Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AE1-181

St. Johns – Freeland 69kV

45.0 MW Energy / 27 MW Capacity

January 2019

Introduction

This Feasibility Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 36.2, as well as the Feasibility Study Agreement between the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is PPL Electric Utilities (PPL EU).

Preface

The intent of the feasibility study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation to the PJM network at a location specified by the Interconnection Customer. The Interconnection Customer may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: (1) Direct Connections, which are new facilities and/or facilities upgrades needed to connect the generator to the PJM network, and (2) Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

In some instances a generator interconnection may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection, 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 impact study is performed.

The Feasibility Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The project developer 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

The IC has proposed a solar generating facility located in Luzerne, Pennsylvania. The installed facilities will have a total capability of 45.0 MW with 27 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is October 27, 2020. **This study does not imply a PPL EU commitment to this in-service date.**

Point of Interconnection (POI)

AE1-181 will interconnect with the PPL EU transmission system via the St. Johns – Freeland 69kV Tie Line. The Point of Interconnection will be where the Customer Interconnection Facilities interconnect with the Transmission Owner Interconnection Facilities. Those specifications can be found below under the Interconnection Customer Requirements.

Cost Summary
AE1-181 will be responsible for the following estimated costs:

Description	Total Cost
Attachment Facilities	$538,000
Direct Connection Network Upgrades	$0
Non Direct Connection Network Upgrades	$300,000
Total Costs	**$838,000**

In addition, the AE1-181 project may be responsible for a contribution to the following costs:

Description	Total Cost
New System Upgrades	$0
Previously Identified Upgrades	$0
Total Costs	**$0**

Cost allocations for these upgrades will be provided in the System Impact Study Report.

Estimated Schedule
The estimated time to complete the scope of work is 12-18 months after the PJM three-party Interconnection Service Agreement (ISA) and Interconnection Construction Service Agreement (ICSA) are signed and PPL EU receives Notice to Proceed from the IC.

Assumptions

- An optimal transmission line route is available
- There are no major environmental, real estate, or permitting issues
- The feasibility of outages was not assessed. Outage feasibility will be assessed during the Facilities Study.

Attachment Facilities

The Attachment Facilities will interconnect with the St. Johns – Freeland 69kV Tie Line 3.055 miles from St. Johns Substation and .6 miles from Freeland Substation.

This scope of work is based on the IC collector substation GPS Coordinates: 41.0208000, -75.9336000.

- Tap the existing St. Johns – Freeland 69kV Tie Line
- Intersperse a new double circuit style tap pole between pole 50014N31654 and pole 50111N31643 as this line is double circuit
- Set tap for existing line on the south side of the existing poles
- Extend new 69kV tap to AE1-181 substation dead-end
- Install new Motor Operated Load Break Air Break switch (MOLBAB) on IC tap line.

Note: PPL EU designates the POI line as the St. Johns –Freeland 69kV Tie line. For the purposes of this report The POI is between St. Johns (SAJO) TP1 and Freeland (FLND) TP1.

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The total preliminary cost estimate for the Attachment work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Attachment Facilities	$538,000

Direct Connection Network Upgrades

None.

Non Direct Connection Network Upgrades

The St. Johns – Freeland 69kV Tie Line section is normally sourced from the Harwood substation.

- The following upgrades are **required** at the Harwood substation:
  - Install new telephone-based DTT equipment.
  - Add telephone facilities accordingly to accommodate the new DTT telephone circuit.
  - Modify the existing Harwood Jenkins #1 69kV 5T and 5S circuit breaker's protection and control schemes.
  - Modify the existing SCADA for new alarms.
  - Modify the existing Alarm Management System (AMS).
  - Install new cables and modify control wiring for the above.
  - Perform system checks and test equipment before placing in service.
- Model IC in CAPE and conduct a wide area short-circuit study two busses away from the IC facilities. Identify affected relays and revise settings as needed.
- Conduct a review of the IC relay settings and engineering package (submitted by IC to PPL EU).

The total preliminary cost estimate for the Non Direct Connection Upgrades is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Remote End Work – Harwood	$300,000
Total Non-Direct Connection Facility Costs	**$300,000**

Interconnection Requirements

Customer Requirements

Requirement from the PJM Open Access Transmission Tariff:

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.

PPL EU Interconnection Requirements

PPL EU applicable technical standards that address requirements for interconnection of generation, transmission, and end user facilities can be found at the following link: https://pjm.com/planning/design-engineering/to-tech-standards/private-ppl.aspx

PPL EU Point(s) of Interconnection (POI) Requirements

The IC will interconnect with the PPL EU transmission system on the St. Johns –Freeland 69kV Tie line. The POI will be where the PPL EU tap line terminates (with insulators) at the first dead-end structure inside the IC substation. The scope of work provided in this Feasibility Study is for facilities to be constructed on the PPL EU side of the POI.

IC Direct Transfer Trip (DTT) Requirements

PPL EU will require an independent communication path, for DTT of the IC Intertie Protective Relaying (IPR) Fault Interrupting Devices (FIDs), consisting of one communication circuit with the Harwood 69kV substation. To ensure reliable communication, the IC shall also provide DTT relaying equipment identical to the PPL EU DTT relaying equipment. All DTT relaying equipment shall connect to the respective telephone communication path. The IC would be responsible for all installation, maintenance, and monthly lease or billing charges for the telephone communications facilities. All DTT relaying equipment should reside within the same location as the IPR and Point of Contact (POC) relaying equipment.

Revenue Metering and SCADA Requirements

PJM Requirements

The Interconnection Customer will be required to install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for IC's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Sections 24.1 and 24.2.

PPL EU Requirements

Installation of revenue grade Bi-directional Metering Equipment will be required in the vicinity of the POI to measure kWh and kVARh. PPL EU will design and supply the required metering equipment; all installation costs would be borne by the IC including CTs/PTs. All metering equipment must meet applicable PPL EU tariff requirements as well as being compliant with all applicable requirements of the PJM agreements. The equipment must provide bidirectional revenue metering (kWh and kVARh) and real-time data (kW, kVAR, circuit breaker status, and generator bus voltages) for the IC's generating resource. The metering equipment should be housed in a control cabinet or similar enclosure and must be accessible to PPL EU metering personnel.

Network Impacts

The Queue Project AE1-181 project was evaluated as a 45 MW (Capacity 27 MW) injection tapping the St Johns Tap – Freeland Tap 69kV line (SAJO TP1 – FLND TP1 69kV) in the ITO area. Project AE1-181 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE1-181 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis – 2022

Generator Deliverability

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

None

Multiple Facility Contingency

(Double Circuit Tower Line contingencies were studied for the full energy output. The contingencies of Line with Failed Breaker and Bus Fault will be performed for 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

Steady-State Voltage Requirements

(Summary of the VAR requirements based upon the results of the steady-state voltage studies)

None

Short Circuit

(Summary of impacted circuit breakers)

New circuit breakers found to be over-duty:
None

Contributions to previously identified circuit breakers found to be over-duty:
None

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

Potential Congestion due to Local Energy Deliverability

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 IC can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

Note: Only the most severely overloaded conditions are listed below. 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 shall study all overload conditions associated with the overloaded element(s) identified.

None

Light Load Analysis

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