SPP Southwest Power Pool

Impact ReStudy for Generator Change and Limited Operation For Generation Interconnection Request GEN-2008-079

SPP Generation Interconnection

(#GEN-2008-079)

May 2012

Executive Summary

<OMITTED TEXT> (Customer) has requested an Impact Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for interconnection of 98.9 MW of wind generation within the balancing authority of Mid-Kansas Electric Power Company (MKEC) in Gray County, Kansas. Customer has requested this Limited Operation Interconnection Study (LOIS) to determine the impacts of interconnecting its generating facility to the transmission system before all required Network Upgrades identified in the DISIS-2009-001-3 Impact Re-Study can be placed into service. Limited Operation Studies are conducted under GIA Section 5.9.

This study assumed that only the higher queued projects identified in Table 1 of this study might go into service before the completion of all Network Upgrades identified in DISIS-2009-001. If any additional generation projects not identified in Table 1 but with queue priority equal to or over GEN-2008-079 request to go into commercial operation before all Network Upgrades identified through the DISIS-2009-001-3 study process as required, then this study must be conducted again to determine whether sufficient limited interconnection capacity exists to interconnect the GEN-2008-079 interconnection request in addition to all higher priority requests in operation or pending operation. These projects are listed in Table 2.

A power flow analysis shows that the Customer's wind facility will have limited interconnection capability until such time that the 115kV upgrades from Spearville – Judson Large identified in the latest DISIS-2009-001 Impact Study can be completed. The limits are described in the body of this report. Power flow analysis was based on both summer and winter peak conditions and light loading cases.

The wind generation facility was studied with forty-three (43) Siemens 2.3 MW wind turbine generators. This Impact study addresses the dynamic stability effects of interconnecting the plant to the rest of the MKEC 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 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. Forty-one (41) contingencies were identified for use in this study. The Transmission System was found to remain stable for the studied contingencies with the added Generation Facilitiy. The Siemens 2.3 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.

1.0 Introduction

<OMITTED TEXT> (Customer) has requested an Impact Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for interconnection of 98.9 MW of wind generation within the balancing authority of Mid-Kansas Electric Power Company (MKEC) in Gray County, Kansas. Customer has requested this Limited Operation Interconnection Study (LOIS) to determine the impacts of interconnecting its generating facility to the transmission system before all required Network Upgrades identified in the DISIS-2009-001-3 Impact Study can be placed into service. Limited Operation Studies are conducted under GIA Section 5.9.

This Impact study addresses the dynamic stability effects of interconnecting the plant to the rest of the MKEC transmission system for the system condition as it will be on December 31, 2012. The wind generation facility was studied with forty-three (43) Siemens 2.3 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 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. Forty-one (41) contingencies were identified for this study.

2.0 Purpose

The purpose of this Limited Operation Interconnection Study (LOIS) is to evaluate the impact of the proposed interconnection on the reliability of the Transmission System. The LOIS 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 LOIS is commenced:

a) are directly interconnected to the Transmission System;
b) are interconnected to Affected Systems and may have an impact on the Interconnection Request;
c) have a pending higher queued Interconnection Request to interconnect to the Transmission System listed in Table 1; or
d) have no Queue Position but have executed an LGIA or requested that an unexecuted LGIA be filed with FERC.

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

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

3.0 Facilities

3.1 Generating Facility

The project was modeled as an equivalent wind turbine generator of 98.9 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 the 34.5/115kV substation transformer. An 115kV transmission line connects the Customer's substation transformer to the POI.

3.2 Interconnection Facility

The Point of Interconnection will be at a tap on the Transmission Owners Cudahy – Judson Large 115kv transmission line. Figure 1 shows the proposed POI. Figure 2 shows the Point of Interconnection.

