

***Generation Interconnection
Feasibility Study Report
Queue Position X1-097***

The Interconnection Customer (IC) has proposed a 50 MWE (50 MWC, 50 MW MFO) fuel cell powered generating facility consisting of 25 fuel cell blocks. The project is to be located in Newcastle County, Delaware. PJM studied X1-097 as a 50 MW injection into the Delmarva Power and Light (DPL) system as an injection into the Red Lion 138kV substation. The project was evaluated for compliance with reliability criteria for summer peak conditions in 2015. The proposed in-service date, as stated in Attachment N, is June 28, 2012.

Point of Interconnection

X1-097 will interconnect with the Delmarva Power and Light transmission system at the Red Lion 138kV substation.

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:

Substation Engineering Estimate:

Scope: Construct a new 138kV terminal at the existing Red Lion 138kV substation by adding a fourth circuit breaker.

Estimate: \$1,500,000

Construction Time: 18 months

Note: If location of generator is greater than 500 feet from substation an additional Interconnection Customer circuit breaker will be required.

Additional costs upon further engineering review may result. Contribution in Aid of Construction (CIAC) tax will be included upon further study.

Transmission Owner Special Operating Requirements

- PHI will require the capability to remotely trip the generator from its System Operations facility.
- The Interconnection Customer will grant its permission for PJM to send PHI all telemetry that the Interconnection Customer sends to PJM.
- 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.

- 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 between the Interconnection Customer and PHI.

Interconnection Customer Scope of Direct Connection Work

The Interconnection Customer (IC) is responsible for all design and construction related 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.

Protective relaying and metering design and installation must comply with PHI's applicable standards. The IC is also required to provide revenue metering and real-time telemetering data to PJM in conformance with the requirements contained in PJM Manuals M-01 and M-14 and the PJM Tariff.

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 (PECO) Linwood-Chichester 2 230 kV line (from bus 213750 to bus 213490 ckt 2) loads from 115.39% to 115.54% (DC power flow) of its emergency rating (983 MVA) for the single contingency '220-43'. This project contributes approximately 9.86 MW to the thermal violation.
2. The (PECO/BG&E) Cooper-Graceton 230 kV line (from bus 214089 to bus 220964 ckt 1) loads from 117.31% to 117.49% (DC power flow) of its emergency rating (485 MVA) for the single contingency 'PJM17'. This project contributes approximately 5.61 MW to the thermal violation.

3. The (PECO) Peach Bottom-Cooper 230 kV line (from bus 213869 to bus 214089 ckt 1) loads from 118.79% to 118.98% (DC power flow) of its emergency rating (485 MVA) for the single contingency 'PJM17'. This project contributes approximately 5.61 MW to the thermal violation.

Short Circuit

No overstressed breakers were identified.

Stability Analysis

Is required and will be performed during System Impact Study phase of the project.

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 (PECO) Linwood-Chichester 2 230 kV line (from bus 213750 to bus 213490 ckt 2) overload will require the installation of a 3rd Chichester-Linwood 230kV line underground with a minimum summer normal and emergency rating of 831/983 MVA. This line is approximately 1.6 miles long. A new 230kV bus position and breaker at Chichester and Linwood Substations will be required for this new line. The estimated cost to perform this work is **\$25,000,000** and will take **4 years** to complete. The cost does not include any right-of-way which may be required.
2. To mitigate the (PECO/BG&E) Cooper-Graceton 230 kV line (from bus 214089 to bus 220964 ckt 1) overload will require the following:

PECO Portion:

The reconductoring of line 220-93 from the Cooper Substation to Graceton Substation to get a minimum summer emergency rating of 725 MVA. The line is approximately 4 miles long. The estimated cost to perform this work is **\$2.8M** and will require **24 months** to complete. This cost is for the PECO portion only.

BGE Portion:

A double circuit line will be built with 1033.5kcmil ACSR creating one circuit by connecting the two lines into one. Rating for 2 – 1033.5kcmil 45/7 ACSR (Ortolan) at 125°C = 968/1227MVA

SN/SE. BGE ownership is for 1.85 miles and the rebuild of 11 structures. It would be built as a double circuit line with the conductors jumpered across at the terminal ends. The line construction is estimated at \$3,000,000. Two breakers (\$400,000/breaker) would need to be replaced at Graceton for a cost of \$800,000. An additional cost of \$200,000 would also be incurred for 4 breaker disconnects and line connections to cover thermal. The project is estimated to take **30 months** to complete: 12 months for the CPCN process & design and an additional 18 months for construction. The total cost of the project is estimated at **\$4.0M**.

3. To mitigate the (PECO) Peach Bottom-Cooper 230 kV line (from bus 213869 to bus 214089 ckt 1) overload will require reconductoring line 220-08 from PB Tap to Cooper Substation to get a minimum summer emergency rating of 741 MVA. The line is approximately 1.4 miles long. The estimated cost to perform this work is **\$1.0M** and will require **24 months** to complete.