Impact ReStudy for Generation Interconnection Request

GEN-2008-013

May, 2012
Generation Interconnection

SPP Southwest Power Pool

Executive Summary

<OMITTED TEXT> (Customer) has requested an Impact Restudy under the Southwest Power Pool Open Access Transmission Tariff (OATT) for interconnection of MW of wind generation within the (OKGE) in Garfield County, Oklahoma. Customer has requested this Impact Restudy to determine the impacts of changing the wind generators from G.E. 1.5MW generator units to G.E. 1.68MW generators.

A revised power flow analysis shows that the Customer's wind facility can interconnect its full 299.04 MW of interconnection capacity. Powerflow analysis was based on both summer and winter peak conditions and light loading cases.

The wind generation facility was studied as a 299.04 MW with a total of one hundred-seventy-eight (178) G.E 1.68MW wind turbine generators. Two analyses have been performed as part of this study. One analysis 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 at the time of the Generating Facility's COD 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 2012 summer peak and 2012 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. This analysis, in which fifty-five (55) contingencies considered, consists of being an operation scenario for the system conditions as they will be on December 31, 2012. The second analysis addresses the change in wind turbine type for material modification on lower queued interconnection requests. For this analysis, the models from the DISIS-2011-002 Impact Study were analyzed. In this analysis, in which sixty-one (61) contingencies were considered, consists of system conditions set for DISIS-2011-002 with its cluster upgrades. The G.E. 1.68MW wind turbines were modeled using information provided by the Customer. Stability Analysis indicates the transmission system will remain stable for the studied contingencies for the added generation.

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 Impact Restudy under the Southwest Power Pool Open Access Transmission Tariff (OATT) for interconnection of MW of wind generation within the (OKGE) in Garfield County, Oklahoma. Customer has requested this Impact Restudy to determine the impacts of changing the wind generators from G.E. 1.5MW generator units to G.E. 1.68MW generators.

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 31, 2012 as well as an analysis for material modification on lower queued projects. The wind generation facility was studied as a 299.04 MW request with a total of with one hundred-seventy-eight (178) G.E. 1.68MW 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 2012 summer peak and 2012 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. Fifty-five contingencies were identified for this study. The second analysis, which consists of sixty-one (61) contingencies, was performed on the latest study models from DISIS-2011-002 Impact Study.

Purpose

The purpose of this Impact ReStudy is to evaluate the impact of the proposed interconnection on the reliability of the Transmission System. The Impact Study 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 Impact Study 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

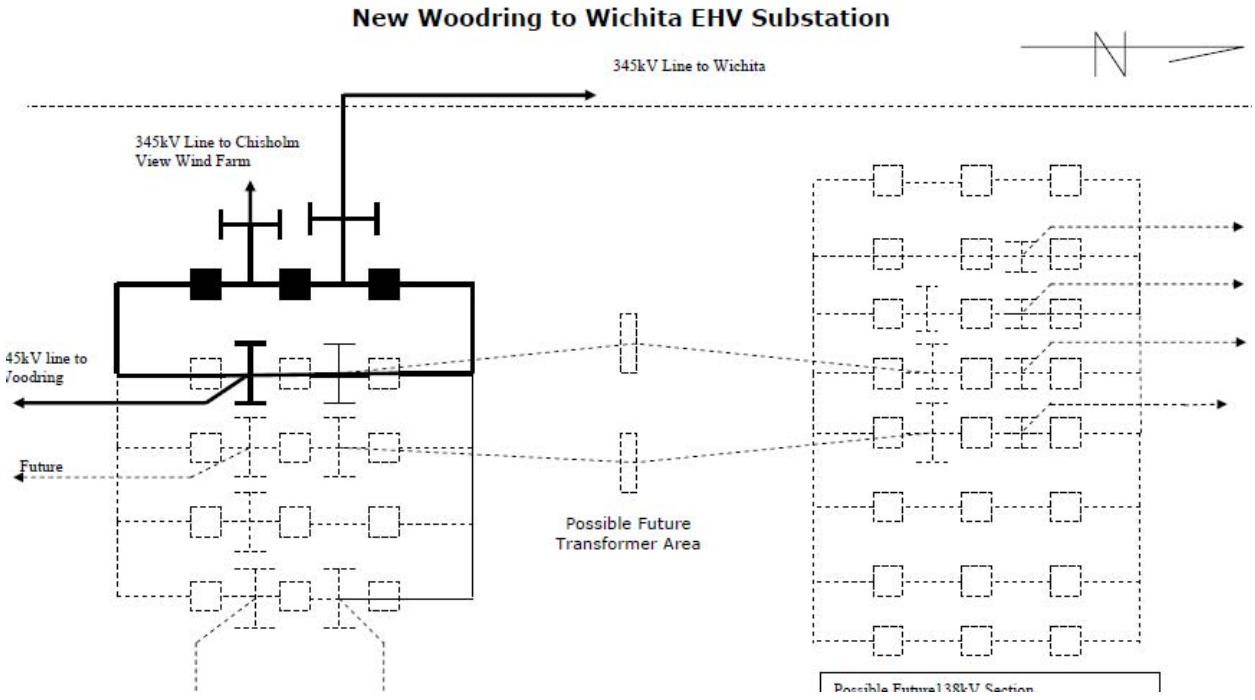
Generating Facility

The project was modeled with the existing plant as two equivalent wind turbine generators of 149.52MW each for a total of 299.04MW output. The wind turbines are connected to two parallel equivalent 0.69/34.5KV generator step units (GSU). The high sides of GSUs are connected to two parallel 34.5/345kV substation transformers. A 345kV transmission line connects the Customer's substation transformer to the POI.

Interconnection Facility

The Point of Interconnection will be at a new 345kV switching station tapping along the Transmission Owners Wichita-Woodring (South of the GEN-2007-025 Tap) 345kV transmission line. 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 is estimated at $9,276,873.



