



**Revised**

**Generation Interconnection**

**Queue Project AE1-187**

**North Lebanon - Cleona 69 KV**

**Feasibility Study Report**

**Capacity : 12.6 MW / Energy : 20 MW**

May, 2019

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## 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 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.

An Interconnection Customer with a proposed new Customer Facility that has a Maximum Facility Output equal to or greater than 100 MW shall install and maintain, at its expense, phasor measurement units (PMUs). See Section 8.5.3 of Appendix 2 to the Interconnection Service Agreement as well as section 4.3 of PJM Manual 14D for additional information.

An Interconnection Customer entering the New Services Queue on or after October 1, 2018 (except those regulated by the United States Nuclear Regulatory Commission) shall provide primary frequency response in accordance with Section 4.7.2 of Appendix 2 to the Interconnection Service Agreement. See PJM Manual 14D Section 7.1.1 for more information.

PJM utilizes manufacturer models to ensure the performance of turbines is properly captured during the simulations performed for stability verification and, where applicable, for compliance with low voltage ride through requirements. Turbine manufacturers provide such models to their customers. The list of manufacturer models PJM has already validated is contained in Attachment B of Manual 14G. Manufacturer models may be updated from time to time, for various reasons such as to reflect changes to the control systems or to more accurately represent the capabilities turbines and controls which are currently available in the field. Additionally, as new turbine models are developed, turbine manufacturers provide such new models which must be used in the conduct of these studies. PJM needs adequate time to evaluate the new models in order to reduce delays to the System Impact Study process timeline.

for the Interconnection Customer as well as other Interconnection Customers in the study group. Therefore, PJM will require that any Interconnection Customer with a new manufacturer model must supply that model to PJM, along with a \$10,000 fully refundable deposit, no later than three (3) months prior to the starting date of the System Impact Study (See Section 4.3 for starting dates) for the Interconnection Request which shall specify the use of the new model. The Interconnection Customer will be required to submit a completed dynamic model study request form (Attachment B-1 of Manual 14G) in order to document the request for the study.

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.

## General

The Interconnection Customer has proposed a new solar generating facility located in Lebanon County, Pennsylvania. The installed facilities will have a total capability of 20 MW Energy with 12.6 MW of this output being recognized by PJM as Capacity Interconnection Rights. The proposed in-service date for this project is April 1, 2021. **This study does not imply a Mid-Atlantic Interstate Transmission, LLC (Transmission Owner or MAIT) commitment to this in-service date.**

## Revisions from Original February 2019 Feasibility Study Report

Under the Attachment Facilities section of the report, the structure number was corrected from ‘838-139’ to ‘94-119’.

## Point of Interconnection

The AE1-187 solar facility will interconnect with the MAIT subtransmission system at either one of the following Point of Interconnection (POI) options:

**POI Option 1:** The primary POI will be accomplished by tapping the North Lebanon – Cleona 69 kV line at a point located approximately 4.29 miles from N. Lebanon substation and approximately 0.1 miles from Cleona substation. The attachment facilities line will be about 0.2 miles from the 69 kV line to the POI.

**POI Option 2:** The secondary POI will be accomplished by tapping the North Lebanon – Annville 69 kV line at a point located approximately 4.29 miles from N. Lebanon.

Please refer to the single line diagram in Appendix 2 for more details. This report presents the estimated costs associated with the primary POI only. No costs are provided for the secondary POI.

## Cost Summary

The following is a summary of the total cost for this AE1-187 project. A detailed items breakdown is shown on the next page. The AE1-187 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	\$ 75,000
Direct Connection Network Upgrade	\$ 0.0
Non Direct Connection Network Upgrades	\$ 668,000
<b>Total Cost</b>	<b>\$ 743,000</b>

Cost allocations for the network connection upgrades (if applicable) will be provided in the System Impact Study Report.

The above shown total cost do not include Contribution in Aid of Construction (CIAC) Federal Income Tax Gross Up charge. The tax amount of \$ 151,400 may or may not be charged to the project based on whether or not this project meets the eligibility requirements of IRS Notice 88-129.

