

***Generation Interconnection
System Impact Study Report***

For

***PJM Generation Interconnection Request
Queue Position AA2-048***

Allenwood-Larrabee 34kV

April 2016

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

Howell Solar LLC, 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.**

Attachment facilities and local upgrades (if required) along with terms and conditions to interconnect AA2-048 will be specified in a separate two party Interconnection Agreement (IA) between Jersey Central Power & Light (JCPL) and the Interconnection Customer as this project is considered FERC non-jurisdictional per the PJM Open Access Transmission Tariff (OATT). From the transmission system perspective, no network impacts were identified as detailed below.

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 Attachment facilities are required to support this interconnection.

Direct Connection Cost Estimate

No Direct Connection facilities are required to support this interconnection.

Non-Direct Connection Cost Estimate

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

Description	Activity Cost	Tax (if applicable)	Total Cost
Adjust remote, relaying, and metering settings	\$ 10,000	\$ 3,200	\$ 13,200
Total Non-Direct Facility Costs	\$ 10,000	\$ 3,200	\$ 13,200

Schedule

Based on the extent of the JCP&L Direct Connection and system upgrades required to support the (AA2-048) generation project, it is expected to take a minimum of 12 months from the date of a fully executed Interconnection Construction Service Agreement to complete the installation. This includes the requirement that the 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.

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 purchase and installation of fully rated 34.5 kV circuit breaker on the high side of the (AA2-048) step-up transformer.

4. 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.
5. The purchase and installation of a 34.5 kV interconnection metering package. FE will provide the ratio and accuracy statements.
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.
9. It will be mandatory for this generation project to have a range of dynamic reactive capability that supports its operation from a 0.95 leading (absorbing vars) to 0.95 lagging (producing vars) power factor measured at the POI. Should the IC fail to provide dynamic reactive capability from the generation project for any reason once interconnected, the FE and/or PJM Dispatchers may need to take action to curtail both the energy and capacity portion of its output to prevent non-compliance with voltage criteria.

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 W3-079 Tap 34.5 kV bus in JCPL. 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 100%. 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.

An analysis was conducted to assess the impact of the (AA2-048) generation project on the system protection requirements in the area. The results of this review have identified the following:

First Energy System Protection Analysis

Under the assumption that the AA2-048 Project will not supply fault current to the JCP&L transmission system and is connected on the customer side of the POI established for the W3-079 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 W3-079 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. The Interconnection Customer will be responsible for meeting the generator interconnection requirements in FE's "Requirements for Transmission Connected Facilities" document.

The fault currents on the Allenwood – Larrabee (S97) 34.5 kV line at the POI are listed below.

Three phase fault current:	7,200 Amps
Single line to ground fault current:	4,080 Amps
Positive Sequence Thevenin (ohms):	$0.8756 + j\ 2.6249$
Zero Sequence Thevenin (ohms):	$1.8279 + j\ 8.9398$

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” document.

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.

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.

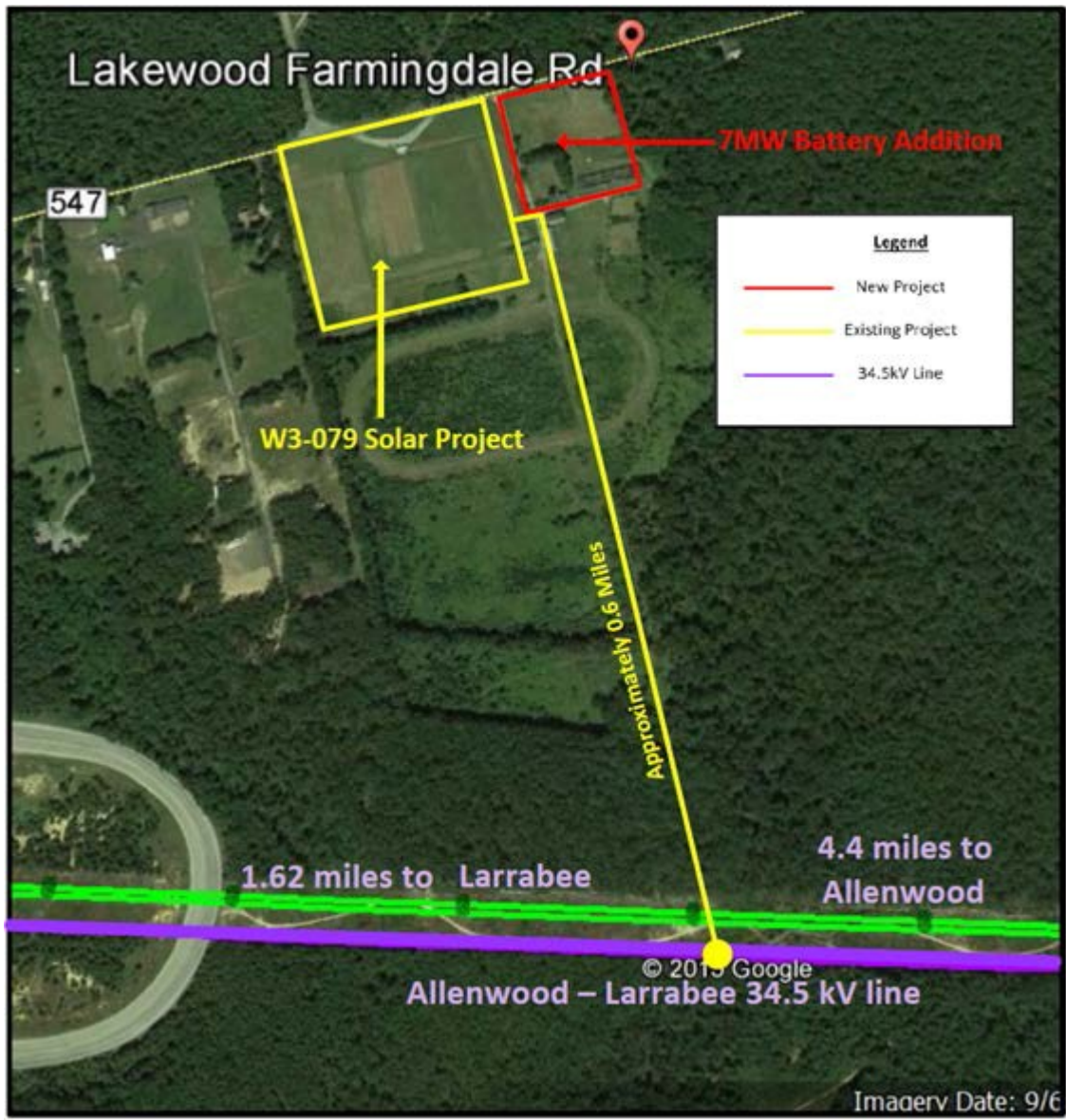
Potential Congestion due to Local Energy Deliverability

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.

Attachment 1. Project Location



Attachment 2. Single Line Diagram

