Preliminary Interconnection System Impact Study for Generation Interconnection Requests

(PISIS-2012-002)

February 2013

Generation Interconnection

SPP Southwest Power Pool

Revision History

Date	Author	Change Description
02/28/2013	SPP	Report Issued (PISIS-2012-002)

Executive Summary

Generation Interconnection customers have requested a Preliminary Interconnection System Impact Study (PISIS) under the Generation Interconnection Procedures (GIP) in the Southwest Power Pool Open Access Transmission Tariff (OATT). The Interconnection Customers' requests have been clustered together for the following System Impact Cluster Study. This System Impact Study analyzes the interconnecting of a single generation interconnection request associated with new generation totaling approximately 81.0 MW of new generation which would be located within the transmission system of Nebraska Public Power District (NPPD). 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.

Power flow analysis has indicated that for the power flow cases studied, 81.0 MW of nameplate generation may be interconnected with transmission system reinforcements within the SPP transmission system. Dynamic stability and power factor analysis has determined the need for reactive compensation in accordance with Order No. 661-A for wind farm interconnection requests and those requirements are listed for each interconnection request within the contents of this report.

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

The total estimated minimum cost for interconnecting the PISIS-2012-002 interconnection customers is $5,700,000. These costs are shown in Appendix E and F. Interconnection Service to PISIS-2012-002 interconnection customers is also contingent upon higher queued customers paying for certain required network upgrades. **The in service date for the PISIS customers will be deferred until the construction of these network upgrades can be completed.**

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

Network Constraints listed in Appendix H are in the local area of the new generation when this generation is injected throughout the SPP footprint for the Energy Resource (ERIS) Interconnection Request. Certain Interconnection Requests were also studied for Network Resource Interconnection Service (NRIS). Those constraints are also listed in Appendix H. Additional Network

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

constraints will have to be verified with a Transmission Service Request (TSR) and associated studies. With a defined source and sink in a TSR, this list of Network Constraints will be refined and expanded to account for all Network Upgrade requirements.

The required interconnection costs listed in Appendix E and F 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.

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Introduction

Pursuant to the Southwest Power Pool (SPP) Open Access Transmission Tariff (OATT), SPP has conducted this Preliminary Interconnection System Impact Study (PISIS) for certain generation interconnection requests in the SPP Generation Interconnection Queue. These interconnection requests have been clustered together for the following System Impact Study. The customers will be referred to in this study as the PISIS-2012-002 Interconnection Customers. This System Impact Study analyzes the interconnecting of multiple generation interconnection requests associated with new generation totaling 81.0 MW of new generation which would be located within the transmission system of Nebraska Public Power District (NPPD). The various generation interconnection requests have differing proposed in-service dates[2]. 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.

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

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

Model Development

Interconnection Requests Included in the Cluster

SPP has included all interconnection requests that submitted a Preliminary Interconnection System Impact Study Agreement no later than September 30, 2012 and were subsequently accepted by Southwest Power Pool under the terms of the Generator Interconnection Procedures (GIP). The interconnection requests that are included in this study are listed in Appendix A.

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 with equal distribution across the SPP footprint. Prior queued projects that requested Network Resource Interconnection Service (NRIS) were dispatched in an additional analysis into the balancing authority of the interconnecting transmission owner.

Development of Base Cases

Power Flow

The 2012 series Transmission Service Request (TSR) Models 2013 spring, 2013 summer and winter peak, 2018 summer and winter peak, and the 2023 summer peak scenario 0 cases were used for this study. After the cases were developed, each of the control areas' resources were then re-dispatched to account for the new generation requests using current dispatch orders.

Dynamic Stability

The 2012 series SPP Model Development Working Group (MDWG) Models 2014 winter and 2014 summer were used as starting points for this study.

Base Case Upgrades

The following facilities are part of the SPP Transmission Expansion Plan or the Balanced Portfolio or recently approved Priority Projects. These facilities, have an approved Notice 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 PISIS-2012-002 Customers have not been assigned acceleration costs for the below listed projects. The PISIS-2012-002 Customers Generation Facilities in service dates may need to be delayed until the completion of the following upgrades. If for some reason, construction on these projects is discontinued, additional restudies will be needed to determine the interconnection needs of the PISIS customers.

- Hitchland 230/115kV area projects[3]:
  - Hitchland – Ochiltree 230kV Project, scheduled for 12/31/2012 in-service

[3] SPP Regional Reliability Projects identified in 2007 STEP. As of the writing of this report, SPP Project Tracking TAGIT shows some of these project's in-service dates have been delayed from the original 2010/2011 in-service dates.

- Balanced Portfolio Projects[4]:
  - Woodward – Border – TUCO 345kV project, scheduled for 5/19/2014 in-service
    - Woodward 345/138kV circuit #2 autotransformer
    - TUCO 345/138kV circuit #2 autotransformer
    - Reactors at Woodward and Border
  - Iatan– Nashua 345kV, scheduled for 6/1/2015 in-service
    - Nashua 345/161kV autotransformer
  - Muskogee– Seminole 345kV, scheduled for 12/31/2012 in-service
  - Post Rock – Axtell 345kV, scheduled for 6/1/2013 in-service
  - Cleveland – Sooner 345kV, scheduled for 12/31/2012 in-service
- Priority Projects[5]:
  - Hitchland – Woodward double circuit 345kV, scheduled for 6/30/2014 in-service
    - Hitchland 345/230kV autotransformer
  - Woodward – Thistle double circuit 345kV, scheduled for 12/31/2014 in-service
  - Spearville – Clark double circuit 345kV, scheduled for 12/31/2014 in-service
  - Clark – Thistle double circuit 345kV, scheduled for 12/31/2014 in-service
  - Thistle – Wichita double circuit 345kV, scheduled for 12/31/2014 in-service
  - Thistle 345/138kV autotransformer, scheduled for 12/31/2014 in-service
  - Thistle – Flat Ridge 138kV, scheduled for 12/31/2014 in-service
- Various MKEC Transmission System Upgrades[6]
  - Harper – Flat Ridge 138kV rebuild, scheduled for 12/31/2013 in-service
  - Flat Ridge – Medicine Lodge 138kV rebuild, scheduled for 12/31/2013 in-service
  - Pratt – Medicine Lodge 115kV rebuild, scheduled for 6/1/2013 in-service
  - Medicine Lodge 138/115kV autotransformer replacement, scheduled for 6/1/2013 in-service
- Northwest 345/138/13.8kV circuit #3 autotransformer, scheduled for 6/1/2017 in-service[7]
- Woodward (OKGE) – Woodward (WFEC) 69kV rebuild, scheduled for 12/1/2013 in-service[8]

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 PISIS-2012-002 study and are assumed to be in service. This list may not be all inclusive. The PISIS-2012-002 Customers at this time do not have responsibility for these facilities but may later be assigned the cost of these facilities if higher queued customers terminate their GIA or withdraw from the interconnection queue. The PISIS-2012-002 Customer Generation Facilities in service dates may need to be delayed until the completion of the following upgrades.

[4] Notice to Construct (NTC) issued June 2009.
[5] Notice to Construct (NTC) issued June 2010.
[6] SPP Transmission Service Projects identified in SPP-2007-AG3-AFS-9.
[7] SPP Transmission Service Project identified in SPP-2009-AG2-AFS6. Per SPP-NTC-20137.
[8] SPP Regional Reliability Project. Per SPP-NTC-20003.

- Upgrades assigned to ICS-2008-001 Interconnection Customers
  - Line Traps at Amarillo South – Swisher 230kV
  - Finney-Holcomb 345kV circuit #2
- Upgrades assigned to DISIS-2009-001 Interconnection Customers:
  - Fort Dodge – North Fort Dodge – Spearville 115kV circuit #2
  - Albion – Petersburg – Neligh 115kV circuit #1 rerate (placed In-Service in 2011)
  - Fort Randall – Madison County – Kelly 230kV circuit #1 rerate (320MVA)
  - Spearville 345/115kV autotransformer circuit #1
- Upgrades assigned to DISIS-2010-001 Interconnection Customers:
  - Post Rock 345/230kV circuit #2 autotransformer
  - South Hays – Hays Plant – Vine Street 115kV circuit #1 rebuild
  - Switch 2749 – Wildorado 69kV circuit # 1 rebuild
  - Washita – Gracemont 138kV circuit #2 (placed In-Service in 2012)
- Upgrades assigned to DISIS-2010-002 Interconnection Customers:
  - Twin Church – Dixon County 230kV circuit #1 rerate (320MVA)
- Upgrades assigned to DISIS-2011-001 Interconnection Customers:
  - Beaver County – Buckner 345kV circuit #1 build
  - Beaver County 345kV Expansion (Tap & Tie Hitchland – Woodward circuit #2 into Beaver County 345kV)
  - Spearville – Mullergren – Reno double circuit 345kV build
  - Matthewson 345kV Substation & Tatonga – Matthewson - Cimarron 345kV circuit #2 build
    - Tatonga terminal equipment upgrade (1792 MVA)
  - Rice County – Circle 230kV conversion
  - Rice County – Lyons 115kV rebuild
  - Rice County 230/115kV autotransformer
  - Lyons – Wheatland 115kV rerate (199 MVA)
  - Hoskins – Dixon County – Twin Church 230kV circuit #1 rerate
  - (NRIS only) Spearville – Mullergren 230kV circuit #1 rebuild
  - (NRIS only) Benton – Wichita 345kV circuit #1 rerate (1195MVA)
  - (NRIS only) FPL Switch – Woodward - Mooreland 138kV circuit #1 rebuild
  - (NRIS only) Glass Mountain – Mooreland 138kV rebuild
  - (NRIS only) Woodward – Woodward EHV 138kV rebuild
  - (NRIS only) Woodward 138/69kV auto replacement
  - (NRIS only) Woodward (OGE) – Woodward (WFEC) 69kV rebuild
- Upgrades assigned to DISIS-2011-002 interconnection Customers:
  - Amoco Wasson – Oxy Tap – Yoakum 230kV circuit #1 – replace line traps
  - Harbine – Crete 115kV circuit #1
  - Jones – Lubbock South 230kV circuit #2 - replace line traps
  - Power System Stabilizers - Install Power System Stabilizers @ Tolk(Units: 1,2) and Jones (Units: 1,2,3,4)
  - Mustang – Yoakum 230kV circuit #1 replace line traps
  - SUB 967 - SUB 968 69kV circuit #1 replace terminal equipment
  - (NRIS only) Allen – Lubbock South 115kV circuit #1 rebuild
  - (NRIS only) Hydro Carbon Tap - Sub974 69kV circuit #1 rewire CT

  - (NRIS only) Lubbock South 230/115kV Autotransformer circuit #2
  - (NRIS only) Nebraska City U Syracuse – SUB 970 circuit #1 replace terminal equipment
  - (NRIS only) Chisholm – Maize – Evans Energy Center 138kV circuit #1 rebuild
  - (NRIS only) Duncan – Tosco – Comanche Tap 69kV circuit #1 rebuild
  - (NRIS only) Cimarron 345/138kV autotransformer #3
  - (NRIS only) Yoakum 230/115kV transformer #2
- Upgrades assigned to DISIS-2012-001 interconnection Customers:
  - Holcomb 345/115/13.8kV Transformer circuit #2
  - Denver North – Mustang 115kV circuit #1 rebuild
  - Denver South – Mustang 115kV circuit#1 rebuild
- Upgrades assigned to DISIS-2012-002 interconnection Customers:
  - Dixon County – Rasmussen 230kV circuit #1 build
  - Sweatwater 345kV Substation & Sweetwater – Gracemont 345kV circuit #1
  - Tuco – Sweetwater 345kV circuit #2
  - Woodward – Tatonga 345kV circuit #2
  - Hobart Junction – Carnegie – Southwest 138kV circuit #1 rebuild
  - Lake Crek – Lone Wolf 69kV circuit #1 Reset CT
  - Remington – Fairfax 138kV circuit #1 increase conductor clearance
  - Shidler – Fairfax – Webb Tap 138kV Increase conductor clearance
  - Tuco 345/230/13.2kV Autotransformer circuit #3
  - Woodring – Hunter 345kV circuit #1 terminal equipment
  - (NRIS only) Cimarron – Czech Hall 138kv circuit #1 rebuild
  - (NRIS only) Cimarron – Draper 345kV circuit #1 terminal equipment
  - (NRIS only) Cimarron – Haymaker 138kV circuit #1 rebuild
  - (NRIS only) Cimarron – Sara 138kV circuit #1 rebuild
  - (NRIS only) Czech Hall – Xerox 138kV circuit #1 rebuild
  - (NRIS only) Haymaker – Division 138kV circuit #1 rebuild
  - (NRIS only) Plant X 230/115/13.2kV transformer circuit #2
  - (NRIS only) Wichita 345/138/13.8kV transformer circuit #3

Potential Upgrades Not in the Base Case

Any potential upgrades that do not have a Notification to Construct (NTC) and 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 were grouped together in fifteen different regional groups based on geographical and electrical impacts. These groupings are shown in Appendix C.

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

Power Flow

For each group, the various wind generating plants were modeled at 80% nameplate of maximum generation. The wind generating plants in the other areas were modeled at 20% nameplate of maximum generation. This process created fifteen different scenarios with each group being studied at 80% nameplate rating. These projects were dispatched as Energy Resources with equal distribution across the SPP footprint. Certain projects that requested Network Resource Interconnection Service were dispatched in an additional analysis into the balancing authority of the interconnecting transmission owner. This method allowed for the identification of network constraints that were common to the regional groupings that could then in turn have the mitigating upgrade cost allocated throughout the entire cluster. Other sensitivity analyses are also performed with each interconnection request modeled at 100% nameplate.

Peaking units were not dispatched in the 2013 spring model. To study peaking units' impacts, the 2013 summer and winter, 2018 summer and winter, and 2023 summer seasonal models were chosen and peaking units were modeled at 100% of the nameplate rating and wind generating facilities were modeled at 10% of the nameplate rating. Each interconnection request was also modeled separately at 100% nameplate for certain analyses.

