Generation Interconnection
Feasibility Study Report
Queue Position X3-074

The Interconnection Customer (IC) has proposed an 11.9 MWE (4.5 MWC; 11.9 MW MFO) solar powered generating facility to be located in Chestertown, Kent County, Maryland. PJM studied X3-074 as an 11.9 MW injection into the Delmarva Power and Light (DPL) system 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 March 31, 2013.

Point(s) of Interconnection

The Interconnection Customer requested a Primary and Secondary Point of Interconnection (POI) be evaluated for the X3-074 project. The Primary POI selected was a 25kV distribution level interconnection at the Chestertown 25kV substation. The Secondary POI selected was a 69kV transmission level interconnection also at the Chestertown substation. The study results are provided in the Transmission Network Impacts section below.

Primary POI Option

X3-074 will interconnect with the Delmarva Power and Light system at the Chestertown 69/25kV substation as follows.

10 MWs will connect to the T1 transformer; 1.9 MWs will connect to the T2 transformer

Direct Connection Requirements

Transmission Owner Scope of Work

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

1. Establish two (2) new 25 kV feeders with 954 aluminum conductor from the Chestertown substation to the PV site – approximately .4 miles.
2. A utility operated recloser will be required on the customer tap that will have proper relaying and communication.
3. Utility grade primary metering will be required.
4. Generation telemetry and remote trip capabilities will be provided to the control center.
5. Perform a detailed time based study.
6. Protection, Planning, and other engineering departments will perform studies, design work, and prepare engineering estimates.
7. Transfer trip may be required.

The estimated cost to perform this work is as follows:

Estimated Costs			
Chestertown Substation T1			
New/Replacement Transformer			$0
954 AAC Express Feeder		Miles	$160,000
Fiber Installation	0.4	Miles	$20,000
Fiber Termination			$30,000
New Feeder Terminal			$300,000
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			$640,000
Subtotal Cost with 18% Overheads			$755,200
Approximate Total Cost with 15% Contingency			$868,480

Estimated Costs			
Chestertown Substation T2			
New/Replacement Transformer			$0
954 AAC Express Feeder		Miles	$160,000
Fiber Installation (N/A)	0.4	Miles	
New Feeder Terminal			$300,000
Recloser w/ Relaying and Communications			$50,000
Utility Grade Metering			$20,000
SCADA Integration into EMS			$10,000
Various Departments Work			$20,000
Subtotal Cost			$560,000
Subtotal Cost with 18% Overheads			$660,800
Approximate Total Cost with 15% Contingency			$759,920

The total approximate cost is **$1,628,400.**

Use of existing feeders and terminals will be investigated in future studies which could potentially reduce overall total cost.

The estimated time to complete this work is **12 - 18 months** after receipt of a fully executed interconnection agreement.

Note: the above cost does not include the Contribution in Aid of Construction (CIAC) tax.

Special 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.

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

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 the Company (the 'Company' referring to ACE, DPL, or PEPCO) to implement these capabilities with settings acceptable to the Company. Until such time, the inverters shall operate with a fixed power factor schedule as supplied by the Company.

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

DPL will commence a time-based dynamic study during the System Impact Study phase to evaluate the project's impact on the DPL 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

Secondary POI Option

PJM studied X3-074 as a 11.9 MW injection at the Chestertown 69kV substation.

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

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None

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No issues identified.

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