Generation Interconnection System Impact Study Report

For

PJM Generation Interconnection Request Queue Position AB1-160

Gold-Sabinsville 115kV

October 2016

Preface

The intent of the System Impact Study is to determine a plan, with approximate cost and construction time estimates, to connect the subject generation interconnection project to the PJM network at a location specified by the Interconnection Customer. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system. All facilities required for interconnection of a generation interconnection project must be designed to meet the technical specifications (on PJM web site) for the appropriate transmission owner.

In some instances an Interconnection Customer may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection or merchant transmission upgrade, may also contribute to the need for the same network reinforcement. The possibility of sharing the reinforcement costs with other projects may be identified in the Feasibility Study, but the actual allocation will be deferred until the System Impact Study is performed.

The System Impact Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The project developer is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by Transmission Owners, the costs may be included in the study.

General

Big Level Wind, LLC, the Interconnection Customer (IC), has proposed an uprate to a proposed wind generating facility located in Potter County, Pennsylvania. The increase is for 20 MW with 3.8 MW of this output being recognized by PJM as capacity. Note that this project is an increase to the Interconnection Customer's Z1-069 project, which will share the same property and connection point. The Z1-069 project will have a capability of 70 MW with 13.3 MW being recognized as capacity. The total capability of the combined Z1-069 and AB1-160 projects will be 90 MW with 17.1 MW being recognized by PJM as capacity. The proposed in-service date for the AB1-160 project is December 2017. **This study does not imply a Pennsylvania Electric Company (Penelec) commitment to this in-service date.**

Point of Interconnection

AB1-160 will interconnect with the Penelec transmission system Gold-Sabinsville 115kV line.

Cost Summary

The AB1-160 project will be responsible for the following costs:

Description	Cost	Tax (if applicable)	Total Cost
Attachment Facilities	$ 0	$ 0	$ 0
Direct Connection Network Upgrades	$ 0	$ 0	$ 0
Non Direct Connection Network Upgrades	$ 12,700	$ 3,800	$ 16,500
Allocation for New System Upgrades	$ 0	$ 0	$ 0

Description	Cost	Tax (if applicable)	Total Cost
Contribution for Previously Identified Upgrades	$ 0	$ 0	$ 0
Total Costs	**$ 12,700**	**$ 3,800**	**$ 16,500**

Attachment Facilities

There are no Attachment Facilities are required to support this interconnection.

Direct Connection Cost Estimate

There are no Direct Connection Facilities are required to support this interconnection.

Non-Direct Connection Cost Estimate

The total preliminary cost estimate for the Non-Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Activity Cost	Tax (if applicable)	Total Cost
Adjust remote end relaying and metering settings.	$ 12,700	$ 3,800	$ 16,500
Total Non-Direct Connection Facility Costs	**$ 12,700**	**$ 3,800**	**$ 16,500**

Interconnection Customer Requirements

1. An Interconnection Customer entering the New Services Queue on or after October 1, 2012 with a proposed new Customer Facility that has a Maximum Facility Output equal to or greater than 100 MW shall install and maintain, at its expense, phasor measurement units (PMUs). See Section 8.5.3 of Appendix 2 to the Interconnection Service Agreement as well as section 4.3 of PJM Manual 14D for additional information.

2. The Interconnection Customer may be required to install and/or pay for metering as necessary to properly track real time output of the facility as well as installing metering which shall be used for billing purposes. See Section 8 of Appendix 2 to the Interconnection Service Agreement as well as Section 4 of PJM Manual 14D for additional information.

3. The Interconnection Customer seeking to interconnect a wind generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per item 5.iv. of Schedule H to the Interconnection Service Agreement.

4. The purchase and installation of a fully rated circuit breaker on the high side of the Z1-069/AB1-160 115/34.5 kV step-up transformer.

5. The purchase and installation of the minimum required FE generation interconnection relaying and control facilities. This includes over/under voltage protection, over/under frequency protection, and zero sequence voltage protection relays.

6. The purchase and installation of a 115 kV interconnection metering instrument transformer. FE will provide the ratio and accuracy specifications based on the customer load and generation levels.

7. The purchase and installation of supervisory control and data acquisition (SCADA) equipment to provide information in a compatible format to the FE Transmission System Control Center.

