Interconnection Facilities Study
For
Generator Interconnection
Request
GEN-2011-016
(IFS-2011-001-01)

SPP Generator
Interconnection

(#GEN-2011-016)

December 2015

Revision History

Date	Author	Change Description
01/12/2012	SPP	Facility Study Report Issued
2/21/2013	SPP	Account for Definitive Interconnection System Impact Restudy Results (DISIS-2011-001-3)
01/10/2014	SPP	Account for Definitive Interconnection System Impact Restudy Results (DISIS-2011-001-4)
12/3/2015	SPP	Revised for change in interconnection configuration at the Ironwood Substation

Summary

The following Facility Study for Generation Interconnection request GEN-2011-016 (IFS-2011-001-01) (200.1MW/Wind) located in Ford County in Kansas. The request for interconnection was placed with SPP in accordance with SPP's Open Access Transmission Tariff, which covers new generation interconnections on SPP's transmission system. This revision covers a change in interconnection configuration that has been requested by the Interconnection Customer to account for the addition of the Ironwood 345kV substation after the posting of the original Interconnection Facilities Study. The request for modification was evaluated in the study found in Appendix A of this report.

Interconnection Customer Interconnection Facilities

The Interconnection Customer will be responsible for the 345 kV transmission line from its wind turbine Collector Substation to the Point of Interconnection (POI), the ITCGP Ironwood 345kV substation located in Ford County, Kansas. In addition, the customer will be responsible for reactive power compensation equipment to maintain 95% lagging (providing vars) and 95% leading (absorbing vars) power factor at the point of interconnection.

Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades

Per the following Facility Study, the Interconnection Customer is responsible for $7,772,232 of Transmission Owner Interconnection Facilities and non-shared network upgrades.

Shared Network Upgrades

The Interconnection Request was evaluated for Network Upgrades beyond the Point of Interconnection that could be eligible for cost sharing in the DISIS-2011-001-6 Impact Restudy. At this time, the Interconnection Customer is allocated $0 for Shared Network Upgrades.

Upgrade Description	Allocated Cost	Total Cost
None		
Total		

If higher queued interconnection customers withdraw from the queue, suspend or terminate their GIA, restudies will have to be conducted to determine the Interconnection Customers' allocation of shared network upgrades. All studies have been conducted on the basis of higher queued interconnection requests and the upgrades associated with those higher queued interconnection requests being placed in service.

Other Network Upgrades

Certain Network Upgrades that are not the cost responsibility of the Customer are required for Interconnection. These Network Upgrades include:

1. None

Depending upon the status of higher or equally queued customers, the Interconnection Customer's in service date may be delayed until the in service date of these Network Upgrades.

Conclusion
Interconnection Service for GEN-2011-016 will be delayed until the Transmission Owner Interconnection Facilities Shared Network Upgrades are constructed. The Customer is responsible for $7,772,232 of Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades. At this time, the Interconnection Customer is allocated $0 for Shared Network Upgrades. After all Interconnection Facilities and Network Upgrades have been placed into service, Interconnection Service for 200.1 MW, as requested by GEN-2011-016, can be allowed. At this time the total allocation of costs of Interconnection Service for GEN-2011-016 are estimated at $7,777,232.

Executive Summary

<OMITTED TEXT> (Customer) has requested a Facility Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for interconnecting a 200.1 MW wind powered generation facility in Ford County, Kansas to the transmission system of ITC-Great Plains (ITC-GP). The wind powered generation facility studied is comprised of eighty seven (87) Siemens SWT 2.3 MW wind turbines. The wind powered generation facility will interconnect into the Ironwood 345kV substation on the Spearville-Clark County 345kV line.

ITC-GP will add a 345kV ring bus at the planned Ironwood substation and terminate the GEN-2011-016 wind farm. The Interconnection Customer's non shared network upgrades and interconnection facilities are estimated at $7,777,232.

The Customer will be responsible for reactive power compensation equipment to maintain 95% lagging (providing vars) and 95% leading (absorbing vars) power factor at the point of interconnection.

1. Introduction

<OMITTED TEXT> (Customer) has requested a Facility Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for interconnecting a 200.1 MW wind powered generation facility in Ford County, Kansas to the transmission system of ITC-Great Plains (ITC-GP). The wind powered generation facility studied is comprised of eighty seven (87) Siemens SWT 2.3 MW wind turbines. The wind powered generation facility will interconnect into the Ironwood 345kV substation on the Spearville-Clark County 345kV line

2. Interconnection Facilities and Network Upgrades

The cost for the Interconnection Facilities and Network Upgrades is listed below in Table 1. The one-line diagram is shown in Figure 1. Details of the design can be acquired from the Transmission Owner, ITC-GP. Transmission Owner will determine the individual equipment ratings for specific Transmission Owner's Interconnection Facilities and Network Upgrades during the detailed design of the facilities.

Table 1: Required Interconnection Facilities and Non Shared Network Upgrades

Project	Description	Estimated Cost
1	ITC-GP – Add 345kV dead-end tower and miscellaneous equipment at Ironwood 345kV Substation	$686,045
2	ITC-GP - Add two (2) 345kV line terminals and three (3) 345kV breakers and associated switches to the Ironwood Substation to accommodate terminals to Spearville and Clark County.	$7,086,187
	Total:	**$7,777,232**

Figure 1: Interconnection Configuration for GEN-2011-016

(Redacted for CEII purposes)

2.1. <u>Customer Facilities</u> – The Customer will be responsible for its Generating Facility, its 345kV radial line, and its 345/34.5 kV substation that will contain a high side 345kV circuit breaker, its 345/34.5 kV transformer(s) and wind turbine collector feeders. In addition, the Customer will be required to install the following equipment in its facilities.

2.1.1. <u>Metering Equipment</u> – The Customer will be responsible for revenue metering equipment.

2.1.2. <u>Reactive Power Equipment</u> – The Customer will be responsible for reactive power compensation equipment to maintain 95% lagging (providing vars) and 95% leading (absorbing vars) power factor at the point of interconnection. Any capacitor banks installed by the Interconnection Customer shall not cause voltage distortion in accordance with Article 9.7.4 of the standard SPP Generation Interconnection Agreement.

3. <u>Voltage Guidelines</u>

Reactive power, voltage regulation and operating requirements will be as per Transmission Operator (TOP) and Transmission Provider directives. Interconnection Customer will operate the Generating Facility to a voltage schedule of 354 kV (1.026 pu) with a bandwidth of +/- 6 kV (0.017 pu) at the Point of Interconnection (POI) utilizing the Generating Facility's required power factor design capability as indicated in DISIS-2011-001. As per DISIS 2011-001, the Interconnection Customer's required power factor capability is 0.95 lagging to 0.95 leading (at the POI).

For further clarification, the Interconnection Customer may meet the +/- 0.95 power factor requirement by utilizing reactive capability from the wind generators or by adding external reactive compensation. Note that any reactive compensation installed by the Interconnection Customer shall not cause voltage distortion in accordance with Article 9.7.6 Power Quality of the Generation Interconnection Agreement.

The Interconnection Customer will regulate the Generating Facility's voltage to the specified voltage set-point within the defined bandwidth stated above using an automatic voltage controller utilizing the inherent reactive power capability in the wind turbines and if applicable external reactive compensation.

The above voltage schedule is subject to change. If the need for a change is identified, it will be done within the limits of the GIA provisions stated in Section 9.6 and the Generating Facility's power factor design criteria as stated above. If a schedule change is needed, appropriate written documentation of the change will be provided to the Interconnection Customer.

The Interconnection Customer is required to have a generator operator available for 24/7 communication with the TOP. The TOP may, at any time request a variance from the schedule in response to system operating/security requirements.

4. Conclusion

The Interconnection Customer's interconnection facilities and Network Upgrades are estimated at $7,777,232.

Appendix A: Modification Study

Modification Impact Study for Generator Interconnection

GEN-2011-016

June 2014
Generator Interconnection

SPP Southwest Power Pool

Executive Summary

This study report addresses the request of the GEN-2011-016 Interconnection Customer for Southwest Power Pool (SPP) to study the modification of the interconnection configuration of its Interconnection Request to interconnect into the Ironwood 345kV Substation in Ford County, Kansas. The GEN-2011-016 Interconnection Request was originally requested to interconnect into the Spearville 345kV Substation in Ford County, Kansas. In December 2013, the SPP Board of Directors approved the construction of the Ironwood Substation located approximately 1.5 miles from Spearville. As this request to move to Ironwood was made prior to GEN-2011-016 executing or requesting the filing of an unexecuted Generator Interconnection Agreement, SPP has agreed to perform this modification impact analysis.

The following Modification Request Impact Study (MRIS) under the Southwest Power Pool Open Access Transmission Tariff (OATT) addresses the interconnection of 200.1 MW of generation to be interconnected as an Energy Resource (ER) into the Transmission System of Sunflower Electric Power Corporation (SUNC) for the system topology and conditions as expected on December 31, 2015. GEN-2011-016 is requesting the interconnection of eighty seven (87) Siemens SWT 2.3 MW wind turbine generators and associated facilities into the Ironwood Substation. For the typical MRIS, both a power flow and transient stability analysis are conducted.

Power flow and dynamic stability analysis from this MRIS has determined that the customer's request to interconnect into the Ironwood 345kV Substation will be able to be accommodated without causing harm to any Interconnection Customers in the Generator Interconnection Queue and does not harm reliability to the SPP Transmission System. The request to modify the interconnection configuration to the Ironwood 345kV Substation is not considered a Material Modification.

For the Interconnection Substation costs required at the Ironwood Substation, ITC-Great Plains, the Transmission Owner of the Ironwood Substation, will need to be asked to perform an Interconnection Facilities Study to determine the costs.

This study only reviewed the modification request to interconnect at the Ironwood Substation and does not address any other Interconnection Service Requirements.

