ASGI-2013-004
Impact Study for Modification Request of Affected System Generator

April 2014
Generator Interconnection

SPP Southwest Power Pool

Executive Summary

This document reports on the findings of an impact restudy for the Affected System Generation Interconnection request, ASGI-2013-004. The Customer has requested this Modification Request Impact Study (MRIS) to determine the impacts to the Southwest Power Pool (SPP) Transmission System for a modification to the generator equipment to be installed.

The Customer is requesting the interconnection of three (3) 14 MVA combustion turbines and associated facilities with a project nameplate rating of 27.6 MW (summer peak) and 36.6 MW (winter peak) that is to be installed on the City of Garden City, Kansas (GCK) 34.5-kV system in Finney County, Kansas. The GCK 34.5-kV facilities that service the Customer interconnect with the Wheatland Electric Cooperative system which is interconnected to the Transmission System of Sunflower Electric Power Corporation (SUNC) at the Morris 115kV substation on the Dobson (SUNC) – Irsik and Doll (SUNC) 115kV transmission line.

The generation project was studied as an Energy Resource (ERIS) initially for an interim period reported in a Limited Operation Impact Study posted December, 2013. The request was subsequently included in the DISIS-2013-002 Definitive Impact Study which was posted in January, 2014. The results of both these Impact Studies determined that the ASGI-2013-004 request can interconnect 27.6MW (summer peak) and 36.6MW (winter peak) with the assumptions described in each study report.

For this modification, the Customer requested to forgo the installation of Power System Stabilizers (PSS) on the study generation. A PSS package for study had been provided by the Customer to SPP to analyze the impacts of the interconnection of the generation. SUNC has no specific criteria for the requirement of PSS on its Transmission System. Therefore, transient stability analysis was conducted for this study for both the LOIS and the DISIS-2013-002 study scenarios to determine the impacts of not requiring the installation of the PSS. The LOIS scenario assumes that only the higher queued projects listed within Table 2 of this study might go into service before the completion of all Network Upgrades identified within Table 3 of this report. If additional generation projects, listed within Table 4, 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 3 of this report are completed, this LOIS scenario may need to be restudied to ensure that interconnection service remains for the ASGI-2013-004 request. The DISIS-2013-002 scenario assumes that both the higher queued projects listed within Table 2 of this study and additional generation projects listed within Table 4 might go into service with the completion of all Network Upgrades identified within Table 3 of this report.

Transient stability analysis for this study has determined that with the assigned upgrades, the transmission system will remain stable for the forty-seven (47) selected faults for the interconnection of ASGI-2013-004. The request to forgo the installation of the Power System Stabilizers is acceptable to SPP.

Since the analysis of the PSS only required stability analysis, powerflow analysis was not performed again for this study. For powerflow constraints, please refer to the latest version of DISIS-2013-002 or LOIS as applicable. Should any other projects, other than those listed within Table 2 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. At times, 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 Customer may be required to reduce its generation output to **0 MW** under certain system conditions to allow system operators to maintain the reliability of the transmission network.

With the assumptions outlined in this report and with all the required network upgrades identified in place, the ASGI-2013-004 request should be able to reliably interconnect to the SPP transmission system.

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).

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Introduction

The Impact Study for Modification Request of ASGI-2013-004 is an affected system generation interconnection study performed to study the impacts of interconnecting the project shown in Table 1. The in-service date assumed for the generation addition was on or around March 2014. This restudy is for a modification to the generator equipment to be installed. The Customer has asked to forgo the installation of Power System Stabilizers (PSS) that were originally provided to SPP for the study of the generation.

Table *1*: Interconnection Requests

Request	Capacity (MW)	Generator Model	Fuel Source	Point of Interconnection
ASGI-2013-004	36.6	14 MVA combustion turbines (GENSAL)	Gas	Morris 115kV (531430)

The system impact study considers the Base Case as well as all Generating Facilities (and with respect to (b) below, any identified Network Upgrades associated with such higher queued interconnection) that, on the date the interconnection 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.

