

Impact Study of Limited Operation for Generator Interconnection

GEN-2011-051

May 2014
Generation Interconnection



Executive Summary

<OMITTED TEXT> (Customer; GEN-2011-051) has requested a Limited Operation System Impact Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for 104.4 MW of wind generation to be interconnected as an Energy Resource (ER) into the Transmission System of Oklahoma Gas and Electric (OKGE) in Woodward County, Oklahoma. GEN-2011-051, under GIA Section 5.9, has requested this Limited Operation Interconnection Study (LOIS) to determine the impacts of interconnecting to the transmission system before all required Network Upgrades identified in the DISIS-2011-002 (or most recent iteration) Impact Study can be placed into service.

This LOIS addresses the effects of interconnecting the plant to the rest of the transmission system for the system topology and conditions as expected in December 2014. GEN-2011-051 is requesting the interconnection of fifty-eight (58) Vestas V90 1.8 MW wind turbine generators and associated facilities at a new OKGE 345kV substation on the Woodward – Tatonga 345kV transmission line. 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 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 2 of this report are completed, this LOIS will need to be restudied to ensure that interconnection service remains for the GEN-2011-051 request.

Power flow analysis from this LOIS has determined that the GEN-2011-051 request can interconnect 104.4 MW of generation as an Energy Resource/Network Resource prior to the completion of the required Network Upgrades, listed within Table 2 of this report. Should any other projects, other than those listed within Table 1 of this report, come into service an additional study may be required to determine if any limited operation service is available. It should be noted that although this LOIS analyzed many of the most probable contingencies, it is not an all-inclusive list that can account for every operational situation. Additionally, the generator may not be able to inject any power onto the Transmission System due to constraints that fall below the threshold of mitigation for a Generator Interconnection request. Because of this, it is likely that the 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.

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 Limited Operation System Impact Study (LOIS) under the Southwest Power Pool (SPP) Open Access Transmission Tariff (OATT) for an interconnection request into the Transmission System of Oklahoma Gas and Electric (OKGE).

The purpose of this study is to reevaluate the impacts of interconnecting GEN-2011-051 request of 104.4 MW comprised of fifty-eight (58) Vestas V90 1.8 MW wind turbine generators and associated facilities interconnecting at a new OKGE 345kV substation on the Woodward – Tatonga 345kV transmission line in Woodward County, Oklahoma. The Customer has requested this amount to be studied as an Energy Resource (ER) with Limited Operation Interconnection Service to commence on or around December of 2014.

Only power flow analysis was conducted for this LOIS. Transient stability analysis was not conducted for this LOIS. 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 12/2014 in-service of GEN-2011-051 for this LOIS. Also listed in Table 1 are both the amount of MWs of interconnection service expected at the effective time of this study and the total MWs requested of interconnection service, the fuel type, the point of interconnection (POI), and the current status of each particular prior queued request.

Table 1: Generation Requests Included within LOIS

Project	MW	Total MW	Fuel Source	POI	Status
GEN-2001-014	96.0	96.0	Wind	Ft Supply 138kV	Commercial Operation
GEN-2001-037	100.0	100.0	Wind	FPL Mooreland Tap 138kV	Commercial Operation
GEN-2005-008	120.0	120.0	Wind	Woodward 138kV	Commercial Operation
GEN-2006-024S	18.9	18.9	Wind	Buffalo Bear Tap 69kV	Commercial Operation
GEN-2006-046	130.0	130.0	Wind	Dewey 138kV	Commercial Operation
GEN-2007-021	201.0	201.0	Wind	Tatonga 345kV	IA Executed/On Schedule
GEN-2007-043	200.0	200.0	Wind	Minco 345kV	Commercial Operation
GEN-2007-044	300.0	300.0	Wind	Tatonga 345kV	IA Executed/On Schedule
GEN-2007-050	151.8	170.0	Wind	Woodward EHV 138kV	Commercial Operation
GEN-2007-062	191.25	765.0	Wind	Woodward EHV 345kV	IA Executed/On Schedule
GEN-2008-003	101.0	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	300.0	300.0	Wind	Cimarron 345kV	Commercial Operation
GEN-2011-007	250.0	250.0	Wind	Tap Cimarron - Woodring (Matthewson) 345kV	IA Executed/On Schedule
GEN-2011-010	100.8	100.8	Wind	Minco 345kV	Commercial Operation
GEN-2011-049	250.0	250.0	Wind	Border 345kV	IA Executed/On Schedule
GEN-2011-054	300.0	300.0	Wind	Cimarron 345kV	IA Executed/On Schedule
GEN-2011-051	104.4	104.4	Wind	Tap Woodward - Tatonga 345kV	IA Pending

