Impact Study of Limited Operation for Generator Interconnection

GEN-2012-037

December 2013
Generator Interconnection Studies

SPP Southwest Power Pool

Executive Summary

<OMITTED TEXT> (Interconnection Customer; GEN-2012-037) has requested a Limited Operation System Impact Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for 196 MW (Summer)/203 MW (Winter) of natural gas combustion turbine (NGCT) generation to be interconnected as an Energy Resource (ER) into a transmission facility of Southwestern Public Service Company (SPS) in Hale County, Texas. GEN-2012-037, 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-2012-002 (or most recent iteration) Impact Study can be placed into service. The Point of Interconnection for the GEN-2012-037 Interconnection Request is the TUCO 345kV substation.

The Customer has requested this LOIS to confirm that adequate interconnection service remains prior to completion of the required network upgrade, the TUCO 345/230/13.2kV autotransformer circuit 3, assuming a January 1, 2015, 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 January 1, 2015 if there is a delay on the TUCO 345/230/13.2kV transformer circuit 3. GEN-2012-037 is requesting the interconnection of one (1) GE 7FA Type NGCT generator and associated facilities rated at 196/203 MW (Summer/Winter) into the existing SPS TUCO 345kV substation. Stability analysis was also 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-2012-037 request.

Power flow analysis from this LOIS has determined that the GEN-2012-037 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 203 MW of Limited Operation Interconnection Service available. This determination is for the period of January 1, 2015 until the completion of the TUCO 345/230/13.2kV autotransformer circuit 3. This ERIS Network Upgrade has a yet to be determined in service date.

Transient Stability analysis has indicated that the Transmission System will remain stable and all generators will remain on line with the addition of the GEN-2012-037 generator.

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-2012-037) 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 Southwestern Public Service Company (SPS).

The Customer has requested this LOIS to confirm that adequate Energy Resource Interconnection Service (ERIS) remains prior to completion of the TUCO 345/230/13.2kV autotransformer circuit 3 required Network Upgrade, assuming a January 1, 2015, 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 1/2015 in-service of GEN-2012-037 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
ASGI-2010-010	42.2	33.4	Wind	Lovington 115kV	Lea County Affected Study
ASGI-2010-020	30.0	24.0	Wind	Tap LE-Tatum – LE-Crossroads 69kV	Lea County Affected Study
ASGI-2010-021	15.0	12.0	Wind	Tap LE-Saunders Tap – LE-Anderson 69kV	Lea County Affected Study
ASGI-2011-001	28.8	23.0	Wind	Lovington 115kV	COMMERCIAL OPERATION
ASGI-2011-003	10.0	8.0	Wind	Hendricks 115kV	COMMERCIAL OPERATION
ASGI-2011-004	20.0	16.0	Wind	Pleasant Hill 69kV	COMMERCIAL OPERATION
GEN-2001-033	180.0	120.0	Wind	San Juan Tap 230kV	COMMERCIAL OPERATION
GEN-2001-036	80.0	64.0	Wind	Norton 115kV	COMMERCIAL OPERATION
GEN-2006-018	167.4	167.4	CT	TUCO 230kV	COMMERCIAL OPERATION
GEN-2006-026	640.0	401.0	CT	Hobbs 230kV & Hobbs 115kV	COMMERCIAL OPERATION
GEN-2008-022	300.0	30.0	Wind	Tap Eddy Co – Tolk 345kV (Chaves Co Tap)	IA EXECUTED/ON SCHEDULE
GEN-2010-006	205.0	205.0	CT	Jones 230kV	COMMERCIAL OPERATION
GEN-2010-046	56.0	56.0	CT	TUCO 230kV	IA EXECUTED/ON SCHEDULE
GEN-2011-045	205.0	205.0	CT	Jones 230kV	COMMERCIAL OPERATION
GEN-2011-046	27.0	27.0	CT	Lopez 115kV	IA EXECUTED/ON SCHEDULE
GEN-2011-048	175.0	175.0	CT	Mustang 230kV	IA EXECUTED/ON SCHEDULE
GEN-2012-001	61.2	49.0	Wind	Tap Grassland – Borden Co (Cirrus Wind Tap)	COMMERCIAL OPERATION
GEN-2012-009	15.0	15.0	CT	Mustang 230kV	FACILITY STUDY
GEN-2012-010	15.0	15.0	CT	Mustang 230kV	FACILITY STUDY
GEN-2012-034	7.0	7.0	CT	Mustang 230kV	IA PENDING
GEN-2012-035	7.0	7.0	CT	Mustang 230kV	IA PENDING
GEN-2012-036	7.0	7.0	CT	Mustang 230kV	IA PENDING
SPS Dist (Hopi)	10.0	10.0	Solar	Hopi 115kV	COMMERCIAL OPERATION
SPS Dist (Jal)	10.0	10.0	Solar	S Jal 115kV	COMMERCIAL OPERATION
SPS Dist (Lea Rd)	10.0	10.0	Solar	Lea Road 115kV	COMMERCIAL OPERATION
SPS Dist (Monument)	10.0	10.0	Solar	Monument 115kV	COMMERCIAL OPERATION
SPS Dist (Ocotillo)	10.0	10.0	Solar	Ocotillo 115kV	COMMERCIAL OPERATION
GEN-2012-037	203.0	203.0	CT	TUCO 345kV	IA EXECUTED/ON SCHEDULE

