Revised
Generation Interconnection
System Impact Study Report

For

PJM Generation Interconnection
Request Queue Position AB1-092

"Moshannon-East Towanda 230 kV"

April 2021

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

Renovo Energy Center LLC, the Interconnection Customer (IC), has proposed an uprate to a planned natural gas generating facility located in Clinton County, Pennsylvania. The proposed uprate will have a capability of 41 MW with 17 MW of this output being recognized by PJM as capacity. Note that this project is an increase to the Interconnection Customer's AA1-111 project, which will share the same property and connection point. The AA1-111 project will have a capability of 463 MW with 463 MW being recognized as capacity. The total capability of the combined AA1-111 and AB1-092 projects will be 504 MW with 480 MW being recognized by PJM as capacity. The proposed Commercial Operation Date for this project is June 2024[1]. **This study does not imply a Mid-Atlantic Interstate Transmission (MAIT) commitment to this in-service date.**

Revisions since February 2018 System Impact Study Report

The AB1-092 System Impact Study results were retooled. With the updated analysis, it was determined that with the exception of the stability reinforcement, no overloads were identified for load flow.

See the Network Impacts section of this report for the updated analysis results. The updated interconnection work scope and cost estimates for both AA1-111 and AB1-092 will be provided in the Facilities Study Report.

[1] The AA1-111/AB1-092 Commercial Operation Date will be updated in the Facilities Study to follow.

Point of Interconnection

AB1-092 will interconnect with the MAIT transmission system along the Moshannon-East Towanda 230kV line.

Cost Summary

The AB1-092 project will be responsible for the following costs:

Description	Cost
Attachment Facilities	$ 0
Direct Connection Network Upgrades	$ 0
Non Direct Connection Network Upgrades	$ 0
Allocation for New System Upgrades	$ 0
Contribution for Previously Identified Upgrades[2]	$ 0
Total Costs	$ 0

[2] Note that the stability reinforcement is included in the updated analysis. The cost responsibility for the stability upgrade is included in the AA1-111 System Impact Study Report. The cost allocation between AA1-111 and this AB1-092 project was not split out as the same customer is responsible. If the AB1-092 project is at any time transferred to another Interconnection Customer, we will determine cost allocation at that time.

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

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

Schedule

This project requires the Stability Reinforcement to be in place as identified in the System Reinforcements section below. The estimated elapsed time to complete this upgrade is 28 months from the signing of the AA1-111 Interconnection Construction Service Agreement and construction kickoff call.

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 AA1- 111/AB1-092 230/25.5 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 230 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 AA1-111/AB1-092 230 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.

MAIT 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 AB1-092 was evaluated as a 17.0 MW (Capacity 17.0 MW) injection as tapping the Chapman-Lobe 230kV line as an upgrade to the AA1-111 project in the PENELEC area. Project AB1-092 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AB1-092 was studied with a commercial probability of 100%. Potential network impacts were as follows:

Study Assumptions:

- The model used in this study includes the Stability reinforcement required by this project. (PJM Network Upgrade Number n5740)

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)

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

None

Short Circuit
(Summary of impacted circuit breakers)

None

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

Affected System Analysis & Mitigation

NYISO Impacts:

NYISO performed a System Impact Study for Q654 considering the AA1-111 generation and found no additional upgrades to be needed.

Short Circuit

(Summary form of Cost allocation for breakers will be inserted here if any)

None

Stability and Reactive Power Requirement

(Results of the dynamic studies should be inserted here)

Due to stability issues identified with the original 230kV interconnection at the AA2-000 (AA1-111), a new 230-345kV interconnection option was studied. With this stability reinforcement, no stability issues are found for AB1-092. The cost of the stability reinforcement is provided in the "Summer Peak Load Flow Analysis Reinforcements" section below.

Summer Peak 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)

Stability Reinforcement

PENELEC
Project Id: n5740
Description: Stability Reinforcement for AA1-111

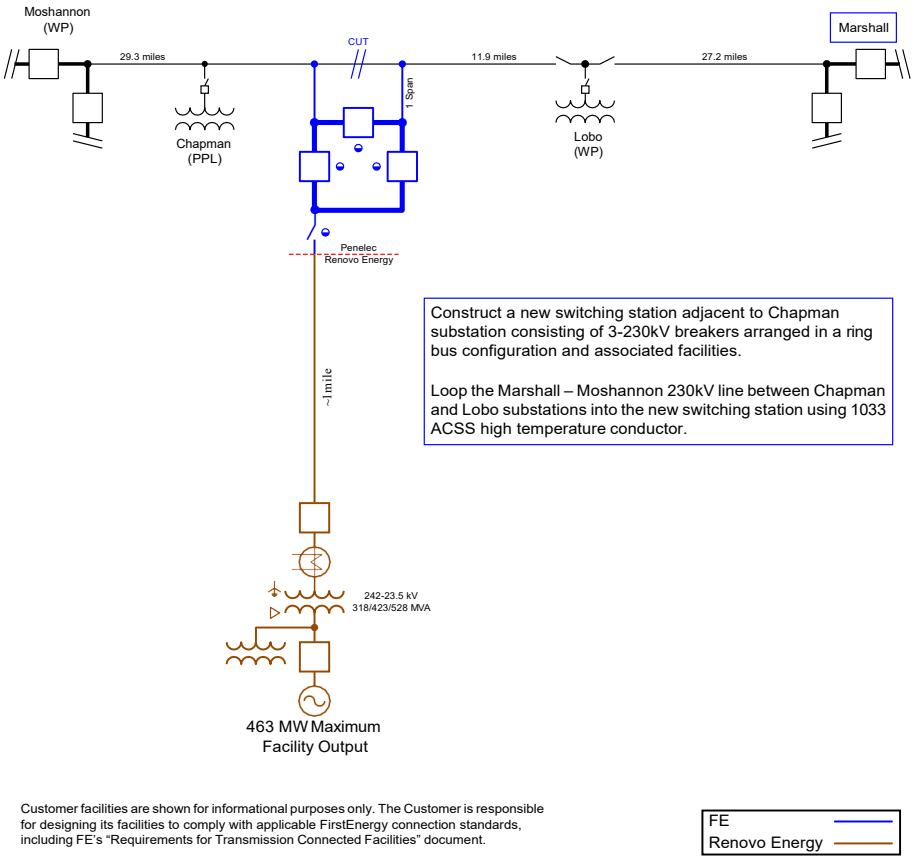
- Install a 230-345kV transformer between the proposed AA1-111 interconnection switchyard and the NYSEG Q654 interconnection switchyard, approximately 1 mile in length.
- At AA1-111 interconnection switchyard, install a 345 / 230 kV transformer, 230 kV breaker, and 345 kV breaker.

