



Report on

# GEN-2023-SR7 Surplus Service Impact Study

**Revision R1     April 26, 2023**

Submitted to  
Southwest Power Pool



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## Revision History

DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION
4/26/2023	Aneden Consulting	Initial Report Issued

## Executive Summary

Aneden Consulting (Aneden) was retained by the Southwest Power Pool (SPP) to perform a Surplus Interconnection Service Impact Study (Study) for GEN-2023-SR7 to utilize the Surplus Interconnection Service being made available by the GEN-2015-007 at its existing Point of Interconnection (POI), the Hoskins 345 kV Substation in the Nebraska Public Power District (NPPD) control area.

GEN-2023-SR7, the proposed Surplus Generating Facility (SGF), will connect to the existing GEN-2015-007 main collection substation and share its main power transformer. In addition, the prior-queued surplus request GEN-2023-SR6 is connected at the same bus and was included in the base models.

GEN-2015-007, the Existing Generating Facility (EGF), has an effective Generator Interconnection Agreement (GIA) with a POI capacity of 160 MW and is making 135 MW of Surplus Interconnection Service available to GEN-2023-SR7 at its point of interconnection. Per the SPP Open Access Transmission Tariff (SPP Tariff), the amount of Surplus Interconnection Service available to the SGF is limited by the amount of Interconnection Service granted to the EGF at the same POI. In addition, the Surplus Interconnection Service is only available up to the amount that can be accommodated without requiring Network Upgrades unless specified in the SPP Tariff<sup>1</sup>.

The proposed SGF configuration consists of 36 x Power Electronics FP4200M2 3.75 MW battery storage (BESS) inverters for a total assumed dispatch of 135 MW. The inverters are rated at 4.2 MW, thus the generating capability of the SGF (151.2 MW) exceeds its requested Surplus Interconnection Service of 135 MW. The injection amount of the SGF must be limited to 135 MW at the POI. The combined generation from GEN-2023-SR6, the SGF, and the EGF may not exceed 160 MW at the POI. GEN-2023-SR7 includes the use of a Power Plant Controller (PPC) to limit the power injection as required. GEN-2023-SR6, the SGF, and the EGF information is shown in Table ES-1 below.

The detailed SGF configuration is captured in Table ES-2 below.

**Table ES-1: EGF, SR6, & SGF Configuration**

Request	Interconnection Queue Capacity (MW)	Fuel Type	Point of Interconnection
GEN-2023-SR7 (SGF)	135	Battery/Storage	Hoskins 345 kV (640226)
GEN-2023-SR6 (Prior-Queued SGF)	100.24	Solar	Hoskins 345 kV (640226)
GEN-2015-007 (EGF)	160	Wind	Hoskins 345 kV (640226)

<sup>1</sup> Allowed Network Upgrades detailed in SPP Open Access Transmission Tariff Attachment V Section 3.3

**Table ES-2: SGF Interconnection Configuration**

Facility	SGF Configuration (GEN-2023-SR7)	
Point of Interconnection	Hoskins 345 kV (640226)	
Configuration/Capacity	36 x PE FP4200M2 3.75 MW (BESS) = 135 MW [dispatch] Units are rated at 4.2 MW, PPC to limit GEN-2023-SR7 to 135 MW at the POI and total POI injection w/ GEN-2015-007 and GEN-2023-SR6 to 160 MW	
Generation Interconnection Line (Shared with the EGF & GEN-2023-SR6 and unchanged)	<b><u>GEN-2015-007 to Turtle Creek 345 kV:</u></b> Length = 8.44 miles R = 0.000345 pu X = 0.004120 pu B = 0.072150 pu Rating MVA = 1084 MVA	<b><u>Turtle Creek to Hoskins 345 kV:</u></b> Length = 6.16 miles R = 0.000255 pu X = 0.003000 pu B = 0.052680 pu Rating MVA = 1195 MVA
Main Substation Transformer <sup>1</sup> (Shared with the EGF & GEN-2023-SR6 and unchanged)	X12 = 8.65% R12 = 0.167%, X23 = 12.5% R23 = 0.167%, X13 = 4.7% R13 = 0.167%, Winding MVA = 108 MVA, Winding 1 & 2 Rating MVA = 180 MVA Winding 3 Rating MVA = 40 MVA	
Equivalent GSU Transformer <sup>1</sup>	Gen 1 Equivalent Qty: 36 X = 8.998%, R = 0.874%, Winding MVA = 151.452 MVA, Rating MVA <sup>2</sup> = 151.5 MVA	
Generator Dynamic Model <sup>3</sup> & Power Factor	36 x PE FP4200M2 4.2 MVA (REGCAU1) <sup>3</sup> Leading: 0.893 Lagging: 0.893	
Reactive Power Devices (Shared with the EGF & GEN-2023-SR6 and unchanged)	1 x 14 MVar 34.5 kV Capacitor Bank	

1) X and R based on Winding MVA, 2) Rating rounded in PSS/E, 3) DYN stability model name

SPP determined that steady-state analysis was not required because the addition of the SGF does not increase the maximum active power output of 160 MW. In addition, the EGF was previously studied at maximum Interconnection Service under all necessary reliability conditions.

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

Aneden performed the analyses using the study data provided for the SGF, GEN-2023-SR6 and the DISIS-2017-002 study models:

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

Aneden reviewed Generation Interconnection Requests (GIRs) that shared the same POI, Hoskins 345 kV, and updated their models as applicable based on SPP’s confirmation of the latest project configurations. As a result, Aneden updated the GEN-2015-007 (EGF) project configuration in the base models.



All analyses were performed using the Siemens PTI PSS/E<sup>2</sup> version 34 software and the results are summarized below.

The results of the reactive power analysis using the 25SP model showed that the SGF project did not need a shunt reactor at the project substation to reduce the POI MVAR to zero when the EGF project and GEN-2023-SR6 have shunts compensating their charging effects. No additional compensation was necessary to offset the capacitive effect on the transmission network caused by the project 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. The applicable reactive power requirements will be further reviewed by the Transmission Owner and/or Transmission Operator.

The short circuit analysis was performed using the 25SP stability model modified for short circuit analysis. The results from the short circuit analysis compared the 25SP model with the EGF and GEN-2023-SR6 online and SGF not connected to an SGF study case (GEN-2023-SR6, EGF, and SGF online). The maximum contribution to three-phase fault currents in the immediate transmission systems due to the addition of the SGF was 0.13 kA. The maximum three-phase fault current level within 5 buses of the POI with the GEN-2023-SR6, EGF, and SGF generators online was 46 kA for the 25SP model. There were several buses with a maximum three-phase fault current over 40 kA. These buses are highlighted in Appendix B.

The dynamic stability analysis was performed using Siemens PTI PSS/E version 34.8.0 software for the two modified study models: 25SP and 25WP, each with four dispatch scenarios. The study scenarios are shown in Table ES-3. 44 events were simulated, which included three-phase faults and single-line-to-ground stuck breaker faults.

