Generation Interconnection

System Impact Study Report

for

Queue Project AE2-059

DERRY TAP-DERRY BUS 69 KV

8.4 MW Capacity / 20 MW Energy

February 2020

1 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.

2 General

The Interconnection Customer (IC) has proposed a Solar generating facility located in **Northumberland County**. The installed facilities will have a total capability of **20 MW** with **8.4 MW** of this output being recognized by PJM as Capacity. The proposed in-service date for this project is March 5, 2021. This study does not imply a TO commitment to this in-service date.

Queue Number	**AE2-059**
Project Name	DERRY TAP-DERRY BUS 69 KV
Interconnection Customer	Dynamic Energy Solutions LLC
State	Maryland
County	Northumberland
Transmission Owner	PPL
MFO	20
MWE	20
MWC	8.4
Fuel	Solar
Basecase Study Year	2022

2.1 Point of Interconnection

AE2-059 will interconnect with the PPL EU transmission system via the Milton-Millville 69 kV line, 2.37 miles from the Derry Tap bus and 7.3 miles from the Derry bus. The Point of Interconnection (POI) will be where the IC tap line terminates (with insulators) on the last PPL EU Attachment Facilities structure.

2.2 Cost Summary

The AE2-059 project will be responsible for the following costs for the physical interconnection:

Description	**Total Cost**
Attachment Facilities	$ 494,000
Direct Connection Network Upgrade	$ 0
Non Direct Connection Network Upgrades	$ 238,000
Total Costs	$ 732,000

In addition, the AE2-059 project may be responsible for the following costs for Network Upgrades to mitigate overloads identified in this report:

Description	Total Cost
System Upgrades	$0[1]

3 Transmission Owner Scope of Work

PPL EU can accommodate this interconnection by installing a single circuit 69 kV tap off of the existing Milton - Millville 69 kV line with a MOLBAB (Motor Operated Load Break Air Break switch) to the AE2-059 POI. The PPL EU scope of work also includes remote end relay work at the Milton Substation.

Study Assumptions

- Availability of optimal transmission line route
- Outage feasibility not assessed until Facilities Study
- No major environmental, real estate, or permitting issues
- IC is responsible for acquisition of easements and right of way for the Attachment Facilities

3.1 Attachment Facilities

69 kV Transmission Line Tap

The Attachment Facilities will connect to the Milton-Millville 69 kV line approximately 2.47 miles from the Milton 230/69 kV Substation. This scope of work is based on the GPS Coordinates: 40°59'21.47"N, 76°47'28.60"W.

- Remove wood pole at grid 26430N30124 and install tap pole.
- Install MOLBAB (Motor Operated Load Break Air Break switch) on tap to dead-end structure in AE2-059 substation.
- Install transposition structure to allow for clearance for crossing under the PPL EU Montour-Sunbury 230 kV line.

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

Description	Total Cost
69 kV Transmission Line Tap	$ 494,000
Total Attachment Facility Costs	$ 494,000

[1] Stability Analysis will be performed during the Facility Study. Additional Network Upgrades may be identified to mitigate stability concerns.

3.2 Direct Connection Cost Estimate

None

3.3 Non-Direct Connection Cost Estimate

Remote End Work – Milton Substation

- 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)
- The following upgrades are required at the Milton substation:
    - Install DTT equipment.
    - Connect DTT equipment to new communication path installed between the Milton substation and the IC customer facilities.
    - Modify the existing Millville - Milton 69kV circuit breaker 13R protection and control schemes.
    - Modify the existing protective relay settings.
    - Modify the existing SCADA for new alarms.
    - Modify the existing Alarm Management System (AMS).
    - Install new cables and modify control wiring for the above.
    - Perform system checks and test equipment before placing in service
    - Update all Millville line designations on equipment, panels, and drawing to reference the new IC customer.

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
Remote End Work – Milton Substation	$ 238,000
Total Non-Direct Connection Facility Costs	$ 238,000

4 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.

5 Interconnection Customer Requirements

5.1 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

5.2 IC Direct Transfer Trip (DTT) Requirements

PPL EU will require an independent communication path, for Direct Transfer Trip (DTT) of the IC Intertie Protective Relaying (IPR) Fault Interrupting Devices (FIDs), consisting of one communication circuit with the Milton 230/69 kV Substation.

PPL EU does not have OPGW available on the Milton-Millville 69 kV line available for DTT to the Milton 230/69 kV Substation. PPL EU assumes that the IC will procure the independent communication path through a third-party provider. Upon request, PPL EU will evaluate the feasibility of installing OPGW on the Milton-Millville 69 kV line for DTT.

6 Revenue Metering and SCADA Requirements

6.1 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.