Powerflow analysis was not performed for this study as expected system topology has not changed.

Two scenarios for Transient Stability analysis were considered and reported for this impact study. A Limited Operation Interconnection Study (LOIS) scenario included prior queued generation interconnection requests. Those listed within Table Table 2 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 of ASGI-2013-004 for this LOIS. Also listed in Table 2 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 2: 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

Table 2: Generation Requests Included within LOIS

Project	MW	Total MW	Fuel Source	POI	Status
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	250.0	Wind	Finney 345kV	Commercial Operation
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 Schedule
GEN-2010-009	165.6	165.6	Wind	Buckner 345kV	Commercial Operation
GEN-2012-007	120.0	120.0	Gas	Rubart 115kV	IA Executed/On Schedule
ASGI-2012-006	22.5	22.5	Steam	Tap Hugoton - Rolla 69kV	Schedule for 2014 In-Service

This LOIS was required because the Customer is requesting interconnection prior to the completion of all upgrades that have been identified in the DISIS-2013-002 Definitive Interconnection System Impact Study (DISIS). Table 3 below lists the required upgrade projects for which this request may have cost responsibility.

Table 3: Upgrade Projects not included in LOIS but Required for Full Interconnection Service

Upgrade Project	Type	Description	Status
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
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
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
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
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
Lancer Project (Build 345/115 transformer and Lancer addition)	Most recent iteration of DISIS 2009-001. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	Upgrade	Current estimated In-Service Date of 2015

Upgrade Project	Type	Description	Status
Buckner - Spearville 345V CKT 1 Terminal Equipment	Most recent iteration of DISIS 2010-002. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	Upgrade	Not authorized to begin construction
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
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
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
GEN-2011-017 Tap - Mullergren 345kV CKT 1	Most recent iteration of DISIS 2011-002. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	Upgrade	Not authorized to begin construction
Mullergren 345/230kV Substation	Most recent iteration of DISIS 2011-002. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	Upgrade	Not authorized to begin construction
Power System Stabilizers (PSS) Installed at Tolk (Units: 1,2) and Jones (Units: 1,2,3,4)	Most recent iteration of DISIS 2011-002. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	Upgrade	Not authorized to begin construction
Dobson - Gano 115kV CKT 1 (Terminal Equipment)	Most recent iteration of DISIS 2012-001. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	Upgrade	Not authorized to begin construction
Garden City - Kansas Ave Water Treatment Plant 115KV CKT 1 Terminal Equipment	Most recent iteration of DISIS 2012-001. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	Upgrade	Not authorized to begin construction

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 the LOIS are listed in Table 4. 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 4: 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

Table 4: Higher or Equally Queued GI Requests not included within LOIS

Project	Remainder MW	Total MW	Fuel	POI	Status
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-2008-092	201.0	201.0	Wind	Knoll 230kV	IA Executed/On Schedule for 2014
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

The DISIS scenario included all projects listed in both Table 2 and Table 4 and their assigned upgrades including those listed in Table 3.

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

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).

Facilities

Generating Facility

ASGI-2013-004 Interconnection Customer's request to interconnect a total of 27.6 MW (summer peak) and 36.6 MW (winter peak) is comprised of three (3) 14 MVA combustion turbines and associated interconnection facilities. The Customer has asked to not install the previously submitted Power System Stabilizer package (PSS) in the generator installation.

Interconnection Facilities

The POI for ASGI-2013-004 Interconnection Customer is through the existing Morris 115kV substation in Finney 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.