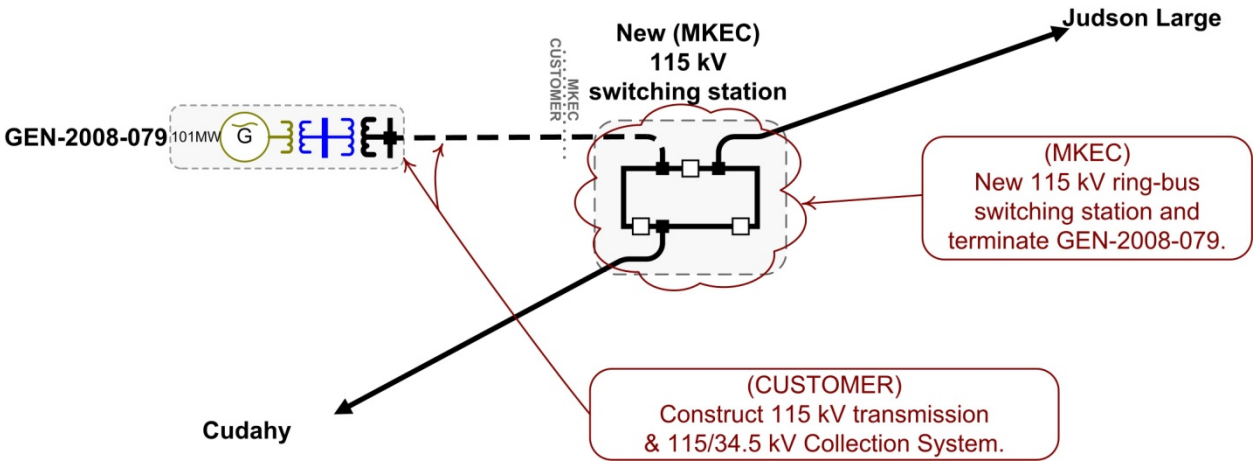

Figure 1: GEN-2008-079 Facility and Proposed Interconnection Configuration

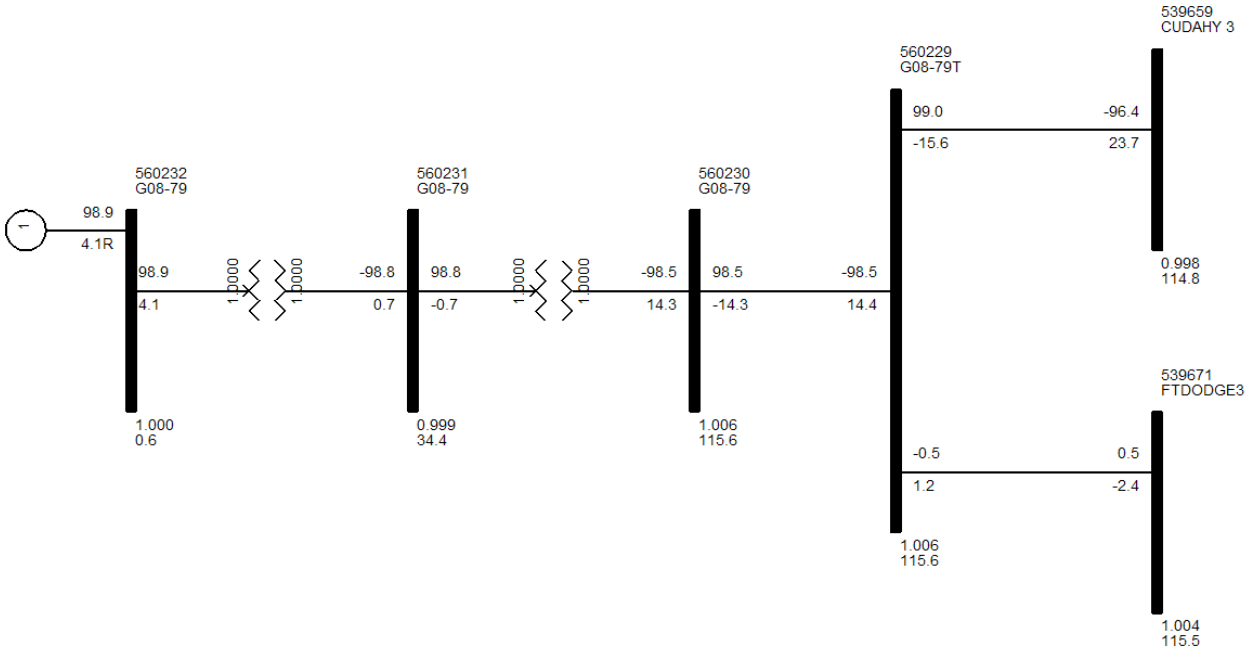

Figure 2: GEN-2008-079 Bus Interconnection

4.0 Power Flow Analysis

A power flow analysis was conducted for the Interconnection Customer's facility using a modified version of the 2011 spring, 2011 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 1 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 MKEC 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 2 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.

Table 1: Prior Queued Projects Included

Project	MW
Montezuma	110
GEN-2001-039A	105
GEN-2002-025A	150
GEN-2003-019	250
GEN-2004-014	100
GEN-2005-012	160
GEN-2006-021	101
GEN-2007-040	133
GEN-2008-018	300
GEN-2008-079	98.9

The projects listed in

Table 2 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 2: Prior Queued Projects Not Included

Project	MW
GEN-2004-014	54.5
GEN-2005-012	90
GEN-2006-006	205.5
GEN-2006-022	150
GEN-2007-038	200
GEN-2007-040	67
GEN-2008-018	105
GEN-2008-124	200

The ACCC analysis indicates that as a result of the Customer's project at full nameplate power the MKEC transmission system will experience thermal overloads as shown in Table 3 and Table 4.

Table 3 represents the results as the transmission system will exist after the completion of the Spearville-Post Rock 345kV line (scheduled for June, 2012). Table 4 represents results as the transmission system will exist after the completion of certain transmission upgrades in the MKEC system scheduled for December 2013.

An Automatic Control System (ACS) and Special Protection System (SPS) have been approved to be installed at the GEN-2008-079 point of interconnection 115kV to monitor the loading on Cudahy – GEN-2008-079T 115kV line. Gen-2008-079 feeders will be tripped one by one if Rate A (normal rate) of Cudahy – GEN-2008-079T 115kV line exceeds 90%. All four feeders will be tripped if Rate B (emergency rate) of Cudahy – Gen-2008-079T 115kV line s at or above 100%.

To accommodate the Interconnection Customer's request to go in service ahead of the required network upgrades necessary to accommodate the request, the following limitations are placed on the Generation Facility.

1. After the completion of the Spearville – Post Rock 345kV line, but prior to upgrade of the Flat Ridge – Harper 138kV line being placed in service (currently scheduled for December 2013), the Generating Facility may interconnect 98.9MW of generation with the ACS and SPS in service as described above.
2. After the completion of the Flat Ridge – Harper 138kV upgrade (scheduled for December 2013), but before the completion of the upgrades required for the Generating Facilty (currently scheduled for 2015), the Generating Facility may interconnect 98.9MW of generation with the ACS and SPS modified as described below.
    a. the ACS will be modified so that the loading of the Cudahy-GEN-2008-079 transmission line does not exceed 65% of Rate A.
    b. The SPS will remain in operation as described above.
3. After the completion of all Network Upgrades required for the Generating Facility, it may interconnect 98.9 MW of generation and the ACS and SPS must be disabled and removed.
4. The SPS has a maximum life of 3 years and must be retired after that point.