**Table ES-3: Study Scenarios (Generator Dispatch MW)**

Scenario	GEN-2015-007 EGF (MW)	GEN-2023-SR6 Prior-Queued SGF (MW)	GEN-2023-SR7 SGF (MW)	SR6 + EGF + SGF (MW)
1	0 (Offline)	0 (Offline)	135	135
2	25	0 (Offline)	135	160
3	0 (Offline)	25	135	160
4	12.5	12.5	135	160

The results of the dynamic stability analysis showed that there were several existing base case issues found in the original DISIS-2017-002 case and in the case with GEN-2023-SR7 included. These issues were not attributed to the GEN-2023-SR7 surplus request and are detailed in Appendix C.

There were no damping or voltage recovery violations attributed to the GEN-2023-SR7 surplus 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.

<sup>2</sup> Power System Simulator for Engineering

The results of the study showed that the Surplus Interconnection Service Request by GEN-2023-SR7 did not negatively impact the reliability of the Transmission System. There were no additional Interconnection Facilities or Network Upgrades identified by the analyses.

SPP has determined that GEN-2023-SR7 may utilize the requested 135 MW of Surplus Interconnection Service being made available by the EGF. The combined generation from GEN-2023-SR6, the SGF, and the EGF may not exceed 160 MW at the POI.

The customer must install monitoring and control equipment as needed to ensure that the SGF does not exceed the granted surplus amount and to ensure that combination of GEN-2023-SR6, the SGF, and the EGF power injected at the POI does not exceed the Interconnection Service amount listed in the EGF's GIA. The monitoring and control scheme may be reviewed by the TO and documented in Appendix C of the SGF GIA.

In accordance with FERC Order No. 827 the SGF, GEN-2023-SR6, and the EGF 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 Southwest Power Pool's OASIS by the customer.



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## 1.0 Scope of Study

Aneden Consulting (Aneden) was retained by the Southwest Power Pool (SPP) to perform a Surplus Service Impact Study (Study) for GEN-2023-SR7, the Surplus Generating Facility (SGF). A Surplus Service Impact Study is performed to identify the impact of the Surplus Interconnection Service on the transmission system reliability and any additional Interconnection Facilities necessary pursuant to the SPP Generator Interconnection Procedures (“GIP”) contained in Attachment V Section 3.3 of the SPP Open Access Transmission Tariff (SPP Tariff). The amount of Surplus Interconnection Service available to the SGF is limited by the amount of Interconnection Service granted to the existing interconnection customer for the Existing Generating Facility (EGF) at the same POI. The Surplus Interconnection Service is only available up to the amount that can be accommodated without requiring Network Upgrades unless specified in the SPP Tariff<sup>3</sup>. The required scope of the study is dependent upon the EGF and SGF specifications. The criteria sections below include the basis of the analyses included in 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 added capacitive effect at the POI caused by the project’s collection system and transmission line’s capacitance. A shunt reactor size was determined for the SGF to offset the capacitive effect and maintain zero (0) MVAR injection at the POI while the plant’s generators and capacitors were offline, and the GEN-2023-SR6 and EGF projects had a shunt compensating for their charging effects.

### 1.2 Short Circuit Analysis

SPP requires that a short circuit analysis be performed to determine the maximum available fault current requiring interruption by protective equipment with GEN-2023-SR6, the SGF, and the EGF online, along with the amount of increase in maximum fault current due to the addition of the SGF. The analysis was performed on two scenarios, with GEN-2023-SR6 and the EGF in service and SGF offline, and a modified case with GEN-2023-SR6, the EGF, and the SGF in service.

### 1.3 Stability Analysis

SPP requires that a dynamic stability analysis be performed to determine whether the SGF, EGF, GEN-2023-SR6, and the transmission system will remain stable and within applicable criteria. Dynamic stability analysis was performed on four dispatch scenarios, the first where the SGF was online at 100% of the assumed dispatch with GEN-2023-SR6 and the EGF offline and disconnected, and three additional scenarios where the SGF was online at 100% of the assumed dispatch and various combinations of GEN-2023-SR6 and the EGF were picking up the remaining EGF GIA capacity. The stability analysis will identify any additional Interconnection Facilities and Network Upgrades necessary.

### 1.4 Steady-State Analysis

The steady-state (thermal/voltage) analyses may be performed as necessary to ensure that all required reliability conditions are studied. If the EGF was not studied under off-peak conditions, off-peak steady state analyses shall be performed to the required level necessary to demonstrate reliable operation of the Surplus Interconnection Service. If the original system impact study is not available for the

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<sup>3</sup> Allowed Network Upgrades detailed in SPP Open Access Transmission Tariff Attachment V Section 3.3

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Interconnection Service, both off-peak and peak analysis may need to be performed for the EGF associated with the request.

An SGF that includes a fuel type (synchronous/non-synchronous) different from the EGF may require a steady-state analysis to study impacts resultant from changes in dispatch to all equal and lower queued requests. The steady-state analysis will identify any additional Interconnection Facilities and Network Upgrades necessary.

### **1.5 Necessary Interconnection Facilities & Network Upgrades**

The SPP Tariff<sup>4</sup> states that the reactive power, short circuit/fault duty, stability, and steady-state analyses (where applicable) for the Surplus Interconnection Service will identify any additional Interconnection Facilities necessary. In addition, the analyses will determine if any Network Upgrades are required for mitigation. The Surplus Interconnection Service is only available up to the amount that can be accommodated without requiring additional Network Upgrades unless (a) those additional Network Upgrades are either (1) located at the Point of Interconnection substation and at the same voltage level as the Generating Facility with an effective GIA, or (2) are System Protection Facilities; and (b) there are no material adverse impacts on the cost or timing of any Interconnection Requests pending at the time the Surplus Interconnection Service request is submitted.

### **1.6 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.

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<sup>4</sup> SPP Open Access Transmission Tariff Section 3.3.4.1

## 2.0 Surplus Interconnection Service Request

The GEN-2023-SR7 Interconnection Customer has requested a Surplus Interconnection Service Impact Study (Study) for GEN-2023-SR7 to utilize the Surplus Interconnection Service being made available by GEN-2015-007 at its existing Point of Interconnection (POI), the Hoskins 345 kV substation in the Nebraska Public Power District (NPPD) control area.

GEN-2023-SR7, the proposed Surplus Generating Facility (SGF), will connect to the existing GEN-2015-007 main collection substation and share its main power transformer. In addition, the prior-queued surplus request GEN-2023-SR6 is connected at the same bus and was included in the base models.

GEN-2015-007, the EGF, has an effective Generator Interconnection Agreement (GIA) with a POI capacity of 160 MW and is making 135 MW of Surplus Interconnection Service available to GEN-2023-SR7 at its point of interconnection. Per the SPP Tariff, the amount of Surplus Interconnection Service available to the SGF is limited by the amount of Interconnection Service granted to the EGF at the same POI. In addition, the Surplus Interconnection Service is only available up to the amount that can be accommodated without requiring additional Network Upgrades unless specified in the SPP Tariff.

At the time of the posting of this report, GEN-2015-007 (EGF) is an active existing generator at the same POI (Hoskins 345 kV) with a queue status of “IA FULLY EXECUTED/COMMERCIAL OPERATION”. GEN-2015-007 is a wind farm, has a maximum summer and winter queue capacity of 160 MW, and has Energy Resource Interconnection Service (ERIS). The EGF was originally studied in the DISIS-2015-001 cluster study. Figure 2-1 shows the power flow model single line diagram for the EGF & SR6 configuration.

