

Report on

GEN-2017-014 Modification Request Impact Study

Revision R1 September 22, 2026

Submitted to
SPP



anedenconsulting.com

TABLE OF CONTENTS

Revision History.....	R-1
Executive Summary.....	ES-1
1.0 Scope of Study	1
1.1 Reactive Power Analysis	1
1.2 Short Circuit Analysis & Stability Analysis	1
1.3 Steady-State Analysis	1
1.4 Study Limitations.....	1
2.0 Project and Modification Request.....	2
3.0 Existing vs Modification Comparison	4
3.1 Stability Model Parameters Comparison	4
3.2 Equivalent Impedance Comparison Calculation.....	4
4.0 Reactive Power Analysis	5
4.1 Methodology and Criteria	5
4.2 Results.....	5
5.0 Short Circuit Analysis.....	7
5.1 Methodology	7
5.2 Results.....	7
6.0 Dynamic Stability Analysis	9
6.1 Methodology and Criteria	9
6.2 Fault Definitions	9
6.3 Results.....	20
7.0 Modified Capacity Exceeds GIA Capacity.....	24
8.0 Material Modification Determination	25
8.1 Results.....	25

LIST OF TABLES

Table ES-1: GEN-2017-014 Modification Request.....	ES-1
Table 2-1: GEN-2017-014 Modification Request.....	3
Table 4-1: Shunt Reactor Size for Reactive Power Analysis.....	5
Table 5-1: Short Circuit Model Parameters*	7
Table 5-2: POI Short Circuit Comparison Results.....	7
Table 5-3: 25SP Short Circuit Comparison Results.....	8
Table 6-1: Fault Definitions.....	10
Table 6-2: GEN-2017-014 Dynamic Stability Results	20

LIST OF FIGURES

Figure 2-1: GEN-2017-014 Single Line Diagram (Existing Configuration*)	2
Figure 2-2: GEN-2017-014 Single Line Diagram (Modification Configuration).....	3
Figure 4-1: GEN-2017-014 Single Line Diagram (Shunt Sizes)	6

APPENDICES

APPENDIX A: GEN-2017-014 Generator Dynamic Model

APPENDIX B: Short Circuit Results

APPENDIX C: Dynamic Stability Results with Existing Base Case Issues & Simulation Plots

Revision History

DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION
9/22/2026	Aneden Consulting	Initial Report Issued

Executive Summary

Aneden Consulting (Aneden) was retained by SPP to perform a Modification Request Impact Study (Study) for GEN-2017-014, an active Generation Interconnection Request (GIR) with a Point of Interconnection (POI) at the Philip Tap 230 kV Substation.

The GEN-2017-014 project interconnects in the Western Area Power Administration (WAPA) transmission system with a capacity of 300 MW. This Study has been requested to evaluate the modification of GEN-2017-014 to change the configuration to 55 x Nordex N163-5.9 wind turbines operating at 5.59 MW for a total assumed dispatch of 307.45 MW. The turbines are rated at 6.0 MVA/5.9 MW, thus the generating capability exceeds its Generator Interconnection Agreement (GIA) Interconnection Service amount. The injection amount must be limited to 300 MW at the POI as listed in Appendix A of the GIA. As a result, the customer must ensure that the amount of power injected at the POI does not exceed the Interconnection Service amount listed in its GIA. The requested modification includes the use of a Power Plant Controller (PPC) to limit the total power injected into the POI.

In addition, the modification request included changes to the generation interconnection line, collection system, generator step-up transformers, reactive devices, and main substation transformers. The existing and modified configurations for GEN-2017-014 are shown in Table ES-1 below.

Table ES-1: GEN-2017-014 Modification Request

Facility	Existing Configuration		Modification Configuration		
Point of Interconnection	PHILIP_T-BE4 230kV (659188)		PHILIP_T-BE4 230kV (659188)		
Configuration/Capacity	119 x 2.52 MW GE 127 turbines (Wind) = 299.88 MW		55 x Nordex N163-5.9 Turbines 5.59 MW (Wind) = 307.45 MW [dispatch] Units are rated at 6.0 MVA/5.9 MW, PPC in place to limit POI to 300 MW		
Generation Interconnection Line ²	Length = 0.05 miles R = 0.000000 pu X = 0.000100 pu B = 0.000000 pu Rating MVA = 461 MVA		Length = 5.48 miles R = 0.001026 pu X = 0.007853 pu B = 0.016346 pu Rating MVA = 330 MVA		
Main Substation Transformer ¹	X = 10.4967%, R = 0.2624%, Winding MVA = 100 MVA, Rating MVA = 160 MVA	X = 10.4967%, R = 0.2624%, Winding MVA = 100 MVA, Rating MVA = 160 MVA	X = 8.0984%, R = 0.212%, Winding MVA = 84 MVA, Rating MVA = 140 MVA	X = 8.0984%, R = 0.212%, Winding MVA = 84 MVA, Rating MVA = 140 MVA	X = 8.0984%, R = 0.212%, Winding MVA = 84 MVA, Rating MVA = 140 MVA
Equivalent GSU Transformer ¹	Gen 1 Equivalent Qty: 55 X = 9.7590%, R = 0.8953%, Winding MVA = 158.7 MVA, Rating MVA = 158.7 MVA	Gen 2 Equivalent Qty: 64 X = 9.7590%, R = 0.8953%, Winding MVA = 186.3 MVA, Rating MVA = 186.3 MVA	Gen 1 Equivalent Qty: 20 X = 7.9214%, R = 1.1188%, Winding MVA = 127 MVA, Rating MVA = 127 MVA	Gen 2 Equivalent Qty: 19 X = 7.9214%, R = 1.1188%, Winding MVA = 120.65 MVA, Rating MVA = 120.65 MVA	Gen 3 Equivalent Qty: 16 X = 7.9214%, R = 1.1188%, Winding MVA = 101.6 MVA, Rating MVA = 101.6 MVA
Equivalent Collector Line ²	R = 0.023550 pu X = 0.010316 pu B = 0.077710 pu	R = 0.016330 pu X = 0.007146 pu B = 0.102210 pu	R = 0.008732 pu X = 0.015623 pu B = 0.014879 pu	R = 0.008851 pu X = 0.015050 pu B = 0.014014 pu	R = 0.011018 pu X = 0.020116 pu B = 0.012318 pu
Generator Dynamic Model ³ & Power Factor	55 x GE 127 wind turbine 2.52MW (REGCA1) ³ Leading: 1.0 Lagging: 1.0	64 x GE 127 wind turbine 2.52MW (REGCA1) ³ Leading: 1.0 Lagging: 1.0	20 x N163-5.9 Turbines 5.59 MW (NXWTG_8692) ³ Leading: 0.922 Lagging: 0.922	19 x N163-5.9 Turbines 5.59 MW (NXWTG_8692) ³ Leading: 0.922 Lagging: 0.922	16 x N163-5.9 Turbines 5.59 MW (NXWTG_8692) ³ Leading: 0.922 Lagging: 0.922
Reactive Power Devices	N/A	N/A	2 x 8.9 MVAR 34.5 kV Capacitor Bank	2 x 8.9 MVAR 34.5 kV Capacitor Bank	2 x 8.9 MVAR 34.5 kV Capacitor Bank

1) X and R based on Winding MVA, 2) All pu are on 100 MVA Base 3) Dyr stability model name

SPP determined that steady-state analysis was not required because the modifications to the project were not significant enough to change the previously studied steady-state conclusions. However, SPP determined that the change in manufacturer from GE to Nordex required short circuit and dynamic stability analyses.

The scope of this study included reactive power analysis, short circuit analysis, and dynamic stability analysis.

Aneden performed the analyses using the modification request data and the DISIS-2022-001-1 stability study models:

- 2025 Summer Peak (25SP),
- 2025 Winter Peak (25WP)

All analyses were performed using the Siemens PTI PSS/E¹ version 34 software and the results are summarized below.

The results of the reactive power analysis using the 25SP model showed that the GEN-2017-014 project needed a 5.8 MVar shunt reactor on the 34.5 kV bus of the project substation with the modifications in place, a decrease from the 18.09 MVar found in the DISIS-2017-001-2 study². This is necessary to offset the capacitive effect on the transmission network caused by the project's transmission line and collector system during reduced generation conditions. The information gathered from the reactive power analysis is provided as information to the Interconnection Customer and Transmission Owner (TO) and/or Transmission Operator (TOP). The applicable reactive power requirements will be further reviewed by the TO and/or TOP.

The short circuit analysis was performed using the 25SP stability model modified for short circuit analysis. The results from the short circuit analysis with the updated topology showed that the maximum GEN-2017-014 contribution to three-phase fault currents in the immediate transmission systems at or near the GEN-2017-014 POI was 1.08 kA. The maximum three-phase fault current level within 5 buses of the POI was 26.7 kA for the 25SP model.

The dynamic stability analysis was performed using Siemens PTI PSS/E version 34.8.1 software for the two modified study models: 25SP and 25WP. 111 fault events were simulated, which included three-phase faults and single-line-to-ground stuck breaker faults.

The results of the dynamic stability analysis showed several existing base case issues that were found in both the original DISIS-2022-001-1 models and in the models with the GEN-2017-014 modification included. These issues were not attributed to the GEN-2017-014 modification request and are detailed in Appendix C.

There were no damping or voltage recovery violations attributed to the GEN-2017-014 modification request observed during the simulated faults. Additionally, the project was found to stay connected during the contingencies that were studied and, therefore, will meet the Low Voltage Ride Through (LVRT) requirements of FERC Order #661A.

