Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AA2-048

Allenwood-Larrabee 34kV

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 storage addition to an existing solar generating facility located in Monmouth County, NJ. This project requests an increase to the install capability of 7 MW with 0 MW of this output being recognized by PJM as capacity. The installed facilities will have a total capability of 14 MW with 2.66 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

AA2-048 will interconnect with the JCPL system along the Allenwood-Larrabee 34kV line.

Cost Summary

The AA2-048 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	$ 10,000	$ 3,200	$ 13,200
Total Costs	**$ 10,000**	**$ 3,200**	**$ 13,200**

Attachment Facilities

No additional Attachment Facilities are required to support this interconnection request.

Direct Connection Cost Estimate

No additional Direct Connection Facilities are required to support this interconnection request.

Non-Direct Connection Cost Estimate

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

Description	Activity Cost	Tax	Total Cost
Protection analysis with possible relay settings changes. Project oversight and commissioning.	$ 10,000	$ 3,200	$ 13,200
Total Non-Direct Connection Facility Costs	**$ 10,000**	**$ 3,200**	**$ 13,200**

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 FE right-of-way unless permission to do so is expressly granted by FE.

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

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

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

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 AA2-048 was studied as a 7.0 MW (Capacity 0.0 MW) injection at the W3-079 Tap 34.5kV substation in the JCPL area. This project is an uprate to a prior project. Project AA2-048 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AA2-048 was studied with a commercial probability of 53% on 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 System Protection Analysis

An analysis was conducted to assess the impact of the AA2-048 Project on the system protection requirements in the area. The results of this review have identified the following: Under the assumption that the AA2-048 Project will not supply fault current to the Jersey Central transmission system and is connected on customer side of the Point of Interconnection (POI) established for the prior project, there will be no protection upgrades needed for the Lakewood -

Allenwood (S97) 34.5 kV line. However, the two independent high speed zones of protection installed at the POI for the prior Project will need to be maintained to sense and clear faults on the developer's side of the POI. Any changes to the protection at the POI need to be reviewed by FirstEnergy to determine whether it coordinates with the FirstEnergy protection.

Note:

The FE "Requirements for Transmission Connected Facilities" document section 14.2.6 states: The winding configurations of the transformer connected to a non-effectively grounded portion of the FE Transmission System shall be determined by FE on a case by case basis. The AA2-048 attachment N data indicates that the 34.5 kV is wye connected which could create reliability issues on the JCP&L system. JCP&L recommends that the Interconnection Customer implement the following:

1. Have the 34.5 kV wye windings not grounded
2. Change proposed transformer to be delta on the 34.5 kV side
3. Convert the interconnection to a ring bus

The fault currents on the Lakewood - Allenwood (S97) 34.5 kV line, 4.4 miles from the Larrabee substation (toward Allenwood) or 1.62 miles from the Allenwood substation (toward Larrabee) are listed below.

	Three-Phase	Single-Line
X/R	3.1209	4.1780
Fault Current (Amps)	7255	4112

These values are for the current system configuration. Any system changes in the area could have a significant impact on these values. It will be the responsibility of the Interconnection Customer to make any protection upgrades required should this occur. The proposed interconnection facilities must be designed in accordance with the FirstEnergy "Requirements for Transmission Connected Facilities."

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.