Table 3: ACCC Analysis with Spearville – Post Rock 345kV Ckt. in-service

SEASON	SOURCE	DIRECTION	MONITOR COMMON NAME	RATEA	RATEB	TDF	TC% LOADING	MW AVAILABLE	CONTINGENCY NAME
11G	G08_079	'TO->FROM'	'CUDAHY - G08-79T 115.00 115KV CKT 1'	120.7	129.5	0.5918	129.6	36.2	'NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1'
11G	G08_079	'TO->FROM'	'CUDAHY - G08-79T 115.00 115KV CKT 1'	120.7	129.5	0.5918	128.4	38.9	'SPEARVILLE (SPEARVL6) 230/115/13.8KV TRANSFORMER CKT 1'
12WP	G08_079	'FROM->TO'	'CUDAHY - KISMET 3 115.00 115KV CKT 1'	120.7	129.5	0.5912	127	41.7	'NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1'
12WP	G08_079	'FROM->TO'	'CUDAHY - KISMET 3 115.00 115KV CKT 1'	120.7	129.5	0.5912	125.8	44.5	'SPEARVILLE (SPEARVL6) 230/115/13.8KV TRANSFORMER CKT 1'
12WP	G08_079	'TO->FROM'	'CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1'	120.7	129.5	0.5912	125.4	45.4	'NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1'
11G	G08_079	'FROM->TO'	'CUDAHY - KISMET 3 115.00 115KV CKT 1'	120.7	129.5	0.5918	124.6	47.1	'NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1'
12WP	G08_079	'TO->FROM'	'CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1'	120.7	129.5	0.5912	124.1	48.1	'SPEARVILLE (SPEARVL6) 230/115/13.8KV TRANSFORMER CKT 1'
11G	G08_079	'FROM->TO'	'CUDAHY - KISMET 3 115.00 115KV CKT 1'	120.7	129.5	0.5918	123.4	49.8	'SPEARVILLE (SPEARVL6) 230/115/13.8KV TRANSFORMER CKT 1'
11G	G08_079	'TO->FROM'	'CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1'	120.7	129.5	0.5918	123.1	50.4	'NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1'
11G	G08_079	'TO->FROM'	'CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1'	120.7	129.5	0.5918	121.9	53.1	'SPEARVILLE (SPEARVL6) 230/115/13.8KV TRANSFORMER CKT 1'
11G	G08_079	'FROM->TO'	'G01_039AT 115.00 - GREENSBURG 115KV CKT 1'	120.7	129.5	0.3944	112.3	60.4	'NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1'
12WP	G08_079	'FROM->TO'	'CUDAHY - KISMET 3 115.00 115KV CKT 1'	120.7	129.5	0.2437	107.2	62.8	'SPP-SUNC-14'
11G	G08_079	'FROM->TO'	'G01_039AT 115.00 - GREENSBURG 115KV CKT 1'	120.7	129.5	0.3944	111.5	63.3	'SPEARVILLE (SPEARVL6) 230/115/13.8KV TRANSFORMER CKT 1'
11G	G08_079	'TO->FROM'	'CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1'	83.9	89.6	0.4993	118.1	68.5	'NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1'
11G	G08_079	'TO->FROM'	'CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1'	83.9	89.6	0.4993	116.7	71.1	'SPEARVILLE (SPEARVL6) 230/115/13.8KV TRANSFORMER CKT 1'
12WP	G08_079	'TO->FROM'	'CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1'	120.7	129.5	0.2437	105.5	71.6	'SPP-SUNC-14'
11G	G08_079	'FROM->TO'	'NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1'	165.1	177.7	0.7883	110.2	78	'CUDAHY - G08-79T 115.00 115KV CKT 1'
12WP	G08_079	'TO->FROM'	'CUDAHY - G08-79T 115.00 115KV CKT 1'	159.3	159.3	0.5912	107.7	80.1	'NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1'
11G	G08_079	'FROM->TO'	'GREENSBURG - SUN CITY 115KV CKT 1'	120.7	129.5	0.3944	106.2	80.7	'NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1'

SEASON	SOURCE	DIRECTION	MONITOR COMMON NAME	RATEA	RATEB	TDF	TC% LOADING	MW AVAILABLE	CONTINGENCY NAME
12WP	G08_079	'FROM->TO'	'G01_039AT 115.00 - GREENSBURG 115KV CKT 1'	120.7	129.5	0.3956	105.8	81.9	'NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1'
12WP	G08_079	'TO->FROM'	'CUDAHY - G08-79T 115.00 115KV CKT 1'	159.3	159.3	0.5912	106.7	82.9	'SPEARVILLE (SPEARVL6) 230/115/13.8KV TRANSFORMER CKT 1'
11G	G08_079	'FROM->TO'	'GREENSBURG - SUN CITY 115KV CKT 1'	120.7	129.5	0.3944	105.3	83.6	'SPEARVILLE (SPEARVL6) 230/115/13.8KV TRANSFORMER CKT 1'
12WP	G08_079	'FROM->TO'	'G01_039AT 115.00 - GREENSBURG 115KV CKT 1'	120.7	129.5	0.3956	104.7	85.4	'SPEARVILLE (SPEARVL6) 230/115/13.8KV TRANSFORMER CKT 1'
11G	G08_079	'TO->FROM'	'MEDICINE LODGE - SUN CITY 115KV CKT 1'	120.7	129.5	0.3944	103.5	89.5	'NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1'
11G	G08_079	'FROM->TO'	'NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1'	165.1	177.7	0.6603	104.2	89.7	'G01_039AT 115.00 - GREENSBURG 115KV CKT 1'
11G	G08_079	'TO->FROM'	'CUDAHY - G08-79T 115.00 115KV CKT 1'	120.7	129.5	0.5936	104.2	91.7	'JUDSON LARGE - NORTH JUDSON LARGE SUB 115KV CKT 1'
11G	G08_079	'TO->FROM'	'MEDICINE LODGE - SUN CITY 115KV CKT 1'	120.7	129.5	0.3944	102.6	92.5	'SPEARVILLE (SPEARVL6) 230/115/13.8KV TRANSFORMER CKT 1'
12WP	G08_079	'FROM->TO'	'CUDAHY - KISMET 3 115.00 115KV CKT 1'	120.7	129.5	0.5929	102.5	95.5	'JUDSON LARGE - NORTH JUDSON LARGE SUB 115KV CKT 1'
12WP	G08_079	'TO->FROM'	'CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1'	120.7	129.5	0.5929	100.8	98.9	'JUDSON LARGE - NORTH JUDSON LARGE SUB 115KV CKT 1'

