GEN-2015-036

Impact Restudy for Generator Modification

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REVISION HISTORY

DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION
02/10/2020	SPP	Initial report issued.

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SUMMARY

The GEN-2015-036 Interconnection Customer has requested a modification to its 303.6 MW Interconnection Request. This system impact restudy was performed to determine the effects of changing turbines from 132 Siemens 2.3 MW wind turbine generators (for a total of 303.6 MW) to 10 GE 2.3 MW and 102 GE 2.75 MW wind turbine generators (for a total of 303.5 MW). In addition, the modification request included changes to the collection system, generation interconnection line, main substation transformer and GSU transformers. The point of interconnection (POI) for GEN-2015-036 remains at the Johnston County 345 kV Substation.

This study was performed by Aneden Consulting to determine whether the request for modification is considered Material. A short circuit analysis, a low-wind/no-wind condition analysis, and stability analysis was performed for this modification request. The study report follows this executive summary.

The generating facility will be required to maintain a 95% lagging (providing VARs) and 95% leading (absorbing VArs) in accordance with FERC Order 827. Additionally, the project will be required to install approximately 26.2 MVArs of reactor shunts on its substation 345 kV bus or provide an alternate means of reactive power compensation. This is necessary to offset the capacitive effect on the transmission network caused by the project's transmission line and collector system during low-wind/no-wind conditions.

There were no other machine rotor angle damping or transient voltage recovery violations observed in the simulated fault events. Additionally, the project wind farm 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. The requested modification is not considered Material.

It should be noted that this study analyzed the requested modification to change generator technology and layout. Powerflow analysis was not performed. This study analyzed many of the most probable contingencies, but it is not an all-inclusive list and cannot account for every operational situation. It is likely that the customer may be required to reduce its generation output to 0 MW, also known as curtailment, under certain system conditions to allow system operators to maintain the reliability of the transmission network.

Nothing in this study should be construed as a guarantee of transmission service or delivery rights. If the customer wishes to obtain deliverability to final customers, a separate request for transmission service must be requested on Southwest Power Pool's OASIS by the customer.

A: CONSULTANT'S MATERIAL MODIFICATION STUDY REPORT

See next page for the Consultant's Material Modification Study report.

Submitted to
Southwest Power Pool

Report On

GEN-2015-036
Modification Request Impact Study

Revision R1

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anedenconsulting.com

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Executive Summary

Aneden Consulting (Aneden) was retained by the Southwest Power Pool (SPP) to perform a Modification Request Impact Study (Study) for GEN-2015-036, an active generation interconnection request with a point of interconnection (POI) at the Johnston County 345 kV.

The GEN-2015-036 project is proposed to interconnect in the Oklahoma Gas & Electric (OKGE) control area with a capacity of 303.6 MW as shown in Table ES-1 below. This Study has been requested to evaluate the modification of GEN-2015-036 to change turbine configuration to a total of 10 x GE 2.3MW + 102 x GE 2.75MW wind turbines for total capacity of 303.5 MW. In addition, the modification request included changes to the collection system, generation interconnection line, main substation transformers, and the GSU transformers. The modification request changes are shown in Table ES-2 below.

Table ES-1: GEN-2015-036 Configuration

Request	Capacity (MW)	Existing Generator Configuration	Point of Interconnection
GEN-2015-036	303.6	132 x Siemens 2.3MW	Johnston County 345 kV (514809)

Table ES-2: GEN-2015-036 Modification Request

<table>
<tr><th>Facility</th><th colspan="2">Existing</th><th colspan="2">Modification</th></tr>
<tr><td>Point of Interconnection</td><td colspan="2">Johnston County 345 kV (514809)</td><td colspan="2">Johnston County 345 kV (514809)</td></tr>
<tr><td>Configuration/Capacity</td><td colspan="2">132 x Siemens 2.3MW = 303.6 MW</td><td colspan="2">10 x GE 2.3MW + 102 x GE 2.75MW = 303.5 MW</td></tr>
<tr><td>Generation Interconnection Line</td><td colspan="2">Length = 11 miles
R = 0.000610 pu
X = 0.005560 pu
B = 0.093990 pu</td><td colspan="2">Length = 16.2 miles
R = 0.000889 pu
X = 0.007931 pu
B = 0.140989 pu</td></tr>
<tr><td>Main Substation Transformer</td><td>Z = 1.2%, Winding 100 MVA, Rating 167 MVA</td><td>Z = 1.2%, Winding 100 MVA, Rating 167 MVA</td><td>Z = 9.5%, Winding 100 MVA, Rating 167 MVA</td><td>Z = 9%, Winding 100 MVA, Rating 167 MVA</td></tr>
<tr><td>GSU Transformer</td><td>Gen 1 Equivalent Qty: 66:

Z = 6%, Rating 171.6 MVA</td><td>Gen 2 Equivalent Qty: 66:

Z = 6%, Rating 171.6 MVA</td><td>Gen 1 Equivalent Qty: 52:

Z = 6.98%, Rating 163.8 MVA</td><td>Gen 2 Equivalent Qty: 60:

Z = 6.98%, Rating 189 MVA</td></tr>
<tr><td>Equivalent Collector Line</td><td>R = 0.005230 pu
X = 0.006810 pu
B = 0.045240 pu</td><td>R = 0.006970 pu
X = 0.010030 pu
B = 0.060510 pu</td><td>R = 0.004717 pu
X = 0.006659 pu
B = 0.056537 pu</td><td>R = 0.003475 pu
X = 0.004935 pu
B = 0.063675 pu</td></tr>
</table>

Aneden performed reactive power analysis, short circuit analysis, and dynamic stability analysis using the modification request data on the initial DISIS-2016-002-1 Group 14 study models. All analyses were performed using the PTI PSS/E version 33.7 software and the results are summarized below.

