Modification Request Impact Study for Generator Interconnection Request

GEN-2008-018

September 2013
Generator Interconnection

Southwest Power Pool

Executive Summary

<OMITTED TEXT> (Customer) has requested a modification to its Generator Interconnection Request, GEN-2008-018, in accordance with Section 4.4 of the Generator Interconnection Procedures (GIP) of the Southwest Power Pool Open Access Transmission Tariff (OATT). GEN-2008-018 is a request for interconnection of 405.15MW of wind generation to be interconnected as an Energy Resource (ER) into a transmission facility of the Southwestern Public Service Company (SPS) in Finney County, Kansas. SPP has undertaken this Modification Request Impact Study (MRIS) to determine the impacts to the transmission system of accommodating the modification request.

The previous impact study "Impact Cluster Study for Generation Interconnection Requests", ICS-2008-001-5, indicated that Finney-Holcomb 345kV circuit #2 is required for interconnection of GEN-2008-018. That study, posted to SPP OASIS on January 22, 2013, can be found at the following web address:
http://http://sppoasis.spp.org/documents/swpp/transmission/studies/files/2008_Generation_Studies/ICS-2008-001-5%20Impact%20Study%20Restudy_1-24-13.pdf.

The previous impact restudy "GEN-2008-018 Impact Restudy for Generator Modification (Turbine Change)" indicated that the interconnection customer's requested change in wind turbine generators from the previously studied GE 1.5MW wind turbine generators to the GE 1.85MW wind turbine generators showed that no stability problems were observed. That study, posted to SPP OASIS on June 11, 2013, can be found at the following web address:
http://sppoasis.spp.org/documents/swpp/transmission/studies/files/2008_Generation_Studies/GEN-2008-018_Impact_Restudy-6-11-2013.pdf

For the typical MRIS, both a power flow and transient stability analysis are conducted. The MRIS assumes that all Generator Interconnection queued projects and assigned system upgrades will go into service to determine adverse impacts from the modification request.

The Customer has requested a system impact study to confirm that a modification in its request for interconnection, a reduction to 350MW of wind generation, will alleviate the need for the Finney-Holcomb 345kV circuit #2 and will not adversely impact the costs for upgrades for other interconnection customers. An additional request was made to analyze GEN-2008-018 with a reduction to 250MW if the 350MW request could not be accommodated. At 250MW, GEN-2008-018 is requesting the interconnection of one-hundred thirty-five (135) General Electric 1.85 MW wind turbine generators and associated facilities into the Finney 345kV substation.

Voltage Stability analysis has determined that the transmission system, without the Finney-Holcomb 345kV circuit #2, will experience potential voltage collapse for loss of the Finney-Holcomb 345kV line for the scenario of GEN-2008-018 interconnected at 350MW. Voltage Stability analysis indicates that for the scenario of GEN-2008-018 interconnected at 250MW, the results indicate a stable transmission system without the second Finney-Holcomb 345kV transmission line.

Transient Stability analysis has determined that the transmission system, without the Finney-Holcomb 345kV circuit #2, will remain stable for the sixty-seven (67) selected faults for the interconnection of GEN-2008-018 with one-hundred thirty-five (135) General Electric 1.85 MW wind turbine generators and associated facilities into the Finney 345kV substation.

A power flow analysis shows that with ERIS Network Upgrades identified in ICS-2008-001-5, the Customer's request to reduce its interconnection to 250MW of wind generation will provide adequate interconnection service to alleviate the need for the Finney-Holcomb 345kV circuit #2 and will not affect the cost of Network upgrades for other Interconnection Customers. Powerflow analysis was based on both summer and winter peak conditions and light loading cases.

The Generating Facility will be required to maintain a 95% lagging (providing vars) and 95% leading (absorbing vars) power factor at the point of interconnection. Additionally, GEN-2008-018 is required to install capacitor banks (30MVar) on its 34.5kV bus and reactor banks (36Mvar) on its 345kV bus in addition to its generator reactive capability (+/- 0.90 power factor)

<u>The request of the Customer to reduce its interconnection capacity to 250MW and the resultant removal of the requirement of the Finney-Holcomb 345kV circuit #2 is not considered a Material Modification under GIP 4.4.</u>

It should be noted that although this MRIS analyzed many of the most probable contingencies, it is not an all-inclusive list that can account for every operational situation. Because of this, it is likely that the Customer may be required to reduce their generation output to 0 MW under certain system conditions to allow system operators to maintain the reliability of the transmission network.

Nothing within this System Impact Study constitutes a request for transmission service or confers upon the Interconnection Customer any right to receive transmission service rights. Should the Customer require transmission service, those rights should be requested through SPP's Open Access Same-Time Information System (OASIS).

This study fulfills SPP's requirements in accordance with GIP 4.4.3 to evaluate the Customer's modification. In accordance, with GIP 4.4.2, the Customer may choose to withdraw its request for modification.

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Introduction

<OMITTED TEXT> (Customer) has requested a modification to its Generator Interconnection Request, GEN-2008-018, in accordance with Section 4.4 of the Generator Interconnection Procedures (GIP) of the Southwest Power Pool Open Access Transmission Tariff (OATT). GEN-2008-018 is a request for interconnection of 405.15MW of wind generation to be interconnected as an Energy Resource (ER) into a transmission facility of the Southwestern Public Service Company (SPS) in Finney County, Kansas. SPP has undertaken this Modification Request Impact Study (MRIS) to determine the impacts to the transmission system of accommodating the modification request.

Purpose

The purpose of this Modification Request Impact Study (MRIS) is to evaluate the impact of the proposed interconnection, GEN-2008-018, on the reliability of the Transmission System. The Customer has requested a system impact study to confirm that a modification in its request for interconnection, a reduction from 405.0MW to 350MW of wind generation, will alleviate the need for the Finney-Holcomb 345kV circuit #2 and will not adversely impact the costs for upgrades for other interconnection customers. An additional request was made to analyze GEN-2008-018 with a reduction to 250MW if the 350MW request could not be accommodated. At 250MW, GEN-2008-018 is requesting the interconnection of one-hundred thirty-five (135) General Electric 1.85 MW wind turbine generators and associated facilities into the Finney 345kV substation.

For the typical MRIS, both a power flow and transient stability analysis are conducted. The MRIS assumes that all Generator Interconnection queued projects and assigned system upgrades will go into service to determine adverse impacts from the modification request. Modification Request Impact Studies are conducted under GIP 4.4 “Modifications”.