¹ Power System Simulator for Engineering

² DISIS-2017-001-2 Restudy of Stability and Short Circuit Analysis – June 16, 2022

Based on the results of the study, SPP determined that the requested modification is **not a Material Modification**. The requested modification does not have a material adverse impact on the cost or timing of any other Interconnection Request with a later Queue priority date. As the requested modification places the generating capacity of the Interconnection Request at a higher amount than its Interconnection Service, the customer must install monitoring and control equipment as needed to ensure that the amount of power injected at the POI does not exceed the Interconnection Service amount listed in its GIA.

In accordance with FERC Order No. 827, the generating facility will be required to provide dynamic reactive power within the range of 0.95 leading to 0.95 lagging at the high-side of the generator substation.

It is likely that the customer may be required to reduce its generation output to 0 MW in real-time, 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 SPP's OASIS by the customer.

1.0 Scope of Study

Aneden Consulting (Aneden) was retained by SPP to perform a Modification Request Impact Study (Study) for GEN-2017-014. A Modification Request Impact Study is a generation interconnection study performed to evaluate the impacts of modifying the DISIS study assumptions. The determination of the required scope of the study is dependent upon the specific modification requested and how it may impact the results of the DISIS study. Impacting the DISIS results could potentially affect the cost or timing of any Interconnection Request with a later Queue priority date, deeming the requested modification a Material Modification. The criteria sections below include reasoning as to why an analysis was either included or excluded from the scope of study.

All analyses were performed using the Siemens PTI PSS/E version 34 software. The results of each analysis are presented in the following sections.

1.1 Reactive Power Analysis

SPP requires that a reactive power analysis be performed on the requested configuration if it is a non-synchronous resource. The reactive power analysis determines the capacitive effect at the POI caused by the project's collection system and transmission line's capacitance. A shunt reactor size was determined to offset the capacitive effect and maintain zero (0) MVar injection at the POI while the plant's generators and capacitors were offline.

1.2 Short Circuit Analysis & Stability Analysis

To determine whether stability and short circuit analyses are required, SPP evaluates the difference between the stability models, the stability model parameters and, if needed, the equivalent collector system impedance between the existing configuration and the requested modification. Dynamic stability analysis and short circuit analysis would be required if the differences listed above were determined to have a significant impact on the most recently performed DISIS stability analysis.

1.3 Steady-State Analysis

Steady-state analysis is performed if SPP deems it necessary based on the nature of the requested change. SPP determined that steady-state analysis was not required because the modifications to the project were not significant enough to change the previously studied steady-state conclusions.

1.4 Study Limitations

The assessments and conclusions provided in this report are based on assumptions and information provided to Aneden by others. While the assumptions and information provided may be appropriate for the purposes of this report, Aneden does not guarantee that those conditions assumed will occur. In addition, Aneden did not independently verify the accuracy or completeness of the information provided. As such, the conclusions and results presented in this report may vary depending on the extent to which actual future conditions differ from the assumptions made or information used herein.

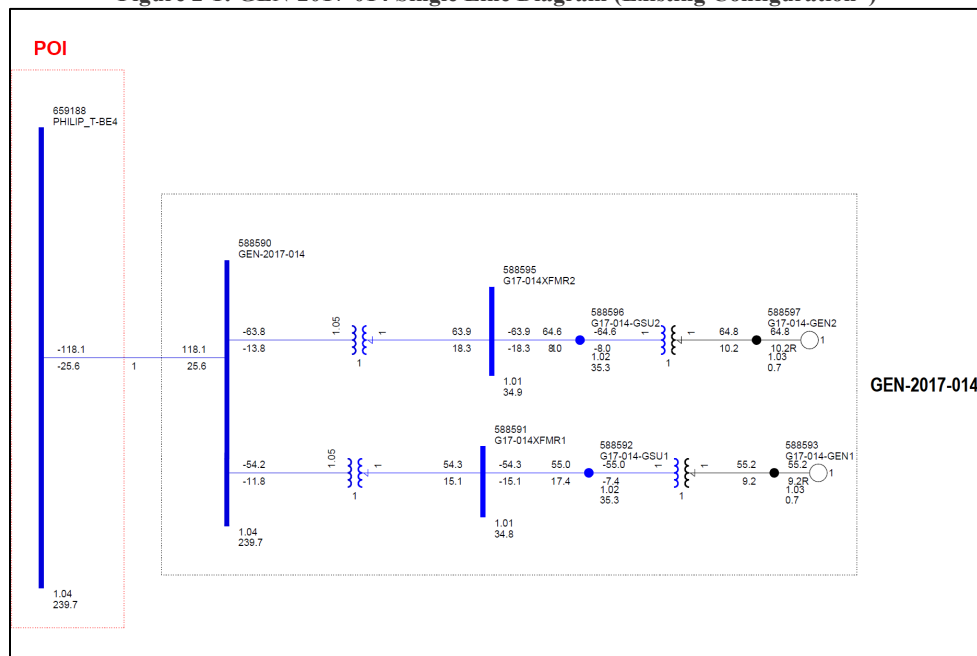
2.0 Project and Modification Request

The GEN-2017-014 Interconnection Customer requested a modification to its Generation Interconnection Request (GIR) with a Point of Interconnection (POI) at the Philip Tap 230 kV Substation in the Western Area Power Administration (WAPA) transmission system.

At the time of report posting, GEN-2017-014 is an active Interconnection Request with a queue status of “IA FULLY EXECUTED/ON SCHEDULE.” GEN-2017-014 is a wind facility with a maximum summer and winter queue capacity of 300 MW with Energy Resource Interconnection Service (ERIS).

The GEN-2017-014 project is currently in the DISIS-2017-001 cluster. Figure 2-1 shows the power flow model single line diagram for the existing GEN-2017-014 configuration using the DISIS-2022-001-1 25SP stability model.

Figure 2-1: GEN-2017-014 Single Line Diagram (Existing Configuration*)



*based on the DISIS-2022-001-1 25SP stability models

This Study has been requested to evaluate the modification of GEN-2017-014 to change the configuration to 55 x Nordex N163-5.9 wind turbines operating at 5.59 MW for a total assumed dispatch of 307.45 MW. The turbines are rated at 6.0 MVA/5.9 MW, thus the generating capability exceeds its Generator Interconnection Agreement (GIA) Interconnection Service amount. The injection amount must be limited to 300 MW at the POI as listed in Appendix A of the GIA. As a result, the customer must ensure that the amount of power injected at the POI does not exceed the Interconnection Service amount listed in its GIA. The requested modification includes the use of a Power Plant Controller (PPC) to limit the total power injected into the POI.

In addition, the modification request included changes to the generation interconnection line, collection system, generator step-up transformers, reactive devices, and main substation transformers. Figure 2-2 shows the power flow model single line diagram for the GEN-2017-014 modification. The existing and modified configurations for GEN-2017-014 are shown in Table 2-1 below.

Figure 2-2: GEN-2017-014 Single Line Diagram (Modification Configuration)

