Impact Study of Limited Operation for Generator Interconnection

GEN-2008-018

February 2013
Generation Interconnection

SPP Southwest Power Pool

Executive Summary

<OMITTED TEXT> (Customer; GEN-2008-018) has requested a Limited Operation System Impact Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for 405.0 MW of wind generation to be interconnected as an Energy Resource (ER) into a transmission facility of the Southwestern Public Service Co. (SPS) in Finney County, Kansas. GEN-2008-018, 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 ICS-2008-001 (or most recent iteration) Impact Study can be placed into service.

The Customer has requested a restudy of the LOIS that was previously performed and posted to SPP OASIS on September 9, 2011. That study can be found at the following web address: http://sppoasis.spp.org/documents/swpp/transmission/studies/files/2008_Generation_Studies/GEN-2008-018_LOIS_Restudy_9_7_11.pdf. The Customer has requested a restudy of this LOIS to confirm that adequate interconnection service remains after the withdrawals and Commercial Operation commencement of certain higher queued projects and secondly to reevaluate the reactive power requirements at the point of interconnection to account for a different collector system layout.

This LOIS addresses the effects of interconnecting the plant to the rest of the transmission system for the system topology and conditions as expected on January 1, 2014. GEN-2008-018 is requesting the interconnection of two-hundred seventy (270) General Electric 1.5 MW wind turbine generators and associated facilities into the Finney 345kV substation. 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 GEN-2008-018 request.

Power flow analysis from this LOIS has determined that the GEN-2008-018 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. There is no more than 348.0 MW of Limited Operation Interconnection Service available for the period of January 1, 2014 until the completion of the Finney – Holcomb 345kV circuit 2, Spearville – Clark (Commanche) – Thistle (Medicine Lodge) – Wichita 345kV double circuit, Hitchland – Woodward 345kV double circuit, and the Woodward – Thistle (Medicine Lodge) 345kV double circuit upgrades. These upgrades, with the exception of Finney-Holcomb, are scheduled for completion in December, 2014. The Finney-Holcomb in service date is as yet undetermined. 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. 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. Transient stability analysis from this LOIS has determined that the transmission system will remain stable for the nineteen (19) selected faults for the limited operation interconnection of GEN-2008-018.

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

<OMITTED TEXT> (Interconnection Customer) has requested a restudy of a Limited Operation System Impact Study (LOIS) under the Southwest Power Pool (SPP) Open Access Transmission Tariff (OATT) for an interconnection request into an existing transmission facility of the Southwestern Public Service Co. (SPS).

The purpose of this study is to reevaluate the impacts of interconnecting GEN-2008-018 request of 405.0 MW comprised of two-hundred seventy (270) General Electric 1.5 MW wind turbine generators and associated facilities interconnecting into the SPS Finney County 345kV substation located in Finney County, Kansas. The Customer has requested this amount to be studied as an Energy Resource (ER) with a Limited Operation Interconnection Service to commence on or around January of 2014.

The Customer has requested a restudy of the LOIS that was previously performed and posted to SPP OASIS on September 9, 2011. That study can be found at the following web address: http://sppoasis.spp.org/documents/swpp/transmission/studies/files/2008_Generation_Studies/GEN-2008-018_LOIS_Restudy_9_7_11.pdf. The Customer has requested a restudy of this LOIS to confirm that adequate interconnection service remains after the withdrawals and Commercial Operation commencement of certain higher queued projects and secondly to reevaluate the reactive power requirements at the point of interconnection to account for a different collector system layout.

