

***Generation Interconnection
Combined Feasibility/System
Impact Study Report***

For

***PJM Generation Interconnection Request
Queue Position AB2-127***

Gilbert 34.5kV

October 2016

Preface

The intent of the Combined Feasibility/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, if any, is included in the System Impact Study.

The 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 associated with them will be addressed when seeking an Interconnection Agreement as outlined below. . Developer will also be responsible for providing and installing metering equipment in compliance with applicable PJM and Transmission Owner standards.

General

Smart Energy Development, Inc, the Interconnection Customer (IC), has proposed a battery storage facility located in Hunterdon. The installed facilities will have a total capability of 16.0 MW with 0.0 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is June 2018. **This study does not imply a Jersey Central Power & Light Company (JCPL) commitment to this in-service date.**

Point of Interconnection

AB2-127 will interconnect with the JCPL system from the Gilbert 34.5kV substation.

Cost Summary

The JCPL project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	\$ 822,300
Direct Connection Network Upgrades	\$ 0
Non Direct Connection Network Upgrades	\$ 0
Transmission System Upgrades	\$ 0
Total Costs	\$ 822,300

Overview

The proposed POI for the AB2-127 generation project will be located at the fence line of the Gilbert 34.5 kV substation. Attachment 1 provides an aerial view of the proposed location of the facility. The direct connection of AB2-127 will be accomplished by extending the Gilbert 34.5 kV substation H bus, and installing the necessary terminal equipment including a breaker, and accepting termination of the IC's line. Attachment 2 shows a conceptual one-line diagram of the proposed connection of AB2-127 to the JCP&L transmission system. 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.

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	Estimated Cost	Tax (if applicable)	Total Cost
Install new 34.5kV terminal for AB2-127 tap at Gilbert SS.	\$ 822,300	\$ 132,400	\$ 954,700
Total Attachment Facilities Cost	\$ 822,300	\$ 132,400	\$ 954,700

Direct Connection Cost Estimate

There are no Direct Connection facilities required to support this request.

Non-Direct Connection Cost Estimate

There are no Non-Direct Connection facilities required to support this request.

Schedule

Based on the extent of the JCP&L primary Direct Connection required to support the AB2-127 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. It assumes 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 upgrades, and that all system outages will be allowed when requested.

Interconnection Customer Requirements

1. The addition of inverter based projects 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. This facility shall be designed with the ability to dynamically maintain a power factor of at least 0.95 leading to 0.95 lagging measured at the generator's terminals.
2. 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:
 1. Dual 411L relays with fiber communication between Gilbert substation and (AB2-127).
 2. Two independent high speed zones of protection for the generation side of (AB2-127) substation to detect and clear fault on the developer's side of the POI as addressed in FE's "Requirements for Transmission Connected Facilities" document.
 3. The protection at the POI needs to be reviewed by FirstEnergy to properly coordinate with the JCP&L protection.

In addition to the JCP&L 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 fully rated interrupting device on the high side of the AB2-127 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 a 34.5 KV interconnection metering package. FE will provide the ratio and accuracy specifications.
4. 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.
5. The establishment of dedicated communication circuits for SCADA to the FE Transmission System Control Center.
6. 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 AB2-127 was evaluated as a 16.0 MW (Capacity 0.0 MW) injection at the Gilbert 34.5kV substation in the JCPL area. Project AB2-127 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AB2-127 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.

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.

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.

Short Circuit

(Summary of impacted circuit breakers)

None.

Affected System Analysis & Mitigation

(Summary of impacts on systems external to PJM)

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.

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.

Light Load Analysis

Light Load Studies to be conducted during later study phases (applicable to wind, coal, nuclear, and pumped storage projects).

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.

Attachment 1. Project Location



Attachment 2. Single Line Diagram