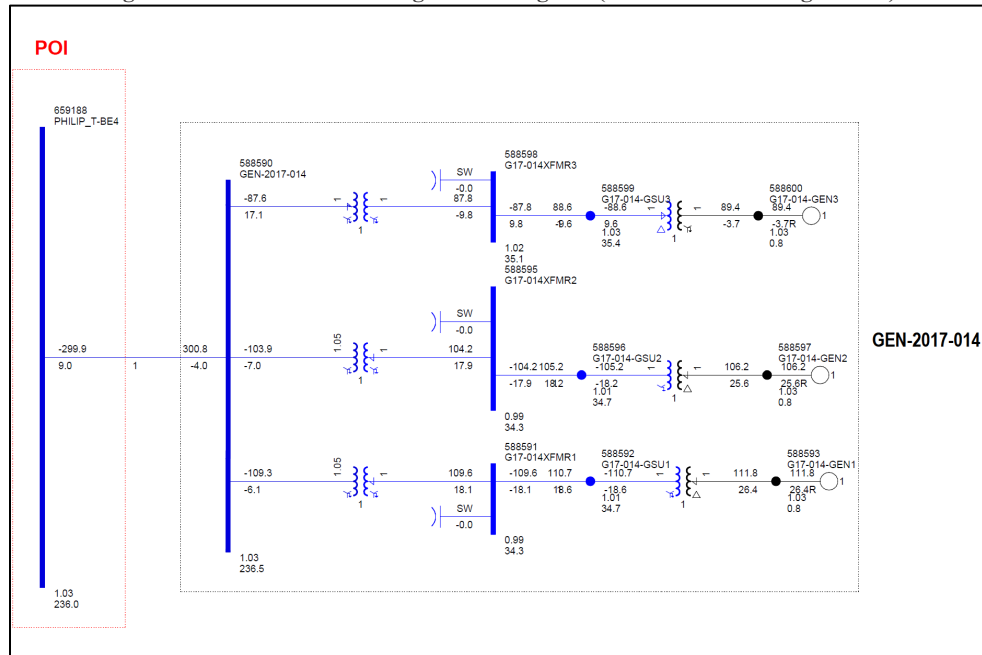


Table 2-1: GEN-2017-014 Modification Request

Facility	Existing Configuration		Modification Configuration		
Point of Interconnection	PHILIP_T-BE4 230kV (659188)		PHILIP_T-BE4 230kV (659188)		
Configuration/Capacity	119 x 2.52 MW GE 127 turbines (Wind) = 299.88 MW		55 x Nordex N163-5.9 Turbines 5.59 MW (Wind) = 307.45 MW [dispatch] Units are rated at 6.0 MVA/5.9 MW, PPC in place to limit POI to 300 MW		
Generation Interconnection Line ²	Length = 0.05 miles R = 0.000000 pu X = 0.000100 pu B = 0.000000 pu Rating MVA = 461 MVA		Length = 5.48 miles R = 0.001026 pu X = 0.007853 pu B = 0.016346 pu Rating MVA = 330 MVA		
Main Substation Transformer ¹	X = 10.4967%, R = 0.2624%, Winding MVA = 100 MVA, Rating MVA = 160 MVA	X = 10.4967%, R = 0.2624%, Winding MVA = 100 MVA, Rating MVA = 160 MVA	X = 8.0984%, R = 0.212%, Winding MVA = 84 MVA, Rating MVA = 140 MVA	X = 8.0984%, R = 0.212%, Winding MVA = 84 MVA, Rating MVA = 140 MVA	X = 8.0984%, R = 0.212%, Winding MVA = 84 MVA, Rating MVA = 140 MVA
Equivalent GSU Transformer ¹	Gen 1 Equivalent Qty: 55 X = 9.7590%, R = 0.8953%, Winding MVA = 158.7 MVA, Rating MVA = 158.7 MVA	Gen 2 Equivalent Qty: 64 X = 9.7590%, R = 0.8953%, Winding MVA = 186.3 MVA, Rating MVA = 186.3 MVA	Gen 1 Equivalent Qty: 20 X = 7.9214%, R = 1.1188%, Winding MVA = 127 MVA, Rating MVA = 127 MVA	Gen 2 Equivalent Qty: 19 X = 7.9214%, R = 1.1188%, Winding MVA = 120.65 MVA, Rating MVA = 120.65 MVA	Gen 3 Equivalent Qty: 16 X = 7.9214%, R = 1.1188%, Winding MVA = 101.6 MVA, Rating MVA = 101.6 MVA
Equivalent Collector Line ²	R = 0.023550 pu X = 0.010316 pu B = 0.077710 pu	R = 0.016330 pu X = 0.007146 pu B = 0.102210 pu	R = 0.008732 pu X = 0.015623 pu B = 0.014879 pu	R = 0.008851 pu X = 0.015050 pu B = 0.014014 pu	R = 0.011018 pu X = 0.020116 pu B = 0.012318 pu
Generator Dynamic Model ³ & Power Factor	55 x GE 127 wind turbine 2.52MW (REGCA1) ³ Leading: 1.0 Lagging: 1.0	64 x GE 127 wind turbine 2.52MW (REGCA1) ³ Leading: 1.0 Lagging: 1.0	20 x N163-5.9 Turbines 5.59 MW (NXWTG_8692) ³ Leading: 0.922 Lagging: 0.922	19 x N163-5.9 Turbines 5.59 MW (NXWTG_8692) ³ Leading: 0.922 Lagging: 0.922	16 x N163-5.9 Turbines 5.59 MW (NXWTG_8692) ³ Leading: 0.922 Lagging: 0.922
Reactive Power Devices	N/A	N/A	2 x 8.9 MVAR 34.5 kV Capacitor Bank	2 x 8.9 MVAR 34.5 kV Capacitor Bank	2 x 8.9 MVAR 34.5 kV Capacitor Bank

1) X and R based on Winding MVA, 2) All pu are on 100 MVA Base 3) Dyr stability model name

3.0 Existing vs Modification Comparison

To determine which analyses are required for the Study, the differences between the existing configuration and the requested modification were evaluated. Aneden performed this comparison and the resulting analyses using a set of modified study models developed based on the modification request data and the DISIS-2022-001-1 stability study models. The analysis was completed using PSS/E version 34 software.

The methodology and results of the comparisons are described below.

3.1 Stability Model Parameters Comparison

SPP determined that short circuit and dynamic stability analyses were required because of the turbine change from GE to Nordex turbines. This is because the short circuit contribution and stability responses of the existing configuration and the requested modification's configuration may differ. The generator dynamic model for the modification can be found in Appendix A.

As short circuit and dynamic stability analyses were already deemed required, a stability model parameters comparison was not needed for the determination of the scope of the study.

3.2 Equivalent Impedance Comparison Calculation

As the turbine change determined that short circuit and dynamic stability analyses were required, an equivalent impedance comparison was not needed for the determination of the scope of the study.

4.0 Reactive Power Analysis

The reactive power analysis was performed for GEN-2017-014 to determine the capacitive charging effects during reduced generation conditions (unsuitable wind speeds, unsuitable solar irradiance, insufficient state of charge, idle conditions, curtailment, etc.) at the generation site and to size shunt reactors that would reduce the project reactive power contribution to the POI to approximately zero.

4.1 Methodology and Criteria

The GEN-2017-014 generators and capacitors were switched out of service while other system elements remained in-service. Shunt reactors were tested at the project's collection substation 34.5 kV buses to reduce the MVar injection at the POI to zero. The size of the shunt reactors is equivalent to the charging current value at unity voltage and the compensation provided is proportional to the voltage effects on the charging current (i.e., for voltages above unity, reactive compensation is greater than the size of the reactor).

Aneden performed the reactive power analysis using the modification request data based on the 25SP DISIS-2022-001-1 stability study model.

4.2 Results

The results from the analysis showed that the GEN-2017-014 project needed approximately 5.8 MVar of compensation at its collector substation to reduce the MVar injection at the POI to zero. This is a decrease from the 18.09 MVar found in the DISIS-2017-001-2 study³. The final shunt reactor requirements are shown in Table 4-1. Figure 4-1 illustrates the shunt reactor size needed to reduce the POI MVar to approximately zero with the updated topology.

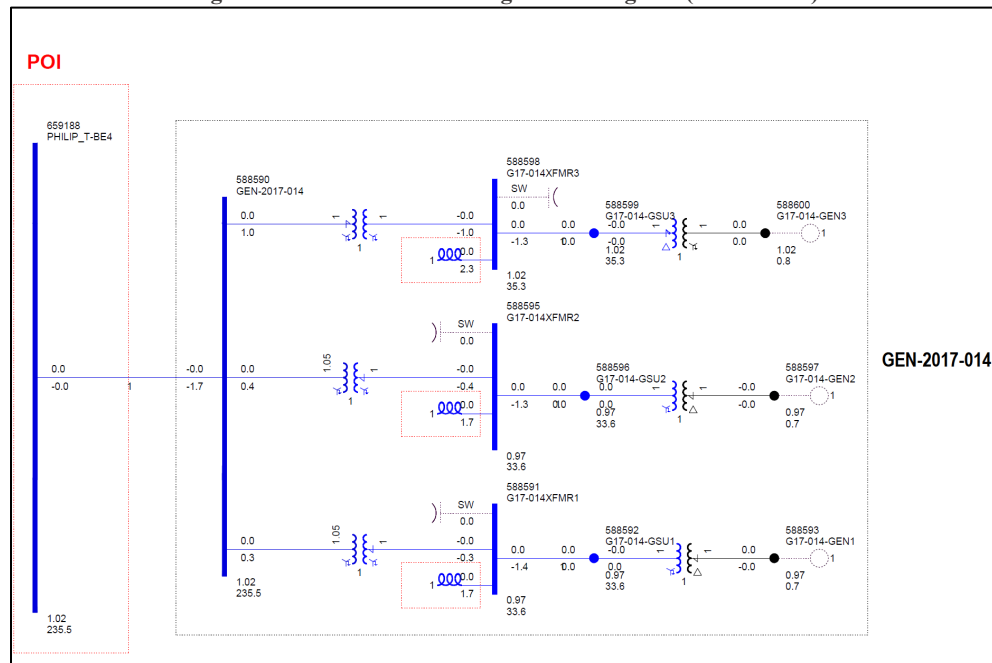
The information gathered from the reactive power analysis is provided as information to the Interconnection Customer and Transmission Owner (TO) and/or Transmission Operator (TOP). The applicable reactive power requirements will be further reviewed by the TO and/or TOP.

Table 4-1: Shunt Reactor Size for Reactive Power Analysis

Machine	POI Bus Number	POI Bus Name	Reactor Size (MVar)
			25SP
GEN-2017-014	659188	PHILIP_T-BE4	5.8

³ DISIS-2017-001-2 Restudy of Stability and Short Circuit Analysis – June 16, 2022

Figure 4-1: GEN-2017-014 Single Line Diagram (Shunt Sizes)



5.0 Short Circuit Analysis

Aneden performed a short circuit study using the 25SP model for GEN-2017-014 to determine the maximum fault current requiring interruption by protective equipment for each bus in the relevant subsystem. The detailed results of the short circuit analysis are provided in Appendix B.

5.1 Methodology

The short circuit analysis included applying a 3-phase fault on buses up to 5 levels away from the 230 kV POI bus. The PSS/E “Automatic Sequence Fault Calculation (ASCC)” fault analysis module was used to calculate the fault current levels in the transmission system with and without GEN-2017-014 online.

Aneden created a short circuit model using the 25SP DISIS-2022-001-1 stability study model by adjusting the GEN-2017-014 short circuit parameters consistent with the submitted data. The adjusted parameters used in the short circuit analysis are shown in Table 5-1 below. No other changes were made to the model.

Table 5-1: Short Circuit Model Parameters*

Parameter	Value by Generator Bus#		
	588600	588597	588593
Machine MVA Base	96	114	120
R (pu)	0.0	0.0	0.0
X'' (pu)	0.5347	0.5347	0.5347

*pu values based on Machine MVA Base

5.2 Results

The results of the short circuit analysis for the 25SP model are summarized in Table 5-2 and Table 5-3. The GEN-2017-014 POI bus (Philip Tap 230 kV) fault current magnitudes for the comparison cases are provided in Table 5-2 showing a fault current of 4.76 kA with the GEN-2017-014 project online. Table 5-3 shows the maximum fault current magnitudes and fault current increases with the GEN-2017-014 project online.

The maximum fault current calculated within 5 buses of the POI was 26.7 kA for the 25SP model. The maximum GEN-2017-014 contribution to three-phase fault currents was about 29.5% and 1.08 kA.