A power factor analysis was not performed as there was no change in the point of interconnection for GEN-2015-036.

The results of the reactive power analysis, also known as the low-wind/no-wind condition analysis, performed using the three main models showed that the GEN-2015-036 project may require a 26.2 MVAr shunt reactor on the 345kV bus of the project substation. The shunt reactor is needed to reduce the reactive power transfer at the POI to approximately zero during low/no wind conditions while the generation interconnection project remains connected to the grid.

The results from the short circuit analysis showed that the maximum change in the fault currents in the immediate systems at or near GEN-2015-036 was approximately 1.21 kA for the 2018SP case and 1.20 kA for the 2026SP case respectively. All three-phase fault current levels with the GEN-2015-036 generator online were below 45 kA for the 2018SP models and 2026SP models.

The dynamic stability analysis was performed using the three DISIS-2016-002-1 models 2017 Winter Peak, 2018 Summer Peak, 2026 Summer Peak. Up to 61 events were simulated, which included three-phase faults, three-phase faults on prior outage cases, and single-line-to-ground faults with stuck breakers faults.

The results of the dynamic stability analysis showed that there were no machine rotor angle damping or transient voltage recovery violations observed in the simulated fault events associated with this modification request study. Additionally, the project wind farm was found to stay connected during the other contingencies that were studied and, therefore, will meet the Low Voltage Ride Through (LVRT) requirements of FERC Order #661A.

The results of this Study show that the GEN-2015-036 Modification Request does not constitute a material modification.

1.0 Introduction

Aneden Consulting (Aneden) was retained by the Southwest Power Pool (SPP) to perform a Modification Request Impact Study (Study) for GEN-2015-036, an active generation interconnection request with point of interconnection (POI) at the Johnston County 345 kV.

The GEN-2015-036 project is proposed to interconnect in the Oklahoma Gas & Electric (OKGE) control area with a combined capacity of 303.6 MW as shown in Table 1-1 below. Details of the modification request are provided in Section 2.0 below.

Table 1-1: Existing GEN-2015-036 Configuration

Request	Capacity (MW)	Existing Generator Configuration	Point of Interconnection
GEN-2015-036	303.6	132 x Siemens 2.3MW	Johnston County 345 kV (514809)

1.1 Scope

The Study included reactive power analysis, short circuit analysis, and dynamic stability analysis. The methodology, assumptions, and results of the analyses are presented in the following five main sections:

1. Project and Modification Request
2. Reactive Power Analysis
3. Short Circuit Analysis
4. Dynamic Stability Analysis
5. Conclusions

Aneden performed the analyses using a set of modified study models developed using the modification request data and the three DISIS-2016-002 ReStudy #1 study models:

1. 2017 Winter Peak (2017WP),
2. 2018 Summer Peak (2018SP), and
3. 2026 Summer Peak (2026SP).

All analyses were performed using the PTI PSS/E version 33.7 software. The results of each analysis are presented in the following sections.

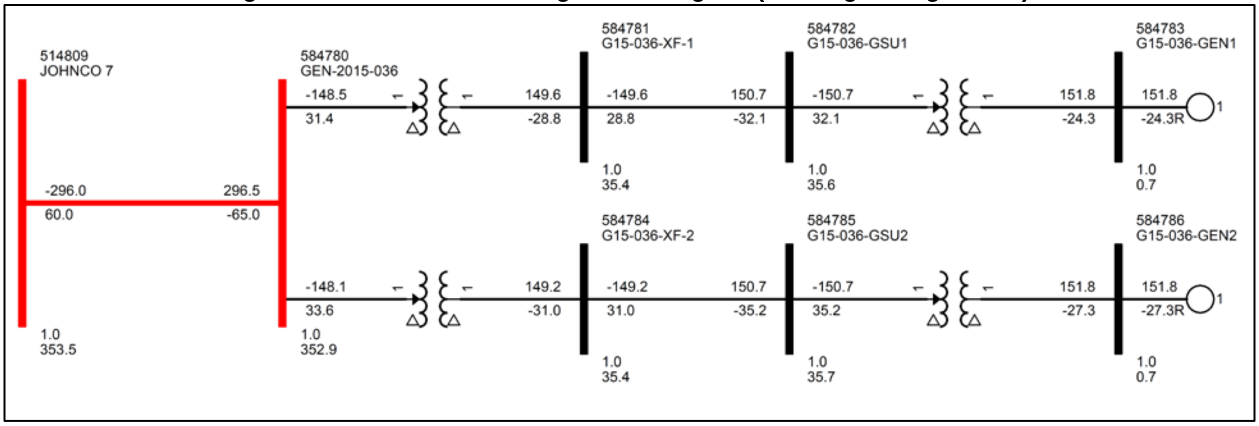
1.2 Study Limitations

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

GEN-2015-036 was originally studied as part of Group 14 in the DISIS-2016-001 study. Figure 2-1 shows the power flow model single line diagram for the existing GEN-2015-036 configuration.

