Generation Interconnection

Combined Feasibility / System Impact Study Report

for

Queue Project AF2-093

DERRY 12.47 KV

1.8 MW Capacity / 3 MW Energy

July 2020

Table of Contents

1 Introduction

This System Impact Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 205, as well as the System Impact 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 System Impact Study is to determine a plan, with approximate cost and construction time estimates, to connect the subject generation interconnection project to the PJM network at a location specified by the Interconnection Customer. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system. All facilities required for interconnection of a generation interconnection project must be designed to meet the technical specifications (on PJM web site) for the appropriate transmission owner.

In some instances an Interconnection Customer may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection or merchant transmission upgrade, may also contribute to the need for the same network reinforcement. 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 System Impact Study is performed.

The System Impact 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.

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.

3 General

The Interconnection Customer (IC), **SolAmerica Energy, LLC**, has proposed a Solar generating facility located in Montour County, Pennsylvania. The installed facilities will have a total capability of 3 MW with 1.8 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is December 31, 2021. This study does not imply a TO commitment to this in-service date.

Queue Number	AF2-093
Project Name	DERRY 12.47 KV
State	Pennsylvania
County	Montour
Transmission Owner	PPL
MFO	3
MWE	3
MWC	1.8
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

AF2-093 will interconnect with the PPL on distribution system via the Derry 12 kV circuit 55-02.

5 Cost Summary

The AF2-093 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$ 3,417,000
System Network Upgrade Costs	$ 0
Total Costs	**$ 3,417,000**

6 Transmission Owner Scope of Work

A preliminary scope of work is provided below. A more detailed scope of work will be provided in the two party Interconnection Agreement between the Interconnection Customer and the Transmission Owner.

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

Description	Total Cost
Attachment Facilities	$ 285,000
Non-Direct Connection Network Upgrades	$ 3,132,000
Total Costs	**$ 3,417,000**

6.1 Attachment Facilities

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

AF2-093 will interconnect with the PPL EU distribution system on the Derry 55-02 12 kV line in the vicinity of 41.034802, -76.678729 through a 12 kV point of contact recloser at the customer point of interconnection. A 12kV line extension will be required.

Description	Total Cost
12 kV point of contact recloser	$ 85,000
12kV line extension to point of interconnection	$ 200,000
Total Attachment Facility Costs	**$ 285,000**

6.2 Direct Connection Scope of Work

None

6.3 Non-Direct Connection Scope of Work

The following non-direct facilities will be required:

- Extend substation yard and fence toward west at Derry 69/12 kV substation
- Remove existing 69 kV structure, install new structures and reroute the 69 kV line at Derry 69/12 kV substation
- Install a 69 kV circuit breaker at Derry 69/12 kV substation (including foundation and 69 kV disconnect)
- Install 2 x 69 kV Potential Transformers (PTs) at Derry 69/12 kV substation
- Install 69 kV 3-phase Current Transformers (CTs) at Derry 69/12 kV substation
- Install 12 kV 3-phase Current Transformers (CTs) at Derry 69/12 kV substation
- Install 12 kV transformer circuit breaker (including foundation and structure upgrade)
- Install Bus differential relaying at Derry 69/12 kV substation
- Install 2 x relay in a box (RIAB) on 55-01 and 55-02 feeders
- Replace 2 x 12kV line circuit breakers for 55-01 and 55-02 feeders at Derry 69/12 kV substation
- Install 12 kV line PT and sync check relay on 55-02 circuit breaker at Derry 69/12 kV substation
- Upgrade the battery system to 48V and increase its capacity at Derry 69/12 kV substation

- Install VIP SCADA system at Derry 69/12 kV substation.
- Additional cable trenching for the 69 kV breaker and relay cabinet at Derry 69/12 kV substation