Dynamic Stability

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

Identification of Network Constraints

The initial set of network constraints were found by using PTI MUST First Contingency Incremental Transfer Capability (FCITC) analysis on the entire cluster grouping dispatched at the various levels mentioned above. These constraints were then screened to determine if any of the generation interconnection requests had at least a 20% Distribution Factor (DF) upon the constraint. Constraints that measured at least a 20% DF from at least one interconnection request were considered for mitigation. Interconnection Requests that have requested Network Resource Interconnection Service (NRIS) were also studied in the NRIS analysis to determine if any constraint had at least a 3% DF. If so, these constraints were considered for mitigation.

Determination of Cost Allocated Network Upgrades

Cost Allocated Network Upgrades of wind generation interconnection requests were determined using the 2013 spring model. Cost Allocated Network Upgrades of peaking units was determined using the 2018 summer peak model. A MUST sensitivity analysis was performed to determine the Distribution Factors (DF), a distribution factor with no contingency that each generation interconnection request had on each new upgrade. The impact each generation interconnection request had on each upgrade project was weighted by the size of each request. Finally the costs due by each request for a particular project were then determined by allocating the portion of each request's impact over the impact of all 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:

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

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

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

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

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

- 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 for Amounts Advanced for Network Upgrades

Interconnection Customer shall be entitled to credits 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 81.0 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 $5,700,000. 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.

A list of constraints that were identified and used for mitigation are listed in Appendix G. Listed within Appendix G are the ERIS constraints with greater than or equal to a 20% DF, as well as, the NRIS constraints that have a DF of 3% or greater. Other Network Constraints which are not requiring mitigation are shown in Appendix H. With a defined source and sink in a TSR, this list of Network Constraints will be refined and expanded to account for all Network Upgrade requirements.

Power Flow Analysis

Power Flow Analysis Methodology

The ACCC function of PSS/E was 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. This satisfies the “more probable” contingency testing criteria mandated by NERC and the SPP criteria.

Power Flow Analysis

A power flow analysis was conducted for each Interconnection Customer’s facility using modified versions of the 2013 spring peak, 2013 summer and winter peak, 2018 summer and winter peak, and the 2023 summer peak models. The output of the Interconnection Customer’s facility was offset in each model by a reduction in output of existing online SPP generation. This method allows the request to be studied as an Energy Resource (ER) Interconnection Request. Certain requests that requested Network Resource Interconnection Service (NRIS) had an additional analysis conducted for displacing resources in the interconnecting Transmission Owner’s balancing authority.

This analysis was conducted assuming that previous queued requests in the immediate area of these interconnect requests were in-service. The analysis of each Customer’s project indicates that criteria violations will occur on the NPPD transmission system under system intact and contingency conditions in the peak seasons.

Cluster Group 1 (Woodward Area)

In addition to the 5,465.9 MW of previously queued generation in the area, 0 MW of new interconnection service was studied. No new constraints were found in this area.

Cluster Group 2 (Hitchland Area)

In addition to the3,180.2 MW of previously queued generation in the area, 0 MW of new interconnection service was studied. No new constraints were found in this area.

Cluster Group 3 (Spearville Area)

In addition to the 5964 MW of previously queued generation in the area, 0 MW of new interconnection service was studied. No new constraints were found in this area.

Cluster Group 4 (NW Kansas Group)

In addition to the 2389.3 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 5 (Amarillo Area)

In addition to the 1,572.6 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 6 (South Texas Panhandle/New Mexico)

In addition to the 3538.77 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 7 (Southwestern Oklahoma)

In addition to the 2101.1.0 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 8 (South Central Kansas/North Oklahoma)

In addition to the 2848.82 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 9/10 (Nebraska)

In addition to the 2148.4 MW of previously queued generation in the area, 81.0 MW of new interconnection service was studied. The following ERIS constraints were observed. The Madison – Kelly 230kV line was found to be constrained for several N-1 conditions. To mitigate this constraint, the conductor clearance on Madison – Kelly 230kV will need to be upgraded.

MONITORED ELEMENT	RATE B (MVA)	TC%LOADING (% MVA)	CONTINGENCY
KELLY - MADISONCO 230.00 230KV CKT 1	320	105.1545	FT RANDAL - UTICA JCT 230KV CKT 1

Cluster Group 12 (Northwest Arkansas)

In addition to the 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 13 (Northwest Missouri)

In addition to the 585.6 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 14 (South Central Oklahoma)

In addition to the 462.2 MW of previously queued generation in the area, 0.0 MW of new interconnection service was studied. No new ERIS constraints were found in this area.

Stability Analysis

A stability analysis was conducted for each Interconnection Customer's facility using modified versions of the 2014 summer and 2014 winter peak models. The stability analysis was conducted with all upgrades in service that were identified in the power flow analysis. For each group, the interconnection requests were studied at 100% nameplate output while the other groups were dispatched at 20% output for wind requests and 100% output for fossil requests. The output of the Interconnection Customer's facility was offset in each model by a reduction in output of existing online SPP generation. The following synopsis is included for each group. The entire stability study for each group can be found in the Appendices.

Cluster Group 1 (Woodward Area)

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

Cluster Group 2 (Hitchland Area)

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

Cluster Group 3 (Spearville Area)

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

Cluster Group 4 (NW Kansas Area)

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

Cluster Group 5 (Amarillo Area)

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

Cluster Group 6 (South Texas Panhandle/New Mexico)

There was no stability analysis conducted in the South Texas Panhandle/New Mexico area due to no requests in the area.

Cluster Group 7 (Southwest Oklahoma Area)

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

Cluster Group 8 (South Central Kansas/North Oklahoma)

There was no stability analysis conducted in the South Central Kansas/North Oklahoma area due to no requests in the area.

Cluster Group 9/10 (Nebraska)

The Group 9 stability analysis for this restudy was performed by SPP staff. Stability analysis has determined that the 81.0 MW of new generation interconnection requests can be accommodated with the addition of all assigned and previously assigned network upgrades. Once the previously

assigned upgrades are placed in service the transmission system will remain stable and low voltage ride through requirements are satisfied for the contingencies studied.

With the power factor requirements and all network upgrades in service, all interconnection request in Group 9 will meet FERC Order #661A low voltage ride through (LVRT) requirements.

Power Factor Requirements:

Request	Size (MW)	Generator Model	Point of Interconnection	Power Factor Requirement at POI	
				Lagging (supplying)	Leading (absorbing)
GEN-2012-005	81.0	G.E. 1.62MW	Madison County 230kV (Tap on Fort Randall – Columbus 230kV)	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.

Cluster Group 12 (Northwest Arkansas Area)

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

Cluster Group 13 (Northwest Missouri Area)

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

Cluster Group 14 (South Central Oklahoma)

There was no stability analysis conducted in the South Central Oklahoma area due to no requests in the area.

Conclusion

The minimum cost of interconnecting 81.0 MW of new interconnection requests included in this Preliminary Interconnection System Impact Study is estimated at $5,700,000 for the Allocated Network Upgrades and Transmission Owner Interconnection Facilities are 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 Network Upgrades determined to be required by short circuit analysis. These studies will be performed if the Interconnection Customer executes the appropriate Interconnection Facilities Study Agreement and provides the required data along with demonstration of Site Control and the appropriate deposit. At the time of the Interconnection Facilities Study, a better determination of the interconnection facilities may be available.

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).

Appendix

A: Generation Interconnection Requests Considered for Impact Study

See next page.

A: Generation Interconnection Requests Considered for Impact 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*
GEN-2012-005	81.00	ER/NR	NPPD	Tap Ft Randall - Columbus (Madison County) 230kV	Tap Ft Randall - Columbus (Madison County) 230kV	6/1/2015	TBD
Total:	**81.00**						

*request dependent upon Priority Projects or Balanced Portfolio may be delayed until 12/31/2014. Other projects in service date to be determined after Facility Study.

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	Tap Fairfax (AECI) - Shilder (AEPW) 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	28.80	SPS	Lovington 115kV	Lea County Affected Study
ASGI-2011-002	10.00	SPS	Herring 115kV	AECI queue Affected Study
ASGI-2011-003	10.00	SPS	Hendricks 115kV	AECI queue Affected Study
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)
GEN-2001-014	96.00	WFEC	Ft Supply 138kV	On-Line
GEN-2001-026	74.00	WFEC	Washita 138kV	On-Line
GEN-2001-033	180.00	SPS	San Juan Tap 230kV	On-Line
GEN-2001-036	80.00	SPS	Norton 115kV	On-Line
GEN-2001-037	102.00	OKGE	FPL Moreland Tap 138kV	On-Line
GEN-2001-039A	105.00	SUNCMKEC	Tap Greensburg - Ft Dodge (Shooting Star Tap) 115kV	On Schedule for 2012
GEN-2001-039M	99.00	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 GEN-2004-023 GEN-2005-003	151.20	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 at 80MW
GEN-2003-021N	75.00	NPPD	Ainsworth Wind Tap 115kV	On-Line
GEN-2003-022	120.00	AEPW	Washita 138kV	On-Line
GEN-2004-005N	30.00	NPPD	St Francis 115kV	On Suspension
GEN-2004-014	154.50	SUNCMKEC	Spearville 230kV	On Schedule for 2012
GEN-2004-020	27.00	AEPW	Washita 34.5kV	On-Line
GEN-2004-023N	75.00	NPPD	Columbus Co 115kV	On-Line
GEN-2005-005	18.00	OKGE	FPL Moreland Tap 138kV	IA Pending
GEN-2005-008	120.00	OKGE	Woodward 138kV	On-Line
GEN-2005-012	250.00	SUNCMKEC	Spearville 345kV	On Schedule for 2012
GEN-2005-013	201.00	WERE	Tap Latham - Neosho (Caney River) 345kV	On-Line
GEN-2006-002	101.00	AEPW	Sweetwater 230kV	On-Line
GEN-2006-006	205.50	SUNCMKEC	Spearville 345kV	IA Pending
GEN-2006-014	300.00	MIPU	Tap Maryville - Midway (Nodway Co) 161kV	On Suspension
GEN-2006-018	170.00	SPS	TUCO Interchange 230kV	On-Line
GEN-2006-020N	42.00	NPPD	Bloomfield 115kV	On-Line

Request	Amount	Area	Requested/Proposed Point of Interconnection	Status or In-Service Date
GEN-2006-020S	18.90	SPS	DWS Frisco 115kV	On Schedule for 3/2012
GEN-2006-021	101.00	SUNCMKEC	Flat Ridge Tap 138kV	On-Line
GEN-2006-022	150.00	SUNCMKEC	Ninnescah 115kV	On Suspension
GEN-2006-024S	19.80	WFEC	Buffalo Bear Tap 69kV	On-Line
GEN-2006-026	604.00	SPS	Hobbs 230kV & Hobbs 115kV	On-Line
GEN-2006-031	75.00	MIDW	Knoll 115kV	On-Line
GEN-2006-032	200.00	MIDW	South Hays 230kV	On Suspension
GEN-2006-035	225.00	AEPW	Sweetwater 230kV	On-Line at 132MW
GEN-2006-037N1	75.00	NPPD	Broken Bow 115kV	On Suspension
GEN-2006-038N005	80.00	NPPD	Broken Bow 115kV	On-Line
GEN-2006-038N019	80.00	NPPD	Petersburg North 115kV	On-Line
GEN-2006-040	108.00	SUNCMKEC	Mingo 115kV	On Suspension
GEN-2006-043	99.00	AEPW	Sweetwater 230kV	On-Line
GEN-2006-044	370.00	SPS	Hitchland 345kV	On Schedule for 2012
GEN-2006-044N	40.50	OPPD	North Petersburg 115kV	On-Line
GEN-2006-045	240.00	SPS	Tap Potter - Plant X 230kV (South Randle County) 230kV	On Suspension
GEN-2006-046	131.00	OKGE	Dewey 138kV	On-Line
GEN-2006-047	240.00	SPS	Tap Bushland - Deaf Smith (Buffalo) 230kV	On Suspension
GEN-2007-011	135.00	SUNCMKEC	Syracuse 115kV	On Suspension
GEN-2007-011N08	81.00	NPPD	Bloomfield 115kV	On-Line
GEN-2007-015	135.00	WERE	Tap Kelly(WERE) - S1399(OPPD) 161kV	On Schedule 2014
GEN-2007-021	201.00	OKGE	Tatonga 345kV	On Schedule for 2014
GEN-2007-025	300.00	WERE	Viola 345kV	On Schedule for 2012
GEN-2007-032	150.00	WFEC	Tap Clinton Junction - Clinton 138kV	On Schedule for 2013
GEN-2007-038	200.00	SUNCMKEC	Spearville 345kV	On Schedule for 2015
GEN-2007-040	200.00	SUNCMKEC	Buckner 345kV	On Schedule for 2012
GEN-2007-043	200.00	OKGE	Minco 345kV	On-Line
GEN-2007-044	300.00	OKGE	Tatonga 345kV	On Schedule for 2014
GEN-2007-046	199.50	SPS	Hitchland 115kV	On Schedule for 2014
GEN-2007-048	400.00	SPS	Tap Amarillo S - Swisher 230kV	On Schedule for 2014
GEN-2007-050	170.00	OKGE	Woodward EHV 138kV	On-Line at 150MW
GEN-2007-052	150.00	WFEC	Anadarko 138kV	On-Line
GEN-2007-057	34.50	SPS	Moore County East 115kV	On Schedule for 2014
GEN-2007-062	765.00	OKGE	Woodward EHV 345kV	On Schedule for 2014
GEN-2008-003	101.00	OKGE	Woodward EHV 138kV	On-Line
GEN-2008-008	60.00	SPS	Graham 69kV	On Suspension
GEN-2008-009	60.00	SPS	San Juan Tap 230kV	On Schedule for 2014
GEN-2008-013	300.00	OKGE	Tap Wichita - Woodring (Hunter) 345kV	On-Line
GEN-2008-017	300.00	SUNCMKEC	Setab 345kV	On Schedule for 2014
GEN-2008-018	405.00	SPS	Finney 345kV	On Schedule for 2012
GEN-2008-019	300.00	OKGE	Tatonga 345kV	On Schedule for 2015
GEN-2008-021	42.00	WERE	Wolf Creek 345kV	On-Line
GEN-2008-022	300.00	SPS	Tap Eddy Co - Tolk (Chaves County) 345kV	On Schedule for 2015
GEN-2008-023	150.00	AEPW	Hobart Junction 138kV	On Schedule for 2012
GEN-2008-025	101.00	SUNCMKEC	Ruleton 115kV	On SchedulE for 2015
GEN-2008-029	250.00	OKGE	Woodward EHV 138kV	On Schedule for 2014
GEN-2008-037	101.00	WFEC	Tap Washita - Blue Canyon Wind 138kV	On-Line