The proposed SGF configuration consists of 36 x PE FP4200M2 3.75 MW battery storage (BESS) inverters for a total assumed dispatch of 160 MW. The inverters are rated at 4.2 MW, thus the generating capability of the SGF (151.2 MW) exceeds its requested Surplus Interconnection Service of 135 MW. The injection amount of the SGF must be limited to 135 MW at the POI. The combined generation from GEN-2023-SR6, the SGF, and the EGF may not exceed 160 MW at the POI. GEN-2023-SR7 includes the use of a Power Plant Controller (PPC) to limit the power injection as required. GEN-2023-SR6, the SGF, and the EGF information is shown in Table 2-1 below.

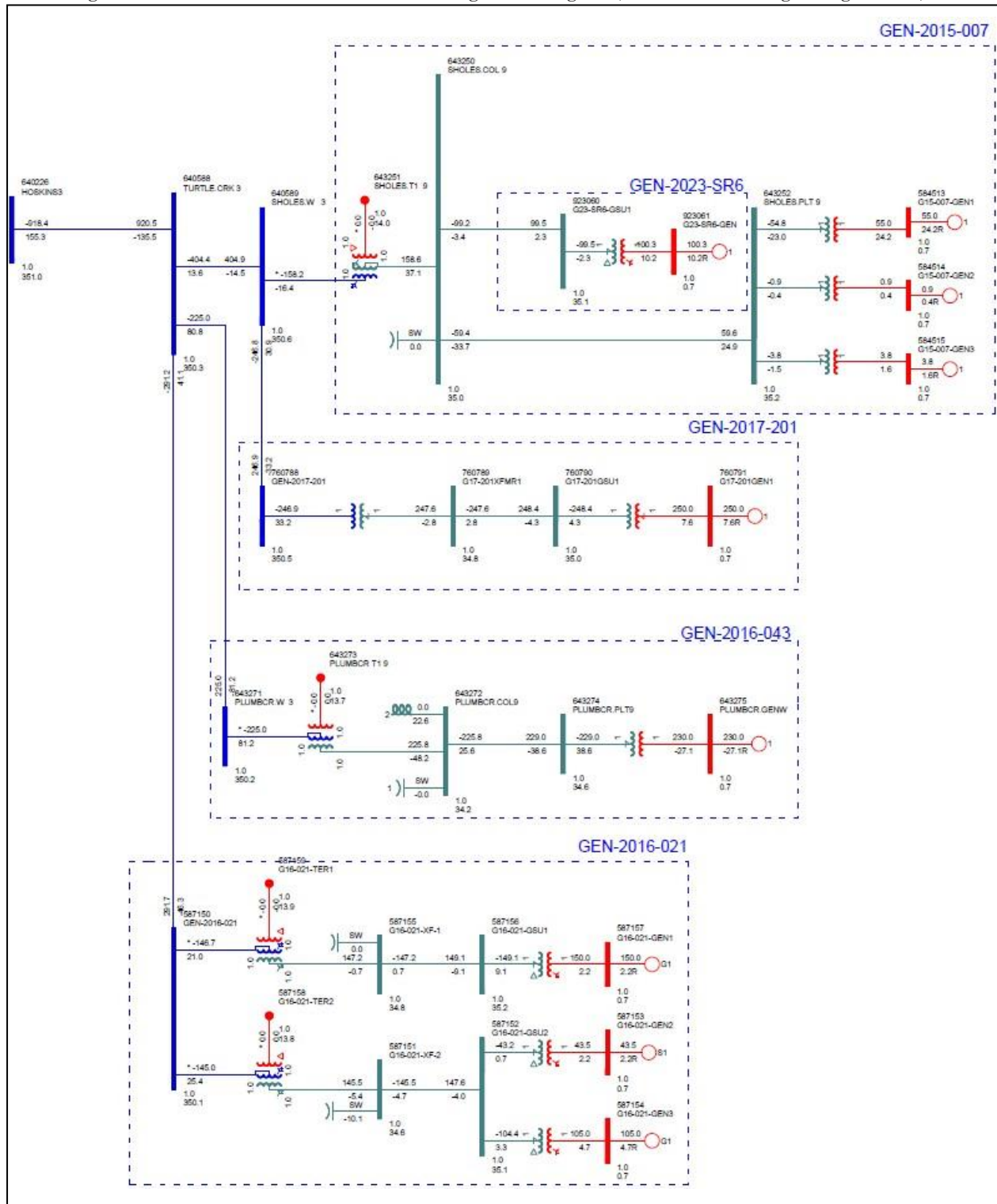
The proposed detailed SGF configuration is captured in Figure 2-2 and Table 2-2 below.

**Table 2-1: EGF, SR6, & SGF Configuration**

Request	Interconnection Queue Capacity (MW)	Fuel Type	Point of Interconnection
GEN-2023-SR7 (SGF)	135	Battery/Storage	Hoskins 345 kV (640226)
GEN-2023-SR6 (Prior-Queued SGF)	100.24	Solar	Hoskins 345 kV (640226)
GEN-2015-007 (EGF)	160	Wind	Hoskins 345 kV (640226)

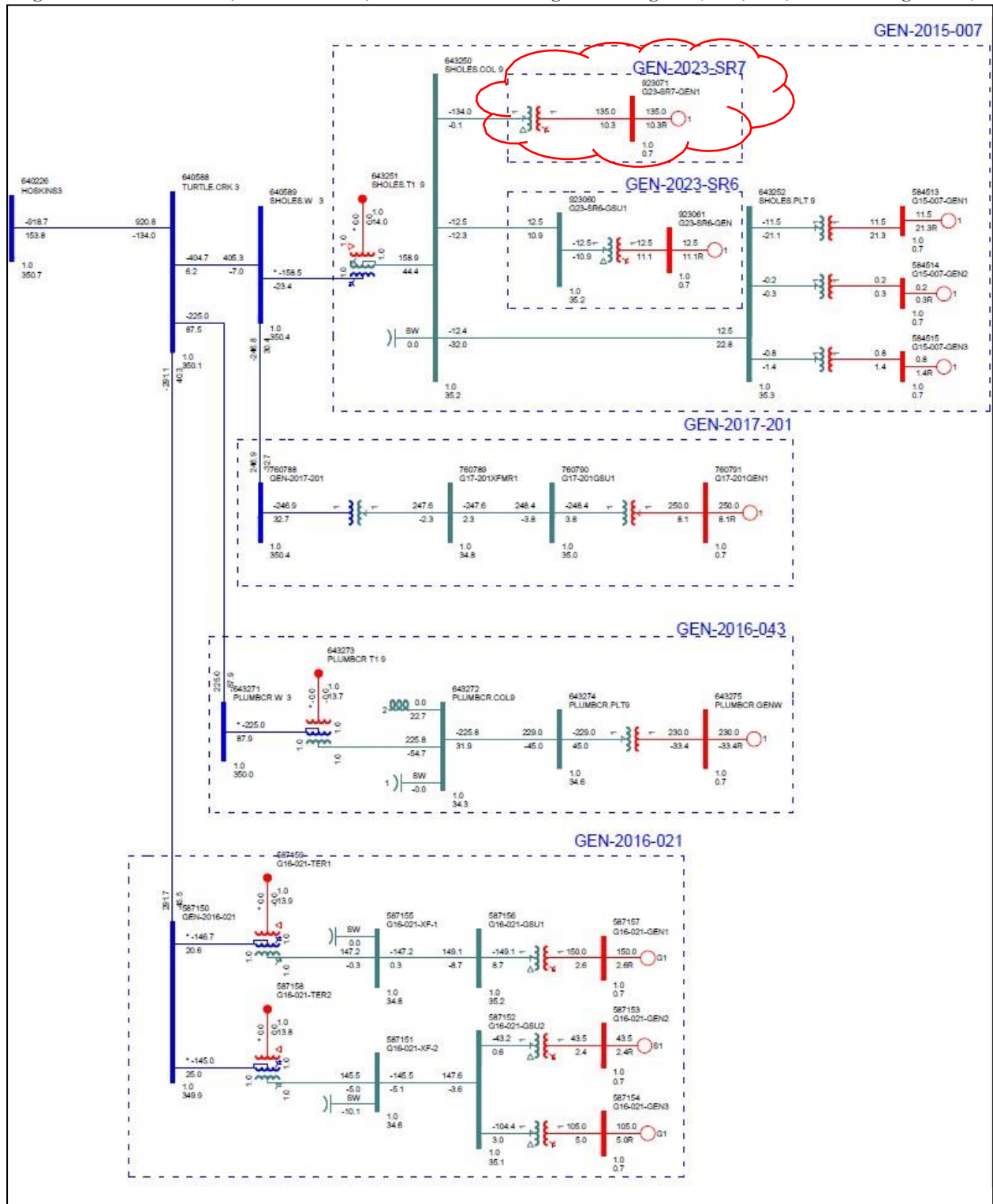
Aneden reviewed the GIRs that shared the same POI, Hoskins 345 kV, and updated as applicable based on SPP’s confirmation of the latest project configurations. As a result, Aneden updated the GEN-2015-007 project configuration in the base models.

