Generation Interconnection Feasibility Study Report – Web Version

For

PJM Generation Interconnection Request Queue Position AA2-119

Glen Falls 138 kV Project

August 2015

Feasibility Study Report
Glen Falls 138 kV (AA2-119)
Generation Interconnection Project

Introduction

This Feasibility Study report provides the documentation of an assessment that has been performed by FirstEnergy (FE) in response to a request made by Interconnection Customer (IC) for the connection of a 550 MW (550 MW Capacity) generation project to the Glen Falls 138 kV (AA2-119) Generation Project on the Mon Power transmission system.

Connection Facilities

In compliance with the RTEP protocol, Interconnection Customer has submitted a "Form of Generation Interconnection Feasibility Study Agreement" to PJM (Attachment 6) that identifies its plan to construct the Glen Falls 138 kV (AA2-119) generation project. The installed facilities will have a total generating capability of 550 MW, of which, 550 MW will be recognized by PJM as a capacity resource.

The Interconnection Customer has requested the study of both a Primary and Secondary Point of Interconnection (POI) for the Project. This report contains detailed connection requirements, direct connection costs and schedule, power flow analysis, short circuit analysis, and a cost and schedule for any associated system reinforcements for the Primary POI. For the Secondary POI, this report only provides the results of the power flow analysis and short circuit analysis. It does not contain a cost/schedule associated with the Direct Connection or any identified system reinforcements pertaining to the analysis performed.

Primary Point of Interconnection:

Glen Falls 138 kV Substation

The proposed primary point of interconnection for the (AA2-119) generation project will be located at the Glen Falls 138 kV substation. Attachment 1 provides the proposed location for the point of interconnection. The direct connection of (AA2-119) will be accomplished by building a new 138 kV line terminal at the Glen Falls substation. Attachment 2 shows a conceptual one-line diagram of the proposed connection of (AA2-119) to the Mon Power transmission system. The Interconnection Customer will be responsible for constructing all of the facilities on its side of the Primary POI including the attachment line, acquiring all easements, properties and permits

that may be required to construct the new terminal and all associated attachment facilities. Interconnection Customer may not install above ground equipment within any Mon Power right-of-way unless permission to do so is expressly granted by Mon Power. The Mon Power facilities required to be upgraded for the Direct Connection of the generation project and the associated cost estimate are shown in Attachment 3.

Secondary Point of Interconnection:

Glen-Falls-Bridgeport and Glen Falls-National Carbon 138 kV lines new ring bus substation

The interconnection of the project at the Secondary POI will be accomplished by constructing a new five breaker ring bus substation on the Glen-Falls-Bridgeport and Glen Falls-National Carbon 138 kV lines. The Interconnection Customer will also be responsible for acquiring all easements, properties and permits that may be required to construct the new station and all associated attachment facilities. As mentioned previously, there is not an estimated cost or schedule provided for the Secondary POI.

PJM Interconnection Study Results

The following is the report describing the results of the analysis performed by PJM engineers with respect to the transmission system impacts.

Network Impacts

The Queue Project AA2-119 was evaluated as a 550.0 MW (Capacity 550.0 MW) injection at Glen Falls138 kV substation in the APS area. Project AA2-119 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AA2-119 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis - 2019

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

None

Multiple Facility Contingency

(Double Circuit Tower Line, Fault with a Stuck Breaker, and Bus Fault contingencies for the full energy output)

1. (AP - AP) The 01GLENFL-01NATLCN 138 kV line (from bus 235334 to bus 235375 ckt 1) loads from 24.34% to 143.44% (**DC power flow**) of its emergency rating (143 MVA) for the line fault with failed breaker contingency outage of 'AP_SB_56'. This project contributes approximately 170.31 MW to the thermal violation.

CONTINGENCY 'AP_SB_56' / GLEN FALLS-BRIDGEPORT HILL STK BKR AT GLEN FALLS
OPEN BRANCH FROM BUS 235334 TO BUS 235306 CKT 1
OPEN BRANCH FROM BUS 235334 TO BUS 235812 CKT 1
OPEN BRANCH FROM BUS 235334 TO BUS 235380 CKT 1
END

Please refer to Appendix 1 for a table containing the generators having contribution to this flowgate.

