Impact Study of Limited Operation for Generator Interconnection

GEN-2007-021

September 2013
Generator Interconnection Studies

SPP Southwest Power Pool

Executive Summary

<OMITTED TEXT> (Interconnection Customer; GEN-2007-021) has requested a Limited Operation System Impact Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for 200 MW of wind generation to be interconnected as an Energy Resource (ER) into a transmission facility of Oklahoma Gas & Electric (OKGE) in Dewey County, Oklahoma. GEN-2007-021, 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 this LOIS to confirm that adequate interconnection service remains prior to completion of all required Network Upgrades, assuming a July 1, 2014, LOIS operation date. July 1, 2014, is studied because that date is prior to the in-service date of the upgrades in Table 2, but after the in-service date of other 345kV lines in the northwest Oklahoma area.

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 July 1, 2014. It is expected that both the Woodward – Hitchland 345kV double circuit and the Woodward – TUCO 345kV will be in-service but, the Woodward – Thistle – Wichita 345kV double circuit will not be in service until December 31, 2014. GEN-2007-021 is requesting the interconnection of one-hundred twenty-five (125) GE 1.6MW wind turbine generators and associated facilities into the OKGE Tatonga 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-2007-021 request.

Power flow analysis from this LOIS has determined that the GEN-2007-021 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 100 MW of Limited Operation Interconnection Service available. This determination is for the period of July 1, 2014 until the completion of the following Network Upgrades:

- Energy Resource Interconnection Service (ERIS) Network Upgrades
  - Thistle – Wichita 345kV double circuit
  - Woodward – Thistle 345kV double circuit

The ERIS Network Upgrades are currently scheduled for completion in January, 2015.
Transient stability analysis from this LOIS has determined that the transmission system will remain stable for all of the fifty-two (52) selected faults for the limited operation interconnection of GEN-2007-021.

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 study analyzed many of the most probable contingencies, it is not an all-inclusive list and cannot account for every operational situation. Because of this, it is likely that the Customer(s) may be required to reduce their generation output to 0 MW, also known as curtailment, under certain system conditions to allow system operators to maintain the reliability of the transmission network.

Nothing in this study should be construed as a guarantee of transmission service or delivery rights. If the customer wishes to obtain deliverability to final customers, 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; GEN-2007-021) has requested 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 Oklahoma Gas & Electric (OKGE).

The Customer has requested this LOIS to confirm that adequate Energy Resource Interconnection Service (ERIS) remains prior to completion of all required Network Upgrades, assuming a July 1, 2014, LOIS operation date.

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 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 7/2014 in-service of GEN-2007-021 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: Regional Generation Requests Included within LOIS by Scenario

Project	MW	Total MW	Fuel Source	POI	Status
GEN-2001-014	77	96.0	Wind	Ft Supply 138kV	COMMERCIAL OPERATION
GEN-2001-037	82	100.0	Wind	FPL Moreland Tap 138kV	COMMERCIAL OPERATION
GEN-2002-008	48	240.0	Wind	Hitchland 345kV	COMMERCIAL OPERATION
GEN-2002-009	16	80.0	Wind	Hansford 115kV	COMMERCIAL OPERATION
GEN-2003-020	32	160.0	Wind	Martin 115kV	COMMERCIAL OPERATION
GEN-2005-008	96	120.0	Wind	Woodward 138kV	COMMERCIAL OPERATION
GEN-2006-020S	4	18.9	Wind	DWS Frisco 115kV	COMMERCIAL OPERATION
GEN-2006-024S	16	19.8	Wind	Buffalo Bear Tap 69kV	COMMERCIAL OPERATION
GEN-2006-044	74	370	Wind	Hitchland 345kV	COMMERCIAL OPERATION
GEN-2006-046	105	131.0	Wind	Dewey 138kV	COMMERCIAL OPERATION
GEN-2007-043	160	200.0	Wind	Minco 345kV	COMMERCIAL OPERATION
GEN-2007-050	136	170.0	Wind	Woodward EHV 138kV	COMMERCIAL OPERATION
GEN-2008-003	81	101.0	Wind	Woodward EHV 138kV	COMMERCIAL OPERATION
GEN-2008-044	197.8	197.8	Wind	Tatonga 345kV	COMMERCIAL OPERATION
GEN-2010-011	29.7	29.7	Wind	Tatonga 345kV	COMMERCIAL OPERATION
GEN-2010-040	240	300.0	Wind	Cimarron 345kV	COMMERCIAL OPERATION
GEN-2011-010	81	100.8	Wind	Minco 345kV	COMMERCIAL OPERATION
SPS Distributed (Dumas 19th St)	4	20.0	Wind	Dumas 19th Street 115kV	COMMERCIAL OPERATION
SPS Distributed (Etter)	4	20.0	Wind	Etter 115kV	COMMERCIAL OPERATION
SPS Distributed (Moore E)	5	25.0	Wind	Moore East 115kV	COMMERCIAL OPERATION
SPS Distributed (Sherman)	4	20.0	Wind	Sherman 115kV	COMMERCIAL OPERATION
SPS Distributed (Spearman)	2	10.0	Wind	Spearman 69kV	COMMERCIAL OPERATION
SPS Distributed (TC-Texas County)	2	20.0	Wind	Texas County 115kV	COMMERCIAL OPERATION
GEN-2007-021	200	200.0	Wind	Tatonga 345kV	IA FULLY 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 Definitive Interconnection System Impact Study (DISIS). Table 2 below lists the required upgrade projects for which this request has or shares cost responsibility. GEN-2007-021 was included within the ICS-2008-001 that was last restudied in early 2013 and posted January 22, 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: Network Upgrade Projects not included (unless otherwise noted) but Required for Full Interconnection Service