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

Table of Contents

Purpose

This study report addresses the request of the Interconnection Customer for GEN-2011-016 for Southwest Power Pool (SPP) study the modification of the interconnection configuration of its Interconnection Request to interconnect into the Ironwood Substation in Ford County, Kansas. The GEN-2011-016 Interconnection Request was originally requested to interconnect into the Spearville 345kV Substation in Ford County, Kansas. At the time of its initial request, the Ironwood Substation was not a viable point of interconnection of the Transmission System. In December 2013, the SPP Board of Directors approved the construction of the Ironwood Substation located approximately 1.5 miles from Spearville. As this request has been made prior to GEN-2011-016 executing or requesting the filing of an unexecuted Generator Interconnection Agreement, SPP has agreed to perform this modification impact analysis.

The following Modification Request Impact Study (MRIS) under the Southwest Power Pool Open Access Transmission Tariff (OATT) addresses the interconnection of 200.1 MW of generation to be interconnected as an Energy Resource (ER) into the Transmission System of Sunflower Electric Power Corporation (SUNC) for the system topology and conditions as expected on December 31, 2015. GEN-2011-016 is requesting the interconnection of eighty seven (87) Siemens SWT 2.3 MW wind turbine generators and associated facilities into the Ironwood Substation. For the typical MRIS, both a power flow and transient stability analysis are conducted.

Both power flow and transient stability analysis were conducted for this Modification Request Impact Study (MRIS).

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

Model Development

Interconnection Requests Included in the Study

SPP included all Generator Interconnection Requests in the SPP Generator Interconnection Queue in the Spearville area through the DISIS-2013-002 Definitive Interconnection System Impact Study (DISIS). These Interconnection Requests are listed in Table 1 below. All Network Upgrades assigned to those Interconnection Requests were also included in the model topology.

Table 1: Generation Requests Included within MRIS

Project	MW	Total MW	Fuel Source	POI	Status
Gray County Wind (Montezuma)	110.0	110.0	Wind	Gray County Tap 115kV	Commercial Operation
GEN-2001-039A (Shooting Star)	105.0	105.0	Wind	Shooting Star Tap 115kV	Commercial Operation
GEN-2001-039M (Central Plains)	99.0	99.0	Wind	Central Plains Tap 115kV	Commercial Operation
GEN-2002-025A (KCPL)	148.5	148.5	Wind	Spearville 230kV	Commercial Operation
GEN-2003-006A (Merridian Way)	200.0	200.0	Wind	Elm Creek 230kV	Commercial Operation
GEN-2003-019 (Smoky Hills)	249.3	249.3	Wind	Smoky Hills Tap 230kV	Commercial Operation
GEN-2004-014 (KCPL)	154.5	154.5	Wind	Spearville 230kV	Commercial Operation
GEN-2005-012 (Westar)	248.4	248.4	Wind	Spearville 345kV	Commercial Operation
GEN-2006-006	205.5	205.5	Wind	Spearville 345kV	IA Executed/On Suspension
GEN-2006-021 (Flat Ridge I)	101.0	101.0	Wind	Flat Ridge Tap 138kV	Commercial Operation
GEN-2007-040 (Cimarron II)	200.1	200.1	Wind	Buckner 345kV	Commercial Operation
GEN-2008-018	250.0	250.0	Wind	Finney 345kV	Commercial Operation
GEN-2008-079 (Ensign)	98.9	98.9	Wind	Tap Cudahy – Ft Dodge 115kV	Commercial Operation
GEN-2008-124	200.1	200.1	Wind	Ironwood 345kV	IA Executed/On Schedule for 1/2016
GEN-2010-009 (Cimarron I)	165.6	165.6	Wind	Buckner 345kV	Commercial Operation
GEN-2010-045	197.8	197.8	Wind	Buckner 345kV	IA Executed/On Schedule for 2017
GEN-2010-057	201.0	201.0	Wind	Rice County 230kV	Commercial Operation
GEN-2011-008	600.0	600.0	Wind	Clark County 345kV	IA Executed/ On Schedule for 2019
GEN-2011-017	299.0	299.0	Wind	Tap Spearville – Post Rock 345kV	IA Executed/On Schedule for 2017
ASGI-2012-006	22.5	22.5	Steam	Tap Hugoton – Rolla 69kV	
GEN-2012-007	108	108	Gas	Tap Hickock – Satanta Tap 115kV	IA Executed/On Schedule for 2014
GEN-2012-011	200	200	Wind	Tap Spearville – Post Rock 345kV (North of GEN 2011-017 Tap)	Facility Study Stage
GEN-2012-024	180	180	Wind	Clark County 345kV	Facility Study Stage
GEN-2013-010	99	99	Wind	Tap Spearville – Post Rock 345kV	Facility Study Stage
GEN-2011-016	200.1	200.1	Wind	Ironwood 345kV	IA Pending

Base Case Network Upgrades

The Network Upgrades included within the cases used for this MRIS study are those facilities that are a part of the SPP Transmission Expansion Plan or the Balanced Portfolio projects that have in-service dates prior to the Customers requested in-service date of December 31, 2015. These facilities have an approved Notification to Construct (NTC), or are in construction stages and expected to be in-service at the effective time of this study. Additionally, upgrades assigned to Interconnection Requests in the Generator Interconnection Queue were included where applicable. No other upgrades were included for this MRIS.

Facilities

Generating Facility

GEN-2011-016 Interconnection Customer's request to interconnect a total of 200.1 MW is comprised of eighty seven (87) Siemens SWT 2.3 MW wind turbine generators and associated facilities.

Interconnection Facilities

The POI for GEN-2011-016 Interconnection Customer is the Ironwood 345kV Substation in Ford County, Kansas.

Power Flow Analysis

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

Model Preparation

Power flow analysis was performed using modified versions of the 2013 series of transmission service request study models including the 2014 and 2019 (spring, summer, and winter) seasonal models. To incorporate the Interconnection Customer's request, a re-dispatch of existing generation within SPP was performed with respect to the amount of the Customer's injection and the interconnecting Balancing Authority. This method allows the request to be studied as an Energy Resource (ERIS) Interconnection Request.

For the Spearville area (DISIS Group 3), the wind generating plants were modeled at 100% nameplate of maximum generation. The wind generating plants in the other areas were modeled at 20% nameplate of maximum generation. These projects were dispatched as Energy Resources with equal distribution across the SPP footprint. This method allowed for the identification of network constraints that were common to the regional groupings that could then in turn have the mitigating upgrade cost allocated throughout the entire cluster. Other sensitivity analyses are also performed with all interconnection requests in each group being dispatched at 100% nameplate.

Peaking units were not dispatched in the 2014 spring model. To study peaking units' impacts, the 2014 summer and winter and 2019 summer and winter, and 2024 summer seasonal models were chosen and peaking units were modeled at 100% of the nameplate rating and wind generating facilities were modeled at 10% of the nameplate rating. Each interconnection request was also modeled separately at 100% nameplate for certain analyses.

All Network Upgrades that are currently assigned to the Interconnection Requests in Table 1are included in the model topology.

Study Methodology and Criteria

The ACCC function of PSS/E is used to simulate contingencies, including single and multiple facility (i.e. breaker-to-breaker, etc.) outages, within all of the control areas of SPP and other control areas external to SPP and the resulting data analyzed. This satisfies the "more probable" contingency testing criteria mandated by NERC and the SPP criteria.

The contingency set includes all SPP control area branches and ties 69kV and above, first tier Non-SPP control area branches and ties 115 kV and above, any defined contingencies for these control areas, and generation unit outages for the SPP control areas with SPP reserve share program redispatch.

The monitor elements include all SPP control area branches, ties, and buses 69 kV and above, and all first tier Non-SPP control area branches and ties 69 kV and above. NERC Power Transfer Distribution Flowgates for SPP and first tier Non-SPP control area are monitored. Additional NERC Flowgates are monitored in second tier or greater Non-SPP control areas. Voltage monitoring was performed for SPP control area buses 69 kV and above.

Results

The ACCC analysis of the impacts from each Interconnection Request on the Transmission System indicates that no new thermal overloads will occur on the SPP Transmission System due to the requested modification. The change in loadings on constraints was less than 0.1% for all constraints (taking into account constraints with more than 3% sensitivity). No additional constraints were found that would impact the interconnection capability of any other Interconnection Customers (constraints with more than 20% sensitivity).

Curtailment and System Reliability

In no way does this study guarantee operation for all periods of time. It should be noted that although this study analyzed many of the most probable contingencies, it is not an all-inclusive list and cannot account for every operational situation. Because of this, it is likely that the Customer may be required to reduce their generation output to 0 MW under certain system conditions to allow system operators to maintain the reliability of the transmission network.

Power Flow Analysis

Table 2: Interconnection Constraints for Reinforcement of GEN-2011-016 @ 200.1MW

Season	Dispatch Group	Flow	Overloaded Element	RATEA (MVA)	RATEB (MVA)	TDF	TC% LOADING	Max MW Available	Contingency
ALL			N/A					200.1	N/A

Table 3: Interconnection Constraints that do not require reinforcement for GEN-2011-016 @ 200.1MW

