Generation Interconnection
Feasibility Study Report
Queue Position AB1-141

The Interconnection Customer (IC) has proposed a 19.8 MW MFO (13.5 MWC) solar generating facility to be located in Sudlersville, Maryland. PJM studied AB1-141 as a 19.8 MW injection into the Delmarva Power and Light Company's (DPL) system and evaluated it for compliance with reliability criteria for summer peak conditions in 2019. The planned in-service date, as stated during the kick-off call, is November 1, 2017.

Point of Interconnection

The IC requested a primary and secondary Point of Interconnection (POI). The primary POI option is a tap of the Church-Price 69 kV circuit (see Attachment 1). The secondary POI option is a tap of the Church-Wye Mills 138 kV circuit.

AB1-141 will require a Point of Interconnection (POI) off DPL's 69 kV Circuit 6710 between Church Substation and Price Substation in Queen Anne's County, Maryland. The connection off of Circuit 6710 will require the construction of a new substation with a 69 kV three position ring bus.

Direct Connection Requirements

Transmission Owner Scope of Direct Connection Work

Substation Engineering Estimate:

Scope: Build a new 69 kV substation with a 3 position ring bus (with provisions to add a 4th position for PJM Queue Project AB1-142) off of the right-of-way for Circuit 6710 in Queen Anne's County, Maryland. Two of the positions on the ring bus will be transmission line terminals for the tie-in of Circuit 6710 to the substation. The third position will be a terminal configured for the interconnection of a generator.

Estimate: $4,526,573

Construction Time: 24 months, plus outage delays

Major Equipment Included in Estimate:

- Control Enclosure, 20' x 15' Qty. 1
- Power Circuit Breaker, 69 kV, 2000A, 40kA, 3 cycle Qty. 3
- Disconnect Switch, 69 kV, 2000A, Manual Wormgear, Arcing Horns Qty. 9
- CT/VT Combination Units, 69 kV Qty. 3
- CVT, 69 kV Qty. 6
- Disconnect Switch Stand, High, 69 kV, Steel Qty. 5
- Disconnect Switch Stand, Low, 69 kV, Steel Qty. 4
- CT/VT Stand, Single Phase, Low, 69 kV, Steel Qty. 3
- CVT Stand, Single Phase, Low, 69 kV, Steel Qty. 6

- SSVT, 69 kV/240-120 V Qty. 1
- Relay Panel, Transmission Line, FL/BU (20") Qty. 3
- Control Panel, 69 kV Circuit Breaker (10") Qty. 3
- Take-off structure, 69 kV Qty. 2
- Bus Support Structure, 3 phase, 69 kV, Steel Qty. 8

Estimate Assumptions:

- Land purchase for the substation is not included. Land purchase to be performed by the Developer
- A 2.5 acre, relatively square lot is available for use
- Site clearing and grading performed by Developer
- Permitting for the site to be performed by the Developer
- Lightning protection (lightning masts) are not required

Transmission Engineering Estimate:
Scope: Reconfigure Line 6710 to accommodate the new line terminal positions at the new substation between Church Substation and Price Substation.
Estimate: $350,000
Construction Time: 24 months

Required Relaying and Communications

New protection relays are required for the new line terminals. An SEL-421 will be required for primary protection and an SEL-311C will be required for back-up protection. A 20" relay panel will be required for each transmission line (2 total).

New protection relays are required for the new generator terminal. An SEL-487 will be required for primary protection and an SEL-387 will be required for back-up protection. A 20" relay panel is required.

A SEL-451 relay on a 10" breaker control panel will be required for the control and operation of the new 69 kV circuit breakers (3 total).A communications panel with an Orion microprocessor, GPS clock, and Ethernet switch will be required on a 20" panel.
The cost of the required relay and communications at the new substation is included in the Substation Interconnection Estimate.

The remote ends of Circuit 6710 at Church Substation and Wye Mills Substation will require relay replacements to install a SEL-421 and SEL-311C relay for primary and back-up protection. The relay replacements at both ends will cost a total of **$400,000** and will require **24 months**, plus any outage delays, to complete.

