Revised
Generation Interconnection
Combined Feasibility/Impact Study Report
for
Queue Project AE2-125
STAHLSTOWN-LIGONIER 25 KV
8.28 MW Capacity / 13.8 MW Energy

November, 2019

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1 Preface

The intent of the Combined Feasibility/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, if any, is included in the System Impact 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.

The 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 associated with them will be addressed when seeking an Interconnection Agreement as outlined below. Developer will also be responsible for providing and installing metering equipment in compliance with applicable PJM and Transmission Owner standards.

2 General

The Interconnection Customer (IC) has proposed a Solar generating facility located in Westmoreland County, Pennsylvania. The installed facilities will have a total capability of 13.8 MW with 8.28 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is September 1, 2021. This study does not imply a Transmission Owner (TO) commitment to this in-service date.

Final attachment facilities and local upgrades (if required) along with terms and conditions to interconnect AE2-125 will be specified in a separate two party Interconnection Agreement (IA) between APS and the Interconnection Customer as this project is considered FERC non-jurisdictional per the PJM Open Access Transmission Tariff (OATT).

From the transmission perspective, no network impacts were identified as detailed in the "Network Impacts" section below.

Queue Number	AE2-125
Project Name	STAHLSTOWN-LIGONIER 25 KV
Interconnection Customer	Glidepath Ventures, LLC
State	Pennsylvania
County	Westmoreland
Transmission Owner	APS
MFO	13.8
MWE	13.8
MWC	8.28
Fuel	Solar
Basecase Study Year	2022

2.1 Point of Interconnection

The interconnection of the project at the Primary POI will be accomplished by tapping the Donegal - Ligonier 25 kV line and constructing a one span tap. The transmission line tap will be located approximately ~5 miles from Donegal substation. The IC will be responsible for acquiring all easements, properties, and permits that may be required to construct both the new interconnection line tap and the associated attachment facilities.

Attachment 1 shows a one-line diagram of the proposed primary direct connection facilities for the AE2-125 generation project to connect to the FirstEnergy ("FE") transmission system. Attachment 2 provides the proposed location for the point of interconnection. IC will be responsible for constructing all of the facilities on its side of the POI, including the attachment facilities which connect the generator to the FE transmission system's direct connection facilities.

2.2 Cost Summary

The AE2-125 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$60,400
Direct Connection Network Upgrade	$0
Non Direct Connection Network Upgrades	$45,100
System Upgrades	$0
Total Costs	$105,500

From the transmission perspective, no network impacts were identified as detailed in the "Network Impacts" section below.

The costs provided above exclude the Contribution in Aid of Construction ("CIAC") Federal Income Tax Gross Up charge. If, at a future date, it is determined that the CIAC Federal Income Tax Gross charge is required, the Transmission Owner shall be reimbursed by the Interconnection Customer for such taxes.

The required Attachment Facilities and Direct and Non-Direct Connection work for the interconnection of the AE2-125 generation project to the FE Transmission System is detailed in the following sections. The associated one-line with the generation project Attachment Facilities and the Primary Direct and Non-Direct Connection facilities are shown in Attachment 1.

3 Transmission Owner Scope of Work

The interconnection of the project at the Primary POI will be accomplished by tapping the Donegal - Ligonier 25 kV line and constructing a one span tap. The line tap will be located approximately ~5 miles from Donegal substation. The IC will be responsible for acquiring all easements, properties, and permits that may be required to construct both the new interconnection line tap and the associated attachment facilities.

Attachment 1 shows a one-line diagram of the proposed primary direct connection facilities for the AE2-125 generation project to connect to the FirstEnergy ("FE") transmission system. Attachment 2 provides the proposed location for the point of interconnection. IC will be responsible for constructing all of the facilities on its side of the POI, including the attachment facilities which connect the generator to the FE transmission system's direct connection facilities.

4 Attachment Facilities

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

Description	Total Cost
Construct 25 kV tap to customer's substation	$21,500
Install 25 kV metering in customer's substation	$38,900
Total Attachment Facility Costs	$60,400

5 Direct Connection Cost Estimate

There is no Direct Connection scope of work for this project.

