



**Generation Interconnection
Feasibility Study Report
for
Queue Project AF2-422
EAST HAZELTON 12.47 KV
12 MW Capacity / 20 MW Energy**

July 2020

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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 Luzerne County, Pennsylvania. The installed facilities will have a total capability of 20 MW with 12 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is March 01, 2022. This study does not imply a TO commitment to this in-service date.

Queue Number	AF2-422
Project Name	EAST HAZELTON 12.47 KV
State	Pennsylvania
County	Luzerne
Transmission Owner	PPL
MFO	20
MWE	20
MWC	12
Fuel	Solar
Basecase Study Year	2023

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

AF2-422 will interconnect with the PPL distribution system via one of the following options:

Option 1: via the East Hazleton 12 kV substation bus

Option 2: via a tap of the Harwood – East Hazleton #1 69 kV Circuit

5 Cost Summary

The AF2-422 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	\$ 4,728,000
Total System Network Upgrade Costs	\$ 0
Total Costs	\$ 4,728,000

This cost excludes CIAC Tax Gross Up charges. Cost allocations for any System Upgrades will be provided in the System Impact Study Report.

6 Transmission Owner Scope of Work

The primary POI is option is an interconnection to a non-FERC jurisdictional distribution circuit. If the Interconnection Customer proceeds with the primary POI selection, the scope, cost and schedule estimate will be outlined in a two party interconnection agreement between the Interconnection Customer and the Transmission Owner. A preliminary estimate is provided below.

AF2-422 will interconnect with the PPL distribution system at the 12 kV Bus 1 at East Hazleton substation. The POI is located at 40.9519100, -75.9448810. A dedicated point of contact circuit breaker will be installed for the customer on Bus 1 at East Hazleton substation. A double conductor run of 750 Copper underground cable will be installed from the circuit breaker to the customer's point of interconnection.

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

Description	Total Cost
Attachment Facilities	\$900,000
Direct Connection Network Upgrade	\$0
Non Direct Connection Network Upgrades	\$3,828,000
Total Physical Interconnection Costs	\$4,728,000

6.1 Attachment Facilities

The following facilities will be constructed from the East Hazelton 69/12 kV Substation to the Point of Interconnection:

- 12 kV point of contact circuit breaker
- 12 kV line PT, directional overcurrent, and sync check relay package on point of contact circuit breaker

In addition, the following facilities will be required to support AF2-422:

- 500 feet of double circuit 750 Copper underground cable from point of contact circuit breaker to point of interconnection

Description	Total Cost
12 kV Point of contact circuit breaker	\$ 420,000
12 kV line PT and directional overcurrent/sync check relay package	\$ 120,000
500 ft. of double-circuit 750 CU underground cable	\$ 360,000
Total Attachment Facility Costs	\$ 900,000

6.2 Direct Connection Scope of Work

None

6.3 Non-Direct Connection Cost Estimate

The following facilities will be constructed from the East Hazelton 69/12 kV Substation to the Point of Interconnection:

- At East Hazelton substation:
 - Install a new point of contact circuit breaker, bus structure, and relaying, including sync check relay
 - Install (2) 69 kV transformer circuit breakers
 - Install (6) 69 kV potential transformers
 - Install transformer differential relaying for both East Hazelton transformers
 - Replace (1) 69 kV transformer structure
 - Replace (1) 12 kV transformer structure
 - Install (2) 69 kV switches
 - Upgrade the 12 kV bus differential relaying
 - Install (1) 12 kV line circuit breaker
 - Install (2) 12 kV transformer circuit breakers
 - Replace the 12 kV bus section circuit breaker
 - Install a switched capacitor on the East Hazelton 41-01

Description	Total Cost
Install new 12 kV line bay, circuit breaker, and relaying x	\$480,000
Install (2) 69 kV circuit breakers	\$480,000
Install (6) 69 kV potential transformers	\$180,000
Install transformer differential relaying	\$480,000
Replace (2) 69 kV transformer structure	\$180,000
Replace (2) 12 kV transformer structures	\$240,000
Install (2) 69 kV switches	\$240,000
Install (1)12 kV line circuit breaker	\$540,000
Install (2) 12 kV transformer circuit breakers	\$480,000
Replace (1) bus section circuit breaker	\$240,000
Replace 12 kV bus differential relaying	\$240,000
Install (1) switched capacitor bank	\$48,000
Total Non-Direct Connection Facility Costs	\$3,828,000

7 Schedule

The estimate time to complete the scope of work is 18 to 24 months after an Interconnection Agreement (IA) is signed and PPL Electric receives notice to proceed from the IC.

8 Transmission Owner Analysis

The 20 MW of solar generation was studied on peak and during daytime minimum loading using CYME Distribution load flow software as well as hand calculations to determine the impact of the generation on the East Hazleton substation and the East Hazleton 12 kV lines.

9 Interconnection Customer Requirements

In order to ensure that the voltage rise at the point of interconnection does not exceed 2.5%, AF2-422 will be required to operate as follows:

AF2-422 would be required to operate at a power factor of 99% leading (absorbing VARs) at all times.

If customers served from East Hazleton 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 Distribution system.

The customer's transformer windings shall be "WYE" to "WYE" with a solidly grounded high side transformer winding. Additional information can be found in PPL's Relay and Control Requirements for Parallel Operation of Distributed Generation document found at the following location:

<https://www.pplelectric.com/-/media/PPLElectric/At-Your-Service/Docs/transmission-services/parallel-generation-requirements-distribution12kVandbelow.pdf?la=en>

If PPL 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 also reserves the right to change the normal source to the customer as required by system conditions.

A point of contact circuit breaker, to be provided by PPL 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'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>

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

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

10 Revenue Metering and SCADA Requirements

10.1 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.

10.2 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

11 Summer Peak - Load Flow Analysis - Primary POI

The Queue Project AF2-422 was evaluated as a 20.0 MW (Capacity 12.0 MW) injection at the **East Hazleton 12 kV substation** in the PPL area. Project AF2-422 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-422 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

11.1 Generation Deliverability

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

None

11.2 Multiple Facility Contingency

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

None

11.3 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

11.4 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
101459462	211708	MCCI TP1	69.0	PPL	211592	HARW	69.0	PPL	1	Base Case	operation	97.0	94.74	105.05	DC	10.0

12 Short Circuit Analysis - Primary POI

Short circuit analysis will be performed during the System Impact Study.

13 Summer Peak - Load Flow Analysis - Secondary POI

The Queue Project AF2-422 was evaluated as a 20.0 MW (Capacity 12.0 MW) injection tapping the **Harwood to East Hazleton #1 69 kV line** in the PPL area. Project AF2-422 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-422 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

13.1 Generation Deliverability

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

None

13.2 Multiple Facility Contingency

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

None

13.3 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

13.4 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

14 Short Circuit Analysis – Secondary POI

Short circuit analysis will be performed during the System Impact Study. Affected Systems

15 NYISO

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