Generation Interconnection
Feasibility Study Report
Queue Position X3-017

The Interconnection Customer (IC) has proposed a 1.99 MW energy only (0 MWC; 1.99 MW MFO) solar powered generating facility to be located in Elsinboro Township, New Jersey. PJM studied X3-017 as a 1.99 MW injection into the Atlantic City Electric Company (ACE) system at the Salem #1 69kV 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, 2011.

Point(s) of Interconnection

The IC requested the Point of Interconnection (POI) for X3-017 to be a 12.47 kV distribution level interconnection.

X3-017 will interconnect with the Atlantic City Electric Company system at a new 69/12kV 37MVA transformer at the Salem substation.

Point(s) of Interconnection Discussion

Description of Atlantic City Electric (ACE) policy

1. Existing 12kV Distribution Circuit
   The existing 12 kV circuit at the solar site is NJ1312 from Quinton Substation. The aggregate limit of large (250 kW and over) generator injection to a single, existing 12kV distribution circuit is 3 MWs. This criteria did not affect this project.

   The aggregate limit of large (250 kW and over) generator injection to a single distribution transformer is 10 MWs. This applies to transformers 22.5 MVA nameplate and larger, which includes the proposed replacement and under construction transformers at Quinton Substation.

   As of the date of this report, Quinton T1 and T2 cannot accept any additional generation. On the T1 transformer, 2 MW of Net Energy Metering projects have requested to connect and 8 MW of a PJM project is being studied. On the T2, 10 MW of a PJM project is being studied.

2. Express Feeder
   Intermittent generation installations over 3 MWs on the 12 kV level will require an express feeder so that other customers on the distribution system may avoid experiencing any voltage and power quality issues that may exist. An express feeder may also be used to reach a substation when there is no existing route. An express feeder is limited to 10 MW.

   The Salem substation was identified as the closest substation (measured in straight line distance to the solar site) based on the site location supplied in the application and/or Kick-off Call. Salem Substation currently has 69, 34.5 and 4 kV voltages. The 34.5 and 4 kV systems are both currently planned to be retired at Salem. Any load served by these systems will either be converted to 69 kV or converted to 12 kV and served through nearby Quinton Substation.

When the 34.5/4 kV transformer has been removed, there will be space in Salem substation to add a 69/12 kV transformer. ACE has no plans to serve customers in this manner. This proposed transformer would be ACE's standard distribution transformer (37 MVA nameplate rating.)

The length of an express feeder is limited to 5 miles, or for the sake of the feasibility study, 3.8 straight line miles. This simplification is used because the feasibility study phase does not allow for the time and resources to examine routes in detail (including existing pole lines, easements, ROW, and environmental issues etc.)

There are no other substations within 3.8 miles of the solar site.

As a result, the project will interconnect with the Atlantic City Electric system at Salem Substation by constructing a new 69/12 kV 37 MVA transformer.

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:

1. Construct one new 69/12 kV 37 MVA transformer, including high and low side breakers, and one new 12 kV feeder terminal position.
2. One new 12 kV feeder with 954 aluminum conductor will be constructed from Salem Substation to the PV site – a distance of approximately 3.0 miles.
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. A detailed, time-based study may be performed during later study phases.
6. Protection, Planning, and other engineering departments will perform studies, design work, and prepare engineering estimates.

The estimated cost to perform this work is:

Estimated Costs			
Salem Substation New Transformer			
New Transformer			$4,150,000
954 AAC Express Feeder	3	Miles	$2,000,000
Recloser w/ Relaying and Communications			$50,000
Utility Grade Metering			$20,000
Detailed Time Based Study			$30,000
Various Departments Work			$20,000
Subtotal Cost			$6,270,000
Subtotal Cost with 18% Overheads			$7,398,600
Approximate Total Cost with 15% Contingency			$8,508,390

The estimated time to complete the work is **24 months**. This time estimate will be contingent on the retirement of Salem's 4kV distribution system. Any delay to the retirement could affect completion date. The transformer installation is also dependant on the availability of the mobile unit.

Additional Operating Requirements

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

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 set non-unity power factor settings between 0.95 lead and 0.95 lag

It is the responsibility of the developer to obtain inverters that can operate with these requirements while also meeting all applicable requirements of IEEE and UL standards such as but not limited to IEEE 1547 and UL 1741.

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