Request	Amount	Area	Requested/Proposed Point of Interconnection	Status or In-Service Date
GEN-2008-044	197.80	OKGE	Tatonga 345kV	On-Line
GEN-2008-046	200.00	OKGE	Sunnyside 345kV	On Suspension
GEN-2008-047	300.00	SPS	Tap Hitchland - Woodward Ckt 1 (Beaver County) 345kV	IA Pending
GEN-2008-051	322.00	SPS	Potter County 345kV	On Schedule for 2012
GEN-2008-071	76.80	OKGE	Newkirk 138kV	On Suspension
GEN-2008-079	98.90	SUNCMKEC	Tap Cudahy - Ft Dodge 115kV	On-Line
GEN-2008-086N02	200.00	NPPD	Tap Ft Randall - Columbus (Madison County) 230kV	On Schedule for 2014
GEN-2008-088	50.60	SPS	Vega 69kV	IA Pending
GEN-2008-092	201.00	MIDW	Knoll 230kV	IA Pending
GEN-2008-098	100.80	WERE	Tap Lacygne - Wolf Creek (Anderson County) 345kV	IA Pending
GEN-2008-119O	60.00	OPPD	S1399 161kV	On-Line
GEN-2008-123N	89.70	NPPD	Tap Guide Rock - Pauline 115kV	On Suspension
GEN-2008-124	200.00	SUNCMKEC	Spearville 345kV	On Schedule for 2014
GEN-2008-124T	42.00	SPS	TC-Keyes Texas County 69kV	IA Pending
GEN-2008-129	80.00	MIPU	Pleasant Hill 161kV	On-Line
GEN-2009-008	199.50	MIDW	South Hays 230kV	On Suspension
GEN-2009-016	100.80	AEPW	Falcon Road 138kV	On Suspension
GEN-2009-020	48.60	MIDW	Tap Nekoma - Bazine 69kV	On Suspension
GEN-2009-025	60.00	OKGE	Tap Deer Creek - Sinclair Blackwell 69kV	On Schedule for 2012
GEN-2009-040	73.80	WERE	Marshall 115kV	On Suspension
GEN-2009-067S	20.00	SPS	Seven Rivers 69kV	On Suspension
GEN-2009-073T	48.00	SPS	TC-Eva Texas County 69kV	IA Pending
GEN-2010-001	300.00	SPS	Tap Hitchland - Woodward Ckt 1 (Beaver County) 345kV	On Schedule for 2014 (204 MW) and 2015 (96 MW)
GEN-2010-003	100.80	WERE	Tap Lacygne - Wolf Creek (Anderson County) 345kV	IA Pending
GEN-2010-005	300.00	WERE	Viola 345kV	On Schedule for 2012
GEN-2010-006	205.00	SPS	Jones 230kV	On-Line
GEN-2010-009	165.60	SUNCMKEC	Buckner 345kV	On-Line
GEN-2010-011	30.00	OKGE	Tatonga 345kV	On Line
GEN-2010-014	358.80	SPS	Hitchland 345kV	On Schedule for 2016
GEN-2010-015	200.10	SUNCMKEC	Spearville 345kV	On Schedule for 2015
GEN-2010-020	20.00	SPS	Roswell 69kV	On Suspension
GEN-2010-029	450.00	SUNCMKEC	Spearville 345kV	IA Pending
GEN-2010-036	4.60	WERE	6th Street 115kV	On Schedule for 2012
GEN-2010-040	300.00	OKGE	Cimarron 345kV	On Schedule for 2012
GEN-2010-041	10.50	OPPD	S 1399 161kV	Facility Study
GEN-2010-044	99.00	NPPD	Harbine 115kV	IA Pending
GEN-2010-045	197.80	SUNCMKEC	Buckner 345kV	IA Pending
GEN-2010-046	56.00	SPS	TUCO Interchange 230kV	On Schedule for 2016
GEN-2010-048	70.00	MIDW	Tap Beach Station - Redline 115kV	IA Pending
GEN-2010-051	200.00	NPPD	Tap Twin Church - Hoskins 230kV	On Schedule for 2014
GEN-2010-055	4.50	AEPW	Wekiwa 138kV	On Schedule for 2013
GEN-2010-056	151.00	MIPU	Tap Saint Joseph - Cooper 345kV	On Schedule for 2015
GEN-2010-057	201.00	MIDW	Rice County 230kV	On-Line
GEN-2010-058	20.00	SPS	Chaves County 115kV	On Suspension
GEN-2010-061	180.00	MIDW	Tap Post Rock - Spearville (GEN-2011-017T) 345kV	Facility Study
GEN-2011-007	250.00	OKGE	Tap Cimarron - Woodring (Matthewson) 345kV	IA Pending
GEN-2011-008	600.00	SUNCMKEC	Clark County 345kV	Facility Study

Request	Amount	Area	Requested/Proposed Point of Interconnection	Status or In-Service Date
GEN-2011-010	100.80	OKGE	Minco 345kV	On Schedule for 2012
GEN-2011-011	50.00	KACP	Iatan 345kV	On-Line
GEN-2011-012	104.50	SPS	Tap Moore County - Hitchland 345kV	IA Pending
GEN-2011-014	201.00	SPS	Tap Hitchland - Woodward Ckt 1 (Beaver County) 345kV	IA Pending
GEN-2011-016	200.10	SUNCMKEC	Spearville 345kV	IA Pending
GEN-2011-017	299.00	SUNCMKEC	Tap Spearville - PostRock (GEN-2011-017T) 345kV	Facility Study
GEN-2011-018	73.60	NPPD	Steele City 115kV	On Schedule for 2013
GEN-2011-019	299.00	OKGE	Woodward 345kV	IA Pending
GEN-2011-020	299.00	OKGE	Woodward 345kV	IA Pending
GEN-2011-021	299.00	SPS	Beaver County 345kV	IA Pending
GEN-2011-022	299.00	SPS	Hitchland 345kV	IA Pending
GEN-2011-023	299.00	SUNCMKEC	Clark County 345kV	Facility Study
GEN-2011-024	299.00	OKGE	Tatonga 345kV	IA Pending
GEN-2011-025	82.30	SPS	Tap Floyd County - Crosby County 115kV	On Suspension
GEN-2011-027	120.00	NPPD	Hoskins 230kV	IA Pending
GEN-2011-037	7.00	WFEC	Blue Canyon 5 138kV	IA Pending
GEN-2011-040	111.00	OKGE	Tap Ratliff - Pooleville 138kV	On Schedule for 2013
GEN-2011-043	150.00	SUNCMKEC	Thistle 345kV	Facility Study
GEN-2011-044	150.00	SUNCMKEC	Thistle 345kV	Facility Study
GEN-2011-045	205.00	SPS	Jones 230kV	IA Pending
GEN-2011-046	27.00	SPS	Lopez 115kV	IA Pending
GEN-2011-048	175.00	SPS	Mustang 230kV	On Schedule for 2014
GEN-2011-049	250.00	OKGE	Border 345kV	IA Pending
GEN-2011-050	109.80	AEPW	Tap Rush Springs - Marlow 138kV	IA Pending
GEN-2011-051	104.40	OKGE	Tap Woodward - Tatonga 345kV	IA Pending
GEN-2011-054	300.00	OKGE	Cimarron 345kV	On Schedule for 2013 (200 MW) and 2014 (99 MW)
GEN-2011-055	52.80	OPPD	South Sterling 69kV	Facility Study
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	IA Pending
GEN-2012-001	61.20	SPS	Tap Grassland - Borden County 230kV	On-Line
GEN-2012-002	101.20	SUNCMKEC	Tap Pile - Scott City 115kV	Facility Study
GEN-2012-004	41.40	OKGE	Tap Ratliff - Pooleville 138kV	IA Pending
GEN-2012-007	120.00	SUNCMKEC	Rubart 115kV	Facility Study
GEN-2012-008	40.00	SPS	Mustang 115kV & Mustang 230kV	Facility Study
GEN-2012-009	15.00	SPS	Mustang 230kV	Facility Study
GEN-2012-010	15.00	SPS	Mustang 230kV	Facility Study
GEN-2012-011	200.00	SUNCMKEC	Tap Spearville - Post Rock 345kV (North of GEN-2011-017 Tap)	Facility Study
GEN-2012-015	25.00	SPS	Caprock 34.5kV	Under Study (DISIS-2012-002)
GEN-2012-016	312.00	WFEC	Tap Woodward - Thistle 345kV Ckt 1	Under Study (DISIS-2012-002)
GEN-2012-017	115.00	NPPD	Cooper 345kV	Under Study (DISIS-2012-002)
GEN-2012-018	200.00	NPPD	Tap Hoskins - Twin Church 230kV (GEN-2010-051T)	Under Study (DISIS-2012-002)
GEN-2012-020	477.12	SPS	TUCO 230kV	Under Study (DISIS-2012-002)
GEN-2012-021	4.80	LES	Terry Bundy Generating Station 115kV	Under Study (DISIS-2012-002)
GEN-2012-023	115.00	WERE	Viola 345kV	Under Study (DISIS-2012-002)

Request	Amount	Area	Requested/Proposed Point of Interconnection	Status or In-Service Date
GEN-2012-024	180.00	SUNCMKEC	Clark County 345kV	Under Study (DISIS-2012-002)
GEN-2012-026	100.00	MIDW	Colby 115kV	Under Study (DISIS-2012-002)
GEN-2012-027	150.70	AEPW	Shidler 138kV	Under Study (DISIS-2012-002)
GEN-2012-028	74.80	WFEC	Gotebo 69kV	Under Study (DISIS-2012-002)
GEN-2012-029	100.30	AEPW	Tap Little Elk - Hobart 138kV	Under Study (DISIS-2012-002)
GEN-2012-031	200.10	OKGE	Cimarron 345kV (GEN-2010-040 Sub)	Under Study (DISIS-2012-002)
GEN-2012-032	300.00	OKGE	Tap Rose Hill - Sooner 345kV	Under Study (DISIS-2012-002)
GEN-2012-033	98.82	OKGE	Tap and Tie South 4th - Bunch Creek & Enid Tap - Fairmont (GEN-2012-033T) 138kV	Under Study (DISIS-2012-002)
GEN-2012-034	7.00	SPS	Mustang 230kV	Under Study (DISIS-2012-002)
GEN-2012-035	7.00	SPS	Mustang 230kV	Under Study (DISIS-2012-002)
GEN-2012-036	7.00	SPS	Mustang 230kV	Under Study (DISIS-2012-002)
GEN-2012-037	203.00	SPS	TUCO 345kV	Under Study (DISIS-2012-002)
GEN-2012-038	203.00	SPS	Tap Border - TUCO 345kV	Under Study (DISIS-2012-002)
GEN-2012-040	76.50	OKGE	Chilocco 138kV	Under Study (DISIS-2012-002)
GEN-2012-041	121.50	OKGE	Tap Rose Hill - Sooner 345kV	Under Study (DISIS-2012-002)
GEN-2012-042	220.00	SUNCMKEC	Spearville 345kV	Under Study (DISIS-2012-002)
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 (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)	10.80	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	Ocotillo 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
Total:	**30,256.9**			

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	102.00	OKGE	FPL Moreland Tap 138kV
GEN-2005-005	18.00	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-2008-019	300.00	OKGE	Tatonga 345kV
GEN-2008-029	250.00	OKGE	Woodward EHV 138kV
GEN-2008-044	197.80	OKGE	Tatonga 345kV
GEN-2010-011	30.00	OKGE	Tatonga 345kV
GEN-2010-040	300.00	OKGE	Cimarron 345kV
GEN-2011-007	250.00	OKGE	Tap Cimarron - Woodring (Matthewson) 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-2011-024	299.00	OKGE	Tatonga 345kV
GEN-2011-051	104.40	OKGE	Tap Woodward - Tatonga 345kV
GEN-2011-054	300.00	OKGE	Cimarron 345kV
GEN-2012-016	312.00	WFEC	Tap Woodward - Thistle 345kV Ckt 1
GEN-2012-031	200.10	OKGE	Cimarron 345kV (GEN-2010-040 Sub)
PRIOR QUEUED SUBTOTAL	**5,465.90**		
AREA TOTAL	**5,465.90**		

GROUP 2: HITCHLAND AREA			
Request	**Capacity**	**Area**	**Proposed Point of Interconnection**
ASGI-2011-002	10.00	SPS	Herring 115kV
GEN-2002-008	240.00	SPS	Hitchland 345kV
GEN-2002-009	80.00	SPS	Hansford 115kV
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	199.50	SPS	Hitchland 115kV
GEN-2007-057	34.50	SPS	Moore County East 115kV
GEN-2008-047	300.00	SPS	Tap Hitchland - Woodward Ckt 1 (Beaver County) 345kV
GEN-2008-124T	42.00	SPS	TC-Keyes Texas County 69kV
GEN-2009-073T	48.00	SPS	TC-Eva Texas County 69kV
GEN-2010-001	300.00	SPS	Tap Hitchland - Woodward Ckt 1 (Beaver County) 345kV
GEN-2010-014	358.80	SPS	Hitchland 345kV
GEN-2011-012	104.50	SPS	Tap Moore County - Hitchland 345kV
GEN-2011-014	201.00	SPS	Tap Hitchland - Woodward Ckt 1 (Beaver County) 345kV
GEN-2011-021	299.00	SPS	Beaver County 345kV
GEN-2011-022	299.00	SPS	Hitchland 345kV
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	**3,180.20**		
AREA TOTAL	**3,180.20**		