8. The establishment of dedicated communication circuits for SCADA report to the FE Transmission System Control Center.

9. A compliance with the FE and PJM generator power factor and voltage control requirements.

10. The execution of a back-up service agreement to serve the customer load supplied from the Z1-069/AB1-160 115 kV interconnection substation when the units are out-of-service. This assumes the intent of the IC is to net the generation with the load.

Revenue Metering and SCADA Requirements

PJM Requirements

The Interconnection Customer will be required to install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for IC's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Sections 24.1 and 24.2.

Penelec Requirements

The Interconnection Customer will be required to comply with all FE Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the "FirstEnergy Requirements for Transmission Connected Facilities" document located at the following links:

http://www.firstenergycorp.com/feconnect
http://www.pjm.com/planning/design-engineering/to-tech-standards.aspx

Network Impacts

The Queue Project AB1-160 was evaluated as a 20.0 MW (Capacity 3.8 MW) injection at the Z1-069 switchyard 115 kV in the Penelec area. Project AB1-160 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AB1-160 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Generator Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

None.

Light Load Analysis

Light Load Studies to be conducted during later study phases (applicable to wind, coal, nuclear, and pumped storage projects).

None.

NYISO Impacts:

NYISO Impacts were identified, the upgrades to be determined during the Facilities Study.

Multiple Facility Contingency

(Double Circuit Tower Line contingencies were studied for the full energy output. The contingencies of Line with Failed Breaker and Bus Fault will be performed for the Impact Study.)

None.

Short Circuit

(Summary of impacted circuit breakers)

None.

Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

None.

Steady-State Voltage Requirements

(Summary of the VAR requirements based upon the results of the steady-state voltage studies)

None.

Stability and Reactive Power Requirement for Low Voltage Ride Through

(Summary of the VAR requirements based upon the results of the dynamic studies)

To be completed as a part of the Facilities Study.

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)

None.

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)

None.

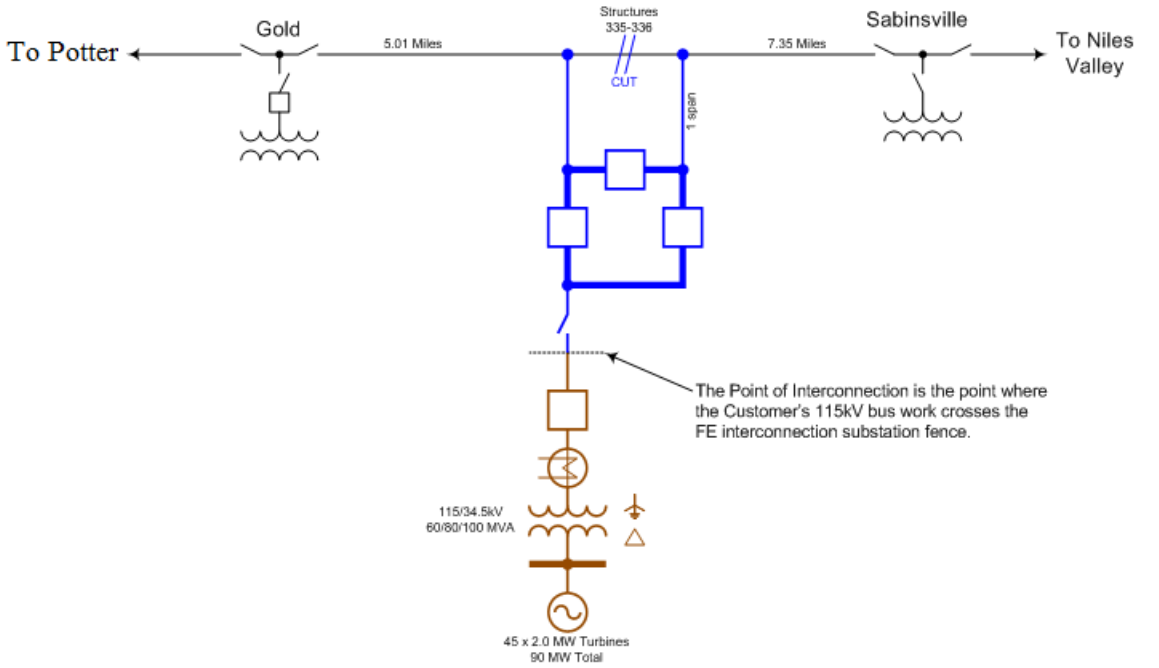
Potential Congestion due to Local Energy Deliverability

