.43
38	FLT38-3PH	0.999	Leading	7.50	0.966	Lagging	-59.12	0.998	Leading	12.87
39	FLT39-3PH	0.997	Leading	16.08	0.981	Lagging	-43.73	0.997	Leading	17.46
40	FLT40-3PH	0.997	Leading	17.55	0.981	Lagging	-43.52	0.997	Leading	18.43
41	FLT41-3PH	0.997	Leading	16.94	0.980	Lagging	-44.16	0.997	Leading	18.23
42	FLT42-3PH	0.997	Leading	17.79	0.981	Lagging	-43.43	0.996	Leading	18.85
43	FLT43-3PH	0.997	Leading	17.69	0.981	Lagging	-43.20	0.996	Leading	18.93
44	FLT44-3PH	0.997	Leading	17.91	0.981	Lagging	-43.22	0.996	Leading	18.91
45	FLT45-3PH	0.997	Leading	17.76	0.981	Lagging	-43.36	0.996	Leading	18.79
46	FLT46-3PH	0.997	Leading	17.88	0.981	Lagging	-42.93	0.996	Leading	19.19
47	FLT47-3PH	0.999	Leading	11.30	0.973	Lagging	-52.45	0.998	Leading	12.29

Table 5-5 (Continued)
Power Factor Analysis: GEN-2015-025

Cont. No.	Case	2015 Summer Peak			2015 Winter Peak			2025 Summer Peak		
		Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
48	FLT48-3PH	0.997	Leading	17.47	0.981	Lagging	-43.84	0.996	Leading	18.74
49	FLT49-3PH	0.997	Leading	17.50	0.981	Lagging	-43.87	0.996	Leading	18.62
50	FLT50-3PH	0.997	Leading	17.83	0.981	Lagging	-43.18	0.996	Leading	18.85
51	FLT51-3PH	0.997	Leading	17.34	0.981	Lagging	-43.43	0.997	Leading	18.39
52	FLT52-3PH	0.997	Leading	17.44	0.981	Lagging	-43.81	0.996	Leading	18.59
53	FLT53-3PH	0.997	Leading	16.11	0.980	Lagging	-44.93	0.997	Leading	17.64
54	FLT54-3PH	0.997	Leading	17.27	0.981	Lagging	-43.77	0.997	Leading	18.34
55	FLT55-3PH	0.997	Leading	17.15	0.981	Lagging	-43.79	0.997	Leading	18.29
56	FLT56-3PH	0.998	Leading	15.13	0.979	Lagging	-45.92	0.997	Leading	18.08
57	FLT57-3PH	0.997	Leading	15.96	0.979	Lagging	-45.70	0.997	Leading	18.40

Table 5-6
Power Factor Analysis: GEN-2015-028

Cont. No.	Case	2015 Summer Peak			2015 Winter Peak			2025 Summer Peak		
		Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
0	Base	0.982	Leading	12.13	0.994	Leading	6.90	0.994	Leading	6.64
1	FLT01-3PH	0.982	Leading	12.15	0.994	Leading	6.79	0.994	Leading	6.64
2	FLT02-3PH	0.984	Leading	11.34	0.996	Leading	5.84	0.996	Leading	5.79
3	FLT03-3PH	0.982	Leading	12.13	0.994	Leading	6.90	0.994	Leading	6.64
4	FLT04-3PH	0.982	Leading	12.06	0.994	Leading	6.81	0.995	Leading	6.58
5	FLT05-3PH	0.982	Leading	11.97	0.995	Leading	6.51	0.995	Leading	6.41
6	FLT06-3PH	0.982	Leading	12.15	0.994	Leading	6.77	0.994	Leading	6.63
7	FLT07-3PH	0.982	Leading	12.13	0.994	Leading	6.90	0.994	Leading	6.64
8	FLT08-3PH	0.984	Leading	11.48	0.995	Leading	6.18	0.996	Leading	5.95
9	FLT09-3PH	0.984	Leading	11.29	0.996	Leading	5.68	0.995	Leading	6.06
10	FLT10-3PH	0.985	Leading	11.10	0.999	Leading	3.30	0.996	Leading	5.81
11	FLT11-3PH	0.982	Leading	11.94	0.987	Leading	10.39	0.995	Leading	6.04
12	FLT12-3PH	0.995	Leading	6.19	1.000	Lagging	-1.82	0.997	Leading	4.89
13	FLT13-3PH	0.983	Leading	11.76	0.994	Leading	6.81	0.995	Leading	6.55
14	FLT14-3PH	0.982	Leading	11.94	0.994	Leading	6.66	0.995	Leading	6.47
15	FLT15-3PH	0.982	Leading	11.95	0.994	Leading	6.65	0.995	Leading	6.54
16	FLT16-3PH	0.982	Leading	11.99	0.994	Leading	6.71	0.995	Leading	6.52
17	FLT17-3PH	N/A	N/A	N/A	N/A	N/A	N/A	0.995	Leading	6.39
18	FLT18-3PH	0.990	Leading	8.97	0.990	Leading	8.81	1.000	Lagging	-1.00
19	FLT19-3PH	0.983	Leading	11.67	0.994	Leading	6.86	0.996	Leading	5.94
20	FLT20-3PH	0.992	Leading	7.97	0.998	Leading	3.86	0.999	Leading	2.85
21	FLT21-3PH	0.975	Leading	14.32	0.990	Leading	8.82	0.994	Leading	7.02
22	FLT22-3PH	0.988	Leading	9.63	0.999	Leading	3.17	0.997	Leading	4.72
23	FLT23-3PH	0.985	Leading	10.88	0.997	Leading	4.90	0.994	Leading	6.61
24	FLT24-3PH	0.982	Leading	12.14	0.994	Leading	6.91	0.994	Leading	6.65
25	FLT25-3PH	0.982	Leading	12.10	0.994	Leading	6.85	0.995	Leading	6.60
26	FLT26-3PH	0.982	Leading	12.11	0.994	Leading	6.90	0.994	Leading	6.62
27	FLT27-3PH	0.982	Leading	12.14	0.994	Leading	6.90	0.994	Leading	6.64
28	FLT28-3PH	0.982	Leading	12.13	0.994	Leading	6.90	0.994	Leading	6.63
29	FLT29-3PH	0.982	Leading	12.13	0.994	Leading	6.90	0.994	Leading	6.64
30	FLT30-3PH	0.982	Leading	12.15	0.994	Leading	6.91	0.994	Leading	6.65
31	FLT31-3PH	0.982	Leading	12.11	0.994	Leading	6.87	0.994	Leading	6.64
32	FLT32-3PH	0.982	Leading	12.13	0.994	Leading	6.90	0.994	Leading	6.63
33	FLT33-3PH	0.982	Leading	11.98	0.995	Leading	6.55	0.995	Leading	6.25
34	FLT34-3PH	0.980	Leading	12.60	0.993	Leading	7.28	0.994	Leading	7.08
35	FLT35-3PH	0.982	Leading	12.13	0.994	Leading	6.94	0.994	Leading	6.63
36	FLT36-3PH	0.982	Leading	12.12	0.994	Leading	6.85	0.994	Leading	6.62
37	FLT37-3PH	0.982	Leading	12.21	0.994	Leading	7.00	0.994	Leading	6.74
38	FLT38-3PH	0.982	Leading	12.00	0.994	Leading	6.69	0.995	Leading	6.59
39	FLT39-3PH	0.982	Leading	12.08	0.994	Leading	6.67	0.995	Leading	6.55
40	FLT40-3PH	0.961	Leading	18.18	0.975	Leading	14.45	0.978	Leading	13.31
41	FLT41-3PH	0.999	Leading	2.82	1.000	Leading	0.64	0.999	Leading	2.33
42	FLT42-3PH	0.978	Leading	13.37	0.994	Leading	6.96	0.992	Leading	8.07
43	FLT43-3PH	0.993	Leading	7.63	0.998	Leading	3.46	1.000	Leading	0.84
44	FLT44-3PH	0.972	Leading	15.31	0.991	Leading	8.58	0.989	Leading	9.41
45	FLT45-3PH	0.980	Leading	12.72	0.995	Leading	6.16	0.994	Leading	7.18
46	FLT46-3PH	0.998	Leading	4.42	0.998	Lagging	-4.09	0.988	Lagging	-9.79
47	FLT47-3PH	0.982	Leading	12.17	0.994	Leading	6.78	0.995	Leading	6.37