## Attachment Facilities

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
Construct 1 span of 69kV line towards Point of Interconnection of the Customer Facility (Tapping the 69 kV line at or near structure 94-119.)	\$ 75,000
Total Direct Connection Facility Costs	<b>\$ 75,000</b>

## Direct Connection Cost Estimate

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

**None.**

## 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 69kV line at or near structure 94-119. Install disconnect switches with SCADA control @ North Lebanon-West Lebanon (94) 69kV Line Tap.	\$ 668,000
Total Direct Connection Facility Costs	<b>\$ 668,000</b>

## Interconnection Customer Requirements

The proposed AE1-187 Customer Facilities must be designed in accordance with FirstEnergy's "Requirements for Transmission Connected Facilities" document located at <http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx>. In particular, Interconnection Customer is responsible for the following:

1. The purchase and installation of fully rated 69 kV circuit breaker to protect the AE1-187 generator lead line. A single breaker must be used to protect this line. FirstEnergy does not approve for individual GSU transformer breakers (if applicable) to protect this line.
2. The purchase and installation of the minimum required FirstEnergy 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 FirstEnergy Transmission System Control Center.
4. Power factor and voltage control requirements: A compliance with the FirstEnergy and PJM generator power factor and voltage control requirements. Interconnection Customer shall design its solar-powered 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 FirstEnergy transmission system.
5. The execution of a back-up service agreement to serve the customer load supplied from the AE1-187 generation project metering point when the units are out-of-service. This assumes the intent of the Interconnection Customer is to net the generation with the load.
6. Interconnection Customer must meet all PJM, ReliabilityFirst, and NERC reliability criteria and operating procedures. For example, the Interconnection Customer 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 FirstEnergy system.
7. System Protection Requirements: Interconnection Customer must design its Customer Facilities in accordance with all applicable standards, including the standards in FirstEnergy's "Requirements for Transmission Connected Facilities" document located online at above shown link. 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 above FirstEnergy requirements apply in addition to any metering or other requirements of PJM.



# **Revenue Metering and SCADA Requirements**

## **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 Interconnection Customer's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Sections 24.1 and 24.2.

## **FirstEnergy Requirements**

Interconnection Customer will be required to comply with all FirstEnergy revenue metering requirements for generation interconnection customers. The FirstEnergy revenue metering requirements may be found in the FirstEnergy "Requirements for Transmission Connected Facilities" document located at the following link:

<http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx>

## **Schedule**

Based on above mentioned scope of work, it is expected to take a minimum of nine (9) months after the signing of an Interconnection Construction Service Agreement. This includes preliminary payment that compensates FirstEnergy for the first three months of the engineering design work that is related to the construction of the AE1-187 interconnection substation. This assumes that there will be no environmental issues with any of the new properties associated with this project, that there will be no delays in acquiring the necessary permits for implementing the defined direct connection and network upgrades, and that PJM will allow all transmission system outages when requested.

## **Network Impacts**

### **Option 1 POI – Summer Peak Analysis – 2022**

The Queue Project AE1-187 was evaluated as a 20 MW (Capacity 12.6 MW) injection tapping the N. Lebanon – Cleona 69 kV line in the MetEd area. Project AE1-187 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE1-187 was studied with a commercial probability of 53%. Potential network impacts were as follows:

#### **Generation Deliverability**

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

None

#### **Multiple Facility Contingency**

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

None

#### **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

#### **Short Circuit**

None. (No overdutied circuit breakers identified)

#### **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

## **System Reinforcements**

### **Short Circuit**

None.

### **Stability and Reactive Power Requirement**

Will be determined at a later study stages.

### **Summer Peak Load Flow Analysis Reinforcements**

#### **New System Reinforcements**

(Upgrades required for mitigating reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)

None

#### **Contribution to Previously Identified System Reinforcements**

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)

None.

## **Option 2 POI – Summer Peak Analysis – 2022**

The Queue Project AE1-187 was evaluated as a 20 MW (Capacity 12.6 MW) injection tapping the North Lebanon to Anneville 69 kV line in the ME area. Project AE1-187 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE1-187 was studied with a commercial probability of 53%. Potential network impacts were as follows:

### **Generation Deliverability**

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

None

### **Multiple Facility Contingency**

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

None

### **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)

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None.

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Will be determined at a later study stages.

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None.

## **Appendix 1: Facility Location**

**PJM Queue Position: AE1-187**

## **Appendix 2: One Line Diagram**

**PJM Queue Position: AE1-187**