Table 4: ACCC Analysis with Flat Ridge – Harper 138kV Ckt. upgrade

SEASON	SOURCE	DIRECTION	MONITOR COMMON NAME	RATEA	RATEB	TDF	TC% LOADING	MW AVAILABLE	CONTINGENCY NAME
11G	G08_079	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.21034	118.4773	16	'NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1'
11G	G08_079	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.21034	117.9513	18	'SPEARVILLE (SPEARVL6) 230/115/13.8KV TRANSFORMER CKT 1'
11G	G08_079	'TO->FROM'	'CUDAHY - G08-79T 115.00 115KV CKT 1'	120.7	129.5	0.58271	125.1205	44	'NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1'
11G	G08_079	'FROM->TO'	'G01_039AT 115.00 - GREENSBURG 115KV CKT 1'	120.7	129.5	0.40352	116.769	46	'NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1'
11G	G08_079	'TO->FROM'	'CUDAHY - G08-79T 115.00 115KV CKT 1'	120.7	129.5	0.58271	123.9488	47	'SPEARVILLE (SPEARVL6) 230/115/13.8KV TRANSFORMER CKT 1'
11G	G08_079	'FROM->TO'	'G01_039AT 115.00 - GREENSBURG 115KV CKT 1'	120.7	129.5	0.40352	115.8646	49	'SPEARVILLE (SPEARVL6) 230/115/13.8KV TRANSFORMER CKT 1'
11G	G08_079	'FROM->TO'	'CUDAHY - KISMET 3 115.00 115KV CKT 1'	120.7	129.5	0.58271	120.1364	55	'NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1'

SEASON	SOURCE	DIRECTION	MONITOR COMMON NAME	RATEA	RATEB	TDF	TC% LOADING	MW AVAILABLE	CONTINGENCY NAME
11G	G08_079	'FROM->TO'	'HARPER - MILAN TAP 138KV CKT 1'	95.6	95.6	0.21103	109.6108	56	'JUDSON LARGE - NORTH JUDSON LARGE SUB 115KV CKT 1'
11G	G08_079	'FROM->TO'	'CUDAHY - KISMET 3 115.00 115KV CKT 1'	120.7	129.5	0.58271	118.9845	58	'SPEARVILLE (SPEARVL6) 230/115/13.8KV TRANSFORMER CKT 1'
11G	G08_079	'TO->FROM'	'CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1'	120.7	129.5	0.58271	118.6557	59	'NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1'
11G	G08_079	'TO->FROM'	'CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1'	120.7	129.5	0.58271	117.5027	61	'SPEARVILLE (SPEARVL6) 230/115/13.8KV TRANSFORMER CKT 1'
11G	G08_079	'FROM->TO'	'GREENSBURG - SUN CITY 115KV CKT 1'	120.7	129.5	0.40352	110.6092	66	'NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1'
11G	G08_079	'FROM->TO'	'GREENSBURG - SUN CITY 115KV CKT 1'	120.7	129.5	0.40352	109.7202	69	'SPEARVILLE (SPEARVL6) 230/115/13.8KV TRANSFORMER CKT 1'
11G	G08_079	'TO->FROM'	'MEDICINE LODGE - SUN CITY 115KV CKT 1'	120.7	129.5	0.40352	107.9063	75	'NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1'
11G	G08_079	'TO->FROM'	'CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1'	83.9	89.6	0.49163	112.8659	77	'NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1'
11G	G08_079	'TO->FROM'	'MEDICINE LODGE - SUN CITY 115KV CKT 1'	120.7	129.5	0.40352	107.017	77	'SPEARVILLE (SPEARVL6) 230/115/13.8KV TRANSFORMER CKT 1'
11G	G08_079	'TO->FROM'	'CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1'	83.9	89.6	0.49163	111.5228	79	'SPEARVILLE (SPEARVL6) 230/115/13.8KV TRANSFORMER CKT 1'
11G	G08_079	'TO->FROM'	'CIMARRON RIVER PLANT - CIMARRON RIVER TAP 115KV CKT 1'	83.9	89.6	0.29378	105.7481	82	'CIMARRON RIVER TAP - EAST LIBERAL 115KV CKT 1'
11G	G08_079	'FROM->TO'	'NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1'	165.1	177.7	0.78053	106.0352	86	'CUDAHY - G08-79T 115.00 115KV CKT 1'
11G	G08_079	'FROM->TO'	'NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1'	165.1	177.7	0.66033	104.2175	89	'G01_039AT 115.00 - GREENSBURG 115KV CKT 1'
11G	G08_079	'FROM->TO'	'NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1'	165.1	177.7	0.78053	103.0258	93	'CUDAHY - KISMET 3 115.00 115KV CKT 1'
11G	G08_079	'FROM->TO'	'NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1'	165.1	177.7	0.78053	102.3895	95	'CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1'
11G	G08_079	'FROM->TO'	'MEDICINE LODGE (MED-LDG4) 138/115/2.72KV TRANSFORMER CKT 1'	56	62	0.21327	101.236	96	'NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1'

5.0 Stability Analysis

5.1 Contingencies Simulated

Two dynamic stability scenarios were considered during the stability analysis. One scenario consists of system conditions set for DISIS-2009-001-3 with its upgrades. The other scenario consists of being a limited operation scenario for the system condition as it will be on December 31, 2012. Forty-one (41) contingencies, listed in Table 5, were considers for the transient stability simulations of systems conditions for DISIS-2009-001-3 and its upgrades. Thirty-seven (37) contingencies, listed in Table 6, were considered for the transient stability simulations pertaining to the system conditions as they will be on December 31, 2012. 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.