2. (AP - AP) The 01GLENFL-01NATLCN 138 kV line (from bus 235334 to bus 235375 ckt 1) loads from 23.71% to 142.81% (**DC power flow**) of its emergency rating (143 MVA) for the bus fault outage of 'AP_C1_89'. This project contributes approximately 170.31 MW to the thermal violation.

CONTINGENCY 'AP_C1_89' /GLEN_FALLS_138_WEST
OPEN BRANCH FROM BUS 235334 TO BUS 235380 CKT 1
OPEN BRANCH FROM BUS 235334 TO BUS 235306 CKT 1
OPEN BRANCH FROM BUS 235334 TO BUS 235812 CKT 1
OPEN BRANCH FROM BUS 235812 TO BUS 235417 CKT 1
END

3. (AP - AP) The 01GLENFL-01NATLCN 138 kV line (from bus 235334 to bus 235375 ckt 1) loads from 22.66% to 141.76% (**DC power flow**) of its emergency rating (143 MVA) for the line fault with failed breaker contingency outage of 'AP_SB_57'. This project contributes approximately 170.31 MW to the thermal violation.

CONTINGENCY 'AP_SB_57' / GLEN FALLS-CHEIFTON STK BKR AT GLEN FALLS

OPEN BRANCH FROM BUS 235334 TO BUS 235380 CKT 1
OPEN BRANCH FROM BUS 235334 TO BUS 235306 CKT 1
OPEN BUS 235417
OPEN BUS 235812
END

4. (AP - AP) The 01GLENFL-01OAKMND 138 kV line (from bus 235334 to bus 235380 ckt 1) loads from 8.44% to 131.73% (**DC power flow**) of its emergency rating (192 MVA) for the line fault with failed breaker contingency outage of 'AP_SB_54'. This project contributes approximately 236.72 MW to the thermal violation.

CONTINGENCY 'AP_SB_54' / GLEN FALLS-HARRISON TAP STK BKR AT GLEN FALLS
OPEN BUS 235349
OPEN BUS 235347
OPEN BUS 235396
OPEN BRANCH FROM BUS 235334 TO BUS 235442 CKT 1
OPEN BRANCH FROM BUS 235334 TO BUS 235375 CKT 1
END

Please refer to Appendix 2 for a table containing the generators having contribution to this flowgate.

5. (AP - AP) The 01GLENFL-01OAKMND 138 kV line (from bus 235334 to bus 235380 ckt 1) loads from 8.39% to 131.68% (**DC power flow**) of its emergency rating (192 MVA) for the bus fault outage of 'AP_C1_88'. This project contributes approximately 236.72 MW to the thermal violation.

CONTINGENCY 'AP_C1_88' /GLEN_FALLS_138_EAST
OPEN BRANCH FROM BUS 235334 TO BUS 235375 CKT 1
OPEN BRANCH FROM BUS 235334 TO BUS 235349 CKT 1
OPEN BRANCH FROM BUS 235334 TO BUS 235442 CKT 1
END

6. (AP - AP) The 01GLENFL-01OAKMND 138 kV line (from bus 235334 to bus 235380 ckt 1) loads from 8.39% to 131.68% (**DC power flow**) of its emergency rating (192 MVA) for the line fault with failed breaker contingency outage of 'AP_SB_53'. This project contributes approximately 236.72 MW to the thermal violation.

CONTINGENCY 'AP_SB_53' / GLEN FALLS-MCALPIN STK BKR AT GLEN FALLS
OPEN BRANCH FROM BUS 235334 TO BUS 235349 CKT 1
OPEN BRANCH FROM BUS 235334 TO BUS 235375 CKT 1
OPEN BRANCH FROM BUS 235334 TO BUS 235442 CKT 1
END

7. (AP - AP) The 01GLENFL-01OAKMND 138 kV line (from bus 235334 to bus 235380 ckt 1) loads from 29.85% to 109.67% (**DC power flow**) of its emergency rating (192 MVA) for the tower line contingency outage of 'AP_C5_130'. This project contributes approximately 153.25 MW to the thermal violation.

