Generation Interconnection
Feasibility Study Report
Queue Position X3-013

The Interconnection Customer (IC) has proposed an 8 MWE (3.04 MWC; 8 MW MFO) solar powered generating facility to be located in Wildwood Crest, New Jersey. PJM studied X3-013 as an 8 MW injection into the Atlantic City Electric Company (ACE) system at the Lake#8 12kV substation and evaluated the project for compliance with reliability criteria for summer peak conditions in 2015. The planned in-service date, as stated in the Attachment N, is November 1, 2012.

Point(s) of Interconnection

The IC requested the Point of Interconnection (POI) for X3-013 to be a 12.47 kV distribution level interconnection.

X3-013 will interconnect with the Atlantic City Electric Company system at the Lake 69/12kV substation as follows:

8 MWs will connect to the existing T6 transformer

Point(s) of Interconnection Discussion

Description of Atlantic City Electric (ACE) policy

1. Existing 12kV Distribution Circuit
   The aggregate limit of large (250 kW and over) generator injection to a single, existing 12kV distribution circuit is 3 MWs. This project exceeds this limit and the existing circuit will not be used for this reason.

2. Express Feeder
   Intermittent generation installations over 3 MWs on the 12 kV level will require an express feeder to avoid undesired interaction with automatic line equipment and so that other customers on the distribution system may avoid experiencing any voltage and power quality issues that may exist. An express feeder is limited to 10 MW.

   Lake Sub. was identified as the closest substation based on the site location supplied in the application and/or Kick-off Call.

   The aggregate limit of large (250 kW and over) generator injection to a single distribution transformer with a rating of 22.5 MVA or larger is 10 MWs. Lake Sub.T6 is available.

   As a result, the project will interconnect with the Atlantic City Electric system at Lake Sub. T6 via a 12 kV express feeder.

   All injection limits, given above in MWs, are subject to more detailed study to ensure feasibility.

Direct Connection Requirements

Transmission Owner Scope of Work

The scope of work and estimated costs for the direct connection facilities is as follows:

For the purpose of this study we will look at connecting 8 MW of PV to the existing T6 transformer at Lake Substation

1. One new 12 kV feeder with 500 kcmil aluminum pre-assembled aerial cable (PAC) will be constructed from Lake Substation to the PV site – a distance of approximately 0.75 miles. The circuit will be built on the existing Corson – Middle – Lake 69 kV transmission line underneath of the existing circuit(s). The below estimate includes the cost to replace some of the existing poles due to the addition of the PAC circuit. More poles may be identified for replacement during later study phases. The circuit will terminate into an underground feed behind Lake Substation.
2. One new 12 kV feeder terminal position will be constructed.
3. A utility operated recloser equipped with the proper relaying and communications will be installed for each feeder serving the PV generator.
4. Utility grade primary metering will be required for each feeder.
5. Generation telemetry and remote trip capability will be provided to PHI's Energy Management System with future capability to adjust output and power factor if needed.
6. A detailed, time-based study may be performed during later study phases.
7. Protection, Planning, and other engineering departments will perform studies, design work, and prepare engineering estimates.
8. Transfer trip will be required. Approximately 1.5 miles of 48SM ADSS fiber optic cable was estimated for this report to provide the communication channel from Lake Sub to the PV site.

The estimated cost to perform this work is:

Estimated Costs			
Lake Substation T6			
PAC Express Feeder	0.75	Miles	$700,000
Fiber Installation (1.5 mile 48SM ADSS)		Miles	$109,000
New Feeder Terminal			$400,000
Recloser w/ Relaying and Communications			$50,000
Utility Grade Metering			$20,000
SCADA Integration into EMS			$10,000
Detailed Time Based Study			$30,000
Various Departments Work			$20,000
Subtotal Cost			$1,339,000
Subtotal Cost with 18% Overheads			$1,580,020
Approximate Total Cost with 15% Contingency			$1,817,023

The estimated time to complete the work is **12-18 months**.

