Southwest Power Pool

Interim Operational Impact Study for Generation Interconnection Request GEN-2008-044 GEN-2010-011

SPP Generation Interconnection

(GEN-2008-044 & GEN-2010-011)

December 2010

Executive Summary

<OMITTED TEXT> (Customer) has requested an Impact Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for interconnection of 227.5 MW of wind generation within the balancing authority of Oklahoma Gas and Electric Corporation (OKGE) in Dewey County, Oklahoma. SPP expects to complete the study process as part of the cluster study DISIS-2010-001. SPP may not be able to complete all interconnection studies required under the OATT in time for the Customer's requested in-service date of July 1, 2011. Therefore, Customer has requested this Interim Operation Impact Study (IOIS) to determine the impacts of interconnecting its generating facility to the transmission system before all required studies can be completed and all required Network Upgrades identified in the DISIS-2010-001 posted on July 30, 2010 can be placed into service. Interim Operational Impact Studies are conducted under GIP Section 11A of the SPP OATT.

This Interim Operational Impact Study covers GEN-2008-044 (197.8MW) and GEN-2010-011 (29.7MW) which are projects by the same customer that interconnect at the same point of interconnection (POI). In this report GEN-2008-044 will refer to both GEN-2008-044 and GEN-2010-011 unless otherwise stated.

This study is intended as an Interim Operational Impact Study that will be used in order to tender an Interim Interconnection Agreement to the Customer for Interim Interconnection Service. If an Interim Interconnection Agreement is not executed with the Customer, this study will be inapplicable. If an Interim Interconnection Agreement is executed with the Customer, this study will be considered inapplicable upon termination of such Interim Interconnection Agreement.

Alternatively, this study may be used as a Limited Operation Study applicable to Article 5.9 of the Standard Generation Interconnection Agreement (GIA). The same conditions apply that if any assumptions are changed, a restudy will need to be performed to determine the feasibility of Limited Operation.

This study assumed that only the higher queued projects identified in Table 1 might go into service before the completion of all Network Upgrades identified in DISIS-2010-001. If any additional generation projects not identified in Table 1 but with queue priority higher than GEN-2008-0044 goes into commercial operation before all Network Upgrades identified through the DISIS-2010-001 study process as required, then this study must be conducted again to determine whether sufficient interim interconnection capacity exists to interconnect the GEN-2008-044 interconnection request in addition to all higher priority requests in operation or pending operation.

For the stability analysis the wind generation facility was studied with ninety-five (95) Siemens SWT223 2.3 MW wind turbine generators and three (3) Siemens 3.0 MW wind turbine generators. This stability study addresses the dynamic stability effects of interconnecting the plant to the rest of the OKGE transmission system for the system condition as it will be on December 1, 2011. Two seasonal base cases were used in the study to analyze the stability impacts of the proposed generation facility. The cases studied were 2011 summer peak and 2011 winter peak cases modified to reflect system conditions at the requested in-service date. Each case was modified to include prior queued projects that are listed in the body of the report. Twenty-eight (28) contingencies were identified for use in this study. The Siemens wind turbines were modeled using information provided by the Customer.

The study has indicated that the Interconnection Customer will only be able to interconnect 80 MW before network upgrades can be placed in service. Interconnecting more generation than 80 MW may cause system instability and is not acceptable. The study has also determined that the installation of a Special Protection Scheme (SPS) designed to trip the study generation for the outage of the Northwest – Tatonga 345kV line will alleviate any system instability. This Special Protection Scheme was approved by the SPP Market and Operations Committee in December 2010. Therefore, the Interconnection Customer Facility will be allowed to interconnect the entire 227Mw on a temporary basis with the SPS in place.

The costs for network upgrades and the interconnection facilities for interim operation are estimated to be $4,000,000. The Customer will also be required to provide additional security in the amount of $4,827,000 per the DISIS-2010-001 study posted in July, 2010. This amount of security will be adjusted as the GEN-2008-044 interconnection request advances through the Cluster interconnection process as stated in SPP's OASIS posting.

Nothing in this study should be construed as a guarantee of transmission service. If the customer wishes to sell power from the facility, a separate request for transmission service shall be requested on Southwest Power Pool's OASIS by the Customer.