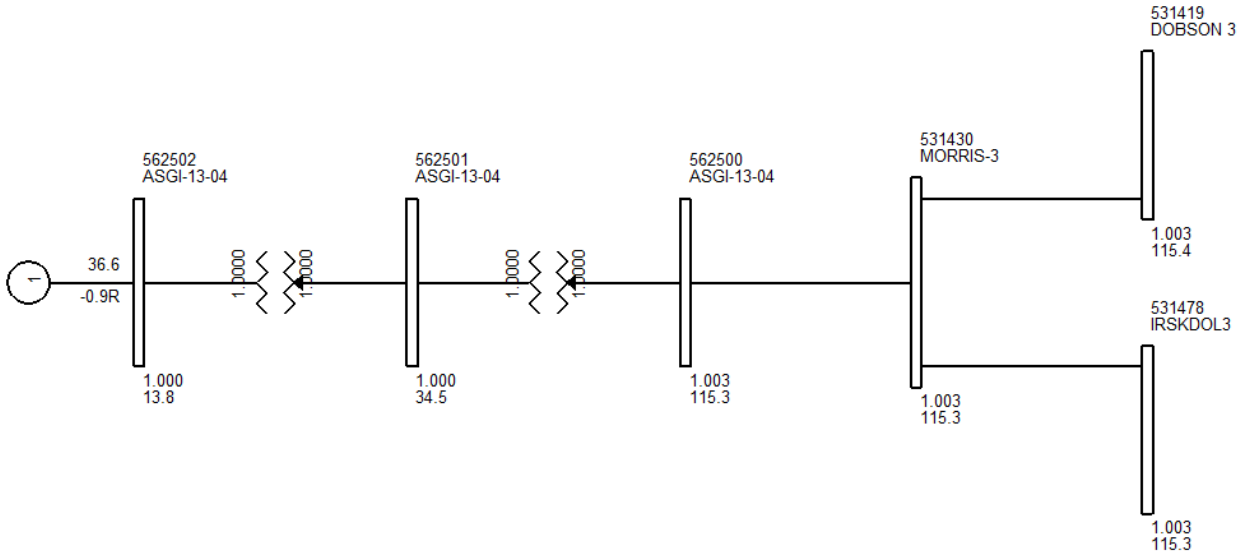

Figure 1: Proposed POI Configuration and Request Power Flow Model

Base Case Network Upgrades

The Network Upgrades included within the cases used for the LOIS scenario 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 ASGI-2013-004 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 the 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.

The Network Upgrades included within the cases used for the DISIS scenario include those facilities described for the LOIS scenario and those upgrades assigned to interconnection customers as described in the DISIS.

Powerflow Analysis

The modification of the Power System Stabilizers did not require powerflow analysis. Please see the previously performed studies for Limited Operation for ASGI-2013-004 and the latest iteration of DISIS-2013-002 for powerflow analysis, constraints, and upgrades required.

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 peak dynamic cases. The cases are then loaded with prior queued interconnection requests and network upgrades assigned to those interconnection requests. Finally the prior queued and study generation are 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

Forty-seven (47) contingencies were identified for use in this study and are listed in Table 5. 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.

Except for transformer faults, the typical sequence of events for a three-phase and a 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 modeled as three-phase faults, unless otherwise noted. The sequence of events for a transformer fault is as follows:

1. apply fault for five (5) cycles
2. clear the fault by tripping the affected transformer facility (unless otherwise noted there will be no re-closing into a transformer fault)