Upgrade Project	Type	Description	Status
Thistle – Wichita 345kV Double Ckt	Priority Project	Build approximately 71 miles of double circuit 345kV	Current Estimated In-Service date 12/31/2014
Woodward – Thistle 345kV Double Ckt	Priority Project	Build approximately 18 miles of double circuit 345kV	Current Estimated In-Service date 12/31/2014

Any changes to these assumptions (for either scenario), 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 Table 3 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 Group 1 (Woodward Area) GI Requests not included within LOIS

Project	Remainder MW	Total MW	Fuel	POI	Status
None					

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

Facilities

Generating Facility

GEN-2007-021 Interconnection Customer's request to interconnect a total of 200 MW is comprised of one-hundred twenty-five (125) GE 1.6 MW wind turbine generators and associated interconnection facilities.

Interconnection Facilities

The POI for GEN-2007-021 Interconnection Customer is the OKGE Tatonga 345kV substation in Dewey County, Oklahoma. 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.

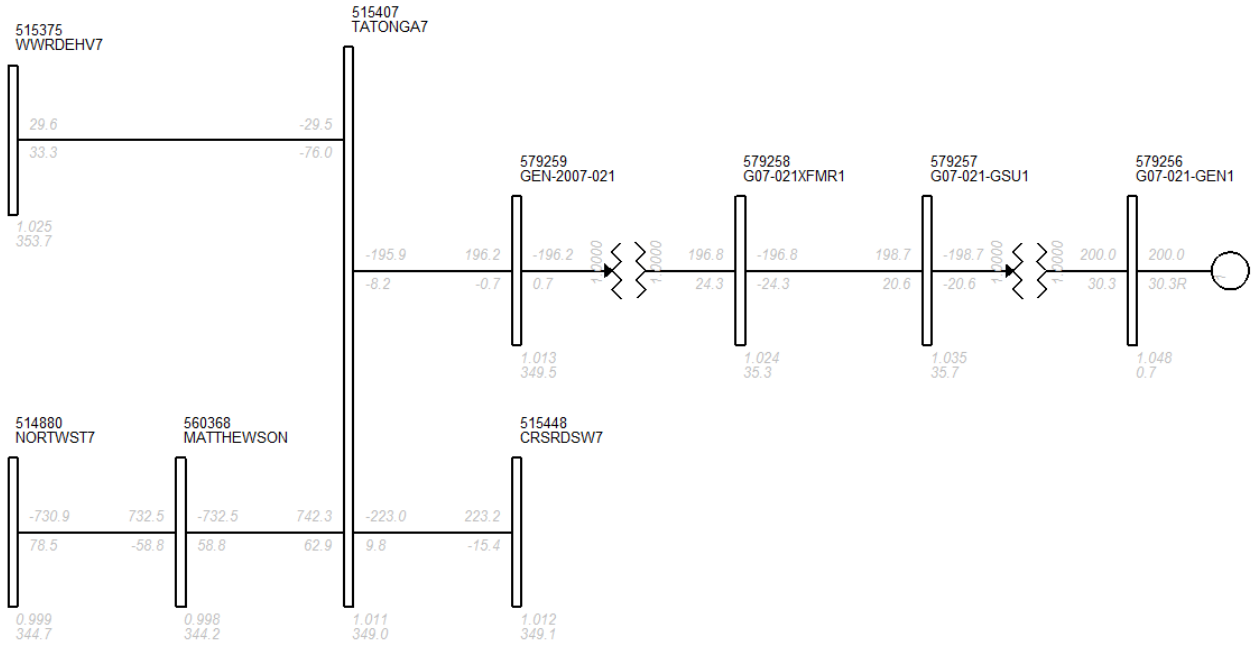

Figure 1: Proposed POI Configuration and Request Power Flow Model

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-2007-021 LOIS requested in-service date of July 1, 2014. These facilities have an approved Notification to Construct (NTC), or are in construction stages and expected to be in-service at the effective time of this study. 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 Interconnection Request (ERIS). 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