Table 5-6 (Continued)
Power Factor Analysis: GEN-2015-028

Cont. No.	Case	2015 Summer Peak			2015 Winter Peak			2025 Summer Peak		
		Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
48	FLT48-3PH	0.982	Leading	12.19	0.994	Leading	7.15	0.994	Leading	6.64
49	FLT49-3PH	0.984	Leading	11.46	0.996	Leading	5.85	0.996	Leading	5.91
50	FLT50-3PH	0.982	Leading	12.13	0.994	Leading	6.90	0.994	Leading	6.64
51	FLT51-3PH	0.982	Leading	12.11	0.994	Leading	6.88	0.994	Leading	6.62
52	FLT52-3PH	0.982	Leading	12.10	0.994	Leading	6.83	0.995	Leading	6.61
53	FLT53-3PH	0.982	Leading	12.04	0.994	Leading	6.83	0.995	Leading	6.55
54	FLT54-3PH	0.982	Leading	12.04	0.994	Leading	6.85	0.995	Leading	6.53
55	FLT55-3PH	0.982	Leading	12.11	0.994	Leading	6.88	0.995	Leading	6.61
56	FLT56-3PH	0.982	Leading	11.99	0.994	Leading	6.77	0.995	Leading	6.54
57	FLT57-3PH	0.982	Leading	12.03	0.994	Leading	6.78	0.995	Leading	6.59

Table 5-7
Power Factor Analysis: GEN-2015-030

Cont. No.	Case	2015 Summer Peak			2015 Winter Peak			2025 Summer Peak		
		Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
0	Base	0.989	Lagging	-29.99	0.927	Lagging	-80.99	0.982	Lagging	-39.01
1	FLT01-3PH	0.976	Lagging	-44.87	0.942	Lagging	-71.08	0.977	Lagging	-44.09
2	FLT02-3PH	0.939	Lagging	-73.36	0.891	Lagging	-101.86	0.940	Lagging	-72.77
3	FLT03-3PH	0.989	Lagging	-29.99	0.927	Lagging	-80.99	0.982	Lagging	-39.01
4	FLT04-3PH	0.991	Lagging	-27.45	0.935	Lagging	-75.95	0.982	Lagging	-38.65
5	FLT05-3PH	0.989	Lagging	-30.28	0.919	Lagging	-85.75	0.980	Lagging	-40.53
6	FLT06-3PH	0.988	Lagging	-31.12	0.921	Lagging	-84.92	0.980	Lagging	-41.05
7	FLT07-3PH	0.989	Lagging	-29.99	0.927	Lagging	-80.99	0.982	Lagging	-39.01
8	FLT08-3PH	0.999	Lagging	-10.59	0.933	Lagging	-76.95	1.000	Lagging	-5.13
9	FLT09-3PH	0.987	Lagging	-33.01	0.943	Lagging	-70.59	0.969	Lagging	-51.24
10	FLT10-3PH	0.994	Lagging	-21.83	0.956	Lagging	-61.37	0.986	Lagging	-33.43
11	FLT11-3PH	0.990	Lagging	-27.86	0.947	Lagging	-67.78	0.979	Lagging	-41.27
12	FLT12-3PH	0.935	Lagging	-76.12	0.822	Lagging	-138.53	0.969	Lagging	-51.37
13	FLT13-3PH	0.992	Lagging	-24.95	0.926	Lagging	-81.49	0.982	Lagging	-38.90
14	FLT14-3PH	0.987	Lagging	-32.84	0.920	Lagging	-84.98	0.980	Lagging	-40.67
15	FLT15-3PH	0.985	Lagging	-35.44	0.916	Lagging	-87.93	0.978	Lagging	-42.74
16	FLT16-3PH	0.989	Lagging	-30.42	0.926	Lagging	-81.66	0.981	Lagging	-39.39
17	FLT17-3PH	N/A	N/A	N/A	N/A	N/A	N/A	0.978	Lagging	-43.11
18	FLT18-3PH	0.986	Lagging	-33.89	0.920	Lagging	-85.00	0.980	Lagging	-40.64
19	FLT19-3PH	0.989	Lagging	-29.43	0.927	Lagging	-81.11	0.982	Lagging	-38.59
20	FLT20-3PH	0.987	Lagging	-32.59	0.923	Lagging	-83.22	0.980	Lagging	-40.36
21	FLT21-3PH	0.989	Lagging	-30.19	0.927	Lagging	-81.14	0.982	Lagging	-39.03
22	FLT22-3PH	0.988	Lagging	-31.17	0.925	Lagging	-82.45	0.981	Lagging	-39.83
23	FLT23-3PH	0.985	Lagging	-34.94	0.918	Lagging	-86.51	0.977	Lagging	-43.44
24	FLT24-3PH	0.988	Lagging	-31.13	0.925	Lagging	-81.93	0.980	Lagging	-40.29
25	FLT25-3PH	0.990	Lagging	-29.15	0.928	Lagging	-80.19	0.982	Lagging	-38.31
26	FLT26-3PH	0.989	Lagging	-30.16	0.927	Lagging	-80.77	0.981	Lagging	-39.10
27	FLT27-3PH	0.989	Lagging	-30.07	0.927	Lagging	-81.15	0.981	Lagging	-39.10
28	FLT28-3PH	0.989	Lagging	-29.99	0.927	Lagging	-80.98	0.982	Lagging	-39.01
29	FLT29-3PH	0.989	Lagging	-29.90	0.927	Lagging	-80.92	0.982	Lagging	-38.92
30	FLT30-3PH	0.989	Lagging	-29.94	0.927	Lagging	-81.01	0.982	Lagging	-38.91
31	FLT31-3PH	0.986	Lagging	-33.38	0.923	Lagging	-83.25	0.977	Lagging	-43.98
32	FLT32-3PH	0.989	Lagging	-29.73	0.927	Lagging	-80.66	0.982	Lagging	-38.80
33	FLT33-3PH	0.985	Lagging	-34.94	0.917	Lagging	-87.30	0.976	Lagging	-44.52
34	FLT34-3PH	0.991	Lagging	-26.75	0.931	Lagging	-78.24	0.985	Lagging	-35.58
35	FLT35-3PH	0.989	Lagging	-30.08	0.927	Lagging	-80.70	0.981	Lagging	-39.04
36	FLT36-3PH	0.989	Lagging	-30.31	0.926	Lagging	-81.35	0.981	Lagging	-39.24
37	FLT37-3PH	0.986	Lagging	-33.28	0.923	Lagging	-83.22	0.979	Lagging	-41.94
38	FLT38-3PH	0.987	Lagging	-32.04	0.923	Lagging	-83.63	0.980	Lagging	-40.71
39	FLT39-3PH	0.988	Lagging	-30.96	0.928	Lagging	-80.40	0.981	Lagging	-39.67
40	FLT40-3PH	0.989	Lagging	-30.39	0.926	Lagging	-81.50	0.981	Lagging	-39.50
41	FLT41-3PH	0.988	Lagging	-30.92	0.925	Lagging	-81.92	0.981	Lagging	-39.66
42	FLT42-3PH	0.988	Lagging	-30.90	0.926	Lagging	-81.69	0.981	Lagging	-39.80
43	FLT43-3PH	0.989	Lagging	-30.26	0.927	Lagging	-81.08	0.981	Lagging	-39.10
44	FLT44-3PH	0.989	Lagging	-29.93	0.927	Lagging	-81.03	0.982	Lagging	-38.94
45	FLT45-3PH	0.989	Lagging	-30.07	0.927	Lagging	-81.14	0.981	Lagging	-39.03
46	FLT46-3PH	0.989	Lagging	-30.00	0.927	Lagging	-80.82	0.982	Lagging	-38.76
47	FLT47-3PH	0.958	Lagging	-59.62	0.863	Lagging	-117.38	0.950	Lagging	-65.42

Table 5-7 (Continued)
Power Factor Analysis: GEN-2015-030

Cont. No.	Case	2015 Summer Peak			2015 Winter Peak			2025 Summer Peak		
		Power Factor		Q (MVAR)	Power Factor		Q (MVAR)	Power Factor		Q (MVAR)
48	FLT48-3PH	0.989	Lagging	-30.51	0.921	Lagging	-84.80	0.983	Lagging	-37.38
49	FLT49-3PH	0.995	Lagging	-20.55	0.943	Lagging	-70.86	0.989	Lagging	-29.55
50	FLT50-3PH	0.989	Lagging	-29.97	0.927	Lagging	-80.97	0.982	Lagging	-38.97
51	FLT51-3PH	0.989	Lagging	-30.14	0.927	Lagging	-80.96	0.981	Lagging	-39.07
52	FLT52-3PH	0.989	Lagging	-30.22	0.926	Lagging	-81.41	0.981	Lagging	-39.17
53	FLT53-3PH	0.989	Lagging	-29.46	0.928	Lagging	-80.54	0.982	Lagging	-38.51
54	FLT54-3PH	0.989	Lagging	-29.56	0.927	Lagging	-80.69	0.982	Lagging	-38.58
55	FLT55-3PH	0.989	Lagging	-29.95	0.927	Lagging	-80.99	0.982	Lagging	-38.98
56	FLT56-3PH	0.992	Lagging	-25.71	0.933	Lagging	-77.46	0.984	Lagging	-35.80
57	FLT57-3PH	0.991	Lagging	-27.43	0.930	Lagging	-79.05	0.983	Lagging	-37.79

Study Generator GEN-2015-001

The Power Factor Analysis shows that GEN-2015-001 has a power factor range of 0.999 lagging (supplying) to 0.991 leading (absorbing) for the 2015 Summer Peak conditions, a power factor range of 0.988 lagging (supplying) to 1.00 (unity) for the 2015 Winter Peak conditions, and a power factor range of 0.995 leading (absorbing) to 1.00 unity for the 2025 Summer Peak conditions.