Season	Dispatch Group	Flow	Scenario	Overloaded Element	RATEA (MVA)	RATEB (MVA)	TDF	TC% LOADING	Contingency
14G	03ALL	-	1	Non-converged Contingency	-	-	0.39916	-	DBL-THIS-CLR
14G	03ALL	-	0	Non-converged Contingency	-	-	0.39417	-	DBL-THIS-CLR
14G	03ALL	FROM->TO	1	HARPER - MILAN TAP 138KV CKT 1	110	110	0.04746	242.9921	DBL-WICH-THI
14G	03ALL	FROM->TO	0	HARPER - MILAN TAP 138KV CKT 1	110	110	0.0471	242.9258	DBL-WICH-THI
14G	03ALL	TO->FROM	1	CLEARWATER - MILAN TAP 138KV CKT 1	110	110	0.04746	230.2652	DBL-WICH-THI
14G	03ALL	TO->FROM	0	CLEARWATER - MILAN TAP 138KV CKT 1	110	110	0.0471	230.1985	DBL-WICH-THI
14G	03G11_016	FROM->TO	1	HARPER - MILAN TAP 138KV CKT 1	110	110	0.04781	208.3461	DBL-WICH-THI
14G	03G11_016	FROM->TO	0	HARPER - MILAN TAP 138KV CKT 1	110	110	0.04746	205.8426	DBL-WICH-THI
14G	3	FROM->TO	1	HARPER - MILAN TAP 138KV CKT 1	110	110	0.04784	202.0865	DBL-WICH-THI
14G	3	FROM->TO	0	HARPER - MILAN TAP 138KV CKT 1	110	110	0.04747	202.0404	DBL-WICH-THI
14G	03G11_016	TO->FROM	1	CLEARWATER - MILAN TAP 138KV CKT 1	110	110	0.04781	197.8094	DBL-WICH-THI
14G	03G11_016	TO->FROM	0	CLEARWATER - MILAN TAP 138KV CKT 1	110	110	0.04746	195.2983	DBL-WICH-THI
14G	3	TO->FROM	1	CLEARWATER - MILAN TAP 138KV CKT 1	110	110	0.04784	191.5495	DBL-WICH-THI
14G	3	TO->FROM	0	CLEARWATER - MILAN TAP 138KV CKT 1	110	110	0.04747	191.5035	DBL-WICH-THI
14G	03G11_016	TO->FROM	1	GREENSBURG - SSTARTP3 115.00 115KV CKT 1	115.1	115.1	0.0381	157.6733	DBL-THIS-CLR
14G	03G11_016	TO->FROM	0	GREENSBURG - SSTARTP3 115.00 115KV CKT 1	115.1	115.1	0.0381	155.0091	DBL-THIS-CLR
14G	3	TO->FROM	1	GREENSBURG - SSTARTP3 115.00 115KV CKT 1	115.1	115.1	0.03811	151.5111	DBL-THIS-CLR
14G	3	TO->FROM	0	GREENSBURG - SSTARTP3 115.00 115KV CKT 1	115.1	115.1	0.03811	151.5017	DBL-THIS-CLR
14G	03ALL	TO->FROM	1	GREENSBURG - SSTARTP3 115.00 115KV CKT 1	115.1	115.1	0.03779	147.412	DBL-IRON-CLR
14G	03ALL	TO->FROM	0	GREENSBURG - SSTARTP3 115.00 115KV CKT 1	115.1	115.1	0.03779	147.3994	DBL-IRON-CLR
14G	03G11_016	FROM->TO	1	GREENSBURG - SUN CITY 115KV CKT 1	115.1	115.1	0.0381	146.283	DBL-THIS-CLR
14G	03G11_016	FROM->TO	0	GREENSBURG - SUN CITY 115KV CKT 1	115.1	115.1	0.0381	143.7144	DBL-THIS-CLR
14G	03ALL	TO->FROM	0	HAYS PLANT - SOUTH HAYS 115KV CKT 1	83	99	0.03032	143.0968	KNOLL 230 - POSTROCK6 230.00 230KV CKT 1
14G	03ALL	TO->FROM	1	HAYS PLANT - SOUTH HAYS 115KV CKT 1	83	99	0.03005	143.0596	KNOLL 230 - POSTROCK6 230.00 230KV CKT 1
14G	03G11_016	TO->FROM	1	MEDICINE LODGE - SUN CITY 115KV CKT 1	115.1	115.1	0.0381	141.149	DBL-THIS-CLR
14G	3	FROM->TO	1	GREENSBURG - SUN CITY 115KV CKT 1	115.1	115.1	0.03811	140.3095	DBL-THIS-CLR
14G	3	FROM->TO	0	GREENSBURG - SUN CITY 115KV CKT 1	115.1	115.1	0.03811	140.3011	DBL-THIS-CLR
14G	03G11_016	TO->FROM	0	MEDICINE LODGE - SUN CITY 115KV CKT 1	115.1	115.1	0.0381	138.6037	DBL-THIS-CLR

Power Flow Analysis

Season	Dispatch Group	Flow	Scenario	Overloaded Element	RATEA (MVA)	RATEB (MVA)	TDF	TC% LOADING	Contingency
14G	03ALL	FROM->TO	0	HAYS PLANT - VINE STREET 115KV CKT 1	80	88	0.03032	137.894	KNOLL 230 - POSTROCK6 230.00 230KV CKT 1
14G	03ALL	FROM->TO	1	HAYS PLANT - VINE STREET 115KV CKT 1	80	88	0.03005	137.8521	KNOLL 230 - POSTROCK6 230.00 230KV CKT 1
14G	03ALL	FROM->TO	1	GREENSBURG - SUN CITY 115KV CKT 1	115.1	115.1	0.03779	136.3638	DBL-IRON-CLR
14G	03ALL	FROM->TO	0	GREENSBURG - SUN CITY 115KV CKT 1	115.1	115.1	0.03779	136.3524	DBL-IRON-CLR
14G	3	TO->FROM	1	MEDICINE LODGE - SUN CITY 115KV CKT 1	115.1	115.1	0.03811	135.2306	DBL-THIS-CLR
14G	3	TO->FROM	0	MEDICINE LODGE - SUN CITY 115KV CKT 1	115.1	115.1	0.03811	135.2223	DBL-THIS-CLR
14G	03ALL	TO->FROM	1	MEDICINE LODGE - SUN CITY 115KV CKT 1	115.1	115.1	0.03779	131.2613	DBL-IRON-CLR
14G	03ALL	TO->FROM	0	MEDICINE LODGE - SUN CITY 115KV CKT 1	115.1	115.1	0.03779	131.2516	DBL-IRON-CLR
14G	03ALL	TO->FROM	0	CIRCLE - MULLERGREN 230KV CKT 1	318.7	318.7	0.08262	128.5873	DBL-WICH-THI
14G	03ALL	TO->FROM	1	CIRCLE - MULLERGREN 230KV CKT 1	318.7	318.7	0.08226	128.5717	DBL-WICH-THI
14G	03G11_016	TO->FROM	1	HAYS PLANT - SOUTH HAYS 115KV CKT 1	83	99	0.0302	128.2171	KNOLL 230 - POSTROCK6 230.00 230KV CKT 1
14G	03ALL	TO->FROM	0	MULLERGREN - SPEARVILLE 230KV CKT 1	398	398	0.12214	127.5089	G12-011T 345.00 - POST ROCK 345KV CKT 1
14G	03ALL	TO->FROM	1	MULLERGREN - SPEARVILLE 230KV CKT 1	398	398	0.1211	127.4746	G12-011T 345.00 - POST ROCK 345KV CKT 1
14G	03G11_016	TO->FROM	0	HAYS PLANT - SOUTH HAYS 115KV CKT 1	83	99	0.03047	127.1079	KNOLL 230 - POSTROCK6 230.00 230KV CKT 1
14G	03ALL	FROM->TO	1	CLEARWATER - GILL ENERGY CENTER WEST 138KV CKT 1	191	191	0.04746	125.5621	DBL-WICH-THI
14G	3	TO->FROM	0	HAYS PLANT - SOUTH HAYS 115KV CKT 1	83	99	0.03046	125.5491	KNOLL 230 - POSTROCK6 230.00 230KV CKT 1
14G	03ALL	FROM->TO	0	CLEARWATER - GILL ENERGY CENTER WEST 138KV CKT 1	191	191	0.0471	125.5242	DBL-WICH-THI
14G	3	TO->FROM	1	HAYS PLANT - SOUTH HAYS 115KV CKT 1	83	99	0.03019	125.5096	KNOLL 230 - POSTROCK6 230.00 230KV CKT 1
14G	03ALL	FROM->TO	0	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.07056	125.0231	DBL-WICH-THI
14G	03ALL	FROM->TO	1	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.07024	125.0071	DBL-WICH-THI
14G	03ALL	TO->FROM	0	KNOLL - N HAYS3 115.00 115KV CKT 1	80	88	0.03032	124.3365	KNOLL 230 - POSTROCK6 230.00 230KV CKT 1
14G	03ALL	TO->FROM	1	KNOLL - N HAYS3 115.00 115KV CKT 1	80	88	0.03005	124.2945	KNOLL 230 - POSTROCK6 230.00 230KV CKT 1
14G	03G11_016	TO->FROM	1	GREENSBURG - SSTARTP3 115.00 115KV CKT 1	115.1	115.1	0.0381	123.5273	DBL-IRON-CLR
14G	03ALL	TO->FROM	0	GREENSBURG - SSTARTP3 115.00 115KV CKT 1	115.1	115.1	0.03779	123.5083	DBL-SPRVL-CL
14G	03G11_016	TO->FROM	1	CIRCLE - MULLERGREN 230KV CKT 1	318.7	318.7	0.10412	122.9472	DBL-THIS-CLR
14G	03G11_016	TO->FROM	0	GREENSBURG - SSTARTP3 115.00 115KV CKT 1	115.1	115.1	0.0381	121.6106	DBL-IRON-CLR
14G	03G11_016	FROM->TO	1	HAYS PLANT - VINE STREET 115KV CKT 1	80	88	0.0302	121.1432	KNOLL 230 - POSTROCK6 230.00 230KV CKT 1
14G	03G11_016	FROM->TO	1	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.09031	121.094	DBL-THIS-CLR
14G	03G11_016	TO->FROM	0	CIRCLE - MULLERGREN 230KV CKT 1	318.7	318.7	0.10413	120.6134	DBL-THIS-CLR
14G	03G11_016	FROM->TO	0	HAYS PLANT - VINE STREET 115KV CKT 1	80	88	0.03047	119.8725	KNOLL 230 - POSTROCK6 230.00 230KV CKT 1
14G	03G11_016	FROM->TO	0	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.09032	119.026	DBL-THIS-CLR
14G	3	TO->FROM	1	GREENSBURG - SSTARTP3 115.00 115KV CKT 1	115.1	115.1	0.03811	118.5781	DBL-IRON-CLR
14G	3	TO->FROM	0	GREENSBURG - SSTARTP3 115.00 115KV CKT 1	115.1	115.1	0.03811	118.5775	DBL-IRON-CLR
14G	3	FROM->TO	0	HAYS PLANT - VINE STREET 115KV CKT 1	80	88	0.03046	118.0971	KNOLL 230 - POSTROCK6 230.00 230KV CKT 1
14G	3	FROM->TO	1	HAYS PLANT - VINE STREET 115KV CKT 1	80	88	0.03019	118.0525	KNOLL 230 - POSTROCK6 230.00 230KV CKT 1
14G	3	TO->FROM	1	CIRCLE - MULLERGREN 230KV CKT 1	318.7	318.7	0.10416	117.3671	DBL-THIS-CLR
14G	3	TO->FROM	0	CIRCLE - MULLERGREN 230KV CKT 1	318.7	318.7	0.10416	117.3651	DBL-THIS-CLR
14G	03ALL	FROM->TO	0	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.06959	116.7271	AXTELL - POST ROCK 345KV CKT 1

