Interim Operational Impact Study for Generation Interconnection Request

GEN-2011-037

November, 2011

November 2011

Southwest Power Pool

Executive Summary

<OMITTED TEXT> (Customer) has requested an Interim Operation Impact Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for interconnection of 6.6 MW of wind generation within the balancing authority of Western Farmers Electric Cooperative (WFEC) in Apache County, Oklahoma. 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 Network Upgrades identified in the DISIS-2011-002 Impact Study can be placed into service. Interim Operational Impact Studies are conducted under GIP Section 11A.

This study assumed that only the higher queued projects identified in Table 3 of this study might go into service before the completion of all Network Upgrades identified in DISIS-2011-002. If any additional generation projects not identified in Table 3 but with queue priority equal to or over GEN-2011-037, those projects listed in Table 4, request to go into commercial operation before all Network Upgrades identified through the DISIS-2011-002 study process as required, then this study must be conducted again to determine whether sufficient limited interconnection capacity exists to interconnect the GEN-2011-037 interconnection request in addition to all higher priority requests in operation or pending operation.

A power flow analysis shows that the Customer's wind facility can interconnect its full 6.6 MW of interconnection capacity with transmission reinforcements. Power flow analysis was based on both summer and winter peak conditions and light loading cases.

The wind generation facility was studied as a 6.6 MW request in addition to the existing 99.0 MW project with a total of sixty-six (66) G.E. 1.6 MW wind turbine generators. This Impact study addresses the dynamic stability effects of interconnecting the plant to the rest of the WFEC transmission system for the system condition as it will be on December 31, 2012. Two seasonal base cases were used in the study to analyze the stability impacts of the proposed generation facility. The cases studied were modified 2011 summer peak and 2011 winter peak cases that were adjusted 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. Sixty-three (63) contingencies were identified for use in this study. The G.E. 1.6 MW wind turbines were modeled using information provided by the Customer.

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.

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Introduction

<OMITTED TEXT> (Customer) has requested an Interim Operation Impact Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for interconnection of 6.6 MW of wind generation within the balancing authority of Western Farmers Electric Cooperative (WFEC) in Apache County, Oklahoma. 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 Network Upgrades identified in the DISIS-2011-002 Impact Study can be placed into service. Interim Operational Impact Studies are conducted under GIP Section 11A.

This Impact study addresses the dynamic stability effects of interconnecting the plant to the rest of the WFEC transmission system for the system condition as it will be on December 31, 2012. The wind generation facility was studied as a 6.6 MW request in addition to the existing 99.0 MW project with a total of with sixty-six (66) G.E. 1.6 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. Sixty-three (63) contingencies were identified for this study.

Purpose

The purpose of this Interim Operation Impact Study (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 3; 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.

Facilities

Generating Facility

The project was modeled with the existing plant as an equivalent wind turbine generator of 105.6 MW output. The wind turbine is connected to an equivalent 0.69/34.5KV generator step unit (GSU). The high side of the GSU is connected to a 34.5/115kV substation transformer to the POI. This equivalent model representation is illustrated in Figure 2.

Interconnection Facility

The Point of Interconnection will be at the Transmission Owners GEN-2003-005 138kV switching station. Figure 1 shows a one-line illustration of the facility and the POI. Figure 2 shows a one-line bus interconnection of the Point of Interconnection.

Cost to interconnect on a Limited basis is estimated at $0.

