Generation Interconnection System Impact Study Report

For

PJM Generation Interconnection Request Queue Position AA1-115

Summit-West Fall 115kV

September 2015

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

EDF Renewable Development, Inc., the Interconnection Customer (IC), has proposed battery storage facility located in Blair County, PA. The installed facilities will have a total capability of 20 MW with 0 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is June 2016. **This study does not imply a Pennsylvania Electric Company (Penelec) commitment to this in-service date.**

Point of Interconnection

AA1-115 will interconnect with the Penelec transmission system at the Thirty-First Street 115kV substation.

Cost Summary

The AA1-115 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$ 0
Direct Connection Network Upgrades	$ 0
Non Direct Connection Network Upgrades	$ 1,069,600
Allocation for New System Upgrades	$ 0
Contribution for Previously Identified Upgrades	$ 0
Total Costs	**$ 1,069,600**

Attachment Facilities

There are no Attachment Facilities required to be constructed by the Transmission Owner.

Direct Connection Cost Estimate

There are no Direct Connection Facilities required to be constructed by the Transmission Owner.

Non-Direct Connection Cost Estimate

The total preliminary cost estimate for the Non-Direct Connection work is given in the table below.

Description	Cost	Tax (if Applicable)	Total Cost
DC - Thirty First Street - Convert existing 115kV 3 breaker ring bus into 4 breaker ring bus *PJM Network Upgrade Number n4637*	$ 1,069,600	$ 332,100	$ 1,401,700
Total Non-Direct Facilities Cost Estimate	**$ 1,069,600**	**$ 332,100**	**$ 1,401,700**

Schedule

Based on the scope of the direct connection for the Project, it is expected to take a minimum of 12 months from the signing of a Connection Service Agreement to complete the installation required for the Project. This assumes there will be no delays in acquiring the necessary permits and that PJM will allow all transmission system outages when requested. It further assumes that the Interconnection Customer will provide all rights-of-way, permits, easements, etc. that will be needed.

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.

In addition to the FE facilities, the 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 a fully rated circuit breaker on the high side of the AA1-115 step-up transformer.
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 an 115kV interconnection metering instrument transformer. FE will provide the ratio and accuracy specifications based on the customer load and generation levels.
4. The purchase and installation of a revenue class meter for each unit to measure the power delivered in compliance with the FE standards.
5. 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.
6. The establishment of dedicated communication circuits for SCADA report to the FE Transmission System Control Center.
7. A compliance with the FE and PJM generator power factor and voltage control requirements.
8. The installation of a 2000A SCADA controlled disconnect switch and the associate conductor to the interconnection point.

The above requirements are in addition to any metering required by PJM.

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 AA1-115 was studied as a 20.0 MW (Capacity 0.0 MW) injection at the 31st St. 115 kV substation in the Penelec area. Project AA1-115 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AA1-115 was studied with a commercial probability of 100% using a Summer Peak 2018 case. 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.

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)

None.

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.

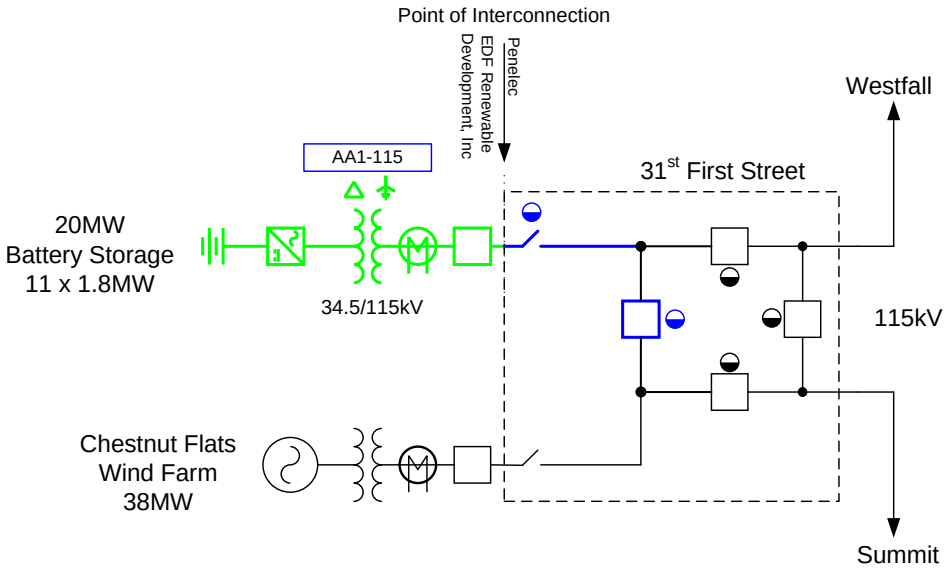
None.

FirstEnergy Voltage Analysis

A voltage fluctuation analysis was performed as part of the System Impact Study. The Thirty First Street 115kV Substation (AA1-115) Project is a battery storage device which has the ability to toggle between its generating and charging states. The results indicate that under single contingency conditions voltage fluctuations exceeding 3% can occur when the unit switches from its generating to a charging state. The Interconnection Customer is required to adhere and comply with the requirements listed in Section 7.1 of the FirstEnergy Requirements for Transmission Connected Facilities document.

Attachment 1. Project Location

Attachment 2. Single Line Diagram



AA1-115 Direct Connection Facilities for a 115kV Battery Storage Facility:
- Convert the existing 3 breaker station to a 4 breaker ring bus
- Install a 2000A SCADA Controlled Disconnect Switch
- Install a new 115kV 40kV 3000A breaker with SCADA control
- Upgrade protection schemes to accommodate new connection.

The Point of Interconnection will be defined as the point where adjoining bus crosses the interconnection substation fence or the point where the customer's line attaches to the interconnection substation dead end structure.