Power Flow Analysis

Season	Dispatch Group	Flow	Scenario	Overloaded Element	RATEA (MVA)	RATEB (MVA)	TDF	TC% LOADING	Contingency
14G	03ALL	FROM->TO	1	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.06899	116.6911	AXTELL - POST ROCK 345KV CKT 1
14G	3	FROM->TO	1	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.09034	116.536	DBL-THIS-CLR
14G	3	FROM->TO	0	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.09034	116.5352	DBL-THIS-CLR
14G	03ALL	FROM->TO	0	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.08986	115.3777	DBL-IRON-CLR
14G	03ALL	FROM->TO	1	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.08986	115.3761	DBL-IRON-CLR
14G	03ALL	TO->FROM	0	N HAYS3 115.00 - VINE STREET 115KV CKT 1	83	99	0.03032	115.2647	KNOLL 230 - POSTROCK6 230.00 230KV CKT 1
14G	03ALL	TO->FROM	1	N HAYS3 115.00 - VINE STREET 115KV CKT 1	83	99	0.03005	115.2274	KNOLL 230 - POSTROCK6 230.00 230KV CKT 1
14G	03ALL	TO->FROM	0	CIRCLE - MULLERGREN 230KV CKT 1	318.7	318.7	0.10357	114.7354	DBL-IRON-CLR
14G	03ALL	TO->FROM	1	CIRCLE - MULLERGREN 230KV CKT 1	318.7	318.7	0.10357	114.7305	DBL-IRON-CLR
14G	03G11_016	FROM->TO	1	GREENSBURG - SUN CITY 115KV CKT 1	115.1	115.1	0.0381	112.7169	DBL-IRON-CLR
14G	03ALL	FROM->TO	0	GREENSBURG - SUN CITY 115KV CKT 1	115.1	115.1	0.03779	112.6771	DBL-SPRVL-CL
14G	03G11_016	TO->FROM	1	MULLERGREN - SPEARVILLE 230KV CKT 1	398	398	0.13146	111.8045	DBL-THIS-CLR
14G	03G11_016	FROM->TO	0	GREENSBURG - SUN CITY 115KV CKT 1	115.1	115.1	0.0381	110.8179	DBL-IRON-CLR
14G	03G11_016	TO->FROM	0	MULLERGREN - SPEARVILLE 230KV CKT 1	398	398	0.13147	109.6746	DBL-THIS-CLR
14G	03ALL	FROM->TO	0	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.06245	109.3076	CIRCLE - MULLERGREN 230KV CKT 1
14G	03ALL	FROM->TO	1	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.06185	109.2725	CIRCLE - MULLERGREN 230KV CKT 1
14G	03ALL	TO->FROM	0	CIRCLE - MULLERGREN 230KV CKT 1	318.7	318.7	0.06941	109.2362	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1
14G	03ALL	TO->FROM	1	CIRCLE - MULLERGREN 230KV CKT 1	318.7	318.7	0.06873	109.1974	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1
14G	03G11_016	TO->FROM	1	CIRCLE - MULLERGREN 230KV CKT 1	318.7	318.7	0.08285	108.3566	DBL-WICH-THI
14G	3	FROM->TO	1	GREENSBURG - SUN CITY 115KV CKT 1	115.1	115.1	0.03811	107.8166	DBL-IRON-CLR
14G	3	FROM->TO	0	GREENSBURG - SUN CITY 115KV CKT 1	115.1	115.1	0.03811	107.8161	DBL-IRON-CLR
14WP	00G11_016	FROM->TO	1	HARPER - MILAN TAP 138KV CKT 1	110	110	0.0479	107.8034	DBL-WICH-THI
14G	03ALL	TO->FROM	0	MULLERGREN - SPEARVILLE 230KV CKT 1	398	398	0.12214	107.7828	G11-17T 345.00 - G12-011T 345.00 345KV CKT 1
14G	03ALL	TO->FROM	1	MULLERGREN - SPEARVILLE 230KV CKT 1	398	398	0.1211	107.7362	G11-17T 345.00 - G12-011T 345.00 345KV CKT 1
14G	03G11_016	TO->FROM	1	MEDICINE LODGE - SUN CITY 115KV CKT 1	115.1	115.1	0.0381	107.7224	DBL-IRON-CLR
14G	03G11_016	TO->FROM	1	KNOLL - N HAYS3 115.00 115KV CKT 1	80	88	0.0302	107.6087	KNOLL 230 - POSTROCK6 230.00 230KV CKT 1
14G	03ALL	TO->FROM	0	MEDICINE LODGE - SUN CITY 115KV CKT 1	115.1	115.1	0.03779	107.5691	DBL-SPRVL-CL
14G	03G11_016	FROM->TO	1	CLEARWATER - GILL ENERGY CENTER WEST 138KV CKT 1	191	191	0.04781	106.9613	DBL-WICH-THI
14G	03G11_016	TO->FROM	0	CIRCLE - MULLERGREN 230KV CKT 1	318.7	318.7	0.08321	106.9349	DBL-WICH-THI
14G	03G11_016	FROM->TO	1	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.07071	106.8398	DBL-WICH-THI
14G	3	TO->FROM	1	MULLERGREN - SPEARVILLE 230KV CKT 1	398	398	0.13148	106.8018	DBL-THIS-CLR
14G	3	TO->FROM	0	MULLERGREN - SPEARVILLE 230KV CKT 1	398	398	0.13148	106.7985	DBL-THIS-CLR
14G	03G11_016	TO->FROM	1	MULLERGREN - SPEARVILLE 230KV CKT 1	398	398	0.12175	106.699	G12-011T 345.00 - POST ROCK 345KV CKT 1
14G	03G11_016	TO->FROM	0	KNOLL - N HAYS3 115.00 115KV CKT 1	80	88	0.03047	106.2148	KNOLL 230 - POSTROCK6 230.00 230KV CKT 1
14G	03G11_016	TO->FROM	0	MEDICINE LODGE - SUN CITY 115KV CKT 1	115.1	115.1	0.0381	105.8302	DBL-IRON-CLR
14G	03G11_016	FROM->TO	0	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.07104	105.5925	DBL-WICH-THI
14G	03G11_016	FROM->TO	0	CLEARWATER - GILL ENERGY CENTER WEST 138KV CKT 1	191	191	0.04746	105.5223	DBL-WICH-THI
14G	03G11_016	TO->FROM	0	MULLERGREN - SPEARVILLE 230KV CKT 1	398	398	0.1228	105.0985	G12-011T 345.00 - POST ROCK 345KV CKT 1