Power flow analysis from this LOIS has determined that the GEN-2007-021 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. ACCC results for this LOIS can be found below in Table 4 and Table 5. Under the assumptions defined by this LOIS, there is no more than 100 MW of Limited Operation Interconnection Service available. These determinations are for the period of July 1, 2014 until the completion of the following required Network Upgrades listed within Table 2. The ERIS Network Upgrades, are scheduled for completion in December, 2014.

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.

Since ER analysis doesn't provide for transmission reinforcements for issues in which the affecting GI request has less than a 20% TDF, Table 5 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.

Curtailment and System Reliability

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

Table 4: Interconnection Constraints of GEN-2007-021 LOIS @ 200.0MW

Season	Dispatch Group	Flow	Overloaded Element	RATEA (MVA)	RATEB (MVA)	TDF	TC% LOADING	Max MW Available	Contingency
13G	01G07_021	TO->FROM	FPL SWITCH - WOODWARD 138KV CKT 1	133	153	0.1934	112.6	100	'NORTHWEST - TATONGA7 345.00 345KV CKT 1'

Table 5: Additional Constraints of GEN-2007-021 LOIS @ 200MW (Not for mitigation within LOIS but possible curtailment issues)

Season	Dispatch Group	Flow	Overloaded Element	RATEA (MVA)	RATEB (MVA)	TDF	TC% LOADING	Contingency
			None					

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 fifty-two (52) contingencies were identified for use in this study. These faults are listed within Table 6. 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 6: Contingencies Evaluated for Limited Operation of GEN-2007-021

	Contingency Number and Name	Description
1	FLT_01_TATONGA7_WWRDEHV7_345kV_3PH	*3-Phase fault on the Tatonga – Woodward 345kV CKT 1 near the Tatonga 345kV bus.*
2	FLT_02_TATONGA7_WWRDEHV7_345kV_1PH	*Single-phase fault similar to previous fault.*
3	FLT_03_TATONGA7_NORTWST7_345kV_3PH	*3-Phase fault on the Tatonga – Northwest 345kV CKT 1 near the Tatonga 345kV bus.*

