Generation Interconnection Feasibility Study Report Queue Position W2-034

The Interconnection Customer (IC) has proposed a 20 MWE (7.5 MWC) solar powered generating facility consisting of ground mounted fixed panel solar photovoltaic arrays. The project is to be located in Salem County, New Jersey. PJM studied W2-034 as a 20 MW injection into the Atlantic City Electric (ACE) system at the Roadstown 12kVsubstation. The project was evaluated for compliance with reliability criteria for summer peak conditions in 2014. The planned in-service date, as stated in the Attachment N, is September 1, 2011.

Point of Interconnection

W2-034 will interconnect to the Atlantic City Electric system at a new substation to be built for the project.

Direct Connection Requirements

Transmission Owner Scope of Direct Connection Work

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

1. Design and construct a new 69/12 kV substation near the Customer Facility. This substation will be built to ACE's specifications and be owned and operated by ACE. ***Note: At this time there are no plans to serve any load from this substation.***
2. Create a transmission loop with a distance of 0.5 miles to the new substation.
3. Establish two new 12 kV feeders with PAC overhead conductor from the new substation to the PV site.
4. A utility operated recloser will be required on the customer tap that will have proper relaying and communication.
5. Utility grade primary metering will be required.
6. SCADA point addition to Control Center will be required.
7. Perform Dynamic Study.
8. Protection, Planning, and other engineering department studies, and design work.
9. Transfer trip to be installed in locations where a generator installation could be islandized with a minimum load that is less than 3 times the size of generator capacity.

The estimated cost to perform this work is as follows:

New Substation			
New Substation			$6,503,000
PAC Express Feeder	0.2	Miles	$80,000
Transmission Feed 69 kV	0.5	Miles	$325,000
Transmission Feed 138 kV	0	Miles	$0
Recloser w/ Relaying and Communications		2	$100,000
Utility Grade Metering		2	$40,000
SCADA Work		2	$20,000
Dynamic Study			$30,000
Various Departments Work			$20,000
Subtotal Cost			$7,118,000
Subtotal Cost with 18% Overheads			$8,399,240
Approximate Total Cost with 15% Contingency			$9,659,126

It is estimated it will take **24 – 36 months** to construct the new substation after receipt of a fully executed Interconnection Service Agreement (ISA) and Interconnection Construction Service Agreement (CSA).

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

Special Operating Requirements

1. ACE 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 of ACE.
2. The Interconnection Customer will grant its permission to PJM for PJM to send ACE all telemetry that the Interconnection Customer sends to PJM.
3. The Interconnection Customer will be required to make provisions for a voice quality phone line within approximately 3 feet of each ACE metering position to facilitate remote interrogation and data collection.

Interconnection Customer Scope of Direct Connection Work

The Interconnection Customer (IC) assumes full responsibility for design and construction of all facilities associated with the W2-034 generating station. Site preparation including grading and an access road, as necessary, is assumed to be by 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 Atlantic City Electric's Applicable Standards.

Inverter Requirements and Capabilities

The Interconnection Customer's inverter should 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 ACE to implement these capabilities with settings acceptable to Pepco Holdings, Inc. (ACE, DPL, and Pepco). 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

None

Stability Analysis

Not required due to project size.

Dynamic Analysis

A time-based dynamic study will be completed during the System Impact Study/Facilities Study phase of W2-034.

AC injection into the grid must follow a ramp up rate that does not negatively affect the distribution system. An inverter capable of dynamic VAR output with Droop and Time Delay settings will be required. Further study will be required to review the impact to the grid under all output scenarios and grid load profiles. The proposed project will be reviewed for protection and coordination issues and any other required upgrades will be identified in future studies.

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. The RDSTN TP-QUINTON 69 kV line (from bus 228223 to bus 228329 ckt 1) loads from 66.39% to 84.07% (DC power flow) of its normal rating (44 MVA) for non-contingency condition. This project contributes approximately 7.78 MW to cause the thermal violation.

2. The CRLS CR2-SHRMAN#2 69 kV line (from bus 228252 to bus 228226 ckt 1) loads from 110.98% to 123.16% (DC power flow) of its normal rating (44 MVA) for non-contingency condition. This project contributes approximately 5.36 MW to cause the thermal violation.

3. The LAUREL#2-LAUREL 69 kV line (from bus 228259 to bus 228218 ckt 1) loads from 123.1% to 131.03% (DC power flow) of its emergency rating (149 MVA) for the single line contingency ('USLC-SM_V4-036B_WITH_W1-085B'). This project contributes approximately 11.83 MW to cause the thermal violation.

4. The RDSTN TP-QUINTON 69 kV line (from bus 228223 to bus 228329 ckt 1) loads from 111.43% to 127.52% (DC power flow) of its emergency rating (56 MVA) for the single line contingency ('WOOD-LAUR'). This project contributes approximately 9.01 MW to cause the thermal violation.

5. The CRLS CR2-SHRMAN#2 69 kV line (from bus 228252 to bus 228226 ckt 1) loads from 255.1% to 267.41% (DC power flow) of its emergency rating (56 MVA) for the single line contingency ('USLC-SM_V4-036B_WITH_W1-085B'). This project contributes approximately 6.89 MW to cause the thermal violation.