Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AC1-011

Emlenton 34.5kV

February 2017

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. 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 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 (IC), has proposed a Natural Gas generating facility located in Shippenville, PA. The installed facilities will have a total capability of 18MW with 18MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is January 5, 2018. **This study does not imply a Mid Atlantic Interstate Transmission (or MAIT) commitment to this in-service date.**

Point of Interconnection

AC1-011 will interconnect with the MAIT distribution system along the Emlenton 34.5kV circuit at pole # 6K5835134.5.

Cost Summary

The AC1-011 project will be responsible for the following costs:

Description	Cost	Tax (if applicable)	Total Cost
Attachment Facilities	$ 140,200	$ 25,200	$ 165,400
Direct Connection Network Upgrades	$ 0	$ 0	$ 0
Non Direct Connection Network Upgrades	$ 108,200	$ 19,500	$ 127,700
Total Costs	**$ 248,400**	**$ 44,700**	**$ 293,100**

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	Activity Cost	Tax (if applicable)	Total Cost
Tap on the Emlenton 34.5 kV line and associated 34.5 kV metering package	$ 140,200	$ 25,200	$ 165,400
Total Attachment Facility Costs	**$ 140,200**	**$ 25,200**	**$ 165,400**

Direct Connection Cost Estimate

No Direct Connection Facilities are required to support this interconnection request.

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	Activity Cost	Tax (if applicable)	Total Cost
Install anti-islanding scheme @ Piney SS	$ 108,200	$ 19,500	$ 127,700
Total Non-Direct Connection Facility Costs	**$ 108,200**	**$ 19,500**	**$ 127,700**

Transmission Owner Scope of Work

It was proposed that the project be studied as an interconnection into the First Energy distribution system as a tap on the 34.5 kV Emlenton circuit. The Interconnection Customer has submitted a "Generation Interconnection Feasibility Study Agreement" to PJM and a proposed single line diagram (see Attachment 7) that identifies their proposal.

The Interconnection Customer is responsible for constructing all of the facilities on its side of the point of interconnection, on the line to the generating plant. The Interconnection Customer will also be responsible for the modifications at the tap that are required due to connecting the facility.

The proposed interconnection facilities must be designed in accordance with the FirstEnergy “Requirements for Transmission Connected Facilities” document and “Technical Requirements for the Interconnection of Customer-Owned generation to the FirstEnergy Distribution System” document.

The 34.5kV interconnection point will require the installation of a Penelec installed/owned radio controlled switch (which will act as the disconnect point between First Energy and the generator interconnection).

Interconnection metering is also required for this generation connection. The 34.5 kV revenue quality metering equipment shall be designed, furnished and installed by FirstEnergy. The Interconnection Customer will be responsible for designing, furnishing and installing a SCADA RTU in their generation substation and obtaining the telecommunication circuits from the RTU to the Penelec Data Center. The connection to the Penelec Data Center will be to provide MW, MVAR and 34.5kV voltage at The Interconnection Customers generation substation. Please reference the FirstEnergy Metering Requirements for Interconnection Customers, for more details on the metering requirements for FirstEnergy.

Schedule: 6 months from the Construction Kick off Meeting.

Interconnection Customer Requirements

1. An Interconnection Customer entering the New Services Queue on or after October 1, 2012 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.

2. The Interconnection Customer may be required to install and/or pay for metering as necessary to properly track real time output of the facility as well as installing metering which shall be used for billing purposes. See Section 8 of Appendix 2 to the Interconnection Service Agreement as well as Section 4 of PJM Manual 14D for additional information.

3. 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.

4. The installation of a Penelec provided 34.5 kV interconnection metering instrument transformer. FE will provide the ratio and accuracy specifications based on the customer load and generation levels.

5. The installation of a Penelec provided revenue class meter for each unit to measure the power delivered in compliance with the FE standards.

6. 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.

7. The establishment of dedicated communication circuits for SCADA report to the FE Transmission System Control Center.

8. A compliance with the FE and PJM generator power factor and voltage control requirements.

9. The rough grade of the property for the AC1-011 Interconnection 34.5 kV tap pole and an access road for the delivery of equipment to this site. The above requirements are in addition to any metering and telecommunications required by PJM as specified in PJM Manuals M-01 and M-14D

10. The execution of a back-up retail service agreement with the electric distribution company to serve the customer load supplied from the Emlenton 34.5 kV generation project interconnection point when the units are out-of-service.

11. Providing all easements, properties and permits that may be required to construct the associated facilities. The schedule above is based on the assumption 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 any necessary permits, and that PJM will allow all Transmission system outages when requested.

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 IC's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Sections 24.1 and 24.2.