Study Generator GEN-2015-015

The Power Factor Analysis shows that GEN-2015-015 has a power factor range of 0.994 lagging (supplying) to 0.994 leading (absorbing) for the 2015 Summer Peak conditions, a power factor range of 0.978 lagging (supplying) to 0.992 leading (absorbing) for the 2015 Winter Peak conditions, and a power factor range of 0.995 lagging (supplying) to 0.992 leading (absorbing) for the 2025 Summer Peak conditions.

Study Generator GEN-2015-016

The Power Factor Analysis shows that GEN-2015-016 has a power factor range of 0.975 to 0.998 leading (absorbing) for the 2015 Summer Peak conditions, a power factor range of 0.973 to 0.997 leading (absorbing) for the 2015 Winter Peak conditions, and a power factor range of 0.979 to 0.998 leading (absorbing) for the 2025 Summer Peak conditions.

Study Generator GEN-2015-024 (Tap Wichita – Thistle circuit 1&2)

The Power Factor Analysis shows that GEN-2015-024 has a power factor range of 0.996 lagging (supplying) to 0.974 leading (absorbing) for the 2015 Summer Peak conditions, a power factor range of 0.0.951 to 1.00 (unity) for the 2015 Winter Peak conditions, and a power factor range of 0.998 lagging (supplying) to 0.972 leading (absorbing) for the 2025 Summer Peak conditions.

<u>Study Generator GEN-2015-025 (Tap Wichita – Thistle circuit 1&2)</u>

The Power Factor Analysis shows that GEN-2015-025 has a power factor range of 0.996 lagging (supplying) to 0.974 leading (absorbing) for the 2015 Summer Peak conditions, a power factor range of 0.0.951 to 1.00 (unity) for the 2015 Winter Peak conditions, and a power factor range of 0.998 lagging (supplying) to 0.972 leading (absorbing) for the 2025 Summer Peak conditions.

<u>Study Generator GEN-2015-028</u>

The Power Factor Analysis shows that GEN-2015-028 has a power factor range of 0.961 to 0.999 leading (supplying) for the 2015 Summer Peak conditions, a power factor range of 0.998 lagging (supplying) to 0.975 leading (absorbing) for the 2015 Winter Peak conditions, and a power factor range of 0.988 lagging (supplying) to 0.978 leading (absorbing) for the 2025 Summer Peak conditions.

<u>Study Generator GEN-2015-030</u>

The Power Factor Analysis shows that GEN-2015-030 has a power factor range of 0.935 to 0.999 lagging (supplying) for the 2015 Summer Peak conditions, a power factor range of 0.822 to 0.956 lagging (supplying) for the 2015 Winter Peak conditions, and a power factor range of 0.940 lagging (supplying) to 1.00 (unity) for the 2025 Summer Peak conditions.

SECTION 6: LOW WIND/NO WIND ANALYSIS

The objective of this task is to determine the impact of low wind or no wind conditions on wind farms that interconnect to a 345 kV or 230 kV bus. The 2015 Summer Peak, 2015 Winter Peak, and 2025 Summer Peak power flows provided by SPP, and corresponding updates, were examined for this analysis.

6.1 Approach

Low wind or no wind conditions were examined for all 345 kV or 230 kV wind farms. Generators were disabled (independently), but the collector systems remained in-service. In order to maintain generation and load balance in the SPP area, the generation was scaled after disabling the respective generator. The amount of reactive power injected into the transmission network was recorded at the respective point of interconnection. This reactive power comes from the capacitance of the project’s transmission lines and collector cables. A shunt reactor was added at the high side bus to bring the Mvar flow into the POI down to approximately zero.

6.2 Low Wind/No Wind Analysis Results

The reactance needed to bring the Mvar flow into the point of interconnect to zero Mvar was recorded for each season for all 345 kV or 230 kV wind farms. Refer to Table 6-1 for the Low

Wind/No Wind Analysis results. The table lists the generators examined and the amount of reactive power needed for zero Mvar flow into the POI for each season.

Table 6-1
Low Wind/No Wind Analysis

Request	Size (MW)	Point of Interconnection	Reactor Size (Mvar)		
			15SP	15WP	25SP
GEN-2015-001	200	Ranch Road 345 kV	9.3	9.3	9.3
GEN-2015-024	220	Tap on Thistle to Wichita 345 kV Ckt #1 and #2	34.8	34.8	34.8
GEN-2015-025	220	Tap on Thistle to Wichita 345 kV Ckt #1 and #2	23.1	23.1	23.1
GEN-2015-030	200.1	Sooner 345 kV	9.8	9.8	9.8

Note for GEN-2015-024 and GEN-2015-025 that share the same POI, the reactor requirements were determined based on the shared 45 mile line from the POI to the high voltage shared bus and their individual contributions. After the shared 45 mile line, the reactor requirements were calculated independently from the shared high side voltage bus to the collector system. Refer to Figure 6-1 for a representation of the reactor requirements that was calculated for both study projects.

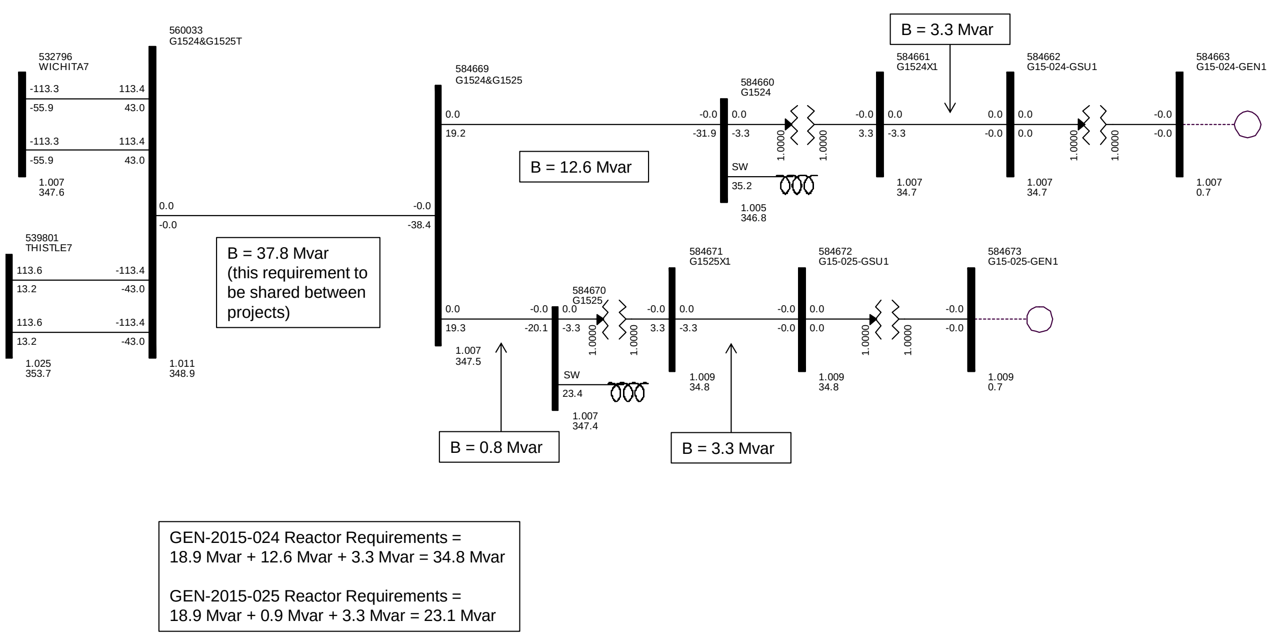

Figure 6-1: Reactor requirement calculation for GEN-2015-024 and GEN-2015-025

SECTION 7: CONCLUSIONS

SUMMARY OF STABILITY ANALYSIS

The Stability Analysis determined that there were no contingencies that resulted in system instability, generation tripping offline, or voltage violations for the 2015 Summer Peak, 2015 Winter Peak, and 2025 Summer Peak conditions when all generation interconnection requests were at 100% output for this analysis. Thus, no mitigations or upgrades were required.