Table 5-2: POI Short Circuit Comparison Results

Case	GEN-OFF Current (kA)	GEN-ON Current (kA)	kA Change	%Change
25SP	3.68	4.76	1.08	29.5%

Table 5-3: 25SP Short Circuit Comparison Results

Voltage (kV)	Max. Current (kA)	Max kA Change	Max %Change
69	4.4	0.08	2.6%
115	26.7	0.52	10.2%
161	20.4	0.00	0.0%
230	19.6	1.08	29.5%
345	10.3	0.05	0.5%
Max	26.7	1.08	29.5%

6.0 Dynamic Stability Analysis

Aneden performed a dynamic stability analysis to identify the impact of the modifications to GEN-2017-014. The analysis was performed according to SPP's Disturbance Performance Requirements⁴. The modification details are described in Section 2.0 above and the dynamic modeling data is provided in Appendix A. The existing base case issues and simulation plots can be found in Appendix C.

6.1 Methodology and Criteria

The dynamic stability analysis was performed using models developed with the requested GEN-2017-014 configuration of 55 x Nordex N163-5.9 inverters operating at 5.59 MW (NXWTG_8692). This stability analysis was performed using Siemens PTI's PSS/E version 34.8.1 software.

The modifications requested for the GEN-2017-014 project were used to create modified stability models for this impact study based on the DISIS-2022-001-1 stability study models:

- 2025 Summer Peak (25SP),
- 2025 Winter Peak (25WP)

The dynamic model data for the GEN-2017-014 project is provided in Appendix A. The power flow models and associated dynamic database were initialized (no-fault test) to confirm that there were no errors in the initial conditions of the system and the dynamic data.

The following system adjustments were made to address existing base case issues that are not attributed to the modification request:

- The frequency protective relays at bus 587763 was disabled after observing the generators tripping during initial three phase fault simulations. This frequency tripping issue is a known PSS/E limitation when calculating bus frequency as it relates to non-conventional type devices.
- The PSSE dynamic simulation iterations and acceleration factor were adjusted as needed to resolve PSSE dynamic simulation crashes.

During the fault simulations, the active power (PELEC), reactive power (QELEC), and terminal voltage (ETERM) were monitored for GEN-2017-014 and other current and prior queued projects in Group 1. In addition, voltages of five (5) buses away from the POI of the GEN-2017-014 were monitored and plotted. The machine rotor angle for synchronous machines and speed for asynchronous machines within the study areas including 330 (AECI), 526 (SPS), 600 (XEL), 615 (GRE), 620 (OTP), 627 (ALTW), 635 (MEC), 640 (NPPD), 645 (OPPD), 652 (WAPA), 659 (BEPC-SPP), 661 (MDU), 663 (BEPC-MISO), 672 (SPC), and 680 (DPC) were monitored. The voltages of all 100 kV and above buses within the study area were monitored as well.

6.2 Fault Definitions

Aneden developed fault events as required to study the modification. The new set of faults was simulated using the modified study models. The fault events included three-phase faults and single-line-to-ground stuck breaker faults. Single-line-to-ground faults are approximated by applying a fault impedance to bring the faulted bus positive sequence voltage to 0.6 pu. The simulated faults are listed and described in Table 6-1 below. These contingencies were applied to the modified 25SP and 25WP models.

⁴ SPP Disturbance Performance Requirements:

[https://www.spp.org/documents/28859/spp%20disturbance%20performance%20requirements%20\(twg%20approved\).pdf](https://www.spp.org/documents/28859/spp%20disturbance%20performance%20requirements%20(twg%20approved).pdf)

Table 6-1: Fault Definitions

Fault ID	Planning Event	Fault Descriptions
FLT1000-SB	P4	Stuck Breaker on PHILIP_T-BE4 (659188) 230 kV Bus a. Apply single phase fault at the PHILIP_T-BE4 (659188) 230 kV Bus b. Clear fault after 16 cycles and trip the following elements: b.1.Trip bus PHILIP_T-BE4 (659188) 230 kV. b.2.Trip bus PHILIP__-BE4 (659192) 230 kV. Trip generator(s) on the Bus G17-014-GEN1 (588593) 0.8 kV Trip generator(s) on the Bus G17-014-GEN2 (588597) 0.8 kV Trip generator(s) on the Bus G17-014-GEN3 (588600) 0.8 kV
FLT1001-SB	P4	Stuck Breaker on PHILIP__-BE4 (659192) 230 kV Bus a. Apply single phase fault at the PHILIP__-BE4 (659192) 230 kV Bus b. Clear fault after 16 cycles and trip the following elements: b.1.Trip bus PHILIP__-BE4 (659192) 230 kV. b.2.Trip bus PHILIP_T-BE4 (659188) 230 kV. Trip generator(s) on the Bus G17-014-GEN1 (588593) 0.8 kV Trip generator(s) on the Bus G17-014-GEN2 (588597) 0.8 kV Trip generator(s) on the Bus G17-014-GEN3 (588600) 0.8 kV
FLT1002-SB	P4	Stuck Breaker on PHILIP 7 (652487) 115 kV Bus a. Apply single phase fault at the PHILIP 7 (652487) 115 kV Bus b. Clear fault after 16 cycles and trip the following elements: b.1.Trip bus PHILIP 7 (652487) 115 kV.
FLT1003-SB	P4	Stuck Breaker on NUNDRWD7 (652485) 115 kV Bus a. Apply single phase fault at the NUNDRWD7 (652485) 115 kV Bus b. Clear fault after 16 cycles and trip the following elements: b.1.Trip the NUNDRWD7 (652485) 115 kV to WICKSVL7 (652493) 115 kV line CKT 1. b.1.Trip the NUNDRWD7 (652485) 115 kV / NUNDRWD4 (652484) 230 kV / NUNDRWD9 (652267) 13.8 kV XFMR CKT 1.
FLT1004-SB	P4	Stuck Breaker on NUNDRWD7 (652485) 115 kV Bus a. Apply single phase fault at the NUNDRWD7 (652485) 115 kV Bus b. Clear fault after 16 cycles and trip the following elements: b.1.Trip the NUNDRWD7 (652485) 115 kV / NUNDRWD4 (652484) 230 kV / NUNDRWD9 (652267) 13.8 kV XFMR CKT 1. b.1.Trip the NUNDRWD7 (652485) 115 kV / NUNDRWD4 (652484) 230 kV / NUNDRWD10 (652266) 13.8 kV XFMR CKT 1.
FLT1005-SB	P4	Stuck Breaker on NUNDRWD7 (652485) 115 kV Bus a. Apply single phase fault at the NUNDRWD7 (652485) 115 kV Bus b. Clear fault after 16 cycles and trip the following elements: b.1.Trip the NUNDRWD7 (652485) 115 kV / NUNDRWD4 (652484) 230 kV / NUNDRWD10 (652266) 13.8 kV XFMR CKT 1. b.2.Trip the NUNDRWD7 (652485) 115 kV to GEN-2017-097 (589350) 115 kV line CKT 1. Trip generator(s) on the Bus G17-097-GEN1 (589353) 0.7 kV Trip generator(s) on the Bus G17-097-GEN2 (589357) 0.7 kV
FLT1006-SB	P4	Stuck Breaker on NUNDRWD7 (652485) 115 kV Bus a. Apply single phase fault at the NUNDRWD7 (652485) 115 kV Bus b. Clear fault after 16 cycles and trip the following elements: b.1.Trip the NUNDRWD7 (652485) 115 kV to GEN-2017-097 (589350) 115 kV line CKT 1. b.2.Trip the NUNDRWD7 (652485) 115 kV to ELSWRTH7 (652477) 115 kV line CKT 1. Trip generator(s) on the Bus G17-097-GEN1 (589353) 0.7 kV Trip generator(s) on the Bus G17-097-GEN2 (589357) 0.7 kV
FLT1007-SB	P4	Stuck Breaker on NUNDRWD4 (652484) 230 kV Bus a. Apply single phase fault at the NUNDRWD4 (652484) 230 kV Bus b. Clear fault after 16 cycles and trip the following elements: b.1.Trip the NUNDRWD4 (652484) 230 kV to PHILIP_T-BE4 (659188) 230 kV line CKT 1. b.1.Trip the NUNDRWD4 (652484) 230 kV to NUNDRWD-LNX3 (652884) 230 kV line CKT Z. b.1.Trip the NUNDRWD4 (652484) 230 kV / NUNDRWD7 (652485) 115 kV / NUNDRWD9 (652267) 13.8 kV XFMR CKT 1.
FLT1008-SB	P4	Stuck Breaker on NUNDRWD4 (652484) 230 kV Bus a. Apply single phase fault at the NUNDRWD4 (652484) 230 kV Bus b. Clear fault after 16 cycles and trip the following elements: b.1.Trip the NUNDRWD4 (652484) 230 kV to WAYSIDE4 (640404) 230 kV line CKT 1. b.1.Trip the NUNDRWD4 (652484) 230 kV / NUNDRWD7 (652485) 115 kV / NUNDRWD10 (652266) 13.8 kV XFMR CKT 1. b.1.Trip the NUNDRWD4 (652484) 230 kV to DRYCREEK-BE4 (659376) 230 kV line CKT 1.