CONTINGENCY 'AP_C5_130' /GLF-WUN_GLF-MRG
OPEN BUS 235349
OPEN BUS 235417
OPEN BUS 235347
OPEN BUS 235396
END

8. (AP - AP) The 01NATLCN-01W MILF 138 kV line (from bus 235375 to bus 235422 ckt 1F) loads from 10.74% to 100.38% (**DC power flow**) of its emergency rating (190 MVA) for the line fault with failed breaker contingency outage of 'AP_SB_56'. This project contributes approximately 170.31 MW to the thermal violation.

CONTINGENCY 'AP_SB_56' / GLEN FALLS-BRIDGEPORT HILL STK BKR AT GLEN FALLS
OPEN BRANCH FROM BUS 235334 TO BUS 235306 CKT 1
OPEN BRANCH FROM BUS 235334 TO BUS 235812 CKT 1
OPEN BRANCH FROM BUS 235334 TO BUS 235380 CKT 1
END

Please refer to Appendix 3 for a table containing the generators having contribution to this flowgate.

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)

1. (AP - AP) The 01CANANV-01SENECA 138 kV line (from bus 235310 to bus 235400 ckt 1) loads from 136.71% to 136.82% (**DC power flow**) of its emergency rating (115 MVA) for the line fault with failed breaker contingency outage of 'AP_SB_411'. This project contributes approximately 6.13 MW to the thermal violation.

CONTINGENCY 'AP_SB_411' / ALBRIGHT BREAKER FAILURE - TIE BREAKER
OPEN BUS 235120
OPEN BUS 235564
OPEN BUS 235565
OPEN BUS 235566
END

Please refer to Appendix 4 for a table containing the generators having contribution to this flowgate.

Steady-State Voltage Requirements

(Results of the steady-state voltage studies should be inserted here)

To be determined

Affected System Analysis & Mitigation

LGEE Impacts:

LGEE Impacts to be determined during later study phases (as applicable).

MISO Impacts:

MISO Impacts to be determined during later study phases (as applicable).

Duke, Progress & TVA Impacts:

Duke Carolina, Progress, & TVA Impacts to be determined during later study phases (as applicable).

OVEC Impacts:

OVEC Impacts to be determined during later study phases (as applicable).

NYISO Impacts:

NYISO Impacts to be determined during later study phases (as applicable).

Delivery of Energy Portion of Interconnection Request

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.

Only the most severely overloaded conditions are listed. 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 will study all overload conditions associated with the overloaded element(s) identified.

Not Applicable

Light Load Analysis - 2019

Light Load Studies to be conducted during later study phases (as required by PJM Manual 14B).

System Reinforcements

Summer Peak Analysis - 2019

Multiple Facility Contingency

1. (AP - AP) The 01GLENFL-01NATLCN 138 kV line:

Glen Falls SS: Upgrade Rider 138 kV terminal to 1075A STE capacity. Replace down conductors and terminal connectors. Estimated Total w Tax: $43,400; Tax: $9,300; Estimated Total: $34,100

Rider SS: Upgrade Glen Falls 138 kV terminal to 1322A LTE capacity. Replace down conductors and terminal connectors. Estimated Total w Tax: $43,400; Tax: $9,300; Estimated Total: $34,100

Re-conductor 10.3 miles of Glen Falls – rider 138 kV circuit, from National Carbon tap to Rider substation with 336 kcmil ACSS conductor. Estimated Total w Tax: $8,922,900; Tax: $1,908,100; Estimated Total: $7,014,800

Estimated Time: 28 months

2. (AP - AP) The 01GLENFL-01NATLCN 138 kV line:
Same reinforcement as Multiple Facility #1

3. (AP - AP) The 01GLENFL-01NATLCN 138 kV line:
Same reinforcement as Multiple Facility #1

4. (AP - AP) The 01GLENFL-01OAKMND 138 kV line:
Glen Falls SS: Upgrade Oak Mound 138 kV terminal to 1322A LTE capacity. Replace line trap, down conductors and terminal connectors. Estimated Total w Tax: $87,200; Tax: $18,700; Estimated Total: $68,500