1.0 Introduction

<OMITTED TEXT> (Customer) has requested an Impact Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for interconnection of 227.5 MW of wind generation within the balancing authority of Oklahoma Gas and Electric Corporation (OKGE) in Dewey County, Oklahoma. SPP expects to complete the Impact Study as part of the cluster study DISIS-2010-001. SPP may not be able to complete all interconnection studies required under the OATT in time for the Customer's requested in-service date of July 1, 2011. Therefore, Customer has requested this Interim Operation Impact Study (IOIS) to determine the impacts of interconnecting its generating facility to the transmission system before all required studies can be completed and all required Network Upgrades identified in the DISIS-2010-001 posted on July 30, 2010 can be placed into service. Interim Operational Impact Studies are conducted under GIP Section 11A of the SPP OATT.

This Interim Operational Impact Study covers GEN-2008-044 (197.8MW) and GEN-2010-011 (29.7MW) which are projects by the same customer that interconnect at the same point of interconnection (POI). In this report GEN-2008-044 will refer to both GEN-2008-044 and GEN-2010-011 unless otherwise stated.

This Impact study addresses the dynamic stability effects of interconnecting the plant to the rest of the OKGE transmission system for the system condition as it will be on December 1, 2011. The wind generation facility was studied with ninety-five (95) Siemens SWT223 2.3 MW wind turbine generators and three (3) Siemens 3.0 MW wind turbine generators. Two seasonal base cases were used in the study to analyze the stability impacts of the proposed generation facility. The cases studied were modified versions of the 2011 summer peak and 2011 winter peak to reflect the system conditions at the requested in-service date. Each case was modified to include prior queued projects that are listed in the body of the report. Twenty-eight (28) contingencies were identified for this study.

2.0 Purpose

The purpose of this IOIS is to evaluate the impact of the proposed interconnection on the reliability of the Transmission System. The IOIS considers the Base Case as well as all Generating Facilities (and with respect to (b) below, any identified Network Upgrades associated with such higher queued interconnection) that, on the date the IOIS 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 higher queued Interconnection Request to interconnect to the Transmission System listed in Table 1; or
d) have no Queue Position but have executed an LGIA or requested that an unexecuted LGIA be filed with FERC.

Any changes to these assumptions, for example, one or more of the previously queued projects not included in this study signing an interconnection agreement, may require a re-study of this request at the expense of the customer.

Nothing in this System Impact Study constitutes a request for transmission service or confers upon the Interconnection Customer any right to receive transmission service.

3.0 Facilities

3.1 Generating Facility

The customer project was modeled as shown in Figure 1.