Table 6-1 Continued

Fault ID	Planning Event	Fault Descriptions
FLT1009-SB	P4	Stuck Breaker on OAHE 4 (652519) 230 kV Bus a. Apply single phase fault at the OAHE 4 (652519) 230 kV Bus b. Clear fault after 16 cycles and trip the following elements: b.1.Trip the OAHE 4 (652519) 230 kV to FTTHOMP4 (652507) 230 kV line CKT 2. b.1.Trip the OAHE 4 (652519) 230 kV / OAHE 7 (652520) 115 kV / OAHE 9 (652589) 13.8 kV XFMR CKT 1. b.3.Trip the OAHE 4 (652519) 230 kV / OAHE6-7G (652558) 13.8 kV XFMR CKT 1. b.1.Trip the OAHE 4 (652519) 230 kV / OAHE 7 (652520) 115 kV / OAHE 29 (652598) 13.8 kV XFMR CKT 1. Trip generator(s) on the Bus OAHE6-7G (652558) 13.8 kV
FLT1010-SB	P4	Stuck Breaker on OAHE 4 (652519) 230 kV Bus a. Apply single phase fault at the OAHE 4 (652519) 230 kV Bus b. Clear fault after 16 cycles and trip the following elements: b.1.Trip the OAHE 4 (652519) 230 kV to NORTHBEND4 (652516) 230 kV line CKT 1. b.1.Trip the OAHE 4 (652519) 230 kV to PHILIP_T-BE4 (659188) 230 kV line CKT 1. b.1.Trip the OAHE 4 (652519) 230 kV to SULLYBT-ER4 (655487) 230 kV line CKT 1. b.1.Trip the OAHE 4 (652519) 230 kV / OAHE2-3G (652556) 13.8 kV XFMR CKT 1. Trip generator(s) on the Bus OAHE2-3G (652556) 13.8 kV
FLT1011-SB	P4	Stuck Breaker on OAHE 4 (652519) 230 kV Bus a. Apply single phase fault at the OAHE 4 (652519) 230 kV Bus b. Clear fault after 16 cycles and trip the following elements: b.1.Trip the OAHE 4 (652519) 230 kV to FTTHOMP4 (652507) 230 kV line CKT 3. b.1.Trip the OAHE 4 (652519) 230 kV to FTTHOMP4 (652507) 230 kV line CKT 4. b.3.Trip the OAHE 4 (652519) 230 kV / OAHE4-5G (652557) 13.8 kV XFMR CKT 1. Trip generator(s) on the Bus OAHE4-5G (652557) 13.8 kV
FLT1012-SB	P4	Stuck Breaker on NUNDRWD7 (652485) 115 kV Bus a. Apply single phase fault at the NUNDRWD7 (652485) 115 kV Bus b. Clear fault after 16 cycles and trip the following elements: b.1.Trip the NUNDRWD7 (652485) 115 kV to ELSWRTH7 (652477) 115 kV line CKT 1. b.2.Trip the NUNDRWD7 (652485) 115 kV to RUSHMORE-RM7 (655763) 115 kV line CKT 1.
FLT1013-SB	P4	Stuck Breaker on NUNDRWD7 (652485) 115 kV Bus a. Apply single phase fault at the NUNDRWD7 (652485) 115 kV Bus b. Clear fault after 16 cycles and trip the following elements: b.1.Trip the NUNDRWD7 (652485) 115 kV to RUSHMORE-RM7 (655763) 115 kV line CKT 1. b.1.Trip the NUNDRWD7 (652485) 115 kV to WICKSVL7 (652493) 115 kV line CKT 1.
FLT9000-3PH	P1	3 Phase fault on PHILIP_T-BE4 (659188) 230 kV to GEN-2017-014 (588590) 230 kV line CKT 1, near PHILIP_T-BE4 (659188) 230 kV. a. Apply fault at the PHILIP_T-BE4 (659188) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. Trip generator(s) on the Bus G17-014-GEN1 (588593) 0.8 kV Trip generator(s) on the Bus G17-014-GEN2 (588597) 0.8 kV Trip generator(s) on the Bus G17-014-GEN3 (588600) 0.8 kV c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9001-3PH	P1	3 Phase fault on GEN-2017-014 (588590) 230 kV to PHILIP_T-BE4 (659188) 230 kV line CKT 1, near GEN-2017-014 (588590) 230 kV. a. Apply fault at the GEN-2017-014 (588590) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. Trip generator(s) on the Bus G17-014-GEN1 (588593) 0.8 kV Trip generator(s) on the Bus G17-014-GEN2 (588597) 0.8 kV Trip generator(s) on the Bus G17-014-GEN3 (588600) 0.8 kV c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9002-3PH	P1	3 Phase fault on PHILIP_T-BE4 (659188) 230 kV to OAHE 4 (652519) 230 kV line CKT 1, near PHILIP_T-BE4 (659188) 230 kV. a. Apply fault at the PHILIP_T-BE4 (659188) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.

Table 6-1 Continued

Fault ID	Planning Event	Fault Descriptions
FLT9003-3PH	P1	3 Phase fault on OAHE 4 (652519) 230 kV to PHILIP_T-BE4 (659188) 230 kV line CKT 1, near OAHE 4 (652519) 230 kV. a. Apply fault at the OAHE 4 (652519) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9004-3PH	P1	3 Phase fault on OAHE 4 (652519) 230 kV to OAHE6-7G (652558) 13.8 kV XFMR CKT 1, near OAHE 4 (652519) 230 kV. a. Apply fault at the OAHE 4 (652519) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. Trip generator(s) on the Bus OAHE6-7G (652558) 13.8 kV
FLT9005-3PH	P1	Prior Outage: OAHE 4 (652519) 230 kV to Transmission Circuit # 3 Phase fault on OAHE 4 (652519) 230 kV to OAHE4-5G (652557) 13.8 kV XFMR CKT 1, near OAHE 4 (652519) 230 kV. a. Apply fault at the OAHE 4 (652519) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. Trip generator(s) on the Bus OAHE4-5G (652557) 13.8 kV
FLT9006-3PH	P1	3 Phase fault on OAHE 4 (652519) 230 kV to OAHE2-3G (652556) 13.8 kV XFMR CKT 1, near OAHE 4 (652519) 230 kV. a. Apply fault at the OAHE 4 (652519) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. Trip generator(s) on the Bus OAHE2-3G (652556) 13.8 kV
FLT9007-3PH	P1	3 Phase fault on OAHE 4 (652519) 230 kV to SULLYBT-ER4 (655487) 230 kV line CKT 1, near OAHE 4 (652519) 230 kV. a. Apply fault at the OAHE 4 (652519) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9008-3PH	P1	3 Phase fault on SULLYBT-ER4 (655487) 230 kV to OAHE 4 (652519) 230 kV line CKT 1, near SULLYBT-ER4 (655487) 230 kV. a. Apply fault at the SULLYBT-ER4 (655487) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9009-3PH	P1	3 Phase fault on SULLYBT-ER4 (655487) 230 kV to SB.LS-WK-ER4 (655510) 230 kV line CKT Z, near SULLYBT-ER4 (655487) 230 kV. a. Apply fault at the SULLYBT-ER4 (655487) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9010-3PH	P1	3 Phase fault on SB.LS-WK-ER4 (655510) 230 kV to WHITLOCK_-RM (655765) 230 kV line CKT 1, near SB.LS-WK-ER4 (655510) 230 kV. a. Apply fault at the SB.LS-WK-ER4 (655510) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9011-3PH	P1	3 Phase fault on SULLYBT-ER4 (655487) 230 kV to SULLYBT-ER8 (655488) 69 kV XFMR CKT 1, near SULLYBT-ER4 (655487) 230 kV. a. Apply fault at the SULLYBT-ER4 (655487) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line.
FLT9012-3PH	P1	3 Phase fault on SULLYBT-ER8 (655488) 69 kV to SULLYBT-ER4 (655487) 230 kV XFMR CKT 1, near SULLYBT-ER8 (655488) 69 kV. a. Apply fault at the SULLYBT-ER8 (655488) 69 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line.
FLT9013-3PH	P1	3 Phase fault on SULLYBT-ER8 (655488) 69 kV to MOS-SLY2-ER8 (655373) 69 kV line CKT 1, near SULLYBT-ER8 (655488) 69 kV. a. Apply fault at the SULLYBT-ER8 (655488) 69 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.

Table 6-1 Continued

Fault ID	Planning Event	Fault Descriptions
FLT9014-3PH	P1	3 Phase fault on SULLYBT-ER8 (655488) 69 kV to OKOBOJO-ER8 (655334) 69 kV line CKT 1, near SULLYBT-ER8 (655488) 69 kV. a. Apply fault at the SULLYBT-ER8 (655488) 69 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9015-3PH	P1	3 Phase fault on OAHE 4 (652519) 230 kV to NORTHBEND4 (652516) 230 kV line CKT 1, near OAHE 4 (652519) 230 kV. a. Apply fault at the OAHE 4 (652519) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9016-3PH	P1	3 Phase fault on NORTHBEND4 (652516) 230 kV to OAHE 4 (652519) 230 kV line CKT 1, near NORTHBEND4 (652516) 230 kV. a. Apply fault at the NORTHBEND4 (652516) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9017-3PH	P1	3 Phase fault on NORTHBEND4 (652516) 230 kV to GEN-2016-094 (587760) 230 kV line CKT 1, near NORTHBEND4 (652516) 230 kV. a. Apply fault at the NORTHBEND4 (652516) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Trip generator(s) on the Bus G16-094-GEN1 (587763) 0.7 kV d. Wait 20 cycles, and then re-close the line in (b) back into the fault. e. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9018-3PH	P1	3 Phase fault on NORTHBEND4 (652516) 230 kV to FTTHOMP4 (652507) 230 kV line CKT 1, near NORTHBEND4 (652516) 230 kV. a. Apply fault at the NORTHBEND4 (652516) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9019-3PH	P1	3 Phase fault on OAHE 4 (652519) 230 kV to FTTHOMP4 (652507) 230 kV line CKT 3, near OAHE 4 (652519) 230 kV. a. Apply fault at the OAHE 4 (652519) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9020-3PH	P1	3 Phase fault on FTTHOMP4 (652507) 230 kV to OAHE 4 (652519) 230 kV line CKT 3, near FTTHOMP4 (652507) 230 kV. a. Apply fault at the FTTHOMP4 (652507) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9021-3PH	P1	3 Phase fault on FTTHOMP4 (652507) 230 kV to NORTHBEND4 (652516) 230 kV line CKT 1, near FTTHOMP4 (652507) 230 kV. a. Apply fault at the FTTHOMP4 (652507) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9022-3PH	P1	3 Phase fault on FTTHOMP4 (652507) 230 kV / FTTHOMP3 (652506) 345 kV / FTTHMP29 (652274) 13.8 kV XFMR CKT 1, near FTTHOMP4 (652507) 230 kV. a. Apply fault at the FTTHOMP4 (652507) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line.
FLT9023-3PH	P1	3 Phase fault on FTTHOMP3 (652506) 345 kV / FTTHOMP4 (652507) 230 kV / FTTHMP29 (652274) 13.8 kV XFMR CKT 1, near FTTHOMP3 (652506) 345 kV. a. Apply fault at the FTTHOMP3 (652506) 345 kV Bus. b. Clear fault after 6 cycles by tripping the faulted line.
FLT9024-3PH	P1	3 Phase fault on FTTHOMP4 (652507) 230 kV to FTRANDL4 (652509) 230 kV line CKT 1, near FTTHOMP4 (652507) 230 kV. a. Apply fault at the FTTHOMP4 (652507) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.