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 cost responsibility. Table 3 below lists the projects that were included with this study. GEN-2011-051 was included within the DISIS-2011-002 that was studied in fall 2011 and posted January 31, 2012. The cluster has been restudied since the original posting. These reports can be located here at the following GI Study URL:

http://sppoasis.spp.org/documents/swpp/transmission/GenStudies.cfm?YearType=2011_Impact_Studies.

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

Upgrade Project	Type	Description	Status
FPL Switch – Mooreland 138kV CKT 1, Rebuild approximately 0.2 miles of 138kV transmission line	Most recent iteration of DISIS 2011-001. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	DISIS-2011-001 Customers	Not authorized to begin construction
FPL Switch – Woodward 138kV CKT 1, Rebuild approximately 12 miles of 138kV transmission line	Most recent iteration of DISIS 2011-001. Previous Network Upgrade not responsibility of Customer but required to support full interconnection.	DISIS-2011-001 Customers	Not authorized to begin construction
Northwest 345/138kV Transformer CKT 3, Build 3 rd Transformer.	Transmission Services upgrade. From SPP-2009-AGP2-AFS study, SPP-NTC-20137.	Build Priority Project	Current Estimated In-Service date of 6/1/2017

Upgrade Project	Type	Description	Status
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.	DISIS-2011-001 Customers	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.	DISIS-2011-001 Customers	Not authorized to begin construction

Table 3: Upgrade Projects included

Upgrade Project	Type	Description	Status
Woodward – Border – TUCO 345kV Project	Most recent iteration of ICS 2008-001. 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
Thistle – Wichita 345kV Dbl CKT	Most recent iteration of ICS 2008-001. 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
Thistle – Woodward 345kV Dbl CKT	Most recent iteration of ICS 2008-001. 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

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 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-2007-050	18.2	170.0	Wind	Woodward EHV 138kV	Commercial Operation
GEN-2007-062	573.75	765.0	Wind	Woodward EHV 345kV	IA Executed/On Schedule
GEN-2008-019	300.0	300.0	Wind	Tatonga 345kV	
GEN-2011-019	299.0	299.0	Wind	Woodward 345kV	IA Executed/On Schedule
GEN-2011-020	299.0	299.0	Wind	Woodward 345kV	IA 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.

Facilities

Generating Facility

GEN-2011-051 Interconnection Customer's request to interconnect a total of 104.4 MW is comprised of fifty-eight (58) Vestas V90 1.8 MW wind turbine generators and associated interconnection facilities.

Interconnection Facilities

The POI for GEN-2011-051 Interconnection Customer is through a tap on the Woodward – Tatonga 345kV transmission line in Woodward 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.