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 1/2014 in-service of GEN-2008-018 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
Lamar DC Tie Import	210.0	210.0	DC Tie	Lamar 345kV	Commercial Operation
SPS Distributed (TC-Texas County)	20.0	20.0	Wind	TC-Texas County 115kV	Commercial Operation
SPS Distributed (Sherman)	20.0	20.0	Wind	Sherman 115kV	Commercial Operation
SPS Distributed (Spearman)	10.0	10.0	Wind	Spearman 115kV	Commercial Operation
SPS Distributed (Etter)	20.0	20.0	Wind	Etter 115kV	Commercial Operation
SPS Distributed (Moore E)	25.0	25.0	Wind	Moore East 115kV	Commercial Operation
SPS Distributed (Dumas 19th St.)	20.0	20.0	Wind	Dumas 19th St. 115kV	Commercial Operation
Gray County Wind (Montezuma)	110.0	110.0	Wind	Gray County Tap 115kV	Commercial Operation
GEN-2001-039A	105.0	105.0	Wind	Shooting Star Tap 115kV	IA Executed/On Schedule
GEN-2001-039M (Central Plains)	99.0	99.0	Wind	Central Plains Tap 115kV	Commercial Operation
GEN-2002-008 (NTWC Noble)	120.0	240.0	Wind	Hitchland 345kV	Commercial Operation
GEN-2002-009 (NTWC-3 JDW-4)	80.0	80.0	Wind	Hansford 115kV	Commercial Operation
GEN-2002-025A (KCPL)	148.5	148.5	Wind	Spearville 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	51.2	Wind	Spearville 230kV	Commercial Operation
GEN-2005-012 (Westar)	248.4	160.0	Wind	Spearville 345kV	Commercial Operation
GEN-2006-020S (DeWind Frisco)	19.8	19.8	Wind	DWS Frisco 115kV	Commercial Operation
GEN-2006-021 (Flat Ridge I)	101.0	101.0	Wind	Flat Ridge Tap 138kV	Commercial Operation
GEN-2006-044	370.0	80.0	Wind	Hitchland 345kV	IA Executed/On Schedule
GEN-2008-018	405.0	405.0	Wind	Finney 345kV	IA Executed/On Schedule

This LOIS was required because the Customer is requesting interconnection prior to the completion of all of their required upgrades listed within the latest iteration of their Impact Cluster Study (ICS). Table 2 below lists the required upgrade projects for which this request has cost responsibility. GEN-2008-018 was included within the ICS-2008-001 that was last restudied in late 2012 and posted January 24, 2013. This report can be located here at the following GI Study URL: http://sppoasis.spp.org/documents/swpp/transmission/GenStudies.cfm?YearType=2008_Impact_Studies.

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

Upgrade Project	Type	Description	Status
Finney – Holcomb 345kV circuit 2		ICS-2008-001 Customers	Current Estimated In-Service date unknown

Upgrade Project	Type	Description	Status
Hitchland – Woodward 345kV double circuit	GIA Appendix A (2eii) Previous Network Upgrade not responsibility of Customer but required to support full interconnection	Build Balanced Portfolio Project	Current Estimated In-Service date of 6/30/2014
Spearville – Clark County – Thistle – Wichita 345kV double circuit	GIA Appendix A (2eii) 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 – Thistle 345kV double circuit	GIA Appendix A (2eii) 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

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-2002-008 (NTWC Noble)	120.0	240.0	Wind	Hitchland 345kV	Commercial Operation for 120.0 MW
GEN-2004-014 (KCPL)	103.3	154.5	Wind	Spearville 230kV	Commercial Operation for 51.2 MW
GEN-2005-012 (Westar)	88.4	248.4	Wind	Spearville 345kV	Commercial Operation for 160.0 MW
GEN-2006-006	205.5	205.5	Wind	Spearville 345kV	IA Pending
GEN-2006-022	150.0	150.0	Wind	Ninnescah 115kV	IA Executed/On Suspension
GEN-2006-044	290.0	370.0	Wind	Hitchland 345kV	IA Executed/On Schedule for 10/31/2012
GEN-2007-038	200.0	200.0	Wind	Spearville 345kV	IA Executed/On Schedule for 8/25/2015
GEN-2008-051	322.0	322.0	Wind	Potter County 345kV	IA Executed/On Schedule for 12/31/2014

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-2008-018 Interconnection Customer's request to interconnect a total of 405.0 MW is comprised of two-hundred seventy (270) General Electric 1.5 MW wind turbine generators and associated interconnection facilities.

Interconnection Facilities

The POI for GEN-2008-018 Interconnection Customer is SPS Finney 345kV 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.