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	Tap Greensburg - Ft Dodge (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	Spearville 345kV
GEN-2006-006	205.50	SUNCMKEC	Spearville 345kV
GEN-2006-021	101.00	SUNCMKEC	Flat Ridge Tap 138kV
GEN-2006-022	150.00	SUNCMKEC	Ninnescah 115kV
GEN-2007-038	200.00	SUNCMKEC	Spearville 345kV
GEN-2007-040	200.00	SUNCMKEC	Buckner 345kV
GEN-2008-018	405.00	SPS	Finney 345kV
GEN-2008-079	98.90	SUNCMKEC	Tap Cudahy - Ft Dodge 115kV
GEN-2008-124	200.00	SUNCMKEC	Spearville 345kV
GEN-2010-009	165.60	SUNCMKEC	Buckner 345kV
GEN-2010-015	200.10	SUNCMKEC	Spearville 345kV
GEN-2010-029	450.00	SUNCMKEC	Spearville 345kV
GEN-2010-045	197.80	SUNCMKEC	Buckner 345kV
GEN-2010-061	180.00	MIDW	Tap Post Rock - Spearville (GEN-2011-017T) 345kV
GEN-2011-008	600.00	SUNCMKEC	Clark County 345kV
GEN-2011-016	200.10	SUNCMKEC	Spearville 345kV
GEN-2011-017	299.00	SUNCMKEC	Tap Spearville - PostRock (GEN-2011-017T) 345kV
GEN-2011-023	299.00	SUNCMKEC	Clark County 345kV
GEN-2011-043	150.00	SUNCMKEC	Thistle 345kV
GEN-2011-044	150.00	SUNCMKEC	Thistle 345kV
GEN-2012-007	120.00	SUNCMKEC	Rubart 115kV
GEN-2012-011	200.00	SUNCMKEC	Tap Spearville - Post Rock 345kV (North of GEN-2011-017 Tap)
GEN-2012-024	180.00	SUNCMKEC	Clark County 345kV
GEN-2012-042	220.00	SUNCMKEC	Spearville 345kV
Gray County Wind (Montezuma)	110.00	SUNCMKEC	Gray County Tap 115kV
PRIOR QUEUED SUBTOTAL	**5,964.00**		
AREA TOTAL	**5,964.00**		

GROUP 4: NW KANSAS AREA

Request	Capacity	Area	Proposed Point of Interconnection
GEN-2001-039M	99.00	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-2006-032	200.00	MIDW	South Hays 230kV
GEN-2006-040	108.00	SUNCMKEC	Mingo 115kV
GEN-2007-011	135.00	SUNCMKEC	Syracuse 115kV
GEN-2008-017	300.00	SUNCMKEC	Setab 345kV
GEN-2008-025	101.00	SUNCMKEC	Ruleton 115kV
GEN-2008-092	201.00	MIDW	Knoll 230kV
GEN-2009-008	199.50	MIDW	South Hays 230kV
GEN-2009-020	48.60	MIDW	Tap Nekoma - Bazine 69kV
GEN-2010-048	70.00	MIDW	Tap Beach Station - Redline 115kV
GEN-2010-057	201.00	MIDW	Rice County 230kV
GEN-2012-002	101.20	SUNCMKEC	Tap Pile - Scott City 115kV
GEN-2012-026	100.00	MIDW	Colby 115kV
PRIOR QUEUED SUBTOTAL	**2,389.30**		
AREA TOTAL	**2,389.30**		

GROUP 5: AMARILLO AREA

Request	Capacity	Area	Proposed Point of Interconnection
GEN-2002-022	240.00	SPS	Bushland 230kV
GEN-2006-045	240.00	SPS	Tap Potter - Plant X 230kV (South Randle County) 230kV
GEN-2006-047	240.00	SPS	Tap Bushland - Deaf Smith (Buffalo) 230kV
GEN-2007-048	400.00	SPS	Tap Amarillo S - Swisher 230kV
GEN-2008-051	322.00	SPS	Potter County 345kV
GEN-2008-088	50.60	SPS	Vega 69kV
Llano Estacado (White Deer)	80.00	SPS	Llano Wind 115kV
PRIOR QUEUED SUBTOTAL	**1,572.60**		
AREA TOTAL	**1,572.60**		

GROUP 6: S-TX PANHANDLE/NW 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	28.80	SPS	Lovington 115kV
ASGI-2011-003	10.00	SPS	Hendricks 115kV
ASGI-2011-004	20.00	SPS	Pleasant Hill 69kV
ASGI-2012-002	18.15	SPS	FE-Clovis Interchange 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	604.00	SPS	Hobbs 230kV & Hobbs 115kV
GEN-2008-008	60.00	SPS	Graham 69kV
GEN-2008-009	60.00	SPS	San Juan Tap 230kV
GEN-2008-022	300.00	SPS	Tap Eddy Co - Tolk (Chaves County) 345kV
GEN-2009-067S	20.00	SPS	Seven Rivers 69kV
GEN-2010-006	205.00	SPS	Jones 230kV
GEN-2010-020	20.00	SPS	Roswell 69kV
GEN-2010-046	56.00	SPS	TUCO Interchange 230kV
GEN-2010-058	20.00	SPS	Chaves County 115kV
GEN-2011-025	82.30	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	Tap Grassland - Borden County 230kV
GEN-2012-008	40.00	SPS	Mustang 115kV & Mustang 230kV
GEN-2012-009	15.00	SPS	Mustang 230kV
GEN-2012-010	15.00	SPS	Mustang 230kV
GEN-2012-015	25.00	SPS	Caprock 34.5kV
GEN-2012-020	477.12	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-2012-038	203.00	SPS	Tap Border - TUCO 345kV
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	Ocotillo 115kV
PRIOR QUEUED SUBTOTAL	**3,538.77**		
AREA TOTAL	**3,538.8**		

GROUP 7: SW OKLAHOMA AREA

Request	Capacity	Area	Proposed Point of Interconnection
GEN-2001-026	74.00	WFEC	Washita 138kV
GEN-2002-005	120.00	WFEC	Red Hills Tap 138kV
GEN-2003-004 GEN-2004-023 GEN-2005-003	151.20	WFEC	Washita 138kV
GEN-2003-005	100.00	WFEC	Anadarko - Paradise (Blue Canyon) 138kV
GEN-2003-022	120.00	AEPW	Washita 138kV
GEN-2004-020	27.00	AEPW	Washita 34.5kV
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-2007-032	150.00	WFEC	Tap Clinton Junction - Clinton 138kV
GEN-2007-052	150.00	WFEC	Anadarko 138kV
GEN-2008-023	150.00	AEPW	Hobart Junction 138kV
GEN-2008-037	101.00	WFEC	Tap Washita - Blue Canyon Wind 138kV
GEN-2009-016	100.80	AEPW	Falcon Road 138kV
GEN-2011-037	7.00	WFEC	Blue Canyon 5 138kV
GEN-2011-049	250.00	OKGE	Border 345kV
GEN-2012-028	74.80	WFEC	Gotebo 69kV
GEN-2012-029	100.30	AEPW	Tap Little Elk - Hobart 138kV
PRIOR QUEUED SUBTOTAL	**2,101.10**		
AREA TOTAL	**2,101.10**		

GROUP 8: N-OK/S-KS AREA

Request	Capacity	Area	Proposed Point of Interconnection
ASGI-2010-006	150.00	AECI	Tap Fairfax (AECI) - Shilder (AEPW) 138kV
GEN-2002-004	200.00	WERE	Latham 345kV
GEN-2005-013	201.00	WERE	Tap Latham - Neosho (Caney River) 345kV
GEN-2007-025	300.00	WERE	Viola 345kV
GEN-2008-013	300.00	OKGE	Tap Wichita - Woodring (Hunter) 345kV
GEN-2008-021	42.00	WERE	Wolf Creek 345kV
GEN-2008-071	76.80	OKGE	Newkirk 138kV
GEN-2008-098	100.80	WERE	Tap Lacygne - Wolf Creek (Anderson County) 345kV
GEN-2009-025	60.00	OKGE	Tap Deer Creek - Sinclair Blackwell 69kV
GEN-2010-003	100.80	WERE	Tap Lacygne - Wolf Creek (Anderson County) 345kV
GEN-2010-005	300.00	WERE	Viola 345kV
GEN-2010-055	4.50	AEPW	Wekiwa 138kV
GEN-2011-057	150.40	WERE	Creswell 138kV
GEN-2012-023	115.00	WERE	Viola 345kV
GEN-2012-027	150.70	AEPW	Shidler 138kV
GEN-2012-032	300.00	OKGE	Tap Rose Hill - Sooner 345kV
GEN-2012-033	98.82	OKGE	Tap and Tie South 4th - Bunch Creek & Enid Tap - Fairmont (GEN-2012-033T) 138kV
GEN-2012-040	76.50	OKGE	Chilocco 138kV
GEN-2012-041	121.50	OKGE	Tap Rose Hill - Sooner 345kV
PRIOR QUEUED SUBTOTAL	**2,848.82**		
AREA TOTAL	**2,848.8**		

GROUP 9/10: 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-2004-005N	30.00	NPPD	St Francis 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	OPPD	North Petersburg 115kV
GEN-2007-011N08	81.00	NPPD	Bloomfield 115kV
GEN-2007-015	135.00	WERE	Tap Kelly(WERE) - S1399(OPPD) 161kV
GEN-2008-086N02	200.00	NPPD	Tap Ft Randall - Columbus (Madison County) 230kV
GEN-2008-119O	60.00	OPPD	S1399 161kV
GEN-2008-123N	89.70	NPPD	Tap Guide Rock - Pauline 115kV
GEN-2009-040	73.80	WERE	Marshall 115kV
GEN-2010-041	10.50	OPPD	S 1399 161kV
GEN-2010-044	99.00	NPPD	Harbine 115kV
GEN-2010-051	200.00	NPPD	Tap Twin Church - Hoskins 230kV
GEN-2011-018	73.60	NPPD	Steele City 115kV
GEN-2011-027	120.00	NPPD	Hoskins 230kV
GEN-2011-055	52.80	OPPD	South Sterling 69kV
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-2012-017	115.00	NPPD	Cooper 345kV
GEN-2012-018	200.00	NPPD	Tap Hoskins - Twin Church 230kV (GEN-2010-051T)
GEN-2012-021	4.80	LES	Terry Bundy Generating Station 115kV
NPPD Distributed (Broken Bow)	8.30	NPPD	Broken Bow 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)	10.80	NPPD	Ord 115kV
NPPD Distributed (Stuart)	2.10	NPPD	Ainsworth 115kV
PRIOR QUEUED SUBTOTAL	**2,148.40**		
GEN-2012-005	81.00	NPPD	Tap Ft Randall - Columbus (Madison County) 230kV
CURRENT CLUSTER SUBTOTAL	**81.00**		
AREA TOTAL	**2,229.4**		

GROUP 12: NW AR AREA

Request	Capacity	Area	Proposed Point of Interconnection
AREA TOTAL	**0.00**		

GROUP 13: NW MISSOURI AREA

Request	Capacity	Area	Proposed Point of Interconnection
GEN-2006-014	300.00	MIPU	Tap Maryville - Midway (Nodway Co) 161kV
GEN-2008-129	80.00	MIPU	Pleasant Hill 161kV
GEN-2010-036	4.60	WERE	6th Street 115kV
GEN-2010-056	151.00	MIPU	Tap Saint Joseph - Cooper 345kV
GEN-2011-011	50.00	KACP	Iatan 345kV
PRIOR QUEUED SUBTOTAL	**585.60**		
AREA TOTAL	**585.60**		

