

***Generation Interconnection
Combined
Feasibility/System Impact Study Report***

For

***PJM Generation Interconnection Request
Queue Position X2-083***

Newark 12kV

October 2011

Preface

The intent of the Combined Feasibility/ System Impact Study is to determine a plan, with approximate cost and construction time estimates, to connect the subject generation interconnection project to the PJM network at a location specified by the Interconnection Customer. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system. All facilities required for interconnection of a generation interconnection project must be designed to meet the technical specifications (on PJM web site) for the appropriate transmission owner.

In some instances an Interconnection Customer may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection or merchant transmission upgrade, may also contribute to the need for the same network reinforcement. The possibility of sharing the reinforcement costs with other projects may be identified in the Feasibility Study, but the actual allocation will be deferred until the System Impact Study is performed.

Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The project developer may be responsible for the right of way, real estate, and construction permit issues. For properties currently owned by Transmission Owners, the costs may be included in the study.

General

Diamond State Generation Partners, LLC, the Interconnection Customer (IC), has proposed a 4 MWE (4 MWC: 4 MW MFO) fuel cell powered generating facility consisting of 2 fuel cell blocks. The project will be located in Newark, Delaware. PJM studied X2-083 as a 4 MW injection into the Delmarva Power and Light system and evaluated the project for compliance with reliability criteria for summer peak conditions in 2015. The proposed in-service date is June 15, 2012.

Point of Interconnection

X2-083 will interconnect with the Delmarva Power and Light (DPL) distribution system as follows (see Attachment 1):

3 MWs will connect to the existing Feeder DE0221 from the Brookside Substation; 1 MW will connect to the existing Feeder DE0603 from the Harmony Substation

Direct Connection Requirements

Transmission Owner (DPL) Scope of Direct Connection Work

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

1. Establish one new 12kV feeder with 397 ACSR conductor from the DE0221 feeder (Brookside substation) to the generating facility – approximately .25 miles.

2. Establish one new 12kV feeder with 477 AAC cable from the DE0603 feeder (Harmony substation) to the generating facility – approximately 1.2 miles.
3. A utility operated recloser will be required on the customer tap that will have proper relaying and communication.
4. Utility grade primary metering will be required.
5. Generation telemetry and remote trip capabilities will be provided to the control center.
6. Protection, Planning, and other engineering departments will perform studies, design work, and prepare engineering estimates.
7. The capability to accept generator output reduction commands should be built into the generator control.
8. Transfer trip may be required.

The estimated cost to perform this work is as follows:

Estimated Costs			
Brookside Substation Feeder DE0221			
397 ACSR Cable Installation	0.25	Miles	\$100,000
Fiber Installation		Miles	\$12,500
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			\$212,500
Subtotal Cost with 18% Overheads			\$250,750
Approximate Total Cost with 15% Contingency			\$288,363

Estimated Costs			
Harmony Substation Feeder DE0603			
477 AAC Cable Installation	1.2	Miles	\$648,000
Fiber Installation		Miles	\$60,000
Recloser w/ Relaying and Communications			\$50,000
Utility Grade Metering			\$20,000
SCADA Integration into EMS			\$10,000
Subtotal Cost			\$788,000
Subtotal Cost with 18% Overheads			\$929,840
Approximate Total Cost with 15% Contingency			\$1,069,316

Approximate Total Cost for Two Feeders: **\$1,357,679**

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 of PHI.
2. The Interconnection Customer will grant its permission to PJM for PJM to send PHI 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.
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 DPL Distribution Engineering.

Interconnection Customer Scope of Direct Connection Work

The Interconnection Customer (IC) assumes full responsibility for the design and construction of all facilities associated with the X2-083 generating facility on the IC side of the Point of Interconnection.

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.

Inverter Requirements and Capabilities

The Interconnection Customer's inverter 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 Fuel Cell 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

None

Stability Analysis

Not required due to project size.

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

Other Charges

DPL reserves the right to charge the Interconnection Customer operation and maintenance expenses to maintain the Inter Connection Customer attachment facilities, including metering and telecommunications facilities, owned by DPL.

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

Attachment 1

