GEN-2018-070

Interim Availability Interconnection Service Impact Study

Published February 2020
By SPP Generator Interconnections Dept.

REVISION HISTORY

DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION
02/06/2020	SPP	Phase 1 report re-issued with SPP summary page.

CONTENTS

SUMMARY

Interconnection Customer GEN-2018-070 has requested an Interim Availability Interconnection System Impact Study (IAIS) consistent with Southwest Power Pool Open Access Transmission Tariff (OATT) for 18.31 MW of wind generation to be interconnected with 18.31 MW of Energy Resource interconnection Service (ERIS) The generator is planned to interconnect to the transmission system of Western Area Power Administration (WAPA) in Bon Homme County, South Dakota.

As the DISIS-2018-002 is scheduled to complete June 2023, GEN-2018-070 has requested SPP to conduct an IAIS to determine the interim amount available to GEN-2018-070 under the following assumptions:

1. All planned transmission system improvements with ISD at the beginning of 2019 or earlier are included in the model
2. Gentleman – Thedford – Holt 345 kV ("R-Plan") Project **NOT** in-service after year end 2019.
3. SPP GEN-2018-070 Generation Interconnection Request in-service first quarter of 2020.

For this IAIS, powerflow and stability analysis were conducted by Burns and MacDonnell (B&M). The IAIS assumes that only the higher-queued projects listed within the B&M reports of this study will be in-service. If additional generation projects with queue priority equal-to or higher-than the study project, request to go into commercial operation, this IAIS may need to be restudied to ensure that interconnection service remains available for the customer's request.

Under the study assumptions outlined above, powerflow and stability analysis from this IAIS has determined GEN-2018-070 can have full interconnection capacity at **18.31 MW ERIS**. However, should any other projects, other than those listed within the B&M reports come into service, an additional study may be required to determine if any new limit exists.

It should be noted that although this IAIS 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, the Customer may be required by the Transmission Provider to reduce their generation output to 0 MW under certain system conditions to allow system operators to maintain the reliability of the transmission network.

Short circuit analysis was not performed for this IAIS study.

Nothing in this study should be construed as a guarantee of delivery or transmission service within Southwest Power Pool's (SPP) transmission system. 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.

A: CONSULTANT'S POWERFLOW AND STABILITY STUDY REPORT

See next page for the B&M powerflow and stability analysis Study report.

Interim Availability Interconnection System Impact Study

Interim Availability Impact Study

Phase I of IAISIS of GEN 2018-070
Project No. 117873

Revision 4
1/2/2020

Interim Availability Interconnection System Impact Study

prepared for

Phase I of IAISIS of GEN 2018-070
Utica Junction

Project No. 117873

Revision 4
1/2/2020

prepared by

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Phoenix, Arizona

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1.0 EXECUTIVE SUMMARY

GEN-2018-070 retained Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell) to perform an Interim Availability Interconnection System Impact Study (the Study or IAISIS) of the interconnection interim request. This study included load flow, stability, and short circuit analysis to determine the impacts on the transmission system caused by the interim interconnection request.

The interconnection interim request (GEN 2018-070) consist of incremental capacity upgrade (due to facility upgrade) on an existing wind project GEN-2015-089 (200-MW). GEN-2015-089 consists of fifty-five (55) 3.83 MW GE wind generators software limited to 3.5 MW and two (2) 3.83 MW GE wind generators software limited to 3.75 MW for a total of fifty-seven (57) 3.83 MW turbines with a generating nameplate of 200.00 MW. GEN-2018-070 requests an increase of 18.3-MW to GEN-2015-089 to retain the existing fifty-seven (57) 3.83 MW GE wind generators and remove their software limits allowing a total generating nameplate of 218.31 MW, to be studied in Group 9. The request summary is shown in Table 1-1.

Table 1-1: Interconnection Interim Request

Group #	Queue Number	Capacity (MW)	MW Requested For Study	Type	Point of Interconnection
9	GEN-2018-070	18.31	18.31	Wind	Utica Junction 230 kV

The Study consists of two (2) phases, with phase I to evaluate the system impacts at the requested commercial operation date and phase II to evaluate the system impacts with most higher and equally queued requests within the same and adjacent study groups achieving commercial operation. Each phase of the Study will include power flow, stability, short circuit, and if necessary limited operation amount analysis. If additional generation projects with queue priority equal to or higher than the study interim request achieves commercial operation, this Study may require an update to ensure that interconnection service remains available for the customer's request.

Note that the Study focuses on the impact caused by this interim request (GEN-2018-070), other queue projects' impact was not monitored. There may be other generation requests that could have limits to their interconnection service, but those are out of the scope of the Study.

In this phase I study, DISIS-2016-001-4 group 9 models provided by SPP were used by Burns & McDonnell to develop the study cases. The following higher queued requests and identified upgrades, not expected to be in-service by the requested commercial operation date, were switched offline in the study cases:

- GEN-2016-023
- GEN-2016-029
- GEN-2016-075 (Stability analysis only)
- R-Plan
    - Thedford 345/115/13.8 kV transformer
    - Gentleman to Thedford 345 kV circuit #1
    - Holt County to Thedford 345 kV circuit #1
- Reroute Laramie River Station to Stegall 345kV circuit #1 through the GEN-2016-023-Tap substation
- Gerald Gentleman Station to Keystone 345 kV circuit #2
- Keystone to Sidney 345 kV circuit #2

The analysis was performed using PSS/E v. 33.12 for steady state and PSS/E v 33.7 for stability.

Power Flow analysis: The interim request (GEN-2018-070) was studied at its maximum requested capacity (18.31MW). The power flow analysis evaluated the system for seven load scenarios (2017 Winter Peak (17WP), 2018 Spring (18G), 2018 Summer Peak (18SP), 2021 Light (21L), 2021 Summer Peak (21SP), 2021 Winter Peak (21WP), and 2026 Summer Peak (26SP)).

Non-converge contingencies as well as thermal and voltage constraints were observed, however the GEN-2018-070 distribution factor (DF) did not meet the SPP criteria to require identification of mitigation for GEN-2018-070

Dynamic Stability analysis: The interim request (GEN-2018-070) and existing facility (GEN-2015-089) was studied at its maximum requested capacity (218.31MW). The stability analysis evaluated the system for three load scenarios (2017 winter peak, 2018 summer peak and 2026 summer peak) simulating faults that included three-phase and single-line-to-ground faults.

The dynamic stability analysis was performed to evaluate the system response for each fault event for the requested MW capacity. The studied areas were monitored and found stable as no transient stability violations were observed during simulation.

Short Circuit analysis: The short circuit analysis evaluated the system for the 2018 and 2026 Summer Peak stability analysis cases. Three-phase fault currents were calculated for the 69 kV and above buses within 5 buses of generator's point of interconnection. The short circuit analysis results show increase of short circuit current with the interconnection of the projects, but detailed comparison with the breaker ratings was not performed. The results from short circuit analysis showed that the maximum change in the fault currents in the immediate systems at or near GEN-2018-070 was approximately 0.143 p.u (62.2 A) at the POI for the 2018SP and 2026SP cases.

Limit Operation Amount Analysis: As no constraints that meet the SPP criteria to require mitigation were observed, the available interconnection capacity is the same as the requested capacity for GEN-2018-070 with only those interconnection requests with queue priority equal to or higher than the study interim request, achieving commercial operation as outlined in this study. Therefore, GEN-2018-070 can interconnect 18.3 MW on interim basis at this time without any additional mitigation.

2.0 INTRODUCTION

Burns & McDonnell is pleased to assist GEN-2018-070 by providing engineering services in support of Southwest Power Pool (SPP) Interim Availability Interconnection System Impact Study (the Study or the IAISIS). The Study is to evaluate system impacts due to the interconnection interim request (GEN-2018-070) within SPP's system.

The Study is to evaluate and identify the adverse system impacts on the SPP system due to the interconnection of the interim request (GEN-2018-070). This Study will include power flow, stability, and short circuit analysis. SPP has directed that the interim request be evaluated using the DISIS-2016-001-4 Group 9 models for Phase I.A summary of the interim request is listed in Table 2-1.

Table 2-1: Interconnection Interim Requests

Group #	Queue Number	Capacity	Type	Point of Interconnection
9	GEN-2018-070	18.31	Wind	Utica 230kV

The Study 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 Study 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 2-2; 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 executing an interconnection agreement and commencing commercial operation, may require a re-study of this Study.

This IAISIS study included prior queued generation interconnection requests. Table 2-2 lists the generation interconnection requests that are assumed to have rights to either full or partial interconnection service prior to the requested February 2020 in-service for this Study. Also listed in Table 2-2 are 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. In the event that any of the projects achieve commercial operation with a capacity above the amount studied, the interim interconnection service will need to be restudied in order to identify the available interconnection service.

The generation requests that were included in the studies for the steady state and stability studies are listed in Appendix B

2.1 Limitations

In the preparation of this report, the information provided to Burns & McDonnell was used to make certain assumptions with respect to conditions which may exist in the future. While Burns & McDonnell believes the assumptions made are reasonable for the purposes of this report, Burns & McDonnell makes no representation that the conditions assumed will, in fact, occur. In addition, while Burns & McDonnell has no reason to believe that the information provided by others, and on which this report is based, is inaccurate in any material respect, Burns & McDonnell has not independently verified such information and cannot guarantee its accuracy or completeness. To the extent that actual future conditions differ from those assumed herein or from the information provided to Burns & McDonnell, the actual results will vary from those presented.

3.0 POWER FLOW ANALYSIS

Power flow analysis is used to determine if the transmission system can accommodate the injection from the request without violating thermal, voltage, or non-converged transmission planning criteria.

3.1 Model Preparation

Power flow analysis for the Interim Study was performed using the SPP Integrated Transmission Planning (ITP) 2017 models developed by SPP for the DISIS-2016-001-4 including the 2017 Winter Peak (17WP), 2018 Spring (18G), 2018 Summer Peak (18SP), 2021 Light (21L), 2021 Summer Peak (21SP), 2021 Winter Peak (21WP), and 2026 Summer Peak (26SP) seasonal models.

For Variable Energy Resources (VER) (solar/wind) in each power flow case, Energy Resource Interconnection Service (ERIS), is evaluated for the generating plants within a geographical area of the interconnection request(s) for the VERs dispatched at 100% nameplate of maximum generation. The VERs in the remote areas are dispatched at 20% nameplate of maximum generation in the peak seasons. The VERs in the remote areas are dispatched at 20% nameplate of maximum generation for Phase I (DISIS-2016-001) and 10% for Phase II (DISIS-2016-002) in the Light season. These projects are dispatched across the SPP footprint using load factor ratios.

Peaking units are not dispatched in the spring, light, or in the “High VER” summer and winter peak cases. To study peaking units’ impacts, the summer and winter peak models are developed with peaking units dispatched at 100% of the nameplate rating and VERs dispatched at 20% of the nameplate rating. Each interconnection request is also modeled separately at 100% nameplate for certain analyses.

All generators (VER and peaking) that requested Network Resource Interconnection Service (NRIS) are dispatched in an additional analysis into the interconnecting Transmission Owner’s (T.O.) area at 100% nameplate with Energy Resource Interconnection Service (ERIS) only requests at 80% nameplate. This method allows for identification of network constraints that are common between regional groupings to have affecting requests share the mitigating upgrade costs throughout the cluster.

For this IAISIS, only the previous queued requests were assumed to be in-service at 100% dispatch in the study group (Group 9) and 20% dispatch in other groups.

In power flow analysis, Group 09 cases include all requests included in DISIS-2016-001-4. The following higher queued requests and identified upgrades, not expected to be in-service by the requested commercial operation date, were switched offline in the study cases:

- GEN-2016-023
- GEN-2016-029
- GEN-2016-075 (Stability analysis only)
- R-Plan
  - Thedford 345/115/13.8 kV transformer
  - Gentleman to Thedford 345 kV circuit #1
  - Holt County to Thedford 345 kV circuit #1
- Reroute Laramie River Station to Stegall 345kV circuit #1 through the GEN-2016-023-Tap substation
- Gerald Gentleman Station to Keystone 345 kV circuit #2
- Keystone to Sidney 345 kV circuit #2

3.2 Study Methodology and Criteria

Network constraints are found by using PSS/E AC Contingency Calculation (ACCC) analysis and TARA DF analysis on the entire set as previously mentioned. All power flow simulations are using the option of area interchange enabled.