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

Note: Only the most severely overloaded conditions are listed below. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which shall study all overload conditions associated with the overloaded element(s) identified

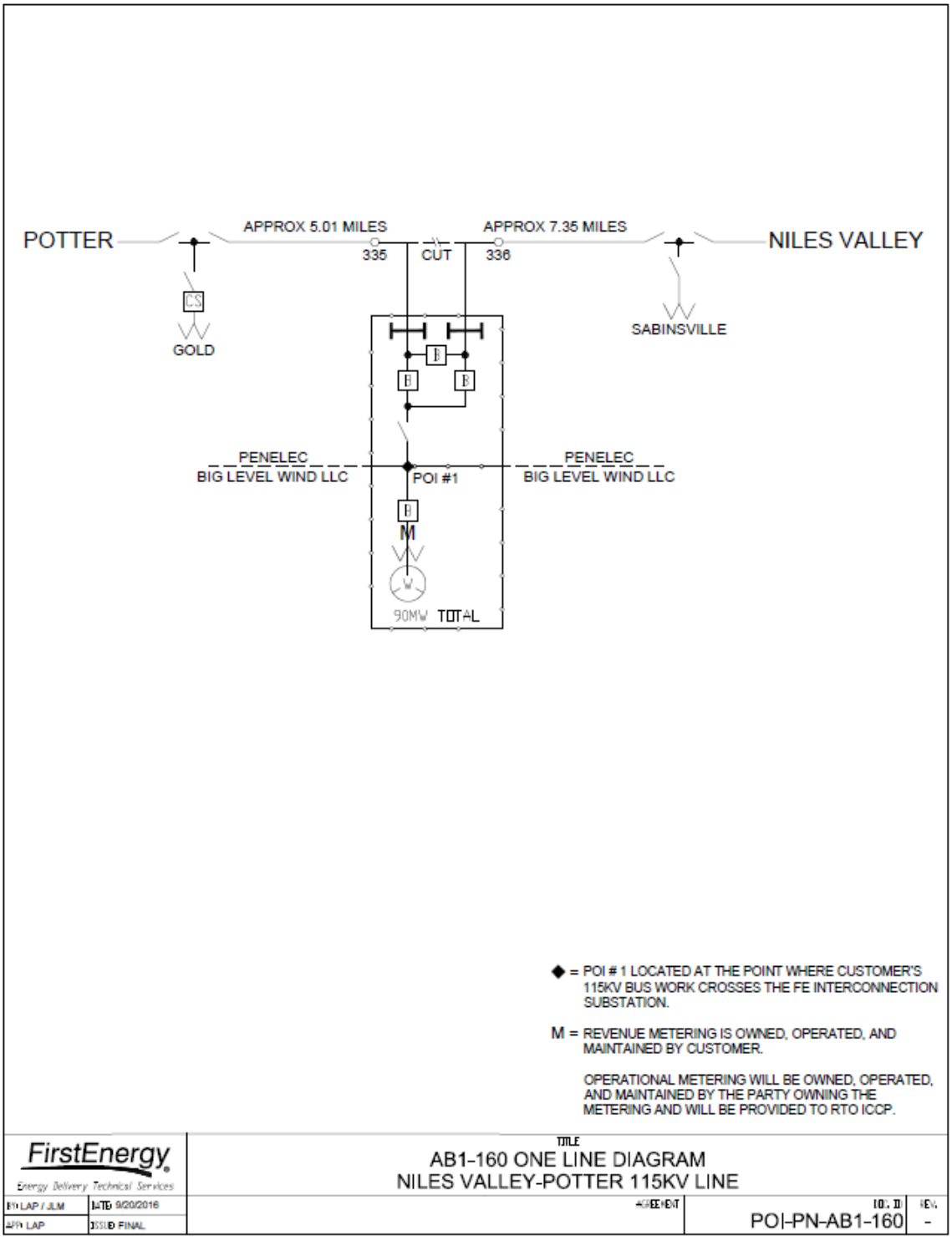
None.

Attachment 1. Planning Single Line Diagram



Customer facilities are shown for informational purposes only. The Customer is responsible for complying with applicable FirstEnergy connection standards, including FE's "Requirements for Transmission Connected Facilities" document.

