Impact Study of Limited Operation for Generator Interconnection

GEN-2013-002
GEN-2013-019

September 2014
Generator Interconnection

SPP Southwest Power Pool

Revision History

Date	Author	Change Description
9/25/2014	SPP	Impact Study of Limited Operation for Generator Interconnection GEN-2013-002 & GEN-2013-019 Report Issued

Executive Summary

This study report addresses the request of two separate Interconnection Requests (GEN-2013-002 and GEN-2013-019) to interconnect their requested generators before the completion of all network upgrades identified in their interconnection studies. The two Interconnection Customer's generation totals 124.2 MW of nameplate generation. The following Limited Operation System Impact Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) addresses the interconnection of 124.2 MW of generation to be interconnected as an Energy Resource (ER) into the Transmission System of Lincoln Electric System (LES). Both GEN-2013-002 and GEN-2013-019 are located in both Lancaster and Gage counties, Nebraska. Under the GIA Section 5.9, these Customers have 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-2013-001-1 and DISIS-2013-002 (or most recent iteration) Impact Study can be placed into service.

This LOIS addresses the effects of interconnecting the generators to the rest of the transmission system for the system topology and conditions as expected on October 15, 2016.

- GEN-2013-002 is requesting the interconnection of twenty-two (22) Siemens 108m 2.3 MW wind turbine generators and associated facilities into a new substation along one of the Sheldon to Folsom 115kV transmission circuits.
- GEN-2013-019 is requesting the interconnection of thirty-two (32) Siemens 108m 2.3 MW wind turbine generators and associated facilities through the substation to be built for GEN-2013-002 along one of the Sheldon to Folsom 115kV transmission circuits.

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 1-1 of this study might go into service before the completion of all Network Upgrades identified within Table 1-2 of this report. If additional generation projects, listed within Table 1-4, 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 1-2 of this report are completed, this LOIS may need to be restudied to ensure that interconnection service remains for the customer's request.

Power flow analysis from this LOIS has determined that the customer's request will be able to interconnect as an Energy Resource prior to the completion of the required Network Upgrades, listed within Table 1-2 of this report. Refer to Table 3-1 and Table 3-2 for the power flow results. Should any other projects, other than those listed within Table 1-1 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(s) 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 Customers 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

Date	Author	Change Description
9/25/2014	SPP	Impact Study of Limited Operation for Generator Interconnection GEN-2013-002 & GEN-2013-019 Report Issued

Executive Summary

network. Transient stability analysis from this LOIS has determined that the transmission system will remain stable for the nine (9) selected faults for the limited operation interconnection of GEN-2013-002 and GEN-2013-019.

Nothing in this study should be construed as a guarantee of delivery or 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.

Table of Contents

1. Purpose

<OMITTED TEXT> (Interconnection Customers) have requested a restudy of a Limited Operation System Impact Study (LOIS) under the Southwest Power Pool (SPP) Open Access Transmission Tariff (OATT) for interconnection requests into the Transmission System of Lincoln Electric System (LES).

The purpose of this study is to evaluate the impacts of interconnecting:

- GEN-2013-002, a request of 50.6 MW comprised of twenty-two (22) Siemens 108m 2.3 MW wind turbine generators and associated facilities interconnecting into a new substation along one of the Sheldon to Folsom 115kV transmission circuits to be located in both Lancaster and Gage counties, Nebraska
- GEN-2013-019, a request of 73.6 MW comprised of thirty-two (32) Siemens 108m 2.3 MW wind turbine generators and associated facilities connecting into the substation to be built for GEN-2013-002 along one of the Sheldon to Folsom 115kV transmission circuits to be located in both Lancaster and Gage counties, Nebraska.

The Customers have requested this amount to be studied as an Energy Resource (ER) with a Limited Operation Interconnection Service to commence on or around October 15, 2016.