For Energy Resource Interconnection Service (ERIS), thermal overloads are determined for system intact (n-0) (greater than 100% of Rate A - normal) and for contingency (n-1) (greater than 100% of Rate B – emergency) conditions.

The overloads are then screened to determine which of the generator interconnection requests have at least

• 3% Distribution Factor (DF) for system intact conditions (n-0),

• 20% DF upon outage-based conditions (n-1), or

• 3% DF on contingent elements that resulted in a non-converged solution.

Interconnection Requests that requested Network Resource Interconnection Service (NRIS) are also studied in a separate NRIS analysis to determine if any constraint measured greater than or equal to a 3% DF. If so, these constraints are also considered for transmission reinforcement under NRIS.

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 monitored 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

Flowrates for SPP and first tier Non-SPP control area are monitored. Additional NERC flowrates are monitored in second tier or greater Non-SPP control areas. Voltage monitoring was performed for SPP control area buses 69 kV and above.

3.3 Results

Non-converge contingencies as well as thermal and voltage constraints were observed, however the GEN-2018-070 distribution factor (DF) did not meet the SPP criteria to require identification of mitigation for GEN-2018-070.

Non-Converged Contingency scenarios:

Contingency #945 (outages of Sarepta – Longwood Ck1 345kV line and Longwood 345/138 kV transformer) did not converge but was able to be solved using temporary reactive support at the Cottonwood 500kV bus. This reactive support was later removed, and the case converged. No additional thermal overloads or voltage violations were observed after this contingency solved (Table 3).

Table 2-1: Temporary Reactive Support on to mitigate non-convergence

Scenario	SEASON	MONTCOMMONNAME	CONT NUMBER	Comment
Without Temporary reactive support	21WP	P23:345:AEPW:LONGWOOD CB 1N20 NBTB	945	TDF of 3.859% was observed
With Temporary reactive support at the Cottonwood 500kV bus	21WP	P23:345:AEPW:LONGWOOD CB 1N20 NBTB	945	No additional thermal overloads or voltage violations were observed after reactive support was removed

4.0 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.

4.1 Methodology

Transient stability analysis was performed using modified versions of the 2016 series of Model Development Working Group (MDWG) dynamic models develop by SPP for DISIS-2016-001-4 which include the 2017 winter, 2018 summer peak, and 2026 summer peak dynamic cases. The cases were provided by SPP and adapted by Burns & McDonnell for the Study to resemble the power flow study cases with regards to prior queued generation requests and topology. Finally, the prior queued and study generation was dispatched into the SPP footprint. Initial simulations were then carried out for a no-disturbance and a simple bump test for a run of twenty (20) seconds each to verify the initial stability of the model.

During the fault simulations, the active power (PELEC), reactive power (QELEC) and terminal voltage (ETERM) were monitored for GEN-2018-070 and other equally and prior queued projects in Group 9. In addition, voltages of five (5) buses away from the POI were monitored and plotted. The machine rotor angle for synchronous machines and speed for asynchronous machines within this study area including 534 (SUNC), 536 (WERE), 540 (GMO), 541 (KCPL), 635 (MEC), 640 (NPPD), 645 (OPPD) and 650 (LES) were monitored. In addition, the voltages of all 100 kV and above buses within the study area were monitored.

4.2 Fault Definitions

The Study contingencies include three-phase faults and single-phase line faults at locations defined by prior SPP studies and provided to Burns & McDonnell. 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's 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.

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.

An additional dispatch scenario called the Gerald Gentleman Station registered NERC floodgate #6006 (GGSSI) was also simulated and the cases studied accordingly.

Based on the configuration of interconnection of the study projects, total of eighty-six (86) contingencies near the POI were identified for this study. These faults are listed within Table 4-1 as shown below.

Table 4-1: Contingencies Evaluated for IAISIS

No.	Fault ID	Fault Descriptions
1	**FLT107-3PH**	3 phase fault on the UticaJ4 (652526) 230 kV to Rasmusn4 (652536) 230kV circuit 1 line a. Apply fault at the UticaJ4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
2	**FLT108-3PH**	3 phase fault on the UticaJ4 (652526) 230kV to VFODNES4 (652398) 230kV circuit 1 line a. Apply fault at the UticaJ4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
3	**FLT109-3PH**	3 phase fault on the UticaJ4 (652526) 230 kV to FTRANDL4 (652509) 230 kV circuit 1 line a. Apply fault at the UticaJ4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
4	**FLT110-3PH**	3 phase fault on the Uticajc4 230/115/13.2kV (652526/652626/652627) Transformer. a. Apply fault at the UticaJ4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line Uticajc4 230/115/13.2kV (652526/652626/652627) Transformer
5	**FLT111-SB**	RASMUSN4 230 kV Stuck Breaker Scenario 1 a. Apply L-G fault at the Rasmusn4 230 kV bus. b. Clear fault after 16 cycles and trip the following elements c. RASMUSN4 (652536) to UticaJ4 (652526) 230 kV d. RASMUSN4 (652536) to Siouxcy4 (652565) 230 kV

No.	Fault ID	Fault Descriptions
6	**FLT112-SB**	VFODNES4 230 kV Stuck Breaker Scenario 1 a. Apply L-G fault at the VFODNES4 230 kV bus. b. Clear fault after 16 cycles and trip the following elements c. VFODNES4 (652398) - Uticajc4 (652526) 230 kV d. VFODNES4 (652398) - Siouxcy4 (652523) 230 Kv
8	**FLT113-SB**	FTRANDL4 230 kV Stuck Breaker Scenario 1 a. Apply L-G fault at the FTRANDL4 230 kV bus. b. Clear fault after 16 cycles and trip the following elements c. FTRANDL4 (652509) to UticaJ4 (652526) 230 kV d. FTRANDL4 (652509) to Meadowgrove4 (640540) 230 kV
9	**FLT114-PO**	Prior Outage of Uticajc4 230 kV (652526) to Rasmusn4 230 kV (652536) CKT 1; 3 phase fault on UTICAJC4 (652526) to FTRANDL4 230 kV (652509) circuit 1 line a. Apply fault at the FTRANDL4 (652509) 230 kV b. Clear fault after 6 cycles by tripping the faulted line
10	**FLT115-PO**	Prior Outage of Uticajc4 230 kV (652526) to VFODNES4 230 kV (652398) CKT 1; 3 phase fault on UTICAJC4 (652526) to FTRANDL4 230 kV (652509) circuit 1 line a. Apply fault at the RASMUSN4 (652536) 230 kV b. Clear fault after 6 cycles by tripping the faulted line
11	**FLT116-PO**	Prior Outage of Uticajc4 230 kV (652526) to FTRANDL4 (652509) CKT 1; 3 phase fault on UTICAJC4 (652526) to RASMUSN4 230 kV (652536) circuit 1 line a. Apply fault at the RASMUSN4 (652536) 230 kV b. Clear fault after 6 cycles by tripping the faulted line
12	**FLT9001-3PH**	3 phase fault on the VFODNES 230/69 kV (652398/652399) Transformer. a. Apply fault at the VFODNES (652398) 230 kV bus b. Clear fault after 6 cycles by tripping the faulted VFODNES 230/69 kV (652398/652399) Transformer.
13	**FLT9002-3PH**	3 phase fault on the VFODNES 230/115/12.5 kV (652398/652397/652396) Transformer. a. Apply fault at the VFODNES (652398) 230 kV bus b. Clear fault after 6 cycles by tripping the faulted VFODNES 230/115/12.5 kV (652398/652397/652396) Transformer.
14	**FLT9003-3PH**	3 phase fault on the VFODNES (652398) 230 kV to SIOUXFL4 (652523) 230 kV circuit 1 line a. Apply fault at the VFODNES 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
15	**FLT9004-3PH**	3 phase fault on the SIOUXFL4 (652523) 230 kV to LETCHER4 (652606) 230 kV circuit 1 line a. Apply fault at the SIOUXFL4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
16	**FLT9005-3PH**	3 phase fault on the SIOUXFL4 (652523) 230 kV to PAHOJA4 (652578) 230 kV circuit 1 line a. Apply fault at the SIOUXFL4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
17	**FLT9006-3PH**	3 phase fault on the SIOUXFL4 (652523) 230 kV to SPLT RK4 (602004) 230 kV circuit 1 line a. Apply fault at the SIOUXFL4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
18	**FLT9007-3PH**	3 phase fault on the SIOUXFL4 (652523) 230 kV to HANLON (652513) 230 kV circuit 1 line a. Apply fault at the SIOUXFL4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.

No.	Fault ID	Fault Descriptions
19	**FLT9008-3PH**	3 phase fault on the SIOUXFL4 230/115/13.2 kV (652523/652524/652233) Transformer a. Apply fault at the SIOUXFL4 (652523) 230 kV bus b. Clear fault after 6 cycles by tripping the faulted SIOUXFL4 230/115/13.2 kV (652523/652524/652233) Transformer.
20	**FLT9009-3PH**	3 phase fault on the VFODNES7 (652397) 115 kV to HANLON (652591) 115 kV circuit 1 line a. Apply fault at the VFODNES7 115 kV bus b. Clear fault after 7 cycles by tripping the faulted line.
21	**FLT9010-3PH**	3 phase fault on the FTRANDL4 (652509) 230 kV to MEADOWGROVE (640540) 230 kV circuit 1 line a. Apply fault at the FTRANDL4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line
22	**FLT9011-3PH**	3 phase fault on the FTRANDL4 (652509) 230 kV to SIOUXCY4 (652565) 230 kV circuit 1 line a. Apply fault at the FTRANDL4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
23	**FLT9012-3PH**	3 phase fault on the FTRANDL4 (652509) 230 kV to FTTHOMP4 (652507) 230 kV circuit 1 line a. Apply fault at the FTRANDL4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
24	**FLT9013-3PH**	3 phase fault on the FTRANDL4 (652509) 230 kV to LAKPLAT4 (652516) 230 kV circuit 1 line a. Apply fault at the FTRANDL4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
25	**FLT9014-3PH**	3 phase fault on the LAKPLAT 230/69 kV (652516/652277) Transformer. a. Apply fault at the LAKPLAT (652516) 230 kV bus b. Clear fault after 6 cycles by tripping the faulted LAKPLAT 230/69 kV (652516/652277) Transformer.
26	**FLT9015-3PH**	3 phase fault on the LAKPLAT4 (652516) 230 kV to FTTHOMP4 (652507) 230 kV circuit 1 line a. Apply fault at the LAKPLAT4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
27	**FLT9016-3PH**	3 phase fault on the FTTHOMP4 (652507) 230 kV to BIGBND14 (652540) 230 kV circuit 1 line a. Apply fault at the FTTHOMP4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line. c. Trip isolated plants at 652542 and 652543
28	**FLT9017-3PH**	3 phase fault on the FTTHOMP4 (652507) 230 kV to WESSINGTON4 (652607) 230 kV circuit 1 line a. Apply fault at the FTTHOMP4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
29	**FLT9018-3PH**	3 phase fault on the FTTHOMP4 (652507) 230 kV to BIGBND24 (652541) 230 kV circuit 1 line a. Apply fault at the FTTHOMP4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line. c. Trip isolated plants at 652544 and 652545
30	**FLT9019-3PH**	3 phase fault on the FTTHOMP4 (652507) 230 kV to HURON (652514) 230 kV circuit 1 line a. Apply fault at the FTTHOMP4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
31	**FLT9020-3PH**	3 phase fault on the FTTHOMP4 (652507) 230 kV to G16-094-TAP (587764) 230 kV circuit 1 line a. Apply fault at the FTTHOMP4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.