Attachment 2. Engineering Single Line Diagram



Attachment 3. Dynamic Simulation Analysis

Executive Summary

Generator Interconnection Request AB1-160 is for an increase in energy injection capability of the Z1-069 Cunningham wind generating facility. The uprate increases the Maximum Facility Output (MFO) of the plant from 70 MW to 90 MW. AB1-160 Point of Interconnection (POI) is at a tap of the Gold - Sabinsville 115 kV line in the Pennsylvania Electric Company (Penelec) transmission system, Potter County, Pennsylvania.

This report describes a dynamic simulation analysis of AB1-160 as part of the overall system impact study.

The load flow scenario for the analysis was based on the RTEP 2019 summer peak case, modified to include applicable queue projects. AB1-160 has been dispatched online at maximum power output, with approximately unity power factor and 1.0 pu voltage at the generator bus.

AB1-160 was tested for compliance with NERC, PJM, Transmission Owner and other applicable criteria. 64 contingencies were studied, each with a 10 second simulation time period. Studied faults included:

a) Steady state operation (20 second simulation);

b) Three phase faults with normal clearing time;

c) Single-phase faults with stuck breaker;

d) Single-phase faults placed at 80% of the line with delayed (Zone 2) clearing at line end remote from fault due to primary communications/relay failure.

No relevant Bus, Tower or High Speed Reclosing (HSR) contingencies were identified.

For all simulations, the queue project under study along with the rest of the PJM system were required to maintain synchronism and with all states returning to an acceptable new condition following the disturbance.

AB1-082 units 1, 2, 3 tripped on contingencies 1B.02 and 1B.03. The AA2-081 units 1, 2, 3 tripped on contingencies 1B.06, 1B.07, 1B.08, 1B.09 and 1B.10. These units tripped as a result of excessive angle deviation due to loss of the 115kV stations. These contingencies were re-run with AB1-160 out-of-service and it was found that the AB1-082 and AA2-081 units still tripped, hence the tripping cannot be attributed to AB1-160.

For the remaining fault contingencies tested on the 2019 summer peak case:

a) Post-contingency oscillations were positively damped with a damping margin of at least 3%.

a) The AB1-160 generator was able to ride through all faults (except for faults where protective action trips a generator(s)).

No mitigations were found to be required.

1. Introduction

Generator Interconnection Request AB1-160 is for an increase in energy injection capability of the Z1-069 Cunningham wind generating facility. The uprate increases the Maximum Facility Output (MFO) of the plant from 70 MW to 90 MW. AB1-160 Point of Interconnection (POI) is at a tap of the Gold - Sabinsville 115 kV line in the Pennsylvania Electric Company (Penelec) transmission system, Potter County, Pennsylvania.

This analysis is effectively a screening study to determine whether the addition of AB1-160 will meet the dynamic requirements of the NERC, PJM and Transmission Owner reliability standards.

In this report the AB1-160 project and how it is proposed to be connected to the grid are first described, followed by a description of how the project is modeled in this study. The fault cases are then described and analyzed, and lastly a discussion of the results is provided.

2. Description of Project

AB1-160 consists of 45 x 2 MW Gamessa G114 Wind Turbines. AB1-160 will be connected to the POI via a 115/34.5/13.8 kV main collector transformer with a rating of 60/80/100 MVA (ONAN/ONAF/ONAF) connected to a 34.5/0.69 kV generator step up (GSU) transformer with a rating of 105.75 MVA (OA). The AB1-160 Point of Interconnection (POI) is at a tap of the Gold - Sabinsville 115 kV circuit as shown in Figure 1.

Table 1 lists the parameters given in the impact study data and the corresponding parameters of the AB1-160 loadflow models.

The dynamic model for the AB1-160 plant is based on the Gamesa G114 PSS/E user defined model supplied by PJM, as indicated by the Developer.

Additional project details are provided in Attachments 1 through 4:

- Attachment 1 contains the Impact Study Data which details the proposed AB1-160 project.
- Attachment 2 shows the one line diagram of the PENELEC network in the vicinity of AB1-160.
- Attachment 3 provides a diagram of the PSS/E model in the vicinity of AB1-160.
- Attachment 4 gives the AB1-160 PSS/E loadflow and dynamic models of the AB1-160 plant.