Cost: $12,572,600[2]
Type: CON
Time Estimate: 28 Months

Note: The AB1-092 project is an uprate to the AA2-000 (AA1-111) and the AB1-092 project requires this system reinforcement to be deliverable to the PJM system.

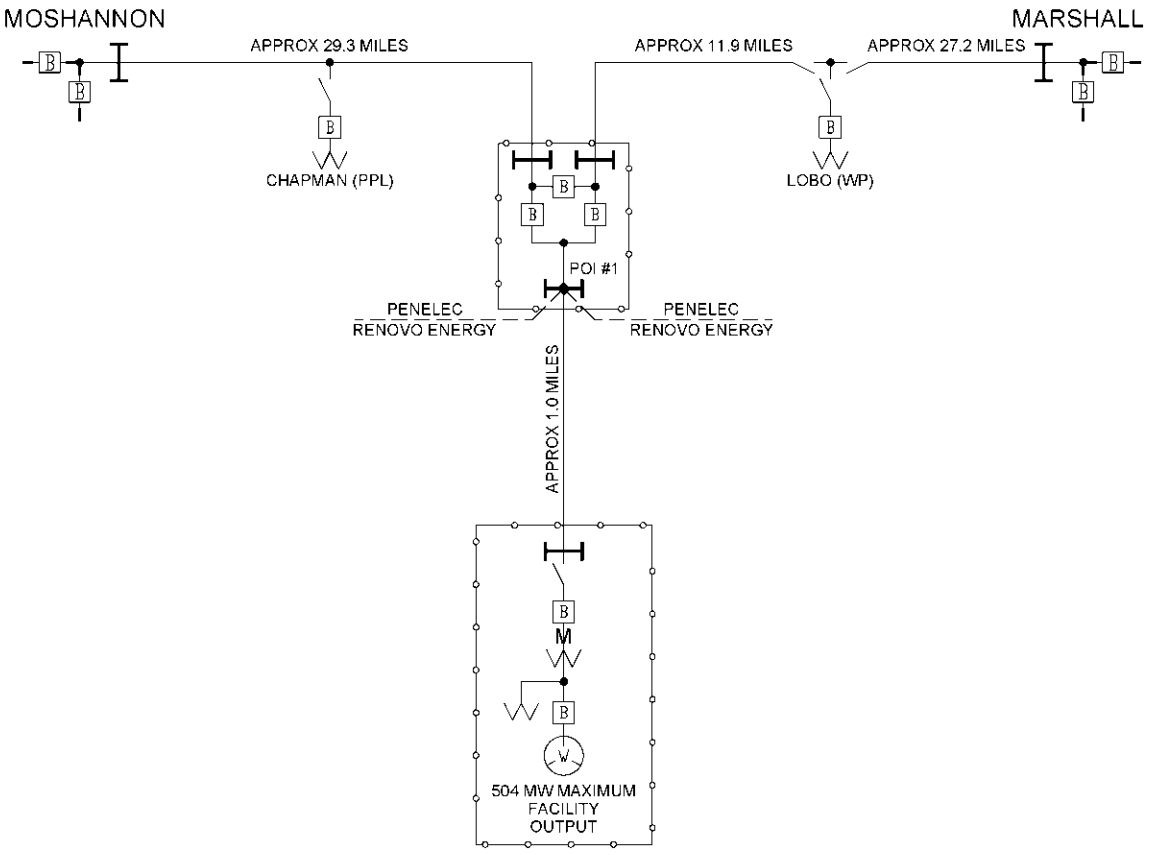
Attachment 1. Project Location

Attachment 2. Planning Single Line Diagram[3]



[3] Note this one line does not include the stability reinforcement. The one line in the Facilities Study will be updated to include the tie between the FE's 230 kV interconnection switchyard and NYSEG's 345 kV switchyard.

Attachment 3. Engineering Single Line Diagram[3]



◆ = POI # 1 LOCATED AT THE POINT WHERE CUSTOMERS 230KV TRANSMISSION ATTACHES TO FE's DEAD-END STRUCTURE.

M = REVENUE METERING IS OWNED, OPERATED, AND MAINTAINED BY CUSTOMER.

OPERATIONAL METERING WILL BE OWNED, OPERATED, AND MAINTAINED BY THE PARTY OWNING THE METERING AND WILL BE PROVIDED TO RTO ICCP.

FirstEnergy Energy Delivery Technical Services	TITLE: AA1-111 FACILITIES STUDY ON THE MARSHALL-MOSHANNON 230KV LINE POINT OF INTERCONNECTION DIAGRAM			
BY: LAP	DATE: 1/28/16	AGREEMENT	DOC. ID: POI-AA1-111	REV: -
APP: LAP	ISSUE: PRELIMINARY			

Attachment 4. Flowgate Details

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.

None