Oak Mound SS: Upgrade Glen Falls 138 kV terminal to 1322A LTE capacity. Replace line trap, down conductors and terminal connectors. Estimated Total w Tax: $94,600; Tax: $20,300; Estimated Total: $74,300

Rebuild 2.5 miles of Glen Falls – Oak Mound 138 kV circuit, from Glen Falls to structure 13, replacing the existing 336.5 kcmil ACSR conductor with 795 ACSR conductor. Estimated Total w Tax: $4,572,000; Tax: $977,700; Estimated Total: $3,594,300

Estimated Time: 23 months

5. (AP - AP) The 01GLENFL-01OAKMND 138 kV line:
Same reinforcement as Multiple Facility #4

6. (AP - AP) The 01GLENFL-01OAKMND 138 kV line:

Same reinforcement as Multiple Facility #4

7. (AP - AP) The 01GLENFL-01OAKMND 138 kV line:
Same reinforcement as Multiple Facility #4

8. (AP - AP) The 01NATLCN-01W MILF 138 kV line:
Same reinforcement as Multiple Facility #1

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)

1. (AP - AP) The 01CANANV-01SENECA 138 kV line:
Canaan Valley SS: Upgrade Seneca Caverns 138 kV line terminal to 825A STE capacity. Replace down conductors and terminal connectors. Estimated Total w Tax: $41,900; Tax: $9,000; Estimated Total: $32,900

Seneca Caverns SS: Upgrade Canaan Valley 138 kV line terminal to 825A LTE capacity. Replace line panel relay. Replace down conductors and terminal connectors. Estimated Total w Tax: $153,700; Tax: $32,900; Estimated Total: $120,800

Estimated Time: 15 months

Short Circuit

Option 1:

Bus Number	Bus Name	BREAKER	Rating Type	Breaker Capacity (Amps)	Duty Percent With AA2-119_OP1_APS	Duty Percent Without AA2-119_OP1_APS	Duty Percent Difference	Duty Amps With AA2-119_OP1_APS	Duty Amps Without AA2-119_OP1_APS	Notes
20064	GLEN FALLS 138.kV	BUCKHANN 50	T	19703	172.13%	87.27%	84.86%	33915.5	17194.9	New Over-duty
20064	GLEN FALLS 138.kV	BarnetR406	T	20189.2	167.99%	85.17%	82.82%	33915.5	17194.9	New Over-duty
20064	GLEN FALLS 138.kV	OAK MOUND 4	T	20335	166.78%	84.56%	82.23%	33915.5	17194.9	New Over-duty
20064	GLEN FALLS 138.kV	1 & 4 XFMRS	T	20918.5	162.13%	82.20%	79.93%	33915.5	17194.9	New Over-duty
20064	GLEN FALLS 138.kV	138 BUS TIE	S	19777.8	142.90%	84.85%	58.05%	28262.9	16782	New Over-duty
20137	RIVESVL 138.kV	10XFMR138OCB	S	18000	100.39%	97.46%	2.93%	18070.5	17543.4	New Over-duty

Option 2:

Bus Number	Bus Name	BREAKER	Rating Type	Breaker Capacity (Amps)	Duty Percent With AA2-119_OP2_APS	Duty Percent Without AA2-119_OP2_APS	Duty Percent Difference	Duty Amps With AA2-119_OP2_APS	Duty Amps Without AA2-119_OP2_APS	Notes
20064	GLEN FALLS 138.kV	BUCKHANN 50	T	19703	142.22%	87.27%	54.95%	28021.4	17194.9	New Over-duty
20064	GLEN FALLS 138.kV	BarnetR406	T	20189.2	138.79%	85.17%	53.63%	28021.4	17194.9	New Over-duty
20064	GLEN FALLS 138.kV	OAK MOUND 4	T	20335	137.80%	84.56%	53.24%	28021.4	17194.9	New Over-duty
20064	GLEN FALLS 138.kV	1 & 4 XFMRS	T	20918.5	133.96%	82.20%	51.76%	28021.4	17194.9	New Over-duty
20064	GLEN FALLS 138.kV	138 BUS TIE	S	19777.8	119.11%	84.85%	34.25%	23556.5	16782	New Over-duty
20137	RIVESVL 138.kV	10XFMR138OCB	S	18000	100.17%	97.46%	2.71%	18031.4	17543.4	New Over-duty