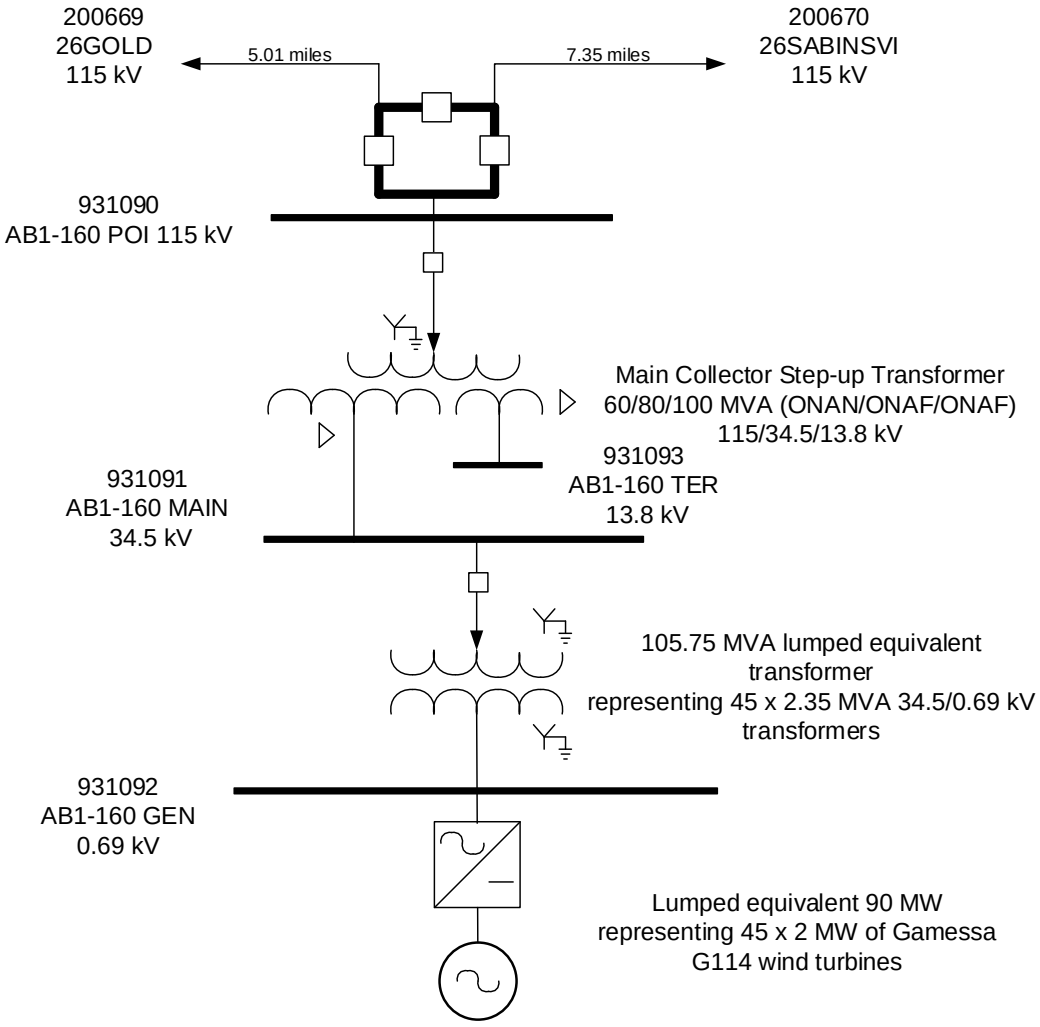


Figure 1: AB1-160 Plant Model

Table 1: AB1-160 Plant Model

	Impact Study Data	Model
Wind Turbines	45 × 2 MW Gamessa G114 wind turbines MVA base = 2 MVA Vt = 0.690 kV	Lumped equivalent representing 45 × Gamessa G114 2 MW wind turbines Pgen 90 MW Pmax 90 MW Pmin 0 MW Qgen 6.8327 MVAr Qmax 29.58 MVAr Qmin -29.58 MVAr Mbase 90 MVA Zsource 0.006301 + j0.1507237 pu @Mbase
GSU transformer	45 x 34.5/0.69 kV two winding transformers Transformer base = 2.35 MVA Rating = 2.35 MVA Impedance = 0.0108 + j0.1155 pu @ MVA base Number of taps = N/A Tap step size = N/A	Lumped equivalent representing 45 x 34.5/0.69 kV 2.35 MVA two winding transformers Transformer base = 105.75 MVA (OA) Rating = 105.75 MVA Impedance = 0.0108 + j0.1155 pu @ MVA base Number of taps = 5 Tap step size = 2.5%
Collector step-up transformer	1 x 115/34.5/13.2 kV three winding transformer Transformer base = 60 MVA Rating = 60/80/100 MVA (ONAN/ONAF/ONAF) Impedance High to low: 0.00339 + j0.0949 High to tertiary: 0.00159 + j0.0562 Low to tertiary: 0.0035 + j0.0859 All impedances are @ MVA base Number of taps = N/A Tap step size = N/A	1 x 115/34.5/13.8 kV three winding transformer Transformer base = 60 MVA Rating = 60/80/100 MVA Impedance High to low: 0.00339 + j0.0949 High to tertiary: 0.00159 + j0.0562 Low to tertiary: 0.0035 + j0.0859 All impedances are @ MVA base Number of taps = 5 Tap step size = 2.5%
Auxiliary load	N/A	N/A
Station load	N/A	N/A
Transmission line	N/A	N/A

3. Loadflow and Dynamics Case Setup

The dynamics simulation analysis was carried out using PSS/E Version 32.2.4.

The load flow scenario and fault cases for this study are based on PJM's Regional Transmission Planning Process[1].

The selected load flow scenario is the RTEP 2019 summer peak case with the following modifications:

a) Addition of all applicable queue projects prior to AB1-160.

b) Addition of AB1-160 queue project.

c) Removal of withdrawn and subsequent queue projects in the vicinity of AB1-160.

d) Dispatch of units in the PJM system to maintain slack generators within limits.

The AB1-160 initial conditions are listed in Table 2, indicating maximum power output, with unity power factor and approximately 1.0 pu voltage at the generator bus.