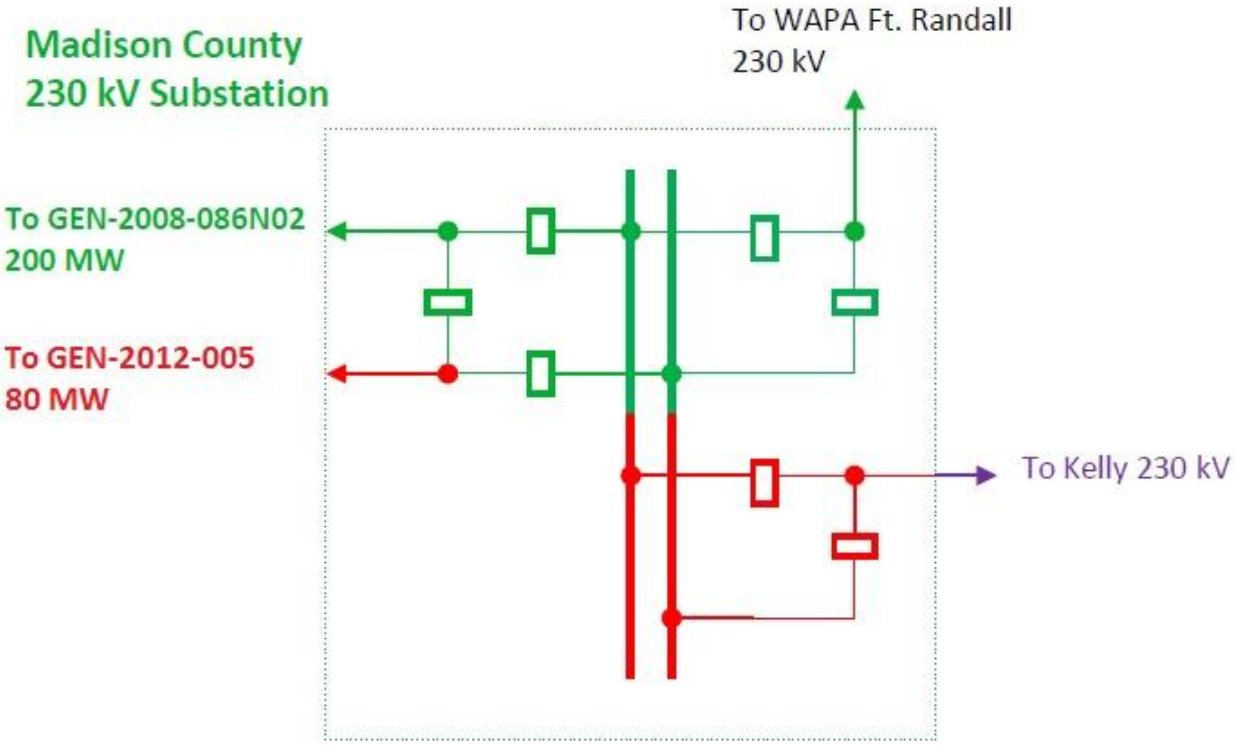
GROUP 14: S OKLAHOMA AREA

Request	Capacity	Area	Proposed Point of Interconnection
GEN-2008-046	200.00	OKGE	Sunnyside 345kV
GEN-2011-040	111.00	OKGE	Tap Ratliff - Pooleville 138kV
GEN-2011-050	109.80	AEPW	Tap Rush Springs - Marlow 138kV
GEN-2012-004	41.40	OKGE	Tap Ratliff - Pooleville 138kV
PRIOR QUEUED SUBTOTAL	**462.20**		
AREA TOTAL	**462.20**		

CLUSTER TOTAL (CURRENT STUDY)	**81.0**	**MW**
PQ TOTAL (PRIOR QUEUED)	**30,256.9**	**MW**
CLUSTER TOTAL (INCLUDING PRIOR QUEUED)	**30,337.9**	**MW**

D: Proposed Point of Interconnection One line Diagrams

GEN-2012-005



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 a Interconnection Request choose to go into service prior to the operation date of any necessary Network Upgrades, the costs associated with those upgrades may be reallocated to the impacted Interconnection Request. The actual costs allocated to each Generation Interconnection Request Customer will be determined at the time of a restudy.

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

Appendix E. Cost Allocation Per Request

(Including Previously Allocated Network Upgrades*)

Interconnection Request and Upgrades	Upgrade Type	Allocated Cost	Upgrade Cost
GEN-2012-005			
GEN-2012-005 Interconnection Costs See Oneline Diagram.	Current Study	$2,100,000.00	$2,100,000.00
Madison Co - Kelly 230kV CKT 1 Upgrade conductor clearance to 100°C for 478MVA rating	Current Study	$3,600,000.00	$3,600,000.00
Twin Church - Dixon County 230kV Increase conductor clearances to accommodate 320MVA facility rating	Previously Allocated		$100,000.00
	Current Study Total	$5,700,000.00	
	TOTAL CURRENT STUDY COSTS:	**$5,700,000.00**	

* 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 Per Request

Interconnection Request and Upgrades	Upgrade Type	Allocated Cost	Upgrade Cost
GEN-2012-005			
GEN-2012-005 Interconnection Costs See Oneline Diagram.	Current Study	$2,100,000.00	$2,100,000.00
Madison Co - Kelly 230kV CKT 1 Upgrade conductor clearance to 100°C for 478MVA rating	Current Study	$3,600,000.00	$3,600,000.00
	Current Study Total	$5,700,000.00	
	TOTAL CURRENT STUDY COSTS:	**$5,700,000.00**	

G: Power Flow Analysis (Constraints Used For Mitigation)

See next page.

Solution	Group	Scenario	Season	Source	Direction	Monitored Element Name	Rate B (MVA)	TDF	TC%LOADING (MVA)	Contingency Name
FDNS	00G12_005	0	13SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.78407	103.7465	'DAK02WAPAB2'
FDNS	00G12_005	0	13SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.78375	103.7714	'FT RANDAL - UTICA JCT 230KV CKT 1'
FDNS	00G12_005	0	13SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.78137	100.5326	'FT RANDAL - SIOUX CITY 230KV CKT 1'
FDNS	00G12_005	0	13SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.77669	100.706	'FT THOMPSON - GRAND ISLAND 345KV CKT 1'
FDNS	00G12_005	0	18SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.78283	100.9928	'FT RANDAL - UTICA JCT 230KV CKT 1'
FDNS	00G12_005	0	18SP	G12_005	'TO->FROM'	KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.78313	100.9279	'DAK02WAPAB2'
FDNS	00G12_005	0	23SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.77841	105.1482	'DAK02WAPAB2'
FDNS	00G12_005	0	23SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.7704	100.3792	'NEB001NPPB2'
FDNS	00G12_005	0	23SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.7704	100.108	'ONEILL - SPENCER 115KV CKT 1'
FDNS	00G12_005	0	23SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.76958	100.9199	'GRAND ISLAND - HOLT.CO3 345.00 345KV CKT 1'
FDNS	00G12_005	0	23SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.77822	105.1545	'FT RANDAL - UTICA JCT 230KV CKT 1'
FDNS	00G12_005	0	23SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.77556	101.8237	'FT RANDAL - SIOUX CITY 230KV CKT 1'
FDNS	00G12_005	0	23SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.7704	100.3466	'FT RANDAL - SPENCER 115KV CKT 1'
FDNS	00G12_005	0	23SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.76957	100.0778	'FT THOMPSON - HOLT.CO3 345.00 345KV CKT 1'
FDNS	00G12_005	0	23SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.7704	100.3792	'LN-WAPA6'
FNSL-Blown up	0	0	18WP	G12_005		Non-Converged Contingency	0	0.03073	9999	'IWA001WAPAB2'
FNSL-Blown up	0	0	18WP	G12_005		Non-Converged Contingency	0	0.03073	9999	'ALTW-B111-SW'

H: Power Flow Analysis (Other Constraints Not Requiring Mitigation)

See next page.

Solution	Group	Scenario	Season	Source	Direction	Monitored Element Name	Rate B (MVA)	TDF	TC%LOADING (MVA)	Contingency Name
FDNS	00G12_005	0	13SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.78407	103.7465	'DAK02WAPAB2'
FDNS	00G12_005	0	13SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.78375	103.7714	'FT RANDAL - UTICA JCT 230KV CKT 1'
FDNS	00G12_005	0	13SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.78137	100.5326	'FT RANDAL - SIOUX CITY 230KV CKT 1'
FDNS	00G12_005	0	13SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.77669	100.706	'FT THOMPSON - GRAND ISLAND 345KV CKT 1'
FDNS	00G12_005	0	18SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.78283	100.9928	'FT RANDAL - UTICA JCT 230KV CKT 1'
FDNS	00G12_005	0	18SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.78313	100.9279	'DAK02WAPAB2'
FDNS	00G12_005	0	23SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.77841	105.1482	'DAK02WAPAB2'
FDNS	00G12_005	0	23SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.7704	100.3792	'NEB001NPPB2'
FDNS	00G12_005	0	23SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.7704	100.108	'ONEILL - SPENCER 115KV CKT 1'
FDNS	00G12_005	0	23SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.76958	100.9199	'GRAND ISLAND - HOLT.CO3 345.00 345KV CKT 1'
FDNS	00G12_005	0	23SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.77822	105.1545	'FT RANDAL - UTICA JCT 230KV CKT 1'
FDNS	00G12_005	0	23SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.77556	101.8237	'FT RANDAL - SIOUX CITY 230KV CKT 1'
FDNS	00G12_005	0	23SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.7704	100.3466	'FT RANDAL - SPENCER 115KV CKT 1'
FDNS	00G12_005	0	23SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.76957	100.0778	'FT THOMPSON - HOLT.CO3 345.00 345KV CKT 1'
FDNS	00G12_005	0	23SP	G12_005	'TO->FROM'	'KELLY - MADISONCO 230.00 230KV CKT 1'	320	0.7704	100.3792	'LN-WAPA6'
FNSL-Blown up	0	0	18WP	G12_005		Non-Converged Contingency	0	0.03073	9999	'IWA001WAPAB2'
FNSL-Blown up	0	0	18WP	G12_005		Non-Converged Contingency	0	0.03073	9999	'ALTW-B111-SW'

I: Power Flow Analysis (Constraints from Category C Contingencies)