Figure 2-1: GEN-2015-007 & GEN-23-SR6 Single Line Diagram (EGF & SR6 Existing Configuration\*)



\*based on the DISIS-2017-002 stability models with GEN-2023-SR6 included

Figure 2-2: GEN-2015-007, GEN-2023-SR6, & GEN-2023-SR7 Single Line Diagram (EGF, SR6, & SGF Configuration)



**Table 2-2: SGF Interconnection Configuration**

Facility	SGF Configuration (GEN-2023-SR7)	
Point of Interconnection	Hoskins 345 kV (640226)	
Configuration/Capacity	36 x PE FP4200M2 3.75 MW (BESS) = 135 MW [dispatch] Units are rated at 4.2 MW, PPC to limit GEN-2023-SR7 to 135 MW at the POI and total POI injection w/ GEN-2015-007 and GEN-2023-SR6 to 160 MW	
Generation Interconnection Line (Shared with the EGF & GEN-2023-SR6 and unchanged)	<b><u>GEN-2015-007 to Turtle Creek 345 kV:</u></b> Length = 8.44 miles R = 0.000345 pu X = 0.004120 pu B = 0.072150 pu Rating MVA = 1084 MVA	<b><u>Turtle Creek to Hoskins 345 kV:</u></b> Length = 6.16 miles R = 0.000255 pu X = 0.003000 pu B = 0.052680 pu Rating MVA = 1195 MVA
Main Substation Transformer <sup>1</sup> (Shared with the EGF & GEN-2023-SR6 and unchanged)	X12 = 8.65% R12 = 0.167%, X23 = 12.5% R23 = 0.167%, X13 = 4.7% R13 = 0.167%, Winding MVA = 108 MVA, Winding 1 & 2 Rating MVA = 180 MVA Winding 3 Rating MVA = 40 MVA	
Equivalent GSU Transformer <sup>1</sup>	Gen 1 Equivalent Qty: 36 X = 8.998%, R = 0.874%, Winding MVA = 151.452 MVA, Rating MVA <sup>2</sup> = 151.5 MVA	
Generator Dynamic Model <sup>3</sup> & Power Factor	36 x PE FP4200M2 4.2 MVA (REGCAU1) <sup>3</sup> Leading: 0.893 Lagging: 0.893	
Reactive Power Devices (Shared with the EGF & GEN-2023-SR6 and unchanged)	1 x 14 MVar 34.5 kV Capacitor Bank	

1) X and R based on Winding MVA, 2) Rating rounded in PSS/E, 3) DYR stability model name



### 3.0 Reactive Power Analysis

The reactive power analysis was performed for GEN-2023-SR7 to determine the capacitive charging effects required due to the SGF 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.

#### 3.1 Methodology and Criteria

For this analysis, the GEN-2016-021, GEN-2016-043 and GEN-2017-201 projects that share the gen-tie line were disconnected. In order to determine the required shunt reactor the SGF would need to compensate for the current charging attributed to its collection system, the reactive power analyses for the EGF and GEN-2023-SR6 were determined first. Once the shunt sizes for the EGF and GEN-2023-SR6 were determined, the SGF incremental shunt reactor size was then calculated.

For each of the shunt reactor sizes calculated, all project generators and capacitors were switched offline while other collector system elements remained in-service. A shunt reactor was tested at the project’s collection substation 34.5 kV bus to set the MVAR flow into the POI to approximately zero. The size of the shunt reactor 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 GEN-2023-SR6 and SGF data based on the 25SP DISIS-2017-002 stability study model.

#### 3.2 Results

Per the methodology described above, the shunt size was determined for the EGF and GEN-2023-SR6 prior to calculating the shunt reactor size for the SGF. The shunt sizes were found to be a 22.2 MVAR reactor for the EGF and 1.3 MVAR for GEN-2023-SR6 to reduce the POI MVAR to approximately zero.

The results from the analysis showed that the SGF did not need a shunt reactor at the project substation to reduce the POI MVAR to zero with the pre-determined shunts for the EGF and GEN-2023-SR6 in-service. The final shunt reactor requirements are shown in Table 3-1. Figure 3-1 illustrates that no additional compensation was necessary to offset the capacitive effect on the transmission network caused by the project during reduced generation conditions.