	Contingency Number and Name	Description
4	FLT_04_TATONGA7_NORTWST7_345kV_1PH	*Single-phase fault similar to previous fault.*
5	FLT_05_WWRDEHV7_TUCO7_345kV_3PH	*3-Phase fault on the Woodward – Tuco 345kV near the Woodward 345kV bus.*
6	FLT_06_WWRDEHV7_TUCO7_345kV_1PH	*Single-phase fault similar to previous fault.*
7	FLT_07_WWRDEHV7_BEAVERCO_345kV_3PH	*3-Phase fault on the Woodward – Beaver Co 345kV near the Woodward345kV bus.*
8	FLT_08_WWRDEHV7_BEAVERCO_345kV_1PH	*Single-phase fault similar to previous fault.*
9	FLT_09_BEAVERCO_HITCHLAND7_345kV_3PH	*3-Phase fault on the Beaver Co – Hitchland 345kV near the Beaver 230kV bus.*
10	FLT_10_BEAVERCO_HITCHLAND7_345kV_1PH	*Single-phase fault similar to previous fault.*
11	FLT_11_HITCHLAND7_FINNEY7_345kV_3PH	*3-Phase fault on the Hitchland – Finney 345kV near the Hitchland 345kV bus.*
12	FLT_12_HITCHLAND7_FINNEY7_345kV_1PH	*Single-phase fault similar to previous fault.*
13	FLT_13_HITCHLAND7_POTTERCO7_345kV_3PH	*3-Phase fault on the Hitchland – Potter Co 345kV near the Hitchland 345kV bus.*
14	FLT_14_HITCHLAND7_POTTERCO7_345kV_1PH	*Single-phase fault similar to previous fault.*
15	FLT_15_FINNEY7_HOLCOMB7_345kV_3PH	*3-Phase fault on the Finney – Holcombe 345kV near the Finney 345kV bus.*
16	FLT_16_FINNEY7_HOLCOMB7_345kV_1PH	*Single-phase fault similar to previous fault.*
17	FLT_17_TUCO7_OKU7_345kV_3PH	*3-Phase fault on the TUCO – OKU 345kV near the TUCO 115kV bus.*
18	FLT_18_TUCO7_OKU7_345kV_1PH	*Single-phase fault similar to previous fault.*
19	FLT_19_NORTWST7_SPRNGCK7_345kV_3PH	*3-Phase fault on the Northwest – Springcreek 345kV near the Northwest 345kV bus.*
20	FLT_20_NORTWST7_SPRNGCK7_345kV_1PH	*Single-phase fault similar to previous fault.*
21	FLT_21_NORTWST7_CIMARON7_345kV_3PH	*3-Phase fault on the Northwest – Cimmarron 345kV near the Northwest 345kV bus.*
22	FLT_22_NORTWST7_CIMARON7_345kV_1PH	*Single-phase fault similar to previous fault.*
23	FLT_23_NORTWST7_ARCADIA7_345kV_3PH	*3-Phase fault on the Northwest – Arcadia 345kV CKT 1 near the Northwest 345kV bus.*
24	FLT_24_NORTWST7_ARCADIA7_345kV_1PH	*Single-phase fault similar to previous fault.*
25	FLT_25_SPRNGCK7_SOONER_345kV_3PH	*3-Phase fault on the Springcreek – Sooner 345 kV CKT 1 near the Springcreek 345kV bus.*
26	FLT_26_SPRNGCK7_SOONER_345kV_1PH	*Single-phase fault similar to previous fault.*
27	FLT_27_CIMARON7_MINCO7_345kV_3PH	*3-Phase fault on the Cimaron – Minco 345 kV CKT 1 near the Cimaron 345kV bus.*
28	FLT_28_CIMARON7_MINCO7_345kV_1PH	*Single-phase fault similar to previous fault.*
29	FLT_29_CIMARON7_DRAPER_345kV_3PH	*3-Phase fault on the Cimaron – Draper 345 kV near the Cimaron 345kV bus.*
30	FLT_30_CIMARON7_DRAPER_345kV_1PH	*Single-phase fault similar to previous fault.*
31	FLT_31_CIMARON7_WOODRNG7_345kV_3PH	*3-Phase fault on the Cimaron – Woodring 345 kV near the Cimaron 345kV bus.*
32	FLT_32_CIMARON7_WOODRNG7_345kV_1PH	*Single-phase fault similar to previous fault.*
33	FLT_33_ARCADIA7_REDBUD7_345kV_3PH	*3-Phase fault on the Arcadia – Redbud 345kV near the Arcadia 345kV bus.*
34	FLT_34_ARCADIA7_REDBUD7_345kV_1PH	*Single-phase fault similar to previous fault.*
35	FLT_35_ARCADIA7_SEMINOL7_345kV_3PH	*3-Phase fault on the Arcadia – Seminole 345kV CKT 1 near the Arcadia 345kV bus.*
36	FLT_36_ARCADIA7_SEMINOL7_345kV_1PH	*Single-phase fault similar to previous fault.*
37	FLT_37_WWRDEHV4_WOOWRD4_138kV_3PH	*3-Phase fault on the Woodward – Woodward EHV 138 kV CKT 1 near the Woodward 138kV bus.*
38	FLT_38_WWRDEHV4_WOOWRD4_138kV_1PH	*Single-phase fault similar to previous fault.*