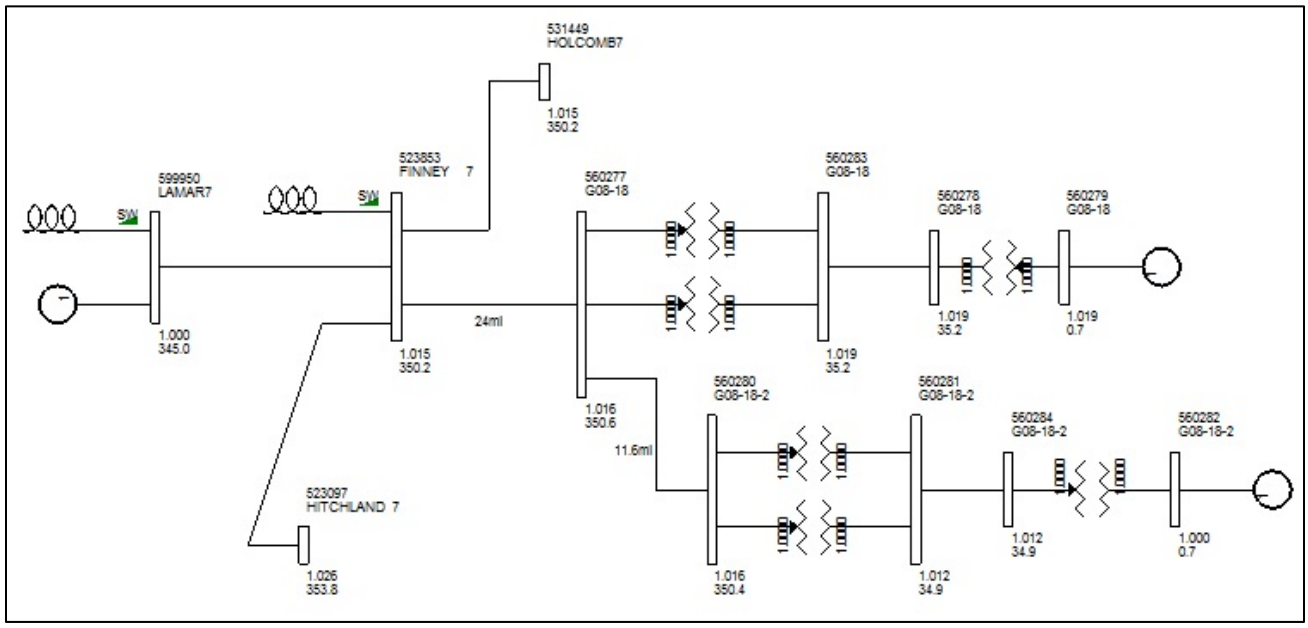

Figure 1: Proposed POI Configuration and Request Power Flow Model

Base Case Network Upgrades

The Network Upgrades included within the cases used for 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 GEN-2008-018 LOIS requested in-service date of January 1, 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.

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 2012 series of transmission service request study models including the 2013 (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 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 Customer can interconnect generation into the SPS transmission system as requested before all required upgrades listed within the ICS-2008-001 study can be placed into service. There is no more than 348 MW of Limited Operation Interconnection Service available for the period of January 1, 2014 until the completion of the Finney – Holcomb 345kV circuit 2, Spearville – Clark – Thistle – Wichita 345kV double circuit, Hitchland – Woodward 345kV double circuit, and the Woodward – Thistle 345kV double circuit upgrades. 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, and 6 below. When GEN-2008-018 is generating 405.0 MW, Table 4, the power flow cases diverge for the loss of Finney – Holcomb

345kV circuit 1. Once the output of GEN-2008-018 is reduced to 360 MW the cases converge for every contingency evaluated. Table 5 shows that the most limiting contingency is the loss of the Post Rock – Spearville 345kV which overloads the Mullergren – Spearville 230kV. Once GEN-2008-018's output is reduced to 348 MW, no additional ER overloads are observed. Since ER analysis doesn't mitigate for those issues in which the affecting GI request has less than a 20% OTDF, Table 6 is provided for informational purposes only so that the Customer understands there may be times 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 can not 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-2008-018 LOIS @ 405.0MW

Season	Dispatch Group	Flow	Overloaded Element	RATEA (MVA)	RATEB (MVA)	TDF	TC% LOADING	Max MW Available	Contingency
			NON-CONVERGED					-NA-	Finney – Holcomb 345kV

