Impact Study of Limited Operation for Generator Interconnection

GEN-2007-021

December 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 interconnection service can be provided prior to completion of the required network upgrades Thistle – Wichita 345kV double circuit and Woodward – Thistle 345kV double circuit, assuming a October 1, 2014, LOIS operation date.

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 October 1, 2014 or if there is a delay on the Thistle – Wichita 345kV or Woodward – Thistle 345kV double circuits. 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. Stability analysis was not performed for this study. 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
    - Spearville - Clark 345kV double circuit
    - Clark – Thistle 345kV double circuit
    - Thistle – Wichita 345kV double circuit
    - Woodward – Thistle 345kV double circuit

July 1, 2014 was chosen because that is the in-service date of the Woodward-Hitchland double circuit 345kV line and the Woodward-Tuco 345kV line. The other ERIS Network Upgrades are currently scheduled for completion in January, 2015.

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 the Thistle – Wichita 345kV double circuit and Woodward – Thistle 345kV double circuit 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

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
GEN-2007-044	300.00	300.00	Wind	Tatonga 345kV	IA FULLY EXECUTED/ON SCHEDULE
GEN-2007-062	765.00	765.00	Wind	Woodward EHV 345kV	IA FULLY EXECUTED/ON SCHEDULE
GEN-2008-019	300.00	300.00	Wind	Tatonga 345kV	IA FULLY EXECUTED/ON SCHEDULE

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.

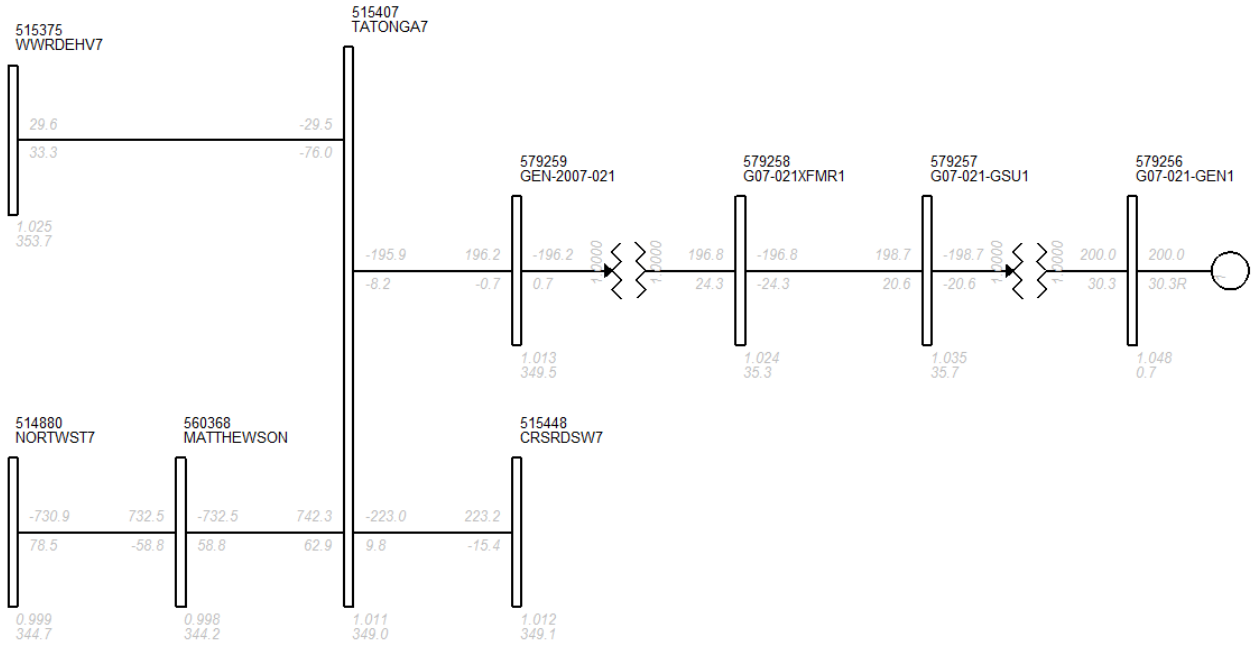

Figure 1: Proposed POI Configuration and Request Power Flow Model

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. Two sets of ACCC results for this LOIS can be found below in Table 4, Table 5, and Table 6. Table 4 contains the results for a delay on the Woodward – Thistle 345kV double circuit, and Table 5 contains the results for a delay on the Thistle – Wichita 345kV double circuit. 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 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.

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 without Woodward – Thistle 345kV double circuit

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	0.1914	112.4	100	'NORTHWEST - TATONGA7 345.00 345KV CKT 1'

Table 5: Interconnection Constraints of GEN-2007-021 LOIS @ 200.0MW without Thistle - Wichita 345kV double circuit

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	0.1914	102.1	130	'NORTHWEST - TATONGA7 345.00 345KV CKT 1'

Table 6: Interconnection Constraints of GEN-2007-021 LOIS @ 200.0MW not considered for Mitigation

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

Stability Analysis

Stability analysis was not performed for this study.

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.

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.