Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position Z2-095

Branchville-Sussex 34kV

August 2014

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 battery facility located in Sussex County, New Jersey. The installed facilities will have a total capability of 10.0 MW with 0.0 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is December 2014. **This study does not imply a Jersey Central Power & Light (JCPL) commitment to this in-service date.**

Point of Interconnection

Z2-095 will interconnect with the JCPL distribution system along the 34kV line between the Branchville and Sussex substations. This project will connect at the same POI as an earlier planned facility.

Cost Summary

The Z2-095 project will be responsible for the following costs:

Description	Total Cost
Transmission Owner facilities	$ 5,500
Transmission Upgrades	$ 0
Total Costs	**$ 5,500**

Transmission Owner Scope of Work

JCPL will required some engineering oversight and commissioning to complete this project.

Description	Total Cost
Engineering oversight and commissioning	$ 5,500
Total Costs	**$ 5,500**

This estimate does not include a Contribution in Aid of Construction ("CIAC") Federal Income Tax Gross Up charge of $1,800. This tax may or may not be charged based on whether or not this project meets the eligibility requirements of IRS Notice 88-129.

System Protection Analysis

An analysis was conducted to assess the impact of the Z2-095 Project on the system protection requirements in the area. The results of this review have identified the following:

Under the assumption that the 10 MW Z2-095 Project will not supply fault current to the JCP&L system, there will be no protection upgrades needed for the Q745 line. The X1-012 Project will be required to have two independent high-speed zones of protection to sense and clear faults on the interconnection transformer which will be addressed as part of the prior project .

Fault currents at the tap point, 3.6 miles from Branchville substation in the direction of Sussex (JC) are listed below.

	Three Phase	Line-Ground
X/R Ratio	3.072	4.009
Fault Current (Amps)	3841	1866

These values are for the current system configuration. Any system changes in the area could have a significant impact on these values. It will be the Interconnection Customer's responsibility to make any protection upgrades required should this occur.

Since the Z2-095 Project will be located behind the existing POI defined for the prior project no additional direction connection facility requirements will apply to the Z2-095 Project at this time.

Interconnection Customer Requirements

In addition to the FE facilities, the Interconnection Customer will also be responsible for meeting all criteria as specified in the applicable sections of the "FE Requirements for Transmission Connected Facilities" document. Since the Z2-095 Project will be connected to the 34.5 kV network, the Interconnection Customer will also be responsible for compliance with the FirstEnergy "Technical Requirements for the Interconnection of Parallel-Operated Generation to the FirstEnergy Distribution System". This includes but is not limited to the following:

1. 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.

2. A compliance with the FE and PJM generator power factor and voltage control requirements. Note that the Z2-095 Project may need to absorb reactive power at the POI to minimize the voltage change should the units rapidly reduce their output or trip off line.

3. The execution of a back-up service agreement to serve the customer load supplied from the Interconnection 34.5 kV substation when the units are out-of-service. This assumes the intent of the Interconnection Customer is to net the generation with the station load.

4. Any complaints from other customers (e.g. flicker complaints) will have to be corrected by the Interconnection Customer. Correction may include changing operation, reducing generation, disconnecting the generators from the Jersey Central system, or other measures.

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. The RTU, the communications channel and all related equipment will be furnished and maintained by the Interconnection Customer. The RTU must communicate with the FE EMS via DNP 3.0 protocol.

6. The following status, control, and metering points will be required:

    a. Interconnection breaker position status and trip control.
    b. Generator real and reactive power output measured at the high-side of the generator step-up transformer.
    c. Generator voltage at the point of interconnection.

7. A compliance with the inverter standard UL1741 and IEEE 1547, "Standard for Interconnecting Distributed resources with Electrical Power Systems", in addition to the power quality standards defined by ReliabilityFirst and PJM.

8. A provision of the necessary generator protection, synchronization controls, and fault detection to initiate a trip to protect the Z2-095 Project equipment from faults on the Jersey Central System.

9. A compliance with the PJM Manuals and Operating instructions to have a plant operator on call 24/7 to respond within a minute to reduce the output of Z2-095 Project when network constraints occur.

10. The Interconnection Customer will not excavate, construct facilities or locate solar panels under the existing FE transmission facilities or on FE right-of-ways without the express permission of FE.

11. The purchase and installation of the standard voice grade (analog) telephone line and associated conduit between the telephone company source and the meter socket or enclosure.

The above requirements are in addition to any metering or other requirements imposed by PJM.

Note that an assumption of this study is that the Z2-095 Project generation will automatically be disconnected whenever the local area network is islanded. If this assumption is not correct, a direct transfer trip scheme will need to be implemented for such situations at the Interconnection Customer's cost.

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.

FirstEnergy 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

Network Impacts

The Queue Project Z2-095 was studied as a 10.0 MW (Capacity 0.0 MW) injection at the W3-140 34.5 kV substation in the JCPL area. Project Z2-095 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project Z2-095 was studied with a commercial probability of 53%. A Summer 2018 case was used for this analysis.

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 contingencies were studied for the full energy output. The contingencies of Line with Failed Breaker and Bus Fault will be performed for the Impact Study.)

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.

FirstEnergy Analysis

The results of the FE analysis show that there are no network upgrades required for the deliverability of the Z2-095 Project to the Jersey Central transmission system. There also are no reinforcements defined for previous projects for which this project will have an impact. However, the Z2-095 Project will be one of eleven proposed generator attachments to the Newton – Branchville – Franklin (F708/ Q745) 34.5 kV line with a total energy capability of over 85 MW. Specifically as shown on Attachment 5, the FE study results show that with all projects at their full energy output, the Q745 line will be thermally constrained under peak summer conditions. The worst overload occurs for loss of the Newton – Branchville (F708) 34.5 kV line, which results in the Branchville - Sussex section of the Q745 line exceeding its emergency rating of 48 MVA by 15%. The mitigation that can be implemented by the Interconnection Customer to alleviate this constraint is to reconductor the Q745 34.5 kV line and replace substation conductors on the line terminal ends. Furthermore, the identified constraint will worsen, and other constraint are likely to appear, as the local load in the area reduces in off peak or lighter load periods. If the developer wishes to pursue this option, further studies will be required to determine the full scope of the work.

In addition, voltage criteria violations such as high voltage under light load conditions and high and low voltages caused by swings in MW output of the attached generation may be constraining. A conclusion of this analysis is therefore that the curtailment of the Z2-095 Project output can be expected at times to maintain the Jersey Central system reliability within the NERC, PJM and FE operations and planning standards.

Attachment 1. Project Location

Attachment 2. Single Line Diagram