SUMMARY OF THE SHORT CIRCUIT ANALYSIS

The short circuit analysis was performed on the 2025 Summer Peak power flow for all study projects. Refer to Table 7-1 for a list of maximum fault currents observed for each study project.

Table 7-1
List of Maximum Fault Currents Observed for Each Study Project

Study Project	Fault Current at POI (kA)	Maximum Fault Current (kA)	Fault Location	Bus Voltage (kV)
GEN-2015-001	13	41.55	NORTWST4	138
GEN-2015-015	8.47	24.47	WICHITA7	345
GEN-2015-016	7.26	24.67	LACYGNE7	345
GEN-2015-024	19.49	41.38	EVANS S4	138
GEN-2015-025				
GEN-2015-028	5.51	15.65	WHEAGLE4	138
GEN-2015-030	22.77	57.59	SEMINOL4	138
ASGI-2015-004	8.59	26.11	ONETA--7	345

SUMMARY OF POWER FACTOR ANALYSIS

Study Generator GEN-2015-001

The Power Factor Analysis shows that GEN-2015-001 has a power factor range of 0.999 lagging (supplying) to 0.991 leading (absorbing) for the 2015 Summer Peak conditions, a power factor range of 0.988 lagging (supplying) to 1.00 (unity) for the 2015 Winter Peak conditions, and a power factor range of 0.995 leading (absorbing) to 1.00 unity for the 2025 Summer Peak conditions.

Study Generator GEN-2015-015

The Power Factor Analysis shows that GEN-2015-015 has a power factor range of 0.994 lagging (supplying) to 0.994 leading (absorbing) for the 2015 Summer Peak conditions, a power factor range of 0.978 lagging (supplying) to 0.992 leading (absorbing) for the 2015 Winter Peak conditions, and a power factor range of 0.995 lagging (supplying) to 0.992 leading (absorbing) for the 2025 Summer Peak conditions.

Study Generator GEN-2015-016

The Power Factor Analysis shows that GEN-2015-016 has a power factor range of 0.975 to 0.998 leading (absorbing) for the 2015 Summer Peak conditions, a power factor range of 0.973 to 0.997 leading (absorbing) for the 2015 Winter Peak conditions, and a power factor range of 0.979 to 0.998 leading (absorbing) for the 2025 Summer Peak conditions.

Study Generator GEN-2015-024 (Tap Wichita – Thistle circuit 1&2)

The Power Factor Analysis shows that GEN-2015-024 has a power factor range of 0.996 lagging (supplying) to 0.974 leading (absorbing) for the 2015 Summer Peak conditions, a power factor range of 0.0.951 to 1.00 (unity) for the 2015 Winter Peak conditions, and a power factor range of 0.998 lagging (supplying) to 0.972 leading (absorbing) for the 2025 Summer Peak conditions.

Study Generator GEN-2015-025 (Tap Wichita – Thistle circuit 1&2)

The Power Factor Analysis shows that GEN-2015-025 has a power factor range of 0.996 lagging (supplying) to 0.974 leading (absorbing) for the 2015 Summer Peak conditions, a power factor range of 0.0.951 to 1.00 (unity) for the 2015 Winter Peak conditions, and a power factor range of 0.998 lagging (supplying) to 0.972 leading (absorbing) for the 2025 Summer Peak conditions.

Study Generator GEN-2015-028

The Power Factor Analysis shows that GEN-2015-028 has a power factor range of 0.961 to 0.999 leading (supplying) for the 2015 Summer Peak conditions, a power factor range of 0.998 lagging (supplying) to 0.975 leading (absorbing) for the 2015 Winter Peak conditions, and a power factor range of 0.988 lagging (supplying) to 0.978 leading (absorbing) for the 2025 Summer Peak conditions.

Study Generator GEN-2015-030

The Power Factor Analysis shows that GEN-2015-030 has a power factor range of 0.935 to 0.999 lagging (supplying) for the 2015 Summer Peak conditions, a power factor range of 0.822 to 0.956 lagging (supplying) for the 2015 Winter Peak conditions, and a power factor range of 0.940 lagging (supplying) to 1.00 (unity) for the 2025 Summer Peak conditions.

SUMMARY OF LOW WIND/NO WIND ANALYSIS

The amount of reactive power injected into the transmission network was recorded at the point of interconnection for GEN-2015-001, GEN-2015-024, GEN-2015-025, and GEN-2015-030 for each season. The maximum reactance needed for zero Mvar flow was 34.8 Mvar for GEN-2015-024 (Tap Wichita – Thistle circuit 1&2). The minimum reactance needed for zero Mvar flow was 9.3 Mvar for GEN-2015-001 (Ranch Road 345 kV).

L: Group 9 Dynamic Stability Analysis Report

See S&C study report on next page

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DISIS-2015-001-1 (GROUP 9)

LITTLE ROCK, AR

SOUTHWEST POWER POOL

DEFINITIVE INTERCONNECTION SYSTEM IMPACT RE-STUDY

S&C PROJECT NUMBER: 9909

DOCUMENT NUMBER: E-850

REVISION: 0

FINAL REPORT

CONFIDENTIAL

DECEMBER 7, 2015

S&C ELECTRIC COMPANY
Excellence Through Innovation

REPORT REVISION HISTORY:

REV	DATE	PREPARED BY	REVIEWED AND APPROVED BY	DESCRIPTION
A	11/16/2015	NCA	SK	Preliminary report issued
0	12/07/2015	NCA	SK	Final report issued

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1. Executive Summary

S&C Electric Company (S&C) has performed a Definitive Interconnection System Impact Re-Study for Group 9, DISIS-2015-001-1 (Group 9), in response to a request through Southwest Power Pool (SPP) Tariff. The results for the original study can be found in the DISIS-2015-001 report, document no. E-850, dated 24th July, 2015. Group 9 originally consisted of six (6) new interconnection (POI) requests (GEN-2014-023, GEN-2014-059, GEN-2014-060, GEN-2015-007, GEN-2015-008, and GEN-2015-023), all of which were wind farm projects. Since this original study, four (4) of the interconnection project requests including GEN-2014-023, GEN-2014-059, GEN-2014-060, and GEN-2015-008, have been withdrawn from Group 9. In this report, S&C has re-performed the study for this group with only the two (2) remaining interconnection requests, i.e. GEN-2015-007 and GEN-2015-023.

S&C has performed dynamic stability analysis for Group 9 under Cluster scenario. Dynamic Stability analysis for Stand-Alone scenarios was excluded from this re-study. The cluster studies were performed using three (3) cluster base cases (2015 Summer Peak, 2015 Winter Peak, and 2025 Summer Peak) provided by SPP. In the cluster studies, both of the interconnection requests were studied at 100% of nameplate MW capacity. A network upgrade from Holt County to Cherry County to Gentleman 345 kV is required for the study projects and nearby generators to ride-through and remain stable for all contingencies. These upgrades are included to the project files at the start of this project, in order to eliminate instability issues. The dynamics stability studies revealed that Group 9 projects met the SPP transient voltage requirement.

S&C has performed power factor analysis on Group 9 Cluster scenarios. Power factor analysis reported the power factors at the study project POI buses for all N-1 (or N-1-1 for prior-outage contingencies) three-phase contingences and marked the contingency at which the required power factor at the study POI project is beyond the normal required capability (from 0.95 lagging to 0.95 leading) of the studied wind farm. In addition, the maximum leading and lagging reactive power demand and power factor found by the power factor analysis study at the POI buses were given in Section 7.

S&C has performed an analysis of no-wind conditions for the interconnection requests being connected to the 345-kV or 230-kV buses. The no-wind analysis was performed under the

Cluster scenarios by taking the interconnection wind generator out of service and determining the Mvar size of a shunt reactor to offset the reactive power that is due to the capacitance of the project's transmission lines and collector cables. The required shunt reactor Mvar ratings are given in Section 8.

S&C has performed a short-circuit analysis for the 2025 Summer Peak under Group 9 Cluster and reported short-circuit results at all buses up to five levels away from the study project POIs.