The control areas monitored are 525, 526, 531, 534, 536, and 640

Table 5: Contingencies Evaluated

	Contingency Number and Name	Description
1	FLT_01_MORRIS3_DOBSON3_115kV_3PH	*3-Phase fault on the Dobson – Morris 115kV line near the Morris 115kV bus.*
2	FLT_02_MORRIS3_DOBSON3_115kV_1PH	*Single-phase fault similar to previous fault.*
3	FLT_03_MORRIS3_IRSKDOL3_115kV_3PH	*3-Phase fault on the Irsik and Doll – Morris 115kV line near the Morris 115kV bus.*
4	FLT_04_MORRIS3_IRSKDOL3_115kV_1PH	*Single-phase fault similar to previous fault.*
5	FLT_05_DOBSON3_LOWETAP3_115kV_3PH	*3-Phase fault on the Dobson – Lowe Tap 115kV line near the Dobson 115kV bus.*
6	FLT_06_DOBSON3_LOWETAP3_115kV_1PH	*Single-phase fault similar to previous fault.*
7	FLT_07_DOBSON3_KSAVWTP3_115kV_3PH	*3-Phase fault on the Dobson – Kansas Ave. Water Treatment Plant 115kV line near the Dobson 345kV bus.*
8	FLT_08_DOBSON3_KSAVWTP3_115kV_1PH	*Single-phase fault similar to previous fault.*
9	FLT_09_DOBSON3_GANO3_115kV_3PH	*3-Phase fault on the Dobson – Gano 115kV line near the Dobson 115kV bus.*
10	FLT_10_DOBSON3_GANO3_115kV_1PH	*Single-phase fault similar to previous fault.*
11	FLT_11_GRDNCTY3_HOLCOMB3_115kV_3PH	*3-Phase fault on the Garden City Plant – Holcomb 115kV line near the Garden City Plant 115kV bus.*
12	FLT_12_GRDNCTY3_HOLCOMB3_115kV_1PH	*Single-phase fault similar to previous fault.*
13	FLT_15_HOLCOMB3_JONES3_115kV_3PH	*3-Phase fault on the Holcomb – Jones 115kV line near the Holcomb 115kV bus.*
14	FLT_16_HOLCOMB3_JONES3_115kV_1PH	*Single-phase fault similar to previous fault.*
15	FLT_17_HOLCOMB3_PLYMELL3_115kV_3PH	*3-Phase fault on the Holcomb – Plymell Switch 115kV line near the Holcomb 115kV bus.*
16	FLT_18_HOLCOMB3_PLYMELL3_115kV_1PH	*Single-phase fault similar to previous fault.*
17	FLT_19_HOLCOMB3_FLETCHR3_115kV_3PH	*3-Phase fault on the Holcomb – Fletcher 115kV line near the Holcomb 115kV bus.*
18	FLT_20_HOLCOMB3_FLETCHR3_115kV_1PH	*Single-phase fault similar to previous fault.*
19	FLT_25_SCOTCTY3_SETAB3_115kV_3PH	*3-Phase fault on the Scott City – Setab 115kV line near the Scott City 115kV bus.*
20	FLT_26_SCOTCTY3_SETAB3_115kV_1PH	*Single-phase fault similar to previous fault.*
21	FLT_27_SCOTCTY3_MANNGT3_115kV_3PH	*3-Phase fault on the Manning Tap – Scott City 115kV line near the Scott City 115kV bus.*
22	FLT_28_SCOTCTY3_MANNGT3_115kV_1PH	*Single-phase fault similar to previous fault.*
23	FLT_33_HOLCOMB7_FINNEY7_345kV_3PH	*3-Phase fault on the Finney – Holcomb 345kV line near the Holcomb 345kV bus.*
24	FLT_34_HOLCOMB7_FINNEY7_345kV_1PH	*Single-phase fault similar to previous fault.*
25	FLT_35_HOLCOMB7_SETAB7_345kV_3PH	*3-Phase fault on the Holcomb – Setab 345kV line near the Holcomb 345kV bus.*
26	FLT_36_HOLCOMB7_SETAB7_345kV_1PH	*Single-phase fault similar to previous fault.*
27	FLT_37_HOLCOMB7_BUCKNER7_345kV_3PH	*3-Phase fault on the Buckner – Holcomb 345kV line near the Holcomb 345kV bus.*
28	FLT_38_HOLCOMB7_BUCKNER7_345kV_1PH	*Single-phase fault similar to previous fault.*
29	FLT_39_FINNEY7_HITCHLAND7_345kV_3PH	*3-Phase fault on the Finney – Hitchland 345kV line near the Finney 345kV bus.*
30	FLT_40_FINNEY7_HITCHLAND7_345kV_1PH	*Single-phase fault similar to previous fault.*
31	FLT_41_SETAB7_MINGO7_345kV_3PH	*3-Phase fault on the Mingo – Setab 345kV line near the Setab 345kV bus.*
32	FLT_42_SETAB7_MINGO7_345kV_1PH	*Single-phase fault similar to previous fault.*
33	FLT_43_BUCKNER7_SPERVIL7_345kV_3PH	*3-Phase fault on the Buckner – Spearville 345kV line near the Buckner 345kV bus.*
34	FLT_44_BUCKNER7_SPERVIL7_345kV_1PH	*Single-phase fault similar to previous fault.*
35	FLT_45_BUCKNER7_BEAVERCO_345kV_3PH	*3-Phase fault on the Beaver County – Buckner 345kV line near the Buckner 345kV bus.*
36	FLT_46_BUCKNER7_BEAVERCO_345kV_1PH	*Single-phase fault similar to previous fault.*
37	FLT_47_HOLCOMB3_HOLCOMB7_115_345kV_3PH	*3-Phase fault on the Holcomb 345kV/115kV transformer near the Holcomb 115kV bus.*
38	FLT_48_SETAB3_SETAB7_115_345kV_3PH	*3-Phase fault on the Setab 345kV/115kV transformer near the Setab 115kV bus.*
39	FLT_49_POBKNRBVRCBUCKNER7_SPERVIL7_345kV_3PH	***Prior Outage of Beaver County – Buckner 345kV line.*** *3-Phase fault on the Buckner – Spearville 345kV line near the Buckner 345kV bus.*
40	FLT_50_POBKNRBVRCBUCKNER7_SPERVIL7_345kV_1PH	*Single-phase fault similar to previous fault.*
41	FLT_51_POBKNRSPRVBUCKNER7_BEAVERCO_345kV_3PH	***Prior Outage of Buckner – Spearville 345kV line.*** *3-Phase fault on the Beaver County – Buckner 345kV line near the Buckner 345kV bus.*