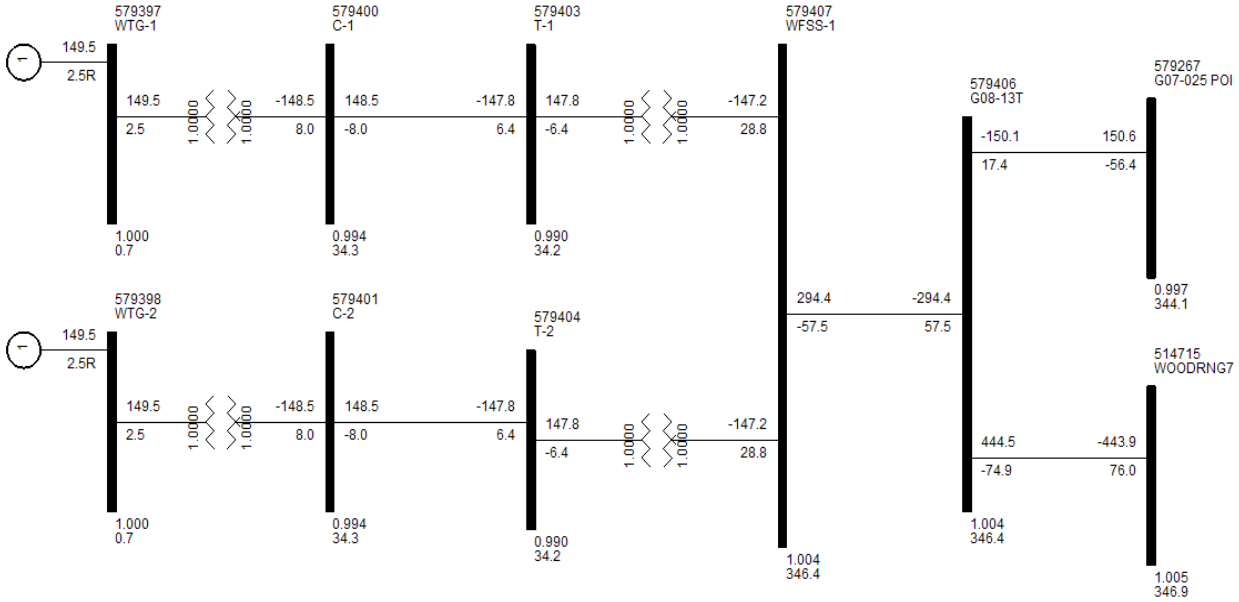


Figure 2: *GEN-2008-013 Bus Interconnection*

Powerflow Analysis

A powerflow analysis was conducted for the Interconnection Customer's facility using a modified version of the 2012 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 OKGE 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.

The ACCC analysis indicates that the Customer's project can interconnect 299.04 MW of generation into the OKGE transmission system.

***Table 1**: ACCC Analysis for GEN-2008-013*

SEASON	SOURCE	DIRECTION	MONTCOMMONNAME	RATEA	RATEB	TDF	TC%LOADING	MW Available	CONTNAME
			None						

Stability Analysis

Contingencies Simulated

Two dynamic transient stability scenarios simulations were conducted in this study. First scenario, sixty-one (61) contingencies considered, consists of system conditions set for DISIS-2011-002 with its cluster upgrades. The second scenario, fifty-five (55) contingencies considered, consists of being a limited operation scenario for the system condition as it will be on December 31, 2012. Table 2 contingencies under consideration are for the DISIS-2011-002 scenario, while Table 3 contingencies under consideration are for the limited operation scenario. 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.

The faults that were defined and simulated are listed in Table 2 below.

***Table 2**: DISIS-2011-002 with Upgrades Contingencies Evaluated*

Cont. No.	Cont. Name	Description
1.	FLT_01_GEN2008013TAP_GEN2007025TAP_345kV_3PH	3 phase fault on the GEN-2008-013 Tap (579406) to GEN-2007-025 Tap (579267) 345kV line, near GEN-2008-013 Tap. a. Apply fault at GEN-2008-013 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.
2.	FLT_02_GEN2008013TAP_GEN2007025TAP_345kV_1PH	*Single phase fault and sequence like previous*
3.	FLT_03_WOODRNG7_GEN2008013TAP_345kV_3PH	3 phase fault on the Woodring (514715) to GEN-2008-013 Tap (579406) 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.
4.	FLT_04_WOODRNG7_GEN2008013TAP_345kV_1PH	*Single phase fault and sequence like previous*
5.	FLT_05_WICHITA7_EMPEC7_345kV_3PH	3 phase fault on the Wichita (532796) to Emporia Energy Center (532768) 345kV line, near Wichita. a. Apply fault at Wichita 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
6.	FLT_06_WICHITA7_EMPEC7_345kV_1PH	*Single phase fault and sequence like previous*

Cont. No.	Cont. Name	Description
7.	FLT_07_WICHITA7_BENTON7_345kV_3PH	3 phase fault on the Wichita (532796) to Benton (532791) 345kV line, near Wichita. a. Apply fault at Wichita 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
8.	FLT_08_WICHITA7_BENTON7_345kV_1PH	*Single phase fault and sequence like previous*
9.	FLT_09_WICHITA7_RENO7_345kV_3PH	3 phase fault on the Wichita (532796) to Reno (532771) 345kV line, near Wichita. a. Apply fault at Wichita 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
10.	FLT_10_WICHITA7_RENO7_345kV_1PH	*Single phase fault and sequence like previous*
11.	FLT_11_WICHITA7_EVANSN4_345_138kV_3PH	3 phase fault on one of the Wichita 345kV (532796) to Evans North 138kV (533040) transformers on the 345kV bus. a. Apply fault at Wichita 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
12.	FLT_12_WICHITA7_THISTLE_345_138kV_3PH	3 phase fault on the Wichita (532796) to Thistle (539801) 345kV line, near Wichita. a. Apply fault at Wichita 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
13.	FLT_13_WICHITA7_THISTLE_345_138kV_1PH	*Single phase fault and sequence like previous*
14.	FLT_14_EVANSN4_EVANSS4_138kV_3PH	3 phase fault on the Evans North (533040) to Evans South (533041) 138kV line, near Evans North. a. Apply fault at Evans North 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.
15.	FLT_15_EVANSN4_EVANSS4_138kV_1PH	*Single phase fault and sequence like previous*
16.	FLT_16_EVANSN4_MAIZE4_138kV_3PH	3 phase fault on the Evans North (533040) to Maize (533054) 138kV line, near Evans North. a. Apply fault at Evans North 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.
17.	FLT_17_EVANSN4_MAIZE4_138kV_1PH	*Single phase fault and sequence like previous*
18.	FLT_18_EVANSN4_SG12COL4_138kV_3PH	3 phase fault on the Evans North (533040) to Colwich (533065) 138kV line, near Evans North. a. Apply fault at Evans North 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.
19.	FLT_19_EVANSN4_SG12COL4_138kV_1PH	*Single phase fault and sequence like previous*