Power Flow Analysis

Season	Dispatch Group	Flow	Scenario	Overloaded Element	RATEA (MVA)	RATEB (MVA)	TDF	TC% LOADING	Contingency
14G	03ALL	TO->FROM	0	MULLERGREN - SPEARVILLE 230KV CKT 1	398	398	0.09762	104.9235	DBL-WICH-THI
14G	03ALL	TO->FROM	1	MULLERGREN - SPEARVILLE 230KV CKT 1	398	398	0.09712	104.9032	DBL-WICH-THI
14G	3	TO->FROM	0	CIRCLE - MULLERGREN 230KV CKT 1	318.7	318.7	0.08324	104.6305	DBL-WICH-THI
14G	3	TO->FROM	1	CIRCLE - MULLERGREN 230KV CKT 1	318.7	318.7	0.08289	104.6116	DBL-WICH-THI
14G	3	TO->FROM	0	KNOLL - N HAYS3 115.00 115KV CKT 1	80	88	0.03046	104.2998	KNOLL 230 - POSTROCK6 230.00 230KV CKT 1
14G	3	TO->FROM	1	KNOLL - N HAYS3 115.00 115KV CKT 1	80	88	0.03019	104.2547	KNOLL 230 - POSTROCK6 230.00 230KV CKT 1
14G	03ALL	FROM->TO	0	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.05976	104.0587	CLARKCOUNTY7345.00 - THISTLE7 345.00 345KV CKT 1
14G	03ALL	FROM->TO	0	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.05976	104.0587	CLARKCOUNTY7345.00 - THISTLE7 345.00 345KV CKT 2
14G	03ALL	FROM->TO	1	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.05938	104.0374	CLARKCOUNTY7345.00 - THISTLE7 345.00 345KV CKT 1
14G	03ALL	FROM->TO	1	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.05938	104.0374	CLARKCOUNTY7345.00 - THISTLE7 345.00 345KV CKT 2
14G	03G11_016	TO->FROM	0	GREENSBURG - SSTARTP3 115.00 115KV CKT 1	115.1	115.1	0.0381	103.7294	DBL-SPRVL-CL
14G	3	FROM->TO	0	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.07106	103.5346	DBL-WICH-THI
14G	3	FROM->TO	1	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.07074	103.5166	DBL-WICH-THI
14G	3	FROM->TO	1	CLEARWATER - GILL ENERGY CENTER WEST 138KV CKT 1	191	191	0.04784	103.3886	DBL-WICH-THI
14G	3	FROM->TO	0	CLEARWATER - GILL ENERGY CENTER WEST 138KV CKT 1	191	191	0.04747	103.3622	DBL-WICH-THI
14G	03ALL	TO->FROM	1	MULLERGREN - SPEARVILLE 230KV CKT 1	398	398	0.13088	103.2932	DBL-IRON-CLR
14G	03ALL	TO->FROM	0	MULLERGREN - SPEARVILLE 230KV CKT 1	398	398	0.13088	103.285	DBL-IRON-CLR
14G	3	TO->FROM	1	MEDICINE LODGE - SUN CITY 115KV CKT 1	115.1	115.1	0.03811	102.8387	DBL-IRON-CLR
14G	3	TO->FROM	0	MEDICINE LODGE - SUN CITY 115KV CKT 1	115.1	115.1	0.03811	102.8383	DBL-IRON-CLR
14G	03ALL	TO->FROM	0	CIRCLE - MULLERGREN 230KV CKT 1	318.7	318.7	0.06841	102.626	AXTELL - POST ROCK 345KV CKT 1
14G	03ALL	TO->FROM	1	CIRCLE - MULLERGREN 230KV CKT 1	318.7	318.7	0.06777	102.5896	AXTELL - POST ROCK 345KV CKT 1
14G	3	TO->FROM	0	MULLERGREN - SPEARVILLE 230KV CKT 1	398	398	0.12281	102.5175	G12-011T 345.00 - POST ROCK 345KV CKT 1
14G	3	TO->FROM	1	MULLERGREN - SPEARVILLE 230KV CKT 1	398	398	0.12177	102.4772	G12-011T 345.00 - POST ROCK 345KV CKT 1
14G	03ALL	FROM->TO	0	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.05522	102.0385	DBL-BVR-WWRD
14G	03ALL	FROM->TO	1	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.05465	102.0023	DBL-BVR-WWRD
14G	03ALL	TO->FROM	0	CIRCLE - MULLERGREN 230KV CKT 1	318.7	318.7	0.06941	101.5333	KNOLL 230 - SMOKYHL6 230.00 230KV CKT 1
14G	03ALL	TO->FROM	1	CIRCLE - MULLERGREN 230KV CKT 1	318.7	318.7	0.06873	101.4945	KNOLL 230 - SMOKYHL6 230.00 230KV CKT 1
14G	03ALL	TO->FROM	0	CIRCLE - MULLERGREN 230KV CKT 1	318.7	318.7	0.06816	101.3178	CLARKCOUNTY7345.00 - THISTLE7 345.00 345KV CKT 1
14G	03ALL	TO->FROM	0	CIRCLE - MULLERGREN 230KV CKT 1	318.7	318.7	0.06816	101.3178	CLARKCOUNTY7345.00 - THISTLE7 345.00 345KV CKT 2
14G	03ALL	TO->FROM	1	CIRCLE - MULLERGREN 230KV CKT 1	318.7	318.7	0.06771	101.2945	CLARKCOUNTY7345.00 - THISTLE7 345.00 345KV CKT 1
14G	03ALL	TO->FROM	1	CIRCLE - MULLERGREN 230KV CKT 1	318.7	318.7	0.06771	101.2945	CLARKCOUNTY7345.00 - THISTLE7 345.00 345KV CKT 2
14G	3	TO->FROM	0	GREENSBURG - SSTARTP3 115.00 115KV CKT 1	115.1	115.1	0.03811	100.8253	DBL-SPRVL-CL
19WP	00G11_016	FROM->TO	1	HARPER - MILAN TAP 138KV CKT 1	110	110	0.04965	100.7826	DBL-WICH-THI
14G	03ALL	TO->FROM	0	MULLERGREN - SPEARVILLE 230KV CKT 1	398	398	0.09671	100.7575	POST ROCK (POSTROCK T1) 345/230/13.8KV TRANSFORMER CKT 1
14G	03ALL	FROM->TO	0	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.0559	100.7242	THISTLE7 345.00 - WICHITA 345KV CKT 1
14G	03ALL	FROM->TO	0	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.0559	100.7242	THISTLE7 345.00 - WICHITA 345KV CKT 2

Power Flow Analysis

Season	Dispatch Group	Flow	Scenario	Overloaded Element	RATEA (MVA)	RATEB (MVA)	TDF	TC% LOADING	Contingency
14G	03ALL	TO->FROM	1	MULLERGREN - SPEARVILLE 230KV CKT 1	398	398	0.09581	100.7174	POST ROCK (POSTROCK T1) 345/230/13.8KV TRANSFORMER CKT 1
14G	03ALL	FROM->TO	1	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.05545	100.698	THISTLE7 345.00 - WICHITA 345KV CKT 1
14G	03ALL	FROM->TO	1	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.05545	100.698	THISTLE7 345.00 - WICHITA 345KV CKT 2
14G	03ALL	FROM->TO	0	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.08986	100.4554	DBL-SPRVL-CL
14WP	00G11_016	FROM->TO	0	HARPER - MILAN TAP 138KV CKT 1	110	110	0.04751	100.4269	DBL-WICH-THI
14G	03G11_016	TO->FROM	1	N HAYS3 115.00 - VINE STREET 115KV CKT 1	83	99	0.0302	100.3776	KNOLL 230 - POSTROCK6 230.00 230KV CKT 1
14G	03ALL	FROM->TO	1	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.05369	99.9	DBL-TGA-MATT
14G	03ALL	FROM->TO	0	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.05418	99.9	DBL-TGA-MATT
14G	03G11_016	FROM->TO	1	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.06944	99.8	AXTELL - POST ROCK 345KV CKT 1
14G	03G11_016	FROM->TO	1	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1	330	330	0.09031	99.8	DBL-IRON-CLR

Stability Analysis

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

Model Preparation

Transient stability analysis was performed using modified versions of the 2013 series of Model Development Working Group (MDWG) dynamic study models including the 2014 winter, 2015 summer, and 2024 summer seasonal models. The cases are then adapted to resemble the power flow study cases with regards to prior queued generation requests and topology. Finally the prior queued and study generation dispatched into the SPP footprint. Initial simulations are then carried out for a no-disturbance run of twenty (20) seconds to verify the numerical stability of the model.

Disturbances

One-hundred five (105) contingencies were identified for the Limited Operation scenario for use in this study. These faults are listed within Table 4. These contingencies included three-phase faults and single-phase line faults at locations defined by SPP. Single-phase line faults were simulated by applying fault impedance to the positive sequence network at the fault location to represent the effect of the negative and zero sequence networks on the positive sequence network. The fault impedance was computed to give a positive sequence voltage at the specified fault location of approximately 60% of pre-fault voltage. This method is in agreement with SPP current practice.

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

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

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

Table 4: Contingencies Evaluated for Limited Operation

Contingency Number and Name		Description
1	FLT_001_SPERVIL7_BUCKNER7_345kV_3PH	*3-Phase fault on the Buckner – Spearville 345kV CKT near the Spearville 345kV bus.*
2	FLT_002_SPERVIL7_BUCKNER7_345kV_1PH	*Single-phase fault similar to previous fault.*
3	FLT_003_SPERVIL7_CLARKCOUNTY7_345kV_3PH	*3-Phase fault on the Clark County – Spearville 345kV CKT near the Spearville 345kV bus.*

	Contingency Number and Name	Description
4	FLT_004_SPERVIL7_CLARKCOUNTY7_345kV_1PH	*Single-phase fault similar to previous fault.*
5	FLT_005_SPERVIL7_IRONWOOD7_345kV_3PH	*3-Phase fault on the Ironwood – Spearville 345kV CKT near the Spearville 345kV bus.*
6	FLT_006_SPERVIL7_IRONWOOD7_345kV_1PH	*Single-phase fault similar to previous fault.*
7	FLT_007_SPERVIL7_G11017TAP_345kV_3PH	*3-Phase fault on the GEN-2011-017-Tap – Spearville 345kV CKT near the Spearville 345kV bus.*
8	FLT_008_SPERVIL7_G11017TAP_345kV_1PH	*Single-phase fault similar to previous fault.*
9	FLT_009_SPERVIL7_SPEARVL6_345_230kV_3PH	*3-Phase fault on the Spearville 345/230/13.8kV transformer near the Spearville 345kV bus.*
10	FLT_010_SPERVIL7_LANCER3_345_115kV_3PH	*3-Phase fault on the Spearville 345/115/13.8kV (Lancer) transformer near the Spearville 345kV bus.*
11	FLT_011_BUCKNER7_HOLCOMB7_345kV_3PH	*3-Phase fault on the Buckner – Holcomb 345kV CKT near the Buckner 345kV bus.*
12	FLT_012_BUCKNER7_HOLCOMB7_345kV_1PH	*Single-phase fault similar to previous fault.*
13	FLT_013_HOLCOMB7_FINNEY7_345kV_3PH	*3-Phase fault on the Finney – Holcomb 345kV CKT near the Holcomb 345kV bus.*
14	FLT_014_HOLCOMB7_FINNEY7_345kV_1PH	*Single-phase fault similar to previous fault.*
15	FLT_015_HOLCOMB7_SETAB7_345kV_3PH	*3-Phase fault on the Holcomb – Setab 345kV CKT near the Holcomb 345kV bus.*
16	FLT_016_HOLCOMB7_SETAB7_345kV_1PH	*Single-phase fault similar to previous fault.*
17	FLT_017_HOLCOMB7_HOLCOMB3_345_115kV_3PH	*3-Phase fault on the Holcomb 345/115/13.8kV transformer near the Holcomb 345kV bus.*
18	FLT_018_FINNEY7_HITCHLAND7_345kV_3PH	*3-Phase fault on the Finney – Hitchland 345kV CKT near the Finney 345kV bus.*
19	FLT_019_FINNEY7_HITCHLAND7_345kV_1PH	*Single-phase fault similar to previous fault.*
20	FLT_020_IRONWOOD7_SPERVIL7_345kV_3PH	*3-Phase fault on the Ironwood – Spearville 345kV CKT near the Ironwood 345kV bus.*
21	FLT_021_IRONWOOD7_SPERVIL7_345kV_1PH	*Single-phase fault similar to previous fault.*
22	FLT_022_IRONWOOD7_CLARKCOUNTY7_345kV_3PH	*3-Phase fault on the Clark County – Ironwood 345kV CKT near the Ironwood 345kV bus.*
23	FLT_023_IRONWOOD7_CLARKCOUNTY7_345kV_1PH	*Single-phase fault similar to previous fault.*
24	FLT_024_CLARKCOUNTY7_THISTLE7_345kV_3PH	*3-Phase fault on the Clark County – Thistle 345kV CKT near the Clark County 345kV bus.*
25	FLT_025_CLARKCOUNTY7_THISTLE7_345kV_1PH	*Single-phase fault similar to previous fault.*
26	FLT_026_THISTLE7_WICHITA7_345kV_3PH	*3-Phase fault on the Thistle – Wichita 345kV CKT near the Thistle 345kV bus.*
27	FLT_027_THISTLE7_WICHITA7_345kV_1PH	*Single-phase fault similar to previous fault.*
28	FLT_028_THISTLE7_WWRDEHV7_345kV_3PH	*3-Phase fault on the Thistle – Woodward 345kV CKT near the Thistle 345kV bus.*
29	FLT_029_THISTLE7_WWRDEHV7_345kV_1PH	*Single-phase fault similar to previous fault.*
30	FLT_030_THISTLE7_THISTLE4_345_138kV_3PH	*3-Phase fault on the Thistle 345/138/13.8kV transformer near the Thistle 345kV bus.*
31	FLT_031_WWRDEHV7_TATONGA7_345kV_3PH	*3-Phase fault on the Tatonga – Woodward 345kV CKT near the Woodward 345kV bus.*
32	FLT_032_WWRDEHV7_TATONGA7_345kV_1PH	*Single-phase fault similar to previous fault.*
33	FLT_033_WWRDEHV7_BORDER7_345kV_3PH	*3-Phase fault on the Border – Woodward 345kV CKT near the Woodward 345kV bus.*
34	FLT_034_WWRDEHV7_BORDER7_345kV_1PH	*Single-phase fault similar to previous fault.*
35	FLT_035_WWRDEHV7_BEAVERCO_345kV_3PH	*3-Phase fault on the Beaver County – Woodward 345kV CKT near the Woodward 345kV bus.*
36	FLT_036_WWRDEHV7_BEAVERCO_345kV_1PH	*Single-phase fault similar to previous fault.*
37	FLT_037_WWRDEHV7_WWRDEHV4_345_138kV_3PH	*3-Phase fault on the Woodward 345/138/13.8kV transformer near the Woodward 345kV bus.*
38	FLT_038_BEAVERCO_HITCHLAND7_345kV_3PH	*3-Phase fault on the Beaver County – Hitchland 345kV CKT near the Beaver County 345kV bus.*
39	FLT_039_BEAVERCO_HITCHLAND7_345kV_1PH	*Single-phase fault similar to previous fault.*

