

# **Impact Study of Limited Operation for Generator Interconnection**

**GEN-2012-002  
GEN-2012-007  
ASGI-2012-006**

**April 2013  
Generation Interconnection**

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## Executive Summary

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This study report addresses the request of three separate Interconnection Customers (GEN-2012-002, GEN-2012-007 and ASGI-2012-006) to interconnect their requested generators before the completion of all network upgrades identified in their interconnection studies. The three Interconnection Customer's generation totals 243.7MW of nameplate generation with a mixture of fuel types. The following Limited Operation System Impact Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) addresses the interconnection of 243.7 MW of combustion and wind generation to be interconnected as an Energy Resource (ER) into the Transmission System of Sunflower Electric Power Corporation (SUNC) in Scott and Grant Counties, Kansas. ASGI-2012-006 is located Stevens County, Kansas in the Pioneer Electric Cooperative system and has ties into the Sunflower Electric Power Corporation (SUNC) Transmission System. Customers, under GIA Section 5.9, have requested this Limited Operation Interconnection Study (LOIS) to determine the impacts of interconnecting to the transmission system before all required Network Upgrades identified in the DISIS-2012-001 (or most recent iteration) Impact Study can be placed into service.

This LOIS addresses the effects of interconnecting the generators to the rest of the transmission system with the system topology and conditions as expected in March 2014. GEN-2012-002 is requesting the interconnection of forty-four (44) Siemens SWT 2.3 MW wind turbine generators and associated facilities into a tap on the Scott City – Pile 115kV transmission line. GEN-2012-007 is requesting the interconnection of twelve (12) Caterpillar (CAT) G20CM34 Gas Reciprocating Engines through a new substation into a tap on the Hickock – Satanta Tap 115kV transmission line. ASGI-2012-006 is requesting the interconnection of a 22.5 MW steam turbine generator with a 17 MW in-house load through a tap on the Hugoton – Rolla 69kV transmission line. For the typical LOIS, both a power flow and transient stability analysis are conducted. The LOIS assumes that only the higher queued projects listed within Table 1 of this study might go into service before the completion of all Network Upgrades identified within Table 2 of this report. If additional generation projects, listed within Table 3, with queue priority equal to or higher than the study project request rights to go into commercial operation before all Network Upgrades identified within Table 2 of this report are completed, this LOIS may need to be restudied to ensure that interconnection service remains for the customer's request.

Power flow analysis from this LOIS has determined that the customer's request will be able to interconnect a limited amount of generation as an Energy Resource prior to the completion of the required Network Upgrades, listed within Table 2 of this report. Refer to Tables 4, 5 and 6 for the Limited Operation Interconnection Service available due to interconnection constraints. Should any other projects, other than those listed within Table 1 of this report, come into service an additional study may be required to determine if any limited operation service is available. It should be noted that although this LOIS analyzed many of the most probable contingencies, it is not an all-inclusive list that can account for every operational situation. Additionally, the generator may not be able to inject any power onto the Transmission System due to constraints that fall below the threshold of mitigation for a Generator Interconnection request. Because of this, it is likely that the Customers 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.

Transient stability analysis for this LOIS has determined that the transmission system will remain stable for the ninety-eight (98) selected faults for the limited operation interconnection of the customers and will meet Low Voltage Ride Through (LVRT) requirements of FERC Order #661A.

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 must be requested on Southwest Power Pool's OASIS by the Customer.

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## Purpose

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<OMITTED TEXT> (Interconnection Customers) have requested a study of a Limited Operation System Impact Study (LOIS) under the Southwest Power Pool (SPP) Open Access Transmission Tariff (OATT) for interconnection requests into the Transmission System of Sunflower Electric Power Corporation (SUNC) as well as an Affected System generator embedded in the Sunflower Electric transmission system.

The purpose of this study is to evaluate the impacts of interconnecting GEN-2012-002 request of 101.2 MW comprised of forty-four (44) Siemens SWT 2.3 MW wind turbine generators and associated facilities interconnecting into a tap on the Scott City – Pile 115kV transmission line in Scott County, Kansas, GEN-2012-007 request of twelve (12) CAT G20CM34 Gas Reciprocating Engines through a new substation into a tap on the Hickock – Satanta tap 115kV transmission line Grant County, Kansas, ASGI-2012-006 request of a 22.5 MW steam turbine generator with a 17 MW in-house load through a tap on the Hugoton – Rolla 69kV transmission line in Stevens County, Kansas. The Customers have requested this amount to be studied as an Energy Resource (ER) with a Limited Operation Interconnection Service to commence on or around March of 2014.

Both power flow and transient stability analysis were conducted for this Limited Operation Interconnection Service. Limited Operation Studies are conducted under GIA Section 5.9.

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 requests not included within this study execute an interconnection agreement and commencing commercial operation, may require a re-study of this LOIS at the expense of the Customer.

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).

This LOIS study included prior queued generation interconnection requests. Those listed within Table 1 are the generation interconnection requests that are assumed to have rights to either full

or partial interconnection service prior to the requested 3/2014 in-service date of the Customers for this LOIS. Also listed in Table 1 are both the amount of MWs of interconnection service expected at the effective time of this study and the total MWs requested of interconnection service, the fuel type, the point of interconnection (POI), and the current status of each particular prior queued request.

*Table 1: Generation Requests Included within LOIS*

Project	MW	Total MW	Fuel Source	POI	Status
GEN-2001-039A	105.0	105.0	Wind	Tap Greensburg - Ft Dodge (Shooting Star Tap) 115kV	Commercial Operation
GEN-2001-039M	99.0	99.0	Wind	Central Plains Tap 115kV	Commercial Operation
GEN-2002-025A	150.0	150.0	Wind	Spearville 230kV	Commercial Operation
GEN-2003-006A	200.0	200.0	Wind	Elm Creek 230kV	Commercial Operation
GEN-2003-019	250.0	250.0	Wind	Smoky Hills Tap 230kV	Commercial Operation
GEN-2004-014	100.0	154.5	Wind	Spearville 230kV	Commercial Operation
GEN-2005-012	167.0	250.0	Wind	Spearville 345kV	Commercial Operation
GEN-2006-021	101.0	101.0	Wind	Flat Ridge Tap 138kV	Commercial Operation
GEN-2007-040	132.0	200.0	Wind	Buckner 345kV	Commercial Operation
GEN-2008-018	250.0	405.0	Wind	Finney 345kV	IA Executed/On Schedule
GEN-2008-079	98.9	98.9	Wind	Tap Cudahy - Ft Dodge 115kV	Commercial Operation
GEN-2009-008	199.5	199.5	Wind	South Hays 230kV	IA Executed/On Suspension
GEN-2009-020	48.3	48.3	Wind	Tap Nekoma - Bazine 69kV	IA Executed/On Suspension
GEN-2010-009	165.6	165.6	Wind	Buckner 345kV	Commercial Operation
GEN-2012-002	101.2	101.2	Wind	Tap Scott City - Pile 115kV	Facility Study Stage
GEN-2012-007	120.0	120.0	Gas	Rubart 115kV	Facility Study Stage
ASGI-2012-006	22.5	22.5	Steam	Tap Hugoton - Rolla 69kV	Facility Study Stage

This LOIS was required because the Customers are requesting interconnection prior to the completion of all of their required upgrades listed within the latest iteration of their Definitive Interconnection System Impact Study (DISIS). Table 2 below lists the required upgrade projects for which this request has cost responsibility. The Customers were included within the DISIS-2012-001 that was studied in spring 2012 and posted July 26, 2012. The cluster has been restudied since the original posting. These reports can be located here at the following GI Study URL:

[http://sppoasis.spp.org/documents/swpp/transmission/GenStudies.cfm?YearType=2012\\_Impact\\_Studies](http://sppoasis.spp.org/documents/swpp/transmission/GenStudies.cfm?YearType=2012_Impact_Studies).

