Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AC2-099

Nursery 36kV

August 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 Methane Gas generating facility located in Painesville, OH. The installed facilities will have a total capability of 3 MW with 3 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is June 30, 2018. **This study does not imply a American Transmission Systems Inc. (or "ATSI") commitment to this in-service date.**

Point of Interconnection

AC2-099 will interconnect with the American Transmission Systems Inc. (or "ATSI") distribution system along the Nursery 36kV line (R-18-NY-G-X 36 kV line).

Cost Summary

The AC2-099 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$ 2,000,000
Direct Connection Network Upgrades	$ 0
Non Direct Connection Network Upgrades	$ 163,400
Total Costs	**$ 2,163,400**

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
Install a 36kV line tap to Interconnection Customer Substation	$ 2,000,000
Total Attachment Facility Costs	**$ 2,000,000**

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
Install relaying and DTT at Nursery substation	$ 163,400
Total Non-Direct Connection Facility Costs	**$ 163,400**

Transmission Owner Scope of Work

A tap connection to the R-18-NY-G-X 36kV sub-transmission circuit will be constructed by The Illuminating Company on behalf of the customer as shown in the Attachment 2. The tap will be located approximately 1.6 miles to the Northeast of Nursery Sub, along Fairport Nursery Rd and Blaise Nemeth Rd. The Point of Interconnection will be located at the point where the line tap connects to the generation facility with manual disconnect (See Attachment 2). A fully rated fault interrupting circuit breaker owned by the customer is required on the high side of the GSU, between the manual disconnect and the GSU to protect the customer's facilities. The Illuminating Company requires a disconnect at the primary metering point that is accessible and lockable by Illuminating Company employees. Additionally, the customer will be responsible for paying all expenses to meet the protection requirements of this project.

Required reinforcements to be constructed by FirstEnergy:

The existing 36 kV sub-transmission line will be tapped approximately 1.6 miles to the Southwest of the point of interconnect, at Fairport Nursery Rd and the N&S RR. The estimate includes: all line work for the 36,000V single-circuit extension from the N&S at Fairport Nursery Rd East to Blaise Nemeth Rd, then Northeast to the approximate identified location for the generating station; wye - broken delta ground detection proximate to the station structure; contract labor & equipment for line work; associated labor for construction supervision & project

management functions, contract engineering and engineering review and acceptance. Also included is the installation of single mode fiber optic cable for Direct Transfer Trip (DTT) along the same pole line. Note that the customer will be responsible for provision of a material lay down area and reporting point for line construction personnel. The material lay down area may require site security items such as fencing and stoning, dusk-to-dawn lighting, conex boxes, etc. The needs will be specified at the time of final design and cost determination. The estimated cost is approximately $2,000,000.

Relay and control work will be required at the Nursery Substation. This includes upgrading the relaying on the 36kV R-18-NY line at Nursery substation in support of the Granger Lake County project. The existing relaying will be replaced by SEL-311C (primary), and SEL-351-7 (backup) relays. Also, included is installation of SEL 2830 and associated fiber optic connections/patch panels for Direct Transfer Trip (DTT). The estimated cost is $ 142,900.

A Dymec Router will be supplied to the Granger Lake County for the SCADA interface and SCADA integration into the FirstEnergy EMS system. The estimate assumes that the GE IBox RTU and lease telephone line to the IBox are supplied and installed by the customer. The router is to be installed by the customer as well. Additionally, the customer is to provide and install a SEL 2830 and associated fiber optic connections/patch panels for Direct Transfer Trip (DTT). The estimated cost is $ 8,400.

Relay setpoint calculations for Nursery Substation protection and testing of the direct transfer trip equipment for interconnection protection will be required. The estimated cost is $12,100.

Transmission Owner Schedule

A proposed 7-month construction schedule is estimated to complete construction and the associated activities listed below from the date of a fully executed Interconnection Construction Service Agreement. A more detailed construction schedule with milestones will be developed for the Interconnection Construction Service Agreement. The schedule is based on certain assumptions as listed in this section.