An Automatic Control System (ACS) and Special Protection System (SPS) will be placed at the GEN-2008-079 point of interconnection 115kV to monitor the loading on Cudahy – GEN-2008-079T 115kV line. Gen-2008-079 feeders will be tripped one by one if Rate A (normal rate) of Cudahy – GEN-2008-079T 115kV line exceeds 90%. All four feeders will be tripped if Rate B (emergency rate) of Cudahy – Gen-2008-079T 115kV lines at or above 100%.

Table 5: DISIS-2009-001-3 with Upgrades Contingencies Evaluated

Cont. No.	Cont. Name	Description
1	FLT01-3PH	3 phase fault on the Holcomb 345kV / 115kV autotransformer near the 345 kV bus (531449). a. Apply fault at the Holcomb 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
2	FLT03-3PH	3 phase fault on the Spearville 345kV / 230kV autotransformer near the 345 kV bus (531469). a. Apply fault at the Spearville 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
3	FLT05-3PH	3 phase fault on the Spearville 230kV / 115kV autotransformer near the 230 kV bus (539695). a. Apply fault at the Spearville 230kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
4	FLT07-3PH	3 phase fault on the Post Rock 345kV / 230kV transformer, near the 345 kV bus (530583). a. Apply fault at the Post Rock 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
5	FLT09-3PH	3 phase fault on the Mullergren 230kV / 115kV transformer, near the 230 kV bus (539679). a. Apply fault at the Post Rock 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.

Cont. No.	Cont. Name	Description
6	FLT11-3PH	3 phase fault on the Spearville (531469) to Gray County (579284) 345kV lines, near Spearville. a. Apply fault at the Spearville 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.
7	FLT12-1PH	*Single phase fault and sequence like previous*
8	FLT13-3PH	3 phase fault on the Spearville (531469) to Post Rock (530583) 345kV line, near Spearville. a. Apply fault at the Spearville 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.
9	FLT14-1PH	*Single phase fault and sequence like previous*
10	FLT15-3PH	3 phase fault on the Spearville (531469) to Clark County (539800) 345kV line, near Spearville. a. Apply fault at the Spearville 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	FLT16-1PH	*Single phase fault and sequence like previous*
12	FLT17-3PH	3 phase fault on the Judson Large (539671) to Dodge City Beef (539645) 115kV line, near Judson Large. a. Apply fault at the Judson Large 115kV 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	FLT18-1PH	*Single phase fault and sequence like previous*
14	FLT19-3PH	3 phase fault on the Judson Large (539671) to GEN-2001-039A Tap (579025) 115kV line, near Judson Large. a. Apply fault at the Judson Large 115kV 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	FLT20-1PH	*Single phase fault and sequence like previous*
16	FLT21-3PH	3 phase fault on the Judson Large (539671) to North Judson Large (539771) 115kV line, near Judson Large. a. Apply fault at the Judson Large 115kV 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	FLT22-1PH	*Single phase fault and sequence like previous*

Cont. No.	Cont. Name	Description
18	FLT23-3PH	3 phase fault on the Spearville (539694) to North Judson Large (539771) 115kV line, near Spearville. a. Apply fault at the Spearville 115kV 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	FLT24-1PH	*Single phase fault and sequence like previous*
20	FLT25-3PH	3 phase fault on the Spearville (539695) to Mullergren (539679) 230kV line, near Spearville. a. Apply fault at the Spearville 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.
21	FLT26-1PH	*Single phase fault and sequence like previous*
22	FLT27-3PH	3 phase fault on the Mullergren (539679) to South Hays (530582) 230kV line, near Mullergren. a. Apply fault at the Mullergren 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.
23	FLT28-1PH	*Single phase fault and sequence like previous*
24	FLT29-3PH	3 phase fault on the Mullergren (539679) to Circle (532871) 230kV line, near Mullergren. a. Apply fault at the Mullergren 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.
25	FLT30-1PH	*Single phase fault and sequence like previous*
26	FLT31-3PH	3 phase fault on the Mullergren (539679) to Heizer (530680) 230kV line, near Mullergren. a. Apply fault at the Mullergren 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.
27	FLT32-1PH	*Single phase fault and sequence like previous*
28	FLT33-3PH	3 phase fault on the Cimarron River Tap (539652) to Cimarron Plant (539654) 115kV line, near Cimarron River Tap. a. Apply fault at the Cimarron River Tap 115kV 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	FLT34-1PH	*Single phase fault and sequence like previous*

Cont. No.	Cont. Name	Description
30	FLT35-3PH	3 phase fault on the Cimarron River Tap (539652) to East Liberal (539672) 115kV line, near Cimarron River Tap. a. Apply fault at the Cimarron River Tap 115kV 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	FLT36-1PH	*Single phase fault and sequence like previous*
32	FLT37-3PH	3 phase fault on the GEN-2008-079T (573029) to Judson Large (539671) 115kV line, near GEN-2008-079T. a. Apply fault at the GEN-2008-079T 115kV 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	FLT38-1PH	*Single phase fault and sequence like previous*
34	FLT39-3PH	3 phase fault on the GEN-2008-079T (573029) to Cudahy (539659) 115kV line, near GEN-2008-079T. a. Apply fault at the GEN-2008-079T 115kV 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	FLT40-1PH	*Single phase fault and sequence like previous*
36	FLT41-3PH	3 phase fault on the Post Rock (530583) to Axtell (640065) 345kV line, near Post Rock. a. Apply fault at the Post Rock 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	FLT42-3PH	*Single phase fault and sequence like previous*
38	FLT43-3PH	3 phase fault on the Post Rock (530584) to South Hays (530582) 230kV line, near Post Rock. a. Apply fault at the Post Rock 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.
39	FLT44-3PH	*Single phase fault and sequence like previous*
40	FLT45-3PH	3 phase fault on the Post Rock (530584) to Knoll (530558) 230kV line, near Post Rock. a. Apply fault at the Post Rock 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.
41	FLT46-3PH	*Single phase fault and sequence like previous*