	Contingency Number and Name	Description
40	FLT_040_WICHITA7_EMPEC7_345kV_3PH	*3-Phase fault on the Emporia Energy Center – Wichita 345kV CKT near the Wichita 345kV bus.*
41	FLT_041_WICHITA7_EMPEC7_345kV_1PH	*Single-phase fault similar to previous fault.*
42	FLT_042_WICHITA7_RENO7_345kV_3PH	*3-Phase fault on the Reno – Wichita 345kV CKT near the Wichita 345kV bus.*
43	FLT_043_WICHITA7_RENO7_345kV_1PH	*Single-phase fault similar to previous fault.*
44	FLT_044_WICHITA7_BENTON7_345kV_3PH	*3-Phase fault on the Benton – Wichita 345kV CKT near the Wichita 345kV bus.*
45	FLT_045_WICHITA7_BENTON7_345kV_1PH	*Single-phase fault similar to previous fault.*
46	FLT_046_WICHITA7_VIOLA7_345kV_3PH	*3-Phase fault on the Viola – Wichita 345kV CKT near the Wichita 345kV bus.*
47	FLT_047_WICHITA7_VIOLA7_345kV_1PH	*Single-phase fault similar to previous fault.*
48	FLT_048_G11017TAP_SPERVIL7_345kV_3PH	*3-Phase fault on the GEN-2011-017-Tap – Spearville 345kV CKT near the GEN-2011-017-Tap 345kV bus.*
49	FLT_049_G11017TAP_SPERVIL7_345kV_1PH	*Single-phase fault similar to previous fault.*
50	FLT_050_G11017TAP_POSTROCK7_345kV_3PH	*3-Phase fault on the GEN-2011-017-Tap – Post Rock 345kV CKT near the GEN-2011-017-Tap 345kV bus.*
51	FLT_051_G11017TAP_POSTROCK7_345kV_1PH	*Single-phase fault similar to previous fault.*
52	FLT_052_POSTROCK7_AXTELL3_345kV_3PH	*3-Phase fault on the Axtell – Post Rock 345kV CKT near the Post Rock 345kV bus.*
53	FLT_053_POSTROCK7_AXTELL3_345kV_1PH	*Single-phase fault similar to previous fault.*
54	FLT_054_POSTROCK7_POSTROCK6_345_230kV_3PH	*3-Phase fault on the Post Rock 345/230/13.8kV transformer near the Post Rock 345kV bus.*
55	FLT_055_AXTELL3_PAULINE3_345kV_3PH	*3-Phase fault on the Axtell – Pauline 345kV CKT near the Axtell 345kV bus.*
56	FLT_056_AXTELL3_PAULINE3_345kV_1PH	*Single-phase fault similar to previous fault.*
57	FLT_057_AXTELL3_SWEETW3_345kV_3PH	*3-Phase fault on the Axtell – Sweetwater 345kV CKT near the Axtell 345kV bus.*
58	FLT_058_AXTELL3_SWEETW3_345kV_1PH	*Single-phase fault similar to previous fault.*
59	FLT_059_AXTELL3_AXTELL7_345_115kV_3PH	*3-Phase fault on the Axtell 345/115/13.8kV transformer near the Axtell 345kV bus.*
60	FLT_060_SPEARVL6_GRTBEND6_230kV_3PH	*3-Phase fault on the Great Bend – Spearville 230kV CKT near the Spearville 230kV bus.*
61	FLT_061_SPEARVL6_GRTBEND6_230kV_1PH	*Single-phase fault similar to previous fault.*
62	FLT_062_SPEARVL6_SPEARVL3_230_115kV_3PH	*3-Phase fault on the Spearville 230/115/13.8kV transformer near the Spearville 230kV bus.*
63	FLT_063_GRTBEND6_CIRCLE6_230kV_3PH	*3-Phase fault on the Circle – Great Bend 230kV CKT near the Great Bend 230kV bus.*
64	FLT_064_GRTBEND6_CIRCLE6_230kV_1PH	*Single-phase fault similar to previous fault.*
65	FLT_065_GRTBEND6_HEIZER6_230kV_3PH	*3-Phase fault on the Great Bend – Heizer 230kV CKT near the Great Bend 230kV bus.*
66	FLT_066_GRTBEND6_HEIZER6_230kV_1PH	*Single-phase fault similar to previous fault.*
67	FLT_067_SHAYS6_GRTBEND6_230kV_3PH	*3-Phase fault on the Great Bend – South Hays 230kV CKT near the South Hays 230kV bus.*
68	FLT_068_SHAYS6_GRTBEND6_230kV_1PH	*Single-phase fault similar to previous fault.*
69	FLT_069_POSTROCK6_SHAYS6_230kV_3PH	*3-Phase fault on the Post Rock – South Hays 230kV CKT near the Post Rock 230kV bus.*
70	FLT_070_POSTROCK6_SHAYS6_230kV_1PH	*Single-phase fault similar to previous fault.*
71	FLT_071_POSTROCK6_KNOLL6_230kV_3PH	*3-Phase fault on the Knoll – Post Rock 230kV CKT near the Post Rock 230kV bus.*
72	FLT_072_POSTROCK6_KNOLL6_230kV_1PH	*Single-phase fault similar to previous fault.*
73	FLT_073_KNOLL6_SMOKYHL6_230kV_3PH	*3-Phase fault on the Knoll – Smoky Hills 230kV CKT near the Knoll 230kV bus.*
74	FLT_074_KNOLL6_SMOKYHL6_230kV_1PH	*Single-phase fault similar to previous fault.*
75	FLT_075_SMOKYHL6_SUMMIT6_230kV_3PH	*3-Phase fault on the Smoky Hills – Summit 230kV CKT near the Smoky Hills 230kV bus.*

Contingency Number and Name		Description
76	FLT_076_SMOKYHL6_SUMMIT6_230kV_1PH	*Single-phase fault similar to previous fault.*
77	FLT_077_NFTDODG3_FTDODGE3_115kV_3PH	*3-Phase fault on the Fort Dodge– North Fort Dodge 115kV CKT near the North Fort Dodge 115kV bus.*
78	FLT_078_NFTDODG3_FTDODGE3_115kV_1PH	*Single-phase fault similar to previous fault.*
79	FLT_079_NFTDODG3_SSTATTP3_115kV_3PH	*3-Phase fault on the North Fort Dodge– Shooting Star Tap 115kV CKT near the North Fort Dodge 115kV bus.*
80	FLT_080_NFTDODG3_SSTATTP3_115kV_1PH	*Single-phase fault similar to previous fault.*
81	FLT_081_FTDODGE3_CRKCK3_115kV_3PH	*3-Phase fault on the Crooked Creek Tap –Fort Dodge 115kV CKT near the Fort Dodge 115kV bus.*
82	FLT_082_FTDODGE3_CRKCK3_115kV_1PH	*Single-phase fault similar to previous fault.*
83	FLT_083_P4SPERBUCKSPER_SPEARVL6_345_230kV_1PH	*Loss of Buckner – Spearville 345kV CKT and Spearville 345/230/13.8kV transformer caused by a stuck breaker (16 cycle without reclose) attempting to clear a Single-Phase fault near the Spearville 345kV bus.*
84	FLT_084_P4SPERCLARSPER_SPEARVL6_345_230kV_1PH	*Loss of Clark County – Spearville 345kV CKT and Spearville 345/230/13.8kV transformer caused by a stuck breaker (16 cycle without reclose) attempting to clear a Single-Phase fault near the Spearville 345kV bus.*
85	FLT_085_P4SPERIRONSPER_SPEARVL6_345_230kV_1PH	*Loss of Ironwood – Spearville 345kV CKT and Spearville 345/230/13.8kV transformer caused by a stuck breaker (16 cycle without reclose) attempting to clear a Single-Phase fault near the Spearville 345kV bus.*
86	FLT_086_P4SPER1117SPER_SPEARVL6_345_230kV_1PH	*Loss of GEN-2011-017-Tap – Spearville 345kV CKT and Spearville 345/230/13.8kV transformer caused by a stuck breaker (16 cycle without reclose) attempting to clear a Single-Phase fault near the Spearville 345kV bus.*
87	FLT_087_P4AXTEPAULAXTE_AXTELL7_345_115kV_1PH	*Loss of Axtell – Pauline 345kV CKT and Axtell 345/115/13.8kV transformer caused by a stuck breaker (16 cycle without reclose) attempting to clear a Single-Phase fault near the Axtell 345kV bus.*
88	FLT_088_P4AXTESWEEAXTE_AXTELL7_345_115kV_1PH	*Loss of Axtell – Sweetwater 345kV CKT and Axtell 345/115/13.8kV transformer caused by a stuck breaker (16 cycle without reclose) attempting to clear a Single-Phase fault near the Axtell 345kV bus.*
89	FLT_089_P4THISWWRDTHIS_THISTLE4_345_138kV_1PH	*Loss of Thistle – Woodward 345kV CKT and Thistle 345/138/13.8kV transformer caused by a stuck breaker (16 cycle without reclose) attempting to clear a Single-Phase fault near the Thistle 345kV bus.*
90	FLT_090_P4THISCLARTHIS_THISTLE4_345_138kV_1PH	*Loss of Clark County – Thistle 345kV CKT and Thistle 345/138/13.8kV transformer caused by a stuck breaker (16 cycle without reclose) attempting to clear a Single-Phase fault near the Thistle 345kV bus.*
91	FLT_091_P4THISWICHTHIS_THISTLE4_345_138kV_1PH	*Loss of Thistle – Wichita 345kV CKT and Thistle 345/138/13.8kV transformer caused by a stuck breaker (16 cycle without reclose) attempting to clear a Single-Phase fault near the Thistle 345kV bus.*
92	FLT_092_P6SPVLCLRKSPVL_IRONWOOD7_345kV_3PH	*Prior outage of Clark County – Spearville 345kV CKT followed by system adjustments. Then 3-Phase fault on the Ironwood – Spearville 345kV CKT near the Spearville 345kV bus.*
93	FLT_093_P7SPVLCLRKSPVL_IRONWOOD7_345kV_1PH	*Single-Phase fault on the Ironwood – Spearville 345kV CKT and Clark County – Spearville 345kV CKT near the Spearville 345kV bus.*
94	FLT_094_P6CLRKSPVLCLRK_IRONWOOD7_345kV_3PH	*Prior outage of Clark County – Spearville 345kV CKT followed by system adjustments. Then 3-Phase fault on the Ironwood – Spearville 345kV CKT near the Clark County 345kV bus.*