Table 2: Upgrade Projects not included but Required for Full Interconnection Service

Upgrade Project	Type	Description	Status
Holcomb 345/115/13.8kV Transformer (Build second 345/115kV transformer at Holcomb)	Shared Network Upgrade to be designed, constructed, and owned by the Transmission Owner. Required to support full interconnection.	DISIS-2012-001 Customers	Not authorized to begin construction
Beaver County 345kV Expansion	Most recent iteration of DISIS 2011-001. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	Upgrade	Not authorized to begin construction
Beaver County – Buckner 345kV CKT 1 (Build approx. 90 miles of 345kV)	Most recent iteration of DISIS 2011-001. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	Upgrade	Not authorized to begin construction
Finney Switching Station – Holcomb 345kV CKT 2	Most recent iteration of ICS 2008-001. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	Upgrade	Not authorized to begin construction
Fort Dodge – North Fort Dodge 115kV CKT 2 (Build approx. 1 mile of 115kV)	Most recent iteration of DISIS 2009-001. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	Upgrade	Not authorized to begin construction
Hitchland 345/230kV Autotransformer CKT 2	Most recent iteration of DISIS 2010-001. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	Build Priority Project	Current Estimated In-Service date of 6/30/2014
Hitchland – Woodward 345kV Dbl CKT	Most recent iteration of DISIS 2011-001. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	Build Priority Project	Current Estimated In-Service date of 6/30/2014
Matthewson – Cimarron 345kV CKT 2	Most recent iteration of DISIS 2011-001. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	Upgrade	Not authorized to begin construction
Mullergren – Reno 345kV Dbl CKT (Build approx. 92 miles of 345kV)	Most recent iteration of DISIS 2011-001. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	Upgrade	Not authorized to begin construction
North Fort Dodge – Spearville 115kV CKT 2	Most recent iteration of DISIS 2009-001. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	Upgrade	Not authorized to begin construction
Spearville – Clark – Thistle 345kV Dbl CKT	Most recent iteration of DISIS 2010-001. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	Build Priority Project	Current Estimated In-Service date of 12/31/2014
Spearville – Mullergren 345kV Dbl CKT (Build approx. 85 miles of 345kV)	Most recent iteration of DISIS 2011-001. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	Upgrade	Not authorized to begin construction

Upgrade Project	Type	Description	Status
Spearville 345/115/13.8kV Transformer CKT 1	Most recent iteration of DISIS 2009-001. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	Upgrade	Not authorized to begin construction
Tatonga – Matthewson 345kV CKT 2	Most recent iteration of DISIS 2011-001. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	Upgrade	Not authorized to begin construction
Thistle – Wichita 345kV Dbl CKT	Most recent iteration of DISIS 2010-001. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	Build Priority Project	Current Estimated In-Service date of 12/31/2014
Woodward 345/138/13.8kV Transformer CKT 2	Most recent iteration of DISIS 2012-001. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	Build Balanced Portfolio Project	Current Estimated In-Service date of 5/19/2014

Any changes to these assumptions, for example, one or more of the previously queued requests not included within this study execute an interconnection agreement and commencing commercial operation, may require a re-study of this LOIS at the expense of the Customer. The higher or equally queued projects that were not included in this study are listed in Table 3. While this list is not all inclusive it is a list of the most probable and affecting prior queued requests that were not included within this LOIS, either because no request for an LOIS has been made or the request is on suspension, etc.

*Table 3: Higher or Equally Queued GI Requests not included within LOIS*

Project	Remainder MW	Total MW	Fuel	POI	Status
GEN-2004-014	54.5	154.5	Wind	Spearville 230kV	Commercial Operation
GEN-2005-012	83.0	250.0	Wind	Spearville 345kV	IA Executed/On Schedule for 2015
GEN-2006-006	205.5	205.5	Wind	Spearville 345kV	IA Executed/On Schedule for 2015
GEN-2006-032	200.0	200.0	Wind	South Hays 230kV	IA Executed/On Suspension
GEN-2006-040	108.0	108.0	Wind	Mingo 115kV	IA Executed/On Suspension
GEN-2007-011	135.0	135.0	Wind	Syracuse 115kV	IA Executed/On Suspension
GEN-2007-038	200.0	200.0	Wind	Spearville 345kV	IA Executed/On Schedule for 08/25/2015
GEN-2007-040	68.0	200.0	Wind	Buckner 345kV	IA Executed/On Schedule for 2012
GEN-2008-017	300.0	300.0	Wind	Setab 345kV	IA Executed/On Schedule for 10/2015
GEN-2008-018	155.0	405.0	Wind	Finney 345kV	IA Executed/On Schedule
GEN-2008-025	101.0	101.0	Wind	Ruleton 115kV	IA Executed/On Schedule for 06/01/2015
GEN-2008-092	201.0	201.0	Wind	Knoll 230kV	IA Pending
GEN-2008-124	200.1	200.1	Wind	Spearville 345kV	IA Executed/On Schedule for 01/01/2016
GEN-2010-015	200.1	200.1	Wind	Spearville 345kV	IA Executed/On Schedule for 01/01/2015

Nothing in this System Impact Study constitutes a request for transmission service or grants the Interconnection Customer any rights to transmission service.



# Facilities

## Generating Facility

GEN-2012-002 Interconnection Customer’s request to interconnect a total of 101.2 MW is comprised of forty-four (44) Siemens SWT 2.3 MW wind turbine generators and associated interconnection facilities. GEN-2012-007 Interconnection Customer’s request to interconnect a total of 120 MW is comprised of twelve (12) Caterpillar (CAT) G20CM34 Gas Reciprocating Engines and associated interconnection facilities. ASGI-2012-006 Interconnection Customer’s request to interconnect a total of 22.5 MW is comprised of a steam turbine generator and associated interconnection facilities with a 17 MW in-house load.

## Interconnection Facilities

### GEN-2012-002

The POI for GEN-2012-002 Interconnection Customer is through a tap on the Scott City – Pile 115kV transmission line in Scott County, Kansas. Figure 1 depicts the one-line diagram of the local transmission system including the POI as well as the power flow model representing the request.