Table 6-1 Continued

Fault ID	Planning Event	Fault Descriptions
FLT9025-3PH	P1	3 Phase fault on FTTHOMP4 (652507) 230 kV to LAKPLAT-ER4 (655475) 230 kV line CKT 1, near FTTHOMP4 (652507) 230 kV. a. Apply fault at the FTTHOMP4 (652507) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9026-3PH	P1	3 Phase fault on FTTHOMP4 (652507) 230 kV to WESSINGTON 4 (652607) 230 kV line CKT 1, near FTTHOMP4 (652507) 230 kV. a. Apply fault at the FTTHOMP4 (652507) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9027-3PH	P1	3 Phase fault on FTTHOMP4 (652507) 230 kV to G17-094-TAP (589324) 230 kV line CKT 1, near FTTHOMP4 (652507) 230 kV. a. Apply fault at the FTTHOMP4 (652507) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9028-3PH	P1	3 Phase fault on FTTHOMP4 (652507) 230 kV to HURON 4 (652514) 230 kV line CKT 2, near FTTHOMP4 (652507) 230 kV. a. Apply fault at the FTTHOMP4 (652507) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9029-3PH	P1	3 Phase fault on FTTHOMP4 (652507) 230 kV to LETCHER4 (652606) 230 kV line CKT 1, near FTTHOMP4 (652507) 230 kV. a. Apply fault at the FTTHOMP4 (652507) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9030-3PH	P1	3 Phase fault on FTTHOMP4 (652507) 230 kV to BIGBND14 (652540) 230 kV line CKT 1, near FTTHOMP4 (652507) 230 kV. a. Apply fault at the FTTHOMP4 (652507) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. Trip generator(s) on the Bus BGBND12G (652542) 13.8 kV Trip generator(s) on the Bus BGBND34G (652543) 13.8 kV c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9031-3PH	P1	3 Phase fault on FTTHOMP4 (652507) 230 kV to BIGBND24 (652541) 230 kV line CKT 2, near FTTHOMP4 (652507) 230 kV. a. Apply fault at the FTTHOMP4 (652507) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. Trip generator(s) on the Bus BGBND56G (652544) 13.8 kV Trip generator(s) on the Bus BGBND78G (652545) 13.8 kV c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9032-3PH	P1	3 Phase fault on FTTHOMP4 (652507) 230 kV / FTTHOMP8 (652276) 69 kV / FTTHOMP9 (652277) 13.8 kV XFMR CKT 1, near FTTHOMP4 (652507) 230 kV. a. Apply fault at the FTTHOMP4 (652507) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. Trip generator(s) on the Bus HYDE -PPW (659291) 0.7 kV
FLT9033-3PH	P1	3 Phase fault on FTTHOMP8 (652276) 69 kV / FTTHOMP4 (652507) 230 kV / FTTHOMP9 (652277) 13.8 kV XFMR CKT 1, near FTTHOMP8 (652276) 69 kV. a. Apply fault at the FTTHOMP8 (652276) 69 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. Trip generator(s) on the Bus HYDE -PPW (659291) 0.7 kV
FLT9034-3PH	P1	3 Phase fault on FTTHOMP8 (652276) 69 kV to MOS-AMES-ER8 (655153) 69 kV line CKT 1, near FTTHOMP8 (652276) 69 kV. a. Apply fault at the FTTHOMP8 (652276) 69 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. Trip generator(s) on the Bus HYDE -PPW (659291) 0.7 kV c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.

Table 6-1 Continued

Fault ID	Planning Event	Fault Descriptions
FLT9035-3PH	P1	3 Phase fault on FTTHOM1-LNX3 (652806) 345 kV to FTTHOMP3 (652506) 345 kV line CKT Z, near FTTHOM1-LNX3 (652806) 345 kV. a. Apply fault at the FTTHOM1-LNX3 (652806) 345 kV Bus. b. Clear fault after 6 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 6 cycles, then trip the line in (b) and remove fault.
FLT9036-3PH	P1	3 Phase fault on FTTHOM2-LNX3 (652807) 345 kV to FTTHOMP3 (652506) 345 kV line CKT Z, near FTTHOM2-LNX3 (652807) 345 kV. a. Apply fault at the FTTHOM2-LNX3 (652807) 345 kV Bus. b. Clear fault after 6 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 6 cycles, then trip the line in (b) and remove fault.
FLT9037-3PH	P1	3 Phase fault on FTTHOM1-LNX3 (652806) 345 kV to CHAPELLE-BE3 (659130) 345 kV line CKT 1, near FTTHOM1-LNX3 (652806) 345 kV. a. Apply fault at the FTTHOM1-LNX3 (652806) 345 kV Bus. b. Clear fault after 6 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 6 cycles, then trip the line in (b) and remove fault.
FLT9038-3PH	P1	3 Phase fault on FTTHOM2-LNX3 (652807) 345 kV to GRPRAR2-LNX3 (652833) 345 kV line CKT 1, near FTTHOM2-LNX3 (652807) 345 kV. a. Apply fault at the FTTHOM2-LNX3 (652807) 345 kV Bus. b. Clear fault after 6 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 6 cycles, then trip the line in (b) and remove fault.
FLT9039-3PH	P1	3 Phase fault on PHILIP_T-BE4 (659188) 230 kV to NUNDRWD4 (652484) 230 kV line CKT 1, near PHILIP_T-BE4 (659188) 230 kV. a. Apply fault at the PHILIP_T-BE4 (659188) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9040-3PH	P1	3 Phase fault on NUNDRWD4 (652484) 230 kV to PHILIP_T-BE4 (659188) 230 kV line CKT 1, near NUNDRWD4 (652484) 230 kV. a. Apply fault at the NUNDRWD4 (652484) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9041-3PH	P1	3 Phase fault on NUNDRWD4 (652484) 230 kV to DRYCREEK-BE4 (659376) 230 kV line CKT 1, near NUNDRWD4 (652484) 230 kV. a. Apply fault at the NUNDRWD4 (652484) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9042-3PH	P1	3 Phase fault on DRYCREEK-BE4 (659376) 230 kV to NUNDRWD4 (652484) 230 kV line CKT 1, near DRYCREEK-BE4 (659376) 230 kV. a. Apply fault at the DRYCREEK-BE4 (659376) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9043-3PH	P1	3 Phase fault on DRYCREEK-BE4 (659376) 230 kV / DRYCREEK-BE7 (659377) 115 kV / DC.KV11A-BE9 (659378) 13.8 kV XFMR CKT 1, near DRYCREEK-BE4 (659376) 230 kV. a. Apply fault at the DRYCREEK-BE4 (659376) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line.
FLT9044-3PH	P1	3 Phase fault on DRYCREEK-BE7 (659377) 115 kV / DRYCREEK-BE4 (659376) 230 kV / DC.KV11A-BE9 (659378) 13.8 kV XFMR CKT 1, near DRYCREEK-BE7 (659377) 115 kV. a. Apply fault at the DRYCREEK-BE7 (659377) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line.
FLT9045-3PH	P1	3 Phase fault on DRYCREEK-BE7 (659377) 115 kV to RAPIDCY7 (652490) 115 kV line CKT 1, near DRYCREEK-BE7 (659377) 115 kV. a. Apply fault at the DRYCREEK-BE7 (659377) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.