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 1-1; 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 1-1 are the generation interconnection requests that are assumed to have rights to either full or partial interconnection service prior to the requested October 15, 2016 in-service of the customers for this LOIS. Also listed in Table 1-1 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 1-1: Generation Requests Included within LOIS

Project	MW	Total MW	Fuel Source	Generator Model	POI	Status
GEN-2002-023N	0.8	0.8	Wind	Type 1 WTG 0.8 MW	Harmony 115kV	Commercial Operation
GEN-2003-021N	75	75	Wind	Vestas 1.65 MW	Ainsworth Wind Tap 115kV	Commercial Operation
GEN-2004-023N	75	75	Coal	GENROU	Columbus Co 115kV	Commercial Operation
GEN-2006-020N	42	42	Wind	Vestas V90 1.8 MW	Bloomfield 115kV	Commercial Operation
GEN-2006-037N1	75	75	Wind	G.E. 1.7 MW	Broken Bow 115kV	IA FULLY EXECUTED/ON SCHEDULE
GEN-2006-038N005	80	80	Wind	G.E. 1.6 MW	Broken Bow 115kV	Commercial Operation
GEN-2006-038N019	80	80	Wind	G.E. 1.5 MW	Petersburg North 115kV	Commercial Operation
GEN-2006-044N	40.5	40.5	Wind	G.E. 1.5 MW	North Petersburg 115kV	Commercial Operation
GEN-2007-011N08	81	81	Wind	Vestas V90 3.0 MW	Bloomfield 115kV	Commercial Operation
GEN-2008-086N02	200.6	200.6	Wind	G.E. 1.7 MW	Tap Ft Randle - Columbus (Madison County) 230kV	IA FULLY EXECUTED/ON SCHEDULE
GEN-2008-119O	60	60	Wind	G.E. 1.5 MW	S1399 161kV	Commercial Operation
GEN-2008-123N	89.7	89.7	Wind	G.E. 1.75 & 1.79 MW	Tap Guide Rock - Pauline 115kV	IA FULLY EXECUTED/ON SCHEDULE
GEN-2009-040	72	72	Wind	Vestas V100 & V110 2.0 MW	Marshall 115kV	IA FULLY EXECUTED/ON SCHEDULE
GEN-2010-041	10.5	10.5	Wind	G.E. 1.715 MW	S 1399 161kV	IA FULLY EXECUTED/ON SCHEDULE
GEN-2011-018	73.6	73.6	Wind	G.E. 100m 1.7 MW	Steele City 115kV	Commercial Operation
GEN-2011-056	3.6	3.6	Hydro	GENSAL	Jeffrey 115kV	Commercial Operation
GEN-2011-056A	3.6	3.6	Hydro	GENSAL	John 1 115kV	Commercial Operation
GEN-2011-056B	4.5	4.5	Hydro	GENSAL	John 2 115kV	Commercial Operation
GEN-2012-021	4.8	4.8	Gas	GENROE	Terry Bundy Generating Station 115kV	Commercial Operation
NPPD Distributed (Broken Bow)	8.3	8.3		GENCLS	Broken Bow 115kV	N/A

Table 1-1: Generation Requests Included within LOIS

Project	MW	Total MW	Fuel Source	Generator Model	POI	Status
NPPD Distributed (Burwell)	3	3	Hydro	GENCLS	Ord 115kV	N/A
NPPD Distributed (Columbus Hydro)	45	45	Hydro	GENSAL	Columbus 115kV	N/A
NPPD Distributed (North Platte - Lexington)	54	54	Hydro	GENSAL	Multiple: Jeffrey 115kV, John_1 115kV, John_2 115kV	N/A
NPPD Distributed (Ord)	10.8	10.8		GENCLS	Ord 115kV	N/A
NPPD Distributed (Stuart)	2.1	2.1		GENCLS	Ainsworth 115kV	N/A
GEN-2013-008	1.2	1.2	Wind	G.E. 100m 1.7 MW	Steele City 115kV	IA FULLY EXECUTED/ON SCHEDULE
GEN-2013-014	25.5	25.5	Wind	G.E. 100m 1.7 MW	Tap Guide Rock - Pauline (GEN-2008-123N Tap) 115kV	IA FULLY EXECUTED/ON SCHEDULE
GEN-2013-002	50.6	50.6	Wind	Siemens 108m VS 2.3 MW	Sheldon-Folsom 115kV	IA Pending
GEN-2013-019	73.6	73.6	Wind	Siemens 108m VS 2.3 MW	Sheldon-Folsom 115kV	IA Pending