No.	Fault ID	Fault Descriptions
32	**FLT9021-3PH**	3 phase fault on the FTTHOMP4 (652507) 230 kV to OAHE (652519) 230 kV circuit 1 line a. Apply fault at the FTTHOMP4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
33	**FLT9022-3PH**	3 phase fault on the FTTHOMP 345/230/13.8 kV (652506/652507/652273) Transformer. a. Apply fault at the FTTHOMP (652507) 230 kV bus b. Clear fault after 6 cycles by tripping the faulted FTTHOMP 345/230/13.8 kV (652506/652507/652273) Transformer.
34	**FLT9023-3PH**	3 phase fault on the FTTHOMP 230/69 kV (652507/652276) Transformer. a. Apply fault at the FTTHOMP 230 kV bus b. Clear fault after 6 cycles by tripping the faulted FTTHOMP 230/69 kV (652507/652276) Transformer.
35	**FLT9024-3PH**	3 phase fault on the 345 kV FTTHOMP3 (652506) to FTTHOM1-LNX3 (652806) circuit Z to GEN-2016-017 Tap (560074) circuit 1 line a. Apply fault at the FTTHOMP3 345 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
36	**FLT9025B-3PH**	3 phase fault on the 345 kV FTTHOMP3 (652506) to FTTHOM2-LNX3 (652807) circuit Z to GRPRAR2-LNX3 (652833) circuit 1 to Grand Prairie (652532) circuit Z line a. Apply fault at the FTTHOMP3 345 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
37	**FLT9026-3PH**	3 phase fault on the G16-094-TAP (587764) 230 kV to OAHE (652519) 230 kV circuit 1 line a. Apply fault at the G16-094-TAP 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
38	**FLT9027-3PH**	3 phase fault on the RASMUSN4 (652536) 230 kV to SIOUXCY4 (652565) 230 kV circuit 1 line a. Apply fault at the RASMUSN4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
39	**FLT9028-3PH**	3 phase fault on the RASMUSN 230/69 kV (652536/652287) Transformer. a. Apply fault at the RASMUSN (652536) 230 kV bus b. Clear fault after 6 cycles by tripping the faulted RASMUSN 230/69 kV (652536/652287) Transformer.
40	**FLT9029-3PH**	3 phase fault on the SIOUXCY 345/230/13.8 kV (652564/652565/652305) Transformer. a. Apply fault at the SIOUXCY (652565) 230 kV bus b. Clear fault after 6 cycles by tripping the faulted SIOUXCY 345/230/13.8 kV (652564/652565/652305) Transformer.
41	**FLT9030-3PH**	3 phase fault on the SIOUXCY 230/161/13.8 kV (652565/652566/652308) Transformer. a. Apply fault at the SIOUXCY (652565) 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line SIOUXCY 230/161/13.8 kV (652565/652566/652308) Transformer.
42	**FLT9031-3PH**	3 phase fault on the SIOUXCY (652565) 230 kV to TWIN CH4 (640386) 230 kV circuit 1 line a. Apply fault at the SIOUXCY 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
43	**FLT9032-3PH**	3 phase fault on the SIOUXCY (652565) 230 kV to DENISON4 (652567) 230 kV circuit 1 line a. Apply fault at the SIOUXCY 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
44	**FLT9033-3PH**	3 phase fault on the SIOUXCY (652565) 230 kV to EAGLE (659900) 230 kV circuit 1 line a. Apply fault at the SIOUXCY 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
45	**FLT9034-3PH**	3 phase fault on the SIOUXCY3 (652564) 345 kV to SIOUXCY-LNX3 (652864) 345 kV circuit Z line a. Apply fault at the SIOUXCY3 345 kV bus b. Clear fault after 6 cycles by tripping the faulted line.

No.	Fault ID	Fault Descriptions
46	**FLT9035-3PH**	3 phase fault on the SIOUXCY3 (652564) 345 kV to RAUN (635200) 345 kV circuit Z line a. Apply fault at the SIOUXCY3 345 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
47	**FLT9036-3PH**	3 phase fault on the FTTHOMP4 (652507) 230 kV to LETCHER4 (652606) 230 kV circuit 1 line a. Apply fault at the FTTHOMP4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
48	**FLT9037-3PH**	3 phase fault on the UTICAJC7 (652626) 115 kV to FREEMAN-ER7 (655418) 115 kV circuit 1 line a. Apply fault at the UTICAJC7 115 kV bus b. Clear fault after 7 cycles by tripping the faulted line.
49	**FLT9038-3PH**	3 phase fault on the UTICAJC7 (652626) 115 kV to MENNOJT7 (660007) 115 kV circuit 1 line a. Apply fault at the UTICAJC7 115 kV bus b. Clear fault after 7 cycles by tripping the faulted line.
50	**FLT9039-3PH**	3 phase fault on the UTICAJC7 (652626) 115 kV to NAPA JCT7 (660026) 115 kV circuit 1 line a. Apply fault at the UTICAJC7 115 kV bus b. Clear fault after 7 cycles by tripping the faulted line.
51	**FLT9040-3PH**	3 phase fault on the MEADOWGROVE (640540) 230 kV to COLMBUS4 (640133) 230 kV circuit 1 line a. Apply fault at the MEADOWGROVE 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
52	**FLT9041-3PH**	3 phase fault on the MEADOWGROVE (640540) 230 kV to PR BRZ4 (648506) 230 kV circuit 1 line a. Apply fault at the MEADOWGROVE 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line, trip generators at PR BRZ
53	**FLT9001-PO1**	Prior Outage of UTICALJC4 230 kV (652526) to RASMUSN 230 kV (652536) circuit 1 line 3 phase fault on the VFODNES 230/69 kV (652398/652399) Transformer. a. Apply fault at the VFODNES 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line VFODNES 230/69 kV (652398/652399) Transformer.
54	**FLT9002-PO1**	Prior Outage of UTICALJC4 230 kV (652526) to RASMUSN 230 kV (652536) circuit 1 line 3 phase fault on the VFODNES 230/115/12.5 kV (652398/652397/652396) Transformer. a. Apply fault at the VFODNES 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line VFODNES 230/115/12.5 kV (652398/652397/652396) Transformer.
55	**FLT9003-PO1**	Prior Outage of UTICALJC4 230 kV (652526) to RASMUSN 230 kV (652536) circuit 1 line 3 phase fault on the VFODNES (652398) 230 kV to SIOUXFL4 (652523) 230 kV circuit 1 line a. Apply fault at the VFODNES 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
56	**FLT9010-PO1**	3 phase fault on the FTRANDL4 (652509) 230 kV to MEADOWGROVE (640540) 230 kV circuit 1 line a. Apply fault at the FTRANDL4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
57	**FLT9011-PO1**	Prior Outage of UTICALJC4 230 kV (652526) to RASMUSN 230 kV (652536) circuit 1 line 3 phase fault on the FTRANDL4 (652509) 230 kV to SIOUXCY4 (652565) 230 kV circuit 1 line a. Apply fault at the FTRANDL4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.

No.	Fault ID	Fault Descriptions
58	**FLT9012-PO1**	Prior Outage of UTICALJC4 230 kV (652526) to RASMUSN 230 kV (652536) circuit 1 line 3 phase fault on the FTRANDL4 (652509) 230 kV to FTTHOMP4 (652507) 230 kV circuit 1 line a. Apply fault at the FTRANDL4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
59	**FLT9013-PO1**	Prior Outage of UTICALJC4 230 kV (652526) to RASMUSN 230 kV (652536) circuit 1 line 3 phase fault on the FTRANDL4 (652509) 230 kV to LAKPLAT4 (652516) 230 kV circuit 1 line a. Apply fault at the FTRANDL4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
60	**FLT9037-PO1**	Prior Outage of UTICALJC4 230 kV (652526) to RASMUSN 230 kV (652536) circuit 1 line 3 phase fault on the UTICAJC7 (652626) 115 kV to FREEMAN-ER7 (655418) 115 kV circuit 1 line a. Apply fault at the UTICAJC7 115 kV bus b. Clear fault after 7 cycles by tripping the faulted line.
61	**FLT9038-PO1**	Prior Outage of UTICALJC4 230 kV (652526) to RASMUSN 230 kV (652536) circuit 1 line 3 phase fault on the UTICAJC7 (652626) 115 kV to MENNOJT7 (660007) 115 kV circuit 1 line a. Apply fault at the UTICAJC7 115 kV bus b. Clear fault after 7 cycles by tripping the faulted line.
62	**FLT9039-PO3**	Prior Outage of UTICALJC4 230 kV (652526) to FTRANDL4 (652509) circuit 1 line 3 phase fault on the UTICAJC7 (652626) 115 kV to NAPA JCT7 (660026) 115 kV circuit 1 line a. Apply fault at the UTICAJC7 115 kV bus b. Clear fault after 7 cycles by tripping the faulted line.
63	**FLT9010-PO4**	Prior Outage of UTICALJC4 230 kV (652526) to VFODNES4 230 kV (652398) circuit 1 line 3 phase fault on the FTRANDL4 (652509) 230 kV to MEADOWGROVE (640540) 230 kV circuit 1 line a. Apply fault at the FTRANDL4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
64	**FLT9011-PO4**	Prior Outage of UTICALJC4 230 kV (652526) to VFODNES4 230 kV (652398) circuit 1 line 3 phase fault on the FTRANDL4 (652509) 230 kV to SIOUXCY4 (652565) 230 kV circuit 1 line a. Apply fault at the FTRANDL4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
65	**FLT9012-PO4**	Prior Outage of UTICALJC4 230 kV (652526) to VFODNES4 230 kV (652398) circuit 1 line 3 phase fault on the FTRANDL4 (652509) 230 kV to FTTHOMP4 (652507) 230 kV circuit 1 line a. Apply fault at the FTRANDL4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
66	**FLT9013-PO4**	Prior Outage of UTICALJC4 230 kV (652526) to VFODNES4 230 kV (652398) circuit 1 line 3 phase fault on the FTRANDL4 (652509) 230 kV to LAKPLAT4 (652516) 230 kV circuit 1 line a. Apply fault at the FTRANDL4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
67	**FLT9027-PO4**	Prior Outage of UTICALJC4 230 kV (652526) to VFODNES4 230 kV (652398) circuit 1 line 3 phase fault on the RASMUSN4 (652536) 230 kV to SIOUXCY4 (652565) 230 kV circuit 1 line a. Apply fault at the RASMUSN4 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
68	**FLT9028-PO4**	Prior Outage of UTICALJC4 230 kV (652526) to VFODNES4 230 kV (652398) circuit 1 line 3 phase fault on the RASMUSN 230/69 kV (652536/652287) Transformer. a. Apply fault at the RASMUSN 230 kV bus b. Clear fault after 6 cycles by tripping the faulted line RASMUSN 230/69 kV (652536/652287) Transformer.

No.	Fault ID	Fault Descriptions
69	**FLT9037-PO4**	Prior Outage of UTICALJC4 230 kV (652526) to VFODNES4 230 kV (652398) circuit 1 line 3 phase fault on the UTICAJC7 (652626) 115 kV to FREEMAN-ER7 (655418) 115 kV circuit 1 line a. Apply fault at the UTICAJC7 115 kV bus b. Clear fault after 6 cycles by tripping the faulted line.
70	**FLT9038-PO4**	Prior Outage of UTICALJC4 230 kV (652526) to VFODNES4 230 kV (652398) circuit 1 line 3 phase fault on the UTICAJC7 (652626) 115 kV to MENNOJT7 (660007) 115 kV circuit 1 line a. Apply fault at the UTICAJC7 115 kV bus b. Clear fault after 7 cycles by tripping the faulted line.
71	**FLT9039-PO4**	Prior Outage of UTICALJC4 230 kV (652526) to VFODNES4 230 kV (652398) circuit 1 line 3 phase fault on the UTICAJC7 (652626) 115 kV to NAPA JCT7 (660026) 115 kV circuit 1 line a. Apply fault at the UTICAJC7 115 kV bus b. Clear fault after 7 cycles by tripping the faulted line.
72	**FLT1001-SB**	Stuck Breaker at UTICAJC7 (652626) a. Apply L-G fault at UTICAJC7 (652626) 115 kV bus. b. Clear fault after 16 cycles and trip the following elements c. UTICAJC7 (652526) 230 kV/ (652626)115 kV/ (652627) 13.2 kV transformer d. UTICAJC7 (652626) 115 kV to FREEMAN-ER7 (655418) 115 kV circuit 1 line
73	**FLT1002-SB**	VFODNES4 230 kV Stuck Breaker Scenario 1 a. Apply L-G fault at the VFODNES4 230 kV bus. b. Clear fault after 16 cycles and trip the following elements c. VFODNES4 (652398) to UticaJ4 (652526) 230 kV d. VFODNES4 230kV (652398) to 69kV (652399) Transformer
74	**FLT1003-SB**	VFODNES4 230 kV Stuck Breaker Scenario 2 a. Apply L-G fault at the VFODNES4 230 kV bus. b. Clear fault after 16 cycles and trip the following elements c. VFODNES4 (652398) to UticaJ4 (652526) 230 kV d. VFODNES4 230kV (652398) to 115kV (652397) to 12.5kV (652396) Transformer
75	**FLT1004-SB**	VFODNES4 230 kV Stuck Breaker Scenario 3 a. Apply L-G fault at the VFODNES4 230 kV bus. b. Clear fault after 16 cycles and trip the following elements c. VFODNES4 (652398) to Siouxcy4 (652523) 230 kV d. VFODNES4 230kV (652398) to 69kV (652399) Transformer
76	**FLT1005-SB**	VFODNES4 230 kV Stuck Breaker Scenario 4 a. Apply L-G fault at the VFODNES4 230 kV bus. b. Clear fault after 16 cycles and trip the following elements c. VFODNES4 (652398) to Siouxcy4 (652523) 230 kV d. VFODNES4 230kV (652398) to 115kV (652397) to 12.5kV (652396) Transformer
77	**FLT1006-SB**	UTICAJC4 230 kV Stuck Breaker Scenario 1 a. Apply L-G fault at the UTICAJC4 (652526) 230 kV bus. b. Clear fault after 16 cycles and trip the following elements c. RASMUSN4 (652536) to UticaJ4 (652526) 230 kV d. VFODNES4 (652398) to UticaJ4 (652526) 230 kV
78	**FLT1007-SB**	UTICAJC4 230 kV Stuck Breaker Scenario 2 a. Apply L-G fault at the UTICAJC4 (652526) 230 kV bus. b. Clear fault after 16 cycles and trip the following elements c. RASMUSN4 (652536) to UticaJ4 (652526) 230 kV d. FTRANDL4 (652509) to UticaJ4 (652526) 230 kV