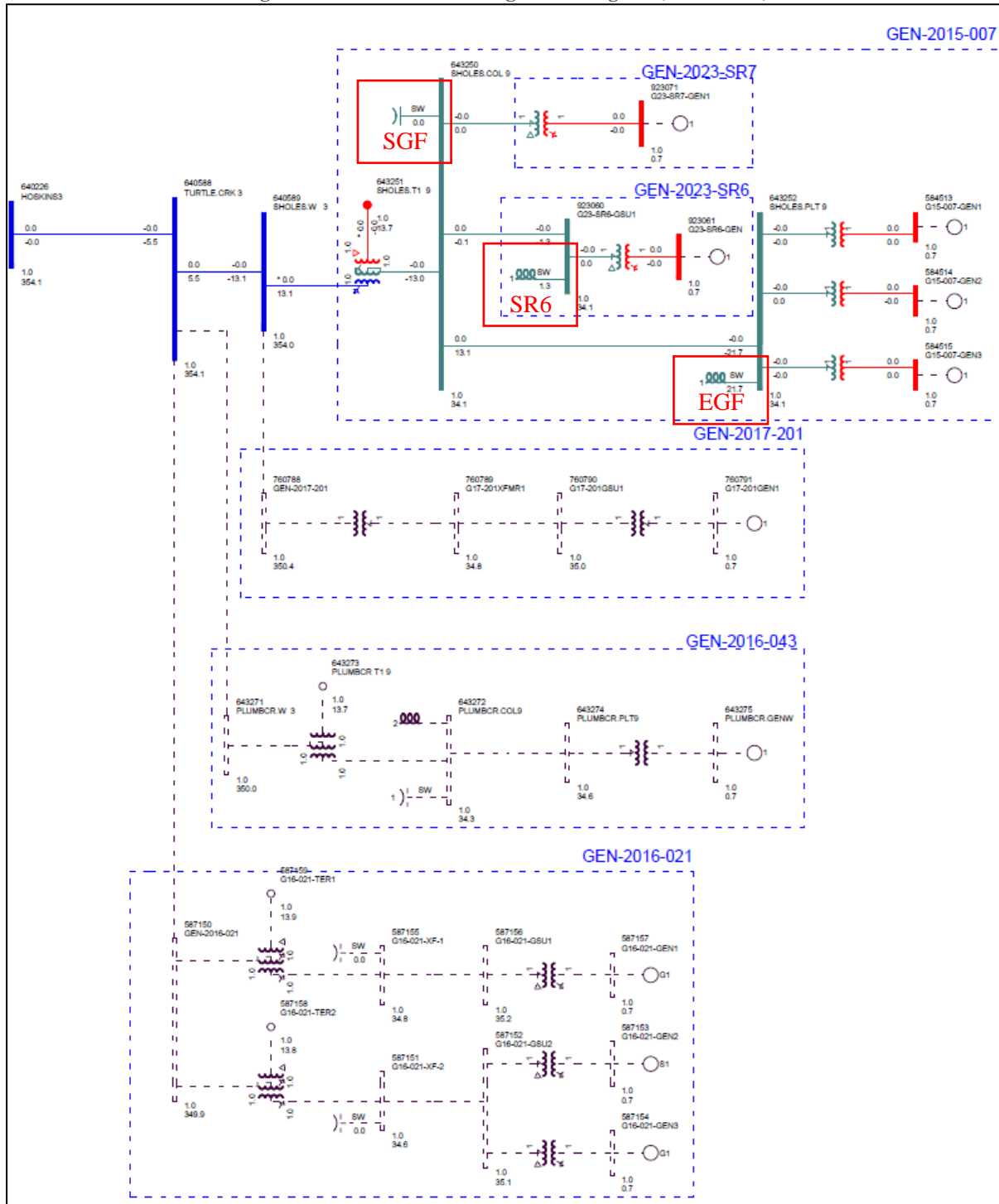
The information gathered from the reactive power analysis is provided as information to the Interconnection Customer and Transmission Owner (TO) and/or Transmission Operator. The applicable reactive power requirements will be further reviewed by the Transmission Owner and/or Transmission Operator.

**Table 3-1: Shunt Reactor Size for Reduced Generation Study**

Machine	POI Bus Number	POI Bus Name	Reactor Size (MVAR)
			25SP
GEN-2023-SR7 (SGF)	640226	Hoskins 345 kV	0



Figure 3-1: GEN-2023-SR7 Single Line Diagram (Shunt Sizes)



## 4.0 Short Circuit Analysis

A short circuit study was performed using the 25SP model to determine the maximum available fault current requiring interruption by protective equipment with GEN-2023-SR6, the SGF, and the EGF online for each bus in the relevant subsystem, and the amount of increase in maximum fault current due to the addition of the SGF. The detailed results of the short circuit analysis are provided in Appendix B.

### 4.1 Methodology

The short circuit analysis included applying a 3-phase fault on buses up to 5 levels away from the 345 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 the SGF online. The first scenario was studied with GEN-2023-SR6, the SGF, and the EGF in service. In the second scenario the SGF was disconnected while both GEN-2023-SR6 and the EGF stayed online in order to determine the impact of the SGF.

Aneden created a short circuit model using the 25SP DISIS-2017-002 stability study model by adjusting the GEN-2023-SR6 and the SGF short circuit parameters consistent with the submitted data. The adjusted parameters used in the short circuit analysis are shown in Table 4-1 below.

**Table 4-1: Short Circuit Model Parameters\***

Parameter	Value by Generator Bus#	
	923061 (GEN-2023-SR6)	923071 (GEN-2023-SR7)
Machine MVA Base	109.2	151.2
R (pu)	0	0
X'' (pu)	0.893	0.893

\*pu values based on Machine MVA Base

### 4.2 Results

The results of the short circuit analysis compared the 25SP model with GEN-2023-SR6 and the EGF online and SGF not connected to the stability Scenario 4 dispatch model with GEN-2023-SR6, the EGF, and the SGF in service. The GEN-2023-SR7 POI bus (Hoskins 345kV – 640226) fault current magnitudes are provided in Table 4-2 showing a maximum fault current of 13.06 kA with GEN-2023-SR6, the EGF, and the SGF online. The addition of the SGF configuration increased the POI bus fault current by 0.13 kA. Table 4-3 shows the maximum fault current magnitudes and fault current increases with the SGF project online.

The maximum fault current calculated within 5 buses of the POI was 46 kA for the 25SP model. There were several buses with a maximum three-phase fault current over 40 kA. These buses are highlighted in Appendix B. The maximum contribution to three-phase fault currents due to the addition of the SGF was about 1% and 0.13 kA<sup>5</sup>.

<sup>5</sup> For buses not on the generation interconnection line

**Table 4-2: POI Short Circuit Comparison Results**

Case	EGF & SR6 Current (kA)	EGF, SR6, & SGF Current (kA)	Max kA Change	Max %Change
25SP	12.93	13.06	0.13	1.0%

**Table 4-3: 25SP Short Circuit Comparison Results<sup>6</sup>**

Voltage (kV)	Max. Current (EGF, SR6, & SGF) (kA)	Max kA Change	Max %Change
69	25.8	0.00	0.0%
115	43.3	0.05	0.3%
161	46.0	0.01	0.0%
230	19.8	0.04	0.4%
345	32.7	0.13	1.0%
<b>Max</b>	<b>46.0</b>	<b>0.13</b>	<b>1.0%</b>

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<sup>6</sup> For buses not on the generation interconnection line

## 5.0 Dynamic Stability Analysis

Aneden performed a dynamic stability analysis to identify the impact of the SGF project. The analysis was performed according to SPP's Disturbance Performance Requirements<sup>7</sup>. The project 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.

### 5.1 Methodology and Criteria

The dynamic stability analysis was performed using models developed with the requested 36 x Power Electronics FP4200M2 3.75 MW (REGCAU1) SGF generating facility configuration included in the cases. In addition, the prior-queued surplus request GEN-2023-SR6 which is connected at the same bus was included in the base models. This stability analysis was performed using Siemens PTI's PSS/E version 34.8.0 software.

Four stability model scenarios were developed using the models from DISIS-2017-002. The study scenarios are shown in Table 5-1.