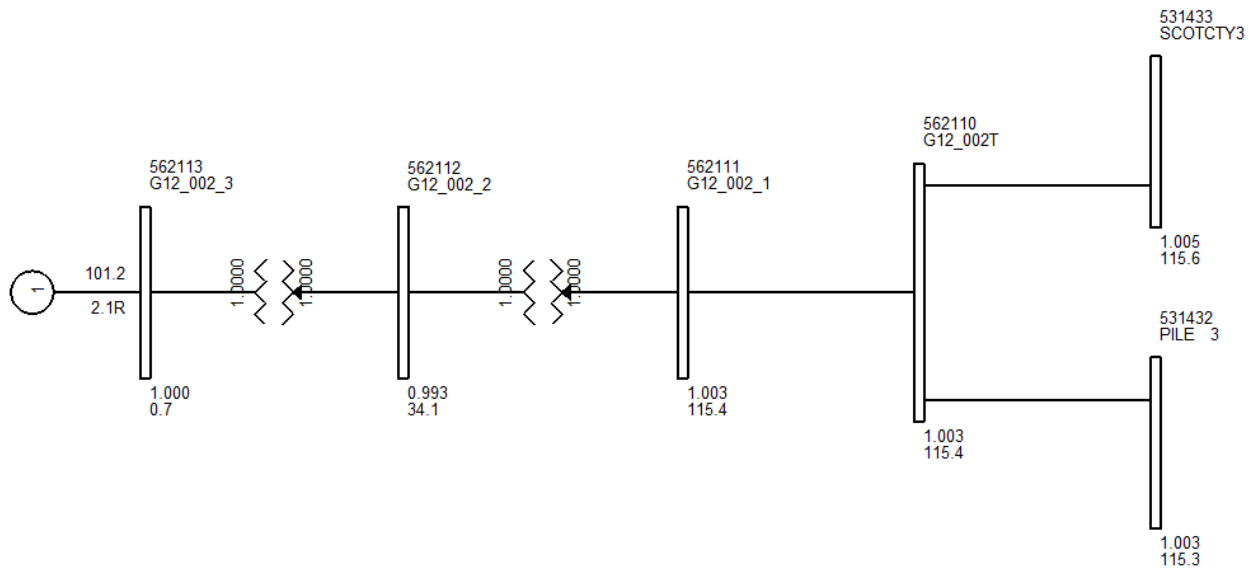


Figure 1: Proposed POI Configuration and Request Power Flow Model

### GEN-2012-007

The POI for GEN-2012-007 Interconnection Customer is through a new substation into a tap on the Hickock – Satanta tap 115kV transmission line in Grant County, Kansas. Figure 2 depicts the one-line diagram of the local transmission system including the POI as well as the power flow model representing the request.

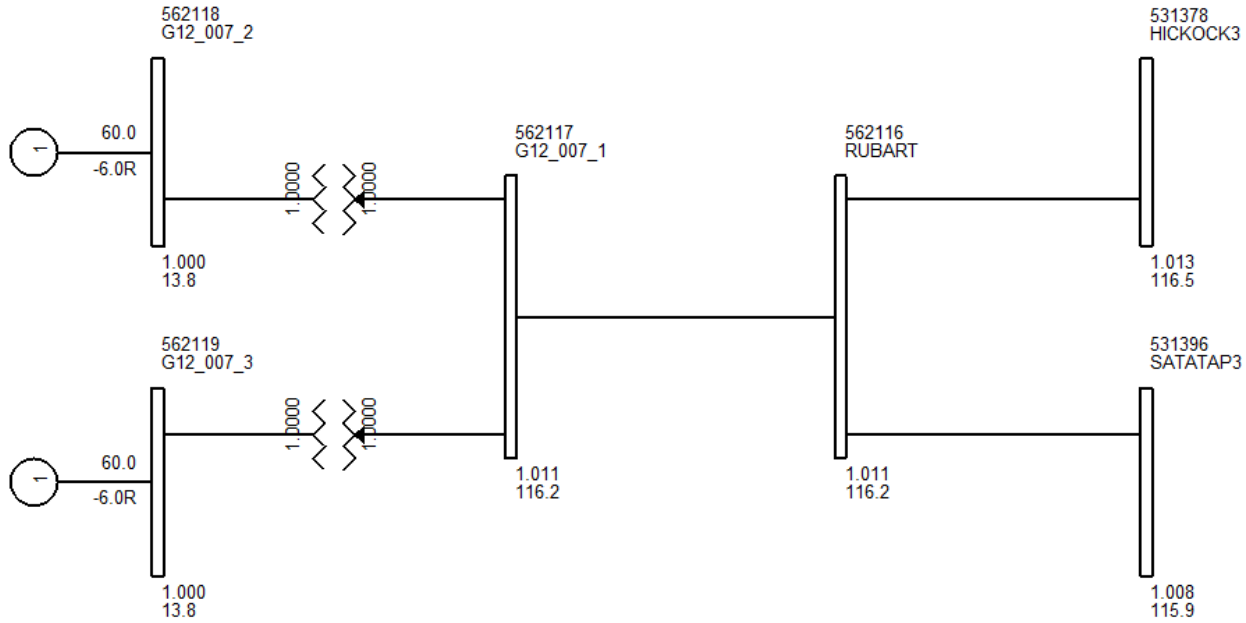


Figure 2: Proposed POI Configuration and Request Power Flow Model

ASGI-2012-006

The POI for ASGI-2012-006 Interconnection Customer is through a tap on the Hugoton – Rolla 69kV transmission line in Stevens County, Kansas. Figure 3 depicts the one-line diagram of the local transmission system including the POI as well as the power flow model representing the request.

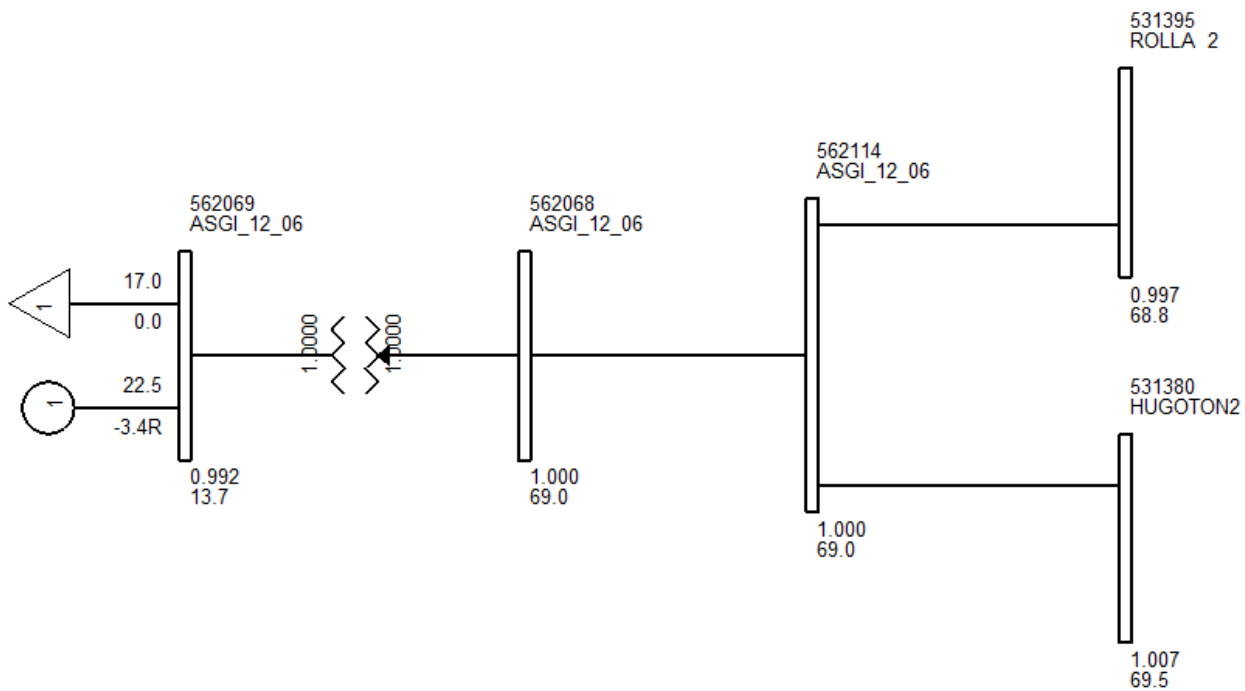


Figure 3: Proposed POI Configuration and Request Power Flow Model

## **Base Case Network Upgrades**

The Network Upgrades included within the cases used for this LOIS 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 LOIS requested in-service date of March 2014. These facilities have an approved Notice to Construct (NTC), or are in construction stages and expected to be in-service at the effective time of this study. No other upgrades were included for this LOIS. If for some reason, construction on these projects is delayed or discontinued, a restudy may be needed to determine the interconnection service availability of the Customer.

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## Power Flow Analysis

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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 2012 series of transmission service request study models including the 2014 (spring, summer, and winter) seasonal models. To incorporate the Interconnection Customers' request, a re-dispatch of existing generation within SPP was performed with respect to the amount of the Customers' injection and the interconnecting Balancing Authority. This method allows the request to be studied as an Energy Resource (ERIS) Interconnection Request. For this LOIS, only the previous queued requests listed in Table 1 were assumed to be in-service.