Table 5: Contingencies Evaluated

	Contingency Number and Name	Description
42	FLT_52_POBKNRSPRVBUCKNER7_BEAVERCO_345kV_1PH	*Single-phase fault similar to previous fault.*
43	FLT_53_POHOLCOMBXFMORRIS3_DOBSON3_115kV_3PH	***Prior Outage of Holcomb 345kV/115kV transformer*** *3-Phase fault on the Dobson – Morris 115kV line near the Morris 115kV bus.*
44	FLT_54_POHOLCOMBXFMORRIS3_DOBSON3_115kV_1PH	*Single-phase fault similar to previous fault.*
45	FLT_55_POHOLCOMBXFMORRIS3_IRSKDOL3_115kV_3PH	***Prior Outage of Holcomb 345kV/115kV transformer*** *3-Phase fault on the Irsik and Doll – Morris 115kV line near the Morris 115kV bus.*
46	FLT_56_POHOLCOMBXFMORRIS3_IRSKDOL3_115kV_1PH	*Single-phase fault similar to previous fault.*
47	FLT_57_SBHOLCOMB3PLYMELL3HOLCOMB3_HOLCOMB7_115_345kV_1PH	***Holcomb 115kV Stuck Breaker*** *1. Apply single-phase fault on the Holcomb – Plymell Switch 115kV line at the Holcomb 115kV bus.* *2.Wait sixteen (16) cycles, clear the fault by tripping Holcomb – Plymell Switch 115kV line and Holcomb 345kV/115kV transformer.*

Transient Stability Results

Results of the stability analysis are summarized in Table 6. These results are valid for ASGI-2013-004 interconnecting with a generation amount up to 27.6 MW (summer peak) and 36.6 MW (winter peak). The results indicate that the transmission system remains stable for all contingencies studied in both the LOIS and DISIS scenarios. The plots will be available upon request.

