Generation Interconnection Facilities Study Report

For

PJM Generation Interconnection Request Queue Position AB2-032/AB2-153

"Church-Wye Mills 138 kV"

December 2019

Table of Contents

A. Transmission Owner Facilities Study Summary 3

1. Description of Project 3

2. Amendments to the System Impact Study or System Impact Study Results 3

3. Interconnection Customer's Milestone Schedule 3

4. Customer's Scope of Work 3

5. Description of Facilities Included in the Facilities Study (DPL's Scope of Work) 4

6. Total Cost of Transmission Owner Facilities Included in the Facilities Study 5

7. Summary of the Schedule for Completion of Work for the Facilities Study 5

B. Transmission Owner Facilities Study Results 5

1. Transmission Lines –New 6

2. Transmission Lines – Upgrade 6

3. New Substation/Switchyard Facilities 6

4. Substation/Switchyard Facility Upgrades 6

5. Telecommunications Facilities – Upgrades 6

6. Metering & Communications 7

7. Environmental, Real Estate and Permitting 7

8. Summary of Results of Study 7

9. Schedules and Assumptions 8

Attachment #1 9

A. Transmission Owner Facilities Study Summary

1. Description of Project

OneEnergy Development, LLC, the Interconnection Customer (IC), has proposed two solar projects, AB2-032 and AB2-153. AB2-03 is a 20 MW Maximum Facility Output (MFO) and 13.6 MW Capacity project and AB2-153 is a 20 MW MFO and 7.6 MW Capacity upgrade project for a combined 40 MW MFO and 21.2 MW Capacity generating resource to be located in Sudlersville, Maryland. PJM studied AB2-032/AB2-153 as a combined 40 MW injection into the Delmarva Power and Light Company's (DPL) system at a tap (AB1-141/AB1-142) of the Church-Wye Mills 138 kV circuit and evaluated it for compliance with reliability criteria for summer peak conditions in 2020.

The interconnection of the AB2-032/AB2-153 combined project will require the addition of a 138 kV line terminal to the ring bus of the DPL substation to be constructed by previous PJM queue projects AB1-141/AB1-142.

The IC is required to construct a switching station within 500 feet of DPL's new substation to be constructed by the AB1-141/AB1-142 project. This station will contain a circuit breaker and the revenue metering equipment and will act as the Point of Interconnection (POI). A short line/bus will connect the POI station to the terminal in the DPL substation's yard (see Attachment #1).

2. Amendments to the System Impact Study or System Impact Study Results

The Attachment Facilities work scope for the AB2-032 and AB2-153 projects, as stated in their System Impact Study Reports, submitted in April 2017, has remained relatively unchanged. Network upgrades contained in both Reports have been removed as a result of a PJM AB2 queue re-tool/re-study driven by the withdrawal of earlier queue projects. In addition, the estimates herein provided were performed in more detail than those provided in the System Impact Study.

3. Interconnection Customer's Milestone Schedule

It is anticipated that the work scope for the AB2-032/AB2-153 projects will be included with that of the AB1-141/AB1-142 projects. Therefore, the planned in-service date for the AB2-03/AB2-153 projects is the same as that of the AB1-141/AB1-142 projects (December 31, 2023).

4. Customer's Scope of Work

The Interconnection Customer (IC) is responsible for all design and construction related to activities on their side of the Point of Interconnection (POI). Site preparation, including clearing, grading and an access road, as necessary, is assumed to be by the IC. Route selection, line design, and right-of-way acquisition for the IC's facilities are not included in this report and are 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.

5. Description of Facilities Included in the Facilities Study (DPL's Scope of Work)

Substation Interconnection Estimate

Scope: Add a new (fourth) position to the 138 kV ring bus substation to be constructed for the previous PJM queue project AB1-141/AB1-142. This includes adding a circuit breaker, disconnect switches, CVT's, foundations, structures, and protection and control systems as required. (PJM Network Upgrade Number n5299)

Estimate: $1,194,140

Construction Time: 24-36 months

Major Equipment Included in Estimate:

- Gas Circuit Breaker, 138 kV, 2000 A, 40 kA, 3-Cycle
- Disconnect Switch, 138 kV, 2000 A, Manual Worm Gear (Three-Phase)
- CVT, 138 kV Class, Single-Phase
- Surge Arrester, 138 kV Station Class, Polymer
- Control Panel, 138 kV Circuit Breaker (10")
- Relay Panel, 138 kV Bus Differential, FL/BU (20")
- Revenue Grade Meter

Substation Estimate Assumptions:

- The scope for PJM Queue Project AB1-141/AB1-142 as defined in its Facilities Study Report has already been completed prior to starting this project. If the AB1-141/AB1-142 substation is not constructed, partially constructed, or is built differently than defined in the Facilities Study, the scope and cost of the AB2-032/AB2-153 project may change.

