Generation Interconnection

Feasibility Study Report

for

Queue Project AG1-267

MARTINS CREEK 69 KV

8 MW Capacity / 20 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 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 Storage generating facility located in Northampton County, Pennsylvania. The installed facilities will have a total capability of 20 MW with 8 MW of this output being recognized by PJM as Capacity. **AG1-267 will be behind the same Point of Interconnection as the existing Martin's Creek CTG (NQ120) and will share the physical interconnection facilities.** The proposed in-service date for this project is October 31, 2021. This study does not imply a TO commitment to this in-service date.

Queue Number	AG1-267
Project Name	MARTINS CREEK 69 KV
State	Pennsylvania
County	Northampton
Transmission Owner	PPL
MFO	20
MWE	20
MWC	8
Fuel	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

AG1-267 will interconnect with the PPL EU transmission system at Bay 1 in the Martins Creek 69 kV substation. AG1-267 will share a gen-tie line with NQ120, Martins Creek CTG's. The Point of Interconnection will be the same location as NQ120.

Note: PPL EU is upgrading the PPL EU Martins Creek 69 kV substation per Supplemental Project s1093. This involves rebuilding the substation adjacent to the existing substation and extending/re-terminating the NQ120 gen tie line. PPL EU is assuming those upgrades are complete prior to the interconnection of AG1-267.

5 Cost Summary

The AG1-267 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$24,400
Total System Network Upgrade Costs	$3,750,000
Total Costs	$3,774,400

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 IC will be installing the generation and new GSU on the existing gen tie line of NQ120. It is PPL EU's understanding that the IC will be adding a circuit breaker to the high side of the existing GSU per PPL EU's latest interconnection requirements. PPL EU will be modifying the protection at the new Martins Creek 69 kV substation to accommodate this change. If these modifications occur prior to the interconnection of AG1-267, PPL EU scope will be limited to the following engineering review activities:

- IC substation facility drawing review and acceptance
- Testing, commissioning, metering, and telemetry coordination

If the upgrades associated with s1093 are not complete prior to the interconnection of AG1-267, additional protection scope at the Martins Creek 69 KV substation will be required.

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

Description	Total Cost
IC substation facility acceptance, testing, commissioning, & telemetry coordination	$ 24,400
Total Physical Interconnection Cost	**$ 24,400**

7 Schedule

The estimated time to complete the scope of work **is 6 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 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.

10 Summer Peak - Load Flow Analysis

The Queue Project AG1-267 was evaluated as a 20 MW (Capacity 8.0 MW) injection at the Martins Creek 69 kV substation in the PPL area. Project AG1-267 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-267 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)

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
165961198	210515	CHHI 2	69	PPL	210965	NAZ A	69.0	PPL	2	PL:20:P42:101894	breaker	66	93.39	106.39	DC	8.58

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 - Summer Peak Load Flow - Primary POI

ID	Index	Facility	Upgrade Description	Cost
165961198	1	CHHI 2 69.0 kV - NAZA 69.0 kV Ckt 2	R-PL-0009 (2341): Rebuild 1.5 miles of the MACR-NAZA #1 and #2 69kV line from Nazareth substation to the CHHI taps. Project Type : FAC Cost : $3,750,000 Time Estimate : 24.0 Months	$3,750,000
			TOTAL COST	$3,750,000

10.6 Flow Gate Details

The following indices contain additional information about each facility presented in the body of the report. For each index, a description of the flowgate and its contingency was included for convenience. The intent of the indices is to provide more details on which projects/generators have contributions to the flowgate in question. All New Service Queue Requests, through the end of the Queue under study, that are contributors to a flowgate will be listed in the indices. Please note that there may be contributors that are subsequently queued after the queue under study that are not listed in the indices. Although this information is not used "as is" for cost allocation purposes, it can be used to gage the impact of other projects/generators. It should be noted the project/generator MW contributions presented in the body of the report are Full MW Impact contributions which are also noted in the indices column named "Full MW Impact", whereas the loading percentages reported in the body of the report, take into consideration the PJM Generator Deliverability Test rules such as commercial probability of each project as well as the ramping impact of "Adder" contributions. The MW Impact found and used in the analysis is shown in the indices column named "Gendeliv MW Impact".

10.6.1 Index 1

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
165961198	210515	CHHI 2	PPL	210965	NAZA	PPL	2	PL:20:P42:101894	breaker	66.0	93.39	106.39	DC	8.58

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
208946	MACR CT	4.8744	50/50	4.8744
959361	AF2-227 C	17.0977	50/50	17.0977
959362	AF2-227 E	11.3985	50/50	11.3985
964091	AG1-267 C	3.4329	50/50	3.4329
964092	AG1-267 E	5.1493	50/50	5.1493
G-007A	G-007A	0.1486	Confirmed LTF	0.1486
VFT	VFT	0.5676	Confirmed LTF	0.5676
CALDERWOOD	CALDERWOOD	0.0154	Confirmed LTF	0.0154
PRAIRIE	PRAIRIE	0.0801	Confirmed LTF	0.0801
CHEOAH	CHEOAH	0.0155	Confirmed LTF	0.0155
CBM-N	CBM-N	0.0564	Confirmed LTF	0.0564
COTTONWOOD	COTTONWOOD	0.0651	Confirmed LTF	0.0651
HAMLET	HAMLET	0.0173	Confirmed LTF	0.0173
GIBSON	GIBSON	0.0175	Confirmed LTF	0.0175
BLUEG	BLUEG	0.0556	Confirmed LTF	0.0556
TRIMBLE	TRIMBLE	0.0178	Confirmed LTF	0.0178
CATAWBA	CATAWBA	0.0105	Confirmed LTF	0.0105

10.7 Queue Dependencies

The Queue Projects below are listed in one or more indices for the overloads identified in your report. These projects contribute to the loading of the overloaded facilities identified in your report. The percent overload of a facility and cost allocation you may have towards a particular reinforcement could vary depending on the action of these earlier projects. The status of each project at the time of the analysis is presented in the table. This list may change as earlier projects withdraw or modify their requests.

Queue Number	Project Name	Status
AF2-227	Martins Creek–Cherry Hill 69 kV	Active
AG1-267	Martins Creek 69 kV	Active

10.8 Contingency Descriptions

Contingency Name	Contingency Definition
PL:20:P42:101894	CONTINGENCY 'PL:20:P42:101894' /* MACR-NAZA #1 69KV; NAZA1 CB @ MACR 69KV DISCONNECT BRANCH FROM BUS 208025 TO BUS 210887 CKT 22 /* MACR 230/69 T22 DISCONNECT BUS 210514 /* CHHI 1 DISCONNECT BUS 210944 /* MOBE END

11 Short Circuit Analysis

The following Breakers are overdutied:

None

11.1 System Reinforcements - Short Circuit

None

12 Affected Systems

None