Activity	Start Month	End Month
• Preliminary Engineering	**1**	**1**
• Permits & Real Estate		
• Detailed Engineering	**2**	**6**
• Equipment Procurement – Delivery	**5**	
• Below Grade Construction	**5**	**6**
• Above Grade Construction	**3**	**7**
• Testing & Commissioning	**7**	**7**

Assumptions/Qualifiers:

The accomplishment of the work on the FE system to support the estimated costs and proposed schedule is dependent on the following:

- Obtaining the necessary line outages
- No equipment delivery, environmental or regulatory delays.
- No permitting or real estate delays.
- No extreme weather.
- No force majeure.
- Availability of external construction crews for installation.

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.

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.

ATSI 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

Metering

Revenue metering equipment will need to be installed at the Point of Interconnection, unless otherwise agreed upon by the customer, FirstEnergy and PJM. The metering shall include, but not limited to, instrument transformers, secondary wiring, meter socket, bidirectional revenue

meter, and associated devices. FirstEnergy shall provide, own, operate, test, and maintain this equipment at the customer's expense.

Operational metering through the use of SCADA will be required to be communicated to the appropriate FirstEnergy Control Center. The generator shall be equipped with a SCADA RTU and shall be connected via an appropriate customer supplied, dedicated digital communications channel to the respective FE FEP diversified locations. The RTU must communicate via DNP 3.0 Protocol, and must provide FE with information as required in Section 11.2 of the FirstEnergy Requirements for Transmission Connected Facilities document.

The customer will be required, as applicable, to comply with all FE and PJM revenue metering and SCADA requirements for generation interconnection customers. The FE revenue metering requirements for generation facilities participating in PJM Energy Markets and connected 46kV or lower may be found in the FE "Requirements for Transmission Connected Facilities" document (Attachment F). PJM's requirements for Revenue and SCADA metering may be found in PJM manuals M-1 and M-14D. These requirements can be found using the links above (under ATSI Requirements)

Network Impacts

The Queue Project AC2-099 was evaluated as a 3.0 MW (Capacity 3.0 MW) injection at the Nursery 36 kV substation in the ATSI area. Project AC2-099 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC2-099 was studied with a commercial probability of 100%. Potential network impacts were as follows:

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.

Attachment 1. System Protection Requirements

Protection Requirements for the new interconnecting substation
The Granger Lake County substation will contain, at a minimum, one 36kV transformer circuit breaker, one 4000kVA, 34.5kV-4.16kV transformer and one 4.16kV transformer circuit breaker. The transformer windings shall be delta-wye grounded (HV-LV) (the low side can be grounded or un-grounded). The 36kV breaker shall be rated 600A continuous, with a minimum 12.5kA interrupting and 150kVBIL rating.

Minimum protective relaying functions for this substation installation shall include SEL-311C (primary), and SEL-351-7 (backup) relays. Also, included is installation of SEL 2830 and associated fiber optic connections/patch panels for Direct Transfer Trip (DTT). Mirrored-bit communication shall be installed between the Granger Lake County SEL 2830 & the Nursery Substation SEL 2830 transceivers via single mode fiber optic cable.

The relaying system shall have a reliable source of DC power independent from the AC system and immune to AC system disturbance or loss (for example - DC battery and charger) to assure proper operation of the protection scheme.

FirstEnergy will complete detailed relay coordination studies to identify off-site relay setting changes required because of this generation interconnection. This may result in additional individual relay replacements being required. These relay replacements will be done at the cost of the customer.

The customer is solely responsible for protecting its own equipment in such a manner that electrical faults or other disturbances on the FE system do not damage its equipment.

Additional requirements
Pending the results of the Dynamics Analysis, yet to be performed, additional protection upgrades may be required.