Generation Interconnection System Impact Study Report

For

PJM Generation Interconnection Request Queue Position AB1-162

“Price 25 kV”

September 2016

Preface

The intent of the 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.

The System Impact Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The Interconnection Customer is 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

Casper Solar Center, LLC, the Interconnection Customer (IC), has proposed a 16.7 MW MFO (6.34 MWC) solar generating facility to be located in Church Hill, Maryland. PJM studied AB1-162 as a 16.7 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 requested by the IC during the kick-off call, is July 1, 2017. This date is not attainable due to the need for additional studies and the Transmission Owner construction schedule.

Point of Interconnection

AB1-162 will require a Point of Interconnection (POI) off DPL's 69 kV Price Substation in Queen Anne's County, Maryland. A POI at Price Substation will require the expansion of the 69 kV bus to a ring bus configuration with a total of 4 terminals (two terminals for Circuit 6710, one terminal for Price T1, and one terminal for AB1-162). See Attachment 1.

Transmission Owner (TO) Scope of Work

Substation Interconnection Estimate

Scope: Reconfigure Price 69 kV Substation to be a 4 position ring bus (with provisions to add a 5th position). This will include adding 3 new 69 kV circuit breakers, disconnect switches, CVTs, line relays, breaker relays, and associated bus equipment and support structures. Create a 69 kV terminal position for the interconnection of a generator. (PJM Network Upgrade Number n5118)

Estimate: $3,472,357
Construction Time: 24 months, plus any outage delays

Major Equipment Included in Estimate:

- Power Circuit Breaker, 69 kV, 2000A, 40kA, 3 cycle Qty. 3
- Disconnect Switch, 69 kV, 2000A, Manual Wormgear, Arcing Horns Qty. 10
- CT/VT Combination Units, 69 kV Qty. 3
- CVTs Qty. 6
- Disconnect Switch Stand, High, 69 kV, Steel Qty. 6
- 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
- Relay Panel, Transmission Line, FL/BU (20") Qty. 3
- Control Panel, 69 kV Circuit Breaker (10") Qty. 3
- Bus Support Structure, 3 phase, 69 kV, Steel Qty. 8

Estimate Assumptions:

- The property adjacent to the East of Price Substation will be purchased for the expansion of the substation. DPL estimates that an additional 1 acre of land will need to be acquired East of Price Substation. The cost of the purchasing this property is not included in the estimate.
- Price Substation's East fence line will need to be expanded out to include the additional area procured for the substation expansion
- Permitting will be performed by DPL
- No expansion of the existing control house is required
- Storm water management is required, as a disturbance of greater than 5000 square feet requires mitigation
- Clearing and grading of the adjacent site is minimal

Transmission Engineering Interconnection Estimate
Scope: Reconfigure Line 6710 to accommodate new line terminal positions at Price Substation. (PJM Network Upgrade Number n5118)
Estimate: $350,000
Construction Time: 24 months

Required Relaying and Communications
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.

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 is required (2 total).

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).
An Ethernet switch will be required to interface the new protection relays with the existing Orion data concentrator. New equipment will need to be installed and tested.

The cost of the required relay and communications at Price Substation is included in the Substation Interconnection Estimate.

Relay replacements at the remote ends of Circuit 6710 at Church Substation and Wye Mills Substation. SEL-421 and SEL-311C relays will be installed 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 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.

It is the IC's responsibility to send the data that PJM and DPL requires directly to PJM. The IC will grant permission for PJM to send DPL the following telemetry that the IC sends to PJM: real time MW, MVAR, volts, amperes, generator status, and interval MWH and MVARH.
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 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 Interconnection Customer Scope of Direct Connection Work Requirements:

- 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. DPL 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, or other method depending upon the specific circumstances and the evaluation by DPL.

2. DPL 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 DPL.

Additional Interconnection Customer Responsibilities:

1. The Interconnection Customer may be required to install and/or pay for metering as necessary to properly track real time output of the facility as well as installing metering which shall be used for billing purposes. See Section 8 of Appendix 2 to the Interconnection Service Agreement as well as Section 4 of PJM Manual 14D for additional information.

Summer Peak Analysis - 2019

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, Fault with a Stuck 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

Summer Peak Load Flow Analysis Reinforcements

New System Reinforcements
(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)

None

Contribution to Previously Identified System Reinforcements
(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)

None

Steady-State Voltage Requirements

No issues identified.