The MRIS considers the Base Case as well as all Generating Facilities (and with respect to (b) below, any identified Network Upgrades associated with such queued interconnection) that, on the date the MRIS is commenced:

a) are directly interconnected to the Transmission System;
b) are interconnected to Affected Systems and may have an impact on the Interconnection Request;
c) have a pending queued Interconnection Request to interconnect to the Transmission System listed; or
d) have no Queue Position but have executed an LGIA or requested that an unexecuted LGIA be filed with FERC.

Nothing within this System Impact Study constitutes a request for transmission service or confers upon the Interconnection Customer any right to receive transmission service rights. Should the Customer require transmission service, those rights should be requested through SPP’s Open Access Same-Time Information System (OASIS).

Facilities

Generating Facility (250MW)

The Customer has requested its interconnection project, GEN-2008-018, to be studied with a total of 249.75MW comprised of one-hundred thirty-five (135) General Electric 1.85 MW wind turbine generators, and associated facilities interconnecting into the Finney 345kV substation. The wind turbines are connected to equivalent 0.69/34.5KV generator step units (GSU). The high side of each GSU is connected to a 34.5/345kV substation transformer. A 345kV transmission line connects the Customer's substation transformer to the POI.

Interconnection Facilities

The POI for GEN-2008-018 Interconnection Customer is SPS Finney 345kV substation in Finney County, Kansas. Figure 1 depicts the one-line diagram of the local transmission system including the POI as well as the power flow model representing the request.

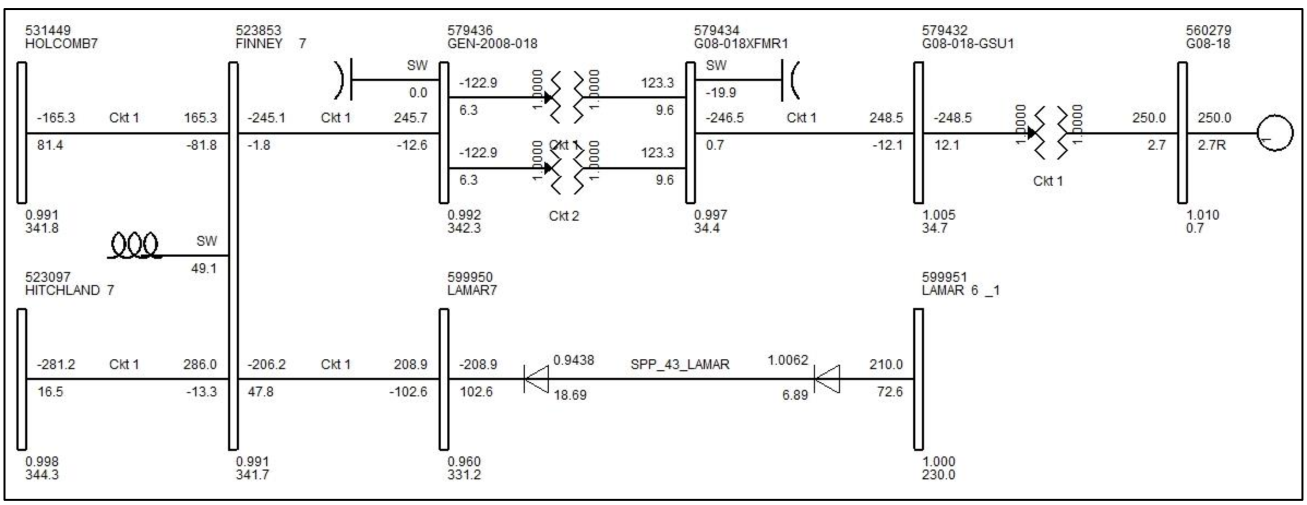

Figure 1: Proposed POI Configuration and Request Power Flow Model

Base Case Network Upgrades

The Network Upgrades included within the cases used for this MRIS are those facilities that are listed in the Impact Study; "Definitive Interconnection System Impact Study for Generation Interconnection Requests", DISIS-2013-001-1. That study, posted to SPP OASIS on August 30, 2013, can be found at the following web address:
http://sppoasis.spp.org/documents/swpp/transmission/studies/files/2013_Generation_Studies/DISIS-2013-001-1_8-30-13_Final_Report.pdf
This list includes facilities that have an approved Notification to Construct (NTC) or are in construction stages that are part of the SPP Transmission Expansion Plan, the Balanced Portfolio, or Priority Projects. Additionally, facilities have been included that do not yet have approval but have been assigned to Generator Interconnection Customers of higher and lower queued projects. No

other upgrades were included for this MRIS. If for any reason, construction on these projects is delayed or discontinued, a restudy may be needed to determine the interconnection service availability of the Customers.

Power Flow Analysis

Power flow analysis is used to determine if the transmission system can accommodate the injection from the interconnection request without violating thermal or voltage transmission planning criteria.

Model Preparation

The 2012 series Transmission Service Request (TSR) Models 2013 spring, 2014 summer and winter peak, and the 2018 summer and winter peak, and 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. This method allows the request to be studied as an Energy Resource (ERIS) Interconnection Request.

Generator Interconnection Requests Included in the Analysis

All active Generator Interconnection Requests in the SPP Generator Interconnection Queue through DISIS-2013-001 were included in this analysis.

Study Methodology and Criteria

A power flow analysis was conducted for the Interconnection Customer's facility using modified versions of the 2013 spring peak, 2014 summer and winter peak, the 2018 summer and winter peak, and 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 Interconnection Service request (ERIS).

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 area of SPS and other control areas in 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.

This analysis was conducted assuming that all queued requests in the immediate area of the interconnect request were in-service. Due to the location the customer's project and the greater potential for impacts on several network upgrades, GEN-2008-018 was independently included in Cluster Group 2, Hitchland Area, and Cluster Group 3, Spearville Area.

Constraints were screened to determine if the customer's generation interconnection request had at least a 20% Distribution Factor (DF) upon any constraint. Constraints that measured at least a 20% DF from the interconnection request were considered for mitigation. The Interconnection Request was also studied in the Network Resource Interconnection Service (NRIS) analysis to determine if any constraint had at least a 3% DF. If so, these constraints were also considered for mitigation due to potential adverse impact to other generator interconnection requests.

Results

ACCC results for the MRIS can be found in Table 1 below. The analysis of the Customer's project, GEN-2008-018 with 350MW of interconnection service into the SPP transmission system, indicates that potential voltage collapse will occur for outage of the Finney-Holcomb 345kV line.