No.	Fault ID	Fault Descriptions
79	**FLT1008-SB**	UTICAJC4 230 kV Stuck Breaker Scenario 3 a. Apply L-G fault at the UTICAJC4 (652526) 230 kV bus. b. Clear fault after 16 cycles and trip the following elements c. UTICAJC4 (652526) 230 kV to (652626) 115kV to (652627) 13.2kV Transformer d. VFODNES4 (652398) to UticaJ4 (652526) 230 kV
80	**FLT1009-SB**	UTICAJC4 230 kV Stuck Breaker Scenario 4 a. Apply L-G fault at the UTICAJC4 (652526) 230 kV bus. b. Clear fault after 16 cycles and trip the following elements c. UTICAJC4 (652526) 230 kV to (652626) 115kV to (652627) 13.2kV Transformer d. FTRANDL4 (652509) to UticaJ4 (652526) 230 kV
81	**FLT1010-SB**	UTICAJC4 (652526) 230kV Stuck Breaker Scenario 5 a. Apply L-G fault at the UTICAJC4 (652526) 230kV bus b. Clear fault after 16 cycles and trip the following elements c. UTICAJC4 (652526) to VFODNES4 (652398) 230 kV line d. UTICAJC4 (652526) to FTRANDL4 (652509) 230 kV line
82	**FLT1011-SB**	UTICAJC4 (652526) 230kV Stuck Breaker Scenario 6 a. Apply L-G fault at the UTICAJC4 (652526) 230kV bus b. Clear fault after 16 cycles and trip the following elements c. UTICAJC4 (652526) 230 kV to (652626) 115kV to (652627) 13.2kV Transformer d. UTICAJC4 (652526) to RASMUSN4 (652536) 230 kV line
83	**FLT9042-3PH**	3 phase fault on the GR ISLD-LNX3 (653871) to HOLT.CO3 (640510) 345 kV circuit 1 line a. Apply fault at the GR ISLD-LNX3 (653871) 345 kV bus b. Clear fault after 6 cycles by tripping the faulted line
84	**FLT9042.1-3PH**	3 phase fault on the GR ISLD-LNX3 (653871) to HOLT.CO3 (640510) 345 kV circuit 1 line a. Apply fault at the HOLT.CO3 (640510) 345 kV bus b. Clear fault after 6 cycles by tripping the faulted line
85	**FLT9043-PO5**	Prior Outage of GR ISLD-LNX3 (653871) to HOLT.CO3 (640510) 345 kV circuit 1 line; 3 phase fault on the UTICAJC4 (652526) to RASMUSN4 (652536) 230 kV circuit 1 line a. Apply fault at the UTICAJC4 (652526) 230kV bus b. Clear fault after 6 cycles by tripping the faulted UTICAJC4 (652526) to RASMUSN4 (652536) 230 kV line
86	**FLT9044-PO5**	Prior Outage of GR ISLD-LNX3 (653871) to HOLT.CO3 (640510) 345 kV circuit 1 line; 3 phase fault on the FTRANDL4 (652509) to SIOUXCY4 (652565) 230 kV circuit 1 line a. Apply fault at the FTRANDL4 (652509) 230kV bus b. Clear fault after 6 cycles by tripping the faulted FTRANDL4 (652509) to SIOUXCY4 (652565) 230 kV line

4.3 Results

The stability analysis was carried out on both the basecase (Prior to the project inclusion) as well as on the transfer case in order to determine the effect of the project on the dynamic stability of the system.

Table 4-2 summarizes result for the SPP Disturbance Performance Requirements machine rotor angle damping and transient voltage recovery criteria as well as system stability for all the faults studied.

Table 4-2: Transient Fault Analysis Results for IAISIS

FAULT	Main			GGS		
	17W	18S	26S	17W	18S	26S
FLT107-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT108-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT109-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT110-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT111-SB	Stable	Stable	Stable	Stable	Stable	Stable
FLT113-SB	Stable	Stable	Stable	Stable	Stable	Stable
FLT1001-SB	Stable	Stable	Stable	Stable	Stable	Stable
FLT1002-SB	Stable	Stable	Stable	Stable	Stable	Stable
FLT1003-SB	Stable	Stable	Stable	Stable	Stable	Stable
FLT1004-SB	Stable	Stable	Stable	Stable	Stable	Stable
FLT1005-SB	Stable	Stable	Stable	Stable	Stable	Stable
FLT1006-SB	Stable	Stable	Stable	Stable	Stable	Stable
FLT1007-SB	Stable	Stable	Stable	Stable	Stable	Stable
FLT1008-SB	Stable	Stable	Stable	Stable	Stable	Stable
FLT1009-SB	Stable	Stable	Stable	Stable	Stable	Stable
FLT9001-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9002-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9003-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9004-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9005-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9006-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9007-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9008-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9009-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9010-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9011-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9012-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9013-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9014-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9015-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9016-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9017-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9018-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9019-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9020-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9021-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9022-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9023-3PH	Stable	Stable	Stable	Stable	Stable	Stable

FAULT	Main			GGS		
	17W	18S	26S	17W	18S	26S
FLT9024-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9025B-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9026-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9027-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9028-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9029-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9030-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9031-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9032-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9033-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9034-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9035-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9036-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9037-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9038-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9039-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9040-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9041-3PH	Stable	Stable	Stable	Stable	Stable	Stable
FLT9002-PO1	Stable	Stable	Stable	Stable	Stable	Stable
FLT9003-PO1	Stable	Stable	Stable	Stable	Stable	Stable
FLT9010-PO1	Stable	Stable	Stable	Stable	Stable	Stable
FLT9011-PO1	Stable	Stable	Stable	Stable	Stable	Stable
FLT9012-PO1	Stable	Stable	Stable	Stable	Stable	Stable
FLT9013-PO1	Stable	Stable	Stable	Stable	Stable	Stable
FLT9037-PO1	Stable	Stable	Stable	Stable	Stable	Stable
FLT9038-PO1	Stable	Stable	Stable	Stable	Stable	Stable
FLT9039-PO1	Stable	Stable	Stable	Stable	Stable	Stable
FLT9001-PO2	Stable	Stable	Stable	Stable	Stable	Stable
FLT9002-PO2	Stable	Stable	Stable	Stable	Stable	Stable
FLT9003-PO2	Stable	Stable	Stable	Stable	Stable	Stable
FLT9010-PO2	Stable	Stable	Stable	Stable	Stable	Stable
FLT9011-PO2	Stable	Stable	Stable	Stable	Stable	Stable
FLT9012-PO2	Stable	Stable	Stable	Stable	Stable	Stable
FLT9013-PO2	Stable	Stable	Stable	Stable	Stable	Stable
FLT9027-PO2	Stable	Stable	Stable	Stable	Stable	Stable
FLT9028-PO2	Stable	Stable	Stable	Stable	Stable	Stable
FLT9001-PO3	Stable	Stable	Stable	Stable	Stable	Stable
FLT9002-PO3	Stable	Stable	Stable	Stable	Stable	Stable
FLT9003-PO3	Stable	Stable	Stable	Stable	Stable	Stable

FAULT	Main			GGS		
	17W	18S	26S	17W	18S	26S
FLT9027-PO3	Stable	Stable	Stable	Stable	Stable	Stable
FLT9028-PO3	Stable	Stable	Stable	Stable	Stable	Stable
FLT9037-PO3	Stable	Stable	Stable	Stable	Stable	Stable
FLT9038-PO3	Stable	Stable	Stable	Stable	Stable	Stable
FLT9039-PO3	Stable	Stable	Stable	Stable	Stable	Stable
FLT9010-PO4	Stable	Stable	Stable	Stable	Stable	Stable
FLT9011-PO4	Stable	Stable	Stable	Stable	Stable	Stable
FLT9012-PO4	Stable	Stable	Stable	Stable	Stable	Stable
FLT9013-PO4	Stable	Stable	Stable	Stable	Stable	Stable
FLT9027-PO4	Stable	Stable	Stable	Stable	Stable	Stable
FLT9028-PO4	Stable	Stable	Stable	Stable	Stable	Stable
FLT9037-PO4	Stable	Stable	Stable	Stable	Stable	Stable
FLT9038-PO4	Stable	Stable	Stable	Stable	Stable	Stable
FLT9039-PO4	Stable	Stable	Stable	Stable	Stable	Stable

No issues were observed during any of the stability runs.

5.0 SHORT CIRCUIT ANALYSIS

5.1 Study Methodology and Criteria

The short circuit analysis was performed on the 2018 & 2026 Summer Peak stability analysis cases using the PSS/E ASCC program. Since the power flow model does not contain negative and zero sequence data, only three-phase symmetrical fault current levels were calculated at the point of interconnection up to and including five levels away.

Short Circuit Analysis was conducting using flat conditions with the following PSS/E ASCCC program settings:

- BUS VOLTAGES SET TO 1 PU AT 0 PHASE ANGLE
- GENERATOR P=0, Q=0
- TRANSFORMER TAP RATIOS=1.0 PU and PHASE ANGLES=0.0
- LINE CHARGING=0.0 IN +/-/0 SEQUENCE
- LOAD=0.0 IN +/- SEQUENCE, CONSIDERED IN ZERO SEQUENCE
- LINE/FIXED/SWITCHED SHUNTS=0.0 AND MAGNETIZING ADMITTANCE=0.0 IN +/-/0 SEQUENCE
- DC LINES AND FACTS DEVICES BLOCKED
- TRANSFORMER ZERO SEQUENCE IMPEDANCE CORRECTIONS IGNORED

5.2 Results

The results of the short circuit analysis for the 2018SP and 2026SP models are summarized in the tables below. Details of the fault current for facilities within 5 buses from the generator's point of interconnection is provided in Appendix C.

Table 5-1: SC Fault Analysis Results for 18SP

Voltage (kV)	Max Delta Change (%) p.u.	Max SC Bus no	Bus Name
69	0.11%	659901	EAGLE 8 69.000
115	1.90%	652626	UTICAJC7 115.00
161	0.68%	652566	SIOUXCY5 161.00
230	**14.34%**	**563230**	**GEN2018-070 230.00**
345	1.24%	652564	SIOUXCY3 345.00

Table 5-2: SC Fault Analysis Results for 26SP

Voltage (kV)	Max Delta Change (%) p.u.	Max SC Bus no	Bus Name
69	0.10	659901	EAGLE 8 69.000
115	1.88	652626	UTICAJC7 115.00
161	0.66	652566	SIOUXCY5 161.00
230	**14.34**	**563230**	**GEN2018-070 230.00**
345	1.20	652564	SIOUXCY3 345.00

6.0 CONCLUSION

The Study determined that Phase I of the power flow, stability, and short circuit analysis conducted to evaluate the GEN-2018-070 interim interconnection did not identify adverse impacts on the SPP system.