This LOIS was required because the Customer is requesting interconnection prior to the completion of all of their required upgrades listed within the latest iteration of their Definitive Interconnection System Impact Study (DISIS). Table 2 below lists the required upgrade projects for which this request has or shares cost responsibility. GEN-2012-037 was included within the DISIS-2012-002 that was last restudied in 2013. This report can be located here at the following GI Study URL: http://sppoasis.spp.org/documents/swpp/transmission/GenStudies.cfm?YearType=2012_Impact_Studies.

*Table 2: Network Upgrade Projects not included **(unless otherwise noted)** but Required for Full Interconnection Service*

Upgrade Project	Type	Status
TUCO 345/230/13.2kV Transformer circuit 3	Shared Network Upgrade	NOT IN MODEL
Woodward – Border – TUCO 345kV	Balanced Portfolio	Current Estimated In-Service Date 5/19/2014 (IN MODEL)
TUCO 345/230/13/2kV Transformer circuit 2	Balanced Portfolio	Current Estimated In-Service Date 5/19/2014 (IN MODEL)

Upgrade Project	Type	Status
Hitchland – Beaver Co – Woodward 345kV Double Circuit	Priority Project	Current Estimated In-Service Date 6/30/2014 (IN MODEL)
Woodward – Thistle – Wichita 345kV Double Circuit	Priority Project	Current Estimated In-Service Date 12/31/2014 (IN MODEL)
Woodward – Thistle 345kV Double Circuit	Priority Project	Current Estimated In-Service Date 12/31/2014 (IN MODEL)
SPS Units Power System Stabilizers (Dynamic Stability)	Previously Allocated	In Service Date TBD (IN DYNAMIC MODEL)

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 6 (NM and West TX Area)
GI Requests not included within LOIS

Project	Remainder MW	Total MW	Fuel	POI	Status
GEN-2012-020	477.12	477.12	Wind	TUCO 230kV	IA PENDING

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-2012-037 Interconnection Customer's request to interconnect one (1) GE 7FA Type natural gas combustion turbine (NGCT) generator and associated facilities rated at 196/203 MW (Summer/Winter).

Interconnection Facilities

The POI for GEN-2012-037 Interconnection Customer is the SPS TUCO 345kV substation in Hale County, Texas. 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.

