Generation Interconnection
Feasibility Study Report
Queue Position X1-112

The Interconnection Customer (IC) has proposed a 20 MWE (4.60 MWC; 20 MW MFO) combined solar and wind powered generating facility. The project consists of a 12 MW wind facility along with an 8 MW solar facility. The project is to be located in Pennsville, New Jersey. PJM studied X1-112 as a 20 MW injection into the Atlantic City Electric (ACE) 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 December 31, 2012.

Point(s) of Interconnection

The Interconnection Customer requested a Primary and Secondary Point of Interconnection (POI) be evaluated for the X1-112 project. The Primary POI selected was a 69kV transmission level interconnection at the Churchtown substation. The Secondary POI selected was a 12kV distribution interconnection also at the Churchtown substation. The results are provided in the Transmission Network Impacts section below.

Direct Connection Requirements

Primary Option

X1-112 will interconnect with the Atlantic City Electric system at a new terminal in the existing Churchtown 69kV substation.

Transmission Owner Scope of Direct Connection Work

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

Attachment Facilities (i.e. terminal position, ring bus, identify substation/line)

Substation Engineering Estimate:
Scope: Construct a new 69kV terminal at the existing Churchtown substation.
Estimate: $1,200,000
Construction Time: 24 – 36 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

The estimated time to complete this work is commences 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. The Company 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 the Company.

2. The Interconnection Customer will grant its permission to PJM for PJM to send the Company the following telemetry data that the Interconnection Customer sends to PJM: real time megawatts, megavars, volts, amperes and status, and interval megawatt-hours, and megavar-hours. For generation 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.

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 Atlantic City Electric'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)

1. The (AE) The Chambers-Pedricktown 230 kV line (from bus 228311 to bus 228312 ckt 1) loads from 106.78% to 108.1% (DC power flow) of its emergency rating (552 MVA) for the single contingency 'CHUR-ORCH'. This project contributes approximately 7.32 MW to the thermal violation.

2. The (AE) The Churchtown-Deepwater 69 kV line (from bus 228319 to bus 228323 ckt 1) loads from 121.80% to 125.89% (DC power flow) of its emergency rating (294 MVA) for the single contingency 'MICK-BRIDG'. This project contributes approximately 12.05 MW to the thermal violation.

3. The (AE) The Pedricktown-Bridgeport 230 kV line (from bus 228312 to bus 228313 ckt 1) loads from 126.11% to 127.42% (DC power flow) of its emergency rating (552 MVA) for the single contingency 'CHUR-ORCH'. This project contributes approximately 7.31 MW to the thermal violation.

Atlantic City Electric Identified Overloads

1. The W3-163Tap - W3-164Tap (228261-228263) loads from 104.46% to 105.73% of its normal rating (44 MVA) for non-contingency. This project contributes approximately 0.59MW.

2. The W3-163Tap - W3-164Tap (228261-228263) loads from 113.82% to 114.94% of its emergency rating (54 MVA) for the "MICK-BRIGE" contingency. This project contributes approximately 0.63MW.

3. The W3-164Tap - Clayton (228263 - 228405) loads from 120.64% to 121.92% of its normal rating (44 MVA) for non-contingency. This project contributes approximately 0.59MW.

4. The W3-164Tap - Clayton (228263 - 228405) loads from 126.92% to 128.04% of its emergency rating (54 MVA) for the "MICK-BRIGE" contingency. This project contributes approximately 0.63MW.

Short Circuit

No issues identified.

Stability Analysis

Not required due to project size.

Other Charges

It is anticipated that the Interconnection Customer will be charged for ongoing operation and maintenance of the attachment facilities. The methodology of calculating this charge is still under development.

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.

1. To mitigate the Chambers-Pedricktown 230kV line overload will require the installation of a second 230/69kV transformer at Churchtown and convert the 69kV system to a ring bus. The estimated cost to perform this work is **$8.6M** and will take **24 to 36 months** to complete.

2. To mitigate the Churchtown-Deepwater 69kV line overload will require the upgrading the Deepwater-Churchtown 69 kV line to 3500 amps minimum. The estimated cost to perform this work is **$1.6M** and will take **30 to 36 months** to complete. The cost does not include environmental or Rights Of Way costs.

3. To mitigate the Pedricktown-Bridgeport 230 kV line overload will require upgrading the Bridgeport 230 kV 1590 AL strand bus to 2-1590 AL at the Pedricktown substation. The estimated cost to perform this work is **$0.02M** and will take **18 to 24 months** to complete.

Contribution to Previously Identified System Reinforcements for Atlantic City Electric Identified Overloads

1-4. To mitigate the above overloads will require the reconductoring of the Woodstown-Clayton 69kV circuit from the intersection of Route 77 and the Woodstown-Clayton 69kV line (proposed

location of connection of W3-163) to the Clayton substation, a distance of 9.5 miles with 795 ACSR. The estimated cost to perform this work is **$3,300,000** and will take **18 to 24 months** to complete.

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 Option

PJM studied X1-112 as a 20 MW injection at the Churchtown 12kV 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

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)

1. The (AE) The Chambers-Pedricktown 230 kV line (from bus 228311 to bus 228312 ckt 1) loads from 106.78% to 108.1% (DC power flow) of its emergency rating (552 MVA) for the single contingency 'CHUR-ORCH'. This project contributes approximately 7.32 MW to the thermal violation.

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Short Circuit

No issue identified.

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