The project was then analyzed at 250MW. These results can be found in Table 2. The analysis of the Customer's project, GEN-2008-018 with 250MW of interconnection service into the SPP transmission system indicates that criteria violations with significant impact from the study project will not occur on the modeled control area of SPS or other control areas of SPP transmission systems under system intact and contingency conditions in the peak seasons. Since ER analysis doesn't mitigate for those issues in which the affecting GI request has less than a 20% OTDF and 3% for NR analysis, Table 3 is provided for informational purposes only so that the Customer understands there may be times when they may be required to reduce their output to maintain system reliability.

Powerflow analysis confirmed the previously identified ERIS constraint of Finney-Holcomb 345kV circuit #2 is not required for GEN-2008-018 with a reduction in interconnection service from 405.0MW to 250.0MW of wind generation. Therefore, analysis indicates that with the ER Network Upgrades identified in DISIS-2013-001, the costs of other Interconnection Customer's upgrades will not be affected if the customer proceeds with the proposed modification.

It should be noted that although this MRIS analyzed many of the most probable contingencies, it is not an all-inclusive list that can account for every operational situation. Because of this, it is likely that the Customer may be required to reduce their generation output to 0 MW under certain system conditions to allow system operators to maintain the reliability of the transmission network.

Table 1: Interconnection Constraints for Mitigation of GEN-2008-018 @ 350.0MW

Season	Dispatch Group	Flow	Overloaded Element	RATEB (MVA)	TDF	TC% LOADING	Contingency
Spring	02ALL		Non-Converged				Finney-Holcomb 345kV ckt 1.

Table 2: Interconnection Constraints for Mitigation of GEN-2008-018 @ 250.0MW

Season	Dispatch Group	Flow	Overloaded Element	RATEB (MVA)	TDF	TC% LOADING	Contingency
			None				

Table 3: Interconnection Constraints not for Mitigation of GEN-2008-018 @ 250.0MW

Season	Dispatch Group	Flow	Overloaded Element	RATEB (MVA)	TDF	TC% LOADING	Contingency
13G	02ALL	'FROM->TO'	'ALEXANDER - NEKOMA 115KV CKT 1'	99	0.04229	103.303	'BUCKNER7 345.00 - SPEARVILLE 345KV CKT 1'
13G	02ALL	'TO->FROM'	'ALEXANDER - NESS CITY 115KV CKT 1'	99	0.04229	104.8733	'BUCKNER7 345.00 - SPEARVILLE 345KV CKT 1'
13G	03ALL	'TO->FROM'	'BENTON - WICHITA 345KV CKT 1'	932	0.11871	101.0756	'CHISHOLM - MAIZEE 4 138.00 138KV CKT 1'
13G	03ALL	'TO->FROM'	'BENTON - WICHITA 345KV CKT 1'	932	0.13541	111.1705	'DBL-TGA-MATT'
13G	03ALL	'TO->FROM'	'BENTON - WICHITA 345KV CKT 1'	932	0.11871	101.5894	'EVANS ENERGY CENTER NORTH - MAIZEW 4 138.00 138KV CKT 1'
13G	03ALL	'TO->FROM'	'BENTON - WICHITA 345KV CKT 1'	932	0.13541	106.0535	'G11_051T 345.00 - TATONGA7 345.00 345KV CKT 1'
13G	03ALL	'TO->FROM'	'BENTON - WICHITA 345KV CKT 1'	932	0.13541	105.6916	'G11_051T 345.00 - WOODWARD DISTRICT EHV 345KV CKT 1'
13G	03ALL	'TO->FROM'	'BENTON - WICHITA 345KV CKT 1'	932	0.11268	118.3622	'GEN532751 1-WOLF CREEK GENERATING STATION UNIT 1'
13G	03G08_018	'TO->FROM'	'BENTON - WICHITA 345KV CKT 1'	932	0.11366	101.2858	'GEN532751 1-WOLF CREEK GENERATING STATION UNIT 1'
13G	3	'TO->FROM'	'BENTON - WICHITA 345KV CKT 1'	932	0.11372	100.6407	'GEN532751 1-WOLF CREEK GENERATING STATION UNIT 1'
13G	03NR	'TO->FROM'	'BENTON - WICHITA 345KV CKT 1'	932	0.04164	106.1605	'GEN532751 1-WOLF CREEK GENERATING STATION UNIT 1'
13G	03ALL	'TO->FROM'	'BENTON - WICHITA 345KV CKT 1'	932	0.1329	104.7554	'HUNTERS7 345.00 - VIOLA 7 345.00 345KV CKT 1'
13G	03ALL	'TO->FROM'	'BENTON - WICHITA 345KV CKT 1'	932	0.1329	107.0867	'HUNTERS7 345.00 - WOODRING 345KV CKT 1'
13G	03ALL	'TO->FROM'	'BENTON - WICHITA 345KV CKT 1'	932	0.11871	101.0779	'MAIZE - MAIZEE 4 138.00 138KV CKT 1'
13G	03ALL	'TO->FROM'	'BENTON - WICHITA 345KV CKT 1'	932	0.11871	101.5859	'MAIZE - MAIZEW 4 138.00 138KV CKT 1'
13G	03ALL	'TO->FROM'	'BENTON - WICHITA 345KV CKT 1'	932	0.11871	101.0778	'SPP-WERE-90'
13G	03ALL	'TO->FROM'	'BENTON - WICHITA 345KV CKT 1'	932	0.11871	101.5895	'SPP-WERE-91'
13G	03ALL	'TO->FROM'	'BENTON - WICHITA 345KV CKT 1'	932	0.11611	100.1848	'WRTOD400'
13G	02G08_018	'FROM->TO'	'BUCKNER7 345.00 - SPEARVILLE 345KV CKT 1'	1328	0.49295	109.6917	'DBL-BVR-WWRD'
13G	2	'FROM->TO'	'BUCKNER7 345.00 - SPEARVILLE 345KV CKT 1'	1328	0.4931	107.9074	'DBL-BVR-WWRD'

