Generation Interconnection

Feasibility Study Report

for

Queue Project AF2-262

FREELAND #1 TAP-JEDDO-HIGHLAND 69 KV

18.9 MW Capacity / 45 MW Energy

July 2020

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1 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.

2 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. Cost allocation rules for network upgrades can be found in PJM Manual 14A, Attachment B. 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 Interconnection Customer seeking to interconnect a wind or solar generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per Schedule H to the Interconnection Service Agreement and Section 8 of Manual 14D.

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.

3 General

The Interconnection Customer (IC) has proposed a Solar generating facility located in Luzerne County, Pennsylvania. The installed facilities will have a total capability of 45 MW with 18.9 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is December 31, 2023. This study does not imply a TO commitment to this in-service date.

Queue Number	AF2-262
Project Name	FREELAND #1 TAP-JEDDO-HIGHLAND 69 KV
State	Pennsylvania
County	Luzerne
Transmission Owner	PPL
MFO	45
MWE	45
MWC	18.9
Fuel	Solar
Basecase Study Year	2023

New Service Customers who can feasibly be commercially operable prior to June 1st of the basecase study year are required to request interim deliverability analysis.

4 Point of Interconnection

AF2-262 will interconnect with the PPL transmission system via one of the following options:

Option 1: via a tap of the East Hazleton – Freeland Tie #1 69 kV circuit between the Freeland Tap #1 and Jeddo-Highland 69 kV buses. The Point of Interconnection (POI) will be at the PPL EU owned termination structure where the Interconnection Customer's generator lead line terminates (with insulators).

Option 2: via a tap of the Freeland Tie #1 69 kV circuit.

5 Cost Summary

The AF2-262 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$ 1,204,000
Total System Network Upgrade Costs	$ 0
Total Costs	$ 1,204,000

These costs do not include CIAC Tax Gross-up. Cost allocations for any System Upgrades will be provided in the System Impact Study Report.

6 Transmission Owner Scope of Work

The total physical interconnection costs is given in the table below:

Description	Total Cost
Attachment Facilities	$ 869,400
Direct Connection Network Upgrade	$ 0
Non Direct Connection Network Upgrades	$ 334,600
Total Costs	$ 1,204,000

PPL EU can accommodate this interconnection by constructing a new transmission line tap off the East Hazleton – Freeland Tie #1 69 kV line and completing associated remote end relay work.

Risks and Assumptions

- No major environmental, real estate, siting, or permitting issues.
- IC is responsible for acquisition of easements, permits, and right of way for any Direct Connection Network Upgrades and Attachment Facilities per PPL EU standards and requirements.
- PPL EU will perform all grading, site preparation, and establish access roads for the PPL EU owned Attachment Facilities per PPL EU standards and requirements.

6.1 Attachment Facilities

69 kV Transmission Line Tap

PPL EU will tap the East Hazleton – Freeland Tie #1 69 kV line at or near GPS Coordinates: 41.015611, -75.921892. PPL EU will extend the tap west towards the IC site. PPL EU will install a motor operated switch and POI termination structure. The IC must build the remainder of the Attachment Facilities from the POI termination structure to the IC substation. The IC is responsible for procuring 100 ft. ROW for these facilities. For the purposes of this Feasibility Study Report cost estimate, PPL EU is assuming all engineering and construction responsibility for land development activities, including grading, site preparation, and new access road. During the Facilities Study phase, PPL EU and the IC will review land development activities, and the IC may choose to perform some, or all, of these activities. The cost estimate will be updated accordingly and included in the Facilities Study Report.

PPL EU work will consist of installing the following:

- Install one (1) new single circuit steel pole high tap structure with custom foundation.
- Install one (1) new single circuit, direct-embed, custom steel, motor operated switch structure.
- Install one (1) new single circuit, direct-embed, steel, tension structure.
- New circuit will consist of three (3) phase 556.6 kcmil 24/7 ACSR conductor and 3/8” shield wire (EHS OHGW).

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
69 kV Transmission Line Tap	$ 869,400
Total Attachment Facility Costs	$ 869,400

6.2 Direct Connection Cost Estimate

None.

6.3 Non-Direct Connection Cost Estimate

Remote End Relay Work – Harwood 69 kV Substation

- Complete remote end relay work at Harwood 69 kV Substation for Direct Transfer Trip.
- 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).

East Hazleton – Freeland Tie #1 69 kV Modifications to tie in the AF2-262 Attachment Facilities

- Tie the new AF2-262 Attachment Facilities into the East Hazleton – Freeland Tie #1 69 kV line.
- Two adjacent structures in the East Hazelton-Freeland Tie line to be reframed to tension.
- Some additional wire and guying may be required in the existing line due to differential spans created by the new tap pole.

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

Description	Total Cost
Remote End Relay Work – Harwood 69 kV Substation	$ 238,000
East Hazleton – Freeland Tie #1 69 kV Modifications to tie in the AF2-262 Attachment Facilities	$ 96,600
Total Non-Direct Connection Facility Costs	$ 334,600

7 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.

8 Interconnection Customer 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

9 Revenue Metering and SCADA Requirements

9.1 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 Section 8 of Attachment O.

9.2 Meteorological Data Reporting Requirements

The solar generation facility shall provide the Transmission Provider with site-specific meteorological data including:

- Temperature (degrees Fahrenheit)
- Atmospheric pressure (hectopascals)
- Irradiance
- Forced outage data

9.3 Interconnected Transmission Owner Requirements

The IC will be required to comply with all Interconnected Transmission Owner's revenue metering requirements for generation interconnection customers located at the following link:

http://www.pjm.com/planning/design-engineering/to-tech-standards/

10 Summer Peak - Load Flow Analysis - Primary POI

The Queue Project AF2-262 was evaluated as a 45.0 MW (Capacity 18.9 MW) injection tapping the **East Hazleton - Freeland Tie #1 69 kV line** in the PPL area. Project AF2-262 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-262 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

10.1 Generation Deliverability

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

None

10.2 Multiple Facility Contingency

(Double Circuit Tower Line, Fault with a Stuck Breaker, and Bus Fault contingencies for the full energy output)

None

10.3 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

10.4 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 developer 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

10.5 System Reinforcements

None

11 Short Circuit Analysis - Primary POI

Short circuit analysis will be performed during the System Impact Study.

12 Summer Peak - Load Flow Analysis - Secondary POI

The Queue Project AF2-262 was evaluated as a 45.0 MW (Capacity 18.9 MW) injection at the **Freeland Tie 69 kV** substation in the PPL area. Project AF2-262 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-262 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

12.1 Generation Deliverability

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

None

12.2 Multiple Facility Contingency

(Double Circuit Tower Line, Fault with a Stuck Breaker, and Bus Fault contingencies for the full energy output)

None

12.3 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

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None

13 Short Circuit Analysis - Secondary POI

Short circuit analysis will be performed during the System Impact Study.