This LOIS was required because the Customers are 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 1-2 below lists the required upgrade projects for which these requests have cost responsibility. Table 1-3 below lists the projects that are not in-service at the time of the Customers in-service date and are not included in this LOIS study. The GEN-2013-002 customer was included within the DISIS-2013-001 that was posted July 31, 2013. The GEN-2013-019 customer was included within the DISIS-2013-002 that was posted July 29, 2013. Both clusters have been restudied since the original posting. These reports can be located at the following Generation Interconnection Study URL:
http://sppoasis.spp.org/documents/swpp/transmission/GenStudies.cfm?YearType=2013_Impact_Studies

Table 1-2: Upgrade Projects Required for Full Interconnection Service

Upgrade Project	Type	Description	Status
GEN-2013-002 TAP - Folsom & Pleasant Hill 115kV CKT 2	Assumed to be in service for the study	Per ITP NT 2011	In-Service date 8-12-2013
Sheldon - GEN-2013-002 Tap 115kV CKT 2	Assumed to be in service for the study	Per ITP NT 2011	In-Service date 8-12-2013
SUB 967 - SUB 968 69kV CKT 1	Assumed to be out of service for the study	Assigned to withdrawn DISIS-2011-002 Customers	Project need under restudy

Table 1-2: Upgrade Projects Required for Full Interconnection Service

Upgrade Project	Type	Description	Status
SUB 968 - SUB 969 69kV CKT 1	Assumed to be out of service for the study	Assigned to withdrawn DISIS-2011-002 Customers	Project need under restudy
West Brock - SUB967 69kV CKT 1	Assumed to be out of service for the study	Assigned to withdrawn DISIS-2011-002 Customers	Project need under restudy
Twin Church - Dixon County 230kV	Assumed to be out of service for the study	Assigned to DISIS-2010-002 & DISIS-2011-001 Customers	Current Estimated In-Service date unknown

Table 1-3: Upgrade Projects Not Included in this Study

Upgrade Project	Type	Description	Status
SUB 967 - SUB 968 69kV CKT 1	Assumed to be out of service for the study	Assigned to withdrawn DISIS-2011-002 Customers	Project need under restudy
SUB 968 - SUB 969 69kV CKT 1	Assumed to be out of service for the study	Assigned to withdrawn DISIS-2011-002 Customers	Project need under restudy
West Brock - SUB967 69kV CKT 1	Assumed to be out of service for the study	Assigned to withdrawn DISIS-2011-002 Customers	Project need under restudy
Twin Church - Dixon County 230kV	Assumed to be out of service for the study	Assigned to DISIS-2010-002 & DISIS-2011-001 Customers	Current Estimated In-Service date unknown

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 1-4. 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 1-4: Higher or Equally Queued GI Requests not included within this LOIS

Project	MW	Total MW	Fuel Source	Generator Model	POI	Status
GEN-2010-051	200	200	Wind	G.E. 1.7 MW	Tap Twin Church - Hoskins 230kV	IA FULLY EXECUTED/ON SCHEDULE
GEN-2011-027	120	120	Wind	G.E. 1.85 MW	Hoskins 230kV	IA FULLY EXECUTED/ON SCHEDULE
GEN-2013-032	204.0	204.0	Wind	G.E. 1.7 MW	Neligh 115kV	TRANSITIONED TO IFS QUEUE

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

2. Facilities

Generating Facility

GEN-2013-002 Interconnection Customer's request to interconnect a total of 50.6 MW is comprised of twenty-two (22) Siemens SWT 2.3 MW wind turbine generators and associated facilities. GEN-2013-019 Interconnection Customer's request to interconnect a total of 73.6 MW is comprised of thirty-two (32) Siemens 2.3 MW wind turbine generators and associated facilities.

Interconnection Facilities

GEN-2013-002 & GEN-2013-019

The POI for GEN-2013-002 & GEN-2013-019 Interconnection Customers is a new substation along one of the Sheldon to Folsom 115kV transmission circuits in Lancaster, Nebraska. Figure 2-1 depicts the one-line diagram of the local transmission system including the POI as well as the power flow model representing the requests.