Season	Dispatch Group	Flow	Overloaded Element	RATEB (MVA)	TDF	TC% LOADING	Contingency
13G	02NR	'FROM->TO'	'BUCKNER7 345.00 - SPEARVILLE 345KV CKT 1'	1328	0.28636	112.0801	'DBL-BVR-WWRD'
13G	03ALL	'TO->FROM'	'CHISHOLM - MAIZEE 4 138.00 138KV CKT 1'	382	0.03986	114.0197	'BENTON - WICHITA 345KV CKT 1'
13G	03ALL	'TO->FROM'	'CIRCLE - MULLERGREN 230KV CKT 1'	319	0.03632	101.7141	'DBL-WICH-THI'
13G	02ALL		'DBL-BVR-WWRD'	0	0.21745	9999	'BASE CASE'
13G	03ALL		'DBL-MUL-RENO'	0	0.13939	9999	'BASE CASE'
13G	03ALL		'DBL-SPRVL-MU'	0	0.13939	9999	'BASE CASE'
13G	03ALL		'DBL-THIS-CLR'	0	0.16081	9999	'BASE CASE'
13G	02ALL	'FROM->TO'	'ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1'	287	0.03404	100.3094	'FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1'
13G	03ALL	'FROM->TO'	'EVANS ENERGY CENTER NORTH - MAIZEW 4 138.00 138KV CKT 1'	382	0.03986	116.7563	'BENTON - WICHITA 345KV CKT 1'
13G	03G08_018	'FROM->TO'	'EVANS ENERGY CENTER NORTH - MAIZEW 4 138.00 138KV CKT 1'	382	0.04014	101.5568	'BENTON - WICHITA 345KV CKT 1'
13G	3	'FROM->TO'	'EVANS ENERGY CENTER NORTH - MAIZEW 4 138.00 138KV CKT 1'	382	0.04015	101.0585	'BENTON - WICHITA 345KV CKT 1'
13G	03ALL		'GRAND ISLAND - SWEETWATER 345KV CKT 1'	717	0.06407	69.83464	'BASE CASE'
23SP	00NR	'FROM->TO'	'HITCHLAND INTERCHANGE (H TP80148301) 230/115/13.2KV TRANSFORMER CKT 1'	250	0.1026	103.3666	'HITCHLAND INTERCHANGE - OCHILTREE 230KV CKT 1'
23SP	00NR	'FROM->TO'	'HITCHLAND INTERCHANGE (H TP80148301) 230/115/13.2KV TRANSFORMER CKT 1'	250	0.1026	103.7831	'OCHILTREE (H TP80219401) 230/115/13.2KV TRANSFORMER CKT 1'
13SP	00NR	'FROM->TO'	'Jones Station Bus#2 - LUBBOCK SOUTH INTERCHANGE 230KV CKT 2'	351	0.0589	103.251	'JONES STATION - LUBBOCK SOUTH INTERCHANGE 230KV CKT 1'
23SP	00NR	'FROM->TO'	'Jones Station Bus#2 - LUBBOCK SOUTH INTERCHANGE 230KV CKT 2'	351	0.05285	116.2161	'JONES STATION - LUBBOCK SOUTH INTERCHANGE 230KV CKT 1'
13G	02NR	'FROM->TO'	'LAWEASOKLUNI'	425	0.18356	115.4	'BASE CASE'
13SP	00NR	'FROM->TO'	'LAWEASOKLUNI'	425	0.18404	150.5	'BASE CASE'
13WP	00NR	'FROM->TO'	'LAWEASOKLUNI'	425	0.16827	168.8	'BASE CASE'
18SP	00NR	'FROM->TO'	'LAWEASOKLUNI'	425	0.18137	136	'BASE CASE'
18WP	00NR	'FROM->TO'	'LAWEASOKLUNI'	425	0.17046	163.4	'BASE CASE'
23SP	00NR	'FROM->TO'	'LAWEASOKLUNI'	425	0.17898	134.9	'BASE CASE'
13G	03ALL	'TO->FROM'	'MULLERGREN - SPEARVILLE 230KV CKT 1'	355.3	0.03434	106.4262	'G11-17T 345.00 - G12-11T 345.00 345KV CKT 1'
13G	03ALL	'TO->FROM'	'MULLERGREN - SPEARVILLE 230KV CKT 1'	355.3	0.03434	127.1232	'G12-11T 345.00 - POST ROCK 345KV CKT 1'
13G	03G08_018	'TO->FROM'	'MULLERGREN - SPEARVILLE 230KV CKT 1'	355.3	0.034	105.1553	'G12-11T 345.00 - POST ROCK 345KV CKT 1'
13G	3	'TO->FROM'	'MULLERGREN - SPEARVILLE 230KV CKT 1'	355.3	0.03403	104.4702	'G12-11T 345.00 - POST ROCK 345KV CKT 1'
13G	03ALL	'FROM->TO'	'SMOKYHL6 230.00 - SUMMIT 230KV CKT 1'	330	0.0333	105.1344	'AXTELL - POST ROCK 345KV CKT 1'
13G	03ALL	'FROM->TO'	'SMOKYHL6 230.00 - SUMMIT 230KV CKT 1'	330	0.03279	100.6465	'DBL-WICH-THI'
23SP	00NR	'TO->FROM'	'STANTON SUB - TUCO INTERCHANGE 115KV CKT 1'	160	0.03695	101.2963	'CARLISLE INTERCHANGE - TUCO INTERCHANGE 230KV CKT 1'
13G	02ALL		'TRF-STEGALL'	0	0.04335	9999	'BASE CASE'
13G	03ALL		'TRF-STEGALL'	0	0.04365	9999	'BASE CASE'
13G	03G08_018		'TRF-STEGALL'	0	0.04362	9999	'BASE CASE'
13G	3		'TRF-STEGALL'	0	0.04363	9999	'BASE CASE'
13SP	00G08_018		'TRF-STEGALL'	0	0.04096	9999	'BASE CASE'
13SP	0		'TRF-STEGALL'	0	0.04091	9999	'BASE CASE'
13WP	00G08_018		'TRF-STEGALL'	0	0.04228	9999	'BASE CASE'
13WP	0		'TRF-STEGALL'	0	0.04222	9999	'BASE CASE'

Season	Dispatch Group	Flow	Overloaded Element	RATEB (MVA)	TDF	TC% LOADING	Contingency
23SP	00NR	'FROM->TO'	'TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2'	252	0.05231	101.7373	'TUCO INTERCHANGE (GE M102345) 230/115/13.2KV TRANSFORMER CKT 1'
23SP	00NR	'FROM->TO'	'TUCO INTERCHANGE (GE M102345) 230/115/13.2KV TRANSFORMER CKT 1'	252	0.05334	100.1369	'TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2'
23SP	00NR	'FROM->TO'	'TUCO INTERCHANGE (GE M102345) 230/115/13.2KV TRANSFORMER CKT 1'	252	0.05334	103.6728	'TUCO INTERCHANGE (ENRCO 136401) 230/115/13.2KV TRANSFORMER CKT 2'
13G	03ALL	'FROM->TO'	'WICHITA (WICHT12X) 345/138/13.8KV TRANSFORMER CKT 1'	440	0.04079	106.8819	'BENTON - WICHITA 345KV CKT 1'
13G	03ALL	'FROM->TO'	'WICHITA (WICHT12X) 345/138/13.8KV TRANSFORMER CKT 1'	440	0.04079	106.9979	'BENTON - WICHITA 345KV CKT 1'

Stability Analysis

Transient stability analysis is used to determine if the transmission system can maintain angular stability and ensure bulk electric system bus voltages stay within planning criteria bandwidth during and after a disturbance while considering the addition of a generator interconnection request.