### 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 LOIS ACCC analysis indicates that the Customers can interconnect a limited amount of generation into the SUNC transmission system before all required upgrades listed within the DISIS-2012-001 study can be placed into service. Refer to Tables 4, 5 and 6 for the Limited Operation Interconnection Service available at the interconnect date of March 2014 due to interconnection constraints. Should any other GI projects, other than those listed within Table 1 of this report, come into service an additional study may be required to determine if any limited operation service is available.

ACCC results for the LOIS can be found in Tables 4, 5, 6, 7 and Appendix A below. Generator Interconnection Energy Resource analysis doesn't mitigate for those issues in which the affecting GI request has less than a 20% OTDF, Table 7 and Appendix A are provided for informational purposes

only so that the Customer understands there may be operational conditions when they may be required to reduce their output to maintain system reliability.

### **Limited Operation and System Reliability**

In no way does this study guarantee limited operation for all periods of time. It should be noted that although this LOIS 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.

Table 4: Interconnection Constraints for Mitigation of GEN-2012-002 LOIS @ 101.2MW

Season	Dispatch Group	Flow	Monitored Element	RATEA (MVA)	RATEB (MVA)	TDF	TC% LOADING	Max MW Available	Contingency
Summer	00G12_002	FROM->TO	G12_002T 115.00 - SCOTT CITY 115KV CKT 1	165.0	198.0	0.856	112.0	84.4	HOLCOMB (HOLCOMB) 345/115/13.8KV TRANSFORMER CKT 1
Winter	00G12_002	FROM->TO	G12_002T 115.00 - SCOTT CITY 115KV CKT 1	165.0	198.0	0.856	100.9	99.9	HOLCOMB (HOLCOMB) 345/115/13.8KV TRANSFORMER CKT 1

Table 5: Interconnection Constraints for Mitigation of GEN-2012-007 LOIS @ 120.0MW

Season	Dispatch Group	Flow	Monitored Element	RATEA (MVA)	RATEB (MVA)	TDF	TC% LOADING	Max MW Available	Contingency
Summer	00G12_007	FROM->TO	G12_002T 115.00 - SCOTT CITY 115KV CKT 1	165.0	198.0	0.435	112.0	91.8	HOLCOMB (HOLCOMB) 345/115/13.8KV TRANSFORMER CKT 1
Winter	00G12_007	TO->FROM	5 HICKOCK - RUBART 115.00 115KV CKT 1	119.5	119.5	1	101.0	118.8	RUBART 115.00 - SANT T 3 115KV CKT 1
Winter	00G12_007	FROM->TO	G12_002T 115.00 - SCOTT CITY 115KV CKT 1	165.0	198.0	0.436	100.9	108.6	HOLCOMB (HOLCOMB) 345/115/13.8KV TRANSFORMER CKT 1
Winter	00G12_007	FROM->TO	RUBART 115.00 - SANT T 3 115KV CKT 1	119.5	119.5	1	100.4	119.5	5 HICKOCK - RUBART 115.00 115KV CKT 1

Table 6: Interconnection Constraints for Mitigation of ASGI-2012-006 LOIS @ 22.5MW

Season	Dispatch Group	Flow	Monitored Element	RATEA (MVA)	RATEB (MVA)	TDF	TC% LOADING	Max MW Available	Contingency
Summer	00ASGI12_006	FROM->TO	G12_002T 115.00 - SCOTT CITY 115KV CKT 1	165.0	198.0	0.387	112.0	18.8	HOLCOMB (HOLCOMB) 345/115/13.8KV TRANSFORMER CKT 1
Winter	00ASGI12_006	FROM->TO	G12_002T 115.00 - SCOTT CITY 115KV CKT 1	165.0	198.0	0.387	100.9	22.2	HOLCOMB (HOLCOMB) 345/115/13.8KV TRANSFORMER CKT 1

Table 7: Additional Constraints of Customers LOIS

Season	Dispatch Group	Flow	Monitored Element	RATEA (MVA)	RATEB (MVA)	TDF	TC% LOADING	ATC Available	Contingency
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.033	132.0	0	ALEXANDER - SAWYER 3 115.00 115KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.054	122.3	0	SPP-SWPS-05
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.054	122.3	0	FINNEY SWITCHING STATION - Hitchland Interchange 345KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.054	112.4	0	FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.044	112.0	0	ST JOHN - ST_JOHN 115KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.038	111.7	0	NORTH JUDSON LARGE SUB - SPEARVILLE 115KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.033	111.4	0	ALEXANDER - NINNES3 115.00 115KV CKT 1

Season	Dispatch Group	Flow	Monitored Element	RATEA (MVA)	RATEB (MVA)	TDF	TC% LOADING	ATC Available	Contingency
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.038	111.3	0	SPEARVILLE (SPEARVL6) 230/115/13.8KV TRANSFORMER CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.038	111.0	0	GEN532751 1-WOLF CREEK GENERATING STATION UNIT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.044	110.1	0	POST ROCK - SPEARVILLE 345KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.043	109.6	0	RENO COUNTY - WICHITA 345KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.046	109.2	0	CIRCLE - MULLERGREN 230KV CKT 1
Spring	03G12_002	TO->FROM	CLEARWATER - MILAN TAP 138KV CKT 1	110	110	0.033	108.6	0	ALEXANDER - SAWYER 3 115.00 115KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.038	107.6	0	45TH ST4 138.00 - EVANS ENERGY CENTER SOUTH 138KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.038	107.5	0	45TH ST4 138.00 - COWSKIN 138KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.035	107.3	0	CUDAHY - G08-79T 115.00 115KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.038	107.2	0	GEN532722 1-EVANS ENERGY CENTER UNIT 2
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.033	107.0	0	NINNESEC3 115.00 - ST JOHN 115KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.040	106.9	0	LAWTON EASTSIDE - OKLAUNION 345KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.035	106.8	0	CUDAHY - KISMET 3 115.00 115KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.035	106.7	0	CIMARRON RIVER TAP - KISMET 3 115.00 115KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.042	106.7	0	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.038	106.4	0	EVANS ENERGY CENTER SOUTH - LAKERIDGE 138KV CKT 1
Spring	03G12_002	TO->FROM	HAYS PLANT - SOUTH HAYS 115KV CKT 1	83	99	0.037	106.0	0	KNOLL 230 - POSTROCK6 230.00 230KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.038	105.6	0	HOOVER NORTH - LAKERIDGE 138KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.044	105.2	0	MIDW-CATB05
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.044	105.1	0	HUNTSVILLE - ST_JOHN 115KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.038	105.1	0	SPP-WERE-32
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.038	104.8	0	CENTENNIAL - COWSKIN 138KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.039	104.7	0	SPP-SWPS-03
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.038	104.4	0	EMPORIA ENERGY CENTER - WICHITA 345KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.038	104.4	0	GEN514805 1-SOONER UNIT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.039	104.3	0	GRAPEVINE INTERCHANGE - STATELINE INTERCHANGE 230KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.038	104.2	0	ROSE HILL - WOLF CREEK 345KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.044	104.1	0	HUNTSVILLE - HUTCHINSON ENERGY CENTER 115KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.038	104.1	0	GEN514806 1-SOONER UNIT 2
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.038	103.8	0	CENTENNIAL - WACO 138KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.030	103.8	0	BUCKNER7 345.00 - HOLCOMB 345KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.039	103.7	0	GRAND ISLAND - SWEETWATER 345KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.040	103.7	0	Hitchland Interchange (H TB80155502) 345/230/13.2KV TRANSFORMER CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.041	103.7	0	POTTER COUNTY INTERCHANGE (WAUK 90343-A) 345/230/13.2KV TRANSFORMER CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.038	103.5	0	RENO COUNTY - SUMMIT 345KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.042	103.4	0	KNOLL 230 - SMOKYHL6 230.00 230KV CKT 1