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
Extend substation yard and fence	$ 480,000
Remove existing 69 kV structure, install new structures, reroute the 69 kV line	$ 360,000
69 kV Circuit breaker (including foundation and 69 kV disconnect)	$ 372,000
2 x 69 kV Potential Transformers (PTs)	$ 192,000
69 kV 3-phase Current Transformers (CTs) (including foundation and structure)	$ 120,000
12 kV 3-phase Current Transformers (CTs) (including foundation and structure)	$ 120,000
12 kV transformer circuit breaker (including foundation and structure upgrade)	$ 420,000
12 kV line PT and sync check relay on 55-02 circuit breaker	$ 60,000
Differential relaying cabinet	$ 240,000
2 x relay in a box (RIAB)	$ 192,000
2 x 12 kV line circuit breaker replacement	$ 240,000
Upgrade the battery system	$ 96,000
VIP SCADA System	$ 120,000
Additional cable trenching for 69 kV breaker and relay cabinet	$ 120,000
Total Non-Direct Connection Facility Costs	**$ 3,132,000**

7 Schedule

The estimated time to complete the scope of work is 18 to 24 months after an Interconnection Agreement (IA) is signed and PPL EU receives Notice to Proceed from the IC.

8 Interconnection Customer Requirements

8.1 Voltage Rise Control

In order to ensure that the voltage rise at the point of interconnection does not exceed 2.5%, the Interconnection Customer will be required to operate at a power factor of 99% lagging (absorbing VARs) at all times. If customers served from Derry substation begin to experience unacceptable voltage fluctuation due to the customer's operations, the customer will be disconnected by PPL EU System Operations and will be required to cease operations and construct reinforcements necessary to mitigate the problem at their expense before being re-energized. Power factor will be monitored via SCADA to ensure this operational requirement is met and maintained. Deviation from this power factor at any time will result in being disconnected from the PPL EU Distribution system.

8.2 Transformer Winding

The customer's transformer windings shall be "WYE" to "WYE" with a solidly grounded high side transformer winding.

8.3 Intertie Protective Relaying Equipment

The customer will have to install an Intertie Protective Relaying (IPR) scheme at their facility for their 3,000 kW solar generator. The customer should refer to the PPL EU web site for the IPR requirements. PPL EU's preference for IPR is the SEL-351 relay package. Note that failure of the single microprocessor-based relay will disable the protection. For that reason, PPL EU requests that a backup relay be installed. Suitable choices for backup are the SEL 351-1 or SEL-751 packages. Note that the SEL-751-A is not allowed. The alternative would be to disconnect the generation in the event that the single relay is out of service. The website addresses are noted below:

https://www.pplelectric.com/-/media/PPLElectric/At-Your-Service/Docs/transmission-services/parallel-generation-requirements-distribution12kVandbelow.pdf?la=enPoint-of-Contact (POC) Recloser

A point of contact recloser, to be provided by PPL EU and paid for by the customer, will be required at the customer's point of interconnection. Additional details on the customer point of contact requirements can be found on PPL EU's Point of Contact Requirements for Distribution Voltage Customer-Owned Facilities document:

https://www.pplelectric.com/-/media/PPLElectric/At-Your-Service/Docs/point-of-contact-requirements-12kV.pdf?la=en

Additional details on the customer point of contact requirements can be found on PPL's Point of Contact Requirements for Distribution Voltage Customer-Owned Facilities document:

https://www.pplelectric.com/-/media/PPLElectric/At-Your-Service/Docs/point-of-contact-requirements-12kV.pdf?la=en

8.4 Other Requirements

If PPL EU needs to operate the system in an abnormal configuration so that the customer is served by a different line, the customer may be asked to turn off their generation while abnormally configured. PPL EU also reserves the right to change the normal source to the customer as required by system conditions.

In addition, information about requirements for a 12.47 kV service can be found at PPL EU's Rules for Electric Meter and Service Installations website:

https://www.pplelectric.com/at-your-service/electric-rates-and-rules/remsi.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

10 Summer Peak Analysis

The Queue Project AF2-093 was evaluated as a 3.0 MW (Capacity 1.8 MW) injection at the Derry 12 kV substation in the PPL area. Project AF2-093 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-093 was studied with a commercial probability of 100.0 %. 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 Steady-State Voltage Requirements

None

10.5 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 Short Circuit Analysis

The following Breakers are overdutied:

None

Attachment 1: One Line Diagram