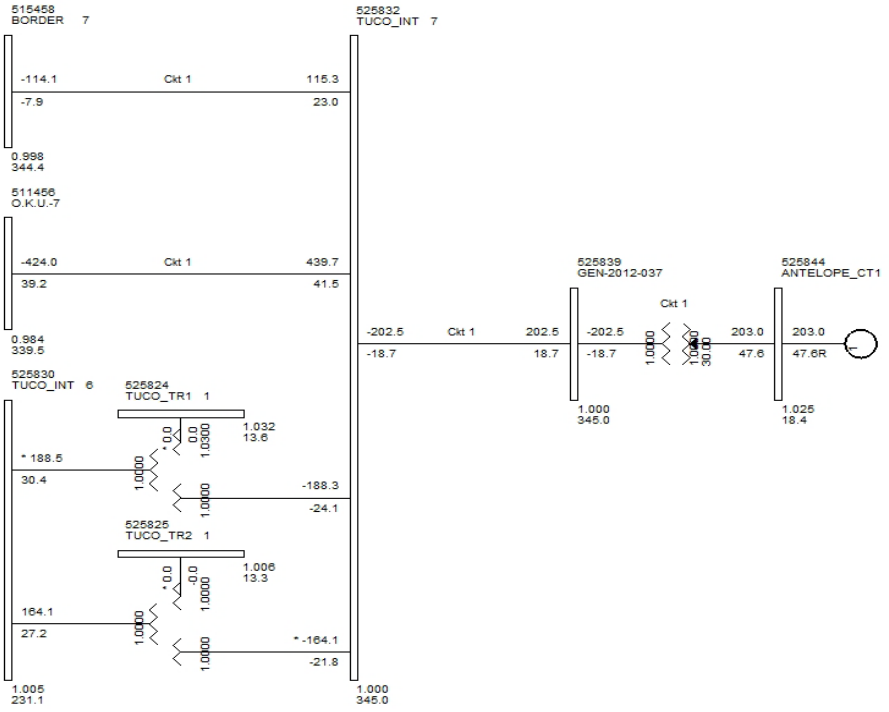

Figure 1: Proposed POI Configuration and Request Power Flow Model

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-2012-037 LOIS requested in-service date of January 1, 2015. 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 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 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-2012-037 request can interconnect a limited amount of generation (203 MW) 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 Tables 4, and 5. Table 4 contains the results that would require a limitation on the amount operating under LOIS. Under the assumptions defined by this LOIS, there is no more than 203 MW of Limited Operation Interconnection Service available. These determinations are for the period of January 1, 2015 until the completion of the required Network Upgrades listed within Table 2. The TUCO 345/230/13.2kV transformer circuit 3, the ERIS Network Upgrade, has a yet to be determined in service date.

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: LOIS Interconnection Constraints of GEN-2012-037 (203.0 MW)

Season	Dispatch Group	Flow	Overloaded Element	RATEA (MVA)	RATEB (MVA)	TDF	TC% LOADING	Max MW Interconnection Available	Contingency
			None					203	

Table 5: LOIS Interconnection Constraints of GEN-2012-037 (203.0 MW) NOT CONSIDERED for Mitigation

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 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

The eighty-two (82) 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-2012-037

	Contingency Number and Name	Description
1	FLT_01_TUCOINT7_OKU7_345kV_3PH	*3-Phase fault on the Oklaunion – Tuco 345kV CKT 1 near the Tuco 345kV bus.*
2	FLT_02_TUCOINT7_OKU7_345kV_1PH	*Single-phase fault similar to previous fault.*
3	FLT_03_TUCOINT7_BORDER7_345kV_3PH	*3-Phase fault on the Border – Tuco 345kV CKT 1 near the Tuco 345kV bus.*