Table 6-1 Continued

Fault ID	Planning Event	Fault Descriptions
FLT9046-3PH	P1	3 Phase fault on DRYCREEK-BE4 (659376) 230 kV to RCDC.E__-BE4 (659271) 230 kV line CKT Z, near DRYCREEK-BE4 (659376) 230 kV. a. Apply fault at the DRYCREEK-BE4 (659376) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9047-3PH	P1	3 Phase fault on NUNDRWD4 (652484) 230 kV to NUNDRWD-LNX3 (652884) 230 kV line CKT Z, near NUNDRWD4 (652484) 230 kV. a. Apply fault at the NUNDRWD4 (652484) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9048-3PH	P1	3 Phase fault on NUNDRWD-LNX3 (652884) 230 kV to MAURINE4 (652497) 230 kV line CKT 1, near NUNDRWD-LNX3 (652884) 230 kV. a. Apply fault at the NUNDRWD-LNX3 (652884) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9049-3PH	P1	3 Phase fault on NUNDRWD4 (652484) 230 kV to WAYSIDE4 (640404) 230 kV line CKT 1, near NUNDRWD4 (652484) 230 kV. a. Apply fault at the NUNDRWD4 (652484) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9050-3PH	P1	3 Phase fault on WAYSIDE4 (640404) 230 kV to NUNDRWD4 (652484) 230 kV line CKT 1, near WAYSIDE4 (640404) 230 kV. a. Apply fault at the WAYSIDE4 (640404) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9051-3PH	P1	3 Phase fault on WAYSIDE4 (640404) 230 kV / WAYSIDE7 (640405) 115 kV / WAYSIDE9 (640406) 13.8 kV XFMR CKT 1, near WAYSIDE4 (640404) 230 kV. a. Apply fault at the WAYSIDE4 (640404) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line.
FLT9052-3PH	P1	3 Phase fault on WAYSIDE7 (640405) 115 kV / WAYSIDE4 (640404) 230 kV / WAYSIDE9 (640406) 13.8 kV XFMR CKT 1, near WAYSIDE7 (640405) 115 kV. a. Apply fault at the WAYSIDE7 (640405) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line.
FLT9053-3PH	P1	3 Phase fault on WAYSIDE7 (640405) 115 kV to CHADRON7 (640109) 115 kV line CKT 1, near WAYSIDE7 (640405) 115 kV. a. Apply fault at the WAYSIDE7 (640405) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9054-3PH	P1	3 Phase fault on WAYSIDE4 (640404) 230 kV to STEGALL-LNX3 (652873) 230 kV line CKT 1, near WAYSIDE4 (640404) 230 kV. a. Apply fault at the WAYSIDE4 (640404) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9055-3PH	P1	3 Phase fault on NUNDRWD4 (652484) 230 kV / NUNDRWD7 (652485) 115 kV / NUNDRWD10 (652266) 13.8 kV XFMR CKT 1, near NUNDRWD4 (652484) 230 kV. a. Apply fault at the NUNDRWD4 (652484) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line.
FLT9056-3PH	P1	3 Phase fault on NUNDRWD7 (652485) 115 kV / NUNDRWD4 (652484) 230 kV / NUNDRWD10 (652266) 13.8 kV XFMR CKT 1, near NUNDRWD7 (652485) 115 kV. a. Apply fault at the NUNDRWD7 (652485) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line.
FLT9057-3PH	P1	3 Phase fault on NUNDRWD7 (652485) 115 kV to ELSWRTH7 (652477) 115 kV line CKT 1, near NUNDRWD7 (652485) 115 kV. a. Apply fault at the NUNDRWD7 (652485) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.

Table 6-1 Continued

Fault ID	Planning Event	Fault Descriptions
FLT9058-3PH	P1	3 Phase fault on ELSWRTH7 (652477) 115 kV to NUNDRWD7 (652485) 115 kV line CKT 1, near ELSWRTH7 (652477) 115 kV. a. Apply fault at the ELSWRTH7 (652477) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9059-3PH	P1	3 Phase fault on NUNDRWD7 (652485) 115 kV to RUSHMORE-RM7 (655763) 115 kV line CKT 1, near NUNDRWD7 (652485) 115 kV. a. Apply fault at the NUNDRWD7 (652485) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9060-3PH	P1	3 Phase fault on RUSHMORE-RM7 (655763) 115 kV to NUNDRWD7 (652485) 115 kV line CKT 1, near RUSHMORE-RM7 (655763) 115 kV. a. Apply fault at the RUSHMORE-RM7 (655763) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9061-3PH	P1	3 Phase fault on NUNDRWD7 (652485) 115 kV to WICKSVL7 (652493) 115 kV line CKT 1, near NUNDRWD7 (652485) 115 kV. a. Apply fault at the NUNDRWD7 (652485) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9062-3PH	P1	3 Phase fault on WICKSVL7 (652493) 115 kV to NUNDRWD7 (652485) 115 kV line CKT 1, near WICKSVL7 (652493) 115 kV. a. Apply fault at the WICKSVL7 (652493) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9063-3PH	P1	3 Phase fault on WICKSVL7 (652493) 115 kV to WALL 7 (652492) 115 kV line CKT 1, near WICKSVL7 (652493) 115 kV. a. Apply fault at the WICKSVL7 (652493) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9064-3PH	P1	3 Phase fault on WALL 7 (652492) 115 kV to WICKSVL7 (652493) 115 kV line CKT 1, near WALL 7 (652492) 115 kV. a. Apply fault at the WALL 7 (652492) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9065-3PH	P1	3 Phase fault on PHILIP 7 (652487) 115 kV to WALL 7 (652492) 115 kV line CKT 1, near PHILIP 7 (652487) 115 kV. a. Apply fault at the PHILIP 7 (652487) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9066-3PH	P1	3 Phase fault on WALL 7 (652492) 115 kV to PHILIP 7 (652487) 115 kV line CKT 1, near WALL 7 (652492) 115 kV. a. Apply fault at the WALL 7 (652492) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9067-3PH	P1	3 Phase fault on RUSHMORE-RM7 (655763) 115 kV to RUSHMORE-RM8 (655764) 69 kV XFMR CKT 1, near RUSHMORE-RM7 (655763) 115 kV. a. Apply fault at the RUSHMORE-RM7 (655763) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line.
FLT9068-3PH	P1	3 Phase fault on RUSHMORE-RM7 (655763) 115 kV to RAPIDCY7 (652490) 115 kV line CKT 1, near RUSHMORE-RM7 (655763) 115 kV. a. Apply fault at the RUSHMORE-RM7 (655763) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.

Table 6-1 Continued

Fault ID	Planning Event	Fault Descriptions
FLT9069-3PH	P1	3 Phase fault on ELSWRTH7 (652477) 115 kV to RAPIDCY7 (652490) 115 kV line CKT 1, near ELSWRTH7 (652477) 115 kV. a. Apply fault at the ELSWRTH7 (652477) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9070-3PH	P1	3 Phase fault on PHILIP_T-BE4 (659188) 230 kV to PHILIP__BE4 (659192) 230 kV line CKT 1, near PHILIP_T-BE4 (659188) 230 kV. a. Apply fault at the PHILIP_T-BE4 (659188) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9071-3PH	P1	3 Phase fault on PHILIP 7 (652487) 115 kV / PHILIP__BE4 (659192) 230 kV / PHILIP__BE9 (659193) 13.2 kV XFMR CKT 1, near PHILIP 7 (652487) 115 kV. a. Apply fault at the PHILIP 7 (652487) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line.
FLT9072-3PH	P1	3 Phase fault on PHILIP 7 (652487) 115 kV to PHILIP 8 (652268) 69 kV XFMR CKT 1, near PHILIP 7 (652487) 115 kV. a. Apply fault at the PHILIP 7 (652487) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line.
FLT9073-3PH	P1	3 Phase fault on PHILIP 7 (652487) 115 kV to WANBLEE 7 (652579) 115 kV line CKT 1, near PHILIP 7 (652487) 115 kV. a. Apply fault at the PHILIP 7 (652487) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9074-3PH	P1	3 Phase fault on WANBLEE 7 (652579) 115 kV to PHILIP 7 (652487) 115 kV line CKT 1, near WANBLEE 7 (652579) 115 kV. a. Apply fault at the WANBLEE 7 (652579) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9075-3PH	P1	3 Phase fault on WANBLEE 7 (652579) 115 kV to MARTIN 7 (652479) 115 kV line CKT 2, near WANBLEE 7 (652579) 115 kV. a. Apply fault at the WANBLEE 7 (652579) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9076-3PH	P1	3 Phase fault on MARTIN 7 (652479) 115 kV to WANBLEE 7 (652579) 115 kV line CKT 2, near MARTIN 7 (652479) 115 kV. a. Apply fault at the MARTIN 7 (652479) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9077-3PH	P1	3 Phase fault on PHILIP 7 (652487) 115 kV to MIDLAND7 (652481) 115 kV line CKT 1, near PHILIP 7 (652487) 115 kV. a. Apply fault at the PHILIP 7 (652487) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9078-3PH	P1	3 Phase fault on MIDLAND7 (652481) 115 kV to PHILIP 7 (652487) 115 kV line CKT 1, near MIDLAND7 (652481) 115 kV. a. Apply fault at the MIDLAND7 (652481) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9079-3PH	P1	3 Phase fault on MIDLAND7 (652481) 115 kV to MIDLAND8 (652263) 69 kV XFMR CKT 1, near MIDLAND7 (652481) 115 kV. a. Apply fault at the MIDLAND7 (652481) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line.