Available upon request

Solution	Group	Scenario	Season	Source	Direction	Monitored Element Name	Rate B (MVA)	TDF	TC%LOADING (MVA)	Contingency Name
FDNS	00G12_005	2CatCD	13SP	G12_005	'TO->FROM'	'COLUMBUS - KELLY 115KV CKT 1'	167	0.33474	116.9497	'COLUMEAST - KELLY 230KV CKT 1 &KELLY - SHELL CREEK 230KV CKT 1'
FDNS	00G12_005	2CatCD	13SP	G12_005	'FROM->TO'	'KELLY (KELLY T1) 230/115/13.2KV TRANSFORMER CKT 1'	167	0.33474	120.1708	'COLUMEAST - KELLY 230KV CKT 1 &KELLY - SHELL CREEK 230KV CKT 1'
FDNS	00G12_005	2CatCD	13SP	G12_005	'FROM->TO'	'KELLY (KELLY T1) 230/115/13.2KV TRANSFORMER CKT 1'	167	0.33474	120.9181	'COLUMEAST - KELLY 230KV CKT 1 &KELLY - SHELL CREEK 230KV CKT 1'
FNSL	00G12_005	2CatCD	13SP	G12_005	'TO->FROM'	'GLADSTONE - SHOAL CREEK 161KV CKT 1'	224	0.03269	103.3865	'KCPL-C2'
FNSL	00G12_005	2CatCD	13SP	G12_005	'FROM->TO'	'NASHUA (NASH 11) 345/161/13.8KV TRANSFORMER CKT 11'	660	0.08373	115.8885	'KCPL-C2'
FNSL	00G12_005	2CatCD	13SP	G12_005	'FROM->TO'	'NASHUA (NASH 11) 345/161/13.8KV TRANSFORMER CKT 11'	660	0.08373	114.0528	'KCPL-C2'
FNSL	00G12_005	2CatCD	13SP	G12_005	'TO->FROM'	'GLADSTONE - SHOAL CREEK 161KV CKT 1'	224	0.03269	102.7059	'KCPLB-6'
FNSL	00G12_005	2CatCD	13SP	G12_005	'FROM->TO'	'NASHUA (NASH 11) 345/161/13.8KV TRANSFORMER CKT 11'	660	0.08373	115.1431	'KCPLB-6'
FNSL	00G12_005	2CatCD	13SP	G12_005	'FROM->TO'	'NASHUA (NASH 11) 345/161/13.8KV TRANSFORMER CKT 11'	660	0.08373	113.3195	'KCPLB-6'
FDNS	00G12_005	2CatCD	13WP	G12_005	'TO->FROM'	'COLUMBUS - KELLY 115KV CKT 1'	167	0.33496	111.8542	'COLUMEAST - KELLY 230KV CKT 1 &KELLY - SHELL CREEK 230KV CKT 1'
FDNS	00G12_005	2CatCD	13WP	G12_005	'FROM->TO'	'KELLY (KELLY T1) 230/115/13.2KV TRANSFORMER CKT 1'	167	0.33496	115.6897	'COLUMEAST - KELLY 230KV CKT 1 &KELLY - SHELL CREEK 230KV CKT 1'
FDNS	00G12_005	2CatCD	13WP	G12_005	'FROM->TO'	'KELLY (KELLY T1) 230/115/13.2KV TRANSFORMER CKT 1'	167	0.33496	115.4093	'COLUMEAST - KELLY 230KV CKT 1 &KELLY - SHELL CREEK 230KV CKT 1'
FNSL-Blown up	00G12_005	2CatCD	13WP	G12_005		Non-Converged Contingency	0	0.0363	9999	'KNOLL 230 - SMOKYHL6 230.00 230KV CKT 1 &SMOKYHL6 230.00 - SUMMIT 230KV CKT 1'
FDNS	00G12_005	2CatCD	18SP	G12_005	'TO->FROM'	'COLUMBUS - KELLY 115KV CKT 1'	167	0.33537	116.2438	'COLUMEAST - KELLY 230KV CKT 1 &KELLY - SHELL CREEK 230KV CKT 1'
FDNS	00G12_005	2CatCD	18SP	G12_005	'FROM->TO'	'KELLY (KELLY T1) 230/115/13.2KV TRANSFORMER CKT 1'	167	0.33537	119.4272	'COLUMEAST - KELLY 230KV CKT 1 &KELLY - SHELL CREEK 230KV CKT 1'
FDNS	00G12_005	2CatCD	18SP	G12_005	'FROM->TO'	'KELLY (KELLY T1) 230/115/13.2KV TRANSFORMER CKT 1'	167	0.33537	120.0387	'COLUMEAST - KELLY 230KV CKT 1 &KELLY - SHELL CREEK 230KV CKT 1'
FDNS	00G12_005	2CatCD	18SP	G12_005	'FROM->TO'	'NASHUA (NASH 11) 345/161/13.8KV TRANSFORMER CKT 11'	660	0.06219	109.0237	'KCPL-C2'
FDNS	00G12_005	2CatCD	18SP	G12_005	'FROM->TO'	'NASHUA (NASH 11) 345/161/13.8KV TRANSFORMER CKT 11'	660	0.06219	107.2806	'KCPL-C2'
FDNS	00G12_005	2CatCD	18SP	G12_005	'FROM->TO'	'NASHUA (NASH 11) 345/161/13.8KV TRANSFORMER CKT 11'	660	0.06219	108.3107	'KCPLB-6'
FDNS	00G12_005	2CatCD	18SP	G12_005	'FROM->TO'	'NASHUA (NASH 11) 345/161/13.8KV TRANSFORMER CKT 11'	660	0.06219	106.5784	'KCPLB-6'
FDNS	00G12_005	2CatCD	18WP	G12_005	'TO->FROM'	'COLUMBUS - KELLY 115KV CKT 1'	167	0.33563	111.7491	'COLUMEAST - KELLY 230KV CKT 1 &KELLY - SHELL CREEK 230KV CKT 1'
FDNS	00G12_005	2CatCD	18WP	G12_005	'FROM->TO'	'KELLY (KELLY T1) 230/115/13.2KV TRANSFORMER CKT 1'	167	0.33563	115.0099	'COLUMEAST - KELLY 230KV CKT 1 &KELLY - SHELL CREEK 230KV CKT 1'
FDNS	00G12_005	2CatCD	18WP	G12_005	'FROM->TO'	'KELLY (KELLY T1) 230/115/13.2KV TRANSFORMER CKT 1'	167	0.33563	115.586	'COLUMEAST - KELLY 230KV CKT 1 &KELLY - SHELL CREEK 230KV CKT 1'
FDNS	00G12_005	2CatCD	23SP	G12_005	'TO->FROM'	'COLUMBUS - KELLY 115KV CKT 1'	167	0.33525	117.2603	'COLUMEAST - KELLY 230KV CKT 1 &KELLY - SHELL CREEK 230KV CKT 1'
FDNS	00G12_005	2CatCD	23SP	G12_005	'FROM->TO'	'KELLY (KELLY T1) 230/115/13.2KV TRANSFORMER CKT 1'	167	0.33525	120.1513	'COLUMEAST - KELLY 230KV CKT 1 &KELLY - SHELL CREEK 230KV CKT 1'
FDNS	00G12_005	2CatCD	23SP	G12_005	'FROM->TO'	'KELLY (KELLY T1) 230/115/13.2KV TRANSFORMER CKT 1'	167	0.33525	121.01	'COLUMEAST - KELLY 230KV CKT 1 &KELLY - SHELL CREEK 230KV CKT 1'
FDNS	00G12_005	2CatCD	23SP	G12_005	'FROM->TO'	'NASHUA (NASH 11) 345/161/13.8KV TRANSFORMER CKT 11'	660	0.05832	107.8471	'KCPL-C2'
FDNS	00G12_005	2CatCD	23SP	G12_005	'FROM->TO'	'NASHUA (NASH 11) 345/161/13.8KV TRANSFORMER CKT 11'	660	0.05832	106.0989	'KCPL-C2'
FDNS	00G12_005	2CatCD	23SP	G12_005	'FROM->TO'	'NASHUA (NASH 11) 345/161/13.8KV TRANSFORMER CKT 11'	660	0.05832	107.1353	'KCPLB-6'
FDNS	00G12_005	2CatCD	23SP	G12_005	'FROM->TO'	'NASHUA (NASH 11) 345/161/13.8KV TRANSFORMER CKT 11'	660	0.05832	105.3974	'KCPLB-6'
FNSL-Blown up	00G12_005	2CatCD	23SP	G12_005		Non-Converged Contingency	0	0.17025	9999	'KCPL-C3'
FDNS	0	2CatCD	13SP	G12_005	'FROM->TO'	'NASHUA (NASH 11) 345/161/13.8KV TRANSFORMER CKT 11'	660	0.0838	112.3957	'KCPL-C2'
FDNS	0	2CatCD	13SP	G12_005	'FROM->TO'	'NASHUA (NASH 11) 345/161/13.8KV TRANSFORMER CKT 11'	660	0.0838	110.5982	'KCPL-C2'
FDNS	0	2CatCD	13SP	G12_005	'FROM->TO'	'NASHUA (NASH 11) 345/161/13.8KV TRANSFORMER CKT 11'	660	0.0838	111.6488	'KCPLB-6'
FDNS	0	2CatCD	13SP	G12_005	'FROM->TO'	'NASHUA (NASH 11) 345/161/13.8KV TRANSFORMER CKT 11'	660	0.0838	109.8647	'KCPLB-6'
FNSL-Blown up	0	2CatCD	13WP	G12_005		Non-Converged Contingency	0	0.03636	9999	'KNOLL 230 - SMOKYHL6 230.00 230KV CKT 1 &SMOKYHL6 230.00 - SUMMIT 230KV CKT 1'
FDNS	0	2CatCD	18SP	G12_005	'FROM->TO'	'NASHUA (NASH 11) 345/161/13.8KV TRANSFORMER CKT 11'	660	0.06226	106.3415	'KCPL-C2'
FDNS	0	2CatCD	18SP	G12_005	'FROM->TO'	'NASHUA (NASH 11) 345/161/13.8KV TRANSFORMER CKT 11'	660	0.06226	104.6362	'KCPL-C2'
FDNS	0	2CatCD	18SP	G12_005	'FROM->TO'	'NASHUA (NASH 11) 345/161/13.8KV TRANSFORMER CKT 11'	660	0.06226	105.6306	'KCPLB-6'
FDNS	0	2CatCD	18SP	G12_005	'FROM->TO'	'NASHUA (NASH 11) 345/161/13.8KV TRANSFORMER CKT 11'	660	0.06226	103.9359	'KCPLB-6'
FDNS	0	2CatCD	23SP	G12_005	'FROM->TO'	'NASHUA (NASH 11) 345/161/13.8KV TRANSFORMER CKT 11'	660	0.05838	105.4353	'KCPL-C2'
FDNS	0	2CatCD	23SP	G12_005	'FROM->TO'	'NASHUA (NASH 11) 345/161/13.8KV TRANSFORMER CKT 11'	660	0.05838	103.7216	'KCPL-C2'
FDNS	0	2CatCD	23SP	G12_005	'FROM->TO'	'NASHUA (NASH 11) 345/161/13.8KV TRANSFORMER CKT 11'	660	0.05838	104.7232	'KCPLB-6'
FDNS	0	2CatCD	23SP	G12_005	'FROM->TO'	'NASHUA (NASH 11) 345/161/13.8KV TRANSFORMER CKT 11'	660	0.05838	103.0197	'KCPLB-6'
FNSL-Blown up	0	2CatCD	23SP	G12_005		Non-Converged Contingency	0	0.04717	9999	'MIDW-CATD02B'
FDNS	09G12_005	2CatCD	13G	G12_005	'FROM->TO'	'KELLY (KELLY T1) 230/115/13.2KV TRANSFORMER CKT 1'	167	0.33527	101.164	'COLUMEAST - KELLY 230KV CKT 1 &KELLY - SHELL CREEK 230KV CKT 1'
FNSL-Blown up	09G12_005	2CatCD	13G	G12_005		Non-Converged Contingency	0	0.03905	9999	'KNOLL 230 - SMOKYHL6 230.00 230KV CKT 1 &SMOKYHL6 230.00 - SUMMIT 230KV CKT 1'
FNSL-Blown up	09G12_005	2CatCD	13G	G12_005		Non-Converged Contingency	0	0.04803	9999	'MIDW-CATD02B'
FNSL-Blown up	9	2CatCD	13G	G12_005		Non-Converged Contingency	0	0.04803	9999	'MIDW-CATD02B'

J: Group 9 Dynamic Stability Analysis Report

See Stability Report on next page.

SPP Southwest Power Pool

Preliminary Interconnection System Impact Study

PISIS-2012-002
(Group 9: Nebraska Area)

SPP Generation
Interconnection Studies

(PISIS-2012-002)

February 2013

Executive Summary

As part of the Preliminary Interconnection System Impact Study (PISIS), a transient stability study has been performed by Southwest Power Pool (SPP) to evaluate the dynamic stability of adding the interconnection request GEN-2012-005 (81.0MW/Wind) in the Nebraska Public Power District (NPPD) area.

GEN-2012-005 consists of fifty (50) General Electric (G.E.) 1.62 MW wind turbines interconnecting at Madison County 230kV substation, which is a tap on Fort Randall – Columbus 230kV line. Fort Randall substation is located in the Western Area Power Administration (WAPA) area and the Columbus substation is located in the Nebraska Public Power District (NPPD) area. As of the posting of this study, there are currently twenty-six (26) prior queued interconnection requests in the Nebraska Grouping (Group 9). GEN-2012-005 is the only current study request in the PISIS-2012-002.

The results of a stability analysis determined that with all assigned and previously assigned network upgrades in service, the interconnection of the PISIS-2012-002 interconnection request can be interconnected while, the transmission system was found to remain stable for both summer and winter peak conditions. Additionally, the wind farm project is found to stay connected during the contingencies that were studied, meeting the Low Voltage Ride Through (LVRT) requirements of FERC Order #661A.

Category C faults in the Nebraska Grouping (Group 9) area were also studied in addition to the study faults for the PISIS-2012-002 request.

The results of the power factor analysis show that the interconnection request is to maintain a power factor of 95% lagging (supplying vars) and 95% leading (absorbing vars) at the point of interconnection.

If any prior or equally queued projects that are included in this Preliminary Interconnection System Impact Study withdraw from the Generation Interconnection queue, then the Preliminary Interconnection System Impact Study Interconnection Customer impacts may no longer be valid.

The estimates do not include any costs associated with the deliverability of the energy to final customers. These costs are determined by separate studies if the Customer requests transmission service through Southwest Power Pool's OASIS. It should be noted that the models used for simulation do not contain all SPP transmission service.

Table of Contents

1.0 Introduction

As part of the Preliminary Interconnection System Impact Study (PISIS), a transient stability study has been performed by Southwest Power Pool (SPP) to evaluate the dynamic stability of adding the interconnection request GEN-2012-005 (81.0MW/Wind) in the Nebraska Public Power District (NPPD) area.

GEN-2012-005 consists of fifty (50) General Electric (G.E.) 1.62 MW wind turbines interconnecting at Madison County 230kV substation, which is a tap on Fort Randall – Columbus 230kV line. Fort Randall substation is located in the Western Area Power Administration (WAPA) area and the Columbus substation is located in the Nebraska Public Power District (NPPD) area. As of the posting of this study, there are currently twenty-six (26) prior queued interconnection requests in the Nebraska Grouping (Group 9). GEN-2012-005 is the only current study request in the PISIS-2012-002.

The results of a stability analysis determined that for the addition of the PISIS-2012-002 interconnection request, the transmission system was found to remain stable for both summer and winter peak conditions. All assigned and previously assigned network upgrades are included in the models. Additionally, the wind farm project is found to stay connected during the contingencies that were studied, meeting the Low Voltage Ride Through (LVRT) requirements of FERC Order #661A.

Category C faults in the Nebraska Grouping (Group 9) area were also studied in addition to the study faults for the PISIS-2012-002 request.

Two seasonal base cases were used in the study to analyze the stability impacts of the proposed generation facility. A 2014 summer peak case and a 2014 winter peak case which were both modified to include the prior queued projects shown in Table 2.

2.0 Purpose

The purpose of this Preliminary Interconnection System Impact Study (PISIS) is to evaluate the impact of the proposed interconnection on the reliability of the SPP Transmission System. Table 1 lists the current study requests that were analyzed in this study. Table 2 lists the prior queued projects in the Nebraska Group (Group 9).

Table 1: PISIS-2012-002 Impact Study Request

Request	Size (MW)	Generator Model	Point of Interconnection
GEN-2012-005	81	GE 1.62MW	Tap Columbus – Ft Randall 230kV line (560006)

Table 2: PISIS-2012-002 Prior Queued Interconnection Requests in Group 9

Request	Size (MW)	Generator Model	Point of Interconnection
GEN-2003-021N	75	GE 1.5MW	Tap on the Ainsworth – Calamus 115kV line (640050)
GEN-2004-005N	30	GE 1.5MW	St Francis 115kV (640351)
GEN-2004-023N	75	GENROU	Columbus 115kV (640119)
GEN-2006-020N	42	Vestas 3.0MW	Bloomfield 115kV (640084)
GEN-2006-037N1	75	GE 1.5MW	Broken Bow 115kV (640089)
GEN-2006-038N005	79.5	GE 1.5MW	Broken Bow 115kV (640089)
GEN-2006-038N019	79.5	Generic wind turbine 1.5MW	Petersburg 115kV (640444)
GEN-2006-044N	40.5	GE 1.5MW	Petersburg 115kV (640444)
GEN-2007-011N08	81	Vestas 3.0MW	Bloomfield 115kV (640084)
GEN-2007-015	135	GE 1.5MW	Tap Kelly – S1399 161kV (560610)
GEN-2008-086N02	200.6	GE 1.7MW	Tap Columbus – Ft Randall 230kV line (560006)
GEN-2008-119O	60	GE 1.5MW	S1399 161kV (646399)
GEN-2008-123N	89.7	SMK203	Tap on the Pauline – Guide Rock 115kV (560137)
GEN-2009-040	73.8	Vestas V90 1.8MW	Marshall 115kV (533349)
GEN-2010-041	10.5	GE 1.5MW	S1399 161kV (646399)
GEN-2010-044	99	Siemens 3.0MW	Harbine 115kV (640208)
GEN-2010-051	200	GE 1.6MW	Tap Twin Church – Hoskins 230kV line (560347)
GEN-2011-018	73.6	Siemens 2.3MW	Steele County 115kV (640426)
GEN-2011-027	120	Nordex N100 2.5MW	Hoskins 230kV (640227)
GEN-2011-055	52.8	GE 1.6MW	South Sterling 69kV (S969, 647969)
GEN-2011-056	3.6 MW increase	GENSAL	Jeffrey 115kV (640238)
GEN-2011-056A	3.6 MW increase	GENSAL	Johnson 1 115kV (640240)
GEN-2011-056B	4.5 MW increase	GENSAL	Johnson 2 115kV (640242)
GEN-2012-017	115 MW increase	GENROU	Cooper 345kV (640139)
GEN-2012-018	200	GE 1.6MW	GEN-2010-051 230kV Tap (560347)
GEN-2012-021	4.8 MW	GENROU	84th & Bluff 115kV (650275)