Reinforcement cost estimate: $250,000 per breaker, Total $1,500,000 for either option (POI)
Schedule estimate: 18-24 months

Stability and Reactive Power Requirement

(Results of the dynamic studies should be inserted here)

To be determined

Light Load Load Flow Analysis Reinforcements

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)

(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)

None

Additional Interconnection Customer Responsibilities:

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.

PJM Analysis Appendices

The following appendices contain additional information about each flowgate presented in the body of the report. For each appendix, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact.

It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

Appendix 1

(AP - AP) The 01GLENFL-01NATLCN 138 kV line (from bus 235334 to bus 235375 ckt 1) loads from 24.34% to 143.44% (**DC power flow**) of its emergency rating (143 MVA) for the line fault with failed breaker contingency outage of 'AP_SB_56'. This project contributes approximately 170.31 MW to the thermal violation.

CONTINGENCY 'AP_SB_56' / GLEN FALLS-BRIDGEPORT HILL STK BKR AT GLEN FALLS
OPEN BRANCH FROM BUS 235334 TO BUS 235306 CKT 1
OPEN BRANCH FROM BUS 235334 TO BUS 235812 CKT 1
OPEN BRANCH FROM BUS 235334 TO BUS 235380 CKT 1
END

Bus Number	Bus Name	Full Contribution
913151	Y1-034 OP1	0.59
920231	AA2-119	170.31

Appendix 2

(AP - AP) The 01GLENFL-01OAKMND 138 kV line (from bus 235334 to bus 235380 ckt 1) loads from 8.44% to 131.73% (**DC power flow**) of its emergency rating (192 MVA) for the line fault with failed breaker contingency outage of 'AP_SB_54'. This project contributes approximately 236.72 MW to the thermal violation.

CONTINGENCY 'AP_SB_54' / GLEN FALLS-HARRISON TAP STK BKR AT GLEN FALLS
OPEN BUS 235349
OPEN BUS 235347
OPEN BUS 235396
OPEN BRANCH FROM BUS 235334 TO BUS 235442 CKT 1
OPEN BRANCH FROM BUS 235334 TO BUS 235375 CKT 1
END

Bus Number	Bus Name	Full Contribution
920231	AA2-119	236.72

Appendix 3

(AP - AP) The 01NATLCN-01W MILF 138 kV line (from bus 235375 to bus 235422 ckt 1F) loads from 10.74% to 100.38% (**DC power flow**) of its emergency rating (190 MVA) for the line fault with failed breaker contingency outage of 'AP_SB_56'. This project contributes approximately 170.31 MW to the thermal violation.

CONTINGENCY 'AP_SB_56' / GLEN FALLS-BRIDGEPORT HILL STK BKR AT GLEN FALLS
OPEN BRANCH FROM BUS 235334 TO BUS 235306 CKT 1
OPEN BRANCH FROM BUS 235334 TO BUS 235812 CKT 1
OPEN BRANCH FROM BUS 235334 TO BUS 235380 CKT 1
END

Bus Number	Bus Name	Full Contribution
913151	Y1-034 OP1	0.59
920231	AA2-119	170.31

Appendix 4

(AP - AP) The 01CANANV-01SENECA 138 kV line (from bus 235310 to bus 235400 ckt 1) loads from 136.71% to 136.82% (**DC power flow**) of its emergency rating (115 MVA) for the line fault with failed breaker contingency outage of 'AP_SB_411'. This project contributes approximately 6.13 MW to the thermal violation.

