Facilities Study Report

For

Physical Interconnection of

PJM Generation Interconnection Request

Project ID AG2-617

"Waugh Chapel 115kV"

Introduction

This Facilities Study has been prepared in accordance with the PJM Open Access Transmission Tariff, as well as the Application and Studies Agreement between the Project Developer and PJM Interconnection, LLC (PJM or Transmission Provider (TP). The Transmission Owner (TO) is Baltimore Gas and Electric (BGE).

This Facility Study was performed to satisfy the Phase 2 Facility Study requirement of the PJM Tariff. The Facility Study is intended to provide scope, cost, and schedule estimates for the project as currently defined and approved for Phase 2 study. In the event project changes are made during DP2 that impact this report, updates will be provided as part of the Phase 3 report. Following execution of the project's final agreement, this report will not be updated to account for other changes made as part of the agreements modification clause and instead the scope of change process will be followed.

A. Transmission Owner Facilities Study Summary

1. PROJECT DESCRIPTION

The Project Developer (PD) Dairy Farm Solar, LLC has proposed interconnecting a photovoltaic (PV) solar Generating Facility located in Gambrills, Anne Arundel County, MD with a designated PJM Project ID of AG2-617. The installed facilities will have a total Maximum Facility Output (MFO) of 55 MW with 33 MW of this output being recognized by PJM as Capacity.

2. POINT OF INTERCONNECTION (POI)

The Generating Facility will interconnect with the BGE transmission system via a direct connection into the Waugh Chapel 115 kV substation. The proposed generation interconnection is shown on the single line diagram in Attachment #1.

3. POINT OF CHANGE IN OWNERSHIP

The Point of Change in Ownership (PCO) will be located at the northwest property adjacent to Waugh Chapel's substation property within a newly constructed fenced area. In this PCO terminal station, there will be three 1PH riser structures from POI leading to a disconnect switch and another three 1PH riser structure to lead the cables to Dairy Farm.

4. SCOPE OF PROJECT DEVELOPER INTERCONNECTION FACILITIES

Project Developer will design, build, own, operate and maintain the Project Developer Interconnection Facilities on Project Developer's side of the Point of Change in Ownership (PCO). This includes, but is not limited to:

- Generator lead line extending from the Generating Facility to the PCO.
- Circuit breakers and associated equipment located between the high side of the MPT(s) or GSU(s) and the PCO.
- Relay and protective equipment, telecommunications equipment, and Supervisory Control and Data Acquisition (SCADA) to comply with the TO's Applicable Technical Requirements and Standards

B. Transmission Owner Facilities Study Results

The following is a description of the planned Transmission Owner facilities for the physical interconnection of the proposed AG2-617 project to BGE transmission system. These facilities shall be designed according to BGE Applicable Technical Requirements and Standards. Once built, BGE will own, operate, and maintain these Facilities.

1. TRANSMISSION OWNER INTERCONNECTION FACILITIES:

A new 115kV XLPE 1200mm^2 copper cable will be installed between the Point of Interconnection (POI) within the BGE Waugh Chapel substation and Point of Change in Ownership (PCO). The proposed 55MW solar plant will interconnect at line position L42. The underground 115kV cable route from the Waugh Chapel 115kV injection point to the cable terminators inside of the PCO will be approximately 1600 feet long.

PCO Terminal Station

The PCO Terminal Station construction shall be developed as part of the Transmission Owner Interconnection Facilities, distinct from the primary substation scope at the contractor's discretion. The PCO terminal station shall serve as a boundary point for housing the high voltage transition which will bridge between BGE and the Project Developer.

This facility will be equipped with a disconnector switch to formally delineate the point of change in ownership (PCO) between the Transmission Owner and the Project Developer.

The following primary equipment will be installed within the PCO terminal station which includes the following but is not limited to:

- Installing six (6) single phase 115kV riser cable terminators and associated structures. Three for each side of the disconnect switch.
- Install one (1) 115kV manually operated air-break disconnect switch rated for 2000A, 100kA MOM, 550kV BIL 3PST MORC with integral ground switch.
- Install six (6) 115kV surge arresters.
- Install one 60-foot lightning mast.

The underground 115kV cable route crossing from the Waugh Chapel 115kV injection point to the cable terminator inside of the project developer yard will be detailed in the Transmission Scope of Work document. See Section 3 for the 115kV substation related network upgrades.