Season	Dispatch Group	Flow	Monitored Element	RATEA (MVA)	RATEB (MVA)	TDF	TC% LOADING	ATC Available	Contingency
Spring	03G12_002	FROM->TO	MOUNDRIDGE (MOUND10X) 138/115/13.8KV TRANSFORMER CKT 1	100	110	0.046	100.7	0	RENO COUNTY - WICHITA 345KV CKT 1
Spring	03G12_002	FROM->TO	MOUNDRIDGE (MOUND10X) 138/115/13.8KV TRANSFORMER CKT 1	100	110	0.046	100.7	0	RENO COUNTY - WICHITA 345KV CKT 1
Spring	03G12_002	TO->FROM	CLEARWATER - MILAN TAP 138KV CKT 1	110	110	0.054	100.1	0	SPP-SWPS-05
Spring	03G12_002	TO->FROM	CLEARWATER - MILAN TAP 138KV CKT 1	110	110	0.054	100.1	0	FINNEY SWITCHING STATION - Hitchland Interchange 345KV CKT 1
Spring	03G12_002	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.038	100.0	0	BASE CASE



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## Stability Analysis

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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 2012 series of Model Development Working Group (MDWG) dynamic study models including the 2014 summer and 2013 winter peak dynamic cases. The cases were adapted to resemble the power flow study cases with regards to prior queued generation requests and topology. Finally the prior queued and study generation was 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

The ninety-eight (98) contingencies were identified for the Limited Operation scenario for use in this study. These faults are listed within Table 8. 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 8: Contingencies Evaluated for Limited Operation

Contingency Number and Name		Description
1	FLT_01_G1202TAP_PILE_115kV_3PH	3-Phase fault on the GEN-2012-002 Tap – Pile 115kV line near the GEN-2012-002 Tap 115kV bus.
2	FLT_02_G1202TAP_PILE_115kV_1PH	Single-phase fault similar to previous fault.
3	FLT_03_G1202TAP_SCOTTCITY3_115kV_3PH	3-Phase fault on the GEN-2012-002 Tap – Scott City 115kV line near the GEN-2012-002 Tap 115kV bus
4	FLT_04_G1202TAP_SCOTTCITY3_115kV_1PH	Single-phase fault similar to previous fault.
5	FLT_05_DOBSON_GANO_115kV_3PH	3-Phase fault on the Dobson – Gano 115kV line near the Dobson 115kV bus.
6	FLT_06_DOBSON_GANO_115kV_1PH	Single-phase fault similar to previous fault.
7	FLT_07_DOBSON_MORRIS_115kV_3PH	3-Phase fault on the Dobson – Morris 115kV line near the Dobson 115kV bus.
8	FLT_08_DOBSON_MORRIS_115kV_1PH	Single-phase fault similar to previous fault.
9	FLT_09_DOBSON_KSAVWTP3_115kV_3PH	3-Phase fault on the Dobson – Kansas Ave Water Treatment Plant 115kV line near the Dobson 115kV bus.
10	FLT_10_DOBSON_KSAVWTP3_115kV_1PH	Single-phase fault similar to previous fault.
11	FLT_11_DOBSON_LOWETAP3_115kV_3PH	3-Phase fault on the Dobson – Lowe Tap 115kV line near the Dobson 115kV bus.
12	FLT_12_DOBSON_LOWETAP3_115kV_1PH	Single-phase fault similar to previous fault.
13	FLT_13_SCOTTCITY3_SETAB_115kV_3PH	3-Phase fault on the Scott City – Setab 115kV line near the Scott City 115kV bus.
14	FLT_14_SCOTTCITY3_SETAB_115kV_1PH	Single-phase fault similar to previous fault.
15	FLT_15_SCOTTCITY3_MANNGTAP_115kV_3PH	3-Phase fault on the Scott City – Manning Tap 115kV line near the Scott City 115kV bus.
16	FLT_16_SCOTTCITY3_MANNGTAP_115kV_1PH	Single-phase fault similar to previous fault.
17	FLT_17_SETAB3_CTYSERV_115kV_3PH	3-Phase fault on the Setab – City Service 115kV line near the Setab 115kV bus.
18	FLT_18_SETAB3_CTYSERV_115kV_1PH	Single-phase fault similar to previous fault.
19	FLT_19_RUBART_SATATAP2_115kV_3PH	3-Phase fault on the Rubart – Satanta Tap 115kV line near the Rubart 115kV bus.
20	FLT_20_RUBART_SATATAP2_115kV_1PH	Single-phase fault similar to previous fault.
21	FLT_21_RUBART_HICKOCK_115kV_3PH	3-Phase fault on the Rubart – Hickock 115kV line near the Rubart 115kV bus.
22	FLT_22_RUBART_HICKOCK_115kV_1PH	Single-phase fault similar to previous fault.
23	FLT_23_SATATAP3_SATANTA3_115kV_3PH	3-Phase fault on the Satanta Tap – Satanta 115kV line near the Satanta Tap 115kV bus.
24	FLT_24_SATATAP3_SATANTA3_115kV_1PH	Single-phase fault similar to previous fault.
25	FLT_25_SATATAP3_PIONTAP3_115kV_3PH	3-Phase fault on the Satanta Tap – Pioneer Tap 115kV line near the Satanta Tap 115kV bus.
26	FLT_25_SATATAP3_PIONTAP3_115kV_1PH	Single-phase fault similar to previous fault.
27	FLT_27_PIONTAP3_PLYMELL_115kV_3PH	3-Phase fault on the Pioneer Tap – Plymell Switch 115kV line near the Pioneer Tap 115kV bus.
28	FLT_28_PIONTAP3_PLYMELL_115kV_1PH	Single-phase fault similar to previous fault.
29	FLT_29_PIONTAP3_SUBLETE_115kV_3PH	3-Phase fault on the Pioneer Tap – Sublette 115kV line near the Pioneer Tap 115kV bus.
30	FLT_30_PIONTAP3_SUBLETE_115kV_1PH	Single-phase fault similar to previous fault.
31	FLT_31_PLYMELL_HOLCOMB3_115kV_3PH	3-Phase fault on the Plymell Switch – Holcomb 115kV line near the Plymell Switch 115kV bus.
32	FLT_32_PLYMELL_HOLCOMB3_115kV_1PH	Single-phase fault similar to previous fault.
33	FLT_33_PLYMELL_PIERCVL3_115kV_3PH	3-Phase fault on the Plymell Switch – Pierceville 115kV line near the Plymell Switch 115kV bus.
34	FLT_34_PLYMELL_PIERCVL3_115kV_1PH	Single-phase fault similar to previous fault.
35	FLT_35_HOLCOMB3_GRDNCTY_115kV_3PH	3-Phase fault on the Holcomb – Garden City 115kV line near the Holcomb 115kV bus.
36	FLT_36_HOLCOMB3_GRDNCTY_115kV_1PH	Single-phase fault similar to previous fault.
37	FLT_37_HOLCOMB3_JONES3_115kV_3PH	3-Phase fault on the Holcomb – Jones 115kV line near the Holcomb 115kV bus.