Table 6: System Conditions as of December 31, 2012 Contingencies Evaluated

Cont. No.	Cont. Name	Description
1	FLT01-3PH	3 phase fault on the Holcomb 345kV / 115kV autotransformer near the 345 kV bus (531449). a. Apply fault at the Holcomb 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
2	FLT03-3PH	3 phase fault on the Spearville 345kV / 230kV autotransformer near the 345 kV bus (531469). a. Apply fault at the Spearville 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
3	FLT05-3PH	3 phase fault on the Spearville 230kV / 115kV autotransformer near the 230 kV bus (539695). a. Apply fault at the Spearville 230kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
4	FLT07-3PH	3 phase fault on the Post Rock 345kV / 230kV transformer, near the 345 kV bus (530583). a. Apply fault at the Post Rock 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
5	FLT09-3PH	3 phase fault on the Mullergren 230kV / 115kV transformer, near the 230 kV bus (539679). a. Apply fault at the Post Rock 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
6	FLT11-3PH	3 phase fault on the Spearville (531469) to Gray County (579284) 345kV lines, near Spearville. a. Apply fault at the Spearville 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.
7	FLT12-1PH	*Single phase fault and sequence like previous*
8	FLT13-3PH	3 phase fault on the Spearville (531469) to Post Rock (530583) 345kV line, near Spearville. a. Apply fault at the Spearville 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.
9	FLT14-1PH	*Single phase fault and sequence like previous*
10	FLT17-3PH	3 phase fault on the Judson Large (539671) to Dodge City Beef (539645) 115kV line, near Judson Large. a. Apply fault at the Judson Large 115kV 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	FLT18-1PH	*Single phase fault and sequence like previous*

Cont. No.	Cont. Name	Description
12	FLT19-3PH	3 phase fault on the Judson Large (539671) to GEN-2001-039A Tap (579025) 115kV line, near Judson Large. a. Apply fault at the Judson Large 115kV 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	FLT20-1PH	*Single phase fault and sequence like previous*
14	FLT21-3PH	3 phase fault on the Judson Large (539671) to North Judson Large (539771) 115kV line, near Judson Large. a. Apply fault at the Judson Large 115kV 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	FLT22-1PH	*Single phase fault and sequence like previous*
16	FLT23-3PH	3 phase fault on the Spearville (539694) to North Judson Large (539771) 115kV line, near Spearville. a. Apply fault at the Spearville 115kV 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	FLT24-1PH	*Single phase fault and sequence like previous*
18	FLT25-3PH	3 phase fault on the Spearville (539695) to Mullergren (539679) 230kV line, near Spearville. a. Apply fault at the Spearville 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.
19	FLT26-1PH	*Single phase fault and sequence like previous*
20	FLT27-3PH	3 phase fault on the Mullergren (539679) to South Hays (530582) 230kV line, near Mullergren. a. Apply fault at the Mullergren 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.
21	FLT28-1PH	*Single phase fault and sequence like previous*
22	FLT29-3PH	3 phase fault on the Mullergren (539679) to Circle (532871) 230kV line, near Mullergren. a. Apply fault at the Mullergren 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.
23	FLT30-1PH	*Single phase fault and sequence like previous*

Cont. No.	Cont. Name	Description
24	FLT31-3PH	3 phase fault on the Mullergren (539679) to Heizer (530680) 230kV line, near Mullergren. a. Apply fault at the Mullergren 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.
25	FLT32-1PH	*Single phase fault and sequence like previous*
26	FLT33-3PH	3 phase fault on the Cimarron River Tap (539652) to Cimarron Plant (539654) 115kV line, near Cimarron River Tap. a. Apply fault at the Cimarron River Tap 115kV 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	FLT34-1PH	*Single phase fault and sequence like previous*
28	FLT35-3PH	3 phase fault on the Cimarron River Tap (539652) to East Liberal (539672) 115kV line, near Cimarron River Tap. a. Apply fault at the Cimarron River Tap 115kV 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	FLT36-1PH	*Single phase fault and sequence like previous*
30	FLT37-3PH	3 phase fault on the GEN-2008-079T (573029) to Judson Large (539671) 115kV line, near GEN-2008-079T. a. Apply fault at the GEN-2008-079T 115kV 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	FLT38-1PH	*Single phase fault and sequence like previous*
32	FLT39-3PH	3 phase fault on the GEN-2008-079T (573029) to Cudahy (539659) 115kV line, near GEN-2008-079T. a. Apply fault at the GEN-2008-079T 115kV 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	FLT40-1PH	*Single phase fault and sequence like previous*
34	FLT43-3PH	3 phase fault on the Post Rock (530584) to South Hays (530582) 230kV line, near Post Rock. a. Apply fault at the Post Rock 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.
35	FLT44-3PH	*Single phase fault and sequence like previous*

Cont. No.	Cont. Name	Description
36	FLT45-3PH	3 phase fault on the Post Rock (530584) to Knoll (530558) 230kV line, near Post Rock. a. Apply fault at the Post Rock 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.
37	FLT46-3PH	*Single phase fault and sequence like previous*

5.2 Further Model Preparation

The base cases for the scenario consisting of DISIS-2009-001-3 and its upgrades, prior queued projects and DISIS-2009-001-3 projects were included.

The base cases for system conditions on December 31, 2012 include prior queued projects as shown in Table 1.

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

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

5.3 Results

Results of the DISIS-2009-001-3 with upgrades stability scenario analysis are summarized in Table 7. This scenario included all required upgrades listed in the latest DISIS-20009-001 Impact Study. The results indicate that for all contingencies studied the transmission system remains stable.

The results of the Limited Operation Study are summarized in Table 8 show that for all contingencies studied the transmission system remains stable.