Figure 2-1: GEN-2015-036 Single Line Diagram (Existing Configuration)



The GEN-2015-036 Modification Request included a turbine configuration change to a total of 10 x GE 2.3MW + 102 x GE 2.75 MW wind turbines for a total capacity of 303.5 MW. In addition, the modification request also included changes to the generation interconnection line, collection system, main substation transformers, and the GSU transformers. The major modification request changes are shown in Figure 2-2 and Table 2-1 below.

Figure 2-2: GEN-2015-036 Single Line Diagram (New Configuration)

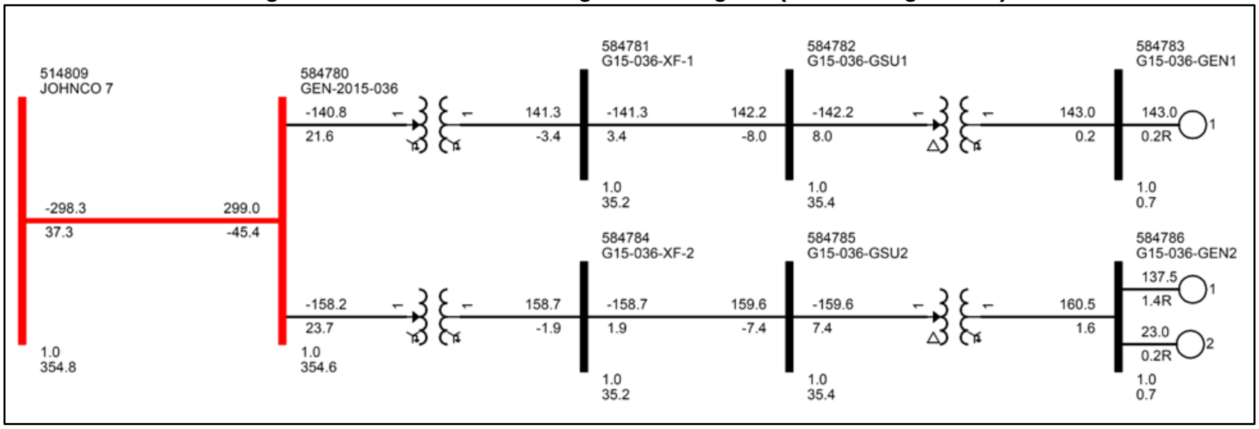


Table 2-1: GEN-2015-036 Modification Request

Facility	Existing		Modification	
Point of Interconnection	Johnston County 345 kV (514809)		Johnston County 345 kV (514809)	
Configuration/Capacity	132 x Siemens 2.3MW = 303.6 MW		10 x GE 2.3MW + 102 x GE 2.75MW = 303.5 MW	
Generation Interconnection Line	Length = 11 miles R = 0.000610 pu X = 0.005560 pu B = 0.093990 pu		Length = 16.2 miles R = 0.000889 pu X = 0.007931 pu B = 0.140989 pu	
Main Substation Transformer	Z = 1.2%, Winding 100 MVA, Rating 167 MVA	Z = 1.2%, Winding 100 MVA, Rating 167 MVA	Z = 9.5%, Winding 100 MVA, Rating 167 MVA	Z = 9%, Winding 100 MVA, Rating 167 MVA
GSU Transformer	Gen 1 Equivalent Qty: 66: Z = 6%, Rating 171.6 MVA	Gen 2 Equivalent Qty: 66: Z = 6%, Rating 171.6 MVA	Gen 1 Equivalent Qty: 52: Z = 6.98%, Rating 163.8 MVA	Gen 2 Equivalent Qty: 60: Z = 6.98%, Rating 189 MVA
Equivalent Collector Line	R = 0.005230 pu X = 0.006810 pu B = 0.045240 pu	R = 0.006970 pu X = 0.010030 pu B = 0.060510 pu	R = 0.004717 pu X = 0.006659 pu B = 0.056537 pu	R = 0.003475 pu X = 0.004935 pu B = 0.063675 pu

3.0 Reactive Power Analysis

The reactive power analysis, also known as the low-wind/no-wind condition analysis, was performed for GEN-2015-036 to determine the reactive power contribution from the project's interconnection line and collector transformer and cables during low/no wind conditions while the project is still connected to the grid 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 the GEN-2015-036 project, the generators were switched out of service while other collector system elements remained in-service. A shunt reactor was tested at the collection substation 345 kV bus to set the MVAr flow into the POI to approximately zero.

3.2 Results

The results from the reactive power analysis showed that the GEN-2015-036 project required an approximately 26.2 MVAr shunt reactor at the project substation, to reduce the POI MVAr to zero. Figure 3-1 illustrates the shunt reactor size required to reduce the POI MVAr to approximately zero. Reactive compensation can be provided either by discrete reactive devices or by the generator itself if it possesses that capability.

Figure 3-1: GEN-2015-036 Single Line Diagram (Shunt Reactor)