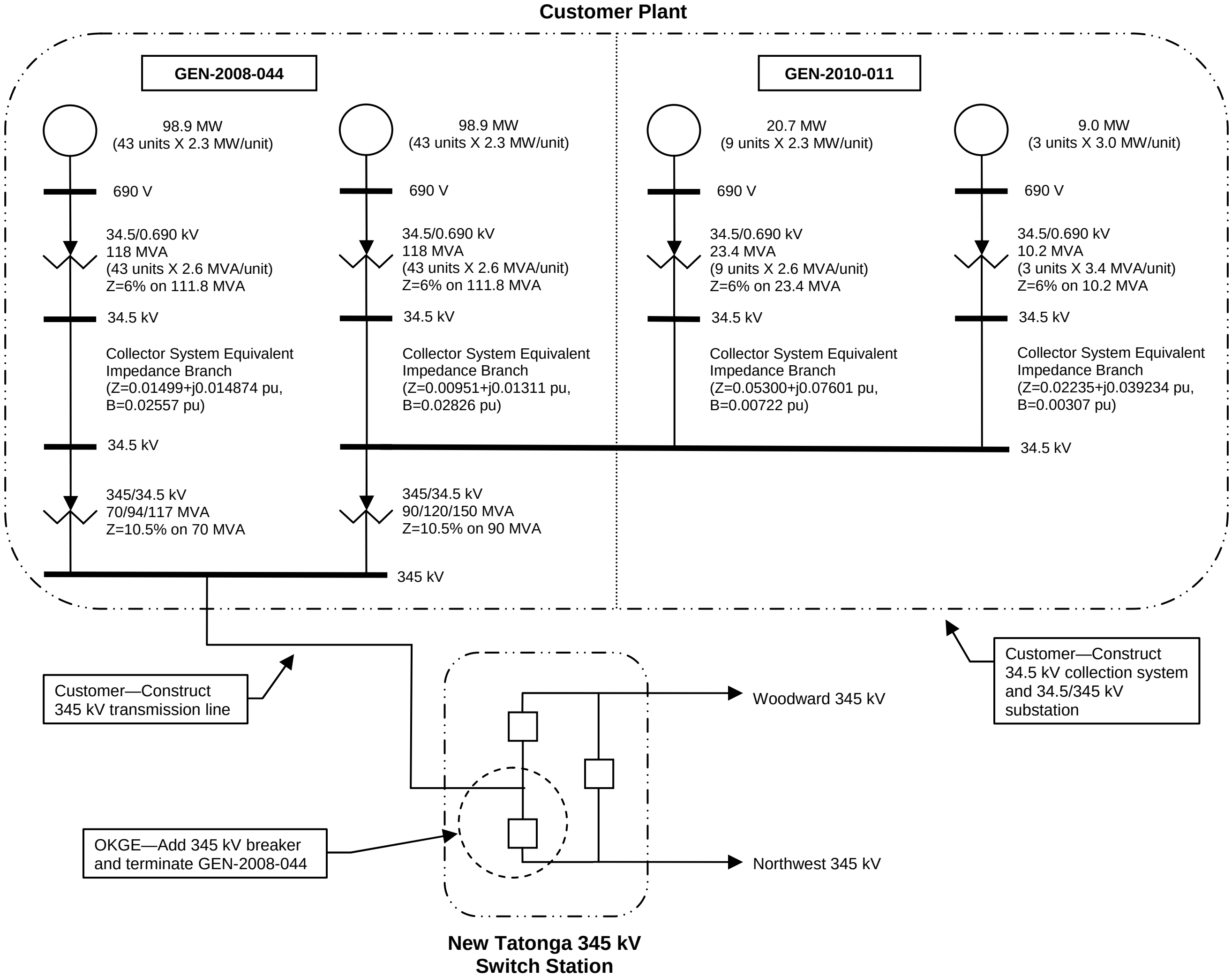

Figure 1: GEN-2008-044 Facility and Proposed Interconnection Configuration

3.2 Interconnection Facility

The Point of Interconnection will be at the Tatonga Substation. Figure 1 shows the proposed POI.

The cost to interconnect on an Interim basis is estimated at $4,000,000.

Customer's latest estimate for cost responsibility for Interconnection Service is given in DISIS-2010-001 at $4,827,000. The Customer will be required to provide additional security in this amount to move forward into an Interim Interconnection Agreement.

4.0 Power Flow Analysis

A powerflow analysis was conducted for the Interconnection Customer's facility using a modified version of the 2011 spring, 2011 summer, and 2011 winter seasonal models. The output of the Interconnection Customer's facility was offset in the model by a reduction in output of existing online SPP generation. This method allows the request to be studied as an Energy Resource (ERIS) Interconnection Request. This analysis was conducted assuming that certain previous queued requests in the immediate area of this interconnect request were in-service.

The Southwest Power Pool (SPP) Criteria states that:

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

The following higher queued projects were included in the power flow analysis. If any additional higher queue positions come into service, a restudy will need to be performed.

Table 1: Prior Queued Projects

Project	MW
GEN-2001-014	94.5
GEN-2001-037	102.0
GEN-2002-005	118.5
GEN-2005-008	120.0
GEN-2006-024S	18.9
GEN-2006-046	131.0
GEN-2007-050	150.0
GEN-2008-003	101.2

The ACCC and function of PSS/E was used to simulate single contingencies in portions of or all of the control areas of OKGE, Western Farmers Electric, Oklahoma Municipal Power Authority, and other control areas within SPP and the resulting data analyzed. This satisfies the "more probable" contingency testing criteria mandated by NERC and the SPP criteria.

In accordance with SPP study procedures, ACCC analysis was performed with the cluster (prior queued projects) at 80% nameplate and the study plant at 100% nameplate. Certain contingencies were also run with all prior queued projects at 100% nameplate. The ACCC analysis indicates that as a result of the Customer's project at full nameplate power the OKGE transmission system may experience voltage collapse for the loss of Tatonga – Northwest 345kV transmission line.   The results of the ACCC analysis are shown in Table 2. Table 3 shows the results of the ACCC analysis with all projects at 100% nameplate.