Cont. No.	Cont. Name	Description
20.	FLT_20_RENO7_SUMMIT7_345kV_3PH	3 phase fault on the Reno (532771) to Summit (532773) 345kV line, near Reno. a. Apply fault at Reno 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
21.	FLT_21_RENO7_SUMMIT7_345kV_1PH	*Single phase fault and sequence like previous*
22.	FLT_22_RENO7_RENO3_345_115kV_3PH	3 phase fault on one of the Reno 345kV (532771) to Reno 115kV (533416) transformers on the 345kV bus. a. Apply fault at Reno 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
23.	FLT_23_BENTON7_ROSEHIL7_345kV_3PH	3 phase fault on the Benton (532791) to Rose Hill (532794) 345kV line, near Benton. a. Apply fault at Benton 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.
24.	FLT_24_BENTON7_ROSEHIL7_345kV_1PH	*Single phase fault and sequence like previous*
25.	FLT_25_BENTON7_WOLFCRK7_345kV_3PH	3 phase fault on the Benton (532791) to Wolf Creek (532797) 345kV line, near Benton. a. Apply fault at Benton 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.
26.	FLT_26_BENTON7_WOLFCRK7_345kV_1PH	*Single phase fault and sequence like previous*
27.	FLT_27_BENTON7_BENTON4_345_138kV_3PH	3 phase fault on one of the Benton 345kV (532791) to Benton 138kV (532986) transformers on the 345kV bus. a. Apply fault at Benton 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
28.	FLT_28_BENTON4_MIDIAN4_138kV_3PH	3 phase fault on the Benton (532986) to Midian (532990) 138kV line, near Benton. a. Apply fault at Benton 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.
29.	FLT_29_BENTON4_MIDIAN4_138kV_1PH	*Single phase fault and sequence like previous*
30.	FLT_30_BENTON4_CHISHLM4_138kV_3PH	3 phase fault on the Benton (532986) to Chisholm (533035) 138kV line, near Benton. a. Apply fault at Benton 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.
31.	FLT_31_BENTON4_CHISHLM4_138kV_1PH	*Single phase fault and sequence like previous*
32.	FLT_32_BENTON4_29TH4_138kV_3PH	3 phase fault on the Benton (532986) to 29th (533024) 138kV line, near Benton. a. Apply fault at Benton 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
33.	FLT_33_BENTON4_29TH4_138kV_1PH	*Single phase fault and sequence like previous*
34.	FLT_34_BENTON4_COMOTAR4_138kV_3PH	3 phase fault on the Benton (532986) to Comotara (533037) 138kV line, near Benton. a. Apply fault at Benton 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.
35.	FLT_35_BENTON4_COMOTAR4_138kV_1PH	*Single phase fault and sequence like previous*
36.	FLT_36_WOODRNG7_MATTW_345kV_3PH	3 phase fault on the Woodring (514715) to Matthewson (560368) 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.
37.	FLT_37_WOODRNG7_MATTW_345kV_1PH	*Single phase fault and sequence like previous*
38.	FLT_38_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.
39.	FLT_39_WOODRNG7_SOONER7_345kV_1PH	*Single phase fault and sequence like previous*
40.	FLT_40_WOODRNG7_WOODRNG4_345_138kV_3PH	3 phase fault on one of the Woodring 345kV (514715) to Woodring 138kV (514714) transformers on the 345kV bus. a. Apply fault at Woodring 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
41.	FLT_41_WOODRNG4_OTTER_138kV_3PH	3 phase fault on the Woodring (514803) to Otter (514714) 138kV line, near Woodring. a. Apply fault at Woodring 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_42_WOODRNG4_OTTER_138kV_1PH	*Single phase fault and sequence like previous*
43.	FLT_43_WOODRNG4_WAUKOTP_138kV_3PH	3 phase fault on the Woodring (514803) to Waukomis Tap (514711) 138kV line, near Woodring. a. Apply fault at Woodring 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_44_WOODRNG4_WAUKOTP_138kV_1PH	*Single phase fault and sequence like previous*
45.	FLT_45_WOODRNG4_MARSHL_138kV_3PH	3 phase fault on the Woodring (514803) to Marshall (514733) 138kV line, near Woodring. a. Apply fault at Woodring 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.
46.	FLT_46_WOODRNG4_MARSHL_138kV_1PH	*Single phase fault and sequence like previous*