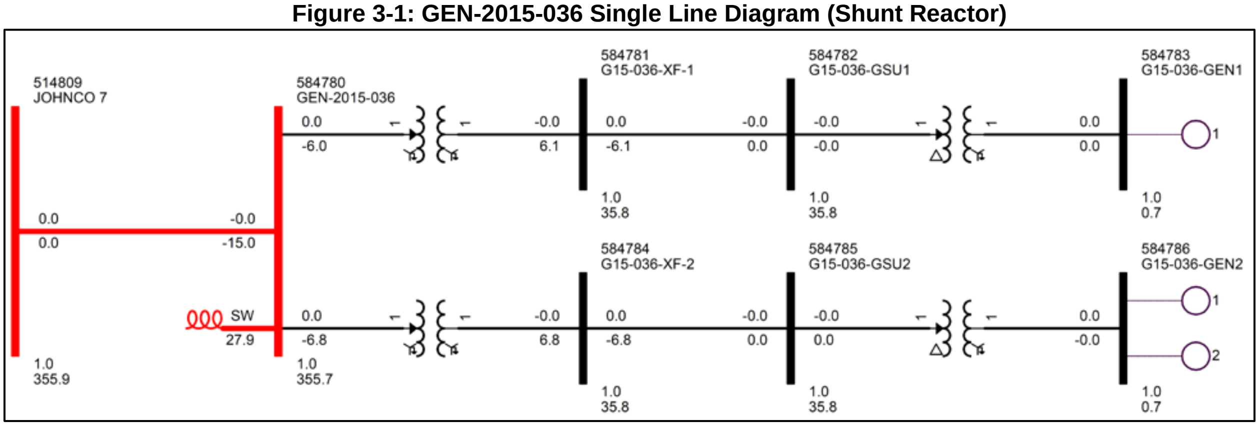


Table 3-1 shows the shunt reactor size determined for the three study models used in the assessment.

Table 3-1: Shunt Reactor Size for Low Wind Study

Machine	POI Bus Number	POI Bus Name	Reactor Size (MVAr)		
			17WP	18SP	26SP
GEN-2015-036	514809	Johnston County 345 kV	26.2	26.2	26.2

4.0 Short Circuit Analysis

A short-circuit study was performed using the 2018SP and 2026SP models for GEN-2015-036. The detail results of the short-circuit analysis are provided in Appendix A.

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 with and without the project online.

4.2 Results

The results of the short circuit analysis for the 2018SP and 2026SP models are summarized in Table 4-1 and Table 4-2 respectively. The maximum increase in fault current was about 12.8%, 1.21 kA. The maximum fault current calculated within 5 buses with GEN-2015-036 was less than 45 kA for the 2018SP and 2026SP models respectively.

Table 4-1: 2018SP Short Circuit Results

Voltage (kV)	Max. Current (kA)	Max kA Change	Max %Change
69	16.5	0.04	0.5%
138	44.7	0.61	4.1%
161	23.3	0.01	0.0%
345	33.4	1.21	12.8%
500	8.5	0.00	0.1%
Max	**44.7**	**1.21**	**12.8%**

Table 4-2: 2026SP Short Circuit Results

Voltage (kV)	Max. Current (kA)	Max kA Change	Max %Change
69	16.6	0.04	0.5%
138	44.4	0.61	4.1%
161	21.4	0.01	0.1%
345	33.3	1.20	12.8%
500	8.1	0.01	0.1%
Max	**44.4**	**1.20**	**12.8%**

5.0 Dynamic Stability Analysis

Aneden performed a dynamic stability analysis to identify the impact of the turbine configuration change and other modifications to the GEN-2015-036 project. The analysis was performed according to SPP's Disturbance Performance Requirements shown in Appendix B. The modification details are described in Section 2.0 above and the dynamic modeling data is provided in Appendix C. The simulation plots can be found in Appendix D.

5.1 Methodology and Criteria

The dynamic stability analysis was performed using models developed with the requested 10 x GE 2.3MW + 102 x GE 2.75 MW turbines configuration for the GEN-2015-036 generating facilities. This stability analysis was performed using PTI's PSS/E version 33.7 software.

The stability models were developed using the models from DISIS-2016-002 for Group 14. The modifications requested to project GEN-2015-036 were used to create modified stability models for this impact study.

The modified dynamics model data for the DISIS-2016-002-1 Group 14 request, GEN-2015-036 is provided in Appendix C. The modified power flow models and associated dynamics database were initialized (no-fault test) to confirm that there were no errors in the initial conditions of the system and the dynamic data.

During the fault simulations, the active power (PELEC), reactive power (QELEC), and terminal voltage (ETERM) were monitored for GEN-2015-036 and other equally and prior queued projects in Group 14. In addition, voltages of five (5) buses away from the POI of GEN-2015-036 were monitored and plotted. The machine rotor angle for synchronous machines and speed for asynchronous machines within this study area including 520 (AEPW), 524 (OKGE), 525 (WFEC), 526 (SPS), 531 (MIDW), 534 (SUNC), 536 (WERE), were monitored. In addition, the voltages of all 100 kV and above buses within the study area were monitored.

5.2 Fault Definitions

Aneden simulated the faults previously simulated for GEN-2015-036 and selected additional fault events for GEN-2015-036 as required. The new set of faults were simulated using the modified study models. The fault events included three-phase faults, three-phase faults on prior outage cases, and single-line-to-ground faults with stuck breakers. The simulated faults are listed and described in Table 5-1 below. These contingencies were applied to the modified 2017 Winter Peak, 2018 Summer Peak, and the 2026 Summer Peak models.