- Any site development, including but not limited to clearing and grading, will be by the IC.
- All permitting for this project will be by the IC.
- Soil conditions are normal for this area such that driven piles will not be required, and standard drilled piers can be used. If soil borings reveal poor soil conditions, more expensive types of foundations may be required.
- The soil is not contaminated and does not require special handling and disposal.

Required Relaying:

The following are the relaying requirements for this project:

- The AB2-032/AB2-153 line/bus will use a current differential scheme for front-line and backup protection.
- A breaker control relay will be added for the new 138 kV circuit breaker to provide control and stuck breaker protection.
- Existing control and protection schemes will be modified as required to accommodate the addition of the new circuit breaker to the ring bus.
- Current and control cables will need to be installed between the IC's control enclosure and the DPL substation's trench system. These will be installed in underground conduit.

DPL reserves the right to review the electrical protection design and relay settings for interconnecting customer facilities to ensure that the protective relaying equipment will be compatible with that installed at the remote substations. DPL personnel must be present at the time of commissioning to witness proper function of the protection scheme and related coordination.

6. Total Cost of Transmission Owner Facilities Included in the Facilities Study

Item	*Total Cost*
Substation Attachment Facilities	$1,194,140
Total Cost	**$1,194,140**

7. Summary of the Schedule for Completion of Work for the Facilities Study

Attachment Facilities	*Timeframe*
Engineering, Procurement, and Construction	24-36 months

B. Transmission Owner Facilities Study Results

This section describes facilities identified to be installed (attachment facilities), replaced, and/or upgraded (upgrade facilities) by DPL to accommodate the project. During detailed design and analysis other components may be identified for installation or replacement due to this interconnection.

1. Transmission Lines –New

None

2. Transmission Lines – Upgrade

None

3. New Substation/Switchyard Facilities

None

4. Substation/Switchyard Facility Upgrades

As necessary, the new substation constructed for previous PJM Queue Projects AB1-141/AB1-142 will be modified as follows to accommodate the AB2-032/AB2-153 interconnection:

- Remove existing bus support structure and its foundations
- Remove the rigid bus presently spanning across the new breaker position
- Install conduit to new equipment from existing cable trench as required
- Install 138 kV overhead span between the IC's yard and DPL's yard
- Install control cables and fiber optic cables in conduits between the IC's yard and DPL's yard
- Install Gas Circuit Breaker, 138 kV, 2000 A, 40 kA, 3-cycle
- Install Disconnect Switches, 138 kV, 2000 A, Three-Phase, Manual Worm Gear
- Install CVT's, 138 kV Class, Single-Phase
- Install concrete slab for 138 kV Breaker
- Install drilled piers for the new switch stand, bus supports and CVT support
- Install drilled piers for the H-Frame Take-off Structure
- Install Disconnect Switch Stand, 138 kV, Steel
- Install three-phase CVT support, 138 kV, Steel
- Install Take-off Structure, H-Frame, 138 kV, Steel
- Install Bus Support Structures, 138 kV, Steel
- Install Digital Revenue Grade Meters
- Install Surge Arresters, 138 kV Class, Polymer
- Install 138 kV substation bus, insulators, connectors, etc. as required
- Install yard lighting as required in the area of the new terminal
- Install new 138 kV bus differential panel
- Install new 138 kV breaker control panel
- Modify existing control and protection schemes as required to accommodate the new breaker
- Test and commission all new or modified relay, control, and communications systems

Telecommunications Facilities – Upgrades

- Fiber optic cable will be installed between the IC's switching station and the new ring bus substation's control enclosure to support any necessary status, control, and metering functions. This will be installed in underground conduit.
- The new relays will be connected to the existing Ethernet switch in the control house.

6. Metering & Communications

A three-phase 138 kV revenue metering point will need to be established within the IC's facility at the POI. The IC will purchase and install all metering instrument transformers (including one spare to be kept on site) as well as construct a metering structure per DPL's specifications. The secondary wiring connections both at the instrument transformers and at the metering enclosure will be completed by DPL's metering technicians. The metering control cable and meter cabinets will be supplied by DPL and installed by the IC's contractors. The IC 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. The IC will provide 120V power to the meter cabinet. DPL will provide both the Primary and Backup meters. DPL's meter technicians will program and install the Primary & Backup solid state multi-function meters for the new metering position.

The Primary meter will be equipped with load profile, telemetry, and DNP outputs. The IC will be provided with the Primary meter's DNP output via RS-485. The IC will be required to make provisions for a POTS line within approximately three feet of the DPL metering position to facilitate remote interrogation and data collection. It is the IC's responsibility to send the data that PJM and DPL require 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.