Contingency Number and Name		Description
4	FLT_04_TUCOINT7_BORDER7_345kV_1PH	*Single-phase fault similar to previous fault.*
5	FLT_07_LES7_SUNNYSD7_345kV_3PH	*3-Phase fault on the Lawton East Side – Sunnyside 345kV CKT 1 near the Lawton East Side 345kV bus.*
6	FLT_08_LES7_SUNNYSD7_345kV_1PH	*Single-phase fault similar to previous fault.*
7	FLT_09_LES7_GRACMNT7_345kV_3PH	*3-Phase fault on the Gracemont – Lawton East Side 345kV CKT 1 near the Lawton East Side 345kV bus.*
8	FLT_10_LES7_GRACMNT7_345kV_1PH	*Single-phase fault similar to previous fault.*
9	FLT_11_BORDER7_WWRDEHV7_345kV_3PH	*3-Phase fault on the Border – Woodward 345kV CKT 1 near the Border 345kV bus.*
10	FLT_12_BORDER7_WWRDEHV7_345kV_1PH	*Single-phase fault similar to previous fault.*
11	FLT_13_WWRDEHV7_G11051TAP_345kV_3PH	*3-Phase fault on the GEN-2011-051-Tap – Woodward 345kV CKT 1 near the Woodward 345kV bus.*
12	FLT_14_WWRDEHV7_G11051TAP_345kV_1PH	*Single-phase fault similar to previous fault.*
13	FLT_15_WWRDEHV7_G12016TAP_345kV_3PH	*3-Phase fault on the GEN-2012-016-Tap – Woodward 345kV CKT 1 near the Woodward 345kV bus.*
14	FLT_16_WWRDEHV7_G12016TAP_345kV_1PH	*Single-phase fault similar to previous fault.*
15	FLT_17_WWRDEHV7_BEAVERCO_345kV_3PH	*3-Phase fault on the Beaver County – Woodward 345kV CKT 1 near the Woodward 345kV bus.*
16	FLT_18_WWRDEHV7_BEAVERCO_345kV_1PH	*Single-phase fault similar to previous fault.*
17	FLT_19_TUCOINT6_SWISHER6_230kV_3PH	*3-Phase fault on the Swisher – Tuco 230kV CKT 1 near the Tuco 230kV bus.*
18	FLT_20_TUCOINT6_SWISHER6_230kV_1PH	*Single-phase fault similar to previous fault.*
19	FLT_21_TUCOINT6_TOLKEAST6_230kV_3PH	*3-Phase fault on the Tolk East – Tuco 230kV CKT 1 near the Tuco 230kV bus.*
20	FLT_22_TUCOINT6_TOLKEAST6_230kV_1PH	*Single-phase fault similar to previous fault.*
21	FLT_23_TUCOINT6_CARLISLE6_230kV_3PH	*3-Phase fault on the Carlisle – Tuco 230kV CKT 1 near the Tuco 230kV bus.*
22	FLT_24_TUCOINT6_CARLISLE6_230kV_1PH	*Single-phase fault similar to previous fault.*
23	FLT_25_TUCOINT6_JONES6_230kV_3PH	*3-Phase fault on the Jones – Tuco 230kV CKT 1 near the Tuco 230kV bus.*
24	FLT_26_TUCOINT6_JONES6_230kV_1PH	*Single-phase fault similar to previous fault.*
25	FLT_27_SWISHER6_NEWHART6_230kV_3PH	*3-Phase fault on the Newhart – Swisher 230 kV CKT 1 near the Swisher 230kV bus.*
26	FLT_28_SWISHER6_NEWHART6_230kV_1PH	*Single-phase fault similar to previous fault.*
27	FLT_29_SWISHER6_G07048TAP_230kV_3PH	*3-Phase fault on the GEN-2007-048-Tap – Swisher 230kV CKT 1 near the Swisher 230kV bus.*
28	FLT_30_SWISHER6_G07048TAP_230kV_1PH	*Single-phase fault similar to previous fault.*
29	FLT_31_TOLKEAST6_ROSEVELTS6_230kV_3PH	*3-Phase fault on the Tolk East – Roosevelt 230 kV CKT 1 near the Tolk East 230kV bus.*
30	FLT_32_TOLKEAST6_ROSEVELTS6_230kV_1PH	*Single-phase fault similar to previous fault.*
31	FLT_33_TOLKEAST6_PLANTX6_230kV_3PH	*3-Phase fault on the Plant X – Tolk East 230kV CKT 2 near the Tolk East 230kV bus.*
32	FLT_34_TOLKEAST6_PLANTX6_230kV_1PH	*Single-phase fault similar to previous fault.*
33	FLT_35_TOLKEAST6_TOLKTAP6_230kV_3PH	*3-Phase fault on the Tolk East – Tolk Tap 230kV CKT 1 near the Tolk East 230kV bus.*
34	FLT_36_TOLKEAST6_TOLKTAP6_230kV_1PH	*Single-phase fault similar to previous fault.*
35	FLT_37_CARLISLE6_LPMILWAKEE6_230kV_3PH	*3-Phase fault on the Carlisle – LP-Milwaukee 230kV CKT 1 near the Carlisle 230kV bus.*
36	FLT_38_CARLISLE6_LPMILWAKEE6_230kV_1PH	*Single-phase fault similar to previous fault.*
37	FLT_39_JONES6_LPHOLLY6_230kV_3PH	*3-Phase fault on the Jones – LP-Holly 230kV CKT 1 near the Jones 230kV bus.*
38	FLT_40_JONES6_LPHOLLY6_230kV_1PH	*Single-phase fault similar to previous fault.*