Table 5-1: Fault Definitions

Fault ID	Fault Descriptions
FLT01-3PH	3 phase fault on JOHNCO 7 345 kV (514809) to PITTSB-7 345 kV (510907), near JOHNCO 7. a. Apply fault at the JOHNCO 7 345 kV bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT02-3PH	3 phase fault on the JOHNCO 7 345 kV (514809) to JOHNCO 4 138 kV (514808) to JOHNCO11 13.8 kV (514810) XFMR, near JOHNCO 7 345 kV. a. Apply fault at the JOHNCO 7 345 kV bus. b. Clear fault after 5 cycles and trip the faulted transformer.
FLT03-3PH	3 phase fault on JOHNCO 7 345 kV (514809) to SUNNYSD7 345 kV (515136), near JOHNCO 7. a. Apply fault at the JOHNCO 7 345 kV bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT04-3PH	3 phase fault on PITTSB-7 345 kV (510907) to VALIANT7 345 kV (510911), near PITTSB-7. a. Apply fault at the PITTSB-7 345 kV bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT05-3PH	3 phase fault on PITTSB-7 345 kV (510907) to SEMINOL7 345 kV (515045), near PITTSB-7. a. Apply fault at the PITTSB-7 345 kV bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT06-3PH	3 phase fault on PITTSB-7 345 kV (510907) to C-RIVER7 345 kV (515422), near PITTSB-7. a. Apply fault at the PITTSB-7 345 kV bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT07-3PH	3 phase fault on JOHNCO 4 138 kV (514808) to RUSSET-4 138 kV (515120), near JOHNCO 4. a. Apply fault at the JOHNCO 4 138 kV bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT08-3PH	3 phase fault on JOHNCO 4 138 kV (514808) to SXMLCKT4 138 kV (515122), near JOHNCO 4. a. Apply fault at the JOHNCO 4 138 kV bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT09-3PH	3 phase fault on JOHNCO 4 138 kV (514808) to CANEYCK4 138 kV (515150), near JOHNCO 4. a. Apply fault at the JOHNCO 4 138 kV bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT10-3PH	3 phase fault on SUNNYSD7 345 kV (515136) to TERRYRD7 345 kV (511568), near SUNNYSD7. a. Apply fault at the SUNNYSD7 345 kV bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT11-3PH	3 phase fault on the SUNNYSD7 345 kV (515136) to SUNNYSD4 138 kV (515135) to SUNNYSD1 13.8 kV (515762) XFMR, near SUNNYSD7 345 kV. a. Apply fault at the SUNNYSD7 345 kV bus. b. Clear fault after 5 cycles and trip the faulted transformer.
FLT12-3PH	3 phase fault on SUNNYSD7 345 kV (515136) to G16-063-TAP 345 kV (560088), near SUNNYSD7. a. Apply fault at the SUNNYSD7 345 kV bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.

Table 5-1 continued

Fault ID	Fault Descriptions
FLT13-SB	Stuck Breaker at JOHNCO 7 (514809) a. Apply single phase fault at JOHNCO 7 bus. b. Clear fault after 16 cycles and trip the following elements c. JOHNCO 7 (514809) - PITTSB-7 (510907) d. JOHNCO 7 (514809) - SUNNYSD7 (515136)
FLT14-SB	Stuck Breaker at JOHNCO 7 (514809) a. Apply single phase fault at JOHNCO 7 bus. b. Clear fault after 16 cycles and trip the following elements c. JOHNCO 7 (514809) - PITTSB-7 (510907) d. JOHNCO 7 345kV (514809) / JOHNCO 4 138 kV (514808) / JOHNCO11 13.8 kV (514810) transformer
FLT15-SB	Stuck Breaker at JOHNCO 7 (514809) a. Apply single phase fault at JOHNCO 7 bus. b. Clear fault after 16 cycles and trip the following elements c. JOHNCO 7 (514809) - SUNNYSD7 (515136) d. JOHNCO 7 345kV (514809) / JOHNCO 4 138 kV (514808) / JOHNCO11 13.8 kV (514810) transformer
FLT16-SB	Stuck Breaker at SUNNYSD7 (515136) a. Apply single phase fault at SUNNYSD7 bus. b. Clear fault after 16 cycles and trip the following elements c. SUNNYSD7 (515136) - JOHNCO 7 (514809) d. SUNNYSD7 (515136) - TERRYRD7 (511568)
FLT17-SB	Stuck Breaker at SUNNYSD7 (515136) a. Apply single phase fault at SUNNYSD7 bus. b. Clear fault after 16 cycles and trip the following elements c. SUNNYSD7 (515136) - JOHNCO 7 (514809) d. SUNNYSD7 (515136) - G16-063-TAP (560088)
FLT18-SB	Stuck Breaker at PITTSB-7 (510907) a. Apply single phase fault at PITTSB-7 bus. b. Clear fault after 16 cycles and trip the following elements c. PITTSB-7 (510907) - VALIANT7 (510911) d. PITTSB-7 (510907) - JOHNCO 7 (514809)
FLT57-3PH	3 phase fault on TERRYRD7 345 kV (511568) to L.E.S.-7 345 kV (511468), near TERRYRD7. a. Apply fault at the TERRYRD7 345 kV bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT58-3PH	3 phase fault on L.E.S.-7 345 kV (511468) to G16-091-TAP 345 kV (587744), near L.E.S.-7. a. Apply fault at the L.E.S.-7 345 kV bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT59-3PH	3 phase fault on L.E.S.-7 345 kV (511468) to O.K.U.-7 345 kV (511456), near L.E.S.-7. a. Apply fault at the L.E.S.-7 345 kV bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT60-3PH	3 phase fault on the L.E.S.-7 345 kV (511468) to L.E.S.-4 138 kV (511467) to LES#5-1 13.8 kV (511411) XFMR ckt 2, near L.E.S.-7 345 kV. a. Apply fault at the L.E.S.-7 345 kV bus. b. Clear fault after 5 cycles and trip the faulted transformer.
FLT61-SB	Stuck Breaker at L.E.S.-7 (511468) a. Apply single phase fault at L.E.S.-7 bus. b. Clear fault after 16 cycles and trip the following elements c. L.E.S.-7 (511468) - G16-091-TAP (587744) d. L.E.S.-7 (511468) - TERRYRD7 (511568)