Table 6-1 Continued

Fault ID	Planning Event	Fault Descriptions
FLT9080-3PH	P1	3 Phase fault on MIDLAND7 (652481) 115 kV to IRVSIMM7 (658174) 115 kV line CKT 1, near MIDLAND7 (652481) 115 kV. a. Apply fault at the MIDLAND7 (652481) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9081-3PH	P1	3 Phase fault on IRVSIMM7 (658174) 115 kV to MIDLAND7 (652481) 115 kV line CKT 1, near IRVSIMM7 (658174) 115 kV. a. Apply fault at the IRVSIMM7 (658174) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9082-3PH	P1	3 Phase fault on IRVSIMM7 (658174) 115 kV to PIERRE 7 (652489) 115 kV line CKT 1, near IRVSIMM7 (658174) 115 kV. a. Apply fault at the IRVSIMM7 (658174) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9083-3PH	P1	3 Phase fault on OAHE 4 (652519) 230 kV / OAHE 7 (652520) 115 kV / OAHE 29 (652598) 13.8 kV XFMR CKT 1, near OAHE 4 (652519) 230 kV. a. Apply fault at the OAHE 4 (652519) 230 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line.
FLT9084-3PH	P1	3 Phase fault on OAHE 7 (652520) 115 kV / OAHE 4 (652519) 230 kV / OAHE 29 (652598) 13.8 kV XFMR CKT 1, near OAHE 7 (652520) 115 kV. a. Apply fault at the OAHE 7 (652520) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line.
FLT9085-3PH	P1	3 Phase fault on OAHE 7 (652520) 115 kV to OAHE 1G (652559) 13.8 kV XFMR CKT 1, near OAHE 7 (652520) 115 kV. a. Apply fault at the OAHE 7 (652520) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. Trip generator(s) on the Bus OAHE 1G (652559) 13.8 kV
FLT9086-3PH	P1	3 Phase fault on OAHE 7 (652520) 115 kV to EAGLEBT7 (652476) 115 kV line CKT 1, near OAHE 7 (652520) 115 kV. a. Apply fault at the OAHE 7 (652520) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9087-3PH	P1	3 Phase fault on EAGLEBT7 (652476) 115 kV to OAHE 7 (652520) 115 kV line CKT 1, near EAGLEBT7 (652476) 115 kV. a. Apply fault at the EAGLEBT7 (652476) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9088-3PH	P1	3 Phase fault on OAHE 7 (652520) 115 kV to ASH TAP (652600) 115 kV line CKT 1, near OAHE 7 (652520) 115 kV. a. Apply fault at the OAHE 7 (652520) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9089-3PH	P1	3 Phase fault on ASH TAP (652600) 115 kV to OAHE 7 (652520) 115 kV line CKT 1, near ASH TAP (652600) 115 kV. a. Apply fault at the ASH TAP (652600) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9090-3PH	P1	3 Phase fault on ASH TAP (652600) 115 kV to PIERRE 7 (652489) 115 kV line CKT 1, near ASH TAP (652600) 115 kV. a. Apply fault at the ASH TAP (652600) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.

Table 6-1 Continued

Fault ID	Planning Event	Fault Descriptions
FLT9091-3PH	P1	3 Phase fault on ASH TAP (652600) 115 kV to GARFLD 7 (658176) 115 kV line CKT 1, near ASH TAP (652600) 115 kV. a. Apply fault at the ASH TAP (652600) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9092-3PH	P1	3 Phase fault on OAHE 7 (652520) 115 kV to IRVSIMM7 (658174) 115 kV line CKT 1, near OAHE 7 (652520) 115 kV. a. Apply fault at the OAHE 7 (652520) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9093-3PH	P1	3 Phase fault on IRVSIMM7 (658174) 115 kV to OAHE 7 (652520) 115 kV line CKT 1, near IRVSIMM7 (658174) 115 kV. a. Apply fault at the IRVSIMM7 (658174) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9094-3PH	P1	3 Phase fault on EAGLEBT7 (652476) 115 kV to FAITH 7 (652243) 115 kV line CKT 1, near EAGLEBT7 (652476) 115 kV. a. Apply fault at the EAGLEBT7 (652476) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave Fault on for 7 cycles, then trip the line in (b) and remove fault.
FLT9095-3PH	P1	3 Phase fault on EAGLEBT7 (652476) 115 kV to EAGLEBE8 (652259) 69 kV XFMR CKT 1, near EAGLEBT7 (652476) 115 kV. a. Apply fault at the EAGLEBT7 (652476) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line.
FLT9096-3PH	P1	3 Phase fault on EAGLEBT7 (652476) 115 kV to EAGLEBW8 (652260) 69 kV XFMR CKT 1, near EAGLEBT7 (652476) 115 kV. a. Apply fault at the EAGLEBT7 (652476) 115 kV Bus. b. Clear fault after 7 cycles by tripping the faulted line.

6.3 Results

Table 6-2 shows the relevant results of the fault events simulated for each of the modified models. Existing DISIS base case issues are documented separately in Appendix C. The associated stability plots are also provided in Appendix C.

Table 6-2: GEN-2017-014 Dynamic Stability Results

Fault ID	25SP			25WP		
	Voltage Violation	Voltage Recovery	Stable	Voltage Violation	Voltage Recovery	Stable
FLT1000-SB	Pass	Pass	Stable	Pass	Pass	Stable
FLT1001-SB	Pass	Pass	Stable	Pass	Pass	Stable
FLT1002-SB	Pass	Pass	Stable	Pass	Pass	Stable
FLT1003-SB	Pass	Pass	Stable	Pass	Pass	Stable
FLT1004-SB	Pass	Pass	Stable	Pass	Pass	Stable
FLT1005-SB	Pass	Pass	Stable	Pass	Pass	Stable
FLT1006-SB	Pass	Pass	Stable	Pass	Pass	Stable
FLT1007-SB	Pass	Pass	Stable	Pass	Pass	Stable
FLT1008-SB	Pass	Pass	Stable	Pass	Pass	Stable
FLT1009-SB	Pass	Pass	Stable	Pass	Pass	Stable

Table 6-2 continued

Fault ID	25SP			25WP		
	Voltage Violation	Voltage Recovery	Stable	Voltage Violation	Voltage Recovery	Stable
FLT1010-SB	Pass	Pass	Stable	Pass	Pass	Stable
FLT1011-SB	Pass	Pass	Stable	Pass	Pass	Stable
FLT1012-SB	Pass	Pass	Stable	Pass	Pass	Stable
FLT1013-SB	Pass	Pass	Stable	Pass	Pass	Stable
FLT9000-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9001-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9002-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9003-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9004-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9005-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9006-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9007-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9008-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9009-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9010-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9011-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9012-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9013-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9014-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9015-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9016-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9017-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9018-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9019-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9020-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9021-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9022-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9023-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9024-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9025-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9026-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9027-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9028-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9029-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9030-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9031-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9032-3PH	Pass	Pass	Stable	Pass	Pass	Stable

Table 6-2 continued

Fault ID	25SP			25WP		
	Voltage Violation	Voltage Recovery	Stable	Voltage Violation	Voltage Recovery	Stable
FLT9033-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9034-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9035-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9036-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9037-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9038-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9039-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9040-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9041-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9042-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9043-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9044-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9045-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9046-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9047-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9048-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9049-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9050-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9051-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9052-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9053-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9054-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9055-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9056-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9057-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9058-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9059-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9060-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9061-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9062-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9063-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9064-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9065-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9066-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9067-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9068-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9069-3PH	Pass	Pass	Stable	Pass	Pass	Stable

Table 6-2 continued

Fault ID	25SP			25WP		
	Voltage Violation	Voltage Recovery	Stable	Voltage Violation	Voltage Recovery	Stable
FLT9070-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9071-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9072-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9073-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9074-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9075-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9076-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9077-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9078-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9079-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9080-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9081-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9082-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9083-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9084-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9085-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9086-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9087-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9088-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9089-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9090-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9091-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9092-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9093-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9094-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9095-3PH	Pass	Pass	Stable	Pass	Pass	Stable
FLT9096-3PH	Pass	Pass	Stable	Pass	Pass	Stable

The results of the dynamic stability showed several existing base case issues that were found in both the original DISIS-2022-001-1 models and the models with the GEN-2017-014 modification included. These issues were not attributed to the GEN-2017-014 modification request and detailed in Appendix C.

There were no damping or voltage recovery violations attributed to the GEN-2017-014 modification request observed during the simulated faults. Additionally, the project was found to stay connected during the contingencies that were studied and, therefore, will meet the Low Voltage Ride Through (LVRT) requirements of FERC Order #661A.

7.0 Modified Capacity Exceeds GIA Capacity

Under FERC Order 845, Interconnection Customers are allowed to request Interconnection Service that is lower than the full generating capacity of their planned generating facilities. The Interconnection Customers must install acceptable control and protection devices that prevent the injection above their requested Interconnection Service amount measured at the POI.

As such, Interconnection Customers are allowed to increase the generating capacity of a generating facility without increasing its Interconnection Service amount stated in its GIA. This is allowable as long as they install the proper control and protection devices, and the requested modification is not determined to be a Material Modification.

The modified generating capacity of GEN-2017-014 exceeds the GIA Interconnection Service amount, 300 MW, as listed in Appendix A of the GIA.

The customer must install monitoring and control equipment as needed to ensure that the amount of power injected at the POI does not exceed the Interconnection Service amount listed in its GIA.

8.0 Material Modification Determination

In accordance with Attachment V of SPP's Open Access Transmission Tariff, for modifications other than those specifically permitted by Attachment V, SPP shall evaluate the proposed modifications prior to making them and inform the Interconnection Customer in writing of whether the modifications would constitute a Material Modification. Material Modification shall mean (1) modification to an Interconnection Request in the queue that has a material adverse impact on the cost or timing of any other Interconnection Request with a later Queue priority date; or (2) planned modification to an Existing Generating Facility that is undergoing evaluation for a Generating Facility Modification or Generating Facility Replacement, and has a material adverse impact on the Transmission System with respect to: i) steady-state thermal or voltage limits, ii) dynamic system stability and response, or iii) short-circuit capability limit; compared to the impacts of the Existing Generating Facility prior to the modification or replacement.

8.1 Results

SPP determined the requested modification is not a Material Modification based on the results of this Modification Request Impact Study performed by Aneden. Aneden evaluated the impact of the requested modification on the prior study results. Aneden determined that the requested modification did not negatively impact the prior study dynamic stability and short circuit results, and the modifications to the project were not significant enough to change the previously studied steady-state conclusions.

This determination implies that any network upgrades already required by GEN-2017-014 would not be negatively impacted and that no new upgrades are required due to the requested modification, thus not resulting in a material adverse impact on the cost or timing of any other Interconnection Request with a later Queue priority date.