6 Non-Direct Connection Cost Estimate

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
Tap the Donegal – Ligonier 25 kV Line and Install 2-25 kV Line Switches	$45,100
Total Direct Connection Facility Costs	$45,100

7 Schedule

Based on the scope of work for the Attachment Facilities and the Direct and Non-Direct Connection facilities, it is expected to take a minimum of **10 months** after the signing of the Interconnection Agreement to complete the installation.

8 Transmission Owner Analysis

8.1 Power Flow Analysis

FE performed an analysis of its underlying transmission <100 kV system. The AE2-125 project did not contribute to any overloads on the FE transmission <100 kV system.

8.2 Short Circuit Analysis

PJM performed a short circuit analysis and the results were verified by FE. The connection of AE2-125 project to the system does not result in any newly overdutied circuit breakers on the FE transmission system and does not have a significant fault current contribution to existing overdutied circuit breakers.

8.3 Stability Analysis

Not required for this project.

9 Interconnection Customer Requirements

9.1 System Protection

The IC must design its Customer Facilities in accordance with all applicable standards, including the standards in FE's "Requirements for Transmission Connected Facilities" document located at: http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx.

Preliminary Protection requirements will be provided as part of the Facilities Study. Detailed Protection Requirements will be provided once the project enters the construction phase.

The IC has requested a non-standard GSU transformer winding configuration. This transformer is in violation of section 14.2.6 of FE's "Requirements for Transmission Connected Facilities" document and will not be accepted. The GSU transformer must have a grounded wye connection on the high (utility) side and a delta connection on the low (generator) side.

9.2 Compliance Issues and Interconnection Customer Requirements

The proposed Customer Facilities must be designed in accordance with FE's "Requirements for Transmission Connected Facilities" document located at: http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx. In particular, the IC is responsible for the following:

1. The purchase and installation of a fully rated 25 kV circuit breaker to protect the AE2-125 generator lead line. A single circuit breaker must be used to protect this line; if the project has several GSU transformers, the individual GSU transformer breakers cannot be used to protect this line.

2. The purchase and installation of the minimum required FE generation interconnection relaying and control facilities. This includes over/under voltage protection, over/under frequency protection, and zero sequence voltage protection relays.

3. The purchase and installation of supervisory control and data acquisition ("SCADA") equipment to provide information in a compatible format to the FE Transmission System Control Center.

4. Compliance with the FE and PJM generator power factor and voltage control requirements.

5. The execution of a back-up service agreement to serve the customer load supplied from the AE2-125 generation project metering point when the units are out-of-service. This assumes the intent of the IC is to net the generation with the load.

The IC will also be required to meet all PJM, ReliabilityFirst, and NERC reliability criteria and operating procedures for standards compliance. For example, the IC will need to properly locate and report the over and under voltage and over and under frequency system protection elements for its units as well as the

submission of the generator model and protection data required to satisfy the PJM and ReliabilityFirst audits. Failure to comply with these requirements may result in a disconnection of service if the violation is found to compromise the reliability of the FE system.

Power Factor Requirements

The IC shall design its non-synchronous Customer Facility with the ability to maintain a power factor of at least 0.95 leading (absorbing VARs) to 0.95 lagging (supplying VARs) measured at the high-side of the facility substation transformer(s) connected to the FE transmission system.

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 FE Requirements

The IC will be required to comply with all FE revenue metering requirements for generation interconnection customers which can be found in FE's "Requirements for Transmission Connected Facilities" document located at: http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx

11 Network Impacts

The Queue Project AE2-125 was evaluated as a 13.8 MW (Capacity 8.3 MW) injection tapping the Stahlstown to Ligonier 25kV line in the APS area. Project AE2-125 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-125 was studied with a commercial probability of 100%. Potential network impacts were as follows:

Summer Peak Load Flow

12 Generation Deliverability

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

None

13 Multiple Facility Contingency

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

None

14 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

15 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

16 Steady State Voltage Requirements

None

17 Stability

Not required for this project.

18 Light Load Analysis

Not required for solar projects.

