



**Generation Interconnection
Feasibility Study Report
for
Queue Project AG1-277
SALEM-BEACON POWER 69 KV
32 MW Capacity / 40 MW Energy**

January 2021

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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 – Battery Storage hybrid generating facility located in Luzerne County, Pennsylvania. The installed facilities will have a total capability of 40 MW with 32 MW of this output being recognized by PJM as Capacity. AG1-277, AG1-278 and AG1-279 are behind the same point of interconnection and will share the same physical interconnection facilities. The proposed in-service date for this project is June 01, 2022. This study does not imply a TO commitment to this in-service date.

Queue Number	AG1-277
Project Name	SALEM-BEACON POWER 69 KV
State	Pennsylvania
County	Luzerne
Transmission Owner	PPL
MFO	40
MWE	40
MWC	32
Fuel	Solar; Storage
Basecase Study Year	2024

Any 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

AG1-277 will interconnect with the PPL Transmission system via a new 69 kV line, 6.42 miles from the Beacon Power Tap bus. The Point of Interconnection (POI) will be at the PPL EU owned termination structure where the Interconnection Customer’s transmission line terminates (with insulators).

Note: PPL EU is removing the Harwood-Berwick 69 kV line from the Salem substation to the Beacon Power Tap bus as a part of baseline project b2838. PPL EU is assuming this circuit is already removed prior to the interconnection of AG1-277. PPL EU plans to use the existing ROW corridor to build a new 69 kV circuit from the Beacon Power Tap bus to the POI to accommodate this request.

5 Cost Summary

The AG1-277 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	\$7,783,400
Total System Network Upgrade Costs	\$2,360,000
Total Costs	\$10,143,400

This cost excludes a Federal Income Tax Gross Up charges. This tax may or may not be charged based on whether this project meets the eligibility requirements of IRS Notice 2016-36, 2016-25 I.R.B. (6/20/2016). If at a future date it is determined that the Federal Income Tax Gross charge is required, the Transmission Owner shall be reimbursed by the Interconnection Customer for such taxes.

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	\$7,548,848
Direct Connection Network Upgrade	\$0
Non-Direct Connection Network Upgrades	\$234,552
Total Physical Interconnection Costs	\$7,783,400

PPL EU can accommodate this interconnection by constructing a new ~6.4 mile 69 kV line from the Beacon Power Tap to the POI and completing associated remote end relay work.

Risks and Assumptions

- No major environmental, real estate, 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.
- B2838 will be complete prior to this project’s interconnection to the PPL EU Transmission System.

6.1 Attachment Facilities

69 kV Transmission Line Tap

PPL EU will tap the new 69 kV line at or near GPS Coordinates: 41.0123, -76.1396. PPL EU will extend the tap towards the IC substation. PPL EU will install a motor operated switch and POI 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:

- Intersperse new tap structure on the new 69 kV line.
- Install one (1) new direct-embed, steel, motor operated switch structure.
- Install one (1) new direct-embed, steel, dead-end tension structure (POI structure).
- Install three (3) phase conductors and 48-count Optical Ground Wire (OPGW) from the new tap structure to the POI structure.
- Install one (1) fiber splice box on the tap structure and one (1) fiber splice box on the POI structure in which to terminate the OPGW.

Build new 69 kV line from Beacon Power Tap to the POI

- Build a new 69 kV line in the existing Harwood-Berwick 69 kV line corridor for ~6.4 miles from Beacon Power Tap to this project’s POI at 41.0123, -76.1396.
- It is assumed that approximately 118 structures will be required for the new line section, ranging in height from 90’-120’.
- It is assumed that approximately 5 of the 118 structures will be custom poles on foundation.

Description	Total Cost
IC substation facility acceptance, testing, commissioning, & telemetry coordination	\$24,400
Build New 69 kV Line from Beacon Power Tap to the Project POI	\$7,524,448
Total Attachment Facility Costs	\$7,548,848

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 the 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).
- PPL EU will have OPGW on the new 69 kV line available as the communication circuit for DTT to the Harwood 69 kV Substation.

The total preliminary cost estimate for the Non-Direct Connection work is given in the table below.

Description	Total Cost
Remote End Relay Work – Harwood 69 kV Substation	\$138,000
Modifications to the Harwood – Beacon 69 kV Line to tie in the Project Attachment Facilities	\$96,552
Total Non-Direct Connection Facility Costs	\$234,552

7 Schedule

The estimated time to complete the scope of work is 18-24 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 Transmission Owner Analysis

PPL identified the following violation on their lower voltage system:

Id	Violation Description	kV
R-PL-0025	thermal violation of 208100 BEAC TP 69.0 kV - 211592 HARW 69.0 kV Ckt Id 1	69 kV

9 Interconnection Customer Requirements

9.1 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>

10 Revenue Metering and SCADA Requirements

10.1 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.

10.2 Meteorological Data Reporting Requirements

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

- Back Panel temperature (Fahrenheit) - (Required for plants with Maximum Facility Output of 3 MW or higher)
- Irradiance (Watts/meter²) - (Required for plants with Maximum Facility Output of 3 MW or higher)
- Ambient air temperature (Fahrenheit) - (Accepted, not required)
- Wind speed (meters/second) - (Accepted, not required)
- Wind direction (decimal degrees from true north) - (Accepted, not required)

10.3 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/>

11 Summer Peak - Load Flow Analysis

The Queue Project AG1-277 was evaluated as a 40 MW (Capacity 32.0 MW) injection at the 69 kV Beacon Power Tap in the PPL area. Project AG1-277 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-277 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

11.1 Generation Deliverability

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

None

11.2 Multiple Facility Contingency

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

None

11.3 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

11.4 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

11.5 System Reinforcements - Summer Peak Load Flow - Primary POI

The following mitigates the PPL lower voltage violation:

ID	Facility	Upgrade Description	Cost
R-PL-0025	BEAC TP - HARW 69.0 kV (PPL)	Rebuild HARW-BERW 69kV line	\$2,360,000
		TOTAL COST	\$2,360,000

12 Short Circuit Analysis

The following Breakers are overdutied:

None

12.1 System Reinforcements - Short Circuit

None

13 Affected Systems

13.1 NYISO

NYISO Impacts to be determined during later study phases (as applicable).