Contingency Number and Name		Description
39	FLT_39_WWRDEHV4_IODINE4_138kV_3PH	*3-Phase fault on the Woodward – Iodine 138 kV near the Woodward 138kV bus.*
40	FLT_40_WWRDEHV4_IODINE4_138kV_1PH	*Single-phase fault similar to previous fault.*
41	FLT_41_NORTWST4_KETCHTP4_138kV_3PH	*3-Phase fault on the Northwest – Ketch Tap 138 kV near the Northwest 138kV bus.*
42	FLT_42_NORTWST4_KETCHTP4_138kV_1PH	*Single-phase fault similar to previous fault.*
43	FLT_43_NORTWST4_BRADEN4_138kV_3PH	*3-Phase fault on the Northwest – Braden Park 138 kV near the Northwest 138kV bus.*
44	FLT_44_NORTWST4_BRADEN4_138kV_1PH	*Single-phase fault similar to previous fault.*
45	FLT_45_NORTWST4_PIEDMNT4_138kV_3PH	*3-Phase fault on the Northwest – Piedmont 138 kV near the Northwest 138kV bus.*
46	FLT_46_NORTWST4_PIEDMNT4_138kV_1PH	*Single-phase fault similar to previous fault.*
47	FLT_47_NORTWST4_LNEOAK4_138kV_3PH	*3-Phase fault on the Northwest – Lone Oak 138 kV near the Northwest 138kV bus.*
48	FLT_48_NORTWST4_LNEOAK4_138kV_1PH	*Single-phase fault similar to previous fault.*
49	FLT_49_ARCADIA7_ARCADIA4_345_138kV_3PH	*3-Phase fault on the Arcadia 345/138kV transformer near the Arcadia 345kV bus.*
50	FLT_50_WWRDEHV7_WWRDEJV4_345_138kV_3PH	*3-Phase fault on the Woodward 345/138kV transformer near the Woodward 345kV bus.*
51	FLT_51_HITCHLAND7_HITCHLAND6_345_230kV_3PH	*3-Phase fault on the Hitchland 345/230kV transformer near the Hitchland 345kV bus.*
52	FLT_52_NORTWST7_NORTWST4_345_138kV_3PH	*3-Phase fault on the Northwest 345/138kV transformer near the Northwest 345kV bus.*

NOTE: The faults denoted by an asterisk (*) were adjusted to allow for no re-closing into the fault. Some 345kV faults on these lines have special operating procedures for re-closing into a three-phase fault.

Power Factor Analysis

Power factor analysis for reactor sizing was not performed for this study.

Results

Results of the transient stability analysis are summarized within Table 7. These results are valid for Customers interconnecting up to 200.0 MW, including specified reactive equipment. The results indicate that the transmission system remains stable for all contingencies studied. The plots will be made available upon request.

Table 7: Fault Analysis Results for Limited Operation of GEN-2007-021

Contingency Number and Name		2014SP	2014WP
1	FLT_01_TATONGA7_WWRDEHV7_345kV_3PH	Stable	Stable
2	FLT_02_TATONGA7_WWRDEHV7_345kV_1PH	Stable	Stable
3	FLT_03_TATONGA7_NORTWST7_345kV_3PH	Stable	Stable
4	FLT_04_TATONGA7_NORTWST7_345kV_1PH	Stable	Stable
5	FLT_05_WWRDEHV7_TUCO7_345kV_3PH	Stable	Stable
6	FLT_06_WWRDEHV7_TUCO7_345kV_1PH	Stable	Stable
7	FLT_07_WWRDEHV7_BEAVERCO_345kV_3PH	Stable	Stable
8	FLT_08_WWRDEHV7_BEAVERCO_345kV_1PH	Stable	Stable
9	FLT_09_BEAVERCO_HITCHLAND7_345kV_3PH	Stable	Stable
10	FLT_10_BEAVERCO_HITCHLAND7_345kV_1PH	Stable	Stable
11	FLT_11_HITCHLAND7_FINNEY7_345kV_3PH	Stable	Stable
12	FLT_12_HITCHLAND7_FINNEY7_345kV_1PH	Stable	Stable