19 System Reinforcements:

None

20 Flow Gate Details

The following appendices contain additional information about each flowgate presented in the body of the report. For each appendix, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact. It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

None

Affected Systems

21 Affected Systems

21.1 LG&E

None

21.2 MISO

None

21.3 TVA

None

21.4 Duke Energy Progress

None

21.5 NYISO

None

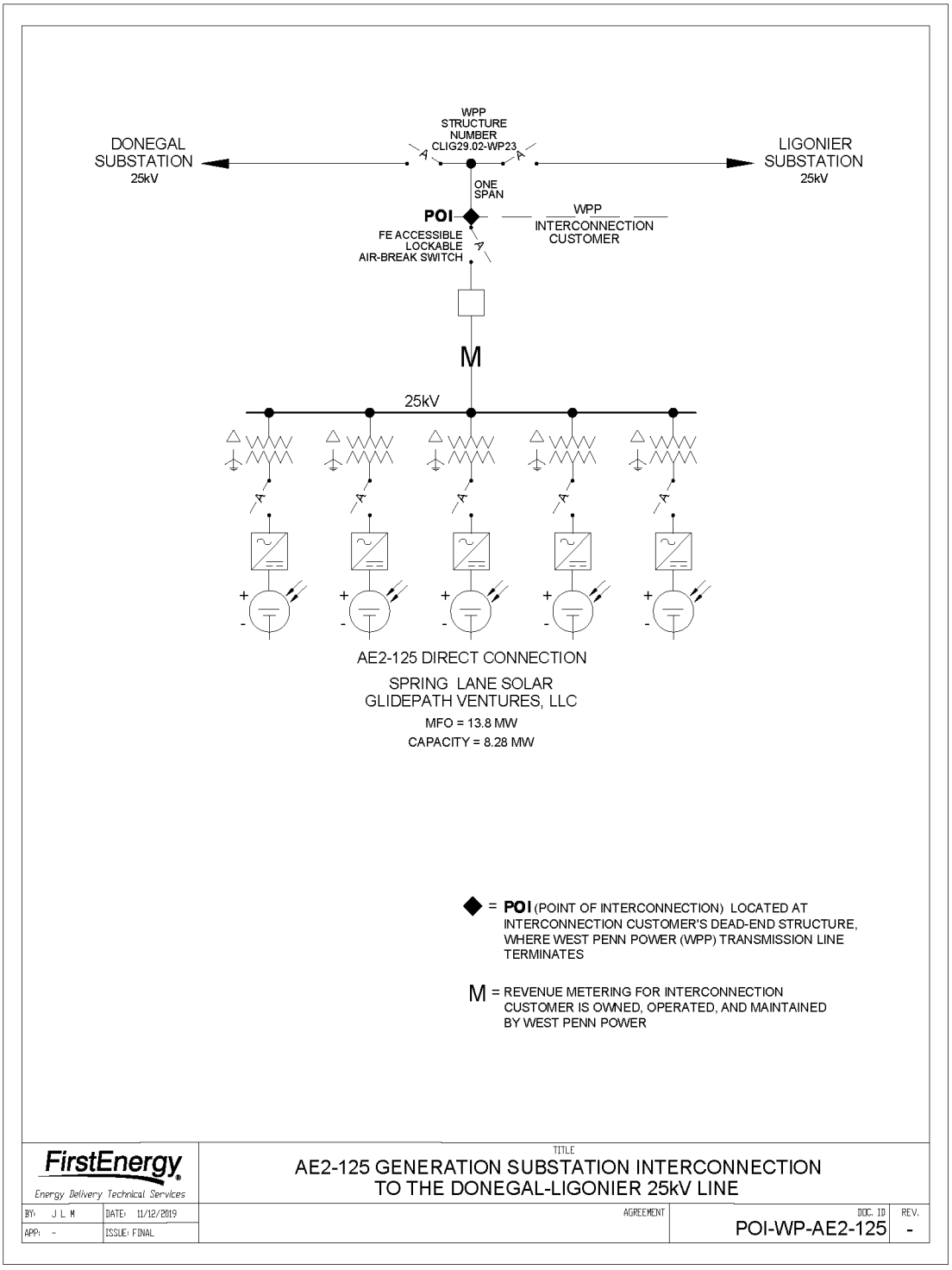
Short Circuit

22 Short Circuit

The following Breakers are overduty:

None

23 Attachment 1: One Line Diagram



24 Attachment 2: Project Location

AL Spring Regional Map with Solar PV site in RED. POI on 25kV segment running from Ligonier to Stahlstown, PA.