Generation Interconnection

Feasibility Study Report

for

Queue Project AG1-259

SUNBURY-DALMATIA 69 KV

8.3 MW Capacity / 19.9 MW Energy

Revised: February 2021

First Issued: 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 Revision History

This report revises the January 2021 report to include violations and reinforcement identified by the Transmission Owner. Please refer to Section 9 and Section 12.5 for details.

4 General

The Interconnection Customer (IC), BAI Group, LLC, has proposed a Solar generating facility located in Northumberland County, Pennsylvania. The installed facilities will have a total capability of 19.9 MW with 8.3 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is August 01, 2022. This study does not imply a TO commitment to this in-service date.

Queue Number	AG1-259
Project Name	SUNBURY-DALMATIA 69 KV
State	Pennsylvania
County	Northumberland
Transmission Owner	PPL
MFO	19.9
MWE	19.9
MWC	8.3
Fuel	Solar
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.

5 Point of Interconnection

AG1-259 will interconnect with the PPL transmission system via the Sunbury - Dauphin 69 kV line, 5.76 miles from the Sunbury Yard 1 bus and 8.0 miles from the Dalmatia 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).

6 Cost Summary

The AG1-259 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$ 1,554,916
Total System Network Upgrade Costs	$ 27,000,000
Total Costs	$ 28,554,916

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 88-129. 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.

7 Transmission Owner Scope of Work

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

Description	Total Cost
Attachment Facilities	$ 893,364
Direct Connection Network Upgrade	$ 0
Non-Direct Connection Network Upgrades	$ 661,552
Total Physical Interconnection Costs	$ 1,554,916

PPL EU can accommodate this interconnection by constructing a new transmission line tap off the Sunbury – Dauphin 69 kV line 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.

7.1 Attachment Facilities

69 kV Transmission Line Tap

PPL EU will tap the Sunbury - Dauphin 69 kV line at or near GPS Coordinates: 40.757037, -76.820670. 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 Sunbury - Dauphin 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.

The total preliminary cost estimate for the Attachment work is given in the table below.

Description	Total Cost
69 kV Tap line, Motor Operated Switch, structures, and foundations	$868,964
IC substation facility acceptance, testing, commissioning, & telemetry coordination	$24,400
Total Attachment Facility Costs	$893,364

7.2 Direct Connection Cost Estimate

None.

7.3 Non-Direct Connection Cost Estimate

Remote End Relay Work – Sunbury 69 kV Substation

- Complete remote end relay work at the Sunbury 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 currently has OPGW on the Sunbury - Dauphin 69 kV line available as the communication circuit for DTT to the Sunbury 69 kV Substation.

Remote End Relay Work – Dauphin 69 kV Substation

- Complete remote end relay work at the Dauphin 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).

Note: The Dauphin 69 kV substation is an alternate transmission source for the IC and may be utilized to radially source this project's POI during outages.

Sunbury - Dauphin 69 kV line Modifications to tie in the project Attachment Facilities

- Reframe the structures on either side of the new tap structure to tension.
- Add fiber throw & two (2) splice boxes on the Sunbury - Dauphin 69 kV line.
- Install motor operated switch structure on each side of the new tap.

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

Description	Total Cost
Modifications to Sunbury - Dauphin 69 kV Line to tie in the AG1-259 Attachment Facilities	$96,552
Install Motor Operated Switches on Sunbury – Dauphin 69 kV Line, one on each side of new tap	$289,000
Remote End Relay Work – Sunbury 69 kV Substation	$138,000
Remote End Relay Work – Dauphin 69 kV Substation	$138,000
Total Non-Direct Connection Facility Costs	$661,552

8 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.

9 Transmission Owner Analysis

PPL identified the following violation:

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CONT NAME	Type	Contingency Definition
167754467	208109	SUNB	PPL	200021	SUNBURY	PPL	PL:08:P42:001375	Breaker	CONTINGENCY 'PL:08:P42:001375' /* SUNB-SUSQ 1 230KV; SUSQ1 CB @ SUNB 230KV DISCONNECT BRANCH FROM BUS 200021 TO BUS 208109 CKT 25 /* SUNB TR25 DISCONNECT BRANCH FROM BUS 208109 TO BUS 208113 CKT 1 /* SUNB-SUSQ DISCONNECT BRANCH FROM BUS 208109 TO BUS 212441 CKT 23 /* SUNB TR23 END

This violation will be evaluated in the System Impact Study and the AG1-259 project's cost allocation will be provided in the System Impact Study report.

10 Interconnection Customer Requirements

10.1 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

11 Revenue Metering and SCADA Requirements

11.1 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.

11.2 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)

11.3 Interconnected Transmission Owner 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.

12 Summer Peak - Load Flow Analysis

The Queue Project AG1-259 was evaluated as a 19.9 MW (Capacity 8.3 MW) injection tapping the 69 kV Sunbury - Dauphin Line in the PPL area. Project AG1-259 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-259 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

12.4 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

12.5 System Reinforcements - Summer Peak Load Flow - Primary POI

ID	Facility	Upgrade Description	Cost
R-PL-0026	208109 SUNB 230.0 kV - 200021 SUNBURY 500.0 kV Ckt Id 24 208109 SUNB 230.0 kV - 200021 SUNBURY 500.0 kV Ckt Id 25	Re-terminate the SUNB 500/230 kV Transformers at Sunbury into double breaker double bus arrangement in the 500kV yard. In the SUNB 230kV yard, re-terminate T24 into a breaker and half position with the SUNB-ELIM line and make the T25 bay double breaker double bus arrangement.	$27,000,000
		TOTAL COST	**$27,000,000**

13 Short Circuit Analysis

The following Breakers are overdutied:

None

13.1 System Reinforcements - Short Circuit

None

14 Affected Systems

14.1 NYISO

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

15 Attachment 1: One Line Diagram