Table 5-1: Study Scenarios (Generator Dispatch MW)

Scenario	GEN-2015-007 EGF (MW)	GEN-2023-SR6 Prior-Queued SGF (MW)	GEN-2023-SR7 SGF (MW)	SR6 + EGF + SGF (MW)
1	0 (Offline)	0 (Offline)	135	135
2	25	0 (Offline)	135	160
3	0 (Offline)	25	135	160
4	12.5	12.5	135	160

The GEN-2023-SR6 and SGF project details were used to create modified stability models for this impact study based on the DISIS-2017-002 stability study models:

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

Aneden reviewed the GIRs that shared the same POI, Hoskins 345 kV, and updated as applicable based on SPP's confirmation of the latest project configurations. As a result, Aneden updated the GEN-2015-007 project configuration in the base models.

The dynamic model data for the GEN-2023-SR7 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 surplus request:

- The Outlaw generators (541550, 541546, & 541549) high voltage protective relays were disabled to avoid high voltage tripping due to controller issues.
- The frequency protective relays at buses 629118, 629119, 629120, 629122, 629123, 600101, 600112, 600113, 600114, 635312, 635316, 635317, 635352, 635354, 636027, 636033, 636035,

<sup>7</sup> 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)

636238, 636239, 635424, 635023, 635213, 635214, & 636309 were 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 voltage protective relays at buses 541514, 762241, 762244, 635332, 760686, & 636038 were disabled to avoid generator tripping due to an instantaneous over voltage spike after fault clearing.

During the fault simulations, the active power (PELEC), reactive power (QELEC), and terminal voltage (ETERM) were monitored for GEN-2023-SR6, the EGF, and the SGF and other current and prior queued projects in their cluster group<sup>8</sup>. In addition, voltages of five (5) buses away from the POI of the SGF were monitored and plotted. The machine rotor angle for synchronous machines and speed for asynchronous machines within the study areas including 627 (ALTW), 635 (MEC), 640 (NPPD), 645 (OPPD), 650 (LES), 652 (WAPA), and 659 (BEPC-SPP) were monitored. The voltages of all 100 kV and above buses within the study area were monitored as well.

**5.2 Fault Definitions**

Aneden developed and simulated fault events as required to study the SGF. 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 5-2 below. These contingencies were applied to the modified 25SP and 25WP models.

**Table 5-2: Fault Definitions**

Fault ID	Planning Event	Fault Descriptions
FLT9001-3PH	P1	3 phase fault on the HOSKINS3 (640226) to RAUN 3 (635200) 345 kV line CKT 1, near HOSKINS3. a. Apply fault at the HOSKINS3 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.
FLT9002-3PH	P1	3 phase fault on the HOSKINS T2 345 kV (640226) /230 kV (640227) /13.8 kV (643082) XFMR CKT 1, near HOSKINS3 345 kV. a. Apply fault at the HOSKINS3 345kV bus. b. Clear fault after 6 cycles and trip the faulted transformer.
FLT9003-3PH	P1	3 phase fault on the HOSKINS T4 345 kV (640226) /115 kV (640228) /13.8 kV (640231) XFMR CKT 1, near HOSKINS3 345 kV. a. Apply fault at the HOSKINS3 345kV bus. b. Clear fault after 6 cycles and trip the faulted transformer.
FLT9004-3PH	P1	3 phase fault on the HOSKINS3 (640226) to ANTELOPE 3 (640520) 345 kV line CKT 1, near HOSKINS3. a. Apply fault at the HOSKINS3 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.
FLT9005-3PH	P1	3 phase fault on the HOSKINS3 (640226) to SHELCRK3 (640342) 345 kV line CKT 1, near HOSKINS3. a. Apply fault at the HOSKINS3 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.

<sup>8</sup> Based on the DISIS-2017-002 Cluster Groups

Table 5-2 continued

Fault ID	Planning Event	Fault Descriptions
FLT9006-3PH	P1	3 phase fault on the ANTELOPE T1 345 kV (640520) /115 kV (640521) /13.8 kV (640524) XFMR CKT 1, near ANTELOPE 345 kV. a. Apply fault at the ANTELOPE 345kV bus. b. Clear fault after 6 cycles and trip the faulted transformer.
FLT9007-3PH	P1	3 phase fault on the SHELCKR3 (640342) to COLMB.E3 (640125) 345 kV line CKT 1, near SHELCKR3. a. Apply fault at the SHELCKR3 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.
FLT9008-3PH	P1	3 phase fault on the SHELLCREEKT1 345 kV (640342) /230 kV (640343) /13.8 kV (643136) XFMR CKT 1, near SHELCKR3 345 kV. a. Apply fault at the SHELCKR3 345kV bus. b. Clear fault after 6 cycles and trip the faulted transformer.
FLT9009-3PH	P1	3 phase fault on the COL.EAST T4 345 kV (640125) /115 kV (640127) /13.8 kV (640129) XFMR CKT 1, near COLMB.E3 345 kV. a. Apply fault at the COLMB.E3 345kV bus. b. Clear fault after 6 cycles and trip the faulted transformer.
FLT9010-3PH	P1	3 phase fault on the RAUN 3 (635200) to J748POI (87487) 345 kV line CKT 1, near RAUN 3. a. Apply fault at the RAUN 3 345 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.
FLT9011-3PH	P1	3 phase fault on the RAUN 3 (635200) to J412POI 3 (635252) 345 kV line CKT 1, near RAUN 3. a. Apply fault at the RAUN 3 345 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.
FLT9012-3PH	P1	3 phase fault on the RAUN 3 (635200) to SIOUXCY3 (652564) 345 kV line CKT 1, near RAUN 3. a. Apply fault at the RAUN 3 345 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.
FLT9013-3PH	P1	3 phase fault on the RAUN 3 (635200) to S3451 3 (645451) 345 kV line CKT 1, near RAUN 3. a. Apply fault at the RAUN 3 345 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.
FLT9014-3PH	P1	3 phase fault on the J748POI (87487) to CHEROKEE 3 (635399) 345 kV line CKT 1, near J748POI. a. Apply fault at the J748POI 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.
FLT9015-3PH	P1	3 phase fault on the J748POI (87487) to J748GENTIE (87486) 345 kV line CKT 1, near J748POI. a. Apply fault at the J748POI 345 kV bus. b. Clear fault after 6 cycles by tripping the faulted line. <b>Trip generator J748GEN1 (87480).</b> <b>Trip generator J748GEN2 (87481).</b> 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.
FLT9016-3PH	P1	3 phase fault on the J412POI 3 (635252) to IDA CO 3 (635206) 345 kV line CKT 1, near J412POI 3. a. Apply fault at the J412POI 3 345 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.