Table 7: DISIS-2009-001-3 with Upgrades Scenario Results of Simulated Contingencies

Cont. No.	Cont. Name	Description	Summer	Winter
1	FLT01-3PH	3 phase fault on the Holcomb 345kV / 115kV autotransformer near the 345 kV bus (531449)..	Stable	Stable
2	FLT03-3PH	3 phase fault on the Spearville 345kV / 230kV autotransformer near the 345 kV bus (531469).	Stable	Stable
3	FLT05-3PH	3 phase fault on the Spearville 230kV / 115kV autotransformer near the 230 kV bus (539695).	Stable	Stable
4	FLT07-3PH	3 phase fault on the Post Rock 345kV / 230kV transformer, near the 345 kV bus (530583)..	Stable	Stable
5	FLT09-3PH	3 phase fault on the Mullergren 230kV / 115kV transformer, near the 230 kV bus (539679).	Stable	Stable
6	FLT11-3PH	3 phase fault on the Spearville (531469) to Gray County (579284) 345kV lines, near Spearville.	Stable	Stable
7	FLT12-1PH	*Single phase fault and sequence like previous*	Stable	Stable
8	FLT13-3PH	3 phase fault on the Spearville (531469) to Post Rock (530583) 345kV line, near Spearville.	Stable	Stable
9	FLT14-1PH	*Single phase fault and sequence like previous*	Stable	Stable
10	FLT15-3PH	3 phase fault on the Spearville (531469) to Clark County (539800) 345kV line, near Spearville.	Stable	Stable
11	FLT16-1PH	*Single phase fault and sequence like previous*	Stable	Stable
12	FLT17-3PH	3 phase fault on the Judson Large (539671) to Dodge City Beef (539645) 115kV line, near Judson Large.	Stable	Stable
13	FLT18-1PH	*Single phase fault and sequence like previous*	Stable	Stable
14	FLT19-3PH	3 phase fault on the Judson Large (539671) to GEN-2001-039A Tap (579025) 115kV line, near Judson Large.	Stable	Stable
15	FLT20-1PH	*Single phase fault and sequence like previous*	Stable	Stable
16	FLT21-3PH	3 phase fault on the Judson Large (539671) to North Judson Large (539771) 115kV line, near Judson Large.	Stable	Stable
17	FLT22-1PH	*Single phase fault and sequence like previous*	Stable	Stable
18	FLT23-3PH	3 phase fault on the Spearville (539694) to North Judson Large (539771) 115kV line, near Spearville.	Stable	Stable
19	FLT24-1PH	*Single phase fault and sequence like previous*	Stable	Stable
20	FLT25-3PH	3 phase fault on the Spearville (539695) to Mullergren (539679) 230kV line, near Spearville.	Stable	Stable
21	FLT26-1PH	*Single phase fault and sequence like previous*	Stable	Stable
22	FLT27-3PH	3 phase fault on the Mullergren (539679) to South Hays (530582) 230kV line, near Mullergren.	Stable	Stable
23	FLT28-1PH	*Single phase fault and sequence like previous*	Stable	Stable

Cont. No.	Cont. Name	Description	Summer	Winter
24	FLT29-3PH	3 phase fault on the Mullergren (539679) to Circle (532871) 230kV line, near Mullergren.	Stable	Stable
25	FLT30-1PH	*Single phase fault and sequence like previous*	Stable	Stable
26	FLT31-3PH	3 phase fault on the Mullergren (539679) to Heizer (530680) 230kV line, near Mullergren.	Stable	Stable
27	FLT32-1PH	*Single phase fault and sequence like previous*	Stable	Stable
28	FLT33-3PH	3 phase fault on the Cimarron River Tap (539652) to Cimarron Plant (539654) 115kV line, near Cimarron River Tap.	Stable	Stable
29	FLT34-1PH	*Single phase fault and sequence like previous*	Stable	Stable
30	FLT35-3PH	3 phase fault on the Cimarron River Tap (539652) to East Liberal (539672) 115kV line, near Cimarron River Tap.	Stable	Stable
31	FLT36-1PH	*Single phase fault and sequence like previous*	Stable	Stable
32	FLT37-3PH	3 phase fault on the GEN-2008-079T (573029) to Judson Large (539671) 115kV line, near GEN-2008-079T.	Stable	Stable
33	FLT38-1PH	*Single phase fault and sequence like previous*	Stable	Stable
34	FLT39-3PH	3 phase fault on the GEN-2008-079T (573029) to Cudahy (539659) 115kV line, near GEN-2008-079T.	Stable	Stable
35	FLT40-1PH	*Single phase fault and sequence like previous*	Stable	Stable
36	FLT41-3PH	3 phase fault on the Post Rock (530583) to Axtell (640065) 345kV line, near Post Rock.	Stable	Stable
37	FLT42-3PH	*Single phase fault and sequence like previous*	Stable	Stable
38	FLT43-3PH	3 phase fault on the Post Rock (530584) to South Hays (530582) 230kV line, near Post Rock.	Stable	Stable
39	FLT44-3PH	*Single phase fault and sequence like previous*	Stable	Stable
40	FLT45-3PH	3 phase fault on the Post Rock (530584) to Knoll (530558) 230kV line, near Post Rock.	Stable	Stable
41	FLT46-3PH	*Single phase fault and sequence like previous*	Stable	Stable

Table 8: System Conditions as on December 31, 2012 Scenario Results of Simulated Contingencies

Cont. No.	Cont. Name	Description	Summer	Winter
1	FLT01-3PH	3 phase fault on the Holcomb 345kV / 115kV autotransformer near the 345 kV bus (531449).	Stable	Stable
2	FLT03-3PH	3 phase fault on the Spearville 345kV / 230kV autotransformer near the 345 kV bus (531469).	Stable	Stable
3	FLT05-3PH	3 phase fault on the Spearville 230kV / 115kV autotransformer near the 230 kV bus (539695).	Stable	Stable