Table 2: ACCC Analysis

Season	Source	Element	Direction	TDF	Rating	Loading	Contingency
11G	G08_044/G10_011	'FPL SWITCH - WOODWARD 138KV CKT 1'	TO->FROM	0.602	153	186	'NORTHWEST - TATONGA7 345.00 345KV CKT 1'
11G	G08_044/G10_011	'FPL SWITCH - MOORELAND 138KV CKT 1'	FROM->TO	0.602	153	124	'NORTHWEST - TATONGA7 345.00 345KV CKT 1'
11G	G08_044/G10_011	'ROMAN NOSE - SOUTHARD 138KV CKT 1'	TO->FROM	0.231	153	103	'NORTHWEST - TATONGA7 345.00 345KV CKT 1'
11G	G08_044/G10_011	'MOORELAND - NINMILE 4 138.00 138KV CKT 1'	FROM->TO	0.224	179	103	'NORTHWEST - TATONGA7 345.00 345KV CKT 1'
11G	G08_044/G10_011	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1'	TO->FROM	0.193	124	126	'NORTHWEST - TATONGA7 345.00 345KV CKT 1'
11G	G08_044/G10_011	'MOOREWOOD SW - NINMILE 4 138.00 138KV CKT 1'	TO->FROM	0.223	179	103	'NORTHWEST - TATONGA7 345.00 345KV CKT 1'
11SP	G08_044/G10_011	'FPL SWITCH - WOODWARD 138KV CKT 1'	TO->FROM	0.602	153	170	'NORTHWEST - TATONGA7 345.00 345KV CKT 1'
11SP	G08_044/G10_011	'FPL SWITCH - MOORELAND 138KV CKT 1'	FROM->TO	0.602	153	115	'NORTHWEST - TATONGA7 345.00 345KV CKT 1'
11SP	G08_044/G10_011	'ROMAN NOSE - SOUTHARD 138KV CKT 1'	TO->FROM	0.231	153	110	'NORTHWEST - TATONGA7 345.00 345KV CKT 1'
11SP	G08_044/G10_011	'MOORELAND - NINMILE 4 138.00 138KV CKT 1'	FROM->TO	0.224	179	124	'NORTHWEST - TATONGA7 345.00 345KV CKT 1'
11SP	G08_044/G10_011	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1'	TO->FROM	0.193	124	124	'NORTHWEST - TATONGA7 345.00 345KV CKT 1'
11SP	G08_044/G10_011	'MOOREWOOD SW - NINMILE 4 138.00 138KV CKT 1'	TO->FROM	0.223	179	124	'NORTHWEST - TATONGA7 345.00 345KV CKT 1'
11SP	G08_044/G10_011	'EL RENO - ROMAN NOSE 138KV CKT 1'	TO->FROM	0.23	153	103	'NORTHWEST - TATONGA7 345.00 345KV CKT 1'
11WP	G08_044/G10_011	'FPL SWITCH - WOODWARD 138KV CKT 1'	TO->FROM	0.602	153	144	'NORTHWEST - TATONGA7 345.00 345KV CKT 1'
11WP	G08_044/G10_011	'FPL SWITCH - MOORELAND 138KV CKT 1'	FROM->TO	0.602	153	117	'NORTHWEST - TATONGA7 345.00 345KV CKT 1'
11WP	G08_044/G10_011	'ROMAN NOSE - SOUTHARD 138KV CKT 1'	TO->FROM	0.231	153	103	'NORTHWEST - TATONGA7 345.00 345KV CKT 1'
11WP	G08_044/G10_011	'MOORELAND - NINMILE 4 138.00 138KV CKT 1'	FROM->TO	0.224	179	113	'NORTHWEST - TATONGA7 345.00 345KV CKT 1'
11WP	G08_044/G10_011	'GLASS MOUNTAIN - MOORELAND 138KV CKT 1'	TO->FROM	0.193	124	137	'NORTHWEST - TATONGA7 345.00 345KV CKT 1'
11WP	G08_044/G10_011	'MOOREWOOD SW - NINMILE 4 138.00 138KV CKT 1'	TO->FROM	0.223	179	113	'NORTHWEST - TATONGA7 345.00 345KV CKT 1'