Table 5-1 continued

Fault ID	Fault Descriptions
FLT62-SB	Stuck Breaker at L.E.S.-7 (511468) a. Apply single phase fault at L.E.S.-7 bus. b. Clear fault after 16 cycles and trip the following elements c. L.E.S.-7 (511468) - O.K.U.-7 (511456) d. L.E.S.-7 (511468) - TERRYRD7 (511568)
FLT63-SB	Stuck Breaker at L.E.S.-7 (511468) a. Apply single phase fault at L.E.S.-7 bus. b. Clear fault after 16 cycles and trip the following elements c. L.E.S.-7 (511468) - TERRYRD7 (511568) d. L.E.S.-7 345kV (511468) / L.E.S.-4 138 kV (511467) / LES#5-1 13.8 kV (511411) transformer ckt 2
FLT64-SB	Stuck Breaker at L.E.S.-7 (511468) a. Apply single phase fault at L.E.S.-7 bus. b. Clear fault after 16 cycles and trip the following elements c. L.E.S.-7 (511468) - O.K.U.-7 (511456) d. L.E.S.-7 (511468) - G16-091-TAP (587744)
FLT65-SB	Stuck Breaker at SUNNYSD7 (515136) a. Apply single phase fault at SUNNYSD7 bus. b. Clear fault after 16 cycles and trip the following elements c. SUNNYSD7 (515136) - TERRYRD7 (511568) d. SUNNYSD7 (515136) - G16-063-TAP (560088)
FLT69-3PH	3 phase fault on G16-063-TAP 345 kV (560088) to HUGO 7 345 kV (521157), near G16-063-TAP. a. Apply fault at the G16-063-TAP 345 kV bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT70-3PH	3 phase fault on the HUGO 7 345 kV (521157) to HUGO PP4 138 kV (520948) to HUGO TERTA 13.8 kV (521189) XFMR, near HUGO 7 345 kV. a. Apply fault at the HUGO 7 345 kV bus. b. Clear fault after 5 cycles and trip the faulted transformer.
FLT71-3PH	3 phase fault on HUGO 7 345 kV (521157) to VALIANT7 345 kV (510911), near HUGO 7. a. Apply fault at the HUGO 7 345 kV bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT72-SB	Stuck Breaker at HUGO 7 (521157) a. Apply single phase fault at HUGO 7 bus. b. Clear fault after 16 cycles and trip the following elements c. HUGO 7 (521157) - VALIANT7 (510911) d. HUGO 7 (521157) - G16-063-TAP (560088)
FLT73-SB	Stuck Breaker at SUNNYSD7 (515136) a. Apply single phase fault at SUNNYSD7 bus. b. Clear fault after 16 cycles and trip the following elements c. SUNNYSD7 (515136) - G16-063-TAP (560088) d. SUNNYSD7 345kV (515136) / SUNNYSD4 138 kV (515135) / SUNYSD 1 13.8 kV (515405) transformer
FLT1001-SB	Stuck Breaker at SUNNYSD7 (515136) a. Apply single phase fault at SUNNYSD7 bus. b. Clear fault after 16 cycles and trip the following elements c. SUNNYSD7 (515136) - JOHNCO 7 (514809) d. SUNNYSD7 345kV (515136) / SUNNYSD4 138 kV (515135) / SUNNYSD1 13.8 kV (515762) transformer

Table 5-1 continued

Fault ID	Fault Descriptions
FLT1002-SB	Stuck Breaker at PITTSB-7 (510907) a. Apply single phase fault at PITTSB-7 bus. b. Clear fault after 16 cycles and trip the following elements c. PITTSB-7 (510907) - SEMINOL7 (515045) d. PITTSB-7 (510907) - C-RIVER7 (515422)
FLT1003-SB	Stuck Breaker at PITTSB-7 (510907) a. Apply single phase fault at PITTSB-7 bus. b. Clear fault after 16 cycles and trip the following elements c. PITTSB-7 (510907) - KIOWA 7 (510925) Drop Kiowa Generators (511944)(511946)(511948)(511945)(511949)(511947)
FLT9001-3PH	3 phase fault on the PITTSB-7 (510907) to KIOWA 7 (510925) 345 kV line circuit 1, near PITTSB-7. a. Apply fault at the PITTSB-7 345 kV bus. b. Clear fault after 5 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 5 cycles, then trip the line in (b) and remove fault. Drop Kiowa Generators (511944)(511946)(511948)(511945)(511949)(511947)
FLT9002-3PH	3 phase fault on the C-RIVER7 (515422) to MUSKOGE7 (515224) 345 kV line circuit 1, near C-RIVER7. a. Apply fault at the C-RIVER7 345 kV bus. b. Clear fault after 5 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 5 cycles, then trip the line in (b) and remove fault.
FLT9003-3PH	3 phase fault on C-RIVER7 345 kV (515422) to C-RIVER4 138 kV (510946) to C-RIVER1 13.8 kV (510947) XFMR, near C-RIVER7 345 kV. a. Apply fault at the C-RIVER7 345 kV bus. b. Clear fault after 5 cycles and trip the faulted transformer.
FLT9004-3PH	3 phase fault on the SEMINOL7 (515045) to MUSKOGE7 (515224) 345 kV line circuit 1, near SEMINOL7. a. Apply fault at the SEMINOL7 345 kV bus. b. Clear fault after 5 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 5 cycles, then trip the line in (b) and remove fault.
FLT9005-3PH	3 phase fault on the SEMINOL7 (515045) to DRAPER 7 (514934) 345 kV line circuit 1, near SEMINOL7 . a. Apply fault at the SEMINOL7 345 kV bus. b. Clear fault after 5 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 5 cycles, then trip the line in (b) and remove fault.
FLT9006-3PH	3 phase fault on the SEMINOL7 (515045) to ARCADIA7 (514908) 345 kV line circuit 1, near SEMINOL7 . a. Apply fault at the SEMINOL7 345 kV bus. b. Clear fault after 5 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 5 cycles, then trip the line in (b) and remove fault.
FLT9007-3PH	3 phase fault on SEMINOL7 345 kV (515045) to SEMINOL4 138 kV (515044) to SEMINO11 14.4 kV (515756) XFMR, near SEMINOL7 345 kV. a. Apply fault at the SEMINOL7 345 kV bus. b. Clear fault after 5 cycles and trip the faulted transformer.
FLT9008-3PH	3 phase fault on the SEMINOL7 (515045) to SEMINL2G (515041) 345/17.1 kV transformer circuit 1, near SEMINOL7. a. Apply fault at the SEMINOL7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer. Drop generator at SEMINL2G (515041)

