Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AC1-078

Beatty-London 138kV

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 Solar generating facility located in Madison County, Ohio. The installed facilities will have a total capability of 176 MW with 66 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is December 31, 2019. **This study does not imply an ATSI commitment to this in-service date.**

Point of Interconnection

AC1-078 will interconnect with the ATSI transmission system along the Beatty-London 138kV line.

Cost Summary

The AC1-078 project will be responsible for the following costs:

Description	Cost	Tax (if applicable)	Total Cost
Attachment Facilities	$ 0	$ 0	$ 0
Direct Connection Network Upgrades	$ 3,802,700	$ 483,100	$ 4,285,800
Non Direct Connection Network Upgrades	$ 409,700	$ 52,078	$ 461,778
Total Costs	**$ 4,212,400**	**$ 535,178**	**$ 4,747,578**

© PJM Interconnection 2017. All rights reserved.

Attachment Facilities

No Attachment Facilities are required to support this interconnection request.

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.

Description	Activity Cost	Tax (if applicable)	Total Cost
Install a 138kV 3-breaker ring bus on the London-Beatty (AEP) line for interconnection to AC1-078 generation substation. @ AC1-078 (London-Beatty Line)	$ 3,381,300	$ 430,000	$ 3,811,300
Loop the Beatty-London 138kV circuit into the proposed 3-breaker ring bus. @ Beatty-London Loop to New 3-Breaker Ring Bus	$ 421,400	$ 53,100	$ 474,500
Total Direct Connection Facility Costs	**$ 3,802,700**	**$ 483,100**	**$ 4,285,800**

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
London 138kV Substation (ATSI): Remote end relay changes for AC1-078 Substation on the 138kV Beatty Line	$ 159,700	$ 20,300	$ 180,000
Beatty Road 138kV Substation (AEP): Remote end relay changes for AC1-078 Substation on the 138kV London Line	$ 250,000	$ 31,778	$ 281,778
Total Non-Direct Connection Facility Costs	**$ 409,700**	**$ 52,078**	**$ 461,778**

© PJM Interconnection 2017. All rights reserved.

Transmission Owner Scope of Work

London-Beatty 138 kV: The primary Point of Interconnection (POI) for the AC1-078 generation project is located one span outside of the proposed ATSI ring bus switch station which will be located on the London-Beatty 138kV line. Please note that Beatty substation is an American Electric Power (AEP) owned facility. Attachments 1 and 2 of this document illustrates the proposed location for the point of interconnection. The direct connection of AC1-078 generation project will be accomplished by utilizing a 3 breaker ring bus to connect to the London-Beatty 138 kV line. Attachment 2 shows a conceptual one-line diagram of the proposed connection of AC1-078 generation project to the ATSI transmission system. The Interconnection Customer will be responsible for constructing all of the facilities on its side of the POI, including the 138 kV line extension to its generation facilities. The Interconnection Customer may not install above ground equipment within any FirstEnergy right-of-way unless permission to do so is expressly granted by FirstEnergy. The ATSI facilities required for the Direct Connection of the generation project and the associated cost estimate are shown in Attachment 3.

Schedule

Based on the extent of the ATSI primary direct connection required to support the AC1-078 generation project, it is expected to take a minimum of eighteen (18) months from the date of a fully executed Interconnection Construction Service Agreement to complete the installation. This includes the requirement for The Interconnection Customer to make a preliminary payment to ATSI which funds the first three months of engineering design that is related to the construction of the Direct Connection facilities. It further assumes that Interconnection Customer will provide all rights-of-way, permits, easements, etc. that will be needed. A further assumption is 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 facility upgrades, and that all system outages will be allowed when requested.

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.

© PJM Interconnection 2017. All rights reserved.

3. The purchase and installation of fully rated 138 kV circuit breakers on the high side of the AC1-078 step-up transformers.

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

5. 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.

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

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

8. The execution of a back-up service agreement to serve the customer load supplied from the AC1-078 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.

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

© PJM Interconnection 2017. All rights reserved.

Network Impacts

The Queue Project AC1-078 was evaluated as a 176.0 MW (Capacity 66.0 MW) injection tapping the London-Beatty 138kV line in the ATSI area. Project AC1-078 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC1-078 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.

© PJM Interconnection 2017. All rights reserved.

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).

© PJM Interconnection 2017. All rights reserved.

Attachment 1. Project Location

© PJM Interconnection 2017. All rights reserved.

Attachment 2. Single Line Diagram

© PJM Interconnection 2017. All rights reserved.