Table 3: ACCC Analysis with Prior Queued at 100% nameplate

Season	Source	Element	Direction	TDF	Rating	Loading	Contingency
11G	G08_044/G10_011	Non-converged contingency					'NORTHWEST - TATONGA7 345.00 345KV CKT 1'
11SP	G08_044/G10_011	Non-converged contingency					'NORTHWEST - TATONGA7 345.00 345KV CKT 1'
11WP	G08_044/G10_011	Non-converged contingency					'NORTHWEST - TATONGA7 345.00 345KV CKT 1'

5.0 Power Factor Analysis

A detailed power factor analysis was completed in the DISIS-2010-001 study, and was not repeated for this interim study.

6.0 Stability Analysis

6.1 Contingencies Simulated

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

The faults that were defined and simulated are listed in Table 4.

Table 4: Contingencies Evaluated

Cont. No.	Cont. Name	Description
1	FLT1_3PH	3 phase fault on the Tatonga (515407) to Northwest (514880) 345kV line, near Tatonga. a. Apply fault at the Tatonga 345kV bus. b. Clear fault after 4 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 4 cycles, then trip the line in (b) and remove fault.
2	FLT2_1PH	*Single phase fault and sequence like previous*
3	FLT3_3PH	3 phase fault on the Woodward (515375) to Tatonga (515407) 345kV line, near Woodward. a. Apply fault at the Woodward 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
4	FL4_1PH	*Single phase fault and sequence like previous*
5	FLT5_3PH	3 phase fault on the Northwest (514880) to Spring Creek (514881) 345kV line, near Nortwest. a. Apply fault at the Northwest 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
6	FLT6_1PH	*Single phase fault and sequence like previous*
7	FL7_3PH	3 phase fault on the Northwest (514880) to Cimaron (514901) 345kV line, near Cimaron. a. Apply fault at the Cimaron 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
8	FLT8_1PH	*Single phase fault and sequence like previous*
9	FLT9_3PH	3 phase fault on the Northwest (514880) to Arcadia (514908) 345kV line, near Arcadia. a. Apply fault at the Arcadia 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
10	FLT10_1PH	*Single phase fault and sequence like previous*
11	FLT11_3PH	3 phase fault on the Northwest 345kV/138kV autotransformer near the 345 kV bus (514880). a. Apply fault at the Northwest 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
12	FLT12_3PH	3 phase fault on the Woodward 345kV/138kV autotransformer near the 345 kV bus (515375). a. Apply fault at the Woodward 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.

Cont. No.	Cont. Name	Description
13	FLT13_3PH	3 phase fault on the Woodward (515376) to Woodward (514785) 138kV line, near Woodward (515376) Ckt1. a. Apply fault at the Woodward 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
14	FLT14_1PH	*Single phase fault and sequence like previous*
15	FLT15_3PH	3 phase fault on the Woodward (515376) to Iodine (514796) 138kV line, near Woodward (515376) Ckt1. a. Apply fault at the Woodward 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
16	FLT16_1PH	*Single phase fault and sequence like previous*
17	FLT17_3PH	3 phase fault on the Cimaron (514898) to El Reno (514819) 138kV line, near Cimaron. a. Apply fault at the Cimaron 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
18	FLT18_1PH	*Single phase fault and sequence like previous*
19	FLT19_3PH	3 phase fault on the Roman Nose (514823) to El Reno (514819) 138kV line, near Roman Nose. a. Apply fault at the Roman Nose 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
20	FLT20_1PH	*Single phase fault and sequence like previous*
21	FLT21_3PH	3 phase fault on the Tuttle Conoco (511425) to Cimaron (514898) 138kV line, near Tuttle Conoco. a. Apply fault at the Tuttle Conoco 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
22	FLT22_1PH	*Single phase fault and sequence like previous*
23	FLT23_3PH	3 phase fault on the Czech Hall (514894) to Cimaron (514898) 138kV line, near Czech Hall. a. Apply fault at the Czech Hall 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
24	FLT24_1PH	*Single phase fault and sequence like previous*
25	FLT25_3PH	3 phase fault on the Haymaker (514863) to Cimaron (514898) 138kV line, near Haymaker. a. Apply fault at the Czech Hall 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
26	FLT26_1PH	*Single phase fault and sequence like previous*