Contingency Number and Name		Description
95	FLT_095_P7CLRKSPVLCLRK_IRONWOOD7_345kV_1PH	*Single-Phase fault on the Ironwood – Spearville 345kV CKT and Clark County – Spearville 345kV CKT near the Clark County 345kV bus.*
96	FLT_096_P6DBLCLARKCOUNTY7_THISTLE7_345kV_3PH	*Prior outage of Clark County – Thistle 345kV CKT 1 followed by system adjustments. Then 3-Phase fault on the Clark County – Thistle 345kV CKT 2 near the Clark County 345kV bus.*
96_R1	FLT_096_P6DBLCLARKCOUNTY7_THISTLE7_345kV_3PH_R1	*Curtail 420MW of Generation near Spearville 345kV. Prior outage of Clark County – Thistle 345kV CKT 1 followed by system adjustments. Then 3-Phase fault on the Clark County – Thistle 345kV CKT 2 near the Clark County 345kV bus.*
97	FLT_097_P7DBLCLARKCOUNTY7_THISTLE7_345kV_1PH	*Single-Phase fault on the Clark County – Thistle 345kV CKT 1 and Clark County – Thistle 345kV CKT 2 near the Clark County 345kV bus.*
97_R1	FLT_097_P7DBLCLARKCOUNTY7_THISTLE7_345kV_1PH_R1	*Curtail 420MW of Generation near Spearville 345kV. Single-Phase fault on the Clark County – Thistle 345kV CKT 1 and Clark County – Thistle 345kV CKT 2 near the Clark County 345kV bus.*
98	FLT_098_P6DBLTHISTLE7_WWRDEHV7_345kV_3PH	*Prior outage of Thistle – Woodward 345kV CKT 1 followed by system adjustments. Then 3-Phase fault on the Thistle – Woodward 345kV CKT 2 near the Thistle 345kV bus.*
99	FLT_099_P7DBLTHISTLE7_WWRDEHV7_345kV_1PH	*Single-Phase fault on the Thistle – Woodward 345kV CKT 1 and Thistle – Woodward 345kV CKT 2 near the Thistle 345kV bus.*
100	FLT_100_P6DBLTHISTLE7_WICHITA7_345kV_3PH	*Prior outage of Thistle – Wichita 345kV CKT 1 followed by system adjustments. Then 3-Phase fault on the Thistle – Wichita 345kV CKT 2 near the Thistle 345kV bus.*
101	FLT_101_P7DBLTHISTLE7_WICHITA7_345kV_1PH	*Single-Phase fault on the Thistle – Wichita 345kV CKT 1 and Thistle – Wichita 345kV CKT 2 near the Thistle 345kV bus.*
102	FLT_102_P6DBLFTDODGE3_NFTDODG3_115kV_3PH	*Prior outage of Fort Dodge – North Fort Dodge 115kV CKT 1 followed by system adjustments. Then 3-Phase fault on the Fort Dodge – North Fort Dodge 115kV CKT 2 near the Fort Dodge 115kV bus.*
103	FLT_103_P7DBLFTDODGE3_NFTDODG3_115kV_1PH	*Single-Phase fault on the Fort Dodge – North Fort Dodge 115kV CKT 1 and Fort Dodge – North Fort Dodge 115kV CKT 2 near the Fort Dodge 115kV bus.*
104	FLT_104_P6NFTDSPVLNFTD_LANCER3_115kV_3PH	*Prior outage of North Fort Dodge – Spearville 115kV CKT 1 followed by system adjustments. Then 3-Phase fault on the Lancer – North Fort Dodge 115kV CKT 1 near the North Fort Dodge 115kV bus.*
105	FLT_105_P7NFTDSPVLNFTD_LANCER3_115kV_1PH	*Single-Phase fault on the North Fort Dodge – Spearville 115kV CKT 1 and Lancer – North Fort Dodge 115kV CKT 1 near the North Fort Dodge 115kV bus.*

Power Factor Analysis and Reactor Requirements

Power factor analysis was performed for this study and is designed to demonstrate the reactive power requirements at the point of interconnection. Power factor analysis was performed both while the generator is dispatched at this study’s determined limited output and off-line. In order to perform the analysis the request and equivalent transmission lines and collectors systems were modeled using specifications provided by the Customer.

Table 5 - Power Factor Analysis and Reactor Requirements

Request	Capacity	POI	Fuel	Generator	Reactor Requirements at POI for 0.0 MW
GEN-2011-016	200.1 MW	Ironwood 345kV	Wind	Siemens 2.3MW	16.0 MVAR

NOTE: As reactive power is required for all projects, the final requirement in the GIA will be the pro-forma 95% lagging to 95% leading at the point of interconnection.

Results

Results of the stability analysis are summarized in Table 6. The results indicate that the transmission system remains stable for all single contingencies studied. A NERC Category “P7” event resulted in potential voltage instability. This instability can be mitigated with generation curtailments that limit the flows on the double circuit line from Clark County – Thistle 345kV. The plots will be available upon request.

Table 6: Fault Analysis Results for Limited Operation

	Contingency Number and Name	2014WP	2015SP	2024SP
1	FLT_001_SPERVIL7_BUCKNER7_345kV_3PH	Stable	Stable	Stable
2	FLT_002_SPERVIL7_BUCKNER7_345kV_1PH	Stable	Stable	Stable
3	FLT_003_SPERVIL7_CLARKCOUNTY7_345kV_3PH	Stable	Stable	Stable
4	FLT_004_SPERVIL7_CLARKCOUNTY7_345kV_1PH	Stable	Stable	Stable
5	FLT_005_SPERVIL7_IRONWOOD7_345kV_3PH	Stable	Stable	Stable
6	FLT_006_SPERVIL7_IRONWOOD7_345kV_1PH	Stable	Stable	Stable
7	FLT_007_SPERVIL7_G11017TAP_345kV_3PH	Stable	Stable	Stable
8	FLT_008_SPERVIL7_G11017TAP_345kV_1PH	Stable	Stable	Stable
9	FLT_009_SPERVIL7_SPEARVL6_345_230kV_3PH	Stable	Stable	Stable
10	FLT_010_SPERVIL7_LANCER3_345_115kV_3PH	Stable	Stable	Stable
11	FLT_011_BUCKNER7_HOLCOMB7_345kV_3PH	Stable	Stable	Stable
12	FLT_012_BUCKNER7_HOLCOMB7_345kV_1PH	Stable	Stable	Stable
13	FLT_013_HOLCOMB7_FINNEY7_345kV_3PH	Stable	Stable	Stable
14	FLT_014_HOLCOMB7_FINNEY7_345kV_1PH	Stable	Stable	Stable
15	FLT_015_HOLCOMB7_SETAB7_345kV_3PH	Stable	Stable	Stable
16	FLT_016_HOLCOMB7_SETAB7_345kV_1PH	Stable	Stable	Stable
17	FLT_017_HOLCOMB7_HOLCOMB3_345_115kV_3PH	Stable	Stable	Stable
18	FLT_018_FINNEY7_HITCHLAND7_345kV_3PH	Stable	Stable	Stable
19	FLT_019_FINNEY7_HITCHLAND7_345kV_1PH	Stable	Stable	Stable
20	FLT_020_IRONWOOD7_SPERVIL7_345kV_3PH	Stable	Stable	Stable
21	FLT_021_IRONWOOD7_SPERVIL7_345kV_1PH	Stable	Stable	Stable
22	FLT_022_IRONWOOD7_CLARKCOUNTY7_345kV_3PH	Stable	Stable	Stable
23	FLT_023_IRONWOOD7_CLARKCOUNTY7_345kV_1PH	Stable	Stable	Stable
24	FLT_024_CLARKCOUNTY7_THISTLE7_345kV_3PH	Stable	Stable	Stable
25	FLT_025_CLARKCOUNTY7_THISTLE7_345kV_1PH	Stable	Stable	Stable
26	FLT_026_THISTLE7_WICHITA7_345kV_3PH	Stable	Stable	Stable