Table 5-2 continued

Fault ID	Planning Event	Fault Descriptions
FLT9017-3PH	P1	3 phase fault on the SC2KU1A 345 kV (652564) /230 kV (652552) /13.8 kV (652304) XFMR CKT 1, near SIOUXCY3 345 kV. a. Apply fault at the SIOUXCY3 345kV bus. b. Clear fault after 6 cycles and trip the faulted transformer.
FLT9018-3PH	P1	3 phase fault on the SIOUXCY-LNX3 (652864) to SPLT RK3 (601006) 345 kV line CKT 1, near SIOUXCY-LNX3. a. Apply fault at the SIOUXCY-LNX3 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.
FLT9019-3PH	P1	3 phase fault on the S3451 3 (645451) to S3454 3 (645454) 345 kV line CKT 1, near S3451 3. a. Apply fault at the S3451 3 345 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.
FLT9020-3PH	P1	3 phase fault on the S3451 3 (645451) to S3459 3 (645459) 345 kV line CKT 1, near S3451 3. a. Apply fault at the S3451 3 345 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.
FLT9021-3PH	P1	3 phase fault on the S3451 T4 345 kV (645451) /161 kV (646251) /13.8 kV (648351) XFMR CKT 1, near S3451 3 345 kV. a. Apply fault at the S3451 3 345kV bus. b. Clear fault after 6 cycles and trip the faulted transformer.
FLT9022-3PH	P1	3 phase fault on the RAUN 345 kV (635200) /24 kV (635214) XFMR CKT 1, near RAUN 3 345 kV. a. Apply fault at the RAUN 3 345kV bus. b. Clear fault after 6 cycles and trip the faulted transformer. <b>Trip generator NEAL 4G (635214).</b>
FLT9023-3PH	P1	3 phase fault on the RAU AC 345 kV (635200) /161 kV (635201) /13.8 kV (635205) XFMR CKT 1, near RAUN 3 345 kV. a. Apply fault at the RAUN 3 345kV bus. b. Clear fault after 6 cycles and trip the faulted transformer.
FLT9024-3PH	P1	3 phase fault on the RAU AC 345 kV (635200) /161 kV (635201) XFMR CKT 2, near RAUN 3 345 kV. a. Apply fault at the RAUN 3 345kV bus. b. Clear fault after 6 cycles and trip the faulted transformer.
FLT9025-3PH	P1	3 phase fault on the SHELCKR4 (640343) to COLMBUS4 (640133) 230 kV line CKT 1, near SHELCKR4. a. Apply fault at the SHELCKR4 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 the KELLY T1 230 kV (640133) /115 kV (640134) /13.2 kV (640135) XFMR CKT 1, near COLUMBUS4 230 kV. a. Apply fault at the COLUMBUS4 230 kV bus. b. Clear fault after 7 cycles and trip the faulted transformer.
FLT9027-3PH	P1	3 phase fault on the COLMBUS4 (640133) to E.COL.4 (640126) 230 kV line CKT 1, near COLMBUS4. a. Apply fault at the COLMBUS4 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 5-2 continued

Fault ID	Planning Event	Fault Descriptions
FLT9028-3PH	P1	3 phase fault on the COLMBUS4 (640133) to MEADOWGROVE4 (640540) 230 kV line CKT 1, near COLMBUS4. a. Apply fault at the COLMBUS4 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 the COLMBUS4 (640133) to COLMB.W4 (640131) 230 kV line CKT 1, near COLMBUS4. a. Apply fault at the COLMBUS4 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 the RAUN 5 (635201) to LIBERTY5 (635230) 230 kV line CKT 1, near RAUN 5. a. Apply fault at the RAUN 5 230 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.
FLT9031-3PH	P1	3 phase fault on the RAUN 5 (635201) to G17-105TAP (762069) 230 kV line CKT 1, near RAUN 5. a. Apply fault at the RAUN 5 230 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.
FLT9032-3PH	P1	3 phase fault on the RAUN 5 (635201) to NEAL S5 (635202) 230 kV line CKT 1, near RAUN 5. a. Apply fault at the RAUN 5 230 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.
FLT9033-3PH	P1	3 phase fault on the RAUN 5 (635201) to NEAL N5 (635203) 230 kV line CKT 1, near RAUN 5. a. Apply fault at the RAUN 5 230 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.
FLT9034-3PH	P1	3 phase fault on the RAUN 5 (635201) to INTCHG 5 (635220) 230 kV line CKT 1, near RAUN 5. a. Apply fault at the RAUN 5 230 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.
FLT9035-3PH	P1	3 phase fault on the HOSKINS4 (640227) to WAKEFIELD 4 (640560) 230 kV line CKT 1, near HOSKINS4. a. Apply fault at the HOSKINS4 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.
FLT9036-3PH	P1	3 phase fault on the HOSKINS T8 230 kV (640227) /34.5 kV (640230) XFMR CKT 1, near HOSKINS4 230 kV. a. Apply fault at the HOSKINS4 230 kV bus. b. Clear fault after 7 cycles and trip the faulted transformer.
FLT9037-3PH	P1	3 phase fault on the RAUN 345 kV (635200) /22 kV (635213) XFMR CKT 1, near RAUN 3 345 kV. a. Apply fault at the RAUN 3 345kV bus. b. Clear fault after 6 cycles and trip the faulted transformer. <b>Trip generator NEAL 3G (635213).</b>
FLT1001-SB	P4	<b>Stuck Breaker on at ANTELOPE 3 (640520)</b> a. Apply single-phase fault at ANTELOPE 3 (640520) on the 345kV bus. b. Clear fault after 16 cycles and trip the following elements c. Trip the bus ANTELOPE 3 (640520).

Table 5-2 continued

Fault ID	Planning Event	Fault Descriptions
FLT1002-SB	P4	<b>Stuck Breaker on at SHELCKR3 (640342)</b> a. Apply single-phase fault at SHELCKR3 (640342) on the 345kV bus. b. Clear fault after 16 cycles and trip the following elements c. Trip the bus SHELCKR3 (640342).
FLT1003-SB	P4	<b>Stuck Breaker on at RAUN 3 (635200)</b> a. Apply single-phase fault at RAUN 3 (635200) on the 345kV bus. b. Clear fault after 16 cycles and trip the following elements c. Trip the RAUN 345 kV (635200) /24 kV (635213) XFMR CKT 1. d. Trip the RAU AC 345 kV (635200) /161 kV (635201) XFMR CKT 2. <b>Trip Generator NEAL (635213).</b>
FLT1004-SB	P4	<b>Stuck Breaker on at RAUN 3 (635200)</b> a. Apply single-phase fault at RAUN 3 (635200) on the 345kV bus. b. Clear fault after 16 cycles and trip the following elements c. Trip the RAUN 345 kV (635200) /24 kV (635214) XFMR CKT 1. d. Trip the RAU AC 345 kV (635200) /161 kV (635201) /13.8 kV (635205) XFMR CKT 1. <b>Trip Generator NEAL (635214).</b>
FLT1005-SB	P4	<b>Stuck Breaker on at RAUN 3 (635200)</b> a. Apply single-phase fault at RAUN 3 (635200) on the 345kV bus. b. Clear fault after 16 cycles and trip the following elements c. Trip the RAUN 3 (635200) to HOSKINS3 (640226) 345kV line CKT 1. d. Trip the RAUN 3 (635200) to S3451 3 (645451) 345kV line CKT 1.
FLT1006-SB	P4	<b>Stuck Breaker on at RAUN 3 (635200)</b> a. Apply single-phase fault at RAUN 3 (635200) on the 345kV bus. b. Clear fault after 16 cycles and trip the following elements c. Trip the RAUN 3 (635200) to J412 POI 3 (635252) 345kV line CKT 1. d. Trip the RAUN 3 (635200) to J748POI (87487) 345kV line CKT 1.
FLT1007-SB	P4	<b>Stuck Breaker on at HOSKINS3 (640226)</b> a. Apply single-phase fault at HOSKINS3 (640226) on the 345kV bus. b. Clear fault after 16 cycles and trip the following elements c. Trip the HOSKINS3 (640226) to RAUN 3 (635200) 345 kV line CKT 1. d. Trip the HOSKINS T2 345 kV (640226) /230 kV (640227) /13.8 kV (643082) XFMR CKT 1.