Short Circuit

No issues identified.

Stability and Reactive Power Requirement

No issues identified.

Delivery of Energy Portion of Interconnection Request
PJM also studied the delivery of the energy portion of this interconnection request. Any 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 Merchant Transmission Interconnection request.
Only the most severely overloaded conditions are listed. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed, which will study all overload conditions associated with the overloaded element(s) identified.

None

Light Load Analysis - 2019
Light Load Studies to be conducted during later study phases (as required by PJM Manual 14B).

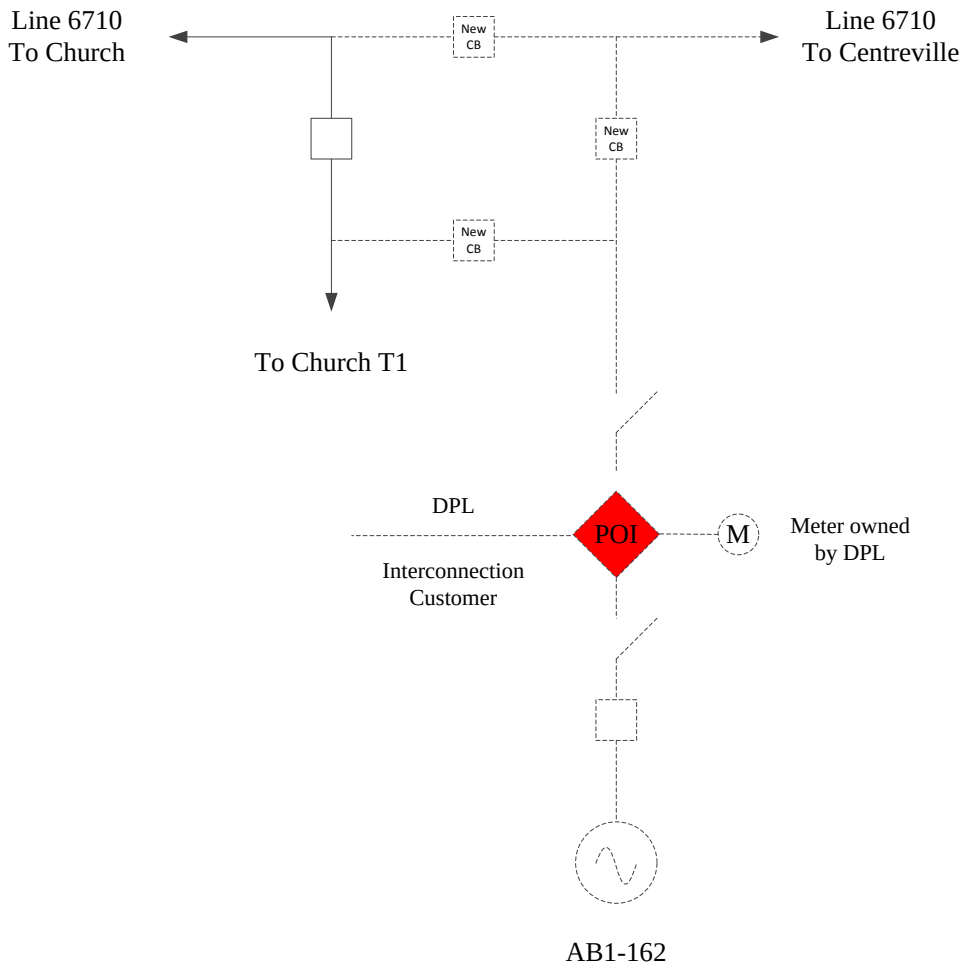
Facilities Study Estimate
The estimated time for PJM to issue a Facilities Study Report is 7 months. The deposit required for the AB1-162 project will be $50,000.

Delmarva Power and Light Costs

Cost estimates will further be refined as a part of the Facilities Study for this project. The Interconnection Customer will be responsible for all costs incurred by DPL in connection with the AB1-162 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 AB1-162 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 AB1-162 project.

Attachment 1

AB1-162
Price 69 kV
Price Substation



An Interconnection Customer circuit breaker will be required no more than 500 feet from the DPL substation.

POI Point of Interconnection