6.2 PPL 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

7 Network Impacts

The Queue Project AE2-059 was evaluated as a 20.0 MW (Capacity 8.4 MW) injection tapping the **Derry Tap – Derry Bus 69 kV** line in the PPL area. Project AE2-059 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-059 was studied with a commercial probability of 1.00. Potential network impacts were as follows:

Summer Peak Load Flow

8 Generation Deliverability

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

None

9 Multiple Facility Contingency

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

None

10 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 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 Stability and Reactive Power Requirement for Low Voltage Ride Through

Stability Analysis will be performed during the Facilities Study. **Additional reinforcements may be identified to mitigate stability concerns.**

13 Light Load Analysis

Not Required

14 System Reinforcements

None

15 Affected Systems

None

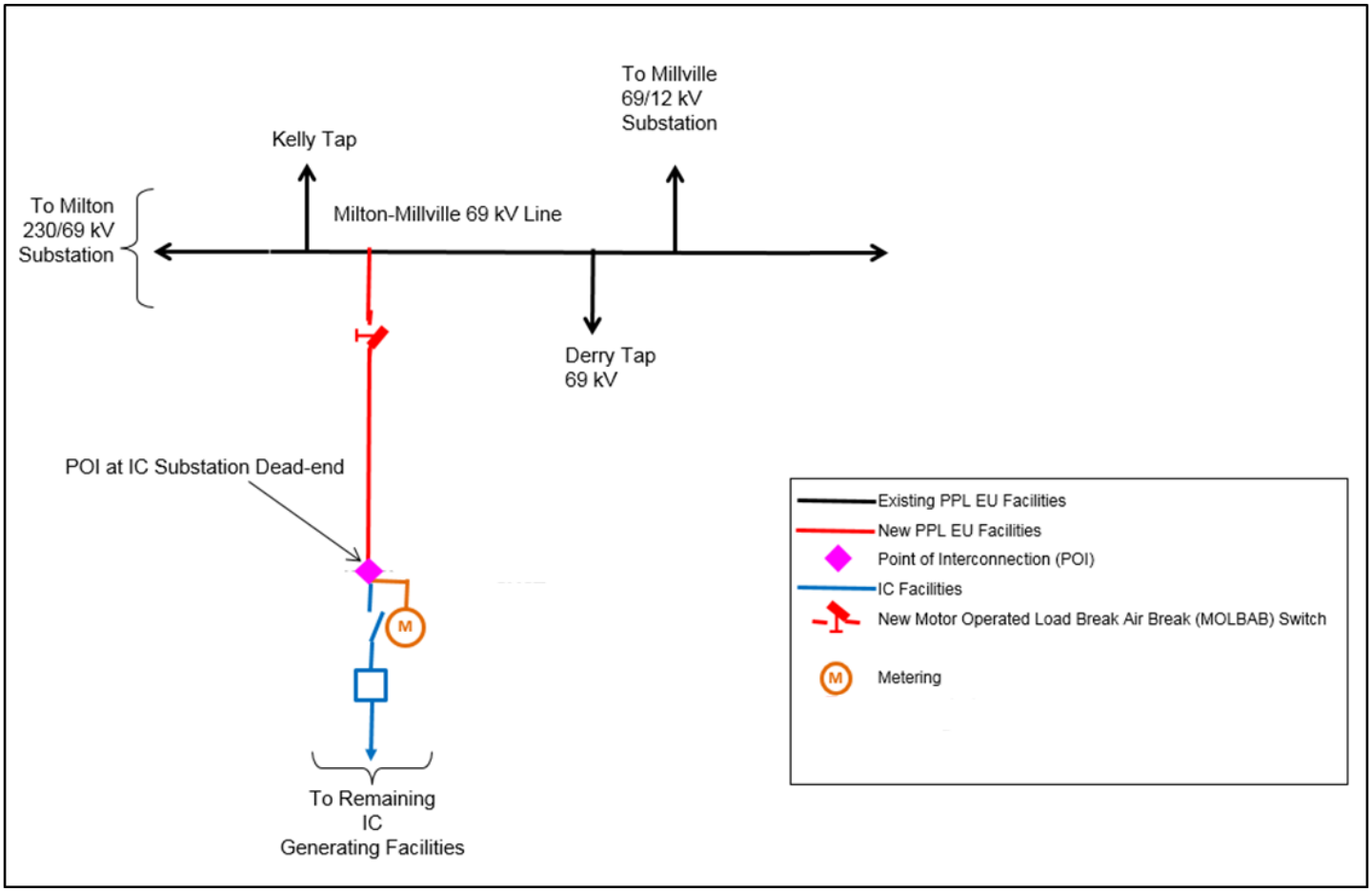
Short Circuit

16 Short Circuit

The following Breakers are over duty:

None

Attachment 1 – Single Line Diagram



Attachment 2 – Project Location