Generation Interconnection

Feasibility Study Report

for

Queue Project AG1-396

DUPHIN-PINE GROVE 69 KV

4 MW Capacity / 7.5 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 generating facility located in Dauphin County, Pennsylvania. The installed facilities will have a total capability of 7.5 MW with 4 MW of this output being recognized by PJM as Capacity. The AG1-396 solar project and AF1-040 battery storage project will share the same interconnection facilities. The proposed in-service date for this project is March 30, 2022. This study does not imply a TO commitment to this in-service date.

Queue Number	AG1-396
Project Name	DUPHIN-PINE GROVE 69 KV
State	Pennsylvania
County	Dauphin
Transmission Owner	PPL
MFO	7.5
MWE	7.5
MWC	4
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.

4 Point of Interconnection

AG1-396 will interconnect with the PPL transmission system sharing the AF1-040 location tapping the 69 kV Gratz Tap to Gratz line.

5 Cost Summary

The AG1-396 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$0[1]
Total System Network Upgrade Costs	$2,500,000
Total Costs	$2,500,000

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

[1] The cost of the physical interconnection will be borne by the AF1-040 project. If AF1-040 withdraws from the PJM interconnection queue, then AG1-396 will be responsible for the physical interconnection costs. Refer to the AF1-040 study reports on the PJM website for the estimated physical interconnection costs.

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 physical interconnection scope of work will be performed under AF1-040. There is no scope of work assigned to AG1-396.

7 Transmission Owner Analysis

PPL identified the following violation on their lower voltage system:

Id	Violation Description	kV
R-PL-0025	thermal violation of 964050 AG1-259 TAP 69.0 kV - 212441 SUNB YD1 69.0 kV Ckt Id 1	69 kV

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:

- 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)

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

The Queue Project AG1-396 was evaluated as a 7.5 MW (Capacity 4 MW) injection sharing the AF1-040 POI location tapping the 69 kV Gratz Tap to Gratz line in the PPL area. Project AG1-396 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-396 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.

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
166251587	964050	AG1-259 TAP	69.0	PPL	212441	SUNB YD1	69.0	PPL	1	Base Case	operation	96.0	95.94	103.75	DC	7.5

10.5 System Reinforcements - Summer Peak Load Flow - Primary POI

Reinforcement below addresses the Transmission Owner Low Voltage violations identified in section 7.

ID	Idx	Facility	Upgrade Description	Cost
R-PL-0027	N/A	AG1-259 TAP 69.0 kV - SUNB YD1	Reconductor ~ 0.1 miles of the SUNB-DAUP 69kV line. Install the second circuit on the existing built for double circuit SUNB-DAUP 69kV line (4.9 miles) and operate in a 6-wire configuration.	$2,500,000
			TOTAL COST	$2,500,000

11 Short Circuit Analysis

The following Breakers are overdutied:

None

11.1 System Reinforcements - Short Circuit

None

12 Affected Systems

12.1 NYISO

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