Contingency Number and Name		Description
38	FLT_38_HOLCOMB3_JONES3_115kV_1PH	Single-phase fault similar to previous fault.
39	FLT_39_HOLCOMB3_FLETCHR3_115kV_3PH	3-Phase fault on the Holcomb – Fletcher 115kV line near the Holcomb 115kV bus.
40	FLT_40_HOLCOMB3_FLETCHR3_115kV_1PH	Single-phase fault similar to previous fault.
41	FLT_41_HICKOCK_AMOCO3_115kV_3PH	3-Phase fault on the Hickock – Amoco 115kV line near the Hickock 115kV bus.
42	FLT_42_HICKOCK_AMOCO3_115kV_1PH	Single-phase fault similar to previous fault.
43	FLT_43_HICKOCK_PIONEER3_115kV_3PH	3-Phase fault on the Hickock – Pioneer 115kV line near the Hickock 115kV bus.
44	FLT_44_HICKOCK_PIONEER3_115kV_1PH	Single-phase fault similar to previous fault.
45	FLT_45_PIONEER3_PKGOAB3_115kV_3PH	3-Phase fault on the Pioneer – Puckett 115kV line near the Pioneer 115kV bus.
46	FLT_46_PIONEER3_PKGOAB3_115kV_1PH	Single-phase fault similar to previous fault.
47	FLT_47_PIONEER3_GRANTTP3_115kV_3PH	3-Phase fault on the Pioneer – Grant Tap 115kV line near the Pioneer 115kV bus.
48	FLT_48_PIONEER3_GRANTTP3_115kV_1PH	Single-phase fault similar to previous fault.
49	FLT_49_PIONEER3_ULYSPLT3_115kV_3PH	3-Phase fault on the Pioneer – Ulysses Plant 115kV line near the Pioneer 115kV bus.
50	FLT_50_PIONEER3_ULYSPLT3_115kV_1PH	Single-phase fault similar to previous fault.
51	FLT_51_PIONEER2_ULUE_69kV_3PH	3-Phase fault on the Pioneer – Ulysses East 69kV line near the Pioneer 115kV bus.
52	FLT_52_PIONEER2_ULUE_69kV_1PH	Single-phase fault similar to previous fault.
53	FLT_53_PIONEER3_ULUNW_69kV_3PH	3-Phase fault on the Pioneer – Ulysses Northwest 69kV line near the Pioneer 115kV bus.
54	FLT_54_PIONEER3_ULUNW_69kV_1PH	Single-phase fault similar to previous fault.
55	FLT_55_ASGI206T_ROLLA_69kV_3PH	3-Phase fault on the ASGI-2012-006 Tap – Rolla 69kV line near the ASGI-2012-006 Tap 69kV bus.
56	FLT_56_ASGI206T_ROLLA_69kV_1PH	Single-phase fault similar to previous fault.
57	FLT_57_HUGOTON2_CHUGTON2_69kV_3PH	3-Phase fault on the Hugoton – Hugoton City 69kV line near the Hugoton 69kV bus.
58	FLT_58_HUGOTON2_CHUGTON2_69kV_1PH	Single-phase fault similar to previous fault.
59	FLT_59_HUGOTON3_GRANTTP3_115kV_3PH	3-Phase fault on the Hugoton – Grant Tap 115kV line near the Hugoton 115kV bus.
60	FLT_60_HUGOTON3_GRANTTP3_115kV_1PH	Single-phase fault similar to previous fault.
61	FLT_61_HUGOTON3_WALKMYR3_115kV_3PH	3-Phase fault on the Hugoton – Walkemeyer 115kV line near the Hugoton 115kV bus.
62	FLT_62_HUGOTON3_WALKMYR3_115kV_1PH	Single-phase fault similar to previous fault.
63	FLT_63_GRANTTP3_GRANT3_115kV_3PH	3-Phase fault on the Grant Tap – Grant 115kV line near the Grant Tap 115kV bus.
64	FLT_64_GRANTTP3_GRANT3_115kV_1PH	Single-phase fault similar to previous fault.
65	FLT_65_WALKMYR3_CIMPLT3_115kV_3PH	3-Phase fault on the Walkemeyer – Cimarron River Station 115kV line near the Walkemeyer 115kV bus.
66	FLT_66_WALKMYR3_CIMPLT3_115kV_1PH	Single-phase fault similar to previous fault.
67	FLT_67_WALKMYR3_NORTH6T2_69kV_3PH	3-Phase fault on the Walkemeyer – Northern Tap 69kV line near the Walkemeyer 69kV bus.
68	FLT_68_WALKMYR3_NORTH6T2_69kV_1PH	Single-phase fault similar to previous fault.
69	FLT_69_WALKMYR3_WOODS_69kV_3PH	3-Phase fault on the Walkemeyer – Woods 69kV line near the Walkemeyer 69kV bus.
70	FLT_70_WALKMYR3_WOODS_69kV_1PH	Single-phase fault similar to previous fault.
71	FLT_71_SETAB7_MINGO7_345kV_3PH	3-Phase fault on the Setab – Mingo 345kV line near the Setab 345kV bus.
72	FLT_72_SETAB7_MINGO7_345kV_1PH	Single-phase fault similar to previous fault.
73	FLT_73_SETAB7_HOLCOMB7_345kV_3PH	3-Phase fault on the Setab – Holcomb 345kV line near the Setab 345kV bus.
74	FLT_74_SETAB7_HOLCOMB7_345kV_1PH	Single-phase fault similar to previous fault.
75	FLT_75_MINGO7_REDWILLOW_345kV_3PH	3-Phase fault on the Mingo – Red Willow 345kV line near the Mingo 345kV bus.
76	FLT_76_MINGO7_REDWILLOW_345kV_1PH	Single-phase fault similar to previous fault.

Contingency Number and Name		Description
77	FLT_77_HOLCOMB7_FINNEY7_345kV_3PH	3-Phase fault on the Holcomb – Finney 345kV line near the Holcomb 345kV bus.
78	FLT_78_HOLCOMB7_FINNEY7_345kV_1PH	Single-phase fault similar to previous fault.
79	FLT_79_HOLCOMB7_BUCKNER_345kV_3PH	3-Phase fault on the Holcomb – Buckner 345kV line near the Holcomb 345kV bus.
80	FLT_80_HOLCOMB7_BUCKNER_345kV_1PH	Single-phase fault similar to previous fault.
81	FLT_81_HOLCOMB3_PLYMELL_115kV_3PH	3-Phase fault on the Holcomb – Plymell 115kV line near the Holcomb 115kV bus.
82	FLT_82_HOLCOMB3_PLYMELL_115kV_1PH	Single-phase fault similar to previous fault.
83	FLT_83_FINNEY_HITCHLND7_345kV_3PH	3-Phase fault on the Finney – Hitchland 345kV line near the Finney 345kV bus.
84	FLT_84_FINNEY_HITCHLND7_345kV_1PH	Single-phase fault similar to previous fault.
85	FLT_85_SPEARVLL7_BUCKNER_345kV_3PH	3-Phase fault on the Spearville – Buckner 345kV line near the Spearville 345kV bus.
86	FLT_86_SPEARVLL7_BUCKNER_345kV_1PH	Single-phase fault similar to previous fault.
87	FLT_87_SPEARVLL7_POSTRCK7_345kV_3PH	3-Phase fault on the Spearville – Post Rock 345kV line near the Spearville 345kV bus.
88	FLT_88_SPEARVLL7_POSTRCK7_345kV_1PH	Single-phase fault similar to previous fault.
89	FLT_89_POSTRCK7_AXTELL_345kV_3PH	3-Phase fault on the Post Rock – Axtell 345kV line near the Post Rock 345kV bus.
90	FLT_90_POSTRCK7_AXTELL_345kV_1PH	Single-phase fault similar to previous fault.
91	FLT_91_SCOTTCITY3_SCOTTCTY2_115_69kV_3PH	3-Phase fault on the Scott City 115kV – Scott City 69 kV transformer near the Scott City 115kV bus.
92	FLT_92_SETAB7_SETAB3_345_115kV_3PH	3-Phase fault on the Setab 345kV – Setab 115 kV transformer near the Setab 115kV bus.
93	FLT_93_HOLCOMB7_HOLCOMB3_345_115kV_3PH	3-Phase fault on the Holcomb 345kV – Holcomb 115kV transformer near the Holcomb 345kV bus.
94	FLT_94_SPEARVLL7_SPEARVLL6_345_230kV_3PH	3-Phase fault on the Spearville 345kV – Spearville 230kV line near the Spearville 345kV bus.
95	FLT_95_POSTRCK7_POSTRCK6_345_230kV_3PH	3-Phase fault on the Post Rock 345kV – Post Rock 230kV line near the Post Rock 345kV bus.
96	FLT_96_HICCOCK3_HICCOCK2_115_69kV_3PH	3-Phase fault on the Hickock 115kV – Hickock 69kV line near the Hickock 115kV bus.
97	FLT_97_PIONEER3_PIONEER2_115_69kV_3PH	3-Phase fault on the Pioneer 115kV – Pioneer 69kV line near the Pioneer 115kV bus.
98	FLT_98_WALKMYR3_WALKMYR2_115_69kV_3PH	3-Phase fault on the Walkemeyer 115kV – Walkemeyer 69kV line near the Walkemeyer 115kV bus.