Table 6: Fault Analysis Results

	Contingency Number and Name	LOIS			DISIS-2013-002		
		2014WP	2015SP	2024SP	2014WP	2015SP	2024SP
1	FLT_01_MORRIS3_DOBSON3_115kV_3PH	OK	OK	OK	OK	OK	OK
2	FLT_02_MORRIS3_DOBSON3_115kV_1PH	OK	OK	OK	OK	OK	OK
3	FLT_03_MORRIS3_IRSKDOL3_115kV_3PH	OK	OK	OK	OK	OK	OK
4	FLT_04_MORRIS3_IRSKDOL3_115kV_1PH	OK	OK	OK	OK	OK	OK
5	FLT_05_DOBSON3_LOWETAP3_115kV_3PH	OK	OK	OK	OK	OK	OK
6	FLT_06_DOBSON3_LOWETAP3_115kV_1PH	OK	OK	OK	OK	OK	OK
7	FLT_07_DOBSON3_KSAVWTP3_115kV_3PH	OK	OK	OK	OK	OK	OK
8	FLT_08_DOBSON3_KSAVWTP3_115kV_1PH	OK	OK	OK	OK	OK	OK
9	FLT_09_DOBSON3_GANO3_115kV_3PH	OK	OK	OK	OK	OK	OK
10	FLT_10_DOBSON3_GANO3_115kV_1PH	OK	OK	OK	OK	OK	OK
11	FLT_11_GRDNCTY3_HOLCOMB3_115kV_3PH	OK	OK	OK	OK	OK	OK
12	FLT_12_GRDNCTY3_HOLCOMB3_115kV_1PH	OK	OK	OK	OK	OK	OK
13	FLT_15_HOLCOMB3_JONES3_115kV_3PH	OK	OK	OK	OK	OK	OK
14	FLT_16_HOLCOMB3_JONES3_115kV_1PH	OK	OK	OK	OK	OK	OK
15	FLT_17_HOLCOMB3_PLYMELL3_115kV_3PH	OK	OK	OK	OK	OK	OK
16	FLT_18_HOLCOMB3_PLYMELL3_115kV_1PH	OK	OK	OK	OK	OK	OK
17	FLT_19_HOLCOMB3_FLETCHR3_115kV_3PH	OK	OK	OK	OK	OK	OK
18	FLT_20_HOLCOMB3_FLETCHR3_115kV_1PH	OK	OK	OK	OK	OK	OK
19	FLT_25_SCOTCTY3_SETAB3_115kV_3PH	OK	OK	OK	OK	OK	OK
20	FLT_26_SCOTCTY3_SETAB3_115kV_1PH	OK	OK	OK	OK	OK	OK
21	FLT_27_SCOTCTY3_MANNGT3_115kV_3PH	OK	OK	OK	OK	OK	OK
22	FLT_28_SCOTCTY3_MANNGT3_115kV_1PH	OK	OK	OK	OK	OK	OK