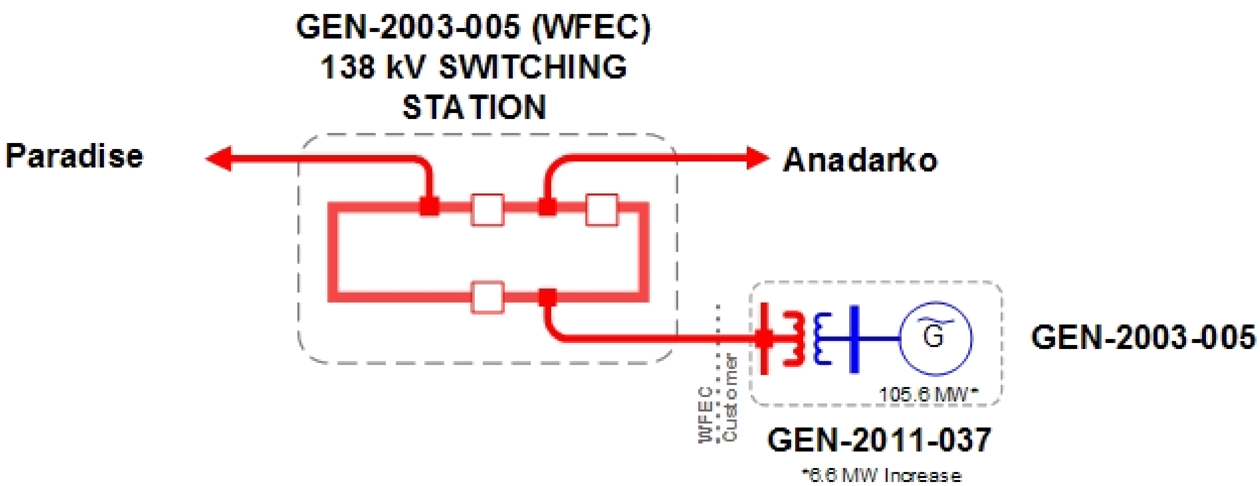

Figure 1: *GEN-2011-037 Facility and Proposed Interconnection Configuration*

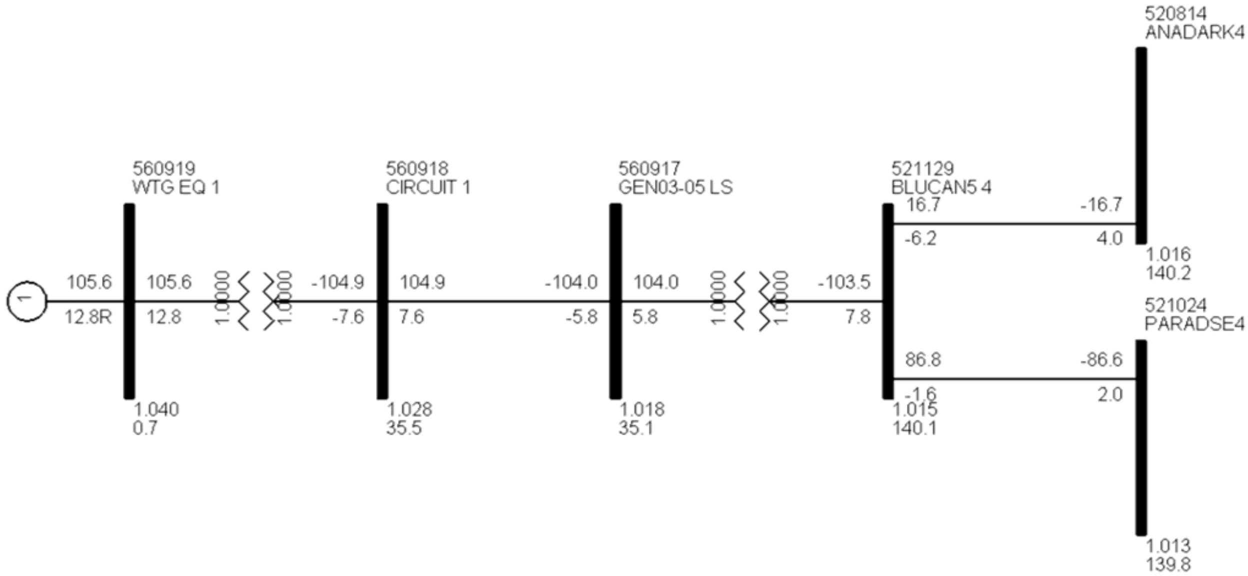

Figure 2: *GEN-2011-037 Bus Interconnection*

Power flow Analysis

A power flow analysis was conducted for the Interconnection Customer's facility using a modified version of the 2011 spring, 2012 summer, and 2012 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 previous queued requests listed in Table 3 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 ACCC function of PSS/E was used to simulate single contingencies in portions of or all of the control area of WFEC 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.