## Results

Results of the stability analysis are summarized in Table 9. These results are valid for Customers interconnecting with a generation amount up to 243.7 MW with reactive equipment. The results indicate that the transmission system remains stable for all contingencies studied. The plots will be available upon request.

Table 9: Fault Analysis Results for Limited Operation

Contingency Number and Name		2014SP	2013WP
1	FLT_01_G1202TAP_PILE_115kV_3PH	STABLE	STABLE
2	FLT_02_G1202TAP_PILE_115kV_1PH	STABLE	STABLE
3	FLT_03_G1202TAP_SCOTTCITY3_115kV_3PH	STABLE	STABLE
4	FLT_04_G1202TAP_SCOTTCITY3_115kV_1PH	STABLE	STABLE
5	FLT_05_DOBSON_GANO_115kV_3PH	STABLE	STABLE
6	FLT_06_DOBSON_GANO_115kV_1PH	STABLE	STABLE

Contingency Number and Name		2014SP	2013WP
7	FLT_07_DOBSON_MORRIS_115kv_3PH	STABLE	STABLE
8	FLT_08_DOBSON_MORRIS_115kv_1PH	STABLE	STABLE
9	FLT_09_DOBSON_KSAVWTP3_115kv_3PH	STABLE	STABLE
10	FLT_10_DOBSON_KSAVWTP3_115kv_1PH	STABLE	STABLE
11	FLT_11_DOBSON_LOWETAP3_115kv_3PH	STABLE	STABLE
12	FLT_12_DOBSON_LOWETAP3_115kv_1PH	STABLE	STABLE
13	FLT_13_SCOTTCITY3_SETAB_115kv_3PH	STABLE	STABLE
14	FLT_14_SCOTTCITY3_SETAB_115kv_1PH	STABLE	STABLE
15	FLT_15_SCOTTCITY3_MANNGTAP_115kv_3PH	STABLE	STABLE
16	FLT_16_SCOTTCITY3_MANNGTAP_115kv_1PH	STABLE	STABLE
17	FLT_17_SETAB3_CTYSERV_115kv_3PH	STABLE	STABLE
18	FLT_18_SETAB3_CTYSERV_115kv_1PH	STABLE	STABLE
19	FLT_19_RUBART_SATATAP2_115kv_3PH	STABLE	STABLE
20	FLT_20_RUBART_SATATAP2_115kv_1PH	STABLE	STABLE
21	FLT_21_RUBART_HICKOCK_115kv_3PH	STABLE	STABLE
22	FLT_22_RUBART_HICKOCK_115kv_1PH	STABLE	STABLE
23	FLT_23_SATATAP3_SATANTA3_115kv_3PH	STABLE	STABLE
24	FLT_24_SATATAP3_SATANTA3_115kv_1PH	STABLE	STABLE
25	FLT_25_SATATAP3_PIONTAP3_115kv_3PH	STABLE	STABLE
26	FLT_25_SATATAP3_PIONTAP3_115kv_1PH	STABLE	STABLE
27	FLT_27_PIONTAP3_PLYMELL_115kv_3PH	STABLE	STABLE
28	FLT_28_PIONTAP3_PLYMELL_115kv_1PH	STABLE	STABLE
29	FLT_29_PIONTAP3_SUBLETE_115kv_3PH	STABLE	STABLE
30	FLT_30_PIONTAP3_SUBLETE_115kv_1PH	STABLE	STABLE
31	FLT_31_PLYMELL_HOLCOMB3_115kv_3PH	STABLE	STABLE
32	FLT_32_PLYMELL_HOLCOMB3_115kv_1PH	STABLE	STABLE
33	FLT_33_PLYMELL_PIERCVL3_115kv_3PH	STABLE	STABLE
34	FLT_34_PLYMELL_PIERCVL3_115kv_1PH	STABLE	STABLE
35	FLT_35_HOLCOMB3_GRDNCTY_115kv_3PH	STABLE	STABLE
36	FLT_36_HOLCOMB3_GRDNCTY_115kv_1PH	STABLE	STABLE
37	FLT_37_HOLCOMB3_JONES3_115kv_3PH	STABLE	STABLE
38	FLT_38_HOLCOMB3_JONES3_115kv_1PH	STABLE	STABLE
39	FLT_39_HOLCOMB3_FLETCHR3_115kv_3PH	STABLE	STABLE
40	FLT_40_HOLCOMB3_FLETCHR3_115kv_1PH	STABLE	STABLE
41	FLT_41_HICKOCK_AMOCO3_115kv_3PH	STABLE	STABLE
42	FLT_42_HICKOCK_AMOCO3_115kv_1PH	STABLE	STABLE
43	FLT_43_HICKOCK_PIONEER3_115kv_3PH	STABLE	STABLE
44	FLT_44_HICKOCK_PIONEER3_115kv_1PH	STABLE	STABLE
45	FLT_45_PIONEER3_PKGOAB3_115kv_3PH	STABLE	STABLE
46	FLT_46_PIONEER3_PKGOAB3_115kv_1PH	STABLE	STABLE
47	FLT_47_PIONEER3_GRANTTP3_115kv_3PH	STABLE	STABLE
48	FLT_48_PIONEER3_GRANTTP3_115kv_1PH	STABLE	STABLE
49	FLT_49_PIONEER3_ULYSPLT3_115kv_3PH	STABLE	STABLE
50	FLT_50_PIONEER3_ULYSPLT3_115kv_1PH	STABLE	STABLE
51	FLT_51_PIONEER2_ULUE_69kv_3PH	STABLE	STABLE
52	FLT_52_PIONEER2_ULUE_69kv_1PH	STABLE	STABLE
53	FLT_53_PIONEER3_ULUNW_69kv_3PH	STABLE	STABLE
54	FLT_54_PIONEER3_ULUNW_69kv_1PH	STABLE	STABLE
55	FLT_55_ASGI1206T_ROLLA_69kv_3PH	STABLE	STABLE
56	FLT_56_ASGI1206T_ROLLA_69kv_1PH	STABLE	STABLE
57	FLT_57_HUGOTON2_CHUGTON2_69kv_3PH	STABLE	STABLE
58	FLT_58_HUGOTON2_CHUGTON2_69kv_1PH	STABLE	STABLE
59	FLT_59_HUGOTON3_GRANTTP3_115kv_3PH	STABLE	STABLE
60	FLT_60_HUGOTON3_GRANTTP3_115kv_1PH	STABLE	STABLE
61	FLT_61_HUGOTON3_WALKMYR3_115kv_3PH	STABLE	STABLE
62	FLT_62_HUGOTON3_WALKMYR3_115kv_1PH	STABLE	STABLE
63	FLT_63_GRANTTP3_GRANT3_115kv_3PH	STABLE	STABLE

