Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AA2-060

Branchville-Sussex #1 34.5kV

August 2015

Preface

The intent of the feasibility study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation to the PJM network at a location specified by the Interconnection Customer. The Interconnection Customer may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: (1) Direct Connections, which are new facilities and/or facilities upgrades needed to connect the generator to the PJM network, and (2) Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

In some instances a generator interconnection may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection, 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 impact study is performed.

The Feasibility 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

The Interconnection Customer (IC), has proposed a storage facility located in Sussex County, NJ. The installed facilities will have a total capability of 6 MW with 0 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is December 2015. **This study does not imply a Jersey Central Power & Light (JCPL) commitment to this in-service date.**

Point of Interconnection

AA2-060 will interconnect with the JCPL system along the Branchville-Sussex 34kV line.

Cost Summary

The AA2-060 project will be responsible for the following costs:

Description	Cost	Tax (if applicable)	Total Cost
Attachment Facilities	$ 440,990	$ 143,100	$ 584,000
Direct Connection Network Upgrades	$ 0	$ 0	$ 0
Non Direct Connection Network Upgrades	$ 0	$ 0	$ 0
Total Costs	**$ 440,990**	**$ 143,100**	**$ 584,000**

Attachment Facilities

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

Description	Activity Cost	Tax (if applicable)	Total Cost
Branchville-Sussex #1 34.5kV line tap. Tap Q745-3 line and extend to proposed battery storage site, including 34.5kV Metering package. Project includes replacing one existing pole (the proposed tap pole) and installing 3 new poles for SCADA controlled MOAB switches, installation of supervisory-controlled, load-break switches on those 3 poles to the customer fuse/POI pole, and any necessary distribution work, guying, etc.	$ 440,900	$ 143,100	$ 584,000
Total Attachment Facility Costs	**$ 440,990**	**$ 143,100**	**$ 584,000**

Notes:

- Detailed environmental review shows probable need for environmental permitting at the site. The developer would be responsible for obtaining any necessary permits.
- Any additional right of way necessary to construct the tap line must be obtained by the developer.

Direct Connection Cost Estimate

No Direct Connection facilities are required to support this interconnection.

Non-Direct Connection Cost Estimate

No Non-Direct Connection facilities are required to support this interconnection.

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 Interconnection Customer will be responsible for constructing all of the facilities on its side of the POI including the attachment line. The Interconnection Customer may not install above ground equipment within any JCP&L right-of-way unless permission to do so is expressly granted by JCP&L.

5. The purchase and installation of fully rated 34.5 kV circuit breaker on the high side of the AA2-060 step-up transformer.

6. 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.

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 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 AA2-060 generation project metering point when the units are out-of-service. This assumes the intent of the Interconnection Customer 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.

JCPL 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 AA2-060 was studied as a 6.0 MW (Capacity 0.0 MW) injection tapping the Branchville Q-Sussex B 34.5kV line in the JCPL area. Project AA2-060 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AA2-060 was studied with a commercial probability of 53% using a Summer Peak 2019 case. Potential network impacts were as follows:

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.

Short Circuit

(Summary of impacted circuit breakers)

None.

FirstEnergy Reactive Assessment

It will be mandatory for the AA2-060 Generation Project to have a range of dynamic reactive capability that supports its operation from a 0.95 leading to 0.95 lagging power factor at the POI. The FE study shows that the addition of this inverter based project without continuous regulation can cause significant voltage swings as its output responds to charge and discharge signals from the regulation market in conjunction with other inverter based generation, and system voltages

can exceed the established limits. Should the Interconnection Customer fail to provide dynamic reactive capability from the AA2-060 Generation Project for any reason once interconnected, the FE and/or PJM Dispatchers may need to take action to curtail output to prevent non-compliance with voltage criteria.

FirstEnergy System Protection Analysis

An analysis was conducted to assess the impact of the generation project on the system protection requirements in the area. The results of this review have identified the following:

- Standard 34.5 kV line protection for the Branchville-Sussex #1 34.5 kV line and the Interconnection Customer 34.5 kV line.

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

FirstEnergy Additional Analysis

Due to the nature of the regulation market driving charge and discharge signals at an unpredictable schedule, additional sensitivity cases including light load & 90/10 probability loading may be deemed necessary. If needed, the studies will be performed for the AA2-060 generation project in the System Impact Study stage of the interconnection process.

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.

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.