Table 6: Fault Analysis Results

	Contingency Number and Name	LOIS			DISIS-2013-002		
		2014WP	2015SP	2024SP	2014WP	2015SP	2024SP
23	FLT_33_HOLCOMB7_FINNEY7_345kV_3PH	OK	OK	OK	OK	OK	OK
24	FLT_34_HOLCOMB7_FINNEY7_345kV_1PH	OK	OK	OK	OK	OK	OK
25	FLT_35_HOLCOMB7_SETAB7_345kV_3PH	OK	OK	OK	OK	OK	OK
26	FLT_36_HOLCOMB7_SETAB7_345kV_1PH	OK	OK	OK	OK	OK	OK
27	FLT_37_HOLCOMB7_BUCKNER7_345kV_3PH	OK	OK	OK	OK	OK	OK
28	FLT_38_HOLCOMB7_BUCKNER7_345kV_1PH	OK	OK	OK	OK	OK	OK
29	FLT_39_FINNEY7_HITCHLAND7_345kV_3PH	OK	OK	OK	OK	OK	OK
30	FLT_40_FINNEY7_HITCHLAND7_345kV_1PH	OK	OK	OK	OK	OK	OK
31	FLT_41_SETAB7_MINGO7_345kV_3PH	OK	OK	OK	OK	OK	OK
32	FLT_42_SETAB7_MINGO7_345kV_1PH	OK	OK	OK	OK	OK	OK
33	FLT_43_BUCKNER7_SPERVIL7_345kV_3PH	OK	OK	OK	OK	OK	OK
34	FLT_44_BUCKNER7_SPERVIL7_345kV_1PH	OK	OK	OK	OK	OK	OK
35	FLT_45_BUCKNER7_BEAVERCO_345kV_3PH	N/A	N/A	N/A	OK	OK	OK
36	FLT_46_BUCKNER7_BEAVERCO_345kV_1PH	N/A	N/A	N/A	OK	OK	OK
37	FLT_47_HOLCOMB3_HOLCOMB7_115_345kV_3PH	OK	OK	OK	OK	OK	OK
38	FLT_48_SETAB3_SETAB7_115_345kV_3PH	OK	OK	OK	OK	OK	OK
39	FLT_49_POBKNRBVRCBUCKNER7_SPERVIL7_345kV_3PH	N/A	N/A	N/A	OK	OK	OK
40	FLT_50_POBKNRBVRCBUCKNER7_SPERVIL7_345kV_1PH	N/A	N/A	N/A	OK	OK	OK
41	FLT_51_POBKNRSPRVBUCKNER7_BEAVERCO_345kV_3PH	N/A	N/A	N/A	OK	OK	OK
42	FLT_52_POBKNRSPRVBUCKNER7_BEAVERCO_345kV_1PH	N/A	N/A	N/A	OK	OK	OK
43	FLT_53_POHOLCOMBXFMORRIS3_DOBSON3_115kV_3PH	N/A	N/A	N/A	OK	OK	OK
44	FLT_54_POHOLCOMBXFMORRIS3_DOBSON3_115kV_1PH	N/A	N/A	N/A	OK	OK	OK
45	FLT_55_POHOLCOMBXFMORRIS3_IRSKDOL3_115kV_3PH	N/A	N/A	N/A	OK	OK	OK
46	FLT_56_POHOLCOMBXFMORRIS3_IRSKDOL3_115kV_1PH	N/A	N/A	N/A	OK	OK	OK
47	FLT_57_SBHOLCOMB3PLYMELL3HOLCOMB3_HOLCOMB7_115_345kV_1PH	N/A	N/A	N/A	OK	OK	OK

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. The required prior queued project wind farms remained online for the fault contingencies described in the Disturbances section of this report.

Power Factor Analysis Results

No power factor analysis was performed since there were no wind farms projects under study. The ASGI-2013-004 request will be required to maintain power factor requirements of 95% lagging (producing vars) and 95% leading (absorbing vars) at the Point of Interconnection.

Conclusion

The SPP ASGI-2013-004 Modification Request Impact Study evaluated the impact of interconnecting the projects shown below.

Table *7*: Interconnection Requests

Request	Capacity (MW)	Generator Model	Fuel Source	Point of Interconnection
ASGI-2013-004	36.6	14 MVA combustion turbines (GENSAL)	Gas	Morris 115kV (531430)

With all Base Case Network Upgrades in service and previously assigned Network Upgrades in service, the ASGI-2013-004 project was found to remain on line, and the transmission system was found to remain stable for all conditions studied. All generators in the monitored areas remained stable for all of the modeled disturbances. The request to forgo the installation of Power System Stabilizers for the ASGI-2013-004 is acceptable to SPP.

Any changes to the assumptions made in this study, for example, one or more of the previously queued requests withdraw or execute an interconnection agreement and commence commercial operation, may require a re-study at the expense of the Customer.