Metering

Three phase 69 kV revenue metering points will need to be established. DPL will purchase and install all metering instrument transformers as well as construct a metering structure. The secondary wiring connections at the instrument transformers will be completed by DPL's metering technicians. The metering control cable and meter cabinets will be supplied and installed by DPL. DPL will install conduit for the control cable between the instrument transformers and the metering enclosure.

The location of the metering enclosure will be determined in the construction phase. DPL will provide both the Primary and the Backup meters. DPL's meter technicians will program and install the Primary & Backup solid state multi-function meters for each new metering position. Each meter will be equipped with load profile, telemetry, and DNP outputs. The IC will be provided with one meter DNP output for each meter. DPL will own the metering equipment for the interconnection point, unless the IC asserts its right to install, own, and operate the metering system.

The estimate for DPL to design, purchase, and install metering as specified in the aforementioned scope for metering is included in the Substation Interconnection Estimate.

Interconnection Customer Scope of Direct Connection Work

The Interconnection Customer 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. Protective relaying and metering design and installation must comply with DPL'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.

DPL requires that an IC circuit breaker is located within 500 feet of the DPL substation to facilitate the relay protection scheme between DPL and the IC at the Point of Interconnection (POI).

Special Operating Requirements

1. The Company (ACE, DPL, and Pepco) will require the capability to remotely disconnect the generator from the grid by communication from its System Operations facility. Such disconnection may be facilitated by a generator breaker, a line recloser, or other method depending upon the specific circumstances and the evaluation by the Company.

2. It is the Interconnection Customer's responsibility to send the data that PJM and the Company require directly to PJM. The Interconnection Customer will grant permission for PJM to send to the Company the following telemetry that the Interconnection Customer sends to PJM: real time MW, MVAR, volts, amperes, generator/status, and interval MWH and MVARH.

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

Network Impacts

Potential transmission network impacts are as follows:

Primary Point of Interconnection

Queue Project AB1-141 was evaluated as a 19.8 MW (Capacity 13.5 MW) tap of the Church-Price 69 kV circuit.

Generator Deliverability

*(Single or N-1 contingencies for the **Capacity** portion only of the interconnection)*

None

Multiple Facility Contingency

*(Double Circuit Tower Line Contingencies only with **full energy** output. Stuck Breaker and Bus Fault contingencies will be applied during the Impact Study)*

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

Not required.

Stability Analysis

To be completed during later phases of the study process if required.

Light Load Analysis

(Light Load Studies to be conducted during later study phases (applicable to wind, coal, nuclear, and pumped storage projects).

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 Interconnection Customer 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:

None

Secondary Point of Interconnection

Queue Project AB1-141 was evaluated as a 19.8 MW (Capacity 13.5 MW) tap of the Church-Wye Mills 138 kV circuit.

Generator Deliverability

*(Single or N-1 contingencies for the **Capacity** portion only of the interconnection)*

None

Multiple Facility Contingency

(Double Circuit Tower Line Contingencies only with full energy output. Stuck Breaker and Bus Fault contingencies will be applied during the Impact Study)

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

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conditions associated with the identified overloaded element(s). As a result of the aggregate energy resources in the area, the following violations were identified:

None

Facilities Study Estimate

The estimated time for PJM to issue a Facilities Study Report is **8 months.** The deposit required for the AB1-141 project will be is **$50,000.**

Cost estimates will further be refined as a part of the Impact Study and Facilities Study for this project. The Interconnection Customer will be responsible for all costs incurred by DPL in connection with the AB1-141 project. Such costs may include, but are not limited to, any transmission system assets currently in DPL's rate base that are prematurely retired due to the AB1-141 project. PJM shall work with DPL to identify these retirement costs and any additional expenses. DPL reserves the right to reassess issues presented in this document and, upon appropriate justification, submit additional costs related to the AB1-141 project.