Table 5-1 continued

Fault ID	Fault Descriptions
FLT9009-3PH	3 phase fault on the SEMINOL7 (515045) to SEMINL3G (515042) 345/20.9 kV transformer circuit 1, near SEMINOL7. a. Apply fault at the SEMINOL7 345 kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer. Drop generator at SEMINL3G (515042)
FLT9010-3PH	3 phase fault on the TERRYRD7 (511568) to RUSHSPR7 (511571) 345 kV line circuit 1, near TERRYRD7. a. Apply fault at the TERRYRD7 345 kV bus. b. Clear fault after 5 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 5 cycles, then trip the line in (b) and remove fault. Drop generators GEN-2015-092 (585283)(585284) and GEN-2015-045 (584862) and GEN-2014-057 (584073)
FLT9011-3PH	3 phase fault on the G16-091-TAP (587744) to GRACMNT7 (515800) 345 kV line circuit 1, near G16-091-TAP. a. Apply fault at the G16-091-TAP 345 kV bus. b. Clear fault after 5 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 5 cycles, then trip the line in (b) and remove fault.
FLT9012-3PH	3 phase fault on the VALIANT7 (510911) to NWTXARK7 (508072) 345 kV line circuit 1, near VALIANT7. a. Apply fault at the VALIANT7 345 kV bus. b. Clear fault after 5 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 5 cycles, then trip the line in (b) and remove fault.
FLT9013-3PH	3 phase fault on the VALIANT7 (510911) to GEN-2016-129 (588200) 345 kV line circuit 1, near VALIANT7. a. Apply fault at the VALIANT7 345 kV bus. b. Clear fault after 5 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 5 cycles, then trip the line in (b) and remove fault. Drop generator GEN-2016-129 (588203)
FLT9014-3PH	3 phase fault on the VALIANT7 (510911) to LYDIA 7 (508298) 345 kV line circuit 1, near VALIANT7. a. Apply fault at the VALIANT7 345 kV bus. b. Clear fault after 5 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 5 cycles, then trip the line in (b) and remove fault.
FLT9015-3PH	3 phase fault on VALIANT7 345 kV (510911) to VALIANT4 138 kV (510918) to VALN3-1 13.8 kV (510939) XFMR, near VALIANT7 345 kV. a. Apply fault at the VALIANT7 345 kV bus. b. Clear fault after 5 cycles and trip the faulted transformer.
FLT9016-3PH	3 phase fault on SUNNYSD7 345 kV (515136) to JOHNCO 7 345 kV (514809), near SUNNYSD7. a. Apply fault at the SUNNYSD7 345 kV bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT9017-3PH	3 phase fault on the G16-063-TAP (560088) to GEN-2016-063 (587430) 345 kV line circuit 1, near G16-063-TAP. a. Apply fault at the G16-063-TAP 345 kV bus. b. Clear fault after 5 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 5 cycles, then trip the line in (b) and remove fault. Drop generator GEN-2016-063 (587436) (587433)
FLT9018-3PH	3 phase fault on the SUNNYSD7 345 kV (515136) to SUNNYSD4 138 kV (515135) to SUNYSD 1 13.8 kV (515405) XFMR, near SUNNYSD7 345 kV. a. Apply fault at the SUNNYSD7 345 kV bus. b. Clear fault after 5 cycles and trip the faulted transformer.