For the Power flow analysis, the studied non-converge contingencies with distribution factor (DF) violation was not identified in cases. No thermal overloads or voltages issues with DF violation were observed for the study cases.

The stability analysis was carried out on both the basecases (Prior to the project inclusion) as well as on the transfer case in order to determine the effect of the project on the dynamic stability of the system. The studied areas listed in the previous section were monitored and found stable during simulation.

The results from short circuit analysis showed that the maximum change in the fault currents in the immediate systems at or near GEN-2018-070 was approximately 0.143 p.u (62.2 Amps) with the original short circuit fault level at 9.3kA, at the POI for the 2018SP and 2026SP cases.

APPENDIX A - SHORT CIRCUIT ANALYSIS DETAILED DATA

Output for 18S MDWG

```
2016 MDWG FINAL WITH 2015 SERIES MMWG FINAL
 MDWG 2018S WITH MMWG 2017S

 OPTIONS USED:
     - SET PRE-FAULT VOLTAGE ON ALL BUSES TO  1.00 PU AT 0 PHASE SHIFT ANGLE
     - SET SYNCHRONOUS/ASYNCHRONOUS MACHINE POWER OUTPUTS TO P=0.0, Q=0.0
     - SET GENERATOR POSITIVE SEQUENCE REACTANCES TO SUBTRANSIENT
     - SET TRANSFORMER TAP RATIOS=1.0 PU AND PHASE SHIFT ANGLES=0.0
     - SET LINE CHARGING=0.0 IN +/-/0 SEQUENCES
     - SET LINE/FIXED/SWITCHED SHUNTS=0.0 AND TRANSFORMER MAGNETIZING ADMITTANCE=0.0 IN +/-/0
SEQUENCES
     - SET LOAD=0.0 IN +/- SEQUENCES
     - DC LINES AND FACTS DEVICES BLOCKED
     - IMPEDANCE CORRECTIONS NOT APPLIED TO TRANSFORMER ZERO SEQUENCE IMPEDANCES

                                   THREE PHASE FAULT
 X---------- BUS ----------X         RE(I+)   IM(I+)
 560074 [G16-017-TAP 345.00] PU      2.1511 -35.4477
 560347 [G10-051-TAP 230.00] PU      2.9213 -27.9086
 563230 [GEN-2015-089230.00] PU      2.9041 -21.2126
 587760 [GEN-2016-094230.00] PU      4.5904 -49.8438
 587764 [G16-094-TAP 230.00] PU      4.6930 -51.1483
 601006 [SPLT RK3    345.00] PU      7.2091 -86.3042
 602004 [SPLT RK4    230.00] PU      4.3927 -49.7654
 603012 [LAWRENC7    115.00] PU      5.3320 -57.2324
 635200 [RAUN   3    345.00] PU     11.3578-150.4341
 635223 [PLYMOTH5    161.00] PU      5.9665 -54.5560
 640080 [BELDEN 7    115.00] PU      3.0499 -12.8292
 640126 [E.COL. 4    230.00] PU      3.6180 -37.4215
 640131 [COLMB.W4    230.00] PU      3.7808 -37.8919
 640133 [COLMBUS4    230.00] PU      4.0557 -43.9410
 640134 [KELLY  7    115.00] PU      4.6619 -34.4299
 640163 [EMERSON7    115.00] PU      2.3610 -10.4745
 640305 [ONEILL 7    115.00] PU      2.5046  -7.3194
 640343 [SHELCRK4    230.00] PU      3.6098 -41.8869
 640349 [SPENCER7    115.00] PU      2.4674  -8.6893
 640386 [TWIN CH4    230.00] PU      4.2358 -33.3178
 640387 [TWIN CH7    115.00] PU      2.5053 -20.8288
 640388 [TWIN CH8    69.000] PU      0.7327  -9.1794
 640424 [S.SIOUXCITY7115.00] PU      1.8192 -14.3318
 640540 [MEADOWGROVE4230.00] PU      2.6757 -21.9346
 648506 [PR BRZ 4    230.00] PU      1.7996 -16.6580
 652235 [SIOUXFL8    69.000] PU      0.2369  -4.6313
 652249 [ARMOUR 8    69.000] PU      0.3121  -2.8882
 652276 [FTTHOMP8    69.000] PU      0.4495  -5.2643
 652277 [LAKPLAT8    69.000] PU      0.2338  -4.7889
 652278 [HANLON18    69.000] PU      0.1240  -3.6032
 652279 [HANLON28    69.000] PU      0.1240  -3.6032
 652287 [RASMUSN8    69.000] PU      0.1530  -3.7728
 652397 [VFODNES7    115.00] PU      0.9533 -12.4721
 652398 [VFODNES4    230.00] PU      3.0808 -27.6388
 652399 [VFODNES8    69.000] PU      0.1805  -5.0134
 652463 [WH SWAN7    115.00] PU      2.9280 -23.7915
 652475 [BONESTL7    115.00] PU      1.7571  -6.6844
 652478 [GREGORY7    115.00] PU      1.1667  -4.0490
 652488 [PHILTAP4    230.00] PU      1.8722 -14.5629
 652501 [ARMOUR 7    115.00] PU      2.0317  -7.9684
 652502 [BERSFRD7    115.00] PU      1.7546  -6.0794
```

```
652505 [FLANDRU7    115.00] PU      2.1050  -7.7806
652506 [FTTHOMP3    345.00] PU      3.1666 -53.9901
652507 [FTTHOMP4    230.00] PU      6.1754 -78.7560
652509 [FTRANDL4    230.00] PU      4.7064 -42.8826
652510 [FTRANDL7    115.00] PU      2.8712 -24.4121
652511 [GAVINS 7    115.00] PU      3.3528 -17.0144
652513 [HANLON 4    230.00] PU      2.3589 -23.7447
652514 [HURON  4    230.00] PU      4.6720 -42.2315
652516 [LAKPLAT4    230.00] PU      2.8985 -22.0310
652518 [MTVERN 7    115.00] PU      1.8552  -8.3382
652519 [OAHE   4    230.00] PU      4.5677 -55.9217
652521 [SULLYBT4    230.00] PU      2.8477 -25.8747
652523 [SIOUXFL4    230.00] PU      4.5244 -51.3222
652524 [SIOUXFL7    115.00] PU      5.2157 -50.5893
652525 [TYNDALL7    115.00] PU      1.9653  -7.2191
652526 [UTICAJC4    230.00] PU      3.8363 -31.0371
652530 [WATERTN4    230.00] PU      5.3361 -55.6785
652536 [RASMUSN4    230.00] PU      3.4581 -25.9796
652540 [BIGBND14    230.00] PU      3.7759 -46.1062
652541 [BIGBND24    230.00] PU      3.7276 -46.8089
652563 [SPENCER5    161.00] PU      4.1884 -24.3134
652564 [SIOUXCY3    345.00] PU      7.3997 -88.1910
652565 [SIOUXCY4    230.00] PU      7.2287 -76.5290
652566 [SIOUXCY5    161.00] PU      5.5821 -55.8345
652567 [DENISON4    230.00] PU      3.0658 -16.7387
652574 [SIOUXCY8    69.000] PU      3.7771 -20.6636
652578 [PAHOJA 4    230.00] PU      3.7429 -28.6031
652583 [DENISON8    69.000] PU      2.6601 -12.8060
652588 [CLEVELD4    230.00] PU      2.5659 -18.7056
652591 [HANLON 7    115.00] PU      1.0147 -10.9239
652606 [LETCHER4    230.00] PU      2.0265 -18.6813
652607 [WESSINGTON 4230.00] PU      2.3375 -26.9222
652614 [CARPENTER 4 230.00] PU      3.1060 -26.8290
652626 [UTICAJC7    115.00] PU      2.2229 -17.2275
652806 [FTTHOM1-LNX3345.00] PU      3.1666 -53.9901
652807 [FTTHOM2-LNX3345.00] PU      3.1666 -53.9901
652833 [GRPRAR2-LNX3345.00] PU      2.7478 -40.5216
652864 [SIOUXCY-LNX3345.00] PU      7.3997 -88.1910
655126 [MOS-VERM-ER869.000] PU      0.5712  -2.2284
655130 [SW808-ER8   69.000] PU      0.4613  -2.8540
655136 [SW832-ER8   69.000] PU      0.4854  -2.9451
655137 [SW833-ER8   69.000] PU      0.5907  -2.3090
655145 [SW870-ER8   69.000] PU      0.3200  -3.2714
655146 [SW873-ER8   69.000] PU      0.3203  -3.2699
655147 [MOS-JEFF-ER869.000] PU      0.4259  -2.8603
655153 [MOS-AMES-ER869.000] PU      0.4738  -5.1900
655161 [SW1109-ER8  69.000] PU      0.6104  -3.4459
655250 [CHMBRLAN-ER869.000] PU      0.5834  -1.7969
655347 [MOS-BCKS-ER869.000] PU      0.5123  -3.4956
655362 [LINCOLN-ER7 115.00] PU      1.5271  -7.1427
655377 [SW1145-ER7  115.00] PU      5.6154 -48.0791
655382 [MOS-C-H-ER8 69.000] PU      0.5837  -3.6303
655383 [MOS-P-T-ER8 69.000] PU      0.3674  -4.5202
655385 [MOS-LKPL-ER869.000] PU      0.2410  -4.7712
655404 [HRRISBRG-ER7115.00] PU      1.5358  -7.2031
655408 [SXFCHCLR-ER7115.00] PU      0.8806  -7.5470
655418 [FREEMAN-ER7 115.00] PU      1.1142  -4.9695
659122 [STORLA 4    230.00] PU      2.3562 -23.9335
659205 [BRDLAND4    230.00] PU      3.9956 -38.3697
659295 [SDPRAIRWND 4230.00] PU      1.7562 -22.2604
659716 [MAPLETAP-LO7115.00] PU      6.8957 -25.1675
```

```
 659900 [EAGLE  4    230.00] PU      4.1469 -27.9361
 659901 [EAGLE  8    69.000] PU      2.1834 -16.0700
 660004 [MITCHEL7    115.00] PU      2.1693 -11.4640
 660005 [TRIPP  7    115.00] PU      1.6383  -8.2687
 660006 [YKNTJCT7    115.00] PU      3.2692 -16.0645
 660007 [MENNOJT7    115.00] PU      2.1333 -12.8718
 660018 [B_H WIND   7115.00] PU      1.2640  -6.9966
 660026 [NAPA JCT7   115.00] PU      3.0318 -15.2879
 660036 [YANKTONEAST7115.00] PU      1.8016  -7.7338
```