Table 2: AB1-160 machine initial conditions

Bus	Name	Unit	PGEN	QGEN	ETERM	POI Voltage
931092	AB1-160 GEN	1	90	0 MVAr	1.001 pu	1.016 pu

Generation within the PJM500 system (area 225 in the PSS/E case) and within the vicinity of AB1-160 has been dispatched online at maximum output (PMAX). The dispatch of generation in the vicinity of AB1-160 is given in Attachment 5.

[1] Manual 14B: PJM Region Transmission Planning Process, Rev 33, May 5 2016, Attachment G : PJM Stability, Short Circuit, and Special RTEP Practices and Procedures.

4. Fault Cases

Tables 3 to 6 list the contingencies that were studied, with representative worst case total clearing times provided by PJM. Each contingency was studied over a 10 second simulation time interval.

The studied contingencies include:

a) Steady state operation (20 second simulation);

b) Three phase faults with normal clearing time;

c) Single-phase faults with stuck breaker;

d) Single-phase faults placed at 80% of the line with delayed (Zone 2) clearing at line end remote from fault due to primary communications/relay failure.

No relevant Tower, Bus or High Speed Reclosing (HSR) contingencies were identified.

Buses at which the faults listed above will be applied are

- AB1-160 115 kV POI
- Potter 115 kV
- Niles Valley 115 kV

The three phase faults with normal clearing time were performed under network intact conditions.

Additional delayed (Zone 2) clearing at remote and faults will be applied on lines from Farmers Valley 115 kV, Mansfield 115 kV and Osceola 115 kV towards the queue project.

Clearing times listed in Tables 3 to 6 are as per Revision 18 of "*2016 Revised Clearing times for each PJM company"* spreadsheet.

Attachment 2 contains the one-line diagrams of the Penelec network in the vicinity of AB1-160, showing where faults were applied.

The positive sequence fault impedances for single line to ground faults were derived from a separate short circuit case, modified to ensure that connected generators in the vicinity of AB1-160 have not withdrawn from the PJM queue, and are not greater than the queue position under study.