Higher queued projects listed in Table 4 were not modeled as in service. If any of these come in service, this study will need to be performed again to determine if any limited interconnection service is available.

The ACCC analysis indicates that the Customer's project can interconnect an additional 6.6 MW of generation into the WFEC transmission system with transmission reinforcements. Until the regional reliability identified Snyder (WFEC) to Snyder (AEPW) 138kV line is placed in-service, expected 2nd quarter 2012, there is only 3.7 MW of interim interconnection service available. The limiting contingencies are listed in Table 1.

***Table 1**: ACCC Analysis for GEN-2011-037*

SEASON	SOURCE	DIRECTION	MONTCOMMONNAME	RATEA	RATEB	TDF	TC%LOADING	MW Available	CONTNAME
11G	G11_037	'TO->FROM'	'ALTUS SW - NAVAJO 69KV CKT 1'	36	36	0.53925	104.9352	3.7	'ANADARKO - BLUCAN5 4 138.00 138KV CKT 1'
11G	G11_037	'FROM->TO'	'SNYDER - TIPTON JCT 69KV CKT 1'	48	48	0.45708	102.2154	4.6	'ANADARKO - BLUCAN5 4 138.00 138KV CKT 1'

Stability Analysis

Contingencies Simulated

Sixty-three (63) 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 2 below.

***Table 2**: Contingencies Evaluated*

Cont. No.	Cont. Name	Description
1.	FLT_MATTHEWSON7_WOODRNG7_345kV_3PH	3 phase fault on the Mathewson (560368) to Woodring (514715) 345kV line, near Mathewson. a. Apply fault at Mathewson 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
2.	FLT_MATTHEWSON7_WOODRNG7_345kV_1PH	*Single phase fault and sequence like previous*
3.	FLT_MATTHEWSON7_CIMARON7_345kV_3PH	3 phase fault on the Mathewson (560368) to Cimarron (514901) 345kV line, near Mathewson. a. Apply fault at Mathewson 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.	FLT_MATTHEWSON7_CIMARON7_345kV_1PH	*Single phase fault and sequence like previous*
5.	FLT_GEN07043POI_CIMARON7_345kV_3PH	3 phase fault on the GEN-2007-043 Tap (579293) to Cimarron (514901) 345kV line, near GEN-2007-043 Tap. a. Apply fault at GEN-2007-043 Tap 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
6.	FLT_GEN07043POI_CIMARON7_345kV_1PH	*Single phase fault and sequence like previous*
7.	FLT_GEN07043POI_GRACMNT7_345kV_3PH	3 phase fault on the GEN-2007-043 Tap (579293) to Gracemont (515800) 345kV line, near GEN-2007-043 Tap. a. Apply fault at GEN-2007-043 Tap 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.

Cont. No.	Cont. Name	Description
8.	FLT_GEN07043POI_GRACMNT7_345kV_1PH	*Single phase fault and sequence like previous*
9.	FLT_GRACMNT7_GRACMNT4_345_138kV_3PH	3 phase fault on the Gracemont 345kV (515800) to Gracemont 138kV (515802) transformer on the 345kV bus. a. Apply fault at Gracemont 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
10.	FLT_GRACMNT7_LES7_345kV_3PH	3 phase fault on the Gracemont (515800) to Lawton Eastside (511468) 345kV line, near Gracemont. a. Apply fault at Gracemont 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
11.	FLT_GRACMNT7_LES7_345kV_1PH	*Single phase fault and sequence like previous*
12.	FLT_CIMARON7_NORTWST7_345kV_3PH	3 phase fault on the Cimarron (514901) to Northwest (514880) 345kV line, near Cimarron. a. Apply fault at Cimarron 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
13.	FLT_CIMARON7_NORTWST7_345kV_1PH	*Single phase fault and sequence like previous*
14.	FLT_CIMARON7_DRAPER7_345kV_3PH	3 phase fault on the Cimarron (514901) to Draper (514934) 345kV line, near Cimarron. a. Apply fault at Cimarron 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
15.	FLT_CIMARON7_DRAPER7_345kV_1PH	*Single phase fault and sequence like previous*
16.	FLT_CIMARON7_CIMARON4_345_138kV_3PH	3 phase fault on the Cimarron 345kV (514901) to Cimarron 138kV (514898) transformer on the 345kV bus. a. Apply fault at Cimarron 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
17.	FLT_WOODRNG7_SOONER7_345kV_3PH	3 phase fault on the Woodring (514715) to Sooner (514803) 345kV line, near Woodring. a. Apply fault at Woodring 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
18.	FLT_WOODRNG7_SOONER7_345kV_1PH	*Single phase fault and sequence like previous*
19.	FLT_WOODRNG7_WICHITA7_345kV_3PH	3 phase fault on the Woodring (514715) to Wichita (532796) 345kV line, near Woodring. a. Apply fault at Woodring 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
20.	FLT_WOODRNG7_WICHITA7_345kV_1PH	*Single phase fault and sequence like previous*