Output for 26S MDWG

```
2016 MDWG FINAL WITH 2015 SERIES MMWG FINAL
 MDWG 2026S WITH MMWG 2026S

 OPTIONS USED:
     - SET PRE-FAULT VOLTAGE ON ALL BUSES TO  1.00 PU AT 0 PHASE SHIFT ANGLE
     - SET SYNCHRONOUS/ASYNCHRONOUS MACHINE POWER OUTPUTS TO P=0.0, Q=0.0
     - SET GENERATOR POSITIVE SEQUENCE REACTANCES TO SUBTRANSIENT
     - SET TRANSFORMER TAP RATIOS=1.0 PU AND PHASE SHIFT ANGLES=0.0
     - SET LINE CHARGING=0.0 IN +/-/0 SEQUENCES
     - SET LINE/FIXED/SWITCHED SHUNTS=0.0 AND TRANSFORMER MAGNETIZING ADMITTANCE=0.0 IN +/-/0
SEQUENCES
     - SET LOAD=0.0 IN +/- SEQUENCES
     - DC LINES AND FACTS DEVICES BLOCKED
     - IMPEDANCE CORRECTIONS NOT APPLIED TO TRANSFORMER ZERO SEQUENCE IMPEDANCES

                                   THREE PHASE FAULT
 X---------- BUS ----------X         RE(I+)   IM(I+)
 560074 [G16-017-TAP 345.00] PU      2.1586 -35.3072
 560347 [G10-051-TAP 230.00] PU      2.9306 -27.9486
 563230 [GEN-2015-089230.00] PU      2.9202 -21.2877
 587760 [GEN-2016-094230.00] PU      4.5651 -49.3330
 587764 [G16-094-TAP 230.00] PU      4.6668 -50.6093
 601006 [SPLT RK3    345.00] PU      7.3017 -87.4416
 602004 [SPLT RK4    230.00] PU      4.4497 -50.2725
 603012 [LAWRENC7    115.00] PU      5.4514 -58.0198
 635200 [RAUN   3    345.00] PU     11.4465-151.1680
 635223 [PLYMOTH5    161.00] PU      6.0352 -55.0561
 640080 [BELDEN 7    115.00] PU      3.0713 -12.8953
 640126 [E.COL. 4    230.00] PU      3.6350 -37.5241
 640131 [COLMB.W4    230.00] PU      3.7980 -38.0072
 640133 [COLMBUS4    230.00] PU      4.0768 -44.0811
 640134 [KELLY  7    115.00] PU      4.6975 -34.5494
 640163 [EMERSON7    115.00] PU      2.3672 -10.4854
 640305 [ONEILL 7    115.00] PU      2.5062  -7.3210
 640343 [SHELCRK4    230.00] PU      3.6268 -42.0062
 640349 [SPENCER7    115.00] PU      2.4697  -8.6918
 640386 [TWIN CH4    230.00] PU      4.2556 -33.4007
 640387 [TWIN CH7    115.00] PU      2.5152 -20.8666
 640388 [TWIN CH8    69.000] PU      0.7340  -9.1868
 640424 [S.SIOUXCITY7115.00] PU      1.8242 -14.3497
 640540 [MEADOWGROVE4230.00] PU      2.6796 -21.9482
 648506 [PR BRZ 4    230.00] PU      1.8010 -16.6633
 652235 [SIOUXFL8    69.000] PU      0.2373  -4.6380
 652249 [ARMOUR 8    69.000] PU      0.3123  -2.8885
 652276 [FTTHOMP8    69.000] PU      0.4497  -5.2601
 652277 [LAKPLAT8    69.000] PU      0.2340  -4.7865
```

652278	[HANLON18 69.000]	PU	0.1241	-3.6049
652279	[HANLON28 69.000]	PU	0.1241	-3.6049
652287	[RASMUSN8 69.000]	PU	0.1531	-3.7744
652397	[VFODNES7 115.00]	PU	0.9554	-12.5002
652398	[VFODNES4 230.00]	PU	3.1034	-27.7876
652399	[VFODNES8 69.000]	PU	0.1805	-5.0183
652463	[WH SWAN7 115.00]	PU	2.9398	-23.8156
652475	[BONESTL7 115.00]	PU	1.7582	-6.6856
652478	[GREGORY7 115.00]	PU	1.1670	-4.0493
652488	[PHILTAP4 230.00]	PU	1.8706	-14.5536
652501	[ARMOUR 7 115.00]	PU	2.0332	-7.9698
652502	[BERSFRD7 115.00]	PU	1.9507	-7.5316
652505	[FLANDRU7 115.00]	PU	2.1131	-7.7982
652506	[FTTHOMP3 345.00]	PU	3.1942	-53.4988
652507	[FTTHOMP4 230.00]	PU	6.1646	-77.0710
652509	[FTRANDL4 230.00]	PU	4.7216	-42.9039
652510	[FTRANDL7 115.00]	PU	2.8831	-24.4366
652511	[GAVINS 7 115.00]	PU	3.5239	-17.7790
652513	[HANLON 4 230.00]	PU	2.3704	-23.8188
652514	[HURON 4 230.00]	PU	4.7098	-42.4224
652516	[LAKPLAT4 230.00]	PU	2.8942	-21.9796
652518	[MTVERN 7 115.00]	PU	1.8565	-8.3388
652519	[OAHE 4 230.00]	PU	4.5426	-55.6174
652521	[SULLYBT4 230.00]	PU	2.8418	-25.8332
652523	[SIOUXFL4 230.00]	PU	4.5844	-51.8659
652524	[SIOUXFL7 115.00]	PU	5.3437	-51.3992
652525	[TYNDALL7 115.00]	PU	1.9840	-7.2603
652526	[UTICAJC4 230.00]	PU	3.8666	-31.2111
652530	[WATERTN4 230.00]	PU	5.3691	-57.0529
652536	[RASMUSN4 230.00]	PU	3.4742	-26.0554
652540	[BIGBND14 230.00]	PU	3.7745	-46.5739
652541	[BIGBND24 230.00]	PU	3.6963	-43.8048
652563	[SPENCER5 161.00]	PU	3.9050	-28.0248
652564	[SIOUXCY3 345.00]	PU	7.4492	-88.6807
652565	[SIOUXCY4 230.00]	PU	7.3058	-77.1180
652566	[SIOUXCY5 161.00]	PU	5.6421	-56.3726
652567	[DENISON4 230.00]	PU	3.0787	-16.7811
652574	[SIOUXCY8 69.000]	PU	3.8057	-20.7441
652578	[PAHOJA 4 230.00]	PU	3.7775	-28.8422
652583	[DENISON8 69.000]	PU	2.6752	-12.8407
652588	[CLEVELD4 230.00]	PU	2.5818	-18.8654
652591	[HANLON 7 115.00]	PU	1.0172	-10.9416
652606	[LETCHER4 230.00]	PU	2.0320	-18.6893
652607	[WESSINGTON 4230.00]	PU	2.3390	-26.8838
652614	[CARPENTER 4 230.00]	PU	3.1237	-26.9575
652626	[UTICAJC7 115.00]	PU	2.2696	-17.4044
652806	[FTTHOM1-LNX3345.00]	PU	3.1942	-53.4988
652807	[FTTHOM2-LNX3345.00]	PU	3.1942	-53.4988
652833	[GRPRAR2-LNX3345.00]	PU	2.7487	-40.5376
652864	[SIOUXCY-LNX3345.00]	PU	7.4492	-88.6807
655126	[MOS-VERM-ER869.000]	PU	0.5714	-2.2290
655130	[SW808-ER8 69.000]	PU	0.4616	-2.8549
655136	[SW832-ER8 69.000]	PU	0.4857	-2.9460
655137	[SW833-ER8 69.000]	PU	0.5910	-2.3095
655145	[SW870-ER8 69.000]	PU	0.3201	-3.2726
655146	[SW873-ER8 69.000]	PU	0.3205	-3.2711
655147	[MOS-JEFF-ER869.000]	PU	0.4262	-2.8612
655153	[MOS-AMES-ER869.000]	PU	0.4740	-5.1859
655161	[SW1109-ER8 69.000]	PU	0.6111	-3.4482
655250	[CHMBRLAN-ER869.000]	PU	0.5832	-1.7965
655347	[MOS-BCKS-ER869.000]	PU	0.5128	-3.4980