5. Evaluation Criteria

This study is focused on AB1-160, along with the rest of the PJM system, maintaining synchronism and having all states return to an acceptable new condition following the disturbance. The recovery criteria applicable to this study are as per PJM's Regional Transmission Planning Process and Transmission Owner criteria:

a) The system with AB1-160 included is transiently stable and post-contingency oscillations should be positively damped with a damping margin of at least 3%..

b) The AB1-160 is able to ride through faults (except for faults where protective action trips AB1-160).

c) Following fault clearing, all bus voltages recover to a minimum of 0.7 per unit after 2.5 seconds (except where protective action isolates that bus).

d) No transmission element trips, other than those either directly connected or designed to trip as a consequence of that fault.

6. Summary of Results

Plots from the dynamic simulations are provided in Attachment 6, with results summarized in Table 3 through Table 6.

AB1-082 units 1, 2, 3 tripped on contingencies 1B.02 and 1B.03. The AA2-081 units 1, 2, 3 tripped on contingencies 1B.06, 1B.07, 1B.08, 1B.09 and 1B.10. These units tripped as a result of excessive angle deviation due to loss of the 115kV stations. These contingencies were re-run with AB1-160 out-of-service and it was found that the AB1-082 and AA2-081 units still tripped, hence the tripping cannot be attributed to AB1-160.

For the remaining fault contingencies tested on the 2019 summer peak case:

a) Post-contingency oscillations were positively damped with a damping margin of at least 3%.

b) The AB1-160 generator was able to ride through all faults (except for faults where protective action trips a generator(s)).

c) Following fault clearing, all bus voltages recover to a minimum of 0.7 per unit after 2.5 seconds (except where protective action isolates that bus).

d) No transmission element trips, other than those either directly connected or designed to trip as a consequence of that fault.

No mitigations were found to be required.

Table 3: Steady State Operation

Fault ID	Duration	AB1-160 No Mitigation
SS.01	Steady state 30 sec	Stable

Table 4: Three-phase Faults With Normal Clearing

Fault ID	Fault description	Clearing Time Near & Remote (Cycles)	AB1-160 No Mitigation
3N.01	Fault at AB1-160 115 kV POI on AB1-160 circuit (Trips AB1-160).	7	Stable[2]
3N.02	Fault at AB1-160 115 kV POI on Gold – Tennessee Gas Pipeline - Potter circuit VM1-1/VM1-2/VM1-3.	7	Stable[2]
3N.03	Fault at AB1-160 115 kV POI on Sabinsville – Niles Valley circuit VM1-3/VM1-4.	7	Stable[2]
3N.04	Fault at Potter 115 kV on Tennessee Gas Pipeline – Gold – AB1-160 circuit VM1-1/VM1-2/VM1-3.	7	Stable
3N.05	Fault at Potter 115 kV on Potter-Two Mile Run – Farmers Valley circuit VM2-2.	7	Stable
3N.06	Fault at Potter 115 kV on Potter 115 kV / 46 kV Transformer 1.	7	Stable
3N.07	Fault at Potter 115 kV on Potter 115 kV / 46 kV Transformer 2.	7	Stable
3N.08	Fault at Niles Valley 115 kV on Sabinsville – AB1-160 circuit VM1-3/VM1-4.	7	Stable
3N.09	Fault at Niles Valley 115 kV on Osceola circuit NVO.	7	Stable
3N.10	Fault at Niles Valley 115 kV on Niles Valley 115 kV / 34.5 kV Transformer 1.	7	Stable
3N.11	Fault at Niles Valley 115 kV on Niles Valley 115 kV / 34.5 kV Transformer 2.	7	Stable
3N.12	Fault at Niles Valley 115 kV on Mansfield circuit NVM.	7	Stable

[2] A single instance of non-convergence at the AB1-160 generator bus was observed during the fault.