Cont. No.	Cont. Name	Description
47.	FLT_47_WOODRNG4_FRM NTAP_138kV_3PH	3 phase fault on the Woodring (514803) to Fairmont (514709) 138kV line, near Woodring. a. Apply fault at Woodring 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_48_WOODRNG4_FRM NTAP_138kV_1PH	*Single phase fault and sequence like previous*
49.	FLT_49_MATTW_TATONG A7_345kV_3PH	3 phase fault on the Matthewson (560368) to Tatonga (515407) 345kV line, near Matthewson. a. Apply fault at Matthewson 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.
50.	FLT_50_MATTW_TATONG A7_345kV_1PH	*Single phase fault and sequence like previous*
51.	FLT_51_MATTW_CIMARO N7_345kV_3PH	3 phase fault on the Matthewson (560368) to Cimarron (514901) 345kV line, near Matthewson. a. Apply fault at Matthewson 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.
52.	FLT_52_MATTW_ CIMARON7_345kV_1PH	*Single phase fault and sequence like previous*
53.	FLT_53_NORTWST7_SPRN GCK7_345kV_3PH	3 phase fault on the Northwest (514880) to Spring Creek (514881) 345kV line, near Northwest. a. Apply fault at 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.
54.	FLT_54_NORTWST7_SPRN GCK7_345kV_1PH	*Single phase fault and sequence like previous*
55.	FLT_55_NORTWST7_ARCA DIA_345kV_3PH	3 phase fault on the Northwest (514880) to Arcadia (514908) 345kV line, near Northwest. a. Apply fault at 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.
56.	FLT_56_NORTWST7_ARCA DIA_345kV_1PH	*Single phase fault and sequence like previous*
57.	FLT_57_NORTWST7_NORT HWST4_345_138kV_3PH	3 phase fault on one of the Northwest 345kV (514880) to Northwest 138kV (514879) transformers on the 345kV bus. a. Apply fault at Northwest 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
58.	FLT_58_NORTWST7_ CIMARON7_345kV_3PH	3 phase fault on the Northwest (514880) to Cimarron (514901) 345kV line, near Northwest. a. Apply fault at 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.
59.	FLT_59_NORTWST7_ CIMARON7_345kV_1PH	*Single phase fault and sequence like previous*

Cont. No.	Cont. Name	Description
60.	FLT_60_NORTWST7_MATTW_345kV_3PH	3 phase fault on the Northwest (514880) to Matthewson (560368) 345kV line, near Northwest. a. Apply fault at 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.
61.	FLT_61_NORTWST7_MATTW_345kV_1PH	*Single phase fault and sequence like previous*

***Table 3**: System Conditions as of December 31, 2012 Contingencies Evaluated*

Cont. No.	Cont. Name	Description
1.	FLT_01_GEN2008013TAP_GEN2007025TAP_345kV_3PH	3 phase fault on the GEN-2008-013 Tap (579406) to GEN-2007-025 Tap (579267) 345kV line, near GEN-2008-013 Tap. a. Apply fault at GEN-2008-013 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.
2.	FLT_02_GEN2008013TAP_GEN2007025TAP_345kV_1PH	*Single phase fault and sequence like previous*
3.	FLT_03_WOODRNG7_GEN2008013TAP_345kV_3PH	3 phase fault on the Woodring (514715) to GEN-2008-013 Tap (579406) 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.
4.	FLT_04_WOODRNG7_GEN2008013TAP_345kV_1PH	*Single phase fault and sequence like previous*
5.	FLT_05_WICHITA7_EMPEC7_345kV_3PH	3 phase fault on the Wichita (532796) to Emporia Energy Center (532768) 345kV line, near Wichita. a. Apply fault at Wichita 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
6.	FLT_06_WICHITA7_EMPEC7_345kV_1PH	*Single phase fault and sequence like previous*
7.	FLT_07_WICHITA7_BENTON7_345kV_3PH	3 phase fault on the Wichita (532796) to Benton (532791) 345kV line, near Wichita. a. Apply fault at Wichita 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
8.	FLT_08_WICHITA7_BENTON7_345kV_1PH	*Single phase fault and sequence like previous*
9.	FLT_09_WICHITA7_RENO7_345kV_3PH	3 phase fault on the Wichita (532796) to Reno (532771) 345kV line, near Wichita. a. Apply fault at Wichita 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.

Cont. No.	Cont. Name	Description
10.	FLT_10_WICHITA7_RENO7_345kV_1PH	*Single phase fault and sequence like previous*
11.	FLT_11_WICHITA7_EVANSN4_345_138kV_3PH	3 phase fault on one of the Wichita 345kV (532796) to Evans North 138kV (533040) transformers on the 345kV bus. a. Apply fault at Wichita 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
12.	FLT_12_EVANSN4_EVANSS4_138kV_3PH	3 phase fault on the Evans North (533040) to Evans South (533041) 138kV line, near Evans North. a. Apply fault at Evans North 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.
13.	FLT_13_EVANSN4_EVANSS4_138kV_1PH	*Single phase fault and sequence like previous*
14.	FLT_14_EVANSN4_MAIZE4_138kV_3PH	3 phase fault on the Evans North (533040) to Maize (533054) 138kV line, near Evans North. a. Apply fault at Evans North 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.
15.	FLT_15_EVANSN4_MAIZE4_138kV_1PH	*Single phase fault and sequence like previous*
16.	FLT_16_EVANSN4_SG12COL4_138kV_3PH	3 phase fault on the Evans North (533040) to Colwich (533065) 138kV line, near Evans North. a. Apply fault at Evans North 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.
17.	FLT_17_EVANSN4_SG12COL4_138kV_1PH	*Single phase fault and sequence like previous*
18.	FLT_18_RENO7_SUMMIT7_345kV_3PH	3 phase fault on the Reno (532771) to Summit (532773) 345kV line, near Reno. a. Apply fault at Reno 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
19.	FLT_19_RENO7_SUMMIT7_345kV_1PH	*Single phase fault and sequence like previous*
20.	FLT_20_RENO7_RENO3_345_115kV_3PH	3 phase fault on one of the Reno 345kV (532771) to Reno 115kV (533416) transformers on the 345kV bus. a. Apply fault at Reno 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
21.	FLT_21_BENTON7_ROSEHIL7_345kV_3PH	3 phase fault on the Benton (532791) to Rose Hill (532794) 345kV line, near Benton. a. Apply fault at Benton 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.
22.	FLT_22_BENTON7_ROSEHIL7_345kV_1PH	*Single phase fault and sequence like previous*