7. Environmental, Real Estate and Permitting

All work to accommodate the interconnection of AB2-032/AB2-153 is dependent upon the IC obtaining all necessary permits. Moreover, the IC shall be responsible for acquiring all necessary real property rights and acquisitions, including but not limited to: rights of way, easements, and fee simple, in a form approved by DPL. Any setbacks in obtaining the necessary real property rights, acquisitions and permits required for this interconnection may delay the construction schedule.

8. Summary of Results of Study

Project Name: Church – Wye Mills 138kV III	Indirect Cost ($)		Direct Cost ($)		Total Cost ($)
Substation Attachment Facilities	**Material**	**Labor/Fees/ Equip.**	**Material**	**Labor/Fees/ Equip.**	
Project & Construction Planning, Project Closing, Permitting, and Material Procurement				$34,397	$34,397
Engineering & Design				$156,824	$156,824
Project Oversight and Overhead Cost	$57,347	$91,069		$7,332	$155,748
Site Work			$2,892	$28,706	$31,598
Demolition			$2,099	$14,353	$16,452
Below Grade/Foundation Construction			$23,107	$116,051	$139,158
Above Grade/Primary Construction			$232,546	$185,204	$417,750
Secondary/P&C /Comm Construction			$77,218	$84,211	$161,429
Testing & Commissioning Activities				$80,784	$80,784
Total Cost	**$57,347**	**$91,069**	**$337,862**	**$707,862**	**$1,194,140**

Generation projects meeting IRS "Safe Harbor" provisions generally do not incur "CIAC" (Contribution in Aid to Construction), a tax collected by the utility for the state or federal government. DPL does not expect to collect CIAC for this project. If for any reason, "CIAC" would be required for this project, it would be the responsibility of the party owning the generator to pay this cost.

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

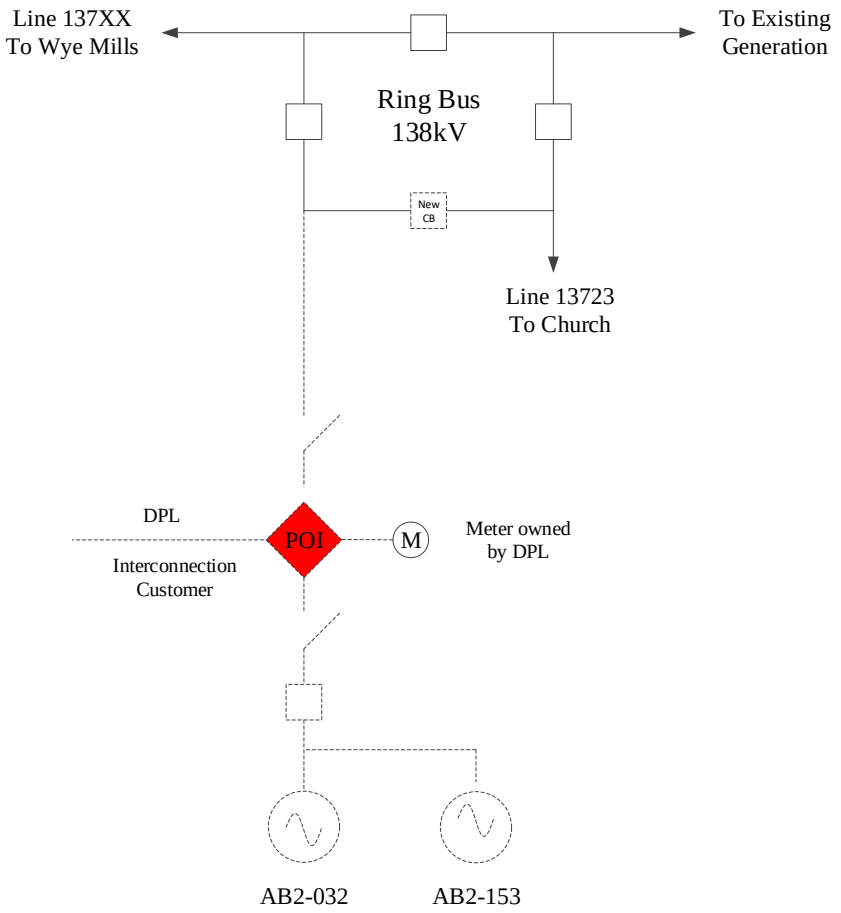
9. Schedules and Assumptions

The overall estimated timeline for DPL to place its direct connect facilities in service for this project is approximately 24-36 months after receipt of a fully executed Interconnection Service Agreement (ISA) and Construction Service Agreement (CSA).

Storm damage and restoration, time of year limitations, permitting issues, outage scheduling, system emergencies, and contractor and equipment availability could also impact the schedule. It is important to note that this project will be incorporated into the existing project work load at DPL at the time of contract execution. If the work load of existing projects is extensive, resource constraints may cause this project to be delayed beyond the projected in-service date.

Attachment #1

AB2-032/AB2-153
Church – Wye Mills 138 kV



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

POI Point of Interconnection