Cont. No.	Cont. Name	Description
27	FLT27_3PH	3 phase fault on the Jensen Tap (514820) to Cimaron (514898) 138kV line, near Jensen Tap. a. Apply fault at the Jensen Tap 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
28	FLT28_1PH	*Single phase fault and sequence like previous*

6.2 Further Model Preparation

The base cases contain prior queued projects as shown in Table 1. 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.

6.3 Results

Results of the stability analysis are summarized in Table 5. The results indicate that for certain outages, the transmission system becomes unstable. For both the summer and winter cases the generators at Mooreland become unstable for the Tatonga (POI) to Northwest 345kV one phase and three phase contingencies. Additionally for the winter case the project windfarm generators tripped off-line as did a number of the prior queued generators. However, for the summer case none of the generators tripped off-line.

Additional simulations were conducted for the outage of the Tatonga to Northwest 345kV line to determine:

1. the effects of network upgrades,
2. the maximum power that can be injected at the POI with the current transmission topology (that is, no network upgrades to the transmission system), and
3. if an implementation of a special protection scheme will allow the customer wind facility to generate the requested maximum power.

These are discussed in the next three sections.

Stability plots for the simulations are in Appendix A.

6.3.1 Network Upgrades

A sensitivity was performed to determine the stability of the project with certain network upgrades installed. The network upgrade consists of implementing a portion of the SPP Priority Projects. Specifically, the upgrades are as follows:

1. Add 345kV double circuit from Woodward to Comanche
2. Add 345kV double circuit from Comanche to Medicine Lodge
3. Add 345kV double circuit from Medicine Lodge to Wichita

These upgrades were added to the summer and winter cases, and the simulations were run again using the same fault contingencies. The results for both cases show that the transmission system remained stable for all the contingencies simulated.

6.3.2 Maximum Power with no Network Upgrades

Analysis was done to determine the maximum power that can be injected into the POI without any additional upgrades. The maximum power that can be injected at the POI with no network upgrades was determined as follows:

1. Reduce the project windfarm power output in multiples of 2.3 MW (which is equivalent of one Siemens wind turbine)
2. Adjust the generator machine base for the number of machines.
3. Adjust the power factor range to be +/- 0.95

4. Run the Tatonga to Northwest 345kV contingency
5. Analyze results. If unstable go to step 1 and repeat steps 1-5.

The following maximum power levels were found:

1. Summer: 89.7MW (39 machines)
2. Winter: 92MW (40 machines)

The summer result is used because it is the worst case condition. A 10% stability margin was added. The final result is that the maximum power the project windfarm is allowed to generate is 80.5 MW (35 machines).

6.3.3 Special Protection Scheme

The following contingencies were used to simulate a special protection scheme to determine the effects on the transmission system:

Cont. No.	Cont. Name	Description
33	FLT33_3PH	3 phase fault on the Tatonga (515407) to Northwest (514880) 345kV line, near Tatonga. a. Apply fault at the Tatonga 345kV bus. b. Clear fault after 4 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 4 cycles, then trip the line in (b) and remove fault. e. Run 2.5 seconds f. Trip Tatonga (515407) to Woodward (515375) 345kV line. g. Drop the Customer wind facility out of service by dropping machines at 576500, 576510, 576600, and 576610.
34	FLT34_1PH	*Single phase fault and sequence like previous*

The results of these simulations show that for both the summer and winter cases and for both the three phase fault and the single line to ground fault the transmission system will remain stable for the Tatonga to Northwest 345kV line outage.