Model Preparation

Transient stability analysis was performed using modified versions of the 2012 series of Model Development Working Group (MDWG) dynamic study models representing the Hitchland geographical study areas or Group 2 within the SPP footprint.

The Group 2 scenario contains the 2014 (summer and winter) and 2023 (summer) seasonal models or cases. The cases are then adapted to resemble the power flow study cases with regards to queued generation requests and topology. Finally the queued and study generation is dispatched into the SPP footprint. Initial simulations are then carried out for a no-disturbance run of twenty (20) seconds to verify the numerical stability of the model.

The software tool, Siemens PSS/E Version 32.1, was used to perform the impact restudy. For simulation purposes, the Customer's facility was simplified by using an equivalent model of the wind farm as shown in Figure 1. The data used to develop the equivalent wind farm model were supplied by the Customer. The Customer also supplied the PSS/E Version 32.1 stability models for the GE 1.85MW wind turbine generators. The GE's reactive power capability provided is +/- 0.90 with a constraint of 800kVAr per turbine when the real power output reaches 1.85MW.

Disturbances

The sixty-seven (67) contingencies were considered for the transient stability simulations used in this study. These faults are listed within Table 4. These contingencies included three-phase faults and single-phase line faults at locations defined by SPP. Single-phase line faults were simulated by applying 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.

With exception to transformers, the typical sequence of events for a three-phase and single-phase fault is as follows:

1. apply fault at particular location
2. continue fault for five (5) cycles, clear the fault by tripping the faulted facility
3. after an additional twenty (20) cycles, re-close the previous facility back into the fault
4. continue fault for five (5) additional cycles
5. trip the faulted facility and remove the fault

Transformer faults are typically only performed for three-phase faults, unless otherwise noted. Additionally the sequence of events for a transformer is to 1) apply a three-phase fault for five (5) cycles and 2) clear the fault by tripping the affected transformer facility. Unless otherwise noted there will be no re-closing into a transformer fault.

Table 4: Contingencies Evaluated

	Contingency Number and Name	Description
1	FLT_01_WWRDEHV7_TATONGA7_345kV_3PH	*3-Phase fault on the Woodward – Tatonga 345kV near the Woodward 345kV bus.*
2	FLT_02_WWRDEHV7_TATONGA7_345kV_1PH	*Single-phase fault similar to previous fault.*
3	FLT_03_FINNEY7_HITCHLAND7_345kV_3PH	*3-Phase fault on the Finney – Hitchland 345kV near the Finney 345kV bus.*
4	FLT_04_FINNEY7_HITCHLAND7_345kV_1PH	*Single-phase fault similar to previous fault.*
5	FLT_05_SETAB7_MINGO7_345kV_3PH	*3-Phase fault on the Mingo – Setab 345kV near the Setab 345kV bus.*
6	FLT_06_SETAB7_MINGO7_345kV_1PH	*Single-phase fault similar to previous fault.*
7	FLT_07_FINNEY7_HOLCOMB7_345kV_3PH	*3-Phase fault on the Finney – Holcomb 345kV near the Finney 345kV bus.*
8	FLT_08_FINNEY7_HOLCOMB7_345kV_1PH	*Single-phase fault similar to previous fault.*
9	FLT_09_FINNEY7_LAMAR7_345kV_3PH	*3-Phase fault on the Finney – Lamar 345kV near the Finney 345kV bus.*
10	FLT_10_FINNEY7_LAMAR7_345kV_1PH	*Single-phase fault similar to previous fault.*
11	FLT_11_KNOLL6_POSTROCK6_230kV_3PH	*3-Phase fault on the Knoll – Post Rock 230kV near the Knoll 230kV bus.*
12	FLT_12_KNOLL6_POSTROCK6_230kV_1PH	*Single-phase fault similar to previous fault.*
13	FLT_13_KNOLL6_SMKYHL6_230kV_3PH	*3-Phase fault on the Knoll – Smoky Hills 230kV near the Knoll 230kV bus.*
14	FLT_14_KNOLL6_SMKYHL6_230kV_1PH	*Single-phase fault similar to previous fault.*
15	FLT_15_HOLCOMB7_BUCKNER7_345kV_3PH	*3-Phase fault on the Buckner – Holcomb 345kV near the Holcomb 345kV bus.*
16	FLT_16_HOLCOMB7_BUCKNER7_345kV_1PH	*Single-phase fault similar to previous fault.*
17	FLT_17_BUCKNER7_SPERVL7_345kV_3PH	*3-Phase fault on the Buckner – Spearville 345kV near the Buckner 345kV bus.*
18	FLT_18_BUCKNER7_SPERVL7_345kV_1PH	*Single-phase fault similar to previous fault.*
19	FLT_19_SPERVL7_POSTROCK7_345kV_3PH	*3-Phase fault on the Post Rock – Spearville 345kV near the Spearville 345kV bus.*
20	FLT_20_SPERVL7_POSTROCK7_345kV_1PH	*Single-phase fault similar to previous fault.*
21	FLT_21_PIONEER3_HICKOCK3_115kV_3PH	*3-Phase fault on the Hickock – Pioneer 115kV near the Pioneer 115kV bus.*
22	FLT_22_PIONEER3_HICKOCK3_115kV_1PH	*Single-phase fault similar to previous fault.*
23	FLT_23_PIONEER3_PKGOAB3_115kV_3PH	*3-Phase fault on the Fletcher – Pioneer 115kV near the Pioneer 115kV bus.*
24	FLT_24_PIONEER3_PKGOAB3_115kV_1PH	*Single-phase fault similar to previous fault.*
25	FLT_25_HOLCOMB7_HOLCOMB3_345_115kV_3PH	*3-Phase fault on the Holcomb 345/115/13.8kV transformer near the Holcomb 345kV bus.*
26	FLT_26_HOLCOMB7_SETAB7_345kV_3PH	*3-Phase fault on the Holcomb – Setab 345kV near the Holcomb 345kV bus.*
27	FLT_27_HOLCOMB7_SETAB7_345kV_1PH	*Single-phase fault similar to previous fault.*
28	FLT_28_SPERVIL7_SPEARVL6_345_230kV_3PH	*3-Phase fault on the Spearville 345/230/13.8kV transformer near the Spearville 345kV bus.*
29	FLT_29_HUGOTON3_WALKMYR3_115kV_3PH	*3-Phase fault on the Hugoton City – Walkemeyer 115kV near the Hugoton City 115kV bus.*
30	FLT_30_HUGOTON3_WALKMYR3_115kV_1PH	*Single-phase fault similar to previous fault.*
31	FLT_31_HUGOTON3_GRANTTAP3_115kV_3PH	*3-Phase fault on the Grant Tap – Hugoton 115kV near the Hugoton 115kV bus.*
32	FLT_32_HUGOTON3_GRANTTAP3_115kV_1PH	*Single-phase fault similar to previous fault.*
33	FLT_33_KISMET3_CIMRIVTP_115kV_3PH	*3-Phase fault on the Kismet – Cimarron River Tap 115kV near the Kismet 115kV bus.*
34	FLT_34_KISMET3_CIMRIVTP_115kV_1PH	*Single-phase fault similar to previous fault.*
35	FLT_35_KISMET3_CUDAHY3_115kV_3PH	*3-Phase fault on the Cudahy – Kismet 115kV near the Kismet 115kV bus.*
36	FLT_36_KISMET3_CUDAHY3_115kV_1PH	*Single-phase fault similar to previous fault.*