Table 5: Interconnection Constraints for Mitigation of GEN-2008-018 LOIS @ 360.0MW

Season	Dispatch Group	Flow	Overloaded Element	RATEA (MVA)	RATEB (MVA)	TDF	TC% LOADING	Max MW Available	Contingency
13G	03G08_018	TO->FROM	MULLERGREN - SPEARVILLE 230KV CKT 1	330.3	355.3	0.223	100.7	348.8	POST ROCK - SPEARVILLE 345KV CKT 1

Table 6: Additional Constraints of GEN-2008-018 LOIS @ 360.0MW Not for Mitigation

Season	Dispatch Group	Flow	Overloaded Element	RATEA (MVA)	RATEB (MVA)	TDF	TC% LOADING	Contingency
13G	03G08_018	FROM->TO	FLATRDG3 - HARPER 138KV CKT 1	95.6	95.6	0.044	110.6	FINNEY SWITCHING STATION – HITCHLAND INTERCHANGE 345KV CKT 1
13G	03G08_018	FROM->TO	FLATRDG3 - HARPER 138KV CKT 1	95.6	95.6	0.036	105.0	POST ROCK - SPEARVILLE 345KV CKT 1
13G	03G08_018	TO->FROM	HAYS PLANT - SOUTH HAYS 115KV CKT 1	83.0	99.0	0.045	103.6	KNOLL 230 - POSTROCK6 230.00 230KV CKT 1
13G	03G08_018	FROM->TO	FLATRDG3 - HARPER 138KV CKT 1	95.6	95.6	0.035	102.2	CIRCLE - MULLERGREN 230KV CKT 1
13G	03G08_018	FROM->TO	FLATRDG3 - HARPER 138KV CKT 1	95.6	95.6	0.033	102.2	RENO COUNTY - WICHITA 345KV CKT 1
13G	03G08_018	FROM->TO	FLATRDG3 - HARPER 138KV CKT 1	95.6	95.6	0.044	101.3	SPP-SWPS-05: Lamar – Finney 345kV and Finney – Hitchland 345kV
13G	03G08_018	FROM->TO	MOUNDRIDGE (MOUND10X) 138/115/13.8KV TRANSFORMER CKT 1	100.0	110.0	0.046	100.8	RENO COUNTY - WICHITA 345KV CKT 1
13G	03G08_018	FROM->TO	MOUNDRIDGE (MOUND10X) 138/115/13.8KV TRANSFORMER CKT 1	100.0	110.0	0.046	100.8	RENO COUNTY - WICHITA 345KV CKT 1
13G	03G08_018	FROM->TO	FLATRDG3 - HARPER 138KV CKT 1	95.6	95.6	0.032	100.3	SMOKYHL6 230.00 - SUMMIT 230KV CKT 1
13G	03G08_018	FROM->TO	HARPER - MILAN TAP 138KV CKT 1	95.6	95.6	0.044	100.0	FINNEY SWITCHING STATION – HITCHLAND INTERCHANGE 345KV CKT 1
13G	03G08_018	FROM->TO	FLATRDG3 - HARPER 138KV CKT 1	95.6	95.6	0.030	99.9	SPP-SWPS-03: Nichols – Grapevine 230kV and Grapevine – Wheeler 230kV

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 2012 series of Model Development Working Group (MDWG) dynamic study models including the 2014 (summer and winter) 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

The nineteen (19) contingencies were identified for the Limited Operation scenario for use in this study. These faults are listed within 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.

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 7: Contingencies Evaluated for Limited Operation

	Contingency Number and Name	Description
1	FLT_01_FINNEY7_HITCHLAND7_345kV_3PH*	*3-Phase fault on the Finney – Hitchland 345kV near the Finney 345kV bus.*
2	FLT_02_FINNEY7_HITCHLAND7_345kV_1PH	*Single-phase fault similar to previous fault.*
3	FLT_03_FINNEY7_HOLCOMB7_345kV_3PH*	*3-Phase fault on the Finney – Holcomb 345kV near the Finney 345kV bus.*
4	FLT_04_FINNEY7_HOLCOMB7_345kV_1PH	*Single-phase fault similar to previous fault.*