CONTINGENCY 'AP_SB_411' / ALBRIGHT BREAKER
FAILURE - TIE BREAKER
OPEN BUS 235120
OPEN BUS 235564
OPEN BUS 235565
OPEN BUS 235566
END

Bus Number	Bus Name	Full Contribution
237518	01_P59+W2-57	7.11
235625	01BACKB	12.95
237503	01HENRY M23	0.62
237512	01ROTHROCK	0.14
292310	K-019	0.27
237508	M-023 E	29.42
292981	N-007 E	1.9
237519	U2-061 E	10.67
918471	AA1-062 C	7.11
918472	AA1-062 E	47.81
918812	AA1-100 E	0.56
920072	AA2-103 E	4.9
920231	AA2-119	0.27

Transmission Owner's Analysis

The following is the report generated by the Transmission Owner (TO) based upon its analysis of the project's impacts on the lower voltage system and the costs and schedules for any transmission and distribution system upgrades.

Power Flow Analysis

A power flow study was conducted to determine the reliability impact of the proposed Glen Falls 138 kV (AA2-119) generation project on the Mon Power transmission system. This study was completed using a 2019 summer peak power flow model that contain a detailed representation of the Mon Power transmission network in the area of the proposed (AA2-119) generation project. The findings and the recommendations from this analysis are based on a contingency review that was performed to identify the facility loadings and/or voltage conditions that violate the ReliabilityFirst, PJM, or FE Planning Criteria and are attributable to this project. Note that in accordance with PJM RTEP study procedures, the (AA2-119) generation project under study and earlier active queue projects are considered to be in-service. All active queue projects after the (AA2-119) project are considered not in-service.

As shown in Attachment 2, the (AA2-119) generation project was studied with a connection to the 138 kV bus at Glen Falls substation through a new 138 kV line terminal. The results from the power flow analysis for both the Primary POI and the Secondary POI are detailed on Attachment 4A and 4B, respectively. As shown, the conclusion from this analysis is that there are network upgrades required for interconnection of the Project.

Short Circuit and Dynamics Analysis

In accordance with the RTEP process, a short circuit analysis was conducted by PJM. Refer to the PJM Analysis above for the results of that analysis.

In accordance with the RTEP Study process, the results of a dynamic analysis for the (AA2-119) generation project will be included in the System Impact Study stage of the RTEP process.

System Protection Analysis

An analysis was conducted to assess the impact of the Glen Falls (AA2-119) generation project on the system protection requirements in the area. The review has identified the following direct connect tie line protection requirements:

- Standard 138 kV line and terminal protection for the Interconnection Customer 138 kV line.

Specific power and protection equipment requirements will be included in the System Impact Study stage of the RTEP process.

Metering

Interconnection Customer will be required to comply with all FE revenue metering requirements for generation interconnection customers. The FE revenue metering requirements may be found in the FE "Requirements for Transmission Connected Facilities" document located at the following link:

http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx

Compliance Issues

The proposed interconnection facilities must be designed in accordance with the FE "Requirements for Transmission Connected Facilities" located at:

http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx

Interconnection Customer will also be responsible for following the requirements of the FE "Approved Vendors and Contractors" document which is also located at the above link.

Interconnection Customer will also be required to meet all PJM, ReliabilityFirst and NERC reliability criteria and operating procedures for standards compliance. For example, Interconnection Customer will need to properly locate and report the over and under voltage and over and under frequency system protection elements for its units as well as the submission of the generator model and protection data required to satisfy the PJM and ReliabilityFirst audits. Failure to comply with these requirements may result in a disconnection of service if the violation is found to compromise the reliability of the Mon Power system.

FE Facility Upgrades and Costs

The results from the power flow analysis for the Primary POI (Attachment 4A) show that there are FE criteria violations that are directly attributable to the Project. Therefore in accordance with the RTEP procedures defined in the PJM Open Access Transmission Tariff and PJM Manuals, the IC is responsible for network upgrades as detailed in Attachment 5.

The Primary POI direct connection costs for the (AA2-119) generation project to the Mon Power transmission system are detailed in Attachment 3. The associated one-line with the generation project direct connection is shown in Attachment 2. The Secondary POI costs are not provided.