	Contingency Number and Name	Description
37	FLT_37_CIMRIVTP_ELIBER3_115kV_3PH	*3-Phase fault on the East Liberal – Cimarron River Tap 115kV near the Cimarron River Tap 115kV bus.*
38	FLT_38_CIMRIVTP_ELIBER3_115kV_1PH	*Single-phase fault similar to previous fault.*
39	FLT_39_CUDAHY3_G0879T_115kV_3PH	*3-Phase fault on the Cudahy – Crooked Creek 115kV near the Cudahy 115kV bus.*
40	FLT_40_CUDAHY3_G0879T_115kV_1PH	*Single-phase fault similar to previous fault.*
41	FLT_41_MEDLDG3_SUNCITY3_115kV_3PH	*3-Phase fault on the Sun City – Medicine Lodge 115kV near the Medicine Lodge 115kV bus.*
42	FLT_42_MEDLDG3_SUNCITY3_115kV_1PH	*Single-phase fault similar to previous fault.*
43	FLT_43_MULGREN6_SHAYS6_230kV_3PH	*3-Phase fault on the Mullergren – South Hays 230kV near the Mullergren 230kV bus.*
44	FLT_44_MULGREN6_SHAYS6_230kV_1PH	*Single-phase fault similar to previous fault.*
45	FLT_45_MULGREN6_CIRCLE6_230kV_3PH	*3-Phase fault on the Mullergren – Circle 230kV near the Mullergren 230kV bus.*
46	FLT_46_MULGREN6_CIRCLE6_230kV_1PH	*Single-phase fault similar to previous fault.*
47	FLT_47_PRATT3_NINNESC3_115kV_3PH	*3-Phase fault on the Ninnescah – Pratt 115kV near the Pratt 115kV bus.*
48	FLT_48_PRATT3_NINNESC3_115kV_1PH	*Single-phase fault similar to previous fault.*
49	FLT_49_PRATT3_SAWYER3_115kV_3PH	*3-Phase fault on the Pratt – Sawyer 115kV near the Pratt 115kV bus.*
50	FLT_50_PRATT3_SAWYER3_115kV_1PH	*Single-phase fault similar to previous fault.*
51	FLT_51_SPEARVL6_MLRGREN6_230kV_3PH	*3-Phase fault on the Mullergren – Spearville 230kV near the Spearville 230kV bus.*
52	FLT_52_SPEARVL6_MLRGREN6_230kV_1PH	*Single-phase fault similar to previous fault.*
53	FLT_53_SPEARVL6_SPEARVL3_230_115kV_3PH	*3-Phase fault on the Spearville 230/115/13.8kV transformer near the Spearville 230kV bus.*
54	FLT_54_SSTARTP3_NFTDODG3_115kV_3PH	*3-Phase fault on the North Fort Dodge – Shooting Star Tap 115kV near the Shooting Star Tap 115kV bus.*
55	FLT_55_SSTARTP3_NFTDODG3_115kV_1PH	*Single-phase fault similar to previous fault.*
56	FLT_56_AXTELL3_PAULINE3_345kV_3PH	*3-Phase fault on the Axtell – Pauline 345kV near the Axtell 345kV bus.*
57	FLT_57_AXTELL3_PAULINE3_345kV_1PH	*Single-phase fault similar to previous fault.*
58	FLT_58_AXTELL3_SWEETW3_345kV_3PH	*3-Phase fault on the Axtell – Sweetwater 345kV near the Axtell 345kV bus.*
59	FLT_59_AXTELL3_SWEETW3_345kV_1PH	*Single-phase fault similar to previous fault.*
60	FLT_60_HITCHLAND7_BEAVERCO_345kV_3PH	*3-Phase fault on the Beaver County – Hitchland 345kV near the Hitchland 345kV bus.*
61	FLT_61_HITCHLAND7_BEAVERCO_345kV_1PH	*Single-phase fault similar to previous fault.*
62	FLT_62_BUCKNER7_BEAVERCO_345kV_3PH	*3-Phase fault on the Beaver County – Buckner 345kV near the Buckner 345kV bus.*
63	FLT_63_BUCKNER7_BEAVERCO_345kV_1PH	*Single-phase fault similar to previous fault.*
64	FLT_64_BEAVERCO_WWRDEHV7_345kV_3PH	*3-Phase fault on the Beaver County – Woodward 345kV near the Beaver County 345kV bus.*
65	FLT_65_BEAVERCO_WWRDEHV7_345kV_1PH	*Single-phase fault similar to previous fault.*
66	FLT_66_HOLCOMB7_FINNEY7_345kV_3PH	*3-Phase fault on the Finney – Holcomb 345kV near the Holcomb 345kV bus.*
67	FLT_67_HOLCOMB7_FINNEY7_345kV_1PH	*Single-phase fault similar to previous fault.*

Power Factor Analysis – Capacitor and Reactor Sizing

Power factor analysis was not performed in this study. The results from the previous impact study "GEN-2008-018 Impact Restudy for Generator Modification (Turbine Change)" remain applicable for the requested modification. That study demonstrated that the facility will be required to maintain a 95% lagging (providing VARs) and 95% leading (absorbing VARs) power factor at the point of interconnection. That study, posted to SPP OASIS on June 11, 2013, can be found at the following web address:

http://sppoasis.spp.org/documents/swpp/transmission/studies/files/2008_Generation_Studies/GEN-2008-018_Impact_Restudy-6-11-2013.pdf

To maintain voltage stability, it is required for the customer to install at least 30MVars of capacitor banks on its 34.5kV buses in addition to the generator reactive capability.