2. Introduction

S&C has performed a Definitive Interconnection System Impact Study, DISIS-2015-001-1 (Group 9), in response to a request through the SPP Tariff. Group 9 consist of two (2) new interconnection requests listed in Table 1, thirty (30) prior-queued projects listed in Table 2, and several adjacent generating units in the WAPA system listed in Table 3 at 100% of power output.

Table 1: Group 9 Generation Interconnection Requests

Project	Size (MW)	Generator Model	Generator Bus(es)	Point of Interconnection (POI)	POI Bus
GEN-2015-007	160.0	GE	584513	Hoskins 345 kV	640226
GEN-2015-023	300.8	GE	584653 and 584656	Holt County 345 kV	640510

Table 2: Prior Queued Projects

Request	Size (MW)	Generator Model	Point of Interconnection
GEN-2003-021N	75	Vestas 1.65 MW (640026)	Tap on the Ainsworth – Calamus 115 kV line (640050)
GEN-2004-023N	75	GENROU (640028)	Columbus 115 kV (640119)
GEN-2006-020N	42	Vestas V90 VCUS 1.8 & 3.0 MW (640421,640441)	Bloomfield 115 kV (640084)
GEN-2006-37N1	75	GE 1.7 MW (640449)	Broken Bow 115 kV (640089)
GEN-2006-038N005	79.5	GE 1.6 MW (640428)	Broken Bow 115 kV (640089)
GEN-2006-038N019	79.5	GE 1.5 MW (640431)	Petersburg 115 kV (640444)
GEN-2006-044N	40.5	GE 1.5 MW (645062)	Petersburg 115 kV (640444)
GEN-2007-011N08	81	Vestas V90 VCRS 3.0 MW (640418)	Bloomfield 115 kV (640084)
GEN-2008-086N02 (replaced by GEN-2014-032)	211.22	GE 100m 1.7 MW (645063, 645063)	Meadow Grove 230 kV (GEN-2008-086N02 POI) (640540)
GEN-2008-119O	60	GE 1.5 MW (645061)	S1399 161kV (646399)
GEN-2008-123N	89.7	GE 100m 1.79 MW, GE 103m 1.72 MW (572054)	Tap on the Pauline – Guide Rock 115 kV (560137)
GEN-2009-040	73.8	Vestas V100 VCSS 2.0 MW (532904)	Marshall 115 kV (533303)
GEN-2010-041	10.5	GE 1.5 MW (580071)	S1399 161kV (646399)
GEN-2010-051	200	GE 100m 1.7 MW (580014, 580017, 580020)	Tap on the Twin Church – Hoskins 230 kV line (560347)
GEN-2011-018 (replaced by GEN-2013-008)	73.6	GE 100m 1.7 MW (640555)	Steele County 115 kV (640426)
GEN-2011-027	120	GE 1.85 MW (580022, 580021, 580023)	Tap Twin Church-Hoskins 230 kV (560347)
GEN-2011-056	3.6 MW increase (Pgen=21.6 MW)	GENSAL (640013)	Jeffrey 115 kV (640238)

GEN-2011-056A	3.6 MW increase (Pgen=21.6MW)	GENSAL (640014)	Johnson 1 115 kV (640240)
GEN-2011-056B	4.5 MW increase (Pgen=23.5 MW)	GENSAL (640015)	Johnson 2 115 kV (640242)
GEN-2012-021	4.8 MW	GENROU (650010)	84th & Bluff 115 kV (650275)
GEN-2013-002	50.6	Siemens 108m 2.3 MW (583703)	Tap Sheldon - SW7&Bennet - Folsom/Pleasant Hill 115 kV (560746)
GEN-2013-008	1.2MW increase to GEN-2011-018 (Pgen=74.8 MW)	GE 100m 1.7 MW (640555)	Steele City (640426) 115 kV
GEN-2013-014	25.5	GE 100m 1.7 MW (583643)	Tap Pauline (640313) – Guide Rock (640206) 115 kV (560137)
GEN-2013-019	73.6	Siemens 108m 2.3 MW (583703)	Tap Sheldon - SW7&Bennet - Folsom/Pleasant Hill 115 kV (560746)
GEN-2013-032	204.0	GE 97.4m 1.7 MW (583783)	Neligh 115 kV (640293)
GEN-2014-004	3.96	GE 97.4m 1.79 MW (640555)	Steele City 115 kV (GEN-2011-018 POI) (640426)
GEN-2014-013	73.5	GE XLE 97.4m (583833)	Meadow Grove 230 kV (GEN-2008-086N02 POI) (640540)
GEN-2014-031	35.8	GE 1.79 MW (583836)	Meadow Grove 230 kV (GEN-2008-086N02 POI) (640540)
GEN-2014-039	73.39	GE 1.79 MW (584093)	Friend 115 kV (640174)
Grand Prairie Wind	400.0	Vestas V110 VCSS 2.0MW (652353/652356)	Holt County – Ft. Thompson 345kV (POI bus #652532)

Table 3: WAPA Generators

Bus #	Bus Name	Pmax (MW)	KV	Unit ID
652546	FTRDL12G	43.0	13.800	1
652546	FTRDL12G	43.0	13.800	2
652547	FTRDL34G	43.0	13.800	3
652547	FTRDL34G	43.0	13.800	4
652548	FTRDL56G	43.0	13.800	5
652548	FTRDL56G	44.0	13.800	6
652549	FTRDL78G	44.0	13.800	7
652549	FTRDL78G	44.0	13.800	8
652575	GAVINS1G	31.0	13.800	1
652576	GAVINS2G	31.0	13.800	2
652577	GAVINS3G	30.0	13.800	3
659116	SPIRI71G	52.0	13.800	1
659117	SPIRI72G	52.0	13.800	2

3. Transmission System and Study Area

The interconnection requests in Group 9 will interconnect into Western Area Power Administration (WAPA, Area #652) and Nebraska Public Power District (NPPD, Area #640).

In addition to Areas #640 and #652, the following areas were monitored also:

- Sunflower Electric Power Corporation (SUNC, Area #534)
- Westar Energy, Inc. (WERE, Area #536)
- Greater Missouri Operations Company (GMO, Area #540)
- Kansas City Power & Light Company (KCP&L, Area #541)
- Omaha Public Power District (OPPD, Area #645)
- Lincoln Electric System (LES, Area #650)
- MidAmerican Energy (MEC, Area #635)

4. Power Flow Base Cases

DISIS-2015-001 (Group 9) and prior-queued projects were modeled as aggregated generating units in the base cases from SPP.

Cluster Scenario Base Cases:

- **MDWG14-15SP_DIS1501_G09.SAV** – 2015 Summer Peak Cluster Base Case for Group 9. New interconnection requests and prior queued projects at 100% output power. The four (4) withdrawn interconnection projects are excluded, i.e. the generator and substation up to the POI are taken out of service.
- **MDWG14-15WP_DIS1501_G09.SAV** – 2015 Winter Peak Cluster Base Case for Group 9. New interconnection requests and prior queued projects at 100% output power. The four (4) withdrawn interconnection projects are excluded, i.e. the generator and substation up to the POI are taken out of service.
- **MDWG14-25SP_DIS1501_G09.SAV** – 2025 Summer Peak Cluster Base Case for Group 9. New interconnection requests and prior queued projects at 100% output power. The four (4) withdrawn interconnection projects are excluded, i.e. the generator and substation up to the POI are taken out of service.

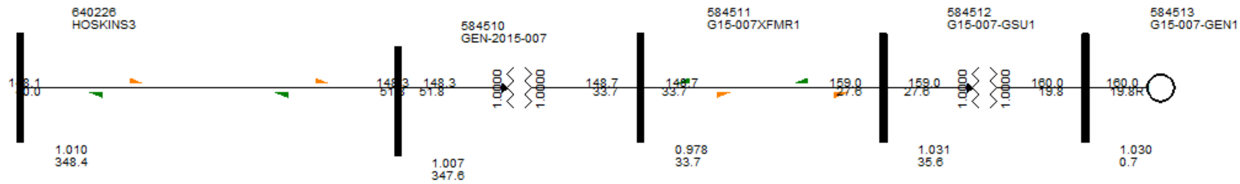
S&C received two additional IDEV files and instructions from SPP, to correct the network parameters in the original cluster base cases, before starting the impact study. They are

(1) Run "GrandIsland_Holt_GrandPrairie_FtThomp_Line_reactor_corrections.idv" on all three season base cases. This idev makes correction to the line reactors on the Grand Island to Holt to Grand Prairie to Ft. Thompson 345 kV line.