	Contingency Number and Name	2014WP	2015SP	2024SP
27	FLT_027_THISTLE7_WICHITA7_345kV_1PH	Stable	Stable	Stable
28	FLT_028_THISTLE7_WWRDEHV7_345kV_3PH	Stable	Stable	Stable
29	FLT_029_THISTLE7_WWRDEHV7_345kV_1PH	Stable	Stable	Stable
30	FLT_030_THISTLE7_THISTLE4_345_138kV_3PH	Stable	Stable	Stable
31	FLT_031_WWRDEHV7_TATONGA7_345kV_3PH	Stable	Stable	Stable
32	FLT_032_WWRDEHV7_TATONGA7_345kV_1PH	Stable	Stable	Stable
33	FLT_033_WWRDEHV7_BORDER7_345kV_3PH	Stable	Stable	Stable
34	FLT_034_WWRDEHV7_BORDER7_345kV_1PH	Stable	Stable	Stable
35	FLT_035_WWRDEHV7_BEAVERCO_345kV_3PH	Stable	Stable	Stable
36	FLT_036_WWRDEHV7_BEAVERCO_345kV_1PH	Stable	Stable	Stable
37	FLT_037_WWRDEHV7_WWRDEHV4_345_138kV_3PH	Stable	Stable	Stable
38	FLT_038_BEAVERCO_HITCHLAND7_345kV_3PH	Stable	Stable	Stable
39	FLT_039_BEAVERCO_HITCHLAND7_345kV_1PH	Stable	Stable	Stable
40	FLT_040_WICHITA7_EMPEC7_345kV_3PH	Stable	Stable	Stable
41	FLT_041_WICHITA7_EMPEC7_345kV_1PH	Stable	Stable	Stable
42	FLT_042_WICHITA7_RENO7_345kV_3PH	Stable	Stable	Stable
43	FLT_043_WICHITA7_RENO7_345kV_1PH	Stable	Stable	Stable
44	FLT_044_WICHITA7_BENTON7_345kV_3PH	Stable	Stable	Stable
45	FLT_045_WICHITA7_BENTON7_345kV_1PH	Stable	Stable	Stable
46	FLT_046_WICHITA7_VIOLA7_345kV_3PH	Stable	Stable	Stable
47	FLT_047_WICHITA7_VIOLA7_345kV_1PH	Stable	Stable	Stable
48	FLT_048_G11017TAP_SPERVIL7_345kV_3PH	Stable	Stable	Stable
49	FLT_049_G11017TAP_SPERVIL7_345kV_1PH	Stable	Stable	Stable
50	FLT_050_G11017TAP_POSTROCK7_345kV_3PH	Stable	Stable	Stable
51	FLT_051_G11017TAP_POSTROCK7_345kV_1PH	Stable	Stable	Stable
52	FLT_052_POSTROCK7_AXTELL3_345kV_3PH	Stable	Stable	Stable
53	FLT_053_POSTROCK7_AXTELL3_345kV_1PH	Stable	Stable	Stable
54	FLT_054_POSTROCK7_POSTROCK6_345_230kV_3PH	Stable	Stable	Stable
55	FLT_055_AXTELL3_PAULINE3_345kV_3PH	Stable	Stable	Stable
56	FLT_056_AXTELL3_PAULINE3_345kV_1PH	Stable	Stable	Stable
57	FLT_057_AXTELL3_SWEETW3_345kV_3PH	Stable	Stable	Stable
58	FLT_058_AXTELL3_SWEETW3_345kV_1PH	Stable	Stable	Stable
59	FLT_059_AXTELL3_AXTELL7_345_115kV_3PH	Stable	Stable	Stable
60	FLT_060_SPEARVL6_GRTBEND6_230kV_3PH	Stable	Stable	Stable
61	FLT_061_SPEARVL6_GRTBEND6_230kV_1PH	Stable	Stable	Stable
62	FLT_062_SPEARVL6_SPEARVL3_230_115kV_3PH	Stable	Stable	Stable
63	FLT_063_GRTBEND6_CIRCLE6_230kV_3PH	Stable	Stable	Stable
64	FLT_064_GRTBEND6_CIRCLE6_230kV_1PH	Stable	Stable	Stable
65	FLT_065_GRTBEND6_HEIZER6_230kV_3PH	Stable	Stable	Stable
66	FLT_066_GRTBEND6_HEIZER6_230kV_1PH	Stable	Stable	Stable
67	FLT_067_SHAYS6_GRTBEND6_230kV_3PH	Stable	Stable	Stable
68	FLT_068_SHAYS6_GRTBEND6_230kV_1PH	Stable	Stable	Stable
69	FLT_069_POSTROCK6_SHAYS6_230kV_3PH	Stable	Stable	Stable
70	FLT_070_POSTROCK6_SHAYS6_230kV_1PH	Stable	Stable	Stable
71	FLT_071_POSTROCK6_KNOLL6_230kV_3PH	Stable	Stable	Stable
72	FLT_072_POSTROCK6_KNOLL6_230kV_1PH	Stable	Stable	Stable
73	FLT_073_KNOLL6_SMOKYHL6_230kV_3PH	Stable	Stable	Stable
74	FLT_074_KNOLL6_SMOKYHL6_230kV_1PH	Stable	Stable	Stable
75	FLT_075_SMOKYHL6_SUMMIT6_230kV_3PH	Stable	Stable	Stable
76	FLT_076_SMOKYHL6_SUMMIT6_230kV_1PH	Stable	Stable	Stable
77	FLT_077_NFTDODG3_FTDODGE3_115kV_3PH	Stable	Stable	Stable
78	FLT_078_NFTDODG3_FTDODGE3_115kV_1PH	Stable	Stable	Stable
79	FLT_079_NFTDODG3_SSTATTP3_115kV_3PH	Stable	Stable	Stable
80	FLT_080_NFTDODG3_SSTATTP3_115kV_1PH	Stable	Stable	Stable
81	FLT_081_FTDODGE3_CRKCK3_115kV_3PH	Stable	Stable	Stable

Contingency Number and Name		2014WP	2015SP	2024SP
82	FLT_082_FTDODGE3_CRKCK3_115kV_1PH	Stable	Stable	Stable
83	FLT_083_P4SPERBUCKSPER_SPEARVL6_345_230kV_1PH	Stable	Stable	Stable
84	FLT_084_P4SPERCLARSPER_SPEARVL6_345_230kV_1PH	Stable	Stable	Stable
85	FLT_085_P4SPERIRONSPER_SPEARVL6_345_230kV_1PH	Stable	Stable	Stable
86	FLT_086_P4SPER1117SPER_SPEARVL6_345_230kV_1PH	Stable	Stable	Stable
87	FLT_087_P4AXTEPAULAXTE_AXTELL7_345_115kV_1PH	Stable	Stable	Stable
88	FLT_088_P4AXTESWEEAXTE_AXTELL7_345_115kV_1PH	Stable	Stable	Stable
89	FLT_089_P4THISWWRDTHIS_THISTLE4_345_138kV_1PH	Stable	Stable	Stable
90	FLT_090_P4THISCLARTHIS_THISTLE4_345_138kV_1PH	Stable	Stable	Stable
91	FLT_091_P4THISWICHTHIS_THISTLE4_345_138kV_1PH	Stable	Stable	Stable
92	FLT_092_P6SPVLCLRKSPVL_IRONWOOD7_345kV_3PH	Stable	Stable	Stable
93	FLT_093_P7SPVLCLRKSPVL_IRONWOOD7_345kV_1PH	Stable	Stable	Stable
94	FLT_094_P6CLRKSPVLCLRK_IRONWOOD7_345kV_3PH	Stable	Stable	Stable
95	FLT_095_P7CLRKSPVLCLRK_IRONWOOD7_345kV_1PH	Stable	Stable	Stable
96	FLT_096_P6DBLCLARKCOUNTY7_THISTLE7_345kV_3PH	Unstable	Unstable	Unstable
96_R1	FLT_096_P6DBLCLARKCOUNTY7_THISTLE7_345kV_3PH_R1	Stable	Stable	Stable
97	FLT_097_P7DBLCLARKCOUNTY7_THISTLE7_345kV_1PH	Unstable	Unstable	Unstable
97_R1	FLT_097_P7DBLCLARKCOUNTY7_THISTLE7_345kV_1PH_R1	Stable	Stable	Stable
98	FLT_098_P6DBLTHISTLE7_WWRDEHV7_345kV_3PH	Stable	Stable	Stable
99	FLT_099_P7DBLTHISTLE7_WWRDEHV7_345kV_1PH	Stable	Stable	Stable
100	FLT_100_P6DBLTHISTLE7_WICHITA7_345kV_3PH	Stable	Stable	Stable
101	FLT_101_P7DBLTHISTLE7_WICHITA7_345kV_1PH	Stable	Stable	Stable
102	FLT_102_P6DBLFTDODGE3_NFTDODG3_115kV_3PH	Stable	Stable	Stable
103	FLT_103_P7DBLFTDODGE3_NFTDODG3_115kV_1PH	Stable	Stable	Stable
104	FLT_104_P6NFTDSPVLNFTD_LANCER3_115kV_3PH	Stable	Stable	Stable
105	FLT_105_P7NFTDSPVLNFTD_LANCER3_115kV_1PH	Stable	Stable	Stable

Conclusion

<OMITTED TEXT> (Interconnection Customers GEN-2011-016) has requested SPP to perform a MRIS to study the modification of the Interconnection Request configuration for interconnection into the Ironwood 345kV Substation on the Sunflower Electric Power Corporation in Ford County, Kansas. The point of interconnection for GEN-2011-016 will be the Ironwood 345kV Substation

Power flow and dynamic stability analysis from this MRIS has determined that the customer's request to interconnect into the Ironwood 345kV Substation will be able to be accommodated without causing harm to any Interconnection Customers in the Generator Interconnection Queue and does not harm reliability to the SPP Transmission System. The request to modify the interconnection configuration to the Ironwood 345kV Substation is not considered a Material Modification.

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