	Contingency Number and Name	2014SP	2014WP
13	FLT_13_HITCHLAND7_POTTERCO7_345kV_3PH	Stable	Stable
14	FLT_14_HITCHLAND7_POTTERCO7_345kV_1PH	Stable	Stable
15	FLT_15_FINNEY7_HOLCOMB7_345kV_3PH	Stable	Stable
16	FLT_16_FINNEY7_HOLCOMB7_345kV_1PH	Stable	Stable
17	FLT_17_TUCO7_OKU7_345kV_3PH	Stable	Stable
18	FLT_18_TUCO7_OKU7_345kV_1PH	Stable	Stable
19	FLT_19_NORTWST7_SPRNGCK7_345kV_3PH	Stable	Stable
20	FLT_20_NORTWST7_SPRNGCK7_345kV_1PH	Stable	Stable
21	FLT_21_NORTWST7_CIMARON7_345kV_3PH	Stable	Stable
22	FLT_22_NORTWST7_CIMARON7_345kV_1PH	Stable	Stable
23	FLT_23_NORTWST7_ARCADIA7_345kV_3PH	Stable	Stable
24	FLT_24_NORTWST7_ARCADIA7_345kV_1PH	Stable	Stable
25	FLT_25_SPRNGCK7_SOONER_345kV_3PH	Stable	Stable
26	FLT_26_SPRNGCK7_SOONER_345kV_1PH	Stable	Stable
27	FLT_27_CIMARON7_MINCO7_345kV_3PH	Stable	Stable
28	FLT_28_CIMARON7_MINCO7_345kV_1PH	Stable	Stable
29	FLT_29_CIMARON7_DRAPER_345kV_3PH	Stable	Stable
30	FLT_30_CIMARON7_DRAPER_345kV_1PH	Stable	Stable
31	FLT_31_CIMARON7_WOODRNG7_345kV_3PH	Stable	Stable
32	FLT_32_CIMARON7_WOODRNG7_345kV_1PH	Stable	Stable
33	FLT_33_ARCADIA7_REDBUD7_345kV_3PH	Stable	Stable
34	FLT_34_ARCADIA7_REDBUD7_345kV_1PH	Stable	Stable
35	FLT_35_ARCADIA7_SEMINOL7_345kV_3PH	Stable	Stable
36	FLT_36_ARCADIA7_SEMINOL7_345kV_1PH	Stable	Stable
37	FLT_37_WWRDEHV4_WOOWRD4_138kV_3PH	Stable	Stable
38	FLT_38_WWRDEHV4_WOOWRD4_138kV_1PH	Stable	Stable
39	FLT_39_WWRDEHV4_IODINE4_138kV_3PH	Stable	Stable
40	FLT_40_WWRDEHV4_IODINE4_138kV_1PH	Stable	Stable
41	FLT_41_NORTWST4_KETCHTP4_138kV_3PH	Stable	Stable
42	FLT_42_NORTWST4_KETCHTP4_138kV_1PH	Stable	Stable
43	FLT_43_NORTWST4_BRADEN4_138kV_3PH	Stable	Stable
44	FLT_44_NORTWST4_BRADEN4_138kV_1PH	Stable	Stable
45	FLT_45_NORTWST4_PIEDMNT4_138kV_3PH	Stable	Stable
46	FLT_46_NORTWST4_PIEDMNT4_138kV_1PH	Stable	Stable
47	FLT_47_NORTWST4_LNEOAK4_138kV_3PH	Stable	Stable
48	FLT_48_NORTWST4_LNEOAK4_138kV_1PH	Stable	Stable
49	FLT_49_ARCADIA7_ARCADIA4_345_138kV_3PH	Stable	Stable
50	FLT_50_WWRDEHV7_WWRDEJV4_345_138kV_3PH	Stable	Stable
51	FLT_51_HITCHLAND7_HITCHLAND6_345_230kV_3PH	Stable	Stable
52	FLT_52_NORTWST7_NORTWST4_345_138kV_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 8.

Table 8: LVRT Contingencies for GEN-2007-021

	Contingency Number and Name	Description
1	FLT_01_TATONGA7_WWRDEHV7_345kV_3PH	*3-Phase fault on the Tatonga – Woodward 345kV CKT 1 near the Tatonga 345kV bus.*

	Contingency Number and Name	Description
2	FLT_02_TATONGA7_WWRDEHV7_345kV_1PH	*Single-phase fault similar to previous fault.*
3	FLT_03_TATONGA7_NORTWST7_345kV_3PH	*3-Phase fault on the Tatonga – Northwest 345kV CKT 1 near the Tatonga 345kV bus.*
4	FLT_04_TATONGA7_NORTWST7_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-2007-021 is found to be in compliance with FERC Order #661A.

Conclusion

<OMITTED TEXT> (Interconnection Customer, GEN-2007-021) has requested a Limited Operation System Impact Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for 200 MW of wind generation to be interconnected as an Energy Resource (ER) into a transmission facility of Oklahoma Gas & Electric (OKGE) in Dewey County, Oklahoma. The point of interconnection will be the Tatonga 345kV substation. GEN-2007-021, 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-2007-021 request can interconnect prior to the completion of the required Network Upgrades, listed within Table 2 of this report. There is no more than **100** MW of Limited Operation Interconnection Service available only as an Energy Resource for the period of July 1, 2014 until the completion of the following Network Upgrades:

Energy Resource Interconnection Service (ERIS) Network Upgrades

- Thistle – Wichita 345kV double circuit
- Woodward – Thistle 345kV double circuit

After these network upgrades are 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 6 with the addition of GEN-2007-021 generation. Additionally, GEN-2007-021 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.