Table 5: Results of Simulated Contingencies

Cont. No.	Cont. Name	Description	Maximum Power Generated: 227.5 MW		Network Upgrades at Maximum Power Generated: 227.5 MW		Reduced Power Generated: 80.5 MW	
			2011 Summer	2011 Winter	2011 Summer	2011 Winter	2011 Summer	2011 Winter
1	FLT1_3PH	3 phase fault on the Tatonga (515407) to Northwest (514880) 345kV line, near Tatonga.	UNSTABLE[1]	UNSTABLE[1,2]	Stable	Stable	Stable	Stable
2	FLT2_1PH	*Single phase fault and sequence like previous*	UNSTABLE[1]	UNSTABLE[1,2]	Stable	Stable	Stable	Stable
3	FLT3_3PH	3 phase fault on the Woodward (515375) to Tatonga (515407) 345kV line, near Woodward.	Stable	Stable	Stable	Stable	Stable	Stable
4	FL4_1PH	*Single phase fault and sequence like previous*	Stable	Stable	Stable	Stable	Stable	Stable
5	FLT5_3PH	3 phase fault on the Northwest (514880) to Spring Creek (514881) 345kV line, near Nortwest.	Stable	Stable	Stable	Stable	Stable	Stable
6	FLT6_1PH	*Single phase fault and sequence like previous*	Stable	Stable	Stable	Stable	Stable	Stable
7	FL7_3PH	3 phase fault on the Northwest (514880) to Cimaron (514901) 345kV line, near Cimaron.	Stable	Stable	Stable	Stable	Stable	Stable
8	FLT8_1PH	*Single phase fault and sequence like previous*	Stable	Stable	Stable	Stable	Stable	Stable
9	FLT9_3PH	3 phase fault on the Northwest (514880) to Arcadia (514908) 345kV line, near Arcadia.	Stable	Stable	Stable	Stable	Stable	Stable
10	FLT10_1PH	*Single phase fault and sequence like previous*	Stable	Stable	Stable	Stable	Stable	Stable
11	FLT11_3PH	3 phase fault on the Northwest 345kV/138kV autotransformer near the 345 kV bus (514880).	Stable	Stable	Stable	Stable	Stable	Stable
12	FLT12_3PH	3 phase fault on the Woodward 345kV/138kV autotransformer near the 345 kV bus (515375).	Stable	Stable	Stable	Stable	Stable	Stable
13	FLT13_3PH	3 phase fault on the Woodward (515376) to Woodward (514785) 138kV line, near Woodward (515376) Ckt1.	Stable	Stable	Stable	Stable	Stable	Stable
14	FLT14_1PH	*Single phase fault and sequence like previous*	Stable	Stable	Stable	Stable	Stable	Stable
15	FLT15_3PH	3 phase fault on the Woodward (515376) to Iodine (514796) 138kV line, near Woodward (515376) Ckt1.	Stable	Stable	Stable	Stable	Stable	Stable
16	FLT16_1PH	*Single phase fault and sequence like previous*	Stable	Stable	Stable	Stable	Stable	Stable
17	FLT17_3PH	3 phase fault on the Cimaron (514898) to El Reno (514819) 138kV line, near Cimaron.	Stable	Stable	Stable	Stable	Stable	Stable
18	FLT18_1PH	*Single phase fault and sequence like previous*	Stable	Stable	Stable	Stable	Stable	Stable
19	FLT19_3PH	3 phase fault on the Roman Nose (514823) to El Reno (514819) 138kV line, near Roman Nose.	Stable	Stable	Stable	Stable	Stable	Stable
20	FLT20_1PH	*Single phase fault and sequence like previous*	Stable	Stable	Stable	Stable	Stable	Stable
21	FLT21_3PH	3 phase fault on the Tuttle Conoco (511425) to Cimaron (514898) 138kV line, near Tuttle Conoco.	Stable	Stable	Stable	Stable	Stable	Stable