Cont. No.	Cont. Name	Description
21.	FLT_WOODRNG7_WOODRNG4_345_138kV_3PH	3 phase fault on the Woodring 345kV (514715) to Woodring 138kV (514714) transformer on the 345kV bus. a. Apply fault at Woodring 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
22.	FLT_HOBJCT4_CARNEG4_138kV_3PH	3 phase fault on the Hobart Jct. (511463) to Carnegie S. (511445) 138kV line, near Hobart Jct. a. Apply fault at Hobart Jct. 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
23.	FLT_HOBJCT4_CARNEG4_138kV_1PH	*Single phase fault and sequence like previous*
24.	FLT_HOBJCT4_CLAFTP4_138kV_3PH	3 phase fault on the Hobart Jct. (511463) to Clinton Sherman AFB Tap (511446) 138kV line, near Hobart Jct. a. Apply fault at Hobart Jct. 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
25.	FLT_HOBJCT4_CLAFTP4_138kV_1PH	*Single phase fault and sequence like previous*
26.	FLT_HOBJCT4_OMALTUS4_138kV_3PH	3 phase fault on the Hobart Jct. (511463) to Tamarack Tap (529302) 138kV line, near Hobart Jct. a. Apply fault at Hobart Jct. 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
27.	FLT_HOBJCT4_OMALTUS4_138kV_1PH	*Single phase fault and sequence like previous*
28.	FLT_HOBJCT4_HOBJCT2_138_69kV_3PH	3 phase fault on the Hobart Jct. 138kV (511463) to Hobart Jct. 69kV (511464) transformer on the 138kV bus. a. Apply fault at Hobart Jct. 138kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
29.	FLT_WASHITA4_SWS4_138kV_3PH	3 phase fault on the Washita (521089) to Southwest Station (511477) 138kV line, near Washita. a. Apply fault at Washita 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
30.	FLT_WASHITA4_SWS4_138kV_1PH	*Single phase fault and sequence like previous*
31.	FLT_WASHITA4_GRACMNT4_138kV_3PH	3 phase fault on the Washita (521089) to Gracemont (515802) 138kV line, near Washita. a. Apply fault at Washita 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
32.	FLT_WASHITA4_GRACMNT4_138kV_1PH	*Single phase fault and sequence like previous*

Cont. No.	Cont. Name	Description
33.	FLT_GRACMNT4_ANADARK4_138kV_3PH	3 phase fault on the Gracemont (515802) to Anadarko (520814) 138kV line, near Gracemont. a. Apply fault at Gracemont 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
34.	FLT_GRACMNT4_ANADARK4_138kV_1PH	*Single phase fault and sequence like previous*
35.	FLT_WASHITA4_ONEY4_138kV_3PH	3 phase fault on the Washita (521089) to Oney (521017) 138kV line, near Washita. a. Apply fault at Washita 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
36.	FLT_WASHITA4_ONEY4_138kV_1PH	*Single phase fault and sequence like previous*
37.	FLT_ELKCTY4_CLAFTP4_138kV_3PH	3 phase fault on the Elk City (511458) to Clinton Sherman AFB Tap (511446) 138kV line, near Elk City. a. Apply fault at Elk City 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
38.	FLT_ELKCTY4_CLAFTP4_138kV_1PH	*Single phase fault and sequence like previous*
39.	FLT_ELKCTY4_CLINTJC4_138kV_3PH	3 phase fault on the Elk City (511458) to Clinton Jct. (511485) 138kV line, near Elk City. a. Apply fault at Elk City 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
40.	FLT_ELKCTY4_CLINTJC4_138kV_1PH	*Single phase fault and sequence like previous*
41.	FLT_ELKCTY4_FALCNRD4_138kV_3PH	3 phase fault on the Elk City (511458) to Falcon Rd. (511511) 138kV line, near Elk City. a. Apply fault at Elk City 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
42.	FLT_ELKCTY4_FALCNRD4_138kV_1PH	*Single phase fault and sequence like previous*
43.	FLT_ELKCTY4_RHWIND4_138kV_3PH	3 phase fault on the Elk City (511458) to Red Hills Wind (521116) 138kV line, near Elk City. a. Apply fault at Elk City 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
44.	FLT_ELKCTY4_RHWIND4_138kV_1PH	*Single phase fault and sequence like previous*