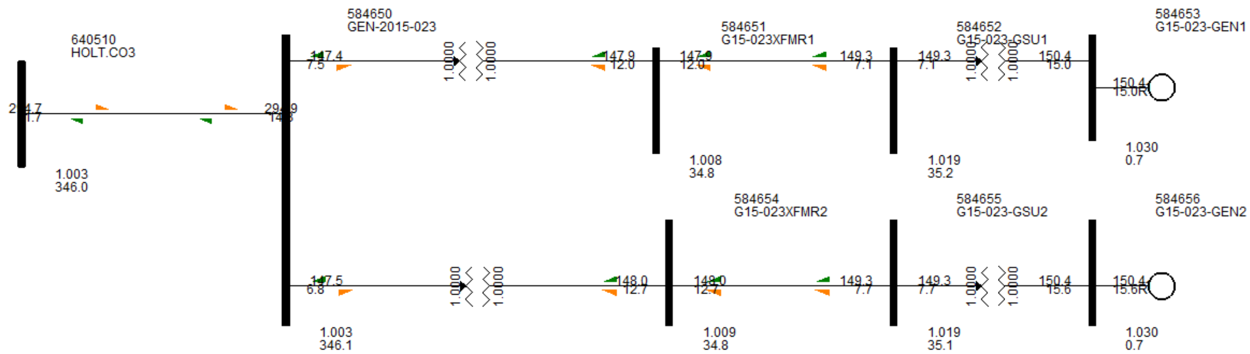
(2) Run "13.DIS-15-1_BUILD_RPLAN-PROJECT[15G 15SP 15WP].idv" on the 2025 Summer Peak case. The idev adds a 345/115 kV transformer (which is missing in this case) at Cherry County 345kV (640500) to Thedford 115kV (640381). The 2015SP and 2015WP cases will not have this transformer and the 345kV line from Holt County (640510) to Cherry County (640500) to Gentleman (640183) since these will not go into service until sometime in 2017.

5. Power Flow Model

SPP's base case power flow models were built in PSS/E 32.2.2. In PSS/E of the same version, S&C created one-line diagrams depicted in Figure 1 for each interconnection request.



(a) Interconnection request GEN-2015-007



(b) Interconnection request GEN-2015-023

Figure 1. One-line Diagrams of the Interconnection Request Projects, a) GEN-2015-007 and b) GEN-2015-023.

6. Dynamic Stability Analysis

6.1. Assumptions

Dynamic stability analysis was performed for all the SPP contingencies listed in Appendix A. Three phase faults were simulated as bolted faults, while single line-to-ground faults were simulated under the assumption that a single line-to-ground fault will cause a 60% drop in the positive-sequence voltage at the fault location.

6.2. Stability Criteria

Dynamic stability studies were performed to ensure system stability following critical faults on the system. The system is considered stable if the following conditions are met:

(1) Disturbances including three-phase and single-phase to ground faults, should not cause synchronous and asynchronous plants disconnected from the transmission grid.

(2) The angular positions of synchronous machine rotor become constant following an aperiodic system disturbance.

(3) 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 ensure that there are no sustained oscillations in power output, speed, frequency, etc.

(4) Voltage magnitudes and angles after the disturbance should settle to a constant and acceptable operating level. Frequencies should settle to the acceptable range within nominal 60 Hz power frequency.

In addition, performance of the transmission system is measured against the Southwest Power Pool Disturbance Criteria Requirements on Angular oscillations and Transient Voltage Recovery, detailed in Appendix B.

6.3. DYNAMIC STABILITY RESULTS

The results of dynamic stability analyses indicated that:

- Generators at bus #584653, #584656, #652353, and #652356 exhibited the stability issues in Contingency #13, #14 and #97 of 2015 SP and 2015 WP Cluster cases. Figure 2 show the instability results for Contingency #13 of 2015 SP Cluster. Note that the same issues were also observed in the original study and discussed with SPP.
- Machines other than those mentioned above remained stable in all the contingencies.
- Bus voltages other than those mentioned above were all met the SPP transient voltage recovery requirements.

Table 4 below summarized the cluster dynamic stability results for each contingency and each peak season.