	Contingency Number and Name	Description
5	FLT_05_FINNEY7_LAMAR7_345kV_3PH*	*3-Phase fault on the Finney – Lamar 345kV near the Finney 345kV bus.*
6	FLT_06_FINNEY7_LAMAR7_345kV_1PH	*Single-phase fault similar to previous fault.*
7	FLT_07_HOLCOMB7_BUCKNER7_345kV_3PH*	*3-Phase fault on the Holcomb – Bucker 345kV near the Holcomb 345kV bus.*
8	FLT_08_HOLCOMB7_BUCKNER7_345kV_1PH	*Single-phase fault similar to previous fault.*
9	FLT_09_HOLCOMB7_HOLCOMB3_345_115kV_3PH	*3-Phase fault on the Holcomb 345/115/13.8kV transformer near the Holcomb 345kV bus.*
10	FLT_10_HOLCOMB7_SETAB7_345kV_3PH*	*3-Phase fault on the Holcomb – Setab 345kV near the Holcomb 345kV bus.*
11	FLT_11_HOLCOMB7_SETAB7_345kV_1PH	*Single-phase fault similar to previous fault.*
12	FLT_12_SPERVIL7_SPEARVL6_345_230kV_3PH	*3-Phase fault on the Spearville 345/230/13.8kV transformer near the Spearville 345kV bus.*
13	FLT_13_SPERVL7_BUCKNER7_345kV_3PH*	*3-Phase fault on the Spearville – Buckner 345kV near the Spearville 345kV bus.*
14	FLT_14_SPERVL7_BUCKNER7_345kV_1PH	*Single-phase fault similar to previous fault.*
15	FLT_15_SPERVL7_G11017_345kV_3PH*	*3-Phase fault on the Spearville – GEN-2011-017T – Post Rock 345kV near the Spearville 345kV bus.*
16	FLT_16_SPERVL7_G11017_345kV_1PH	*Single-phase fault similar to previous fault.*
17	FLT_17_POTTERCO7_POTTERCO6_345_230kV_3PH	*3-Phase fault on the Potter County 345/230/13.2kV transformer near the Potter County 345kV bus.*
18	FLT_18_HITCHLAND7_POTTERCO7_345kV_3PH*	*3-Phase fault on the Hitchland – Potter County 345kV near the Hitchland 345kV bus.*
19	FLT_19_HITCHLAND7_POTTERCO7_345kV_1PH	*Single-phase fault similar to previous fault.*

NOTE: The faults denoted by an asterisk (*) were adjusted to allow for no re-closing into the fault. Because the Southwestern region of SPP is connected via few and very long tie lines to the rest of SPP, 345kV faults on these lines have special operating procedures for re-closing into a three-phase fault.

Power Factor Analysis – Reactor Sizing

Power factor analysis for reactor sizing was performed for this study. In order to perform this analysis the request and equivalent transmission lines and collectors systems were modeled using specifications provided by the Customer. The cases are modeled such that the generation and capacitor banks are switched out of service but the wind farm's transmission subsystem (345kV and 34.5kV) remains in-service. The charging from these open-ended transmission facilities is then monitored for worst case reactive power injections into the POI under differing system conditions.

Analysis shows that the approximate amount of charging provided by the GEN-2008-018 subsystem is 43.9 Mvars. It is recommended that the Customer install at least 44.0 Mvars of Reactors to compensate for this injection into the transmission system. It is recommended that all of this reactive support be installed at the POI to counter the injection of capacitance from the long (24 miles) 345kV Customer substation lead. Should the Customer choose to not install all of the reactors at the POI, additional reactors may be required.

Results

Results of the stability analysis are summarized in Table 6. These results are valid for GEN-2008-018 interconnecting with a generation amount up to 405.0 MW. The results indicate that the transmission system remains stable for all contingencies studied. The plots will be available upon request.