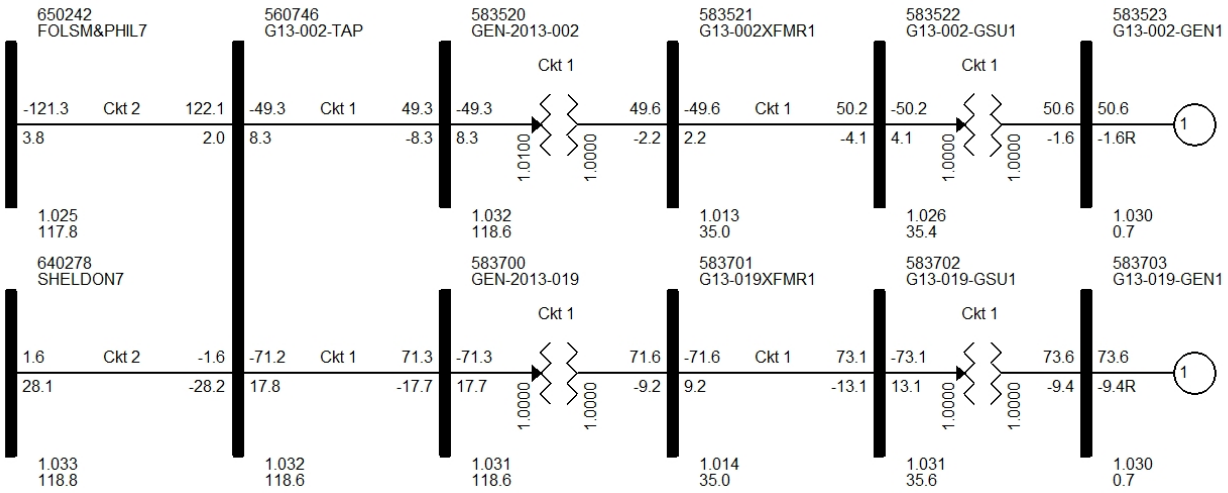

Figure 2-1: Proposed POI Configuration and Request Power Flow Model

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 Customers requested in-service date of October 15, 2016. 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(s).

3. 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 1-1 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 Customers can interconnect their generation into the LES transmission system as requested before all required upgrades listed within the DISIS-2013-001 and DISIS-2013-002 study can be placed into service. Should any other GI projects, other than those listed within Table 1-1 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 3-1, Table 3-2, and Table 3-3 below. Table 3-3 has the overloads that are less than 20% TDF and are not for mitigation. Generator Interconnection Energy Resource analysis doesn't mitigate for those issues in which the affecting GI request has less than a 20% OTDF.

Curtailment and System Reliability

In no way does this study guarantee 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.

Power Flow Analysis

Table 3-1: Interconnection Constraints for Reinforcement of GEN-2013-002 LOIS @ 50.6MW

Season	Dispatch Group	Flow	Overloaded Element	RATEA (MVA)	RATEB (MVA)	TDF	TC% LOADING	Max MW Available	Contingency
ALL			N/A					50.6	N/A

Table 3-2: Interconnection Constraints for Reinforcement of GEN-2013-019 LOIS @ 73.6MW

Season	Dispatch Group	Flow	Overloaded Element	RATEA (MVA)	RATEB (MVA)	TDF	TC% LOADING	Max MW Available	Contingency
ALL			N/A					73.6	N/A

Table 3-3: Interconnection Constraints that do not require reinforcement

Season	Dispatch Group	Flow	Source	Overloaded Element	RATEA (MVA)	RATEB (MVA)	TDF	TC% LOADING	Contingency
ALL			G13_002	N/A					ALL
ALL			G13_019	N/A					ALL

4. Stability Analysis

Transient stability analysis is used to determine if the transmission system can maintain angular stability and ensure bus voltages stay within planning criteria bandwidth during and after a disturbance while considering the addition of a generator interconnection request.

Model Preparation

Transient stability analysis was performed using modified versions of the 2013 series of Model Development Working Group (MDWG) dynamic study models including the 2014 winter and 2015 summer 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

Nine contingencies were identified for the Limited Operation scenario for use in this study. These faults are listed within Table 4-1. 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 4-1: Contingencies Evaluated for Limited Operation