Cont. No.	Cont. Name	Description
45.	FLT_ELKCITY6_ELKCTY4_230_138kV_3PH	3 phase fault on the Elk City 230kV (511490) to Elk City 138kV (511458) transformer on the 230kV bus. a. Apply fault at Elk City 230kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
46.	FLT_ELKCTY4_ELKCTY2_138_69kV_3PH	3 phase fault on the Elk City 138kV (511458) to Elk City 69kV (511459) transformer on the 138kV bus. a. Apply fault at Elk City 138kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
47.	FLT_ANADARK4_SWS4_138kV_3PH	3 phase fault on the Anadarko (520814) to Southwest Station (511477) 138kV line, near Anadarko. a. Apply fault at Anadarko 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
48.	FLT_ANADARK4_SWS4_138kV_1PH	*Single phase fault and sequence like previous*
49.	FLT_ANADARK4_CORNTP4_138kV_3PH	3 phase fault on the Anadarko (520814) to Cornville Tap (520867) 138kV line, near Anadarko. a. Apply fault at Anadarko 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
50.	FLT_ANADARK4_CORNTP4_138kV_1PH	*Single phase fault and sequence like previous*
51.	FLT_ANADARK4_GEORGIA4_138kV_3PH	3 phase fault on the Anadarko (520814) to Georgia St. (520923) 138kV line, near Anadarko. a. Apply fault at Anadarko 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
52.	FLT_ANADARK4_GEORGIA4_138kV_1PH	*Single phase fault and sequence like previous*
53.	FLT_ANADARK4_POCASET4_138kV_3PH	3 phase fault on the Anadarko (520814) to Pocasset (520867) 138kV line, near Anadarko. a. Apply fault at Anadarko 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
54.	FLT_ANADARK4_POCASET4_138kV_1PH	*Single phase fault and sequence like previous*
55.	FLT_ANADARK4_ANADARK2_138_69kV_3PH	3 phase fault on the Anadarko 138kV (520814) to Anadarko 69kV (520810) transformer on the 138kV bus. a. Apply fault at Anadarko 138kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
56.	FLT_BLUCAN54_ANADARK4_138kV_3PH	3 phase fault on the GEN-2003-005 Tap (521129) to Anadarko (520814) 138kV line, near GEN-2003-005 Tap. a. Apply fault at GEN-2003-005 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.

Cont. No.	Cont. Name	Description
57.	FLT_BLUCAN54_ANADARK4_138kV_1PH	*Single phase fault and sequence like previous*
58.	FLT_BLUCAN54_PARADSE4_138kV_3PH	3 phase fault on the GEN-2003-005 Tap (521129) to Paradise (521024) 138kV line, near GEN-2003-005 Tap. a. Apply fault at GEN-2003-005 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.
59.	FLT_BLUCAN54_PARADSE4_138kV_1PH	*Single phase fault and sequence like previous*
60.	FLT_ALTUSJT4_SNYDER4_138kV_3PH	3 phase fault on the Altus Jct. (511440) to Snyder (511435) 138kV line, near Altus Jct. a. Apply fault at Altus Jct. 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
61.	FLT_ALTUSJT4_SNYDER4_138kV_1PH	*Single phase fault and sequence like previous*
62.	FLT_SWEETWT6_WHEELER6_230kV_3PH	3 phase fault on the Sweetwater (511541) to Wheeler (523777) 230kV line, near Sweetwater. a. Apply fault at Sweetwater 230kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
63.	FLT_SWEETWT6_WHEELER6_230kV_1PH	*Single phase fault and sequence like previous*

Further Model Preparation

The base cases contain prior queued projects as shown in Table 3.