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655362 [LINCOLN-ER7 115.00] PU      1.5303  -7.1518
655377 [SW1145-ER7  115.00] PU      5.7512 -48.8089
655382 [MOS-C-H-ER8 69.000] PU      0.5843  -3.6328
655383 [MOS-P-T-ER8 69.000] PU      0.3678  -4.5242
655385 [MOS-LKPL-ER869.000] PU      0.2412  -4.7688
655404 [HRRISBRG-ER7115.00] PU      1.5391  -7.2123
655408 [SXFCHCLR-ER7115.00] PU      0.8822  -7.5573
655418 [FREEMAN-ER7 115.00] PU      1.1209  -4.9836
659122 [STORLA 4    230.00] PU      2.3592 -23.9210
659205 [BRDLAND4    230.00] PU      4.0240 -38.5239
659295 [SDPRAIRWND 4230.00] PU      1.7570 -22.2391
659716 [MAPLETAP-LO7115.00] PU      6.9959 -25.3568
659900 [EAGLE  4    230.00] PU      4.1963 -28.1191
659901 [EAGLE  8    69.000] PU      2.2216 -16.1640
660004 [MITCHEL7    115.00] PU      2.1762 -11.4768
660005 [TRIPP  7    115.00] PU      1.6469  -8.2868
660006 [YKNTJCT7    115.00] PU      3.4028 -16.5465
660007 [MENNOJT7    115.00] PU      2.1636 -12.9582
660018 [B_H WIND   7115.00] PU      1.2694  -7.0084
660026 [NAPA JCT7   115.00] PU      3.1366 -15.6604
660036 [YANKTONEAST7115.00] PU      1.8347  -7.8274
```

APPENDIX B – PRIOR QUEUED INTERCONNECTION REQUESTS, INCLUDED IN STUDY

IAISIS Steady state Analysis:

Gen Bus Name	Area	Zone	PGen	Pmax
G04_014	534	1546	30.9	154.5
G05-12-CB2	534	1549	16.1	91
G05-12-GEN2	534	1549	62	167.9
G06-44-2	526	1502	16	80
G06-44-3	526	1502	22	110
G06-44-4	526	1502	20	100
G0762-WTG2	524	566	42.4	210
G08_037-GEN	525	589	20.16	100.8
G08-123N-GEN	640	686	89.7	89.7
G08-124-WTG1	534	1529	40.02	200.1
G09_001IS_2	652	659	40	200
G10-011	524	566	5.94	29.7
G10-046-GEN	526	1405	0	56
G10-051-GEN	640	686	200	200
G10-055-GEN	520	546	0	4.5
G1014-GEN	645	686	10.5	10.5
G10-14-GEN1	526	1502	35.42	177.1
G10-14-GEN2	526	1502	36.34	181.7
G11-008-GEN1	534	1630	40	200
G11-008-GEN2	534	1630	40	200
G11-008-GEN3	534	1630	40	200
G11-014-GEN	524	566	40.2	201
G11-016-GEN	534	1549	40.02	200.1
G11-019-GEN	524	566	35	175
G11-020-GEN	524	566	33	165
G11-025-GEN	526	1505	16	80
G11-027-GEN	640	686	120	120
G11-037-GEN	525	591	1.4	7
G11-050-GEN	520	549	21.96	109.8
G113 MOWER W	600	602	34.61	98.9
G1149G1504	524	566	50.14	250.7
G1149G1504	524	566	10.58	52.9
G12_012IS_3	652	90	15	75
G12-020-GEN	526	1505	49.06	245.3
G12-024	534	1	36	180
G12-028	525	1	14.96	74.8
G13_002_3	650	696	50.6	50.6
G13_027_3	526	1506	30	148.35
G13-019	650	696	73.6	73.6

Gen Bus Name	Area	Zone	PGen	Pmax
G13-030	524	566	60	300
G13-032	640	686	204	204
G14_001_3	536	1537	40.12	200.6
G14_001IS_3	652	1603	20.74	103.7
G14_010IS_2	652	1628	30	150
G14_020_3	520	549	20	100
G14_031_2	640	686	35.8	35.8
G14_035_3	526	1507	6	30
G14_039_3	640	686	73.39	73.4
G14_056_3	524	567	50	250
G14_057_3	520	549	50	250
G14_064_3	524	566	49.68	248.4
G14-021-GEN1	541	595	31.6	158
G14-021-GEN2	541	595	28.4	142
G15_001_3	524	566	40	200
G15_001_3	524	566	0.3	1.5
G15_005_3	541	595	36.8	184
G15_005_3	541	595	3.22	16.11
G15_007_3	640	686	160	160
G15_013_3	525	590	23.99	120
G15_014_3	526	1505	30	150
G15_015_3	524	566	30.91	154.56
G15_016_3	541	1550	40	200
G15_020_3	526	1504	19.99	99.96
G15_021_3	534	1525	4	20
G15_023_4	640	686	150.36	150.36
G15_023_5	640	686	150.36	150.36
G15_024_3	536	1537	44	220
G15_025_4	536	1537	44	220
G15_029_3	524	566	32.2	161
G15034_3	524	566	40	200
G15036_4	524	567	30.36	151.8
G15036_5	524	567	30.36	151.8
G15045_2	520	549	0	20
G15046_3	652	1628	60	300
G15047_3	524	566	60	300
G15048_3	524	566	40	200
G15052_3	536	1537	60	300
G15055_3	525	589	8	40
G15056_3	526	1505	20.24	101.2

Gen Bus Name	Area	Zone	PGen	Pmax
G15057_3	524	567	20	100
G15063_3	524	566	60	300
G15064_3	534	1528	39.56	197.8
G15065_3	534	1528	40.48	202.4
G15066_3	524	566	49.68	248.4
G15069_3	536	1535	60	300
G15071_3	520	549	40	200
G15073_3	536	1534	40.02	200.1
G15076_4	640	686	79.2	79.2
G15076_5	640	686	79.2	79.2
G15082_3	524	566	40	200
G15087_3	640	686	66	66
G15088_3	640	686	300	300
G15089_3	652	1604	218.31	218.31
G15090_3	536	1537	44	220
G15092_3	520	549	28	140
G15092_4	520	549	22	110
G15093_3	524	567	28	140
G15093_4	524	567	22	110
G15095_3	525	587	35.2	176
G15098_3	652	1602	20	100
G16-003-GEN1	524	566	49.68	248.4
G16-004-GEN1	652	1628	40.32	201.6
G16-005-GEN1	534	1529	0	150
G16-007-GEN1	652	1605	20.01	100.05
G16-009-GEN1	524	566	0	14.5
G16-009-GEN2	524	566	0	14.5
G16-015-GEN1	526	1508	20	100
G16-016-GEN1	531	1520	15.64	78.2
G16-017-GEN1	652	1604	50.14	250.7
G16-020-GEN1	525	587	30	150
G16-022-GEN1	524	566	30.36	151.84
G16-028-GEN1	520	548	20	100
G16-030-GEN1	524	567	20	100
G16-032-GEN1	524	569	40	200
G16-037-GEN1	520	549	60	300
G16-043-GEN1	640	686	230	230
G16-045-GEN1	524	569	49.68	248.4
G16-045-GEN2	524	569	50.14	250.7
G16-046-GEN1	534	1529	59.8	299

Gen Bus Name	Area	Zone	PGen	Pmax
G16-050-GEN1	640	686	250.7	250.7
G16-056-GEN1	526	1505	40	200
G16-057-GEN1	524	569	49.68	248.4
G16-057-GEN2	524	569	50.14	250.7
G16-061-GEN1	524	566	50.14	250.7
G16-062-GEN1	526	1508	50.14	250.7
G16-063-GEN1	524	567	40	200
G16-067-GEN1	534	1528	14.72	73.6
G16-068-GEN1	524	566	50	250
G16-069-GEN1	526	1507	6.27	31.35
G16-071-GEN1	524	566	40.02	200.1
G16-075-GEN1	652	1604	50	50
J183 PROSEW2	600	606	49.58	99.1
J183 PROSEW1	600	606	50.44	100.8
J290 BORDR W	600	605	52.5	150
J278 PVS W2	600	602	35	100
J278 PVS W1	600	602	35	100
J263 COURT W	620	605	35	100
J262 COURT W	620	605	35	100
J233_3	627	665	0	215
J233_2	627	665	0	210
J233_1	627	665	0	210

IAISIS Dynamic and Short Circuit Analysis:

Gen Bus Name	Area	Zone	PGen	Pmax	Notes
G830_GEN	615	639	14.82	99.82	
G11-014-GEN1	524	566	19.8	99	
G11-014-GEN2	524	566	19.8	99	
G10-055-GEN1	520	546	4.8	4.8	
G15-089-GEN1	999	1604	218.9	219.5	
G08-123NGEN1	640	686	80.5	80.5	
G08-123NGEN2	640	686	2	2	
G08-123NGEN3	640	686	7.16	7.16	
G08-047-GEN1	524	566	49.98	249.9	
G08-047-GEN2	524	566	9.86	49.3	
G10-014-GEN1	1	1	35.42	177.1	
G10-014-GEN2	1	1	36.34	181.7	
G08-022-GEN3	526	1507	10	50	
G08-098-GEN2	536	1536	2	10	
G10-003-GEN1	536	1536	19.74	98.7	
G06-044GEN1A	526	1502	16	80	
G06-044GEN2A	526	1502	15.2	76	
G06-044GEN2B	526	1502	26.8	134	
G08-018-GEN1	526	1502	49.95	249.8	
G08-051-GEN2	526	1503	32.2	161	
G06-020NGEN2	640	686	6	6	
G08-124-GEN1	534	1529	19.78	98.9	
G08-124-GEN2	534	1529	20.24	101.2	
G10-051-GEN1	640	686	22.1	22.1	
G10-051-GEN2	640	686	57.8	57.8	
G10-051-GEN3	640	686	119	119	
G11-027-GEN1	640	686	70.3	70.3	
G11-027-GEN2	640	686	40.7	40.7	
G11-027-GEN3	640	686	9.25	9.25	
G10-046-GEN1	526	1505	56.05	56.05	
G10-041-GEN1	645	691	10.5	10.5	
G11-025-GEN1	526	1505	1.37	6.86	
G11-025-GEN2	526	1505	0.4	2	
G11-025-GEN3	526	1505	0.42	2.1	
G11-025-GEN4	526	1505	13.8	69	
G11-008-GEN1	534	1529	40	200	
G11-016-GEN1	524	1529	40.02	200.1	
G11-008-GEN2	534	1529	40	200	

G11-008-GEN3	534	1529	40	200	
G11-049-GEN1	524	566	30.36	151.8	
G11-050-GEN1	520	549	21.6	108	
G13-022-GEN1	526	1504	4.84	24.2	
G12-024-GEN1	534	1529	35.64	178.2	
G13-002-GEN1	650	696	50.6	50.6	
G13-019-GEN1	650	696	73.6	73.6	
G13-030-GEN1	524	566	29.9	149.5	
G13-030-GEN2	524	566	29.9	149.5	
G13-027-GEN1	526	1505	29.67	148.4	
G14-001-GEN1	536	1537	20.16	100.8	
G14-001-GEN2	536	1537	19.74	98.7	
G14-020-GEN1	520	549	6.8	34	
G14-020-GEN2	520	549	13.02	65.1	
G14-033-GEN2	526	1507	0.64	3.2	
G14-035-GEN1	526	1507	6	30	
G14-056-GEN2	524	567	3.58	17.9	
G14-056-GEN3	1	1	27	135	
G14-057-GEN1	520	549	49.98	249.9	
G14-039-GEN1	640	686	60	60	
G14-039-GEN2	640	686	13.34	13.34	
G14-064-GEN1	524	566	49.68	248.4	
G14-037-GEN1	1	1	18.4	92	
G14-037-GEN2	1	1	21.6	108	
G14-040-GEN1	1	1	33.58	167.9	
G14-040-GEN2	1	1	30.36	151.8	
G15-007-GEN1	640	686	160	160	
G15-013-GEN1	525	590	23.99	120	
G15-015-GEN1	524	566	26.77	133.9	
G15-015-GEN2	524	566	4.14	20.7	
G15-020-GEN1	526	1504	19.99	99.96	
G15-021-GEN1	534	1525	4	20	
G15-023-GEN1	640	686	150.36	150.4	
G15-023-GEN2	640	686	150.36	150.4	
G15-030-GEN1	524	566	40.02	200.1	
G15-029-GEN1	524	566	32.2	161	
G15-034-GEN1	524	566	39.33	196.7	
G15-034-GEN2	524	566	0.67	3.35	
G15-036-GEN1	524	567	30.36	151.8	
G15-036-GEN2	524	567	30.36	151.8	
G15-045-GEN1	520	549	20	20	

G15-046-GEN1	652	1628	60	300	
G15-048-GEN1	524	566	40	200	
G15-052-GEN1	536	1537	60	300	
G15-055-GEN1	525	589	8	40	
G15-056-GEN1	526	1505	20.24	101.2	
G15-057-GEN1	524	567	1.79	8.95	
G15-057-GEN2	524	567	13.34	66.7	
G15-057-GEN3	524	567	5	25	
G15-058-GEN1	526	1507	10	50.01	
G15-064-GEN1	534	1528	39.56	197.8	
G15-065-GEN1	534	1528	40.48	202.4	
G15-066-GEN1	524	566	49.68	248.4	
G15-068-GEN1	526	1505	60	300	
G15-069-GEN1	536	1535	59.85	299.3	
G15-071-GEN1	520	549	40	200	
G15-073-GEN1	536	1534	6.76	33.78	
G15-073-GEN2	536	1534	33.26	166.3	
G15-075-GEN1	526	1505	10.3	51.48	
G15-076-GEN1	640	686	79.2	79.2	
G15-076-GEN2	640	686	79.2	79.2	
G15-079-GEN1	526	1506	25.84	129.2	
G15-080-GEN1	526	1506	25.84	129.2	
G15-082-GEN1	524	566	40	200	
G15-084-GEN1	520	533	10.26	51.3	
G15-085-GEN1	520	590	24.48	122.4	
G15-087-GEN1	640	686	66	66	Excluded from LOIS 2015-89
G15-088-GEN1	640	686	300	300	
G15-093-GEN1	524	567	28	140	
G15-093-GEN2	524	567	22	110	
G15-092-GEN1	520	549	28	140	
G15-092-GEN2	520	549	22	110	
G15-095-GEN1	525	587	35.2	176	
G15-096-GEN2	652	1628	2.51	12.53	
G15-098-GEN1	652	1602	19.79	98.9	
G16-003-GEN1	524	566	49.68	248.4	
G16-004-GEN1	652	659	3.6	18	
G16-004-GEN2	652	659	36.72	183.6	
G16-005-GEN1	534	1529	30	150	
G16-007-GEN1	652	1605	20.01	100.1	
G16-009-GEN1	524	566	14.5	14.5	
G16-009-GEN2	524	566	14.5	14.5	

G16-015-GEN1	526	1508	20	100	
G16-016-GEN1	531	1520	15.64	78.2	
G16-017-GEN1	652	1604	50.14	250.7	
G16-020-GEN1	525	587	30	150	
G16-022-GEN1	524	566	30.36	151.8	
G16-028-GEN1	520	548	20	100	