Table 8: Fault Analysis Results for Limited Operation

	Contingency Number and Name	2014SP	2014WP
1	FLT_01_FINNEY7_HITCHLAND7_345kV_3PH	Stable	Stable
2	FLT_02_FINNEY7_HITCHLAND7_345kV_1PH	Stable	Stable
3	FLT_03_FINNEY7_HOLCOMB7_345kV_3PH	Stable	Stable
4	FLT_04_FINNEY7_HOLCOMB7_345kV_1PH	Stable	Stable
5	FLT_05_FINNEY7_LAMAR7_345kV_3PH	Stable	Stable
6	FLT_06_FINNEY7_LAMAR7_345kV_1PH	Stable	Stable
7	FLT_07_HOLCOMB7_BUCKNER7_345kV_3PH	Stable	Stable
8	FLT_08_HOLCOMB7_BUCKNER7_345kV_1PH	Stable	Stable
9	FLT_09_HOLCOMB7_HOLCOMB3_345_115kV_3PH	Stable	Stable
10	FLT_10_HOLCOMB7_SETAB7_345kV_3PH	Stable	Stable
11	FLT_11_HOLCOMB7_SETAB7_345kV_1PH	Stable	Stable
12	FLT_12_SPERVIL7_SPEARVL6_345_230kV_3PH	Stable	Stable
13	FLT_13_SPERVL7_BUCKNER7_345kV_3PH	Stable	Stable
14	FLT_14_SPERVL7_BUCKNER7_345kV_1PH	Stable	Stable
15	FLT_15_SPERVL7_G11017_345kV_3PH	Stable	Stable
16	FLT_16_SPERVL7_G11017_345kV_1PH	Stable	Stable
17	FLT_17_POTTERCO7_POTTERCO6_345_230kV_3PH	Stable	Stable
18	FLT_18_HITCHLAND7_POTTERCO7_345kV_3PH	Stable	Stable
19	FLT_19_HITCHLAND7_POTTERCO7_345kV_1PH	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 7.

Table 9: LVRT Contingencies

	Contingency Number and Name	Description
1	FLT_01_FINNEY7_HITCHLAND7_345kV_3PH	*3-Phase fault on the Finney – Hitchland 345kV near the Finney 345kV bus.*
2	FLT_02_FINNEY7_HITCHLAND7_345kV_1PH	*Single-phase fault similar to previous fault.*
3	FLT_03_FINNEY7_HOLCOMB7_345kV_3PH	*3-Phase fault on the Finney – Holcomb 345kV near the Finney 345kV bus.*
4	FLT_04_FINNEY7_HOLCOMB7_345kV_1PH	*Single-phase fault similar to previous fault.*
5	FLT_05_FINNEY7_LAMAR7_345kV_3PH	*3-Phase fault on the Finney – Lamar 345kV near the Finney 345kV bus.*
6	FLT_06_FINNEY7_LAMAR7_345kV_1PH	*Single-phase fault similar to previous fault.*

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. GEN-2008-018 is found to be in compliance with FERC Order #661A.

Conclusion

<OMITTED TEXT> (Interconnection Customer, GEN-2008-018) has requested a Limited Operation System Impact Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for 405.0 MW of wind generation to be interconnected as an Energy Resource (ER) into a transmission facility of the Southwestern Public Service Co. (SPS) in Finney County, Kansas. The point of interconnection will be the Finney 345kV substation. GEN-2008-018, 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 ICS-2008-001 (or most recent iteration) Impact Study can be placed into service.

Power flow analysis from this LOIS has determined that the GEN-2008-018 request can interconnect prior to the completion of the required Network Upgrades, listed within Table 2 of this report. There is no more than 348.0 MW of Limited Operation Interconnection Service available for the period of January 1, 2014 until the completion of the Finney – Holcomb 345kV circuit 2, Spearville – Clark (Commanche) – Thistle (Medicine Lodge) – Wichita 345kV double circuit, Hitchland – Woodward 345kV double circuit, and the Woodward – Thistle (Medicine Lodge) 345kV double circuit upgrades. The Finney-Holcomb 345kV line does not have a determined in service eate. The other upgrades are scheduled for completion in December, 2014. After this network upgrade is completed, limited operation may be available until such time that higher queued projects listed in Table 3 come into service.

Transient stability analysis indicates that the transmission system will remain stable for the contingencies listed within Table 5 with the addition of GEN-2008-018 generation. Additionally, GEN-2008-018 was 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.

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