In order to perform the reactor sizing analysis, the request and equivalent transmission lines and collectors systems were modeled using specifications provided by the Customer. The cases were modeled such that the generation and capacitor banks are switched out of service but the wind farm's transmission subsystem (345kV and 34.5kV) remains in-service. The charging from these open-ended transmission facilities was then monitored for worst case reactive power injections into the POI under differing system conditions.

Analysis showed that the approximate amount of charging provided by the GEN-2008-018 subsystem is 35.9 Mvars. It was recommended that the Customer install at least 36.0 Mvars of Reactors to compensate for this injection into the transmission system. It was recommended that all of this reactive support be installed at the POI to counter the injection of capacitance from the long (approximately 24 miles) 345kV Customer substation lead. Should the Customer choose to not install all of the reactors at the POI, additional reactors may be required.

Results

Results of the stability analysis are summarized in Table 5. These results are valid for GEN-2008-018**Error! Reference source not found.** interconnecting with a generation amount up to 250.0 MW. The results indicate that the transmission system remains stable for all contingencies studied. All faults were run for both summer and winter cases, and no tripping occurred in this study. Complete sets of plots for summer and winter cases will be available upon request.

Table 5: Fault Analysis Results

Contingency Number and Name		2014SP	2014WP	2023SP
1	FLT_01_WWRDEHV7_TATONGA7_345kV_3PH	Stable	Stable	Stable
2	FLT_02_WWRDEHV7_TATONGA7_345kV_1PH	Stable	Stable	Stable
3	FLT_03_FINNEY7_HITCHLAND7_345kV_3PH	Stable	Stable	Stable
4	FLT_04_FINNEY7_HITCHLAND7_345kV_1PH	Stable	Stable	Stable
5	FLT_05_SETAB7_MINGO7_345kV_3PH	Stable	Stable	Stable
6	FLT_06_SETAB7_MINGO7_345kV_1PH	Stable	Stable	Stable
7	FLT_07_FINNEY7_HOLCOMB7_345kV_3PH	Stable	Stable	Stable
8	FLT_08_FINNEY7_HOLCOMB7_345kV_1PH	Stable	Stable	Stable
9	FLT_09_FINNEY7_LAMAR7_345kV_3PH	Stable	Stable	Stable
10	FLT_10_FINNEY7_LAMAR7_345kV_1PH	Stable	Stable	Stable
11	FLT_11_KNOLL6_POSTROCK6_230kV_3PH	Stable	Stable	Stable
12	FLT_12_KNOLL6_POSTROCK6_230kV_1PH	Stable	Stable	Stable
13	FLT_13_KNOLL6_SMKYHL6_230kV_3PH	Stable	Stable	Stable
14	FLT_14_KNOLL6_SMKYHL6_230kV_1PH	Stable	Stable	Stable
15	FLT_15_HOLCOMB7_BUCKNER7_345kV_3PH	Stable	Stable	Stable
16	FLT_16_HOLCOMB7_BUCKNER7_345kV_1PH	Stable	Stable	Stable
17	FLT_17_BUCKNER7_SPERVL7_345kV_3PH	Stable	Stable	Stable
18	FLT_18_BUCKNER7_SPERVL7_345kV_1PH	Stable	Stable	Stable
19	FLT_19_SPERVL7_POSTROCK7_345kV_3PH	Stable	Stable	Stable
20	FLT_20_SPERVL7_POSTROCK7_345kV_1PH	Stable	Stable	Stable

	Contingency Number and Name	2014SP	2014WP	2023SP
21	FLT_21_PIONEER3_HICKOCK3_115kV_3PH	Stable	Stable	Stable
22	FLT_22_PIONEER3_HICKOCK3_115kV_1PH	Stable	Stable	Stable
23	FLT_23_PIONEER3_PKGOAB3_115kV_3PH	Stable	Stable	Stable
24	FLT_24_PIONEER3_PKGOAB3_115kV_1PH	Stable	Stable	Stable
25	FLT_25_HOLCOMB7_HOLCOMB3_345_115kV_3PH	Stable	Stable	Stable
26	FLT_26_HOLCOMB7_SETAB7_345kV_3PH	Stable	Stable	Stable
27	FLT_27_HOLCOMB7_SETAB7_345kV_1PH	Stable	Stable	Stable
28	FLT_28_SPERVIL7_SPEARVL6_345_230kV_3PH	Stable	Stable	Stable
29	FLT_29_HUGOTON3_WALKMYR3_115kV_3PH	Stable	Stable	Stable
30	FLT_30_HUGOTON3_WALKMYR3_115kV_1PH	Stable	Stable	Stable
31	FLT_31_HUGOTON3_GRANTTAP3_115kV_3PH	Stable	Stable	Stable
32	FLT_32_HUGOTON3_GRANTTAP3_115kV_1PH	Stable	Stable	Stable
33	FLT_33_KISMET3_CIMRIVTP_115kV_3PH	Stable	Stable	Stable
34	FLT_34_KISMET3_CIMRIVTP_115kV_1PH	Stable	Stable	Stable
35	FLT_35_KISMET3_CUDAHY3_115kV_3PH	Stable	Stable	Stable
36	FLT_36_KISMET3_CUDAHY3_115kV_1PH	Stable	Stable	Stable
37	FLT_37_CIMRIVTP_ELIBER3_115kV_3PH	Stable	Stable	Stable
38	FLT_38_CIMRIVTP_ELIBER3_115kV_1PH	Stable	Stable	Stable
39	FLT_39_CUDAHY3_G0879T_115kV_3PH	Stable	Stable	Stable
40	FLT_40_CUDAHY3_G0879T_115kV_1PH	Stable	Stable	Stable
41	FLT_41_MEDLDG3_SUNCITY3_115kV_3PH	Stable	Stable	Stable
42	FLT_42_MEDLDG3_SUNCITY3_115kV_1PH	Stable	Stable	Stable
43	FLT_43_MULGREN6_SHAYS6_230kV_3PH	Stable	Stable	Stable
44	FLT_44_MULGREN6_SHAYS6_230kV_1PH	Stable	Stable	Stable
45	FLT_45_MULGREN6_CIRCLE6_230kV_3PH	Stable	Stable	Stable
46	FLT_46_MULGREN6_CIRCLE6_230kV_1PH	Stable	Stable	Stable
47	FLT_47_PRATT3_NINNESC3_115kV_3PH	Stable	Stable	Stable
48	FLT_48_PRATT3_NINNESC3_115kV_1PH	Stable	Stable	Stable
49	FLT_49_PRATT3_SAWYER3_115kV_3PH	Stable	Stable	Stable
50	FLT_50_PRATT3_SAWYER3_115kV_1PH	Stable	Stable	Stable
51	FLT_51_SPEARVL6_MLRGREN6_230kV_3PH	Stable	Stable	Stable
52	FLT_52_SPEARVL6_MLRGREN6_230kV_1PH	Stable	Stable	Stable
53	FLT_53_SPEARVL6_SPEARVL3_230_115kV_3PH	Stable	Stable	Stable
54	FLT_54_SSTARTP3_NFTDODG3_115kV_3PH	Stable	Stable	Stable
55	FLT_55_SSTARTP3_NFTDODG3_115kV_1PH	Stable	Stable	Stable
56	FLT_56_AXTELL3_PAULINE3_345kV_3PH	Stable	Stable	Stable
57	FLT_57_AXTELL3_PAULINE3_345kV_1PH	Stable	Stable	Stable
58	FLT_58_AXTELL3_SWEETW3_345kV_3PH	Stable	Stable	Stable
59	FLT_59_AXTELL3_SWEETW3_345kV_1PH	Stable	Stable	Stable
60	FLT_60_HITCHLAND7_BEAVERCO_345kV_3PH	Stable	Stable	Stable
61	FLT_61_HITCHLAND7_BEAVERCO_345kV_1PH	Stable	Stable	Stable
62	FLT_62_BUCKNER7_BEAVERCO_345kV_3PH	Stable	Stable	Stable
63	FLT_63_BUCKNER7_BEAVERCO_345kV_1PH	Stable	Stable	Stable
64	FLT_64_BEAVERCO_WWRDEHV7_345kV_3PH	Stable	Stable	Stable
65	FLT_65_BEAVERCO_WWRDEHV7_345kV_1PH	Stable	Stable	Stable
66	FLT_66_HOLCOMB7_FINNEY7_345kV_3PH	Stable	Stable	Stable
67	FLT_67_HOLCOMB7_FINNEY7_345kV_1PH	Stable	Stable	Stable

