Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position W1-055

Broadway 34.5kV

July 2010

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 20 MW (7.6 MW capacity) solar generating facility. The facility will be located in Franklin Township, New Jersey.

Point of Interconnection

W1-055 will interconnect with the Jersey Central Power & Light distribution system at one of two options. Option 1 is to connect a 12.5kV distribution circuit. Option 2 is to connect to a 34kV line from the Broadway substation.

Preliminary Analysis

A preliminary analysis was performed to determine the feasibility of connecting 20 MW of capacity to the primary POI selected by the Interconnection Customer; a nearby 12.47 kV circuit. The analysis concluded that there is not sufficient capacity to connect the entire 20 MW to one 12.47 kV circuit.

JCP&L evaluated the cost to extend four 12.47 kV lines to the Project in order to accommodate the 20 MW of capacity on its distribution system. The total estimated cost to construct four new 12.47 kV circuits from four different substations including the design, engineering, acquisition of materials, construction of required facilities, substation upgrades and metering is estimated at $12,320,000.

See Attachment 1 for approximate locations and distances for each of the four substations.

Least Cost Solution

Upon further analysis, a least cost solution was developed based on the secondary POI selected by the IC; a nearby 34.5 kV circuit. This solution would require a new 34.5 kV three breaker ring bus substation to be constructed at the collector site to accommodate the Project connection. This will also require an extension 34.5 kV lines through the switching station to the new Broadway Solar substation and installation of 2- 34.5/12.5KV Modular Substation Transformers.

A conceptual one-line diagram for the new Broadway Solar three breaker 34.5 kV ring bus substation is shown on Attachment 2. While FE will construct, own and operate the new Broadway Solar 34.5 kV substation and the facilities for its attachment to the FE system, the Interconnection Customer will be responsible for acquiring all easements, properties and permits that will be required. The Interconnection Customer will also be responsible for providing a level graded site for the new Broadway Solar 34.5 kV substation and an access road as a prerequisite before work can begin. A summary of the W1-055 Project Direct Connection facilities that will be required and their estimated cost are shown below

The Interconnection Customer will be responsible for meeting all criteria defined in the "FE Requirements for Transmission Connected Facilities" document that is posted on the PJM and FE web sites. This includes the provision of a reactive power capability sufficient to maintain a composite power delivery for the facility at the interconnection point at a power factor between .95 leading (absorbing MVARs) and .90 lagging (producing MVARs). Since the proposed solar generation project will provide no reactive power.

FE Facility Upgrades (To be paid by customer)

The following is a summary of the FE facilities that will be required for the direct connection of the W1-055 Generation Project:

1. Construct New 34.5 kV Substation for 3 Breaker Ring Bus for the project attachment. This includes the design and engineering required, the acquisition of materials and construction of the required facilities.

2. Implement the upgrades required at the Broadway 34.5 kV substation. This includes an extension of the 34.5 kV lines from the Broadway substation to the Broadway Solar substation.

3. Install 2 -14MVA transformers per JCP &L Mod substations designs.

Infrastructure Upgrade Estimated Costs (By JCP&L):

Total Estimated Costs (by JCP&L) is $7,987,200

Breakdown is as follows:

1. Construct New 34.5 kV Substation for 3 Breaker Ring Bus for the project attachment. This includes the design and engineering required, the acquisition of materials and construction of the required facilities.

   (Cost Estimate $3,899,500)

2. Implement the upgrades required at the Broadway 34.5 kV substation. This includes an extension of the 34.5 kV lines from the Broadway substation to the Broadway Solar substation.

   (Cost Estimate $867,700)

3. Install 2 - 14MVA transformers per JCP &L Mod substations designs.

   (Cost Estimate $3,200,000)

4. Metering based on us installing and owning the equipment.

   (Cost Estimate $20,000)

The above costs do not include taxes. If appropriate, this could add approximately an additional 34% to the Project cost.

All JCPL costs are not subject to refundable provisions of the NJ-BPU Tariff for Electric service.

All Right of Ways (ROW) are the responsibility of the IC to obtain.

NOTE: This is an estimate based on similar work orders previously worked by JCP&L for the types of work described in the analysis above. It is accurate to within plus or minus 50 percent.

Should the customer want to proceed with the connection of this facility a contract with JCPL will be developed based on these costs and a true-up of actual charges will be made at the completion of the project.

The applicant will be responsible for the actual cost of construction. FE herein reserves the right to return to any issues in this document and, upon appropriate justification, request additional monies to complete any connections to the transmission system.

Interconnection Customer Requirements

The Interconnection Customer will be responsible for constructing the radial attachment facilities from its collector point to the Solar 34.5 kV substation. 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 the minimum required FE generation interconnection relaying and control facilities.

2. Interconnect Customer (IC) will install a pole adjacent to JCP&L's pole as point of interconnection. On this pole the IC will install cutout fuses with load break capability, primary metering transformer bracket per the FE Construction Standards of page# 10-347. JCP&L will install and purchase the revenue metering CTs and PTs. Based on the ratio and accuracy specifications based on the customer load and generation levels.

3. The installation of a revenue class bi-directional meter to measure the power delivery from the IC units in compliance with the FE standards.

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 report to the FE Transmission System Control Center and for dialup access to revenue metering.

6. IC provides all trenching, cables and conduit from JCP&L's point of interconnection pole to connect his PV generation facilities.

7. IC must meet all applicable JCP&L/FirstEnergy standards and requirements which are included in the current Tariff for Service.

8. IC's inverter-based generation must be UL listed or certified to comply with the requirements of IEEE 1547.

9. IC's four(4) main breaker shall have a SEL 351 Multi-function relay(or equivalent) which is required for interconnection protection. The main breaker must be on the high side of the customer's transformer. All breakers, lightning protection etc. should meet JCP&L/FE's minimum BIL Ratings.

10. IC must meet requirements of N.J.A.C. 14:4-9 ("In front of meter" all power sold to PJM and Interconnection standards for Class I Renewable Energy Systems), as well as IEEE 1547, and IEEE 1547.1

11. IC must meet applicable FE Distributed Generation Technical requirements for the interconnection of generation to the FE Distribution system

Note that the above requirements are in addition to any metering and communication facilities that must be installed for PJM compliance.

Timetable for Construction:

Total time to complete this project is 24-36 months from receipt of “Interconnect Agreement”, “Construction Agreement” and receipt of “Estimated Project Costs”.

JCP&L estimates 9 months after receipt of above for design work to be completed.

JCP&L estimates it will require an additional 15-25 months to complete the identified infrastructure upgrades.

Network Impacts

Queue project W1-055 was studied as a(n) 20.0MW (7.6MW of which was Capacity) injection into JCPL's system at the Broadway 34.5kV substation. Project W1-055 was evaluated for compliance with reliability criteria for summer peak conditions in 2014. Potential network impacts were as follows:

Generator Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

No problems identified.

Multiple Facility Contingency

(Double Circuit Tower Line Contingencies only with full energy output. Stuck Breaker and Bus Fault contingencies will be applied during the Impact Study)

No problems identified.

Contribution to Previously Identified Overloads

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have % allocation of cost responsibility which will be calculated and reported for the Impact Study.)

No problems identified.

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.

Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of the surrounding generation. Any potential 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 Transmission Interconnection request.

Note: Only the most severely overloaded conditions are listed. 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 analyzes all overload conditions associated with the overloaded element(s) identified. As a result of the aggregate energy resources in the area, the following violations were identified.

No problems identified.

Short Circuit

Not required.

Stability Analysis

Not required.

Attachment 1
Preliminary Analysis

Attachment 2

Least Cost Solution Single Line Diagram