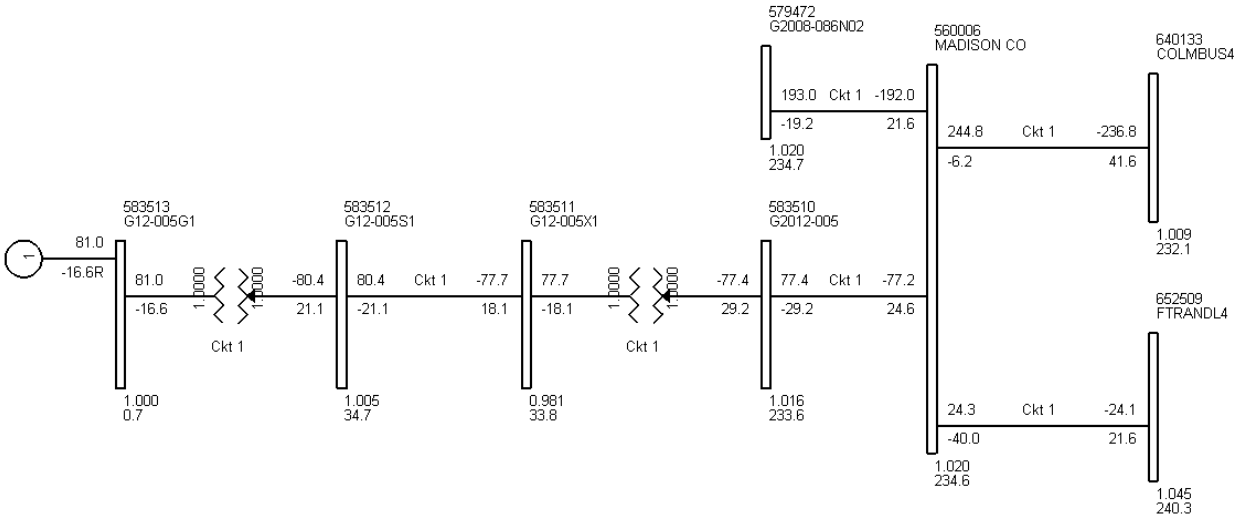
If any prior or equally queued projects that are included in this Preliminary Interconnection System Impact Study withdraw from the Generation Interconnection queue, then the Preliminary Interconnection System Impact Study Interconnection Customer impacts may no longer be valid.

3.0 Facilities

3.1 Interconnection Facility

GEN-2012-005 generating facility is studied with the assumption that it would be using fifty (50) General Electric (G.E.) 1.62 MW wind turbines. The nameplate rating of each turbine is 1.62 MW (1,620kW) with a machine base of 1.78MVA (1,780kVA). Each wind turbine has a 34.5kV/0.69kV 1.75MVA (1,750kVA) transformer. Customer's Interconnection Facilities will include one (1) 230/34.5kV 60/100MVA transformer. The Point of Interconnection (POI) will be at Madison County 230kV substation, which is a tap on the Fort Randall – Columbus 230kV line. Figure 1 shows a detailed one-line diagram of the GEN-2012-005 facility.

Figure 1: GEN-2012-005 Facility POI One-line Diagram



4.0 Stability Study Criteria

4.1 Contingencies Simulated

Twenty-eight (28) contingencies were considered for the transient stability simulations. The faults that were defined and simulated are listed in Table 3. These contingencies included three phase faults and a single phase line to ground (SLG) fault at locations defined by SPP. The Single-phase fault was simulated by applying a fault impedance to the positive sequence network at the fault location to represent the effect of the negative and zero sequence networks on the positive sequence network. The fault impedance was computed to give a positive sequence voltage at the specified fault location of approximately 60% of pre-fault voltage. This method is in agreement with SPP current practice.

In this restudy SPP monitored the generators and transmission lines in Areas 531, 534, 536, 540, 541, 640, 645, 650, 652.

Table 3: Contingencies Evaluated

Cont. No.	Cont. Name	Description
1	FLT01-3PH	3 phase fault on the Madison County (560006) to Columbus (640133) 230kV line, near Madison County. a. Apply fault at the Madison County 230kV bus. b. Clear fault after 6 cycles by tripping the faulted line.
2	FLT02-3PH	3 phase fault on the Madison County (560006) to Fort Randall (652509) 230kV line, near Madison County. a. Apply fault at the Madison County 230kV bus. b. Clear fault after 6 cycles by tripping the faulted line.
3	FLT03-3PH	3 phase fault on Fort Randall (652509) to Fort Thompson (652507) 230kV line, near Fort Randall. a. Apply fault at the Fort Randall 230kV bus. b. Clear fault after 65 cycles by tripping the faulted line.
4	FLT04-3PH	3 phase fault on Fort Randall (652509) to Lake Platte (652516) 230kV line, near Fort Randall. a. Apply fault at the Fort Randall 230kV bus. b. Clear fault after 6 cycles by tripping the faulted line.
5	FLT05-3PH	3 phase fault on Fort Randall (652509) to Utica Junction (652526) 230kV line, near Fort Randall. a. Apply fault at the Fort Randall 230kV bus. b. Clear fault after 6 cycles by tripping the faulted line.
6	FLT06-3PH	3 phase fault on Fort Randall (652509) to Sioux City (652565) 230kV line, near Fort Randall. a. Apply fault at the Fort Randall 230kV bus. b. Clear fault after 6 cycles by tripping the faulted line.
7	FLT07-3PH	3 phase fault on Fort Randall (652510) to Armour (652501) 115kV line, near Fort Randall. a. Apply fault at the Fort Randall 115kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
8	FLT08-3PH	3 phase fault on Fort Randall (652510) to Spencer (640349) 115kV line, near Fort Randall. a. Apply fault at the Fort Randall 115kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
9	FLT09-3H	3 phase fault on Fort Randall (652510) to Bonesteel (652475) 115kV line, near Fort Randall. a. Apply fault at the Fort Randall 115kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
10	FLT10-3PH	3 phase fault on Fort Randall (652510) to WH Swan (652463) 115kV line, near Fort Randall. a. Apply fault at the Fort Randall 115kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
11	FLT11-3PH	3 phase fault on Columbus (640133) to Columbus East (640126) 230kV line, near Columbus. a. Apply fault at the Columbus 230kV bus. b. Clear fault after 6 cycles by tripping the faulted line.
12	FLT12-3PH	3 phase fault on Columbus (640133) to Columbus West (640131) 230kV line, near Columbus. a. Apply fault at the Columbus 230kV bus. b. Clear fault after 6 cycles by tripping the faulted line.

Cont. No.	Cont. Name	Description
13	FLT13-3PH	3 phase fault on Columbus (640133) to Shell Creek (640343) 230kV line, near Columbus. a. Apply fault at the Columbus 230kV bus. b. Clear fault after 6 cycles by tripping the faulted line.
14	FLT14-3PH	3 phase fault on Columbus (640136) to Columbus Southeast (640124) 115kV line, near Columbus. a. Apply fault at the Columbus 115kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
15	FLT15-3PH	3 phase fault on Columbus (640136) to Columbus East (640127) 115kV line, near Columbus. a. Apply fault at the Columbus 115kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
16	FLT16-3PH	3 phase fault on Columbus (640136) to Creston (640151) 115kV line, near Columbus. a. Apply fault at the Columbus 115kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
17	FLT17-3PH	3 phase fault on Columbus (640136) to Genoa (640181) 115kV line, near Columbus. a. Apply fault at the Columbus 115kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
18	FLT18-3PH	3 phase fault on Columbus (640136) to Silver Creek (640345) 115kV line, near Columbus. a. Apply fault at the Columbus 115kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
19	FLT19-3PH	3 phase fault on Columbus (640136) to Schuyler (640336) 115kV line, near Columbus. a. Apply fault at the Columbus 115kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
20	FLT20-3PH	3 phase fault on Shell Creek (640342) to Columbus East (640125) 345kV line, near Shell Creek. a. Apply fault at the Shell Creek 345kV bus. b. Clear fault after 4.5 cycles by tripping the faulted line.
21	FLT21-3PH	3 phase fault on Shell Creek (640342) to Hoskins (640226) 345kV line, near Shell Creek. a. Apply fault at the Shell Creek 345kV bus. b. Clear fault after 4.5 cycles by tripping the faulted line.
22	FLT22-3PH	3 phase fault on Columbus East (640127) to David City (640157) 115kV line, near Columbus East. a. Apply fault at the Columbus East 115kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
23	FLT23-3PH	3 phase fault on Columbus East (640127) to Columbus Gen ADM (640119) 115kV line, near Columbus East. a. Apply fault at the Columbus East 115kV bus. b. Clear fault after 6.5 cycles by tripping the faulted line.
24	FLT24-3PH	3 phase fault on Fort Thompson (652506) to Grand Island (652571) 345kV line, near Fort Thompson. a. Apply fault at the Fort Thompson 345kV bus. b. Clear fault after 4.5 cycles by tripping the faulted line.
25	FLT25-3PH	3 phase fault on Columbus East (640127) 115kV to Columbus East (640125) 345kV/(640129) 13.8kV transformer at the 115kV bus. a. Apply fault at the Columbus East 115kV bus. b. Clear fault after 5.5 cycles by tripping the faulted line.
26	FLT26-3PH	3 phase fault on Columbus East (640127) 115kV to Columbus East (640126) 230kV/(643036) 13.8kV transformer at the 115kV bus. a. Apply fault at the Columbus East 115kV bus. b. Clear fault after 5.5 cycles by tripping the faulted line.

Cont. No.	Cont. Name	Description
27	FLT27-3PH	3 phase fault on Columbus (640133) 230kV to Kelly (640134) 115kV/(640135) 13.2kV transformer at the 230kV bus. a. Apply fault at the Columbus 230kV bus. b. Clear fault after 5.5 cycles by tripping the faulted line.
28	FLT28-3PH	3 phase fault on Fort Randall (652509) 230kV to Fort Randall (652510) 115kV transformer at the 230kV bus. a. Apply fault at the Fort Randall 230kV bus. b. Clear fault after 5.5 cycles by tripping the faulted line.
29	FLT29-1PH	SLG fault on Kelly – Columbus West 230 kV line. Stuck PCB at Kelly. a. Apply fault on Kelly 230 kV bus. b. b. Clear Columbus West end of line at 6.0 cycles. Leave fault on open-ended line. c. c. Clear Kelly 230 kV bus and fault at 14.5 cycles.

4.2 NERC Category C Contingencies Simulated

Four (4) contingencies were considered for the transient stability simulations. The faults that were defined and simulated are listed in Table 4. These contingencies included a three phase fault and single phase line to ground (SLG) faults at locations defined by SPP. The Single-phase fault was simulated by applying a fault impedance to the positive sequence network at the fault location to represent the effect of the negative and zero sequence networks on the positive sequence network. The fault impedance was computed to give a positive sequence voltage at the specified fault location of approximately 60% of pre-fault voltage. This method is in agreement with SPP current practice.

In this restudy SPP monitored the generators and transmission lines in Areas 531, 534, 536, 540, 541, 640, 645, 650, 652.

Table 4: Category C Contingencies Evaluated

Cont. No.	Cont. Name	Description
30	FLTC03-3PH	Prior outage of Fairport (300039) – St Joe (541199) 345kV with a 3-phase fault near Cooper (640139) on Cooper (640139) – St Joe (541199) 345kV. a. Apply 3-phase fault at Cooper (640139) 345kV bus b. Run for 5 cycles c. Clear fault 3-phase fault at Cooper (640139) 345kV d. Trip line from Cooper (640139) to G10-056-Tap (560663) 345kV
31	FLTC11-1PH	SLG fault at the S3451 (645451) end of the S3451 (645451) -S3459 (645459) and S3451 (645451) - S3454 (645454) 345kV lines. Normal clearing (4.5 cycles) a. Apply SLG fault at S3451 (645451) 345kV bus b. Run for 4.5 cycles c. Clear fault at S3451 (645451) 345kV bus d. Trip line from S3451 (645451) to S3459 (645459) 345kV e. Trip line from S3451 (645451) to S3454 (645454) 345kV
32	FLTC12-1PH	SLG fault at the S3451 (645451) end of the S3451 (645451)-Raun (635200) 345kV line, followed by a stuck breaker and the opening (4.5cycles) of transformer T4 (64545/345kv – 646251/161kV – 648351/13.8kV) at S3451. a. Apply SLG fault at S3451 (645451) 345kV bus b. Run for 4.5 cycles c. Trip line from S3451 (645451) to Raun (635200) 345kV d. Clear fault at S3451 (645451) 345kV bus e. Apply SLG fault at S3451 (645451) 345kV bus f. Run for 10 cycles g. Disconnect three winding transformer (S3451 T4) at bus 645451/646251/648351 h. Clear fault at S3451 (645451) 345kV bus
33	FLTC13-1PH	SLG fault at S1206 (646206) on the S1206 (646206) - S1232 (66232) 161kV line, followed by a stuck breaker and the opening of the S1206 (646206) - S1201 (646201) 161kV line. a. Apply SLG fault at S1206 (646206) 161kV bus b. Run for 8.5 cycles c. Trip line from S1206 (646206) to S1232 (646232) 161kV d. Clear fault at S1206 (646206) 161kV bus e. Apply SLG fault at S1206 (646206) 161kV bus f. Run for 10.5 cycles g. Trip line from S1206 (646206) to S1201 (646201) 161kV h. Clear fault at S1206 (646206) 161kV bus

4.3 Further Model Preparation

The base cases contain prior queued projects as shown in Table 2. All prior queued projects are dispatched at 100% nameplate.

The wind generation from the study customer and the previously queued customers were dispatched into the SPP footprint.