Note that all cost estimates contained in this document were produced without a detailed engineering review and are therefore subject to change. More accurate estimates will be determined as a part of the System Impact Study. Interconnection Customer will be responsible for the actual cost of the direct connection that is implemented. FE herein

reserves the right to return to any issues in this document and, upon appropriate justification, request additional monies to complete any reinforcements to the transmission system.

Interconnection Customer Requirements

In addition to the Mon Power facilities, Interconnection Customer is responsible to provide metering, disconnect switches and high-side breakers for each unit, as Interconnection Customer will own this equipment. Interconnection Customer will also be responsible for meeting all criteria as specified in the applicable sections of the FE "Requirements for Transmission Connected Facilities" document including:

1. The purchase and installation of fully rated 138 kV circuit breaker on the high side of the (AA2-119) step-up transformers.

2. 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.

3. 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.

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

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

6. The execution of a back-up service agreement to serve the customer load supplied from the (AA2-119) generation project metering point when the units are out-of-service. This assumes the intent of Interconnection Customer is to net the generation with the load.

The above requirements are in addition to any metering or other requirements imposed by PJM.

Summary

The Interconnection Customer generation project Direct Connection for the Primary POI will require the facility upgrades defined in Attachment 3. As shown in Attachment 3, the estimated cost of the new 138 kV terminal at Glen Falls substation (AA2-119) Direct Connection facilities (substation, breaker, disconnects, CTs, VTs, etc.) is $1,700,500. This cost includes a Federal Income Tax Gross Up charge of $ 363,700. This tax may or may not be charged based on whether or not this project meets the eligibility requirements of IRS Notice 88-129. Power flow results for the (AA2-119) generation project indicates facility upgrades are required in the Mon Power service territory, as shown in Attachment 5. Additionally, the six overdutied breakers identified in the PJM portion of this report were not (as of the time was report issued) included in the project costs. Therefore, the IC should add approximately $1,500,000 for the cost of replacing/upgrading those six circuit breakers.

Based on the extent of the Mon Power primary Direct Connection and network upgrades required to support the (AA2-119) generation project, it is expected to take a minimum of 28 months from the date of a fully executed Interconnection Construction Service Agreement to complete the installation. This includes the requirement for Interconnection Customer to make a preliminary payment to FE which funds the first three months of engineering design that is related to the construction of the Direct Connection facilities. It further assumes that Interconnection Customer will provide all rights-of-way, permits, easements, etc. that will be needed. A further assumption is that there will be no environmental issues with any of the new properties associated with this project, that there will be no delays in acquiring the necessary permits for implementing the defined direct connection and network upgrades, and that all system outages will be allowed when requested.

Attachment 1
Glen Falls 138 kV
(AA2-119) Generation Project
Project Location

Attachment 2
Glen Falls 138 kV
(AA2-119) Generation Project
Interconnection Customer
Primary POI Proposed Interconnection Single Line Diagram

Attachment 3
Glen Falls 138 kV
(AA2-119) Generation Project
Primary POI Direct Connection Requirements

Duration: 23 months

Estimate No.	Description	Total with Tax	Tax	Total Cost
MP-S-277	Grade and extend fence and ground grid approximately 50' x 180'. Extend 138 kV bus and install 138 kV 3000A breaker, 3000A disconnects, foundations, control cable, structures, and all associated facilities. 16'x16' expansion of existing concrete control building @ Glen Falls	$1,700,500	$363,700	$1,336,800
	Totals	**$1,700,500**	**$363,700**	**$1,336,800**

Attachment 4A
Glen Falls 138 kV (AA2-119) Generation Project
PJM Contingency Analysis Results Primary POI

Outage Description	Overloaded Element	Rating (MVA)	Flow (MVA)	% Rating
'AP_SB_411' ALBRIGHT BREAKER FAILURE - TIE BREAKER	Canaan Valley-Seneca Valley 138 kV Line	115	157.3	136.82
AP_SB_54' GLEN FALLS-HARRISON TAP STK BKR AT GLEN FALLS	Glen Falls- Oak Mound 138 kV Line	192	252.9	131.73
AP_SB_56' GLEN FALLS-BRIDGEPORT HILL STK BKR AT GLEN FALLS	Glen Falls- National Carbon Tap 138kV Line	143	205.1	143.44
AP_SB_56' GLEN FALLS-BRIDGEPORT HILL STK BKR AT GLEN FALLS	National Carbon Tap-Rider 138kV Line	190	190.7	100.38

