

***Generation Interconnection  
System Impact Study Report***

***For***

***PJM Generation Interconnection Request  
Queue Position AB1-141***

***“Church-Price 69 kV I”***

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**

OneEnergy Development, LLC, 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 requested by the IC during the kick-off call, is November 1, 2017. This date is not attainable due to the need for additional studies and the Transmission Owner construction schedule.

### **Point of Interconnection**

AB1-141 will require a Point of Interconnection (POI) off DPL's 138 kV Circuit 13723 between Church Substation and Wye Mills Substation in Queen Anne's County, Maryland. The connection off of Circuit 13723 will require the construction of a new substation with a 138 kV three position ring bus (see Attachment 1).

### **Transmission Owner (TO) Scope of Work**

#### **Substation Interconnection Estimate**

**Scope:** Build a new 138 kV substation with a 3 position ring bus (with provisions to add a 4<sup>th</sup> position for PJM Queue Projects AB2-032/AB2-153) off of the right-of-way for Circuit 13723 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 13723 to the substation. The third position will be a terminal configured for the interconnection of a generator. (PJM Network Upgrade Number n5119)

**Estimate:** \$4,600,000

**Construction Time:** 24 months, plus outage delays

**Major Equipment Included in Estimate:**

• Control Enclosure, 20' x 15'	Qty. 1
• Power Circuit Breaker, 138 kV, 2000A, 40kA, 3 cycle	Qty. 3
• Disconnect Switch, 138 kV, 2000A, Manual Wormgear, Arcing Horns	Qty. 9
• CT/VT Combination Units, 138 kV	Qty. 3
• CVT, 138 kV	Qty. 6
• Disconnect Switch Stand, High, 138 kV, Steel	Qty. 5
• Disconnect Switch Stand, Low, 138 kV, Steel	Qty. 4
• CT/VT Stand, Single Phase, Low, 138 kV, Steel	Qty. 3
• CVT Stand, Single Phase, Low, 138 kV, Steel	Qty. 6
• SSVT, 138 kV/240-120 V	Qty. 1
• Relay Panel, Transmission Line, FL/BU (20")	Qty. 3
• Control Panel, 138 kV Circuit Breaker (10")	Qty. 3
• Take-off structure, 138 kV	Qty. 2
• Bus Support Structure, 3 phase, 138 kV, Steel	Qty. 8

**Estimate Assumptions:**

- Land purchase for the substation is not included. Land purchase to be performed by the Developer
- A 3.0 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

**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 138 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.

## **Metering**

Three phase 138 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 AB1-141 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 AB1-141 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.

# AB1-141

## Church – Wye Mills 138kV

### New 138kV Substation

