Generation Interconnection
Feasibility Study Report
Queue Position X3-026

The Interconnection Customer (IC) has proposed a1 MW energy only (0 MWC; 1 MW MFO) solar powered generating facility to be located in Buena Vista Township, New Jersey.
PJM studied X3-026 as a 1 MW injection into the Atlantic City Electric Company (ACE) system at 50% tap between the Minotola and Lewis 138kV substations 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 December 31, 2012.

Point(s) of Interconnection

The IC requested the Point of Interconnection (POI) for X3-026 to be a 12.47 kV distribution level interconnection.

X3-026 will interconnect with the Atlantic City Electric Company system at a new 138/12kV substation to be constructed adjacent to the Landis-Lewis 138kV circuit (see Attachment 1).

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 criteria did not affect this project.

   The Minotola substation was identified as the closest substation based on the site location supplied in the application and/or Kick-off Call. Minotola has two 138/12 kV transformers. 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 transformers at Minotola Sub

   As of the date of this report, the T1 and T2 transformers at Minotola cannot accept any additional generation. On the T1 transformer, 0.8 MW of Net Energy Metering projects have requested to connect and 9.2 MW of a PJM project is being studied. On the T2 transformer, 1.3 MW of Net Energy Metering projects have requested to connect and 8.7 MW of a PJM project is being studied. The addition of a third distribution transformer was considered and ruled out as a potential upgrade to this substation as part of previous studies.

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 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.) No other substations are within 3.8 straight line miles of this proposed solar site.

3. New Substation
   In order to realistically convey the cost to safely and reliably handle additional generation in this area while still receiving service at the distribution level, the cost was supplied for a new 138/12 kV distribution substation. This substation will be supplied by extending existing transmission lines. It is the developer's responsibility to verify eligibility for solar renewable energy certificates with New Jersey's Clean Energy Program if desired.

   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. Design and construct a new 138/12 kV substation at the PV site. This substation will be built to the Company's (the "Company" referring to ACE, DPL, or PEPCO) specifications for a distribution substation and be owned and operated by the Company. *Note: There are no plans to serve any load from this substation, however it will be built so that it can serve load in the future. The developer shall supply adequate land for the installation of the substation. The land shall be in close proximity to roads and be on buildable high land.*
2. Create a transmission loop by cutting into the Landis – Lewis (1409) 138 kV line and installing approximately 0.2 miles of double circuit pole lines to the new substation.
3. Establish one new 12 kV feeder with overhead conductor from the new substation to the PV site.
4. A utility operated recloser equipped with the proper relaying and communications will be installed for each feeder serving the PV generator.
5. Utility grade primary metering will be required for each feeder.
6. Generation telemetry and remote trip capability will be provided to the control center.
7. A detailed, time-based study may be performed during later study phases.
8. 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			
New Substation			
New Substation			$7,062,000
Express Feeder (Including recloser)	1		$70,000
Transmission Feed 138 kV	0.4	Miles	$350,000
Fiber Installation (5 miles of fiber assumed)			$250,000
Utility Grade Metering		1	$20,000
SCADA Integration into EMS		1	$10,000
Detailed Time Based Study			$30,000
Various Departments Work			$20,000
Subtotal Cost			$7,812,000
Subtotal Cost with 18% Overheads			$9,218,160
Approximate Total Cost with 15% Contingency			$10,600,884

The estimated time to complete the work is **24 – 36 months** after receipt of a fully executed interconnection agreement.

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