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.

***Table 3**: Prior Queued Projects Included*

Project	MW
GEN-2003-005	100
GEN-2006-035	225
GEN-2007-032	150
GEN-2008-023	148.8
GEN-2008-037	100.8
GEN-2008-046	198

Project	MW
GEN-2009-016	100.8
GEN-2010-012	65
GEN-2010-040	300.3
GEN-2011-010	100.8
GEN-2011-040	110.4

The projects listed in Table 4 are higher or equally queued projects that are not included in this analysis. If any of these projects come into service, this study will need to be re-performed to determine if any limited capacity is available.

Table 4*: Prior Queued Projects Not Included*

Project	MW
None	

Results

Results of the stability analysis are summarized in Table 5. These results are valid for GEN-2011-037 interconnecting with a generation amount of 6.6 MW. The results indicate that for all contingencies studied the transmission system remains stable.

Table 5*: Contingencies Evaluated*

Cont. No.	Cont. Name	Description	2011 Summer	2011 Winter
1.	FLT_MATTHEWSON7_WOODRNG7_345kV_3PH	3 phase fault on the Mathewson (560368) to Woodring (514715) 345kV line, near Mathewson.	Stable	Stable
2.	FLT_MATTHEWSON7_WOODRNG7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
3.	FLT_MATTHEWSON7_CIMARON7_345kV_3PH	3 phase fault on the Mathewson (560368) to Cimarron (514901) 345kV line, near Mathewson.	Stable	Stable
4.	FLT_MATTHEWSON7_CIMARON7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
5.	FLT_GEN07043POI_CIMARON7_345kV_3PH	3 phase fault on the GEN-2007-043 Tap (579293) to Cimarron (514901) 345kV line, near GEN-2007-043 Tap.	Stable	Stable
6.	FLT_GEN07043POI_CIMARON7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
7.	FLT_GEN07043POI_GRACMNT7_345kV_3PH	3 phase fault on the GEN-2007-043 Tap (579293) to Gracemont (515800) 345kV line, near GEN-2007-043 Tap.	Stable	Stable
8.	FLT_GEN07043POI_GRACMNT7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable

Cont. No.	Cont. Name	Description	2011 Summer	2011 Winter
9.	FLT_GRACMNT7_GRACMNT4_345_138kV_3PH	3 phase fault on the Gracemont 345kV (515800) to Gracemont 138kV (515802) transformer on the 345kV bus.	Stable	Stable
10.	FLT_GRACMNT7_LES7_345kV_3PH	3 phase fault on the Gracemont (515800) to Lawton Eastside (511468) 345kV line, near Gracemont.	Stable	Stable
11.	FLT_GRACMNT7_LES7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
12.	FLT_CIMARON7_NORTWST7_345kV_3PH	3 phase fault on the Cimarron (514901) to Northwest (514880) 345kV line, near Cimarron.	Stable	Stable
13.	FLT_CIMARON7_NORTWST7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
14.	FLT_CIMARON7_DRAPER7_345kV_3PH	3 phase fault on the Cimarron (514901) to Draper (514934) 345kV line, near Cimarron.	Stable	Stable
15.	FLT_CIMARON7_DRAPER7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
16.	FLT_CIMARON7_CIMARON4_345_138kV_3PH	3 phase fault on the Cimarron 345kV (514901) to Cimarron 138kV (514898) transformer on the 345kV bus.	Stable	Stable
17.	FLT_WOODRNG7_SOONER7_345kV_3PH	3 phase fault on the Woodring (514715) to Sooner (514803) 345kV line, near Woodring.	Stable	Stable
18.	FLT_WOODRNG7_SOONER7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
19.	FLT_WOODRNG7_WICHITA7_345kV_3PH	3 phase fault on the Woodring (514715) to Wichita (532796) 345kV line, near Woodring.	Stable	Stable
20.	FLT_WOODRNG7_WICHITA7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
21.	FLT_WOODRNG7_WOODRNG4_345_138kV_3PH	3 phase fault on the Woodring 345kV (514715) to Woodring 138kV (514714) transformer on the 345kV bus.	Stable	Stable
22.	FLT_HOBJCT4_CARNEG4_138kV_3PH	3 phase fault on the Hobart Jct. (511463) to Carnegie S. (511445) 138kV line, near Hobart Jct.	Stable	Stable
23.	FLT_HOBJCT4_CARNEG4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
24.	FLT_HOBJCT4_CLAFTP4_138kV_3PH	3 phase fault on the Hobart Jct. (511463) to Clinton Sherman AFB Tap (511446) 138kV line, near Hobart Jct.	Stable	Stable
25.	FLT_HOBJCT4_CLAFTP4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
26.	FLT_HOBJCT4_OMALTUS4_138kV_3PH	3 phase fault on the Hobart Jct. (511463) to Tamarack Tap (529302) 138kV line, near Hobart Jct.	Stable	Stable
27.	FLT_HOBJCT4_OMALTUS4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
28.	FLT_HOBJCT4_HOBJCT2_138_69kV_3PH	3 phase fault on the Hobart Jct. 138kV (511463) to Hobart Jct. 69kV (511464) transformer on the 138kV bus.	Stable	Stable
29.	FLT_WASHITA4_SWS4_138kV_3PH	3 phase fault on the Washita (521089) to Southwest Station (511477) 138kV line, near Washita.	Stable	Stable

Cont. No.	Cont. Name	Description	2011 Summer	2011 Winter
30.	FLT_WASHITA4_SWS4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
31.	FLT_WASHITA4_GRACMNT4_138kV_3PH	3 phase fault on the Washita (521089) to Gracemont (515802) 138kV line, near Washita.	Stable	Stable
32.	FLT_WASHITA4_GRACMNT4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
33.	FLT_GRACMNT4_ANADARK4_138kV_3PH	3 phase fault on the Gracemont (515802) to Anadarko (520814) 138kV line, near Gracemont.	Stable	Stable
34.	FLT_GRACMNT4_ANADARK4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
35.	FLT_WASHITA4_ONEY4_138kV_3PH	3 phase fault on the Washita (521089) to Oney (521017) 138kV line, near Washita.	Stable	Stable
36.	FLT_WASHITA4_ONEY4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
37.	FLT_ELKCTY4_CLAFTP4_138kV_3PH	3 phase fault on the Elk City (511458) to Clinton Sherman AFB Tap (511446) 138kV line, near Elk City.	Stable	Stable
38.	FLT_ELKCTY4_CLAFTP4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
39.	FLT_ELKCTY4_CLINTJC4_138kV_3PH	3 phase fault on the Elk City (511458) to Clinton Jct. (511485) 138kV line, near Elk City.	Stable	Stable
40.	FLT_ELKCTY4_CLINTJC4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
41.	FLT_ELKCTY4_FALCNRD4_138kV_3PH	3 phase fault on the Elk City (511458) to Falcon Rd. (511511) 138kV line, near Elk City.	Stable	Stable
42.	FLT_ELKCTY4_FALCNRD4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
43.	FLT_ELKCTY4_RHWIND4_138kV_3PH	3 phase fault on the Elk City (511458) to Red Hills Wind (521116) 138kV line, near Elk City.	Stable	Stable
44.	FLT_ELKCTY4_RHWIND4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
45.	FLT_ELKCITY6_ELKCTY4_230_138kV_3PH	3 phase fault on the Elk City 230kV (511490) to Elk City 138kV (511458) transformer on the 230kV bus.	Stable	Stable
46.	FLT_ELKCTY4_ELKCTY2_138_69kV_3PH	3 phase fault on the Elk City 138kV (511458) to Elk City 69kV (511459) transformer on the 138kV bus.	Stable	Stable
47.	FLT_ANADARK4_SWS4_138kV_3PH	3 phase fault on the Anadarko (520814) to Southwest Station (511477) 138kV line, near Anadarko.	Stable	Stable
48.	FLT_ANADARK4_SWS4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
49.	FLT_ANADARK4_CORNTP4_138kV_3PH	3 phase fault on the Anadarko (520814) to Cornville Tap (520867) 138kV line, near Anadarko.	Stable	Stable
50.	FLT_ANADARK4_CORNTP4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable

Cont. No.	Cont. Name	Description	2011 Summer	2011 Winter
51.	FLT_ANADARK4_GEORGIA4_138kV_3PH	3 phase fault on the Anadarko (520814) to Georgia St. (520923) 138kV line, near Anadarko.	Stable	Stable
52.	FLT_ANADARK4_GEORGIA4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
53.	FLT_ANADARK4_POCASET4_138kV_3PH	3 phase fault on the Anadarko (520814) to Pocasset (520867) 138kV line, near Anadarko.	Stable	Stable
54.	FLT_ANADARK4_POCASET4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
55.	FLT_ANADARK4_ANADARK2_138_69kV_3PH	3 phase fault on the Anadarko 138kV (520814) to Anadarko 69kV (520810) transformer on the 138kV bus.	Stable	Stable
56.	FLT_BLUCAN54_ANADARK4_138kV_3PH	3 phase fault on the GEN-2003-005 Tap (521129) to Anadarko (520814) 138kV line, near GEN-2003-005 Tap.	Stable	Stable
57.	FLT_BLUCAN54_ANADARK4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
58.	FLT_BLUCAN54_PARADSE4_138kV_3PH	3 phase fault on the GEN-2003-005 Tap (521129) to Paradise (521024) 138kV line, near GEN-2003-005 Tap.	Stable	Stable
59.	FLT_BLUCAN54_PARADSE4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
60.	FLT_ALTUSJT4_SNYDER4_138kV_3PH	3 phase fault on the Altus Jct. (511440) to Snyder (511435) 138kV line, near Altus Jct.	Stable	Stable
61.	FLT_ALTUSJT4_SNYDER4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
62.	FLT_SWEETWT6_WHEELER6_230kV_3PH	3 phase fault on the Sweetwater (511541) to Wheeler (523777) 230kV line, near Sweetwater.	Stable	Stable
63.	FLT_SWEETWT6_WHEELER6_230kV_1PH	*Single phase fault and sequence like previous*	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 the prior queued wind farms will remain on line when the POI voltage is drawn down to 0.0 pu. These contingencies are shown in Table 6.

***Table 6**: Contingencies Evaluated*

Cont. Name	Description
FLT_BLUCAN54_ANADARK4_138kV_3PH	3 phase fault on the GEN-2003-005 Tap (521129) to Anadarko (520814) 138kV line, near GEN-2003-005 Tap. a. Apply fault at GEN-2003-005 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.
FLT_BLUCAN54_PARADSE4_138kV_3PH	3 phase fault on the GEN-2003-005 Tap (521129) to Paradise (521024) 138kV line, near GEN-2003-005 Tap. a. Apply fault at GEN-2003-005 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.

The prior queued project wind farms remained online for the fault contingencies described in this section and for all the fault contingencies described in the Contingencies Simulated section. GEN-2011-037 is found to be in compliance with FERC Order #661A.

Conclusion

<OMITTED TEXT> (Customer) has requested a Interim Operation Impact Study for Interim interconnection service of 6.6 MW of wind generation within the balancing authority of Western Farmers Electric Cooperative (WFEC) in Apache County, Oklahoma, in accordance with section 11A of the Standard Generation Interconnection Agreement (GIA) in the SPP OATT.

Power flow analysis showed that the Customer's wind facility can interconnect 6.6 MW of wind generation with transmission reinforcements.

The stability analysis results of this study show that the wind generation facility and the transmission system remain stable for all contingencies studied. Also, GEN-2011-037 is found to be in compliance with FERC Order #661A.

The projects listed in Table 4 are higher or equally queued projects that are not included in this analysis. If any of these projects come into service, this study will need to be re-performed to determine if any interim interconnection service is available.

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.