Table 5: Single-phase Faults With Stuck Breaker

Fault ID	Fault description	Clearing Time Near & Remote (Cycles)	AB1-160 No Mitigation
1B.01	Fault at AB1-160 115 kV POI on AB1-160 circuit. Breaker stuck to AB1-160. Fault cleared with loss of Gold – Tennessee Gas Pipeline – Potter and Sabinsville – Niles Valley circuit (Trips AB1-160).	7 / 20	Stable
1B.02	Fault at Potter 115 kV on Tennessee Gas Pipeline – Gold – AB1-160 circuit VM1-1/VM1-2/VM1-3. Breaker BT stuck. Fault cleared with loss of Two Mile Run – Farmers Valley circuit VM2-2 and Potter 115 kV / 46 kV Transformer 1 and 2	7 / 20	Stable[3]
1B.03	Fault at Potter on Potter-Two Mile Run-Farmers Valley circuit VM2-2. Breaker BT stuck. Fault cleared with loss of Tennessee Gas Pipeline – Gold – AB1-160 circuit VM1-1/VM1-2/VM1-3 and Potter 115 kV / 46 kV Transformer 1 and 2	7 / 20	Stable[3]
1B.04	Fault at Potter 115 kV on Potter 115 kV / 46 kV Transformer 1. Breaker BK1 stuck. Fault cleared with loss of Two Mile Run – Farmers Valley circuit VM2-2.	7 / 20	Stable
1B.05	Fault at Potter 115 kV on Potter 115 kV / 46 kV Transformer 2. Breaker BK2 stuck. Fault cleared with loss of Tennessee Gas Pipeline – Gold – AB1-160 circuit VM1-1/VM1-2/VM1-3	7 / 20	Stable
1B.06	Fault at Niles Valley 115 kV on Sabinsville – AB1-160 circuit VM1-3/VM1-4. Breaker 3 stuck. Fault cleared with loss of all Niles Valley 115 kV circuits	7 / 20	Stable[4]
1B.07	Fault at Niles Valley 115 kV on Osceola circuit NVO. Breaker 1 stuck. Fault cleared with loss of all Niles Valley 115 kV circuits	7 / 20	Stable[4]
1B.08	Fault at Niles Valley 115 kV on Niles Valley 115 kV / 34.5 kV Transformer 1. Breaker 15 stuck. Fault cleared with loss of all Niles Valley 115 kV circuits	7 / 20	Stable[4]

[3] AB1-082 units 1, 2, 3 tripped as a result of excessive angle deviation.
[4] AA2-081 units 1, 2, 3 tripped as a result of excessive angle deviation.

Fault ID	Fault description	Clearing Time Near & Remote (Cycles)	AB1-160 No Mitigation
1B.09	Fault at Niles Valley 115 kV on Niles Valley 115 kV / 34.5 kV Transformer 2. Breaker 16 stuck. Fault cleared with loss of all Niles Valley 115 kV circuits	7 / 20	Stable[4]
1B.10	Fault at Niles Valley 115 kV on Mansfield circuit NVM. Breaker 2 stuck. Fault cleared with loss of all Niles Valley 115 kV circuits	7 / 20	Stable[4]

Table 6: Single-phase Faults With Delayed (Zone 2) Clearing at line end closest to AB1-160 POI

Fault ID	Fault description	Clearing Time Near & Remote (Cycles)	AB1-160 No Mitigation
1D.01	Fault at 80% of line from AB1-160 115 kV POI to Gold – Tennessee Gas Pipeline – Potter circuit VM1-1/VM1-2/VM1-3. Delayed clearing at AB1-160.	7 / 7	Not studied[5]
1D.02	Fault at 80% of line from AB1-160 115 kV POI to Sabinsville – Niles Valley circuit VM1-3/VM1-4. Delayed clearing at AB1-160.	7 / 7	Not studied[5]
1D.03	Fault at 80% of line from Potter to Two Mile Run – Farmers Valley circuit VM2-2. Delayed clearing at Potter.	7 / 56	Stable
1D.04	Fault at 80% of line from Niles Valley to Osceola. Delayed clearing at Niles Valley.[6]	7 / 36	Stable
1D.05	Fault at 80% of line from Niles Valley to Mansfield. Delayed clearing at Niles Valley.	7 / 66	Stable

[5] The Z1-069 stability study identified the need for dual-primary relaying on both 115 kV lines out of the Z1-069 ring bus.This relaying is assumed to be in place, so this contingency has not been studied.
[6] The Niles Valley – Osceola 115kV line does not have pilot relaying and only has one level of time delayed protection, the clearing time provided is with that relaying in service.

Attachment 1. Impact Study Data

Attachment 2. Penelec One Line Diagram

Attachment 3. PSS/E Model One Line Diagram

Attachment 4. AB1-160 PSS/E Dynamic Model

Attachment 5. AB1-160 PSS/E Case Dispatch

Attachment 6. Plots from Dynamic Simulations