22	FLT22_1PH	*Single phase fault and sequence like previous*	Stable	Stable	Stable	Stable	Stable	Stable
23	FLT23_3PH	3 phase fault on the Czech Hall (514894) to Cimaron (514898) 138kV line, near Czech Hall.	Stable	Stable	Stable	Stable	Stable	Stable
24	FLT24_1PH	*Single phase fault and sequence like previous*	Stable	Stable	Stable	Stable	Stable	Stable
25	FLT25_3PH	3 phase fault on the Haymaker (514863) to Cimaron (514898) 138kV line, near Haymaker.	Stable	Stable	Stable	Stable	Stable	Stable
26	FLT26_1PH	*Single phase fault and sequence like previous*	Stable	Stable	Stable	Stable	Stable	Stable
27	FLT27_3PH	3 phase fault on the Jensen Tap (514820) to Cimaron (514898) 138kV line, near Jensen Tap.	Stable	Stable	Stable	Stable	Stable	Stable
28	FLT28_1PH	*Single phase fault and sequence like previous*	Stable	Stable	Stable	Stable	Stable	Stable
33	FLT33_3PH	3 phase fault on the Tatonga (515407) to Northwest (514880) 345kV line, near Tatonga. a. Apply fault at the Tatonga 345kV bus. b. Clear fault after 4 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 4 cycles, then trip the line in (b) and remove fault. e. Run 2.5 seconds f. Trip Tatonga (515407) to Woodward (515375) 345kV line. g. Drop the Customer wind facility out of service by dropping machines at 576500, 576510, 576600, and 576610.	Stable	Stable				
34	FLT34_1PH	*Single phase fault and sequence like previous*	Stable	Stable				

1. **Generators at Mooreland became unstable**
2. **Project windfarm generators tripped off line. Several prior queued generators tripped off line.**

6.4 Special Protection Scheme Powerflow Sensitivity

A powerflow sensitivity was undertaken with the powerflow cases used in Section 4.0 to evaluate overloads under the contingency of Northwest-Tatonga 345kV with the study generation tripped off.

No overloads were observed for conditions with Northwest-Tatonga 345kV outaged and with the study generation tripped off that were not observed in a pre-project state.

6.5 Status of the Special Protection Scheme

The Interconnection Customer requested a Special Protection Scheme as allowed in SPP Criteria. The Special Protection scheme was approved by all applicable SPP Working Groups and the Market and Operations Policy Committee (MOPC) in December 2010.

Based on the approval of the SPS by the MOPC, the Interconnection Customer will be allowed to interconnect the entire 227MW on a temporary basis using the SPS until such time that the network upgrades can be placed in service or upon the next approval interval as stated in SPP Criteria.

6.6 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.

The project wind farm at the requested power level of 227.5 MW did not remain online for all the fault contingencies described in section 6.1. However, when the network upgrades described in section 6.3.1 were added or when the maximum power was reduced to the level described in section 6.3.2, GEN-2008-044 is found to be in compliance with FERC Order #661A.

7.0 Conclusion

<OMITTED TEXT> (Customer) has requested an Interim Operation Impact Study for interim interconnection service of 227.5 MW of wind generation within the balancing authority of Oklahoma Gas and Electric Company (OKGE) in Dewey County, Oklahoma, in accordance with Section 11A of the SPP OATT.

The results of this study show that the wind generation facility and the transmission system did not remain stable for all contingencies studied. In order for the project to operate at the requested 227.5 MW, upgrades to the network need to be completed. Also, this study shows that without network upgrades the maximum power level that the project may generate is 80.5 MW. Finally, this study shows that if a special protection scheme is implemented for the Tatonga to Northwest 345kV line outage the transmission system will remain stable for the maximum requested power generation.

Based on the approval of the SPP Market and Operations Committee, the Interconnection Customer will be able to interconnect the Generating Facility on a temporary basis for the full 227MW.

Also, GEN-2008-044 is found to be in compliance with FERC Order #661A only when network upgrades are installed or when the maximum generation is 80.5 MW without the network upgrades.

The Customer will also be required to provide security in the amount of $4,827,000 per the DISIS-2010-001 Impact Study in addition to the $4,000,000 in interconnection substation costs in order to move forward into an Interim Interconnection Agreement. Failure by the Customer to provide the security in this amount in accordance with the Interim Interconnection will cause this Interim Operation Impact Study and the Interim Interconnection Agreement to become invalid. The amount of security will be adjusted as the GEN-2008-044 interconnection request advances through the Cluster interconnection process as stated in SPP's OASIS posting.

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.

APPENDIX A.

STABILITY PLOTS

- FLT1_3PH Summer Peak – No upgrades, generation dispatched at 227MW
- FLT1_3PH Winter Peak – No upgrades, generation dispatched at 227MW
- FLT33_3PH Summer Peak – No upgrades, generation dispatched at 227MW, Special Protection Scheme in effect
- FLT33_3PH Winter Peak – No upgrades, generation dispatched at 227MW, Special Protection Scheme in effect

All plots available on request.