G16-030-GEN1	524	567	19.98	99.9	
G16-032-GEN1	524	569	40	200	
G16-037-GEN1	520	549	60	300	
G16-043-GEN1	640	686	219.6	219.6	
G16-043-GEN2	640	686	10.35	10.35	
G16-045-GEN1	524	569	49.68	248.4	
G16-045-GEN2	524	569	50.14	250.7	
G16-046-GEN1	534	1529	59.8	299	
G16-050-GEN1	640	686	250.7	250.7	Excluded from LOIS 2015-89
G16-056-GEN1	526	1505	40	200	
G16-057-GEN1	524	569	49.68	248.4	
G16-057-GEN2	524	569	50.14	250.7	
G16-061-GEN1	524	566	50.14	250.7	
G16-062-GEN1	526	1508	50.14	250.7	
G16-063-GEN1	524	567	20	100	
G16-063-GEN2	524	567	20	100	
G16-067-GEN1	534	1528	14.72	73.6	
G16-068-GEN1	524	566	28	140	
G16-068-GEN2	524	566	22	110	
G16-069-GEN1	526	1507	6.27	31.35	
G16-073-GEN1	536	1537	44	220	
G01-036-GEN1	526	1504	16	80	
G05-008-GEN1	524	566	24	120	
ASGI10-010 1	526	1508	34.09	42.2	
ASGI1605_GEN	652	1604	4	20	
ASGI1606_GEN	652	1634	4	20	
ASGI1607_GEN	652	1634	4	20	
ASGI1603_GEN	541	1550	12	12	
ASGI164_GEN1	526	1504	0.08	0.4	
ASGI164_GEN2	526	1504	1.92	9.6	
ASGI1706-GEN	330	301	47.6	238	
ASGI1708-GEN	330	305	28.5	142.5	
ASGI1708-G2	330	305	3.22	16.1	

IAISIS MISO Generators:

Gen Bus Name	Area	Zone	PGen	Pmax
J399	600	601	232	232
J407 G1	627	665	14.97	100
J407 G2	627	665	14.97	100
J405	661	1636	38.39	40
J506-A-GEN	635	635	100	100
J506-B-GEN	635	635	100	100
J442 G	620	655	30.73	200
J436 D-VAR	620	655	0	0
J436 G	620	655	30	150
J437 D-VAR	620	655	0	0
J437 G	620	655	30	150
J438 G	627	665	170	170
J449 G	627	665	30.25	202
J412 G1	635	679	15.36	100.24
J412 G2	635	679	15.36	100.24
J455 G1	635	679	30	150
J455 G2	635	679	30	150
J391	600	1627	47.99	50
J493 G	620	648	30	150
J488 G	620	655	30.36	151.8
J432 G	600	606	19.6	98
J460 G	600	601	20	100
J460 G2	600	601	20	100
J489 G	620	655	30.36	151.8
J495 G1	627	665	100	100
J495 G2	627	665	100	100
J527 G	635	679	125	125
J527 G2	635	679	125	125
J528 G	635	679	100	100
J528 G2	635	679	100	100
J485 G	613	656	9.37	9.37
J485 G	613	656	9.37	9.37
J485 G	613	656	9.37	9.37
J485 G	613	656	9.37	9.37
J485 G	613	656	9.37	9.37
J475 G1	635	680	168	168
J475 G2	635	680	32	32
J534 G	635	679	125	125
J534 G2	635	679	125	125
J535 G	635	679	210	210
J525 G	600	640	6.6	33
J510 G	620	655	266	284.5
J504 G	627	665	50	50
J526 G	620	655	30	150
J526 G2	620	655	30	150
J529J590GEN1	635	679	25	125
J529J590GEN1	635	679	9	45
J529J590GEN2	635	679	25	125
J529J590GEN2	635	679	9	45
J530 G	635	680	125	125
J530 G2	635	680	125	125

J302 G	661	1636	20.24	101.2
J414 G	627	665	2.76	13.8
J414 G	627	665	21.24	106.2
J415 G4	627	665	18	90
J415 G1	627	665	2.3	11.5
J415 G2	627	665	2.3	11.5
J415 G3	627	665	17.5	87.5
J439 G1	635	679	47.6	238
J439 G2	635	679	52.4	262
J457 G	661	1636	30	150
J459 G	620	620	40	200
J476 G	635	679	49.2	246
J503 G	661	1636	19.78	98.9
J511 G1	615	643	3.6	18
J511 G2	615	643	36.4	182
J512 G1	600	606	4	20
J512 G2	600	606	46	230
J541 G	356	1330	80	400
J555 G	635	680	140	140
J569 G	600	606	20	100
J575 G	600	606	20	100
J577 G	600	606	20	100
J583 G	1	1	200	200
J593 G	652	1628	44.8	224
J596 G	652	1604	20	100
J599 G	652	1636	40	200
J607 G	661	1636	30	150
J611 G	540	596	22	110
J613 G	620	648	20	100
J614 G	627	630	13.2	66
J615 G	635	680	70	70
J637 G1	600	606	19.6	98
J524-GEN	635	680	100	100
J523-GEN	627	665	10	50
J183 PROSEW1	600	606	43.34	100.8
J183 PROSEW2	600	606	42.61	99.1
J278 PVS W1	600	602	43	100
J278 PVS W2	600	602	43	100
J290 BORDR W	600	605	64.5	150
J262 COURT W	620	605	43	100
J263 COURT W	620	605	43	100
J426-STONRAY	600	1	14.97	100
J400	600	606	29.75	62
J385	600	601	47.99	100
J233_1	627	665	217	217
J233_2	627	665	217	217
J233_3	627	665	231	231
J416_GEN1	627	1	13.1	87.5
J416_GEN1	627	1	1.72	11.5
J416_GEN2	627	1	13.48	90
J416_GEN2	627	1	1.72	11.5
J500 W1	635	680	168	168
J500 W2	635	680	166	166
J500 W3	635	680	166	166

J499 W1	635	680	170	170
J499 W2	635	680	170	170
J498 W1	635	680	170	170
J498 W2	635	680	170	170
J587 G1	600	606	20	100
J587 G2	600	606	20	100
J594 G1	627	665	30	150
J594 G2	627	665	30	150
J597 G1	600	606	30	150
J597 G2	600	606	30	150
J598 G1	356	1330	30	150
J598 G2	356	1330	30	150
J638 G1	600	606	20.8	104
J638 G1	600	606	20	100

GEN-2015-089 LOIS Study SPP Generator Projects

Project	MW	Service	Fuel Type	Group Number	Included in Study
GEN-2003-021N	75	ER	Wind	09 NEB	Yes
GEN-2004-023N	75	ER	Coal	09 NEB	Yes
GEN-2006-020N	42	ER	Wind	09 NEB	Yes
GEN-2006-038N005	80	ER	Wind	09 NEB	Yes
GEN-2006-038N019	80	ER	Wind	09 NEB	Yes
GEN-2007-011N08	81	ER	Wind	09 NEB	Yes
GEN-2008-119O	60	ER	Wind	09 NEB	Yes
GEN-2006-037N1	74.8	ER	Wind	09 NEB	Yes
GEN-2006-044N	40.5	ER	Wind	09 NEB	Yes
GEN-2008-086N02	201	ER	Wind	09 NEB	Yes
GEN-2008-123N	89.7	ER	Wind	09 NEB	Yes
GEN-2009-040	73.8	ER	Wind	09 NEB	Yes
GEN-2010-041	10.5	ER	Wind	09 NEB	Yes
GEN-2010-051	200	ER	Wind	09 NEB	Yes
GEN-2011-018	73.6	ER/NR	Wind	09 NEB	Yes
GEN-2011-027	120	ER/NR	Wind	09 NEB	Yes
GEN-2011-056	3.6	ER	Hydro	09 NEB	Yes
GEN-2011-056A	3.6	ER	Hydro	09 NEB	Yes
GEN-2011-056B	4.5	ER	Hydro	09 NEB	Yes
GEN-2012-021	4.8	ER	Gas	09 NEB	Yes
GEN-2013-002	50.6	ER/NR	Wind	09 NEB	Yes
GEN-2013-008	1.2	ER	Wind	09 NEB	Yes
GEN-2013-019	73.6	ER/NR	Wind	09 NEB	Yes
GEN-2013-032	204	ER	Wind	09 NEB	Yes
GEN-2014-004	3.96	ER	Wind	09 NEB	Yes
GEN-2014-013	73.5	ER/NR	Wind	09 NEB	Yes
GEN-2014-031	35.8	ER/NR	Wind	09 NEB	Yes

GEN-2014-032	10.22	ER/NR	Wind	09 NEB	Yes
GEN-2014-039	73.39	ER/NR	Wind	09 NEB	Yes
GEN-2007-017IS	200	ER/NR	Wind	09 NEB	Yes
GEN-2007-018IS	200	ER/NR	Wind	09 NEB	Yes
GEN-2015-007	160	ER	Wind	09 NEB	Yes
GEN-2015-023	300.72	ER/NR	Wind	09 NEB	Yes
GEN-2015-076	158.4	ER	Wind	09 NEB	Yes
GEN-2015-088	300	ER/NR	Wind	09 NEB	Yes
GEN-2016-043	230	ER	Wind	09 NEB	Yes
GEN-2015-089	200	*ER*	*Wind*	*09 NEB*	Yes

GEN-2015-089 LOIS Transmission Projects included in the study:

SPP Notification to Construct (NTC) ID	Project Owner	Transmission Upgrade Name	Estimated Date of Upgrade Completion (EOC)
200309	SPS	Largarto - Sage Brush 115 kV Ckt 1	12/15/2016
200309	SPS	Cardinal - Lagarto 115 kV Ckt 1	12/15/2016
200309	SPS	Cardinal 115 kV Substation	12/15/2016
200309	SPS	Sage Brush 115 kV Substation	12/16/2016
20098	OPPD	Nebraska City - Mullin Creek 345 kV (OPPD)	12/31/2016
20097	TSMO	Sibley - Mullin Creek 345 kV	12/31/2016
20097	TSMO	Nebraska City - Mullin Creek 345 kV (GMO)	12/31/2016
200253	NPPD	Neligh 345/115 kV Substation	6/1/2017
200391	OGE	DeGrasse 345/138kV project	6/1/2017
200411	SPS	Ponderosa - Ponderosa Tap 115 kV Ckt 1	6/1/2017
200396	WFEC	DeGrasse 345/138kV project	6/1/2017
200360	SPS	National Enrichment Plant - Targa 115 kV Ckt 1	8/15/2017
200395	SPS	Livingston Ridge 115 kV Substation Conversion	8/31/2017
200256	SPS	Chaves - Price 115 kV Ckt 1 Rebuild	12/30/2017
200256	SPS	CV Pines - Price 115 kV Ckt 1 Rebuild	12/30/2017
200256	SPS	Capitan - CV Pines 115 kV Ckt 1 Rebuild	12/30/2017
200359	SPS	Carlisle 230/115kV transformer replacement	12/31/2017
200255	AEP	Chisholm - Gracemont 345kV Ckt 1 (AEP)	3/1/2018
200255	AEP	Chisholm 345/230 kV Substation	3/1/2018
200255	AEP	Chisholm 230 kV	3/1/2018
200240	OGE	Chisholm - Gracemont 345 kV Ckt 1 (OGE)	3/1/2018
200395	SPS	Seminole 230/115kV transformer Ckt 1 & 2 replacement	5/15/2018
200360	SPS	Cardinal - Targa 115 kV Ckt 1 Rebuild	5/31/2018
200228	MKEC	Viola 345/138kV project	6/1/2018
200309	SPS	Hobbs 345/230 kV Ckt 1 Transformer	6/1/2018
200282	SPS	China Draw - Yeso Hills 115 kV Ckt 1	6/1/2018
200282	SPS	Dollarhide - Toboso Flats 115 kV Ckt 1	6/1/2018

SPP Notification to Construct (NTC) ID	Project Owner	Transmission Upgrade Name	Estimated Date of Upgrade Completion (EOC)
200309	SPS	Hobbs - Kiowa 345 kV Ckt 1	6/1/2018
200309	SPS	Kiowa 345 kV Substation	6/1/2018
200309	SPS	Kiowa - North Loving 345 kV Ckt 1	6/1/2018
200309	SPS	North Loving 345 kV Terminal Upgrades	6/1/2018
200309	SPS	China Draw - North Loving 345 kV Ckt 1	6/1/2018
200309	SPS	China Draw 345 kV Ckt 1 Terminal Upgrades	6/1/2018
200309	SPS	China Draw 345/115 kV Ckt 1 Transformer	6/1/2018
200309	SPS	North Loving 345/115 kV Ckt 1 Transformer	6/1/2018
200309	SPS	Kiowa 345/115 kV Ckt 1 Transformer	6/1/2018
200411	SPS	Livingston Ridge - Sage Brush 115 kV Ckt 1	6/1/2018
200309	SPS	Lagarto 115 kV Substation	6/1/2018
200309	SPS	Hobbs – Yoakum – TUCO 345kV project	6/1/2018
200395	SPS	Terry County – Wolfforth 115kV Ckt 1 terminal equipment replacement	6/1/2018
200228	WERE	Viola 345/138kV project	6/1/2018
200223	OGE	Tatonga - Woodward District EHV 345 kV Ckt 2	7/1/2018
200223	OGE	Matthewson - Tatonga 345 kV Ckt 2	7/1/2018
200360	SPS	IMC #1 Tap - Livingston Ridge 115 kV Ckt 1 Rebuild	11/16/2018
200360	SPS	Intrepid West - Potash Junction 115 kV Ckt 1 Rebuild	11/16/2018
200360	SPS	IMC #1 Tap - Intrepid West 115 kV Ckt 1 Rebuild	11/16/2018
200395	SPS	Canyon West – Dawn – Panda – Deaf Smith 115kV Ckt 1	12/15/2018
200395	SPS	Harrington East – Potter 230kV Ckt 1 terminal equipment replacement	6/1/2019
200262	SPS	Yoakum County Interchange 230/115kV transformer Ckt 1 & 2 replacement	6/1/2019
200309	SPS	Hobbs - Yoakum 345 kV Ckt 1	6/1/2020
200395	SPS	Tuco - Yoakum 345 kV Ckt 1	6/1/2020
200395	SPS	Yoakum 345/230 kV Ckt 1 Transformer	6/1/2020
200369	SPS	Canyon East Sub – Randall County Interchange 115kV Ckt 1	12/31/2020
200391	OGE	DeGrasse 345 kV Substation	6/1/2017 (RTO Determined Need Date)
200391	OGE	DeGrasse 345/138 kV Transformer	6/1/2017 (RTO Determined Need Date)
200391	OGE	DeGrasse - Knob Hill 138 kV New Line	6/1/2017 (RTO Determined Need Date)
200391	OGE	DeGrasse 138 kV Substation (OGE)	6/1/2017 (RTO Determined Need Date)

APPENDIX C – STABILITY ANALYSIS PLOTS AND RESULTS

CREATE AMAZING.

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