Cont. No.	Cont. Name	Description
23.	FLT_23_BENTON7_WOLFCRK7_345kV_3PH	3 phase fault on the Benton (532791) to Wolf Creek (532797) 345kV line, near Benton. a. Apply fault at Benton 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.
24.	FLT_24_BENTON7_WOLFCRK7_345kV_1PH	*Single phase fault and sequence like previous*
25.	FLT_25_BENTON7_BENTON4_345_138kV_3PH	3 phase fault on one of the Benton 345kV (532791) to Benton 138kV (532986) transformers on the 345kV bus. a. Apply fault at Benton 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
26.	FLT_26_BENTON4_MIDIAN4_138kV_3PH	3 phase fault on the Benton (532986) to Midian (532990) 138kV line, near Benton. a. Apply fault at Benton 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_27_BENTON4_MIDIAN4_138kV_1PH	*Single phase fault and sequence like previous*
28.	FLT_28_BENTON4_CHISHLM4_138kV_3PH	3 phase fault on the Benton (532986) to Chisholm (533035) 138kV line, near Benton. a. Apply fault at Benton 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.
29.	FLT_29_BENTON4_CHISHLM4_138kV_1PH	*Single phase fault and sequence like previous*
30.	FLT_30_BENTON4_29TH4_138kV_3PH	3 phase fault on the Benton (532986) to 29th (533024) 138kV line, near Benton. a. Apply fault at Benton 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.
31.	FLT_31_BENTON4_29TH4_138kV_1PH	*Single phase fault and sequence like previous*
32	FLT_32_BENTON4_COMOTAR4_138kV_3PH	3 phase fault on the Benton (532986) to Comotara (533037) 138kV line, near Benton. a. Apply fault at Benton 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.
33.	FLT_33_BENTON4_COMOTAR4_138kV_1PH	*Single phase fault and sequence like previous*
34.	FLT_34_WOODRNG7_CIMARON7_345kV_3PH	3 phase fault on the Woodring (514715) to Cimarron (514901) 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.
35.	FLT_35_WOODRNG7_CIMARON7_345kV_1PH	*Single phase fault and sequence like previous*

Cont. No.	Cont. Name	Description
36.	FLT_36_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.
37.	FLT_37_WOODRNG7_SOONER7_345kV_1PH	*Single phase fault and sequence like previous*
38.	FLT_38_WOODRNG7_WOODRNG4_345_138kV_3PH	3 phase fault on one of the Woodring 345kV (514715) to Woodring 138kV (514714) transformers on the 345kV bus. a. Apply fault at Woodring 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
39.	FLT_39_WOODRNG4_OTTER_138kV_3PH	3 phase fault on the Woodring (514803) to Otter (514714) 138kV line, near Woodring. a. Apply fault at Woodring 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_40_WOODRNG4_OTTER_138kV_1PH	*Single phase fault and sequence like previous*
41.	FLT_41_WOODRNG4_WAUKOTP_138kV_3PH	3 phase fault on the Woodring (514803) to Waukomis Tap (514711) 138kV line, near Woodring. a. Apply fault at Woodring 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_42_WOODRNG4_WAUKOTP_138kV_1PH	*Single phase fault and sequence like previous*
43.	FLT_43_WOODRNG4_MARSHL_138kV_3PH	3 phase fault on the Woodring (514803) to Marshall (514733) 138kV line, near Woodring. a. Apply fault at Woodring 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_44_WOODRNG4_MARSHL_138kV_1PH	*Single phase fault and sequence like previous*
45.	FLT_45_WOODRNG4_FRMNTAP_138kV_3PH	3 phase fault on the Woodring (514803) to Fairmont (514709) 138kV line, near Woodring. a. Apply fault at Woodring 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.
46.	FLT_46_WOODRNG4_FRMNTAP_138kV_1PH	*Single phase fault and sequence like previous*
47.	FLT_51_NORTWST7_SPRNGCK7_345kV_3PH	3 phase fault on the Northwest (514880) to Spring Creek (514881) 345kV line, near Northwest. a. Apply fault at 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.
48.	FLT_52_NORTWST7_SPRNGCK7_345kV_1PH	*Single phase fault and sequence like previous*

Cont. No.	Cont. Name	Description
49.	FLT_53_NORTWST7_ARCADIA_345kV_3PH	3 phase fault on the Northwest (514880) to Arcadia (514908) 345kV line, near Northwest. a. Apply fault at 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.
50.	FLT_54_NORTWST7_ARCADIA_345kV_1PH	*Single phase fault and sequence like previous*
51.	FLT_55_NORTWST7_NORTHWST4_345_138kV_3PH	3 phase fault on one of the Northwest 345kV (514880) to Northwest 138kV (514879) transformers on the 345kV bus. a. Apply fault at Northwest 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
52.	FLT_56_NORTWST7_CIMARON7_345kV_3PH	3 phase fault on the Northwest (514880) to Cimarron (514901) 345kV line, near Northwest. a. Apply fault at 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.
53.	FLT_57_NORTWST7_CIMARON7_345kV_1PH	*Single phase fault and sequence like previous*
54.	FLT_58_NORTWST7_TATONGA7_345kV_3PH	3 phase fault on the Northwest (514880) to Tatonga (515407) 345kV line, near Northwest. a. Apply fault at 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.
55.	FLT_59_NORTWST7_TATONGA7_345kV_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-2001-014	96
GEN-2001-037	100
GEN-2002-004	150
GEN-2005-008	120
GEN-2005-013	201
GEN-2006-024S	19.8

Project	MW
GEN-2006-046	131
GEN-2007-025	300
GEN-2007-043	200
GEN-2007-050	170
GEN-2008-003	101
GEN-2008-013	300

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 service is available.

***Table 4**: Prior Queued Projects Not Included in the 2012 COD Scenario*

Project	MW
GEN-2005-005	18
GEN-2007-006	160
GEN-2007-021	201
GEN-2007-044	300
GEN-2007-051	200
GEN-2007-062	765

Results

Results of the stability analysis are summarized in Table 5. These results are valid for GEN-2008-013 interconnecting with a generation amount of 299.04 MW. The results indicate that for all contingencies studied the transmission system remains stable.