Initial simulations were carried out on both base cases and cases with the added generation for a no-disturbance run of 20 seconds to verify the numerical stability of the model. All cases were confirmed to be stable.

5.0 Results

5.1 Stability Fault Analysis

Results of the stability analysis are summarized in Table 5. The results indicate that the transmission system is stable for all contingencies tested summer and winter cases.

Results of the stability analysis for Category C faults are summarized in Table 6. The results indicate that the transmission system is stable for all contingencies tested summer and winter cases.

Table 5: Results of Simulated Contingencies

Cont. No.	Cont. Name	Description	Summer	Winter
1	FLT01-3PH	3 phase fault on the Madison County (560006) to Columbus (640133) 230kV line, near Madison County.	STABLE	STABLE
2	FLT02-3PH	3 phase fault on the Madison County (560006) to Fort Randall (652509) 230kV line, near Madison County.	STABLE	STABLE
3	FLT03-3PH	3 phase fault on Fort Randall (652509) to Fort Thompson (652507) 230kV line, near Fort Randall.	STABLE	STABLE
4	FLT04-3PH	3 phase fault on Fort Randall (652509) to Lake Platte (652516) 230kV line, near Fort Randall.	STABLE	STABLE
5	FLT05-3PH	3 phase fault on Fort Randall (652509) to Utica Junction (652526) 230kV line, near Fort Randall.	STABLE	STABLE
6	FLT06-3PH	3 phase fault on Fort Randall (652509) to Sioux City (652565) 230kV line, near Fort Randall.	STABLE	STABLE
7	FLT07-3PH	3 phase fault on Fort Randall (652510) to Armour (652501) 115kV line, near Fort Randall.	STABLE	STABLE
8	FLT08-3PH	3 phase fault on Fort Randall (652510) to Spencer (640349) 115kV line, near Fort Randall.	STABLE	STABLE
9	FLT09-3PH	3 phase fault on Fort Randall (652510) to Bonesteel (652475) 115kV line, near Fort Randall.	STABLE	STABLE
10	FLT10-3PH	3 phase fault on Fort Randall (652510) to WH Swan (652463) 115kV line, near Fort Randall.	STABLE	STABLE
11	FLT11-3PH	3 phase fault on Columbus (640133) to Columbus East (640126) 230kV line, near Columbus.	STABLE	STABLE
12	FLT12-3PH	3 phase fault on Columbus (640133) to Columbus West (640131) 230kV line, near Columbus.	STABLE	STABLE
13	FLT13-3PH	3 phase fault on Columbus (640133) to Shell Creek (640343) 230kV line, near Columbus.	STABLE	STABLE
14	FLT14-3PH	3 phase fault on Columbus (640136) to Columbus Southeast (640124) 115kV line, near Columbus.	STABLE	STABLE
15	FLT15-3PH	3 phase fault on Columbus (640136) to Columbus East (640127) 115kV line, near Columbus.	STABLE	STABLE
16	FLT16-3PH	3 phase fault on Columbus (640136) to Creston (640151) 115kV line, near Columbus.	STABLE	STABLE
17	FLT17-3PH	3 phase fault on Columbus (640136) to Genoa (640181) 115kV line, near Columbus.	STABLE	STABLE
18	FLT18-3PH	3 phase fault on Columbus (640136) to Silver Creek (640345) 115kV line, near Columbus.	STABLE	STABLE
19	FLT19-3PH	3 phase fault on Columbus (640136) to Schuyler (640336) 115kV line, near Columbus.	STABLE	STABLE
20	FLT20-3PH	3 phase fault on Shell Creek (640342) to Columbus East (640125) 345kV line, near Shell Creek.	STABLE	STABLE
21	FLT21-3PH	3 phase fault on Shell Creek (640342) to Hoskins (640226) 345kV	STABLE	STABLE

Cont. No.	Cont. Name	Description	Summer	Winter
		line, near Shell Creek.		
22	FLT22-3PH	3 phase fault on Columbus East (640127) to David City (640157) 115kV line, near Columbus East.	STABLE	STABLE
23	FLT23-3PH	3 phase fault on Columbus East (640127) to Columbus Gen ADM (640119) 115kV line, near Columbus East.	STABLE	STABLE
24	FLT24-3PH	3 phase fault on Fort Thompson (652506) to Grand Island (652571) 345kV line, near Fort Thompson.	STABLE	STABLE
25	FLT25-3PH	3 phase fault on Columbus East (640127) 115kV to Columbus East (640125) 345kV/(640129) 13.8kV transformer at the 115kV bus.	STABLE	STABLE
26	FLT26-3PH	3 phase fault on Columbus East (640127) 115kV to Columbus East (640126) 230kV/(643036) 13.8kV transformer at the 115kV bus.	STABLE	STABLE
27	FLT27-3PH	3 phase fault on Columbus (640133) 230kV to Kelly (640134) 115kV/(640135) 13.2kV transformer at the 230kV bus.	STABLE	STABLE
28	FLT28-3PH	3 phase fault on Fort Randall (652509) 230kV to Fort Randall (652510) 115kV transformer at the 230kV bus.	STABLE	STABLE
29	FLT28-1PH	SLG fault on Kelly – Columbus West 230 kV line. Stuck PCB at Kelly.	STABLE	STABLE

Table 6: Category C Results of Simulated Contingencies

Cont. No.	Cont. Name	Description	Summer	Winter
30	FLTC03-3PH	Prior outage of Fairport (300039) – St Joe (541199) 345kV with a 3-phase fault near Cooper (640139) on Cooper (640139) – St Joe	STABLE	STABLE
31	FLTC11-1PH	SLG fault at the S3451 (645451) end of the S3451 (645451) -S3459 (645459) and S3451 (645451) - S3454 (645454) 345kV lines.	STABLE	STABLE
32	FLTC12-1PH	SLG fault at the S3451 (645451) end of the S3451 (645451)-Raun (635200) 345kV line, followed by a stuck breaker and the opening (4.5cycles) of transformer T4 (64545/345kv – 646251/161kV – 648351/13.8kV) at S3451.	STABLE	STABLE
33	FLTC13-1PH	SLG fault at S1206 (646206) on the S1206 (646206) - S1232 (66232) 161kV line, followed by a stuck breaker and the opening of the S1206 (646206) - S1201 (646201) 161kV line.	STABLE	STABLE

5.2 Power Factor Analysis

A power factor analysis was performed for GEN-2012-005 by modeling a VAR generator at the Point of Interconnection (POI) bus. The VAR generator was set to hold a voltage schedule of 1.00 per unit at the Point of Interconnection (POI) for GEN-2012-005. The analysis was done for both the summer and winter cases. The contingencies and results are shown in Tables 7.

The results show that the wind generator is required to maintain a power factor of 95% lagging (supplying vars) and 95% leading (absorbing vars) at the point of interconnection.

Table 7: GEN-2012-005 Power Factor Table

Bus 560006 (POI) voltage: 1.000 PU (SP) / 1.000 PU (WP)		Summer				Winter			
Contingency Number	Contingency Description	P Gen (MW)	Q Gen (MVAR)	p.f. (POI)		P Gen (MW)	Q Gen (MVAR)	p.f. (POI)	
CONT_00	BASECASE	81.00	-21.9	0.965	LEAD	81.00	-23	0.962	LEAD
CONT_01	Loss of Madison County (560006) to Columbus (640133) 230kV line	81.00	-11.3	0.990	LEAD	81.00	-12.6	0.988	LEAD
CONT_02	Loss of Madison County (560006) to Fort Randall (652509) 230kV line	81.00	-4.2	0.999	LEAD	81.00	-1.7	1.000	LEAD
CONT_03	Loss of Randall (652509) to Fort Thompson (652507) 230kV line	81.00	-22.1	0.965	LEAD	81.00	-22.8	0.963	LEAD
CONT_04	Loss of Fort Randall (652509) to Lake Platte (652516) 230kV line	81.00	-22.4	0.964	LEAD	81.00	-23.2	0.961	LEAD
CONT_05	Loss of Fort Randall (652509) to Utica Junction (652526) 230kV line	81.00	-20	0.971	LEAD	81.00	-20.5	0.969	LEAD
CONT_06	Loss of Fort Randall (652509) to Sioux City (652565) 230kV line	81.00	-20	0.971	LEAD	81.00	-21.3	0.967	LEAD
CONT_07	Loss of Fort Randall (652510) to Armour (652501) 115kV line	81.00	-21.9	0.965	LEAD	81.00	-23.3	0.961	LEAD
CONT_08	Loss of Fort Randall (652510) to Spencer (640349) 115kV line	81.00	-21.4	0.967	LEAD	81.00	-22.6	0.963	LEAD
CONT_09	Loss of Fort Randall (652510) to Bonesteel (652475) 115kV line	81.00	-21.8	0.966	LEAD	81.00	-23	0.962	LEAD
CONT_10	Loss of Fort Randall (652510) to WH Swan (652463) 115kV line	81.00	-21.6	0.966	LEAD	81.00	-23.1	0.962	LEAD
CONT_11	Loss of Columbus (640133) to Columbus East (640126) 230kV line	81.00	-23	0.962	LEAD	81.00	-23.9	0.959	LEAD
CONT_12	Loss of Columbus (640133) to Columbus West (640131) 230kV line	81.00	-21.2	0.967	LEAD	81.00	-21.3	0.967	LEAD
CONT_13	Loss of Columbus (640133) to Shell Creek (640343) 230kV line	81.00	-18.1	0.976	LEAD	81.00	-18.2	0.976	LEAD
CONT_14	Loss of Columbus (640136) to Columbus Southeast (640124) 115kV line	81.00	-21.9	0.965	LEAD	81.00	-23	0.962	LEAD
CONT_15	Loss of Columbus (640136) to Columbus East (640127) 115kV line	81.00	-21.9	0.965	LEAD	81.00	-23	0.962	LEAD
CONT_16	Loss of Columbus (640136) to Creston (640151) 115kV line	81.00	-22	0.965	LEAD	81.00	-23.1	0.962	LEAD
CONT_17	Loss of Columbus (640136) to Genoa (640181) 115kV line	81.00	-21.4	0.967	LEAD	81.00	-23.1	0.962	LEAD
CONT_18	Loss of Columbus (640136) to Silver Creek (640345) 115kV line	81.00	-21.9	0.965	LEAD	81.00	-23.1	0.962	LEAD
CONT_19	Loss of Columbus (640136) to Schuyler (640336) 115kV line	81.00	-22.3	0.964	LEAD	81.00	-23.7	0.960	LEAD
CONT_20	Loss of Shell Creek (640342) to Columbus East (640125) 345kV line	81.00	-20.9	0.968	LEAD	81.00	-22.1	0.965	LEAD
CONT_21	Loss of Shell Creek (640342) to Columbus East (640125) 345kV line	81.00	-20.8	0.969	LEAD	81.00	-21.8	0.966	LEAD
CONT_22	Loss of Columbus East (640127) to David City (640157) 115kV line	81.00	-22.1	0.965	LEAD	81.00	-23.1	0.962	LEAD
CONT_23	Loss of Columbus East (640127) to Columbus Gen ADM (640119) 115kV line	81.00	-22.1	0.965	LEAD	81.00	-23.3	0.961	LEAD
CONT_24	Loss of Fort Thompson (652506) to Grand Island (652571) 345kV line	81.00	-18.2	0.976	LEAD	81.00	-20.7	0.969	LEAD
CONT_25	Loss of Columbus East (640127) 115kV to Columbus East (640125) 345kV/(640129) 13.8kV transformer	81.00	-20.4	0.970	LEAD	81.00	-20.8	0.969	LEAD
CONT_26	Loss of Columbus East (640127) 115kV to Columbus East (640126) 230kV/(643036) 13.8kV transformer	81.00	-23	0.962	LEAD	81.00	-24	0.959	LEAD

Bus 560006 (POI) voltage: 1.000 PU (SP) / 1.000 PU (WP)		Summer				Winter			
Contingency Number	Contingency Description	P Gen (MW)	Q Gen (MVAR)	p.f. (POI)		P Gen (MW)	Q Gen (MVAR)	p.f. (POI)	
CONT_27	Loss of Columbus (640133) 230kV to Kelly (640134) 115kV/(640135) 13.2kV transformer	81.00	-21.6	0.966	LEAD	81.00	-23.1	0.962	LEAD
CONT_28	Loss of Fort Randall (652509) 230kV to Fort Randall (652510) 115kV transformer	81.00	-11.7	0.990	LEAD	81.00	-11.2	0.991	LEAD

Lowest leading power factor
Lowest lagging power factor

5.3 FERC LVRT Compliance

FERC Order 661A Low Voltage Ride-Through Provisions (LVRT), which went into effect January 1, 2006, requires that wind generating plants remain in-service during 3-phase faults at the point of interconnection that draw the voltage down at the POI to 0.0 pu.

6.0 Conclusion

A transient stability study has been performed by Southwest Power Pool (SPP) to evaluate adding the interconnection request GEN-2012-005 (81.0MW/Wind) in the Nebraska Public Power District (NPPD) area.

The PISIS-2012-002 study has twenty-six (26) prior queued interconnection requests and GEN-2012-005 is the only request in the current study in the Nebraska Public Power District (NPPD) area.

The results of a stability analysis determined that for the addition of the PISIS-2012-002 interconnection request, the transmission system was found to remain stable for both summer and winter peak conditions. All assigned and previously assigned upgrades are included in the models. Additionally, the wind farm project is found to stay connected during the contingencies that were studied, meeting the Low Voltage Ride Through (LVRT) requirements of FERC Order #661A.

The results of the power factor analysis show that the interconnection request is to maintain a power factor of 95% lagging (supplying vars) and 95% leading (absorbing vars) at the point of interconnection.

The estimates do not include any costs associated with the deliverability of the energy to final customers. These costs are determined by separate studies if the Customer requests transmission service through Southwest Power Pool's OASIS. It should be noted that the models used for simulation do not contain all SPP transmission service.

All plots are available upon request.