Contingency Number and Name		2014SP	2013WP
64	FLT_64_GRANTTP3_GRANT3_115kV_1PH	STABLE	STABLE
65	FLT_65_WALKMYR3_CIMPLT3_115kV_3PH	STABLE	STABLE
66	FLT_66_WALKMYR3_CIMPLT3_115kV_1PH	STABLE	STABLE
67	FLT_67_WALKMYR3_NORTH6T2_69kV_3PH	STABLE	STABLE
68	FLT_68_WALKMYR3_NORTH6T2_69kV_1PH	STABLE	STABLE
69	FLT_69_WALKMYR3_WOODS_69kV_3PH	STABLE	STABLE
70	FLT_70_WALKMYR3_WOODS_69kV_1PH	STABLE	STABLE
71	FLT_71_SETAB7_MINGO7_345kV_3PH	STABLE	STABLE
72	FLT_72_SETAB7_MINGO7_345kV_1PH	STABLE	STABLE
73	FLT_73_SETAB7_HOLCOMB7_345kV_3PH	STABLE	STABLE
74	FLT_74_SETAB7_HOLCOMB7_345kV_1PH	STABLE	STABLE
75	FLT_75_MINGO7_REDWILLOW_345kV_3PH	STABLE	STABLE
76	FLT_76_MINGO7_REDWILLOW_345kV_1PH	STABLE	STABLE
77	FLT_77_HOLCOMB7_FINNEY7_345kV_3PH	STABLE	STABLE
78	FLT_78_HOLCOMB7_FINNEY7_345kV_1PH	STABLE	STABLE
79	FLT_79_HOLCOMB7_BUCKNER_345kV_3PH	STABLE	STABLE
80	FLT_80_HOLCOMB7_BUCKNER_345kV_1PH	STABLE	STABLE
81	FLT_81_HOLCOMB3_PLYMELL_115kV_3PH	STABLE	STABLE
82	FLT_82_HOLCOMB3_PLYMELL_115kV_1PH	STABLE	STABLE
83	FLT_83_FINNEY_HITCHLND7_345kV_3PH	STABLE	STABLE
84	FLT_84_FINNEY_HITCHLND7_345kV_1PH	STABLE	STABLE
85	FLT_85_SPEARVLL7_BUCKNER_345kV_3PH	STABLE	STABLE
86	FLT_86_SPEARVLL7_BUCKNER_345kV_1PH	STABLE	STABLE
87	FLT_87_SPEARVLL7_POSTRCK7_345kV_3PH	STABLE	STABLE
88	FLT_88_SPEARVLL7_POSTRCK7_345kV_1PH	STABLE	STABLE
89	FLT_89_POSTRCK7_AXTELL_345kV_3PH	STABLE	STABLE
90	FLT_90_POSTRCK7_AXTELL_345kV_1PH	STABLE	STABLE
91	FLT_91_SCOTTCITY3_SCOTTCTY2_115_69kV_3PH	STABLE	STABLE
92	FLT_92_SETAB7_SETAB3_345_115kV_3PH	STABLE	STABLE
93	FLT_93_HOLCOMB7_HOLCOMB3_345_115kV_3PH	STABLE	STABLE
94	FLT_94_SPEARVLL7_SPEARVLL6_345_230kV_3PH	STABLE	STABLE
95	FLT_95_POSTRCK7_POSTRCK6_345_230kV_3PH	STABLE	STABLE
96	FLT_96_HICKOCK3_HICKOCK2_115_69kV_3PH	STABLE	STABLE
97	FLT_97_PIONEER3_PIONEER2_115_69kV_3PH	STABLE	STABLE
98	FLT_98_WALKMYR3_WALKMYR2_115_69kV_3PH	STABLE	STABLE

### FERC LVRT Compliance

FERC Order #661A places specific requirements on wind farms through its Low Voltage Ride Through (LVRT) provisions. For Interconnection Agreements signed after December 31, 2006, wind farms shall stay on line for faults at the POI that draw the voltage down at the POI to 0.0 pu.

Fault contingencies were developed to verify that wind farms remain on line when the POI voltage is drawn down to 0.0 pu. These contingencies are shown in Table 10.

Table 10: LVRT Contingencies

Contingency Number and Name		Description
1	FLT_01_G1202TAP_PILE_115kV_3PH	3-Phase fault on the GEN-2012-002 Tap – Pile 115kV line near the GEN-2012-002 Tap 115kV bus.
2	FLT_02_G1202TAP_PILE_115kV_1PH	Single-phase fault similar to previous fault.
3	FLT_19_RUBART_SATATAP2_115kV_3PH	3-Phase fault on the Rubart – Satanta Tap 115kV line near the Rubart 115kV bus.
4	FLT_21_RUBART_HICKOCK_115kV_3PH	3-Phase fault on the Rubart – Hickock 115kV line near the Rubart 115kV bus.

Contingency Number and Name		Description
5	FLT_55_ASGI1206T_ROLLA_69kV_3PH	<i>3-Phase fault on the ASGI-2012-006 Tap – Rolla 69kV line near the ASGI-2012-006 Tap 69kV bus.</i>
6	FLT_57_HUGOTON2_CHUGTON2_69kV_3PH	<i>3-Phase fault on the Hugoton – Hugoton City 69kV line near the Hugoton 69kV bus.</i>

The required prior queued project wind farms remained online for the fault contingencies described in this section as well as the fault contingencies described in the Disturbances section of this report. The Customers are found to be in compliance with FERC Order #661A.

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## Conclusion

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<OMITTED TEXT> (Interconnection Customers, GEN-2012-002, GEN-2012-007 and ASGI-2012-006) have requested a Limited Operation System Impact Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for 243.7 MW of combustion and wind generation to be interconnected as an Energy Resource (ER) into the Transmission System of Sunflower Electric Power Corporation (SUNC) in Scott and Grant Counties, Kansas. ASGI-2012-006 is located Stevens County, Kansas in the Pioneer Electric Cooperative system and is embedded in the Sunflower Electric Power Corporation (SUNC) Transmission System. The point of interconnection for GEN-2012-002 will be a tap on the Scott City – Pile 115kV transmission line. The point of interconnection for GEN-2012-007 will be through a new substation into a tap on the Hickock – Satanta Tap 115kV transmission line. The point of interconnection for ASGI-2012-006 will be through a tap on the Hugoton – Rolla 69kV transmission line. The Customers, under GIA Section 5.9, has requested this Limited Operation Interconnection Study (LOIS) to determine the impacts of interconnecting to the transmission system before all required Network Upgrades identified in the DISIS-2012-001 (or most recent iteration) Impact Study can be placed into service.

Power flow analysis from this LOIS has determined that the Customers request can interconnect a limited amount of generation as an Energy Resource prior to the completion of the required Network Upgrades, listed within Table 2 of this report. Refer to Tables 4, 5 and 6 for the Limited Operation Interconnection Service available due to interconnection constraints.

Transient stability analysis indicates that the transmission system will remain stable for the contingencies listed within Table 8 with the addition of the Customers generation. Additionally, the Customers were found to be in compliance with FERC Order #661A when studied as listed within this report.

Any changes to these assumptions, for example, one or more of the previously queued requests not included within this study execute an interconnection agreement and commencing commercial operation, may require a re-study of this LOIS at the expense of the Customer or Customers.

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



**A. Additional Constraints Maximum Wind Scenario (Not for Mitigation)**

See next page.