Contingency Number and Name		Description
39	FLT_41_JONES6_LUBBCKSTH6_230kV_3PH	*3-Phase fault on the Jones – Lubbock South 230kV CKT 1 near the Jones 230kV bus.*
40	FLT_42_JONES6_LUBBCKSTH6_230kV_1PH	*Single-phase fault similar to previous fault.*
41	FLT_43_JONES6_LUBBCKEST6_230kV_3PH	*3-Phase fault on the Jones – Lubbock East 230kV CKT 1 near the Jones 230kV bus.*
42	FLT_44_JONES6_LUBBCKEST6_230kV_1PH	*Single-phase fault similar to previous fault.*
43	FLT_45_JONES6_GRASSLAND6_230kV_3PH	*3-Phase fault on the Grassland – Jones 230kV CKT 1 near the Jones 230kV bus.*
44	FLT_46_JONES6_GRASSLAND6_230kV_1PH	*Single-phase fault similar to previous fault.*
45	FLT_47_TUCOINT3_HALECNTY3_115kV_3PH	*3-Phase fault on the Hale County – Tuco 115kV CKT 1 near the Tuco 115kV bus.*
46	FLT_48_TUCOINT3_HALECNTY3_115kV_1PH	*Single-phase fault similar to previous fault.*
47	FLT_49_TUCOINT3_FLOYDCNTY3_115kV_3PH	*3-Phase fault on the Floyd County – Tuco 115kV CKT 1 near the Tuco 115kV bus.*
48	FLT_50_TUCOINT3_FLOYDCNTY3_115kV_1PH	*Single-phase fault similar to previous fault.*
49	FLT_51_TUCOINT3_STANTONW3_115kV_3PH	*3-Phase fault on the Stanton West – Tuco 115kV CKT 1 near the Tuco 115kV bus.*
50	FLT_52_TUCOINT3_STANTONW3_115kV_1PH	*Single-phase fault similar to previous fault.*
51	FLT_53_TUCOINT3_LUBBCKEST3_115kV_3PH	*3-Phase fault on the Lubbock East – Tuco 115kV CKT 1 near the Tuco 115kV bus.*
52	FLT_54_TUCOINT3_LUBBCKEST3_115kV_1PH	*Single-phase fault similar to previous fault.*
53	FLT_55_TUCOINT7_TUCOINT6_345_230kV_3PH	*3-Phase fault on the Tuco 345/230kV transformer CKT 1 near the Tuco 345kV bus.*
54	FLT_56_WWRDEHV7_WWRDEHV4_345_138kV_3PH	*3-Phase fault on the Woodward 345/138kV transformer CKT 1 near the Woodward 345kV bus.*
55	FLT_57_LES7_LES4_345_138kV_3PH	*3-Phase fault on the Lawton East Side 345/138kV transformer CKT 1 near the Lawton East Side 345kV bus.*
56	FLT_58_TUCOINT6_TUCOINT3_230_115kV_3PH	*3-Phase fault on the Tuco 230/115kV transformer CKT 1 near the Tuco 115kV bus.*
57	FLT_59_SWISHER6_SWISHER3_230_115kV_3PH	*3-Phase fault on the Swisher 230/115kV transformer CKT 1 near the Swisher 115kV bus.*
58	FLT_60_CARLISLE6_CARLISLE3_230_115kV_3PH	*3-Phase fault on the Carlisle 230/115kV transformer CKT 1 near the Carlisle 115kV bus.*
59	FLT_61_WWRDEHV7_G12016TAP_DBL_345kV_3PH	*3-Phase fault on the GEN-2012-016-Tap – Woodward 345kV CKT 1 & 2 near the Woodward 345kV bus.*
60	FLT_62_WWRDEHV7_G12016TAP_DBL_345kV_1PH	*Single-phase fault similar to previous fault.*
61	FLT_63_WWRDEHV7_BEAVERCO_DBL_345kV_3PH	*3-Phase fault on the Beaver County – Woodward 345kV CKT 1 & 2 near the Woodward 345kV bus.*
62	FLT_64_WWRDEHV7_BEAVERCO_DBL_345kV_1PH	*Single-phase fault similar to previous fault.*
63	FLT_65_TOLKWEST6_PLANTX6_DBL_230kV_3PH	*3-Phase fault on the Plant X – Tolk 230kV CKT 1 & 2 near the Tolk West 230kV bus.*
64	FLT_66_TOLKWEST6_PLANTX6_DBL_230kV_1PH	*Single-phase fault similar to previous fault.*
65	FLT_67_JONES6_LUBBCKSTH6_DBL_230kV_3PH	*3-Phase fault on the Jones – Lubbock South 230kV CKT 1 & 2 near the Jones 230kV bus.*
66	FLT_68_JONES6_LUBBCKSTH6_DBL_230kV_1PH	*Single-phase fault similar to previous fault.*
67	FLT_69_TOLKEAST6_ROSEVELTS6_230kV_3PH*	*3-Phase fault on the Tolk East – Roosevelt 230 kV CKT 1 near the Tolk East 230kV bus. No reclose.*
68	FLT_70_TOLKEAST6_ROSEVELTS6_230kV_1PH*	*Single-phase fault similar to previous fault.*
69	FLT_71_TOLKEAST6_PLANTX6_230kV_3PH*	*3-Phase fault on the Plant X – Tolk East 230kV CKT 2 near the Tolk East 230kV bus. No reclose.*
70	FLT_72_TOLKEAST6_PLANTX6_230kV_1PH*	*Single-phase fault similar to previous fault.*

