



**Generation Interconnection
System Impact Study Report
for**

Queue Project AE2-060

MIFFLINTOWN BUS-MIFFLINTOWN TAP 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 Juniata County, Pennsylvania. 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, 2019. This study does not imply a TO commitment to this in-service date.

Queue Number	AE2-060
Project Name	MIFFLINTOWN BUS-MIFFLINTOWN TAP 69 KV
Interconnection Customer	Dynamic Energy Solutions LLC
State	Pennsylvania
County	Juniata
Transmission Owner	PPL
MFO	20
MWE	20
MWC	8.4
Fuel	Solar
Basecase Study Year	2022

2.1 Point of Interconnection

AE2-060 will interconnect with the PPL EU transmission system via the Mifflintown Tap 69 kV line, 1.07 miles from the Mifflintown bus and 2.47 miles from the Mifflintown Tap bus. The POI will be where the PPL EU tap line terminates (with insulators) at the first dead-end structure inside the IC substation.

The scope of work provided in this Feasibility Study is for facilities to be constructed on the PPL EU side of the POI.

2.2 Cost Summary

The AE2-060 project will be responsible for the following costs for the physical interconnection:

Description	Total Cost
Attachment Facilities	\$ 418,000
Direct Connection Network Upgrade	\$ 0
Non Direct Connection Network Upgrades	\$ 238,000
Total Costs	\$ 656,000

In addition, the AE2-060 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 will construct a new 69 kV tap line from the Mifflintown Tap 69 kV line to the IC collector substation. The Mifflintown Tap 69 kV line is operated radially and therefore remote end relay work is required at the Juniata Substation only.

Report 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 Mifflintown 69 kV Tap off the Juniata-Richfield 69 kV line. This scope of work is based on the IC collector substation GPS Coordinates: 40°33'34.23"N, 77°22'51.33"W.

- Remove steel pole at grid 10266S44687 and install tap pole.
- Install MOLBAB (Motor Operated Load Break Air Break Switch) on tap to dead-end structure in AE2-060 substation.
- Re-frame adjacent suspension structure to tension.

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	\$ 418,000
Total Attachment Facility Costs	\$ 418,000

¹ Stability Analysis will be performed during the Facilities 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 – Juniata 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 Juniata substation:
 - Install DTT equipment.
 - Connect DTT equipment to new communication path installed between the Juniata substation and the IC customer facilities
 - Modify the existing Richfield 69kV circuit breaker #14 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 Richfield line designations on equipment, panels, and drawings to reference the new IC.

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 – Juniata 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 Juniata - Richfield 69 kV line available for DTT to the Juniata 500/230/69 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 Juniata – Richfield 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 AE2-060 was evaluated as a 20.0 MW (Capacity 8.4 MW) injection at **MIFFLINTOWN BUS-MIFFLINTOWN TAP 69 KV** line in the PPL area. Project AE2-060 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-060 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

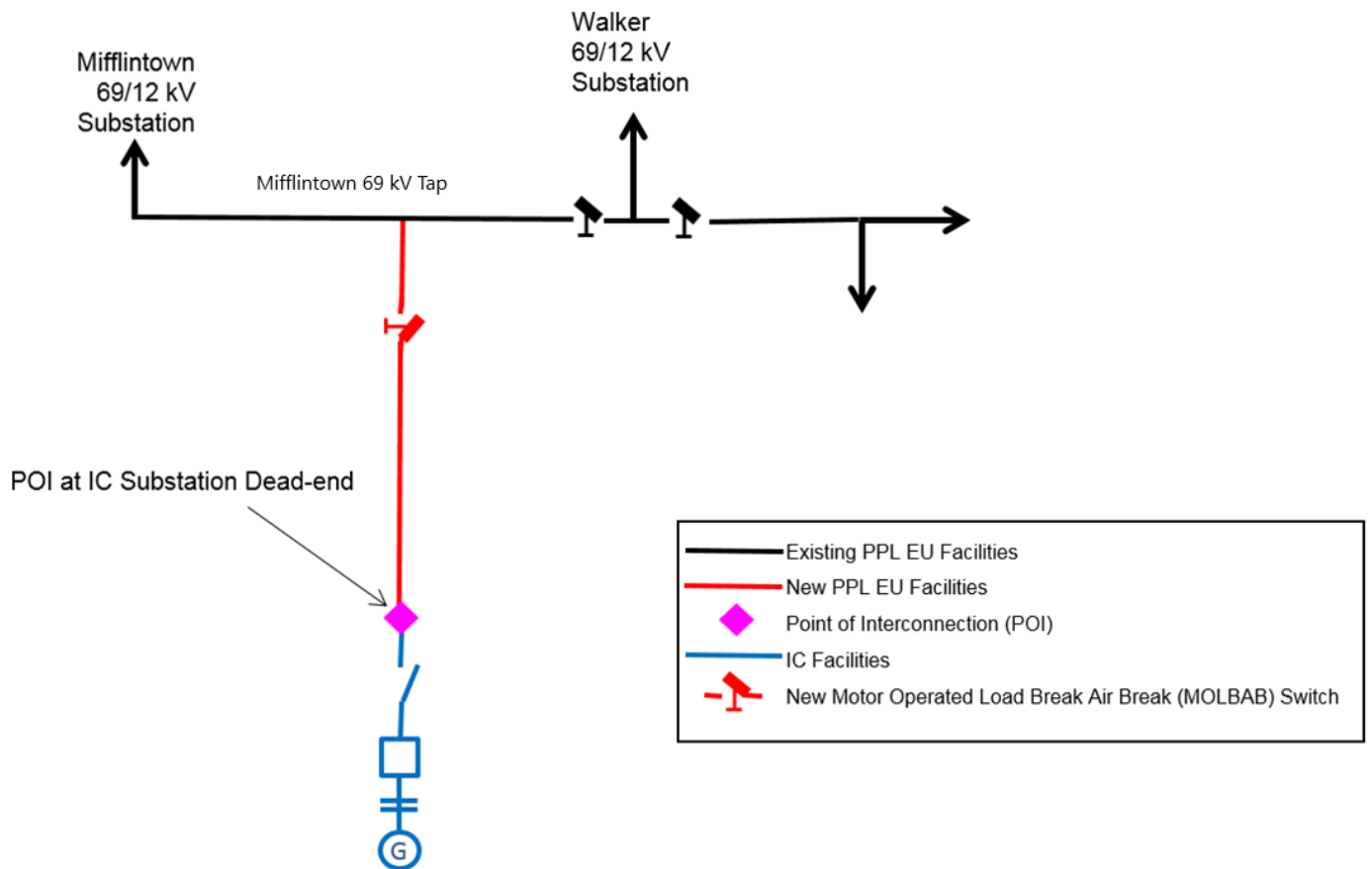
16 Short Circuit

The following Breakers are over duty:

None

Attachment 1

Single Line Diagram



Attachment 2

Project Location