Additional Operating Requirements

1. PHI will require the capability to remotely trip the generator from its System Operations facility. Such tripping may be facilitated by either a generator breaker, inverter (if so equipped), or a line recloser, depending upon the specific circumstances and the evaluation by PHI.

2. It is the Interconnection Customer's responsibility to send the data that PJM and the Company requires directly to PJM. The Interconnection Customer will grant permission for PJM to send the Company the following telemetry that the Interconnection Customer sends to PJM: real time MW, MVAR, volts, amperes, generator/status, and interval MWH and MVARH.

3. The Interconnection Customer will be required to make provisions for a voice quality phone line within approximately 3 feet of each Company metering position to facilitate remote interrogation and data collection.

4. A mutually acceptable means of interrupting and disconnecting the generator with a visible break, able to be tagged and locked out, shall be worked out with PHI Engineering.

Interconnection Customer Scope of Work

The Interconnection Customer (IC) is responsible for all design and construction related to activities on their side of the Point of Interconnection. Site preparation, including grading and an access road, as necessary, is assumed to be by the IC. Route selection, line design, and right-of-way acquisition of the direct connect facilities is not included in this report, and is the responsibility of the IC.

The IC will be required to install metering and telemetry equipment to provide revenue metering and real-time telemetry data to PJM. The requirements for this equipment are listed in Appendix 2, Section 8 of Attachment O to the PJM Tariff, as well as PJM Manuals 01 and 14D. Protective relaying and metering design and installation must comply with PHI's Applicable Standards.

The Interconnection Customer will purchase and install all metering instrument transformers as well as construct a metering structure per PHI's specifications. The secondary wiring connections at the instrument transformers will be completed by the Interconnection Customer's contractors and inspected by PHI, while the secondary wiring work at the metering enclosure will be completed by PHI's meter technicians. The metering control cable and meter cabinets will be supplied by PHI and installed by the Interconnection Customer's contractors. PHI's meter technicians will program and install two solid state multi function meters (Primary & Backup) for the new metering position. Each meter will be equipped with load profile, telemetry, and form-c pulse outputs.

Inverter Requirements and Capabilities

The inverter at the DG location shall have the following capabilities:

1. Voltage flicker reduction through dynamic VAR response
2. Ramp rate control
3. SCADA communications
4. Curtailment or other mitigation ability if high voltage were to occur
5. Low voltage and system disturbance ride through
6. Ability to receive and respond to a transfer trip or SCADA signal including real power curtailment and power factor changes

The inverter shall operate in accordance with the IEEE 1547 series of standards that have been approved. While inverters should be capable of voltage stabilization thru dynamic VAR response and capable of low voltage and system disturbance ride through, neither of these capabilities shall be implemented until such time that the IEEE 1547 series of standards are revised and approved to include standards for these capabilities. At such time as these revised standards become available, the PV owner/operator shall cooperate with PHI (ACE, DPL, or PEPCO) to implement these capabilities with settings acceptable to PHI. Until such time, the inverters shall operate with a fixed power factor schedule as supplied by PHI.

Transmission Network Impacts

Potential transmission network impacts are 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, Line with Failed 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

No issues identified.

Stability Analysis

Not required due to project size.

Dynamic Analysis

ACE will commence a time-based dynamic study during the System Impact Study phase to evaluate the project's impact on the ACE distribution system. Once complete, the results of the study will be reviewed and the proposed project will be evaluated for protection and coordination issues. Other required upgrades may be identified at that time.

System Protection

Protective relaying and metering design and installation must comply with PHI's applicable standards. Any other costs determined by system protection as a result of the short circuit studies will be supplied in the near future.

Other Charges

PHI reserves the right to charge the Interconnection Customer Operation and Maintenance expenses to maintain the Interconnection Customer's Attachment Facilities, including metering and telecommunications facilities which are owned by PHI.

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. "Network Impacts," initially caused by the addition of this project's generation)

None

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project.

None

Potential Congestion due to Local Energy Deliverability

(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 below. There is no guarantee of full deliverability 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 identified overloaded element(s). As a result of the aggregate energy resources in the area, the following violations were identified:

These are ***not*** required reliability upgrades.

None