	Contingency Number and Name	Description
71	FLT_73_TOLKEAST6_TOLKTAP6_230kV_3PH*	*3-Phase fault on the Tolk East – Tolk Tap 230kV CKT 1 near the Tolk East 230kV bus. No reclose.*
72	FLT_74_TOLKEAST6_TOLKTAP6_230kV_1PH*	*Single-phase fault similar to previous fault.*
73	FLT_75_JONES6_LPHOLLY6_230kV_3PH*	*3-Phase fault on the Jones – LP-Holly 230kV CKT 1 near the Jones 230kV bus. No reclose.*
74	FLT_76_JONES6_LPHOLLY6_230kV_1PH*	*Single-phase fault similar to previous fault.*
75	FLT_77_JONES6_LUBBCKSTH6_230kV_3PH*	*3-Phase fault on the Jones – Lubbock South 230kV CKT 1 near the Jones 230kV bus. No reclose.*
76	FLT_78_JONES6_LUBBCKSTH6_230kV_1PH*	*Single-phase fault similar to previous fault.*
77	FLT_79_JONES6_LUBBCKEST6_230kV_3PH*	*3-Phase fault on the Jones – Lubbock East 230kV CKT 1 near the Jones 230kV bus. No reclose.*
78	FLT_80_JONES6_LUBBCKEST6_230kV_1PH*	*Single-phase fault similar to previous fault.*
79	FLT_81_JONES6_GRASSLAND6_230kV_3PH*	*3-Phase fault on the Grassland – Jones 230kV CKT 1 near the Jones 230kV bus. No reclose.*
80	FLT_82_JONES6_GRASSLAND6_230kV_1PH*	*Single-phase fault similar to previous fault.*
81	FLT_83_TOLKWEST6_PLANTX6_DBL_230kV_3PH*	*3-Phase fault on the Plant X – Tolk 230kV CKT 1 & 2 near the Tolk West 230kV bus.*
82	FLT_84_TOLKWEST6_PLANTX6_DBL_230kV_1PH*	*Single-phase fault similar to previous fault.*

NOTE: The faults denoted by an asterisk (*) were adjusted to allow for no re-closing into the fault. Some 230kV faults on these lines have special operating procedures for re-closing into a three-phase fault.

Power Factor Analysis

Power factor analysis or reactor sizing was not performed for this study. Combustion Turbines are required to provide +/- 95% power factor at the point of interconnection.

Results

Results of the transient stability analysis are summarized within Table 7. These results are valid for Customers interconnecting up to 203.0 MW, including specified reactive equipment. The results indicate that the transmission system remains stable for all contingencies studied. For those faults listed as "Low Voltage Violations," SPP views these violations as being remote from the studied request and not caused by GEN-2012-037. The plots will be made available upon request.

Table 7: Fault Analysis Results for Limited Operation of GEN-2012-037

	Contingency Number and Name	2014WP	2015SP
1	FLT_01_TUCOINT7_OKU7_345kV_3PH	Stable	Stable
2	FLT_02_TUCOINT7_OKU7_345kV_1PH	Stable	Stable
3	FLT_03_TUCOINT7_BORDER7_345kV_3PH	Stable	Stable
4	FLT_04_TUCOINT7_BORDER7_345kV_1PH	Stable	Stable
5	FLT_07_LES7_SUNNYSD7_345kV_3PH	Stable	Stable
6	FLT_08_LES7_SUNNYSD7_345kV_1PH	Stable	Stable
7	FLT_09_LES7_GRACMNT7_345kV_3PH	Stable	Stable
8	FLT_10_LES7_GRACMNT7_345kV_1PH	Stable	Stable
9	FLT_11_BORDER7_WWRDEHV7_345kV_3PH	Stable	Stable
10	FLT_12_BORDER7_WWRDEHV7_345kV_1PH	Stable	Stable
11	FLT_13_WWRDEHV7_G11051TAP_345kV_3PH	Stable	Stable
12	FLT_14_WWRDEHV7_G11051TAP_345kV_1PH	Stable	Stable
13	FLT_15_WWRDEHV7_G12016TAP_345kV_3PH	Stable	Stable
14	FLT_16_WWRDEHV7_G12016TAP_345kV_1PH	Stable	Stable
15	FLT_17_WWRDEHV7_BEAVERCO_345kV_3PH	Stable	Stable