***Table 5**: DISIS-2011-002 with Upgrades Scenario Results of Contingencies Evaluated*

Cont. No.	Cont. Name	Description	Summer	Winter
1.	FLT_01_GEN2008013TAP_GEN2007025TAP_345kV_3PH	3 phase fault on the GEN-2008-013 Tap (579406) to GEN-2007-025 Tap (579267) 345kV line, near GEN-2008-013 Tap.	Stable	Stable
2.	FLT_02_GEN2008013TAP_GEN2007025TAP_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
3.	FLT_03_WOODRNG7_GEN2008013TAP_345kV_3PH	3 phase fault on the Woodring (514715) to GEN-2008-013 Tap (579406) 345kV line, near Woodring.	Stable	Stable
4.	FLT_04_WOODRNG7_GEN2008013TAP_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
5.	FLT_05_WICHITA7_EMPEC7_345kV_3PH	3 phase fault on the Wichita (532796) to Emporia Energy Center (532768) 345kV line, near Wichita.	Stable	Stable
6.	FLT_06_WICHITA7_EMPEC7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable

Cont. No.	Cont. Name	Description	Summer	Winter
7.	FLT_07_WICHITA7_BENTON7_345kV_3PH	3 phase fault on the Wichita (532796) to Benton (532791) 345kV line, near Wichita.	Stable	Stable
8.	FLT_08_WICHITA7_BENTON7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
9.	FLT_09_WICHITA7_RENO7_345kV_3PH	3 phase fault on the Wichita (532796) to Reno (532771) 345kV line, near Wichita.	Stable	Stable
10.	FLT_10_WICHITA7_RENO7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
11.	FLT_11_WICHITA7_EVANSN4_345_138kV_3PH	3 phase fault on one of the Wichita 345kV (532796) to Evans North 138kV (533040) transformers on the 345kV bus.	Stable	Stable
12.	FLT_12_WICHITA7_THISTLE_345_138kV_3PH	3 phase fault on the Wichita (532796) to Thistle (539801) 345kV line, near Wichita.	Stable	Stable
13.	FLT_13_WICHITA7_THISTLE_345_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
14.	FLT_14_EVANSN4_EVANSS4_138kV_3PH	3 phase fault on the Evans North (533040) to Evans South (533041) 138kV line, near Evans North.	Stable	Stable
15.	FLT_15_EVANSN4_EVANSS4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
16.	FLT_16_EVANSN4_MAIZE4_138kV_3PH	3 phase fault on the Evans North (533040) to Maize (533054) 138kV line, near Evans North.	Stable	Stable
17.	FLT_17_EVANSN4_MAIZE4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
18.	FLT_18_EVANSN4_SG12COL4_138kV_3PH	3 phase fault on the Evans North (533040) to Colwich (533065) 138kV line, near Evans North.	Stable	Stable
19.	FLT_19_EVANSN4_SG12COL4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
20.	FLT_20_RENO7_SUMMIT7_345kV_3PH	3 phase fault on the Reno (532771) to Summit (532773) 345kV line, near Reno.	Stable	Stable
21.	FLT_21_RENO7_SUMMIT7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
22.	FLT_22_RENO7_RENO3_345_115kV_3PH	3 phase fault on one of the Reno 345kV (532771) to Reno 115kV (533416) transformers on the 345kV bus.	Stable	Stable
23.	FLT_23_BENTON7_ROSEHIL7_345kV_3PH	3 phase fault on the Benton (532791) to Rose Hill (532794) 345kV line, near Benton.	Stable	Stable
24.	FLT_24_BENTON7_ROSEHIL7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
25.	FLT_25_BENTON7_WOLFCRK7_345kV_3PH	3 phase fault on the Benton (532791) to Wolf Creek (532797) 345kV line, near Benton.	Stable	Stable
26.	FLT_26_BENTON7_WOLFCRK7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
27.	FLT_27_BENTON7_BENTON4_345_138kV_3PH	3 phase fault on one of the Benton 345kV (532791) to Benton 138kV (532986) transformers on the 345kV bus.	Stable	Stable
28.	FLT_28_BENTON4_MIDIAN4_138kV_3PH	3 phase fault on the Benton (532986) to Midian (532990) 138kV line, near Benton.	Stable	Stable
29.	FLT_29_BENTON4_MIDIAN4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
30.	FLT_30_BENTON4_CHISHLM4_138kV_3PH	3 phase fault on the Benton (532986) to Chisholm (533035) 138kV line, near Benton.	Stable	Stable
31.	FLT_31_BENTON4_CHISHLM4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable

Cont. No.	Cont. Name	Description	Summer	Winter
32.	FLT_32_BENTON4_29TH4_138kV_3PH	3 phase fault on the Benton (532986) to 29th (533024) 138kV line, near Benton.	Stable	Stable
33.	FLT_33_BENTON4_29TH4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
34.	FLT_34_BENTON4_COMOTAR4_138kV_3PH	3 phase fault on the Benton (532986) to Comotara (533037) 138kV line, near Benton.	Stable	Stable
35.	FLT_35_BENTON4_COMOTAR4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
36.	FLT_36_WOODRNG7_MATTW_345kV_3PH	3 phase fault on the Woodring (514715) to Matthewson (560368) 345kV line, near Woodring.	Stable	Stable
37.	FLT_37_WOODRNG7_MATTW_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
38.	FLT_38_WOODRNG7_SOONER7_345kV_3PH	3 phase fault on the Woodring (514715) to Sooner (514803) 345kV line, near Woodring.	Stable	Stable
39.	FLT_39_WOODRNG7_SOONER7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
40.	FLT_40_WOODRNG7_WOODRNG4_345_138kV_3PH	3 phase fault on one of the Woodring 345kV (514715) to Woodring 138kV (514714) transformers on the 345kV bus.	Stable	Stable
41.	FLT_41_WOODRNG4_OTTER_138kV_3PH	3 phase fault on the Woodring (514803) to Otter (514714) 138kV line, near Woodring.	Stable	Stable
42.	FLT_42_WOODRNG4_OTTER_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
43.	FLT_43_WOODRNG4_WAUKOTP_138kV_3PH	3 phase fault on the Woodring (514803) to Waukomis Tap (514711) 138kV line, near Woodring.	Stable	Stable
44.	FLT_44_WOODRNG4_WAUKOTP_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
45.	FLT_45_WOODRNG4_MARSHL_138kV_3PH	3 phase fault on the Woodring (514803) to Marshall (514733) 138kV line, near Woodring.	Stable	Stable
46.	FLT_46_WOODRNG4_MARSHL_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
47.	FLT_47_WOODRNG4_FRMNTAP_138kV_3PH	3 phase fault on the Woodring (514803) to Fairmont (514709) 138kV line, near Woodring.	Stable	Stable
48.	FLT_48_WOODRNG4_FRMNTAP_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
49.	FLT_49_MATTW_TATONGA7_345kV_3PH	3 phase fault on the Matthewson (560368) to Tatonga (515407) 345kV line, near Matthewson.	Stable	Stable
50.	FLT_50_MATTW_TATONGA7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
51.	FLT_51_MATTW_CIMARON7_345kV_3PH	3 phase fault on the Matthewson (560368) to Cimarron (514901) 345kV line, near Matthewson.	Stable	Stable
52.	FLT_52_MATTW_CIMARON7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
53.	FLT_53_NORTWST7_SPRNGCK7_345kV_3PH	3 phase fault on the Northwest (514880) to Spring Creek (514881) 345kV line, near Northwest.	Stable	Stable
54.	FLT_54_NORTWST7_SPRNGCK7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
55.	FLT_55_NORTWST7_ARCADIA_345kV_3PH	3 phase fault on the Northwest (514880) to Arcadia (514908) 345kV line, near Northwest.	Stable	Stable
56.	FLT_56_NORTWST7_ARCADIA_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable

Cont. No.	Cont. Name	Description	Summer	Winter
57.	FLT_57_NORTWST7_NORTHWST4_345_138kV_3PH	3 phase fault on one of the Northwest 345kV (514880) to Northwest 138kV (514879) transformers on the 345kV bus.	Stable	Stable
58.	FLT_58_NORTWST7_CIMARON7_345kV_3PH	3 phase fault on the Northwest (514880) to Cimarron (514901) 345kV line, near Northwest.	Stable	Stable
59.	FLT_59_NORTWST7_CIMARON7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
60.	FLT_60_NORTWST7_MATTW_345kV_3PH	3 phase fault on the Northwest (514880) to Matthewson (560368) 345kV line, near Northwest.	Stable	Stable
61.	FLT_61_NORTWST7_MATTW_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable

***Table 6**: System Conditions as on December 31, 2012 Scenario Results of Contingencies Evaluated*

Cont. No.	Cont. Name	Description	Summer	Winter
1.	FLT_01_GEN2008013TAP_GEN2007025TAP_345kV_3PH	3 phase fault on the GEN-2008-013 Tap (579406) to GEN-2007-025 Tap (579267) 345kV line, near GEN-2008-013 Tap.	Stable	Stable
2.	FLT_02_GEN2008013TAP_GEN2007025TAP_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
3.	FLT_03_WOODRNG7_GEN2008013TAP_345kV_3PH	3 phase fault on the Woodring (514715) to GEN-2008-013 Tap (579406) 345kV line, near Woodring.	Stable	Stable
4.	FLT_04_WOODRNG7_GEN2008013TAP_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
5.	FLT_05_WICHITA7_EMPEC7_345kV_3PH	3 phase fault on the Wichita (532796) to Emporia Energy Center (532768) 345kV line, near Wichita.	Stable	Stable
6.	FLT_06_WICHITA7_EMPEC7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
7.	FLT_07_WICHITA7_BENTON7_345kV_3PH	3 phase fault on the Wichita (532796) to Benton (532791) 345kV line, near Wichita.	Stable	Stable
8.	FLT_08_WICHITA7_BENTON7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
9.	FLT_09_WICHITA7_RENO7_345kV_3PH	3 phase fault on the Wichita (532796) to Reno (532771) 345kV line, near Wichita.	Stable	Stable
10.	FLT_10_WICHITA7_RENO7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
11.	FLT_11_WICHITA7_EVANSN4_345_138kV_3PH	3 phase fault on one of the Wichita 345kV (532796) to Evans North 138kV (533040) transformers on the 345kV bus.	Stable	Stable
12.	FLT_12_EVANSN4_EVANSS4_138kV_3PH	3 phase fault on the Evans North (533040) to Evans South (533041) 138kV line, near Evans North.	Stable	Stable
13.	FLT_13_EVANSN4_EVANSS4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
14.	FLT_14_EVANSN4_MAIZE4_138kV_3PH	3 phase fault on the Evans North (533040) to Maize (533054) 138kV line, near Evans North.	Stable	Stable
15.	FLT_15_EVANSN4_MAIZE4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable

Cont. No.	Cont. Name	Description	Summer	Winter
16.	FLT_16_EVANSN4_SG12COL4_138kV_3PH	3 phase fault on the Evans North (533040) to Colwich (533065) 138kV line, near Evans North.	Stable	Stable
17.	FLT_17_EVANSN4_SG12COL4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
18.	FLT_18_RENO7_SUMMIT7_345kV_3PH	3 phase fault on the Reno (532771) to Summit (532773) 345kV line, near Reno.	Stable	Stable
19.	FLT_19_RENO7_SUMMIT7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
20.	FLT_20_RENO7_RENO3_345_115kV_3PH	3 phase fault on one of the Reno 345kV (532771) to Reno 115kV (533416) transformers on the 345kV bus.	Stable	Stable
21.	FLT_21_BENTON7_ROSEHIL7_345kV_3PH	3 phase fault on the Benton (532791) to Rose Hill (532794) 345kV line, near Benton.	Stable	Stable
22.	FLT_22_BENTON7_ROSEHIL7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
23.	FLT_23_BENTON7_WOLFCRK7_345kV_3PH	3 phase fault on the Benton (532791) to Wolf Creek (532797) 345kV line, near Benton.	Stable	Stable
24.	FLT_24_BENTON7_WOLFCRK7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
25.	FLT_25_BENTON7_BENTON4_345_138kV_3PH	3 phase fault on one of the Benton 345kV (532791) to Benton 138kV (532986) transformers on the 345kV bus.	Stable	Stable
26.	FLT_26_BENTON4_MIDIAN4_138kV_3PH	3 phase fault on the Benton (532986) to Midian (532990) 138kV line, near Benton.	Stable	Stable
27.	FLT_27_BENTON4_MIDIAN4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
28.	FLT_28_BENTON4_CHISHLM4_138kV_3PH	3 phase fault on the Benton (532986) to Chisholm (533035) 138kV line, near Benton.	Stable	Stable
29.	FLT_29_BENTON4_CHISHLM4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
30.	FLT_30_BENTON4_29TH4_138kV_3PH	3 phase fault on the Benton (532986) to 29th (533024) 138kV line, near Benton.	Stable	Stable
31.	FLT_31_BENTON4_29TH4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
32.	FLT_32_BENTON4_COMOTAR4_138kV_3PH	3 phase fault on the Benton (532986) to Comotara (533037) 138kV line, near Benton.	Stable	Stable
33.	FLT_33_BENTON4_COMOTAR4_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
34.	FLT_34_WOODRNG7_CIMARON7_345kV_3PH	3 phase fault on the Woodring (514715) to Cimarron (514901) 345kV line, near Woodring.	Stable	Stable
35.	FLT_35_WOODRNG7_CIMARON7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
36.	FLT_36_WOODRNG7_SOONER7_345kV_3PH	3 phase fault on the Woodring (514715) to Sooner (514803) 345kV line, near Woodring.	Stable	Stable
37.	FLT_37_WOODRNG7_SOONER7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
38.	FLT_38_WOODRNG7_WOODRNG4_345_138kV_3PH	3 phase fault on one of the Woodring 345kV (514715) to Woodring 138kV (514714) transformers on the 345kV bus.	Stable	Stable
39.	FLT_39_WOODRNG4_OTTER_138kV_3PH	3 phase fault on the Woodring (514803) to Otter (514714) 138kV line, near Woodring.	Stable	Stable
40.	FLT_40_WOODRNG4_OTTER_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable

Cont. No.	Cont. Name	Description	Summer	Winter
41.	FLT_41_WOODRNG4_WAUKOTP_138kV_3PH	3 phase fault on the Woodring (514803) to Waukomis Tap (514711) 138kV line, near Woodring.	Stable	Stable
42.	FLT_42_WOODRNG4_WAUKOTP_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
43.	FLT_43_WOODRNG4_MARSHL_138kV_3PH	3 phase fault on the Woodring (514803) to Marshall (514733) 138kV line, near Woodring.	Stable	Stable
44.	FLT_44_WOODRNG4_MARSHL_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
45.	FLT_45_WOODRNG4_FRMNTAP_138kV_3PH	3 phase fault on the Woodring (514803) to Fairmont (514709) 138kV line, near Woodring.	Stable	Stable
46.	FLT_46_WOODRNG4_FRMNTAP_138kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
47.	FLT_51_NORTWST7_SPRNGCK7_345kV_3PH	3 phase fault on the Northwest (514880) to Spring Creek (514881) 345kV line, near Northwest.	Stable	Stable
48.	FLT_52_NORTWST7_SPRNGCK7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
49.	FLT_53_NORTWST7_ARCADIA_345kV_3PH	3 phase fault on the Northwest (514880) to Arcadia (514908) 345kV line, near Northwest.	Stable	Stable
50.	FLT_54_NORTWST7_ARCADIA_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
51.	FLT_55_NORTWST7_NORTHWST4_345_138kV_3PH	3 phase fault on one of the Northwest 345kV (514880) to Northwest 138kV (514879) transformers on the 345kV bus.	Stable	Stable
52.	FLT_56_NORTWST7_CIMARON7_345kV_3PH	3 phase fault on the Northwest (514880) to Cimarron (514901) 345kV line, near Northwest.	Stable	Stable
53.	FLT_57_NORTWST7_CIMARON7_345kV_1PH	*Single phase fault and sequence like previous*	Stable	Stable
54.	FLT_58_NORTWST7_TATONGA7_345kV_3PH	3 phase fault on the Northwest (514880) to Tatonga (515407) 345kV line, near Northwest.	Stable	Stable
55.	FLT_59_NORTWST7_TATONGA7_345kV_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 wind farm 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_01_GEN2008013TAP_GEN2007025TAP_345kV_3PH	3 phase fault on the GEN-2008-013 Tap (579406) to GEN-2007-025 Tap (579267) 345kV line, near GEN-2008-013 Tap. a. Apply fault at GEN-2008-013 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.
FLT_03_WOODRNG7_GEN2008013TAP_345kV_3PH	3 phase fault on the Woodring (514715) to GEN-2008-013 Tap (579406) 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.

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-2008-013 is found to be in compliance with FERC Order #661A.

Conclusion

<OMITTED TEXT> (Customer) has requested an Impact Restudy for interconnection service of 299.04 MW of wind generation within the balancing authority of Oklahoma Gas & Electric (OKGE) in Garfield County, Oklahoma. The purpose of this study is to evaluated the change in wind generators to the G.E. 1.68MW wind generation unit.

Power flow analysis showed that the Customer's wind facility can interconnect 299.04 MW of wind generation.

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-2008-013 is found to be in compliance with FERC Order #661A.

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.