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

Appendix A

Plots of Machines and Buses within the Monitored Areas

(Additional Plots Available upon request)

Appendix B

Project Model

PSS/E 32 Power Flow Data

```
@! ********** ASGI-2013-004 100% Summer **********
@! POI @ Morris 115kV 531430
@! Combustion Turbine
@! Pmax=27.6MW-S/36.6MW-W
@! +0.80/-0.99 PF Range
Version 32
@! ---------- Bus Data ----------
BAT_BUS_DATA_2,583690,1,,,, 115.00,,,'ASGI2013-004',;
BAT_BUS_DATA_2,583691,1,,,,  34.50,,,'A13-004XFMR1',;
BAT_BUS_DATA_2,583692,1,,,,  34.50,,,'A13-004-GSU1',;
BAT_BUS_DATA_2,583693,2,,,,  13.80,,,'A13-004-GEN1',;
@! ---------- Generator Data ----------
BAT_PLANT_DATA,583693,, 1.03,,;
BAT_PLANT_DATA,583693,, 1.03,,;
@! Summer 27.6MW
 BAT_MACHINE_DATA_2,583693,'1',1,,,,,0, 27.6,, 20.7000, -3.9327, 27.6, 0.0, 42.0, 0.0081, 0.297,,,,,,,, 1.00,;
@! Winter 36.6MW
@!BAT_MACHINE_DATA_2,583693,'1',1,,,,,0, 36.6,, 27.4500, -5.2152, 36.6, 0.0, 42.0, 0.0081, 0.297,,,,,,,, 1.00,;
@! ---------- Unit Transformers ----------
BAT_TWO_WINDING_DATA,583692,583693,'1',1,,,,,, 5,,,,1,0,1,2,1,0.004656,0.06984, 31.5,,,,,, 52.5, 52.5, 52.5,,,,,,,,,,,,,;
@! Assumed X/R=30 for Z=6.3% @ 25MVA 115/34.5/13.8kV XFMR
BAT_TWO_WINDING_DATA,583690,583691,'1',1,,,,,,33,,,,1,0,1,2,1,0.002099,0.06297, 25.0,,,,,, 41.7, 41.7, 41.7,,,,,,,,,,,,,;
@! Circuit impedance data not provided
@! ---------- Transmission Line Parameters ----------
BAT_BRANCH_DATA,583691,583692,'1',,,,,,, 0.00000, 0.00001, 0.00000,,,,,,,,,,,,;
BAT_BRANCH_DATA,531430,583690,'1',,,,,,, 0.00000, 0.00001, 0.00000,,,,,,,,,,,,;
@END
```

PSS/E 32 Dynamics Data

```
/ ***** ASGI-2013-004 *****
/ Combustion Turbine
583693 'GENSAL' 1
       5.7500   0.0650   0.1890   1.5520   0.0000
       2.6900   1.3100   0.3370   0.2970   0.1080
       0.0400   0.4400   /
/ Note: Replaced TF3 with a typical value.
 583693 'AC7B'   1
       0.0050   6.0000   1.6000   1.5200   0.0000
       1.0000   0.0000   1.0000   0.0000   1.0000
      -0.9500   23.877   10.000   0.0000   0.0000
       0.0000   0.2000   0.1800   0.0200   1.0000
       0.3500   5.3000   0.0000   3.1000   0.1690
       4.1000   0.1780   /
/ Power System Stabilizer Disabled for Modification Request Impact Study
/ 583693 'PSS2B'  1  1 000000 3 000000 5 1
/       2.0000   2.0000   0.0000   2.0000   0.0000
/       2.0000   0.6450   1.0000   0.5000   0.1000
/       15.000   0.3000   2.0000   0.2000   0.0100
/       0.2000   0.0100   99.000  -99.000   99.000
/      -99.000   0.0500  -0.0500   /
```