2. STAND ALONE NETWORK UPGRADES

None

Installation of fiber cable circuits

Fiber optic cables shall be installed between the control house at the Waugh Chapel Substation and the Project Developer facility to support relaying, metering, and SCADA requirements. Fiber cable slack shall be coiled in two independent handholes located within the PCO site and then extended to the Project Developer site. Final fiber requirements shall be determined upon commencement of design and engineering activities following execution of the applicable agreement.

3. NETWORK UPGRADES

The Network Upgrades will include, but are not limited to, the following:

Expanding/Upgrading existing BGE substation:

The existing substation, Waugh Chapel Substation 115 kV area, will be expanded/upgraded to interconnect the project with the BGE transmission system.

A new 115kV 3000A 63kA breaker will be installed in vacant tie breaker position B45, including associated wiring, connectors, grounding, and protection, control, and alarm provisions. The proposed 55MW solar plant will interconnect at POI. The scope of work is detailed in this document and includes, but is not limited to:

1) Construct an underground connection perpendicular to the bay towards the northeast side of the station and utilize three (3) single-phase cable termination assemblies, develop an underground 115kV conductor.
2) Install three (3) 115kV cable terminators
3) Install three (3) 115kV Surge arresters
4) Install three (3) 115kV CCVT's
5) Install approximately 60 feet of 5" Ø EH IPS Al Tube bus.
6) Install three (3) A-frames
7) Install one (1) 115kV 3000A Gas Circuit Breaker
8) Install associated protective relaying, control, and metering equipment necessary to support the new tie breaker and the interconnection transmission line at the existing control house panels.

4. OTHER SCOPE OF WORK

For the **Transmission Owner (TO) Build Option**, the Transmission Owner is responsible for the engineering, procurement, and construction of all scope of work identified in:

- Section B.1 – Transmission Owner Interconnection Facilities (TOIF)
- Section B.3 – Network Upgrades

5. MILESTONE SCHEDULE FOR COMPLETION OF BGE WORK

Facilities outlined in this report are estimated to take 60 months to be constructed, from the time of the first PJM Project Kick-Off meeting. This schedule may be impacted by the timeline for property acquisition, procurement and installation of long lead items, the ability to obtain outages to construct and test the proposed facilities.

Description	Start month	Finish month
Property Acquisition (Optional)	1	18
Detailed Design	6	20
Permitting	1	18
Construction	25	60

6. ASSUMPTIONS IN DEVELOPING SCOPE/COST/SCHEDULE

- The estimated overall schedule assumes that there will not be any impacts by storm damage and restoration, time of the year limitations, permitting issues, outage scheduling, system emergencies, and contractor and equipment availability.
- Scheduling BGE's remote end work at Waugh Chapel substation is related to the Project Developer's schedule. The Project Developer shall coordinate all design and engineering, permitting, construction, and commissioning activities with BGE.
- This project will be incorporated into the existing workload at BGE at the time of contract execution. If the workload of said project is extensive, resource constraints may cause this project to be delayed beyond the in service date considered in the schedule.
- Material lead times are subject to change. The quoted lead times in the scope of work document reflect current supply chain conditions. Current 115kV circuit breaker lead times are 24 weeks and could change before the project starts.
- To the extent the developer has the ownership or property rights BGE may need to build its network upgrade, this facility study assumes that we can build the required network upgrade on the land identified. To the extent that additional land may be required outside of what is shown, neither the estimate nor schedule proposed accounts for the costs or time to acquire other suitable property.

- Total underground route length is approximately 0.3 miles.
- HDD and open cut trenching costs are estimated with the assumption of no rock excavation for the entirety of the transmission line route.
- Sump pump system components (pumps, cables, alarm system, and accessories) have been excluded from this estimate. These costs will be included in subsequent revisions once additional information has been obtained.
- No stormwater management costs associated with road improvements in impervious areas along with minimal increase in impervious areas at the POI/PCO location were included in this cost estimate. Stormwater management analysis and costs from the potential increase in impervious areas due to road improvements to be considered at later design stages.
- Preliminary nominal costs for permitting applications included; final estimated permitting costs to be evaluated during detailed design.

7. REVENUE METERING REQUIREMENTS

All revenue metering needed for this interconnection project must meet the metering requirements stated in Appendix 2, Section 8 of the AG2-617 GIA, and in PJM Manuals M01 and M14D. The details of applicable revenue metering requirements are given in the Exelon Utilities Transmission Facility Interconnection Requirements posted on PJM website.

The revenue metering shall be installed on the Project Developer side of the PCO. The revenue metering point shall be established within the Project Developer's facility between the high-voltage side of the MPT(s) or GSU(s) and the PCO.