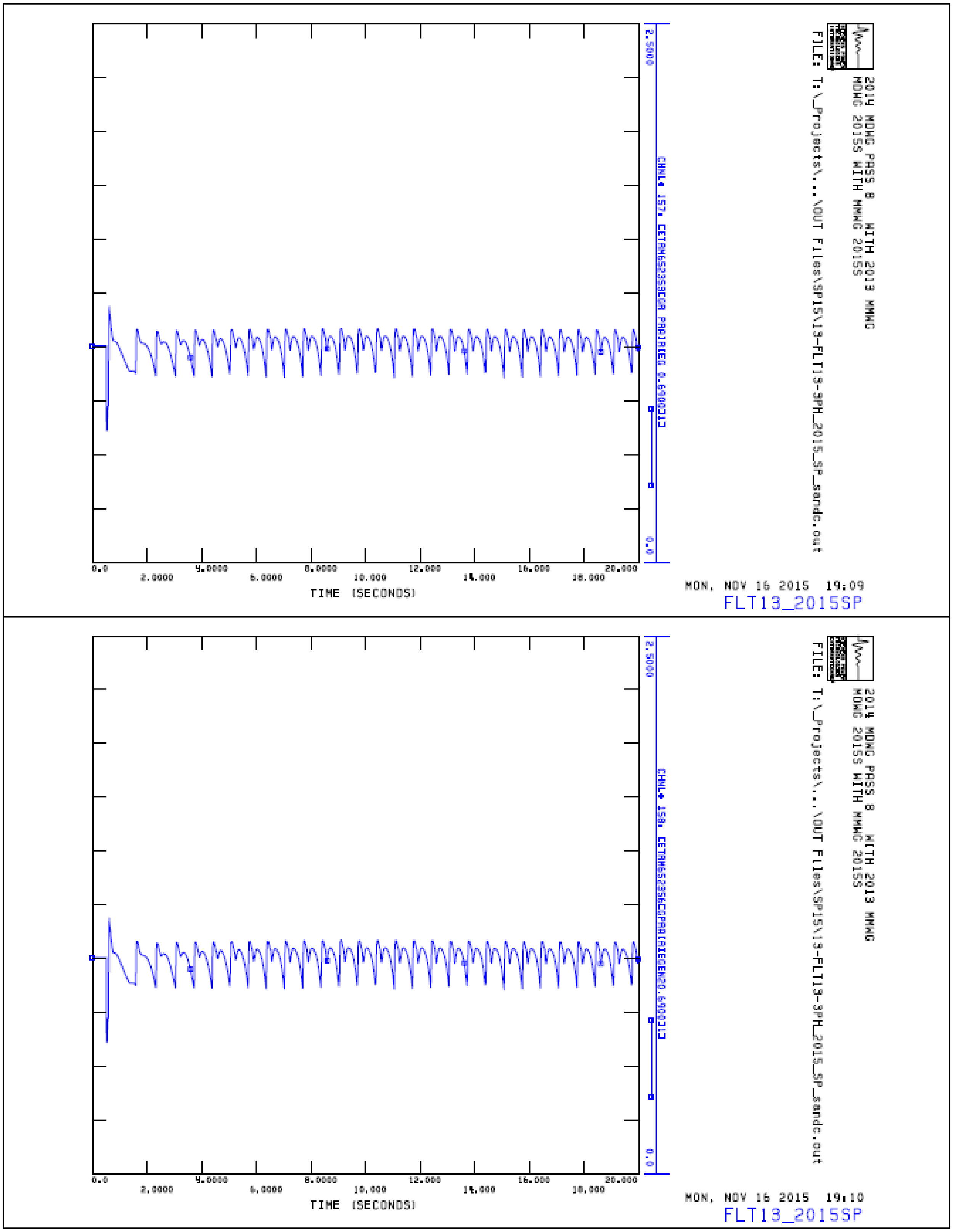


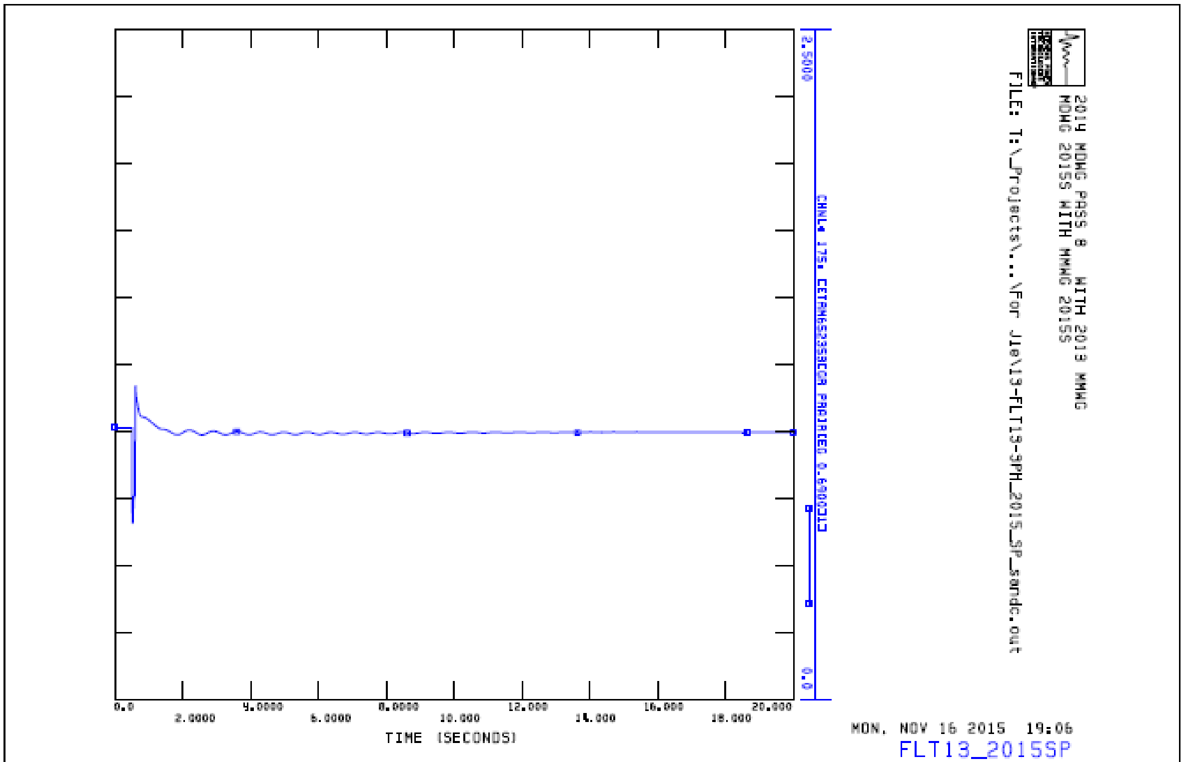
Figure 2. Unstable Machines #652353 and #652356 in Contingency #13, 2015 SP Cluster

Table 4: Group 9 Cluster Dynamic Stability Results

Cont. No.	Cont. Name	2015 Summer Peak	2015 Winter Peak	2025 Summer Peak
1	FLT01-3PH	STABLE	STABLE	STABLE
2	FLT03-3PH	STABLE	STABLE	STABLE
3	FLT08-3PH	STABLE	STABLE	STABLE
4	FLT08-3PH	STABLE	STABLE	STABLE
5	FLT10-3PH	STABLE	STABLE	STABLE
6	FLT11-3PH 2025SP Only	N/A	N/A	STABLE
7	FLT12-3PH	STABLE	STABLE	STABLE
8	FLT13-3PH	UNSTABLE	UNSTABLE	STABLE
9	FLT14-3PH	UNSTABLE	UNSTABLE	STABLE
10	FLT15-3PH	STABLE	STABLE	STABLE
11	FLT16-3PH	STABLE	STABLE	STABLE
12	FLT17-3PH	STABLE	STABLE	STABLE
13	FLT27-3PH	STABLE	STABLE	STABLE
14	FLT28-3PH	STABLE	STABLE	STABLE
15	FLT29-PO	STABLE	STABLE	STABLE
16	FLT30-PO	STABLE	STABLE	STABLE
17	FLT36-3PH	STABLE	STABLE	STABLE
18	FLT37-1PH	STABLE	STABLE	STABLE
19	FLT40-3PH	STABLE	STABLE	STABLE
20	FLT41-1PH	STABLE	STABLE	STABLE
21	FLT42-3PH	STABLE	STABLE	STABLE
22	FLT43-1PH	STABLE	STABLE	STABLE
23	FLT47-PO	STABLE	STABLE	STABLE
24	FLT62-3PH	STABLE	STABLE	STABLE
25	FLT63-3PH	STABLE	STABLE	STABLE
26	FLT64-PO	STABLE	STABLE	STABLE
27	FLT65-PO	STABLE	STABLE	STABLE
28	FLT66-3PH 2015SP and 2015WP Only	STABLE	STABLE	N/A
29	FLT67-3PH 2025SP Only	N/A	N/A	STABLE
30	FLT68-3PH	STABLE	STABLE	STABLE
31	FLT69-PO	STABLE	STABLE	STABLE
32	FLT70-3PH	STABLE	STABLE	STABLE
33	FLT71-PO	STABLE	STABLE	STABLE
34	FLT72-3PH	STABLE	STABLE	STABLE
35	FLT73-3PH	STABLE	STABLE	STABLE
36	FLT74-3PH	STABLE	STABLE	STABLE
37	FLT75-3PH	STABLE	STABLE	STABLE
38	FLT76-3PH	STABLE	STABLE	STABLE
39	FLT77-PO	STABLE	STABLE	STABLE
40	FLT78-SB	STABLE	STABLE	STABLE
41	FLT79-SB	STABLE	STABLE	STABLE
42	FLT80-SB	STABLE	STABLE	STABLE
43	FLT81-SB 2025SP Only	N/A	N/A	STABLE

Cont. No.	Cont. Name	2015 Summer Peak	2015 Winter Peak	2025 Summer Peak
44	FLT82-3PH	STABLE	STABLE	STABLE
45	FLT90-3PH	STABLE	STABLE	STABLE
46	FLT91-3PH	STABLE	STABLE	STABLE
47	FLT92-3PH 2025SP Only	N/A	N/A	STABLE
48	FLT93-3PH	STABLE	STABLE	STABLE
49	FLT94-3PH	STABLE	STABLE	STABLE
50	FLT95-3PH	STABLE	STABLE	STABLE
51	FLT96-3PH	STABLE	STABLE	STABLE
52	FLT97-PO	UNSTABLE	UNSTABLE	STABLE
53	FLT98-PO	STABLE	STABLE	STABLE
54	FLT99-PO	STABLE	STABLE	STABLE
55	FLT100-SB	STABLE	STABLE	STABLE
56	FLT101-SB	STABLE	STABLE	STABLE
57	FLT102-SB	STABLE	STABLE	STABLE

The resolution to the instabilities observed in contingencies #13, #14, and #97 was to add the upgrade from the Holt County to Cherry County to Gentleman 345kV, to the unstable contingencies. Essentially, it required us to apply the second IDEV file “13.DIS-15-1_BUILD_RPLAN-PROJECT[15G 15SP 15WP].idv” to cases in 2015 SP and 2015 WP that exhibited the stability issues. Tests found that after the Holt County to Cherry County to Gentleman 345 kV upgrade was added to the base case, the stability issues were eliminated. Figure 3 show the results of the upgrade for Contingency #13 of 2015 SP Cluster.