Frist Energy Requirements

The Interconnection Customer will be required to comply with all FE Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the "FirstEnergy Requirements for Transmission Connected Facilities" document located at the following links:

http://www.firstenergycorp.com/feconnect
http://www.pjm.com/planning/design-engineering/to-tech-standards.aspx

The FE operating company (Penelec) shall provide, own, operate, test, and maintain the revenue metering equipment at the Interconnection Customer's (IC) expense. The revenue metering equipment includes, but is not limited to, current transformers, voltage transformers, secondary wires, meter socket, bidirectional revenue meter, and associated devices. The IC shall mount the instrument transformers unless otherwise agreed to by Penelec. The instrument transformers and meter socket shall be installed in a location that is readily accessible to authorized Penelec representatives. Penelec will provide the IC access to bidirectional kWh and kVARh pulses from the Penelec meter at the IC's expense if requested. The IC shall, at its expense, install, own, operate, test, and maintain any metering and telemetry equipment that may be required to provide real-time meter data to FE or PJM.

Network Impacts

The Queue Project AC1-011 was evaluated as a 18.0 MW (Capacity 18.0 MW) injection at the Piney 34.5kV substation in the Penelec area. Project AC1-011 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC1-011 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis - 2020

Generator 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

(Summary of impacted circuit breakers)

None.

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.

New System Reinforcements

(Upgrades required to mitigate 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.

Light Load Analysis - 2020

Light Load Studies to be conducted during later study phases (as required by PJM Manual 14B).

Stability and Reactive Power Requirement

Stability and Reactive study to be completed during later study phases

Steady-State Voltage Requirements

Steady-State Voltage study to be completed during later study phases

Affected System Analysis & Mitigation

NYISO Impacts:

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

Attachment 1. Single Line Diagram

Attachment 2. Site Plan

Attachment 3. Protection Requirements

The 34.5kV interconnection proposal will require the Interconnection Customer to meet applicable "Technical Requirements" as outlined in First Energy's document titled “Technical Requirements for the Interconnection of Customer-Owned Generation to the FirstEnergy Distribution System".

Protection requirements are included in that document.

Meeting the protection requirements for this application will include (but not be limited to):

Voltage and synch check

FirstEnergy designed, provided, & installed, at the Interconnection Customer expense, modifications to Penelec's Piney Substation, to add 34.5kV system voltage and synchronism checking equipment for the 34.5kV Emlenton Circuit Breaker (CB), and located on the substation relay panel. This equipment will connect to existing potential transformer secondary outputs.

DTT

Also, meeting the protection requirements (for anti-island protection) will involve installation of a Direct Transfer Trip (DTT) system. the Interconnection Customer shall pay for and provide overall system equipment design, and installation (except for the connection to Penelec equipment as covered below). The DTT system type and design shall be subject to FirstEnergy's approval. Due to the significant size of the proposed generation .vs. Penelec’s circuit loading, a fiber optic communication DTT system is strongly preferred.

The DTT system shall include transmitter/receiver equipment. The transmitter equipment, so as to receive CB status (from Penelec's 34.5kV Emlenton CB at Piney Substation) will be located in local proximity to this Penelec equipment. Hardware, which will provide CB status to the DTT transmitter, will be designed, provided by, and installed by FirstEnergy, at the Interconnection Customer expense.

A receiver shall be located at the Interconnection Customer Emlenton generation facility to receive the tripping signal. Tripping of the the Interconnection Customer Emlenton generator would be required (via the DTT) for an open, or trip out, condition of Penelec's Emlenton CB mentioned above.

Tripping of the the Interconnection Customer Emlenton generator would be required for a loss of DTT communication channel between the transmitters and receiver, as well as for times of nonfunctional DTT transmitter/receiver terminals. The Interconnection Customer Emlenton generator will not re-connect to the Penelec system until full integrity of the DTT system is restored.

The Interconnection Customer shall provide RTU normal/alarm operational status of the DTT system to the Penelec Load Dispatch Office. This monitoring shall be a continuous monitoring

of the communication channel and operational readiness of the transmitter/receiver terminals, i.e., overall system integrity.

Maintenance and upkeep of the DTT system will be at the Interconnection Customer expense.

General Concerns

It is to be understood by the Interconnection Customer (and subsequent operator), for any abnormal 34.5kV operation of the Penelec system which would cause the Interconnection Customer Emlenton generation facility to be electrically isolated from Penelec's Piney Substation via the normal 34.5kV circuit, the Interconnection Customer Emlenton generator will disconnect, and remain disconnected, from the Penelec system until the normal 34.5kV circuit is restored.

Notes

The proposed interconnection Owners/developers facilities must be designed in accordance with the Generator Interconnection Technical Requirement for Distribution Connection Facilities document located at either of the following links:

www.firstenergycorp.com/feconnect

www.pjm.com/planning/design-engineering/to-tech-standards.aspx

Additional Note: F.E.'s policy, (as noted in F.E. (Engineering Practices)) EP (# 02-280 C 3.11)

Generator owner is responsible to provide adequate protection (for their equipment) under any distribution system operating condition' - which includes 'Separation from supply' (i.e. tripping of F.E. circuit breakers) and 'Re-synchronizing the generation after electric restoration of the supply' (i.e. reclosing of F.E. circuit breakers).

Generator owner protection must be designed to coordinate with the reclosing practices of FirstEnergy line protective devices. The generator must cease to energize the FirstEnergy circuit to which it is connected prior to reclosing of any (FE) automatic reclosing devices.