Table 5-1 continued

Fault ID	Fault Descriptions
FLT01-PO2	**Prior Outage of JOHNCO 7 (514809) to SUNNYSD7 (515136) line;** 3 phase fault on JOHNCO 7 345 kV (514809) to PITTSB-7 345 kV (510907), near JOHNCO 7. a. Apply fault at the JOHNCO 7 345 kV bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT01-PO3	**Prior Outage of JOHNCO 7 345kV (514809) / JOHNCO 4 138 kV (514808) / JOHNCO11 13.8 kV (514810) transformer;** 3 phase fault on JOHNCO 7 345 kV (514809) to PITTSB-7 345 kV (510907), near JOHNCO 7. a. Apply fault at the JOHNCO 7 345 kV bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT03-PO1	**Prior Outage of JOHNCO 7 (514809) to PITTSB-7 (510907) line;** 3 phase fault on JOHNCO 7 (514809) – SUNNYSD7 (515136) near JOHNCO 7 a. Apply fault at the JOHNCO 7 bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT03-PO3	**Prior Outage of JOHNCO 7 345kV (514809) / JOHNCO 4 138 kV (514808) / JOHNCO11 13.8 kV (514810) transformer;** 3 phase fault on JOHNCO 7 (514809) – SUNNYSD7 (515136) near JOHNCO 7 a. Apply fault at the JOHNCO 7 bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT02-PO1	**Prior Outage of JOHNCO 7 (514809) to PITTSB-7 (510907) line;** 3 phase fault on the JOHNCO 7 345kV (514809) / JOHNCO 4 138 kV (514808) / JOHNCO11 13.8 kV (514810) transformer near JOHNCO 7 a. Apply fault at the JOHNCO 7 bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT02-PO2	**Prior Outage of JOHNCO 7 (514809) to SUNNYSD7 (515136) line;** 3 phase fault on the JOHNCO 7 345kV (514809) / JOHNCO 4 138 kV (514808) / JOHNCO11 13.8 kV (514810) transformer near JOHNCO 7 a. Apply fault at the JOHNCO 7 bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT9016-PO4	**Prior Outage of SUNNYSD7 (515136) to TERRYRD7 (511568) line;** 3 phase fault on SUNNYSD7 (515136) – JOHNCO 7 (514809) near SUNNYSD7 a. Apply fault at the SUNNYSD7 bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
FLT9016-PO5	**Prior Outage of SUNNYSD7 (515136) to G16-063-TAP (560088) line;** 3 phase fault on SUNNYSD7 (515136) – JOHNCO 7 (514809) near SUNNYSD7 a. Apply fault at the SUNNYSD7 bus. b. Clear fault after 5 cycles and trip the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.

5.3 Results

Table 5-2 shows the results of the fault events simulated for each of the models. The associated stability plots are provided in Appendix D.

The results of the dynamic stability analysis showed that there were no machine rotor angle damping or transient voltage recovery violations observed in the simulated fault events associated with this modification request study. Additionally, the project wind farm was found to stay connected during the other contingencies that were studied and, therefore, will meet the Low Voltage Ride Through (LVRT) requirements of FERC Order #661A.

Table 5-2: GEN-2015-036 Dynamic Stability Results

Fault ID	17W			18S			26S		
	Voltage Recovery	Voltage Violation	Stable	Voltage Recovery	Voltage Violation	Stable	Voltage Recovery	Voltage Violation	Stable
FLT01-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT02-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT03-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT04-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT05-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT06-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT07-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT08-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT09-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT10-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT11-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT12-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT13-SB	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT14-SB	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT15-SB	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT16-SB	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT17-SB	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT18-SB	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT57-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT58-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT59-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT60-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT61-SB	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT62-SB	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT63-SB	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT64-SB	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT65-SB	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT69-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT70-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT71-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT72-SB	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT73-SB	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable

Table 5-2 continued

Fault ID	17W			18S			26S		
	Voltage Recovery	Voltage Violation	Stable	Voltage Recovery	Voltage Violation	Stable	Voltage Recovery	Voltage Violation	Stable
FLT1001-SB	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT1002-SB	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT1003-SB	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT9001-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT9002-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT9003-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT9004-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT9005-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT9006-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT9007-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT9008-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT9009-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT9010-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT9011-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT9012-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT9013-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT9014-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT9015-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT9016-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT9017-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT9018-3PH	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT02-PO1	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT03-PO1	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT01-PO2	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT02-PO2	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT01-PO3	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT03-PO3	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT9016-PO4	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable
FLT9016-PO5	Pass	Pass	Stable	Pass	Pass	Stable	Pass	Pass	Stable

6.0 Conclusions

The Interconnection Customer for GEN-2015-036 requested a Modification Request Impact Study to assess the impact of the turbine and facility changes to a configuration with a total of 10 x GE 2.3MW + 102 x GE 2.75MW wind turbines for a total capacity of 303.5 MW. In addition, the modification request included changes to the generation interconnection lines, collection system, main substation transformers, and the GSU transformers.

A power factor analysis was not performed as there was no change in the point of interconnection for GEN-2015-036.

The results of the reactive power analysis, also known as the low-wind/no-wind condition analysis, performed using all three models showed that the combined GEN-2015-036 project may require a 26.2 MVAr shunt reactor on the 345kV bus of the project substation. The shunt reactor is needed to reduce the reactive power transfer at the POI to approximately zero during low/no wind conditions while the generation interconnection project remains connected to the grid.

The results from the short circuit analysis showed that the maximum change in the fault currents in the immediate systems at or near GEN-2015-036 was approximately 1.21 kA for the 2018SP and 1.20 kA for the 2026SP cases respectively. All three-phase fault current levels with the GEN-2015-036 generator online were below 45 kA for the 2018SP models and 2026SP models.

The results of the dynamic stability analysis showed that there were no machine rotor angle damping or transient voltage recovery violations observed in the simulated fault events associated with this modification request study. Additionally, the project wind farm was found to stay connected during the other contingencies that were studied and, therefore, will meet the Low Voltage Ride Through (LVRT) requirements of FERC Order #661A.

The results of this Study show that the GEN-2015-036 Modification Request does not constitute a material modification.