5.3 Scenario 1 Results

Table 5-3 shows the relevant results of the fault events simulated for each of the modified cases in Scenario 1. Existing DISIS base case issues are documented separately in Appendix C. The associated stability plots are also provided in Appendix C.

Table 5-3: Scenario 1 Dynamic Stability Results (EGF = 0 MW, SR6 = 0 MW, SGF = 135 MW)

Fault ID	25SP			25WP		
	Volt Violation	Volt Recovery	Stable	Volt Violation	Volt Recovery	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

Table 5-3 continued

Fault ID	25SP			25WP		
	Volt Violation	Volt Recovery	Stable	Volt Violation	Volt Recovery	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
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
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

The results of the Scenario 1 dynamic stability analysis showed that there were several existing base case issues found in the original DISIS-2017-002 case and the case with GEN-2023-SR7 included. These issues were not attributed to the GEN-2023-SR7 surplus request and detailed in Appendix C.

There were no damping or voltage recovery violations attributed to the GEN-2023-SR7 surplus 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.

**5.4 Scenario 2 Results**

Table 5-4 shows the relevant results of the fault events simulated for each of the modified cases in Scenario 2. Existing DISIS base case issues are documented separately in Appendix C. The associated stability plots are also provided in Appendix C.

**Table 5-4: Scenario 2 Dynamic Stability Results (EGF = 25 MW, SR6 = 0 MW, SGF = 135 MW)**

Fault ID	25SP			25WP		
	Volt Violation	Volt Recovery	Stable	Volt Violation	Volt Recovery	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

Table 5-4 continued

Fault ID	25SP			25WP		
	Volt Violation	Volt Recovery	Stable	Volt Violation	Volt Recovery	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
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
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

The results of the Scenario 2 dynamic stability analysis showed that there were several existing base case issues found in the original DISIS-2017-002 case and the case with GEN-2023-SR7 included. These issues were not attributed to the GEN-2023-SR7 surplus request and detailed in Appendix C.

There were no damping or voltage recovery violations attributed to the GEN-2023-SR7 surplus 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.

**5.5 Scenario 3 Results**

Table 5-5 shows the relevant results of the fault events simulated for each of the modified cases in Scenario 3. Existing DISIS base case issues are documented separately in Appendix C. The associated stability plots are also provided in Appendix C.

Table 5-5: Scenario 3 Dynamic Stability Results (EGF = 0 MW, SR6 = 25 MW, SGF = 135 MW)

Fault ID	25SP			25WP		
	Volt Violation	Volt Recovery	Stable	Volt Violation	Volt Recovery	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

Table 5-5 continued

Fault ID	25SP			25WP		
	Volt Violation	Volt Recovery	Stable	Volt Violation	Volt Recovery	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
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
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

The results of the Scenario 3 dynamic stability analysis showed that there were several existing base case issues found in the original DISIS-2017-002 case and the case with GEN-2023-SR7 included. These issues were not attributed to the GEN-2023-SR7 surplus request and detailed in Appendix C.

There were no damping or voltage recovery violations attributed to the GEN-2023-SR7 surplus 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.

**5.6 Scenario 4 Results**

Table 5-6 shows the relevant results of the fault events simulated for each of the modified cases in Scenario 4. Existing DISIS base case issues are documented separately in Appendix C. The associated stability plots are also provided in Appendix C.

**Table 5-6: Scenario 4 Dynamic Stability Results (EGF = 12.5 MW, SR6 = 12.5 MW, SGF = 135 MW)**

Fault ID	25SP			25WP		
	Volt Violation	Volt Recovery	Stable	Volt Violation	Volt Recovery	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



Table 5-6 continued

Fault ID	25SP			25WP		
	Volt Violation	Volt Recovery	Stable	Volt Violation	Volt Recovery	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
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
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

The results of the Scenario 4 dynamic stability analysis showed that there were several existing base case issues found in the original DISIS-2017-002 case and the case with GEN-2023-SR7 included. These issues were not attributed to the GEN-2023-SR7 surplus request and detailed in Appendix C.

There were no damping or voltage recovery violations attributed to the GEN-2023-SR7 surplus 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.

## 6.0 Necessary Interconnection Facilities and Network Upgrades

This study identified the impact of the Surplus Interconnection Service on the transmission system reliability and any additional Interconnection Facilities or Network Upgrades necessary. The Surplus Interconnection Service is only available up to the amount that can be accommodated without requiring additional Network Upgrades unless (a) those additional Network Upgrades are either (1) located at the Point of Interconnection substation and at the same voltage level as the Generating Facility with an effective GIA, or (2) are System Protection Facilities; and (b) there are no material adverse impacts on the cost or timing of any Interconnection Requests pending at the time the Surplus Interconnection Service request is submitted.

### 6.1 Interconnection Facilities

This study did not identify any additional Interconnection Facilities required by the addition of the SGF.

### 6.2 Network Upgrades

This study did not identify any Network Upgrades required by the addition of the SGF. SPP will reach out to the TO to determine if there are any necessary additional Network Upgrades that are either (1) located at the Point of Interconnection substation and at the same voltage level as the Generating Facility with an effective GIA, or (2) are System Protection Facilities.

## 7.0 Surplus Interconnection Service Determination and Requirements

In accordance with Attachment V of the SPP Tariff, SPP shall evaluate the request for Surplus Interconnection Service and inform the Interconnection Customer in writing of whether the Surplus Interconnection Service can be utilized without negatively impacting the reliability of the Transmission System and without any additional Network Upgrades necessary unless specified in the SPP Tariff.

### 7.1 Surplus Service Determination

SPP determined the request for Surplus Interconnection Service does not negatively impact the reliability of the Transmission System and no required Network Upgrades or Interconnection Facilities were identified by this Surplus Interconnection Service Impact Study performed by Aneden. Aneden evaluated the impact of the requested Surplus Interconnection Service on the prior study results and determined that the requested Surplus Interconnection Service resulted in similar dynamic stability and short circuit analyses and that the prior study steady-state results are not negatively impacted.

SPP has determined that GEN-2023-SR7 may utilize the requested 135 MW of Surplus Interconnection Service being made available by GEN-2015-007.

### 7.2 Surplus Service Requirements

The amount of Surplus Interconnection Service available to be used is limited by the amount of Interconnection Service granted to the existing interconnection customer at the same POI. The combined generation from GEN-2023-SR6, the SGF, and the EGF may not exceed 160 MW at the POI, which is the total Interconnection Service amount currently granted to the EGF.

The customer must install monitoring and control equipment as needed to ensure that the SGF does not exceed the granted surplus amount and to ensure that combination of GEN-2023-SR6, the SGF, and EGF power injected at the POI does not exceed the Interconnection Service amount listed in the EGF's GIA. The monitoring and control scheme may be reviewed by the TO and documented in Appendix C of the SGF GIA.

SPP will reach out to the TO to determine if there are any necessary additional Network Upgrades that are either (1) located at the Point of Interconnection substation and at the same voltage level as the Generating Facility with an effective GIA, or (2) are System Protection Facilities.