Cont. No.	Cont. Name	Description	Summer	Winter
4	FLT07-3PH	3 phase fault on the Post Rock 345kV / 230kV transformer, near the 345 kV bus (530583).	Stable	Stable
5	FLT09-3PH	3 phase fault on the Mullergren 230kV / 115kV transformer, near the 230 kV bus (539679).	Stable	Stable
6	FLT11-3PH	3 phase fault on the Spearville (531469) to Gray County (579284) 345kV lines, near Spearville.	Stable	Stable
7	FLT12-1PH	*Single phase fault and sequence like previous*	Stable	Stable
8	FLT13-3PH	3 phase fault on the Spearville (531469) to Post Rock (530583) 345kV line, near Spearville.	Stable	Stable
9	FLT14-1PH	*Single phase fault and sequence like previous*	Stable	Stable
10	FLT17-3PH	3 phase fault on the Judson Large (539671) to Dodge City Beef (539645) 115kV line, near Judson Large.	Stable	Stable
11	FLT18-1PH	*Single phase fault and sequence like previous*	Stable	Stable
12	FLT19-3PH	3 phase fault on the Judson Large (539671) to GEN-2001-039A Tap (579025) 115kV line, near Judson Large.	Stable	Stable
13	FLT20-1PH	*Single phase fault and sequence like previous*	Stable	Stable
14	FLT21-3PH	3 phase fault on the Judson Large (539671) to North Judson Large (539771) 115kV line, near Judson Large.	Stable	Stable
15	FLT22-1PH	*Single phase fault and sequence like previous*	Stable	Stable
16	FLT23-3PH	3 phase fault on the Spearville (539694) to North Judson Large (539771) 115kV line, near Spearville.	Stable	Stable
17	FLT24-1PH	*Single phase fault and sequence like previous*	Stable	Stable
18	FLT25-3PH	3 phase fault on the Spearville (539695) to Mullergren (539679) 230kV line, near Spearville.	Stable	Stable
19	FLT26-1PH	*Single phase fault and sequence like previous*	Stable	Stable
20	FLT27-3PH	3 phase fault on the Mullergren (539679) to South Hays (530582) 230kV line, near Mullergren.	Stable	Stable
21	FLT28-1PH	*Single phase fault and sequence like previous*	Stable	Stable
22	FLT29-3PH	3 phase fault on the Mullergren (539679) to Circle (532871) 230kV line, near Mullergren.	Stable	Stable
23	FLT30-1PH	*Single phase fault and sequence like previous*	Stable	Stable
24	FLT31-3PH	3 phase fault on the Mullergren (539679) to Heizer (530680) 230kV line, near Mullergren.	Stable	Stable
25	FLT32-1PH	*Single phase fault and sequence like previous*	Stable	Stable
26	FLT33-3PH	3 phase fault on the Cimarron River Tap (539652) to Cimarron Plant (539654) 115kV line, near Cimarron River Tap.	Stable	Stable
27	FLT34-1PH	*Single phase fault and sequence like previous*	Stable	Stable
28	FLT35-3PH	3 phase fault on the Cimarron River Tap (539652) to East Liberal (539672) 115kV line, near Cimarron River Tap.	Stable	Stable

Cont. No.	Cont. Name	Description	Summer	Winter
29	FLT36-1PH	*Single phase fault and sequence like previous*	Stable	Stable
30	FLT37-3PH	3 phase fault on the GEN-2008-079T (573029) to Judson Large (539671) 115kV line, near GEN-2008-079T.	Stable	Stable
31	FLT38-1PH	*Single phase fault and sequence like previous*	Stable	Stable
32	FLT39-3PH	3 phase fault on the GEN-2008-079T (573029) to Cudahy (539659) 115kV line, near GEN-2008-079T.	Stable	Stable
33	FLT40-1PH	*Single phase fault and sequence like previous*	Stable	Stable
34	FLT43-3PH	3 phase fault on the Post Rock (530584) to South Hays (530582) 230kV line, near Post Rock.	Stable	Stable
35	FLT44-3PH	*Single phase fault and sequence like previous*	Stable	Stable
36	FLT45-3PH	3 phase fault on the Post Rock (530584) to Knoll (530558) 230kV line, near Post Rock.	Stable	Stable
37	FLT46-3PH	*Single phase fault and sequence like previous*	Stable	Stable

5.4 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.

Two 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 9.

Table 9: LVRT Fault Contingencies

Cont. Name	Description
FLT31-3PH	3 phase fault on the GEN-2008-079T (573029) to Judson Large (539671) 115kV line, near GEN-2008-079T. a. Apply fault at the GEN-2008-079T 115kV 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.
FLT33-3PH	3 phase fault on the GEN-2008-079T (573029) to Cudahy (539659) 115kV line, near GEN-2008-079T. a. Apply fault at the GEN-2008-079T 115kV 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 project wind farm remained online for the fault contingencies described in this section and for all the fault contingencies described in section 6.2. GEN-2008-079 is found to be in compliance with FERC Order #661A.

6.0 Power Factor Analysis

The power factor analysis for this request has not been repeated. The customer is still required to provide 95% lagging (providing vars) and 95% leading (absorbing vars) at the point of interconnection as indicated in earlier studies for power factor.

7.0 Conclusion

<OMITTED TEXT> (Customer) has requested an Limited Operation Impact Study for limited interconnection service of 98.9 MW of wind generation within the balancing authority of Mid-Kansas Electric Power Company (MKEC) in Gray County, Kansas, in accordance with the Article 5.9 of the Standard GIA.

The GEN-2008-079 will be restricted to the interconnection service limits described in this report assuming all projects listed in Table 1 come on line and assuming projects listed in Table 2 do not come on line before all network upgrades can be constructed.

The results of this study show that the wind generation facility and the transmission system remain stable for all contingencies studied. Also, GEN-2008-079 is found to be in compliance with FERC Order #661A.

The projects listed in Table 2 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.

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.