Contingency Number and Name		Description
1	FLT_01_G13002_Sheldon_115kV_3PH	*3-Phase fault on the G13-002 Tap - Sheldon 115kV CKT near the G13-002 115kV bus.*
2	FLT_02_G13002_Folsom_115kV_3PH	*3-Phase fault on the G13-002 Tap - Folsom 115kV CKT near the G13-002 115kV bus.*
3	FLT_03_Sheldon_BPSSUB_115kV_3PH	*3-Phase fault on the Sheldon – BPS Sub 115kV CKT near the Sheldon 115kV bus.*
4	FLT_04_Sheldon_Clatonia_115kV_3PH	*3-Phase fault on the Sheldon – Clatonia 115kV CKT near the Sheldon 115kV bus.*
5	FLT_05_Sheldon_Crete_115kV_3PH	*3-Phase fault on the Sheldon – Crete 115kV CKT near the Sheldon 115kV bus.*
6	FLT_06_Sheldon_Firth_115kV_3PH	*3-Phase fault on the Sheldon – Firth 115kV CKT near the Sheldon 115kV bus.*
7	FLT_07_Folsom_Pioneers_115kV_3PH	*3-Phase fault on the Folsom – Pioneers 115kV CKT near the Folsom 115kV bus.*
8	FLT_08_Folsom_Rokeby_115kV_3PH	*3-Phase fault on the Folsom – Rokeby 115kV CKT near the Folsom 115kV bus.*
9	FLT_09_Sheldon_Moore3_115_345kV_3PH	*3-Phase fault on the Sheldon – Moore 115/345/13.8kV transformer at the 115kV bus*

Power Factor Analysis

Power factor analysis was not performed again for this study. The results from DISIS-2013-001-1 remain applicable for GEN-2013-002 and the results from DISIS-2013-002 remain applicable for GEN-2013-019. In order to perform the analysis the request and equivalent transmission lines and collectors systems were modeled using specifications provided by the Customer for those studies.

Results

Results of the stability analysis are summarized in Table 4-2. These results are valid for the Customers interconnecting with a generation amount up to 124.2 MW given the study assumptions. The results indicate that the transmission system remains stable for all single contingencies studied. The plots will be available upon request.

Table 4-2: Fault Analysis Results for Limited Operation

Contingency Number and Name		2014WP	2015SP
1	FLT_01_G13002_Sheldon_115kV_3PH	Stable	Stable
2	FLT_02_G13002_Folsom_115kV_3PH	Stable	Stable
3	FLT_03_Sheldon_BPSSUB_115kV_3PH	Stable	Stable
4	FLT_04_Sheldon_Clatonia_115kV_3PH	Stable	Stable
5	FLT_05_Sheldon_Crete_115kV_3PH	Stable	Stable
6	FLT_06_Sheldon_Firth_115kV_3PH	Stable	Stable
7	FLT_07_Folsom_Pioneers_115kV_3PH	Stable	Stable
8	FLT_08_Folsom_Rokeby_115kV_3PH	Stable	Stable
9	FLT_09_Sheldon_Moore3_115_345kV_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 4-4.

Table 4-3: LVRT Contingencies

Contingency Name	Description
FLT_01_G13002_Sheldon_115kV_3PH	*3-Phase fault on the G13-002 Tap - Sheldon 115kV CKT near the G13-002 115kV bus.*
FLT_02_G13002_Folsom_115kV_3PH	*3-Phase fault on the G13-002 Tap - Folsom 115kV CKT near the G13-002 115kV bus.*

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. Customers are found to be in compliance with FERC Order #661A.

5. Conclusion

<OMITTED TEXT> (Interconnection Customers GEN-2013-002 and GEN-2013-019) have requested a Limited Operation System Impact Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for a total of 124.2 MW of wind generation to be interconnected as an Energy Resource (ER) into the Transmission System of Lincoln Electric System (LES) in Lancaster, Nebraska. The point of interconnection for GEN-2013-002 & GEN-2013-019 will be a new substation along one of the Sheldon to Folsom 115kV transmission circuits. The Customers, under GIA Section 5.9, have 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-2013-001-1 and DISIS-2013-002 (or most recent iteration) Impact Study can be placed into service.

Power flow analysis from this LOIS has determined that the Customers request can interconnect their generation as an Energy Resource prior to the completion of the required Network Upgrades, listed within Table 1-3 of this report. Should any other projects, other than those listed within Table 1-1 of this report, come into service an additional study may be required to determine if any limited operation service is available. Refer to Table 3-1 and Table 3-2 for the Limited Operation Interconnection Service available due to interconnection constraints.

Transient stability analysis indicates that the transmission system will remain stable for the contingencies listed within Table 4-1 with the addition of the Customers generation. Additionally, the Customers were 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.