Attachment 4B
Glen Falls 138 kV (AA2-119) Generation Project
PJM Contingency Analysis Results Secondary POI

Outage Description	Overloaded Element	Rating (MVA)	Flow (MVA)	% Rating
AP_SB_409' GLENN FALLS BREAKER FAILURE - TIE BREAKER	AA2-119 Tap- Bridgeport 138 kV	228	263.1	115.38
AP_SB_409' GLENN FALLS BREAKER FAILURE - TIE BREAKER	National Carbon Tap-West Milford 138kV Line	190	273.9	144.14
'AP_SB_411' ALBRIGHT BREAKER FAILURE - TIE BREAKER	Canaan Valley-Seneca Valley 138 kV Line	115	157.3	136.8
AP_SB_409' GLENN FALLS BREAKER FAILURE - TIE BREAKER	AA2-119 Tap- National Carbon Tap 138 kV	143	288.2	201.56

Attachment 5
Glen Falls 138 kV
(AA2-119) Generation Project
Primary POI Network Upgrades and Conceptual Cost Estimates

Glen Falls- Oak Mound Rating Increase Duration: 23 months

Estimate No.	Description	Total with Tax	Tax	Total Cost
MP-S-247	Glen Falls SS - Upgrade Oak Mound 138kV terminal to 1322A LTE capacity for PJM AA2-119 feasibility study. Replace line trap, down conductors and terminal connectors.	$87,200	$18,700	$68,500
MP-S-248	Oak Mound SS - Upgrade Glen Falls 138kV terminal to 1322A LTE capacity for PJM AA2-119 feasibility study. Replace line trap, down conductors and terminal connectors.	$94,600	$20,300	$74,300
MP-T-85	Glen Falls - Oak Mound 138kV, 2.5 Mile Rebuild - Rebuild 2.5 miles of Glen Falls-Oak Mound 138kV circuit, from Glen Falls to structure 13, replacing existing 336.5 kcmil ACSR conductor with 795 ACSR Conductor.	$4,572,000	$977,700	$3,594,300
	Totals	**$4,753,800**	**$1,016,700**	**$3,737,100**

Glen Falls- Rider Rating Increase Duration: 28 months

Estimate No.	Description	Total with Tax	Tax	Total Cost
MP-S-245	Glen Falls SS - Upgrade Rider 138kV terminal to 1075A STE capacity for PJM AA2-119 feasibility study. Replace down conductors and terminal connectors.	$43,400	$9,300	$34,100
MP-S-246	Rider SS - Upgrade Glen Falls 138kV line terminal to 1322A STE capacity for PJM AA2-119 feasibility study. Replace down conductors and terminal connectors.	$43,400	$9,300	$34,100
MP-T-84	Glen Falls to Rider 138kV, 10.3 Mile Reconductor - Reconductor 10.3 miles of Glen Falls-Rider 138kV circuit, from the National Carbon tap to Rider Substation, with 336 kcmil ACSS.	$8,922,900	$1,908,100	$7,014,800
	Totals	**$9,009,700**	**$1,926,700**	**$7,083,000**

Canaan Valley- Seneca Rating Increase Duration: 15 months

Estimate No.	Description	Total with Tax	Tax	Total Cost
MP-S-249	Canaan Valley SS - Upgrade Seneca Caverns138kV line terminal to 825A STE capacity for PJM AA2-119 feasibility study. Replace down conductors and terminal connectors.	$41,900	$9,000	$32,900
MP-S-250	Seneca Caverns SS - Upgrade Canaan Valley 138kV line terminal to 825A LTE capacity for PJM AA2-119 feasibility study. Replace line relay panel. Replace down conductors and terminal connectors.	$153,700	$32,900	$120,800
	Totals	**$195,600**	**$41,900**	**$153,700**