	Contingency Number and Name	2014WP	2015SP
16	FLT_18_WWRDEHV7_BEAVERCO_345kV_1PH	Stable	Stable
17	FLT_19_TUCOINT6_SWISHER6_230kV_3PH	Stable	Stable
18	FLT_20_TUCOINT6_SWISHER6_230kV_1PH	Stable	Stable
19	FLT_21_TUCOINT6_TOLKEAST6_230kV_3PH	Stable	Stable
20	FLT_22_TUCOINT6_TOLKEAST6_230kV_1PH	Stable	Stable
21	FLT_23_TUCOINT6_CARLISLE6_230kV_3PH	Stable	Stable
22	FLT_24_TUCOINT6_CARLISLE6_230kV_1PH	Stable	Stable
23	FLT_25_TUCOINT6_JONES6_230kV_3PH	Stable	Stable
24	FLT_26_TUCOINT6_JONES6_230kV_1PH	Stable	Stable
25	FLT_27_SWISHER6_NEWHART6_230kV_3PH	N/A	Stable
26	FLT_28_SWISHER6_NEWHART6_230kV_1PH	N/A	Stable
27	FLT_29_SWISHER6_G07048TAP_230kV_3PH	Stable	Stable
28	FLT_30_SWISHER6_G07048TAP_230kV_1PH	Stable	Stable
29	FLT_31_TOLKEAST6_ROSEVELTS6_230kV_3PH	Low Voltage Violations	Low Voltage Violations
30	FLT_32_TOLKEAST6_ROSEVELTS6_230kV_1PH	Stable	Stable
31	FLT_33_TOLKEAST6_PLANTX6_230kV_3PH	Low Voltage Violations	Low Voltage Violations
32	FLT_34_TOLKEAST6_PLANTX6_230kV_1PH	Stable	Stable
33	FLT_35_TOLKEAST6_TOLKTAP6_230kV_3PH	Low Voltage Violations	Low Voltage Violations
34	FLT_36_TOLKEAST6_TOLKTAP6_230kV_1PH	Stable	Stable
35	FLT_37_CARLISLE6_LPMILWAKEE6_230kV_3PH	Stable	Stable
36	FLT_38_CARLISLE6_LPMILWAKEE6_230kV_1PH	Stable	Stable
37	FLT_39_JONES6_LPHOLLY6_230kV_3PH	Stable	Stable
38	FLT_40_JONES6_LPHOLLY6_230kV_1PH	Stable	Stable
39	FLT_41_JONES6_LUBBCKSTH6_230kV_3PH	Stable	Stable
40	FLT_42_JONES6_LUBBCKSTH6_230kV_1PH	Stable	Stable
41	FLT_43_JONES6_LUBBCKEST6_230kV_3PH	Stable	Stable
42	FLT_44_JONES6_LUBBCKEST6_230kV_1PH	Stable	Stable
43	FLT_45_JONES6_GRASSLAND6_230kV_3PH	Stable	Stable
44	FLT_46_JONES6_GRASSLAND6_230kV_1PH	Stable	Stable
45	FLT_47_TUCOINT3_HALECNTY3_115kV_3PH	Stable	Stable
46	FLT_48_TUCOINT3_HALECNTY3_115kV_1PH	Stable	Stable
47	FLT_49_TUCOINT3_FLOYDCNTY3_115kV_3PH	Stable	Stable
48	FLT_50_TUCOINT3_FLOYDCNTY3_115kV_1PH	Stable	Stable
49	FLT_51_TUCOINT3_STANTONW3_115kV_3PH	Stable	Stable
50	FLT_52_TUCOINT3_STANTONW3_115kV_1PH	Stable	Stable
51	FLT_53_TUCOINT3_LUBBCKEST3_115kV_3PH	Stable	Stable
52	FLT_54_TUCOINT3_LUBBCKEST3_115kV_1PH	Stable	Stable
53	FLT_55_TUCOINT7_TUCOINT6_345_230kV_3PH	Stable	Stable
54	FLT_56_WWRDEHV7_WWRDEHV4_345_138kV_3PH	Stable	Stable
55	FLT_57_LES7_LES4_345_138kV_3PH	Stable	Stable
56	FLT_58_TUCOINT6_TUCOINT3_230_115kV_3PH	Stable	Stable
57	FLT_59_SWISHER6_SWISHER3_230_115kV_3PH	Stable	Stable
58	FLT_60_CARLISLE6_CARLISLE3_230_115kV_3PH	Stable	Stable
59	FLT_61_WWRDEHV7_G12016TAP_DBL_345kV_3PH	Stable	Stable
60	FLT_62_WWRDEHV7_G12016TAP_DBL_345kV_1PH	Stable	Stable
61	FLT_63_WWRDEHV7_BEAVERCO_DBL_345kV_3PH	Stable	Stable
62	FLT_64_WWRDEHV7_BEAVERCO_DBL_345kV_1PH	Stable	Stable
63	FLT_65_TOLKWEST6_PLANTX6_DBL_230kV_3PH	Low Voltage Violations	Low Voltage Violations
64	FLT_66_TOLKWEST6_PLANTX6_DBL_230kV_1PH	Stable	Stable
65	FLT_67_JONES6_LUBBCKSTH6_DBL_230kV_3PH	Stable	Stable
66	FLT_68_JONES6_LUBBCKSTH6_DBL_230kV_1PH	Stable	Stable
67	FLT_69_TOLKEAST6_ROSEVELTS6_230kV_3PH*	Stable	Stable
68	FLT_70_TOLKEAST6_ROSEVELTS6_230kV_1PH*	Stable	Stable
69	FLT_71_TOLKEAST6_PLANTX6_230kV_3PH*	Stable	Stable
70	FLT_72_TOLKEAST6_PLANTX6_230kV_1PH*	Stable	Stable
71	FLT_73_TOLKEAST6_TOLKTAP6_230kV_3PH*	Stable	Stable
72	FLT_74_TOLKEAST6_TOLKTAP6_230kV_1PH*	Stable	Stable

