

# ***Generation Interconnection Feasibility Study Report Queue Position X2-045***

The Interconnection Customer (IC) has proposed a 20 MWE (7.6 MWC; 20 MW MFO) solar powered generating facility to be located in Worcester County, Maryland. PJM studied X2-045 as a 20 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 June 30, 2013.

## **Point(s) of Interconnection**

The Interconnection Customer requested a Primary and Secondary Point of Interconnection (POI) be evaluated for the X2-045 project. The Primary POI selected was a 69kV transmission level interconnection at the Kenney 69kV substation. The Secondary POI selected was a 69kV transmission level interconnection at a tap of the Kenney-Mt. Olive 69kV circuit. The study results are provided in the Transmission Network Impacts section below.

## **Direct Connection Requirements**

### **Primary POI Option**

X2-045 will interconnect with the Delmarva Power and Light system at the Kenney 69kV substation.

### **Transmission Owner Scope of Direct Connection Work**

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

#### **Substation Engineering Estimate:**

**Scope:** Add an additional bus position to the 69kV ring-bus at the Kenney substation.

**Estimate:** \$1,000,000

**Construction Time:** 18 – 24 months

#### **Transmission Engineering Estimate:**

**Scope:** Install a self-supporting 69kV steel pole with a concrete foundation, motor operated disconnects and a short span to PHI substation.

**Estimate:** \$125,000

**Construction Time:** 24 months

Note: If location of generator is greater than 500 feet from substation, circuit breaker will be necessary

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. The Interconnection Customer will grant its permission to PJM for PJM to send the PHI the following telemetry data that the Interconnection Customer sends to PJM: real time megawatts, megavars, 3 phase volts, 3 phase amperes and status, and interval megawatt-hours, and megavar-hours. For generation projects larger than 10 MW, a direct telemetry connection to PHI System Operations will be required via a radial connection to PHI's telecommunications system or a rented data circuit, at the Interconnection Customer's cost.
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 Direct Connection 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 Interconnection Customer will be responsible for contributing to future O & M costs associated with the direct connect facilities.

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.

### **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.

**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.

1. (DP&L) The Piney Grove-Mount Hermon 69 kV line (from bus 232274 to bus 232272 ckt 1) loads from 148.42% to 154.54% (DC power flow) of its emergency rating (143 MVA) for the operational contingency 'CKT 23002'. This project contributes approximately 8.75 MW to the thermal violation.
2. (DP&L) The Kings Creek-Loretto 138 kV line (from bus 232129 to bus 232127 ckt 1) loads from 134.15% to 137.34% (DC power flow) of its emergency rating (351 MVA) for the operational contingency 'CKT 23002'. This project contributes approximately 11.21 MW to the thermal violation.
3. (DP&L) The Piney Grove-Piney Grove 138/230 kV transformer (from bus 232128 to bus 232007 ckt 1) loads from 119.15% to 122.77% (DC power flow) of its emergency rating (424 MVA) for the operational contingency 'CKT 13713'. This project contributes approximately 15.32 MW to the thermal violation.
4. (DP&L) The T-144 TAP-Costen 138 kV line (from bus 886230 to bus 232807 ckt 1) loads from 100.11% to 104.65% (DC power flow) of its emergency rating (247 MVA) for the operational contingency 'CKT 23002'. This project contributes approximately 11.21 MW to the thermal violation.
5. (DP&L) The Mount Hermon-North Salisbury 69 kV line (from bus 232272 to bus 232271 ckt 1) loads from 104.85% to 111.11% (DC power flow) of its emergency rating (140 MVA) for the operational contingency 'CKT 23002'. This project contributes approximately 8.75 MW to the thermal violation.

## **Secondary POI Option**

PJM studied X2-045 as a 20 MW injection at a tap of the Kenney-Mt. Olive 69kV circuit.

## **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.

### **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.

1. (DP&L) The Piney Grove-Mount Hermon 69 kV line (from bus 232274 to bus 232272 ckt 1) loads from 148.42% to 154.69% (DC power flow) of its emergency rating (143 MVA) for the operational contingency 'CKT 23002'. This project contributes approximately 8.96 MW to the thermal violation.
2. (DP&L) The Piney Grove-Piney Grove 138/230 kV transformer (from bus 232128 to bus 232007 ckt 1) loads from 119.15% to 122.73% (DC power flow) of its emergency rating (424 MVA) for the operational contingency 'CKT 13713'. This project contributes approximately 15.19 MW to the thermal violation.

3. (DP&L) The Kings Creek-Loretto 138 kV line (from bus 232129 to bus 232127 ckt 1) loads from 134.15% to 137.28% (DC power flow) of its emergency rating (351 MVA) for the operational contingency 'CKT 23002'. This project contributes approximately 11.00 MW to the thermal violation.
4. (DP&L) The T-144 TAP-Costen 138 kV line (from bus 886230 to bus 232807 ckt 1) loads from 100.11% to 104.57% (DC power flow) of its emergency rating (247 MVA) for the operational contingency 'CKT 23002'. This project contributes approximately 11.00 MW to the thermal violation.
5. (DP&L) The Mount Hermon-North Salisbury 69 kV line (from bus 232272 to bus 232271 ckt 1) loads from 104.85% to 111.25% (DC power flow) of its emergency rating (140 MVA) for the operational contingency 'CKT 23002'. This project contributes approximately 8.96 MW to the thermal violation.