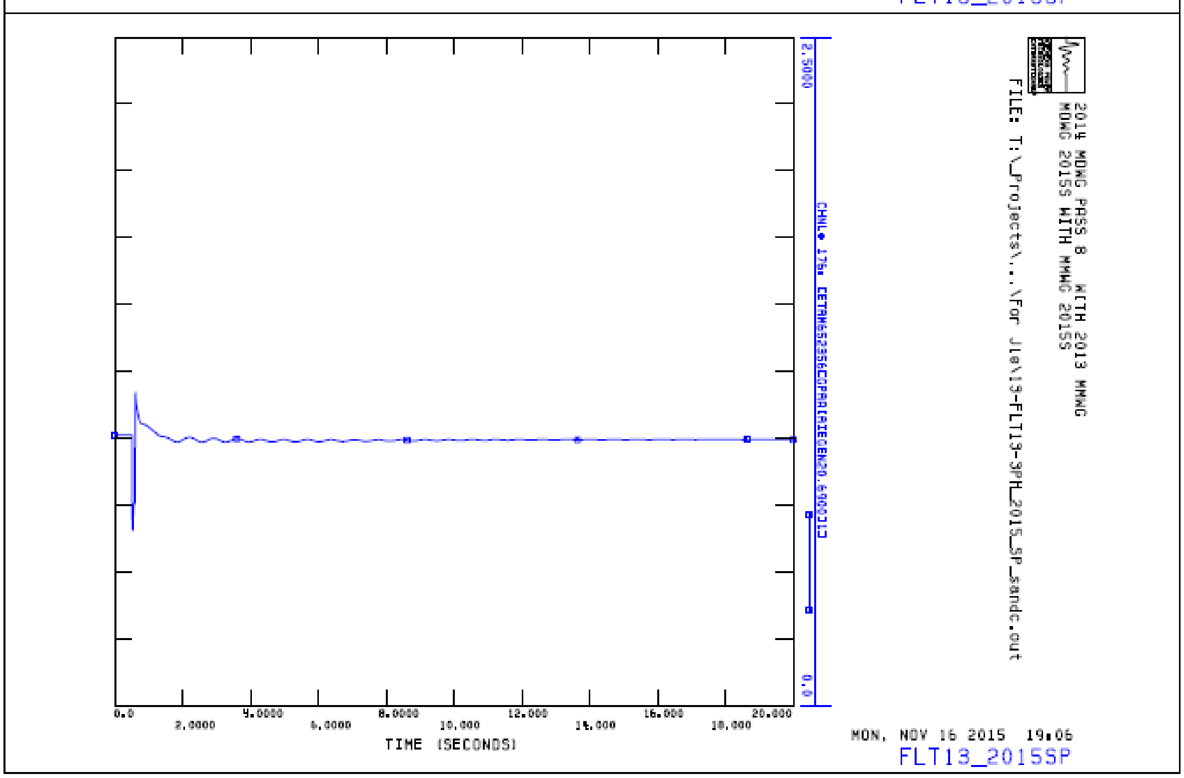


Figure 3. Stable Machines #652353 and #652356 in Contingency #13, 2015 SP Cluster after the upgrade

Plots of cluster dynamic stability results for each contingency and each season are given in Appendix C. The results indicated that no generator tripping or experiencing instabilities. Dynamic stability analysis thus concluded that Group 9 successfully rode through all the contingencies specified by SPP and the nearby areas retained frequency and voltage stabilities.

7. Power Factor Analysis

The power factor analysis was performed under the cluster bases and for all N-1 (N-1-1 for prior-outage contingencies) three-phase contingencies shown in the Fault Definition table in Appendix A. Single-phase contingencies and N-2 contingencies were excluded from the study. Prior to the run, the cluster base cases were slightly altered by turning off the reactive capability of the study project wind farms and by placing a new var generator at each wind farm high voltage bus for supporting the reactive power. The var generators were set to hold the voltage schedule at the interconnection project consistent with the voltage schedules in the provided base case or 1.0 p.u. voltage (whichever is higher).

Table 5 gives the voltage schedule at each interconnection request location in the original cluster base cases.

Table 5: Base Case Voltages at the Interconnection Request POI Bus

Request	POI	2015 Summer Peak (p.u.)	2015 Winter Peak (p.u.)	2025 Summer Peak (p.u.)
GEN-2015-007	640226	1.0101	1.01	1.0163
GEN-2015-023	640510	1.0028	1.0152	1.0127

The power factor analysis results for Group 9 interconnection requests are presented in Appendix D tables. We marked in pink the contingency at which the required power factor at the study POI project is beyond the normal required capability (from 0.95 lagging to 0.95 leading) of the studied wind farm. We also provided a summary table below of the maximum leading/lagging reactive power demand and power factor found by the power factor analysis at the POI of the interconnection requests.

Table 6: Summary of Power Factor Analysis at the POI

Request	Capacity	Capacity	Reactive Power/Power Factor at POI	
			Leading (absorbing vars)	Lagging (generating vars)
GEN-2015-007	160.0 MW	640226	-131.8 Mvar / PF = 0.772	28.8 Mvar / PF = 0.984
GEN-2015-023	300.7 MW	640510	-30.4 Mvar / PF = 0.995	141.7 Mvar / PF = 0.904

NOTE: As specified in SPP's Tariff the final requirement in the GIA will be the pro-forma 95% lagging to 95% leading at the point of interconnection.

8. No Wind Conditions Analysis

S&C has performed an analysis of no wind conditions for the interconnection requests at the 345-kV bus. The no-wind analysis was performed under the Cluster scenarios by taking the interconnection wind generator out of service and placing a shunt reactor at the project substation high side to offset the reactive power that comes from the capacitance of the project's transmission lines and collector cables. The size of the shunt reactor was adjusted such that the net Mvar flow into the POI from the studied wind farm was approximately zero. Table 7 gives the shunt reactor Mvar for the studied projects.

Table 7: Shunt Reactor Mvar Determined by No Wind Study

Request	POI	2015 Summer Peak	2015 Winter Peak	2025 Summer Peak
GEN-2015-007	640226	16.7	16.7	16.7
GEN-2015-023	640510	17.2	17.2	17.2

9. Short-Circuit Study

A short-circuit study has been performed on the power flow models for the 2025 Summer Peak Season for each generator using the Cluster Scenario model. Short-circuit analysis includes applying a 3-phase fault on buses up to 5 levels away from the POI of each interconnection request project. PSS/E "Automatic Sequence Fault Calculation (ASCC)" fault analysis module was used for the purpose of short-circuit analysis. The results of the short-circuit analysis have been recorded for all the buses up to five levels away from the point of interconnection of each interconnection request project. Detailed results of the short-circuit study are provided in Appendix E.

10. Conclusions and Recommendations

- Group 9 dynamic analysis results, for cluster scenarios, indicated that generators at bus #584653, #584656, #652353, and #652356 exhibited the instability issues in Contingencies #13, #14 and #97 of 2015 SP and 2015 WP Cluster cases. The same issues were also observed in the original study and discussed with SPP and the resolution was to add the upgrade from the Holt County to Cherry County to Gentleman 345 kV, to the unstable contingencies. Essentially, it required us to apply the second IDEV file "13.DIS-15-1_BUILD_RPLAN-PROJECT[15G 15SP 15WP].idv" to cases in 2015 SP and 2015 WP that exhibited the stability issues. Except the aforementioned contingencies the interconnection requests are expected to successfully ride through all other N-1, N-1-1, and N-2 fault contingency specified by SPP, retaining angular, frequency and voltage stability at the nearby areas and meeting the transient voltage recovery requirement by SPP. It is thus concluded that Group 9 study projects with the required upgrades are expected to successfully interconnect into the transmission system at their desired locations for 100% power outputs.

- The results of power factor analysis indicate that all interconnection requests are required to maintain a power factor of 0.95 lagging to 0.95 leading at the POI to meet SPP's requirements.

- The results of no-wind study suggested that to offset the reactive power from the capacitance of the interconnection project's transmission lines and collector cables during the no-wind conditions, 16.7 Mvar for GEN-2015-007, and 17.2 Mvar for GEN-2015-023.

- A short-circuit study has been performed on the power flow models for the 2025 Summer Peak Season for each generator using the Cluster Scenario model. A 3-phase fault is applied on buses up to 5 levels away from the POI of each interconnection request project and the results of the study have been presented.

APPENDIX A

SPP GROUP 9 FAULT DEFINITIONS (SUBMITTED IN A SEPARATE FILE)

APPENDIX B

SOUTHWEST POWER POOL DISTURBANCE PERFORMANCE REQUIREMENTS (SUBMITTED IN A SEPARATE FILE)

APPENDIX C

DYNAMIC STABILITY PLOTS FOR CLUSTER SCENARIO (SUBMITTED IN SEPARATE FILES FROM APPENDIX C-1 TO C-3)

C-1 Group 9 Cluster Dynamic Stability Plots For 2015 Summer Peak Case

C-2 Group 9 Cluster Dynamic Stability Plots For 2015 Winter Peak Case

C-3 Group 9 Cluster Dynamic Stability Plots For 2025 Summer Peak Case

Each contingency consists of (60) subplots:

- Subplot #1 are the (6) monitor system phase angle channels in the original snapshot file provided by SPP.
- Subplot #2 to Subplot #52 are results for (51) generators in the scope of study.
- Subplots #53 to Subplot #56 are voltages at the POI buses in the scope of study.
- Subplots #57 to Subplot #60 are frequencies at the POI buses in the scope of study.

APPENDIX D

POWER FACTOR ANALYSIS RESULTS (SUBMITTED IN SEPARATE FILE FROM APPENDIX D-1 TO D-2)

D-1 Group 9 Power Factor Results for Interconnection Request GEN-2015-007 (#640226)

D-2 Group 9 Power Factor Results for Interconnection Request GEN-2015-023 (#640510)

APPENDIX E

SHORT-CIRCUIT STUDY RESULTS (SUBMITTED IN A SEPARATE FILE)