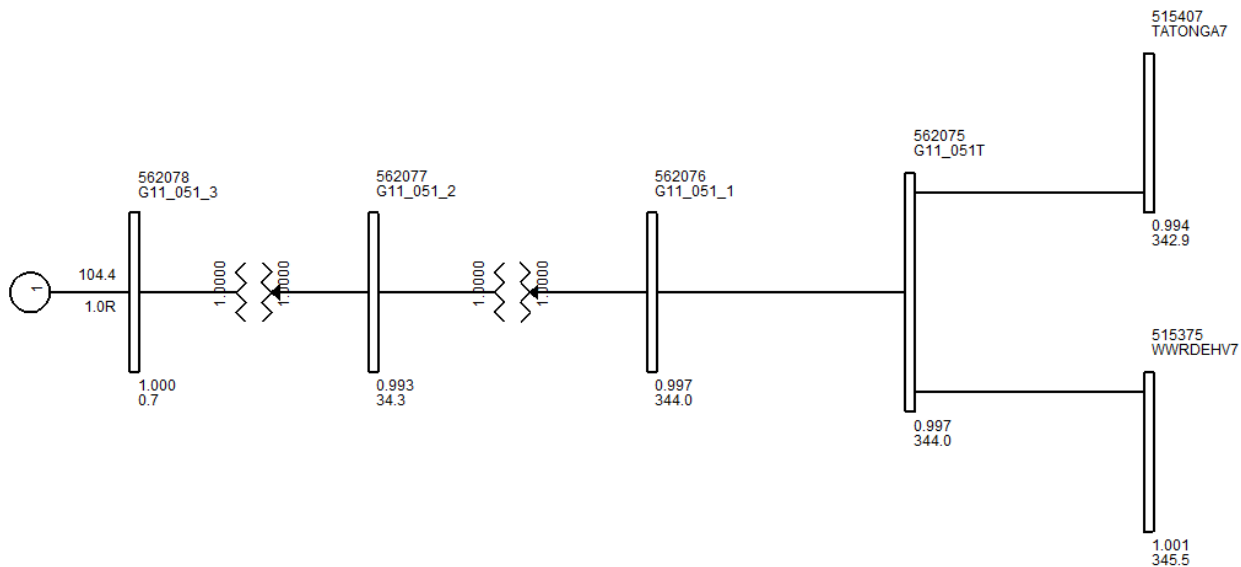


Figure 1: Proposed POI Configuration and Request Power Flow Model

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-2011-051 LOIS requested in-service date of December 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 2013 series of transmission service request study models including the 2014 (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 OKGE transmission system as requested before all required upgrades listed within the DISIS-2011-002 study can be placed into service. Should any other GI requests, 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 Table 5 and 6 below. Generator Interconnection Energy Resource analysis doesn't mitigate for those issues in which the affecting GI request has less than a 20% OTDF, Table 6 is provided for informational purposes only so that the Customer understands there may be operational conditions when they may be required to reduce their output to maintain system reliability.

Limited Operation and System Reliability

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

Table 5: Interconnection Constraints for Mitigation of GEN-2011-051 LOIS @ 104.4MW

Season	Dispatch Group	Flow	Monitored Element	RATEA (MVA)	RATEB (MVA)	TDF	TC% LOADING	Max MW Available	Contingency
All			N/A					104.4	N/A

Table 6: Additional Constraints of GEN-2011-051 LOIS @ 104.4MW

Season	Dispatch Group	Flow	Monitored Element	RATEA (MVA)	RATEB (MVA)	TDF	TC% LOADING	Max Available	Contingency
All			N/A					104.4	N/A

Stability Analysis

Transient stability analysis was not performed for this Limited Operation Impact Study.

Conclusion

<OMITTED TEXT> (Interconnection Customer, GEN-2011-051) has requested a Limited Operation System Impact Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for 104.4 MW of wind generation to be interconnected as an Energy Resource (ER) into the transmission facility of Oklahoma Gas and Electric Services (OKGE) in Woodward County, Oklahoma. The point of interconnection will be through a new OKGE substation on the Woodward – Tatonga 345kV transmission line. GEN-2011-051, under GIA Section 5.9, has requested this Limited Operation Interconnection Study (LOIS) to determine the impacts of interconnecting to the transmission system before all required Network Upgrades identified in the DISIS-2011-002 (or most recent iteration) Impact Study can be placed into service.

Power flow analysis from this LOIS has determined that the GEN-2011-051 request can interconnect prior to the completion of the required Network Upgrades, listed within Table 2 of this report.

Transient stability analysis was not performed for this Limited Operation Impact Study.

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, will 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.