	Contingency Number and Name	2014WP	2015SP
73	FLT_75_JONES6_LPHOLLY6_230kV_3PH*	Stable	Stable
74	FLT_76_JONES6_LPHOLLY6_230kV_1PH*	Stable	Stable
75	FLT_77_JONES6_LUBBCKSTH6_230kV_3PH*	Stable	Stable
76	FLT_78_JONES6_LUBBCKSTH6_230kV_1PH*	Stable	Stable
77	FLT_79_JONES6_LUBBCKEST6_230kV_3PH*	Stable	Stable
78	FLT_80_JONES6_LUBBCKEST6_230kV_1PH*	Stable	Stable
79	FLT_81_JONES6_GRASSLAND6_230kV_3PH*	Stable	Stable
80	FLT_82_JONES6_GRASSLAND6_230kV_1PH*	Stable	Stable
81	FLT_83_TOLKWEST6_PLANTX6_DBL_230kV_3PH*	Stable	Stable
82	FLT_84_TOLKWEST6_PLANTX6_DBL_230kV_1PH*	Stable	Stable

FERC LVRT Compliance

Natural Gas Combustion Turbines are not subject to FERC Order #661A. No LVRT analysis was performed.

Conclusion

<OMITTED TEXT> (Interconnection Customer, GEN-2012-037) has requested a Limited Operation System Impact Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for 196/203 MW (Summer/Winter) of NGCT generation to be interconnected as an Energy Resource (ER) into a transmission facility of SPS in Hale County, Texas. The point of interconnection will be the TUCO 345kV substation. GEN-2012-037, 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-2012-002 (or most recent iteration) Impact Study can be placed into service.

Power flow analysis from this LOIS has determined that the GEN-2012-037 request can interconnect prior to the completion of the required Network Upgrades, listed within Table 2 of this report. There is no more than **203** MW of Limited Operation Interconnection Service available only as an Energy Resource for the period of January 1, 2015 until the completion of the following Network Upgrade:

Energy Resource Interconnection Service (ERIS) Network Upgrades
- TUCO 345/230/13.2kV autotransformer circuit 3

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 has indicated that the Transmission System will remain stable and all generators will remain on line with the addition of the GEN-2012-037 generator.

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.