FERC LVRT Compliance

FERC Order #661A places specific requirements on wind farms through its Low Voltage Ride Through (LVRT) provisions. For Interconnection Agreements signed after December 31, 2006, wind farms shall stay on line for faults at the POI that draw the voltage down at the POI to 0.0 pu.

Fault contingencies were developed to verify that wind farms remain on line when the POI voltage is drawn down to 0.0 pu. These contingencies are shown in Table 6.

Table 6: LVRT Contingencies

	Contingency Number and Name	Description
1	FLT_03_FINNEY7_HITCHLAND7_345kV_3PH	*3-Phase fault on the Finney – Hitchland 345kV near the Finney 345kV bus.*
2	FLT_07_FINNEY7_HOLCOMB7_345kV_3PH	*3-Phase fault on the Finney – Holcomb 345kV near the Finney 345kV bus.*

Based on the dynamic results and with all network upgrades in service, GEN-2008-018 did not cause any stability problems and remained stable for all faults studied. Additionally, the project wind farm was found to stay connected during the contingencies that were studied and therefore, meet the Low Voltage Ride Through (LVRT) requirements of FERC Order #661A.

Conclusion

<OMITTED TEXT> (Customer) has requested a modification to its Generator Interconnection Request, GEN-2008-018, in accordance with Section 4.4 of the Generator Interconnection Procedures (GIP) of the Southwest Power Pool Open Access Transmission Tariff (OATT). GEN-2008-018 is a request for interconnection of 405.15MW of wind generation to be interconnected as an Energy Resource (ER) into a transmission facility of the Southwestern Public Service Company (SPS) in Finney County, Kansas. SPP has undertaken this Modification Request Impact Study (MRIS) to determine the impacts to the transmission system of accommodating the modification request.

For the typical MRIS, both a power flow and transient stability analysis are conducted. The MRIS assumes that all Generator Interconnection queued projects and assigned system upgrades will go into service to determine adverse impacts from the modification request.

The Customer has requested a system impact study to confirm that a modification in its request for interconnection, a reduction to 350MW of wind generation, will alleviate the need for the Finney-Holcomb 345kV circuit #2 and will not adversely impact the costs for upgrades for other interconnection customers. A second request to evaluate the project at 250MW was made in the event that the 350MW request could not be accommodated. At 250MW, GEN-2008-018 is requesting the interconnection of one-hundred thirty-five (135) General Electric 1.85 MW wind turbine generators and associated facilities into the Finney 345kV substation.

A power flow analysis shows that with ERIS Network Upgrades identified in ICS-2008-001-5, the Customer's request to reduce its interconnection to 250MW of wind generation will provide adequate interconnection service to alleviate the need for the Finney-Holcomb 345kV circuit #2 and will not affect the cost of Network upgrades for other Interconnection Customers. Powerflow analysis was based on both summer and winter peak conditions and light loading cases. The request at 350MW could not be accommodated due to potential voltage collapse for the outage of the existing Finney-Holcomb 345kV line.

A transient stability analysis has determined that the transmission system, without the Finney-Holcomb 345kV circuit #2, will remain stable for the sixty-seven (67) selected faults for the interconnection of GEN-2008-018 with one-hundred thirty-five (135) General Electric 1.85 MW wind turbine generators and associated facilities into the Finney 345kV substation.

The Generating Facility will be required to maintain a 95% lagging (providing vars) and 95% leading (absorbing vars) power factor at the point of interconnection. Additionally, GEN-2008-018 is required to install capacitor banks (30MVar) on its 34.5kV bus and reactor banks (36Mvar) on its 345kV bus in addition to its generator reactive capability (+/- 0.90 power factor)

<u>The request of the Customer to reduce its interconnection capacity to 250MW and the resultant removal of the requirement of the Finney-Holcomb 345kV circuit #2 is not considered a Material Modification under GIP 4.4.</u>

It should be noted that although this MRIS analyzed many of the most probable contingencies, it is not an all-inclusive list that can account for every operational situation. Because of this, it is likely that the Customer may be required to reduce their generation output to 0 MW under certain system conditions to allow system operators to maintain the reliability of the transmission network.

Nothing within this System Impact Study constitutes a request for transmission service or confers upon the Interconnection Customer any right to receive transmission service rights. Should the Customer require transmission service, those rights should be requested through SPP’s Open Access Same-Time Information System (OASIS).

This study fulfills SPP’s requirements in accordance with GIP 4.4.3 to evaluate the Customer’s modification. In accordance, with GIP 4.4.2, the Customer may choose to withdraw its request for modification.