Revenue meters, revenue grade instrument transformers, and the associated communication equipment shall be installed, owned, tested and maintained by the Project Developer. The Project Developer shall be responsible for providing real-time telemetry data and market settlement data to PJM.

Protective relaying and metering design and installation must comply with the Applicable Technical Requirements and Standards identified in Schedule D of the AG2-617 GIA.

8. LAND REQUIREMENTS FOR INTERCONNECTION SUBSTATION

The Project Developer will be responsible for acquiring land for the Terminal Station. Approximate area of the PCO Terminal Station is 5000 sq.ft. Project Developer shall transfer the land ownership to the Transmission Owner.

This Facility Study Report assumes an average cost of $200K per acre. The estimated time for procurement of the land (including permitting) is 18 months and has been reflected in the schedule.

Land requirements for the Interconnection Substation needed for this interconnection project must meet the requirements in the “Exelon Mid-Atlantic Interconnection Guidelines” as well as PJM standards as posted on the PJM website. Once construction is completed, the PD will be required to transfer ownership of the terminal station (including real estate) to BGE.

9. APPLICABLE TECHNICAL REQUIREMENTS AND STANDARDS

The following Technical Requirements and Standards are applicable to this Facilities Study Report, including, but not limited to, the following:

- International Building Code – Latest Edition as Applicable per the Prevailing Building Code
- Local Trades Building Codes – Latest Edition as Applicable
- ASCE 7 Minimum Design Load for Buildings and Other Structures
- ASCE 24 – Flood Resistant Design and Construction
- ASCE 48 – Design of Steel Transmission Pole Structures
- ASCE MOP 74 – Guidelines for Electrical Transmission Line Structural Loading
- ASCE MOP 113 – Substation Structure Design Guide
- ACI 318 – Building Code Requirements for Reinforced Concrete Construction
- AISC Steel Construction Manual – Latest Edition or as Applicable
- PJM Manual 14D: Generator Operational Requirements

- ANSI/AISC 303 – Code of Standard Practice for Steel Buildings and Bridges
- TMS 402/602 – Building Code Requirements and Specification for Masonry Structures.
- EPB-11008, Substation Engineering & Design Quality Control Process QAQC
- EPB-11013, Substation Design High Voltage & Civil Scope Template Guideline
- EPB-11101, Guidelines for Substation Site Development
- EPB-11106, Waterways and Floodplains
- EPB-11108, Guidelines for Substation Fencing and Walls
- EPB-11110, Guidelines for Protecting Against Fires in Outdoor Substations & Switching Stations
- EPB-11114, Substation Foundation design and Standard Configurations.
- EPB-11115, Substation Right Tree Right Place Program
- EPB-11124, Guide Sheet for Tapered Steel Pole and Pipe Type Structures
- EPB-11128, Secondary Containment Design Methodology
- EPB-11129, Guidelines for Substation High Security Fence
- EPB-11130, Guidelines for Wildlife Protection Inside Substations
- EPB-11131, Substation Geotechnical Study Requirements
- EPB-11132, Concrete Design Applications for Substation and Transmission
- EPB-11133, Gas Insulated Switchgear (GIS) Building/Enclosure Design Guide
- EPB-11401 Guidelines for the Installation of UG Cables
- EPB-11407 Current Ratings for Outdoor Bus Conductors
- EPB-11410, Designing Substation Rigid Buses (DES-18)
- EPB-11411, Minimum Electrical Clearance for Outdoor Substations
- EPB-13026, Control Enclosure Design Guide
- EPB-13006 Rev 1 – Transmission Line Protection Application Guide
- EPB-13023 Rev 1 – Transmission Breaker Failure Protection Application Guide
- EPB-13038 Rev 1 – Substation Metering and Monitoring Application Guide
- EPB-13055 Rev 0 – Design Guide for Disturbance Monitoring Equipment
- EPB-13060 Rev 0 – Substation Alarm Guide
- EPB-13057 – Permissive and Direct Transfer Trip Design Guide
- Exelon Utility Companies' Transmission Facility Interconnection Requirements
- Exelon Large Load Protection & Control Customer Interface Requirements
- PJM Manual 07: PJM Protection Standards
- PJM Manual 01: Control Center and Data Exchange Requirements
- PJM Manual 14A: New Services Request Process

10. ENVIRONMENTAL AND PERMITING

Environmental permits will be required for any proposed impacts to protected natural resources such as wetlands and waterways, that will include but not limited to: grading, erosion and sediment control, stormwater management plans, civil permits, and local county permits may be required. Additional permit needs may be identified during detailed engineering design.

B. APPENDIX

Attachment #1: Single line Diagram for Physical Interconnection

