Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position X3-029

Belvidere

January 2012

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 Belvidere, New Jersey. The installed facilities will have a total capability of 11.15 MW with 0.0 MW of this output being recognized by PJM as capacity. This means that the remaining 11.15 MW will be curtailable should a system reliability constraint occur.

Point of Interconnection

X3-029 will interconnect with the Jersey Central Power & Light system at the Interconnection Customer owned substation. This substation is fed by the 34kV lines N742 and P744, both between the Pequest and Hoffman substations.

FirstEnergy Analysis

The Interconnection Customer owns the existing substation, which is served by two 34.5 kV lines from Pequest substation, the Pequest – Hoffman (N742) and Pequest – Hoffman (P744) 34.5 kV lines (see Attachment 2). These lines are also owned by the Interconnection Customer and the point of interconnection on each line is at the Pequest substation fence. The revenue metering is located in the Pequest substation. The N742 and P744 lines are networked in a double-breaker scheme and the X3-029 Project generator will be connected between those two breakers, as shown on Attachment 3.

In summary, Attachment 3 shows a conceptual one-line diagram of the Direct Connection facilities that will be required for the X3-029 Project. As indicated, the X3-029 Project will be studied as an 11.15 MW injection to the Jersey Central 34.5 kV system at the Interconnection Customer substation. There will be no modifications required to the FE system for the direct connection of the X3-029 Project.

Power Flow Analysis

A Power Flow study was conducted to determine the reliability impact of the proposed X3-029 Project on the FE Transmission System. This study was completed using a 2013 summer peak and light load power flow that contain a detailed representation of the Jersey Central transmission networks in the area of the proposed X3-029 Project. Note that the year 2013 was chosen for study rather than 2016 since this is the first summer period when the X Queue solar projects are scheduled for service. The findings and the recommendations from this analysis are based on a contingency review that was performed to identify the facility loadings and/or voltage conditions that violate the Reliability*First*, PJM or FE Planning Criteria and are attributable to this project.

The results of the FE analysis show that there are no network upgrades required for the deliverability of the X3-029 Project generation to the Jersey Central and PJM transmission systems. There also are no reinforcements defined for previous projects for which this project will have an impact.

Short Circuit and Dynamics Analysis

In accordance with the RTEP process, a short circuit analysis will not be conducted by PJM since the X3-029 Project connection is to the 34.5 kV system. Therefore, the FE Protection staff conducted a short circuit review of the project connection. The FE analysis showed that no FE circuit breaker will exceed its interrupting capability with the implementation of the X3-029 Project. Therefore no circuit breaker reinforcements will be required.

System Protection Analysis

An analysis was conducted to assess the impact of the X3-029 Project on the system protection requirements in the area. The results of this review have identified that there will be no protection upgrades needed for the addition of the X3-029 Project. However, the X3-029 Project will be required to have two independent high-speed zones of protection to sense and clear faults on the interconnection transformer.

Fault currents at the Interconnection Customer substation are listed below.

	THREE-PHASE	SINGLE-LINE
X/R	25.5	27.7
Fault Current (Amps)	13718	14745

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.

Metering

The FirstEnergy Revenue Metering Requirements may be found in the FirstEnergy Requirements for Transmission Connected Facilities document located at the following links:

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

The existing revenue metering equipment at Pequest substation was reviewed and found to be sufficient for the addition of the X3-029 Project.

Compliance Issues

The proposed interconnection facilities must be designed in accordance with the FirstEnergy "Requirements for Transmission Connected Facilities" located at:

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

This includes the provision of a reactive power capability sufficient to maintain a composite power delivery for the facility at the interconnection point at a power factor between .95 leading (absorbing 3.7 MVAR) and .90 lagging (producing 5.4 MVAR). If this capability cannot be provided by the solar units, a dynamic device such as a STATCOM or SVC must be installed at the X3-029 Project substation at the Interconnection Customer's cost.

The Interconnection Customer will also be responsible for following the requirements of the "FirstEnergy Wholesale Generation Interconnection (WGI) Manual" and the "FE Approved Vendors and Contractors" documents which are also located at the above link.

In addition, the Interconnection Customer will be required to meet all PJM, Reliability*First* and NERC reliability criteria and operating procedures for standards compliance. For example, the Developer 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 Reliability*First* 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 FE system.

FE Facility Upgrades and Costs

The results of the FE analysis shows that no planning criteria violations are attributable to the addition of the X3-029 Project for the conditions studied. Therefore the conclusion is that no Transmission or Distribution system reinforcements will be required to provide the requested service.

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 X3-029 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. This includes the installation of intertie relays at the point of interconnection that either trip the breaker at the point of interconnection or the individual generators beyond the point of interconnection. The function of the intertie relays must include over/under voltage and over/under frequency protection. Note that these intertie relays are in addition to and must be separate from of the two relays that provide independent high speed zone of protection to sense and clear faults. They include the installation of an SEL-351-7 (Version 7) relay or its equivalent for power elements, a potential transformer or CCVT's on the high side of the transformer, and current transformers on the high side of the transformer.

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

3. 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.

4. 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 FirstEnergy EMS via DNP 3.0 protocol.

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

    a. Interconnection breaker position status and trip control (as shown on Attachment 3).

    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.

6. An installation of two independent high-speed zones of protection to sense and clear faults on the interconnection transformer.

7. A provision of the necessary generator protection, synchronization controls, and fault detection to initiate a trip to protect the X3-029 Project equipment from faults on the Jersey Central System.

8. 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 X3-029 Project when network constraints occur.

9. Upon execution of an Interconnection Agreement, the Interconnection Customer must cancel its current net metered retail customer account with JCP&L and convert it to a cogeneration account to allow for proper settlement of load and generation activity.

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 X3-029 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.

Network Impacts

Queue project X3-029 was studied as a(n) 11.15 MW (0.0 MW of which was Capacity) injection into JCPL's system at the HOFFMAN 34.5 kV substation. Project X3-029 was evaluated for compliance with reliability criteria for summer peak conditions in 2015.

Potential transmission network impacts are as follows:

Generator Deliverability

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

No violations identified.

Multiple Facility Contingency

(Double Circuit Tower Line contingencies only with full energy output. Stuck Breaker and Bus Fault contingencies will be applied during the Impact Study)

No violations identified.

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.)

No violations identified.

New System Reinforcements

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

None required.

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 required.

Short Circuit

(Report over-dutied breakers.)

None required.

Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of the surrounding generation. Any potential 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 Transmission Interconnection request.

Note: Only the most severely overloaded conditions are listed. 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 analyzes all overload conditions associated with the overloaded element(s) identified. As a result of the aggregate energy resources in the area, the following violations were identified.

No violations identified.

Summary

The connection of the X3-029 Project to the FE transmission system will require no network upgrades and no new Direct Connection facilities. Therefore the Interconnection Customer will only have a cost responsibility for the integration of the X3-029 Project SCADA points with the Jersey Central EMS system. As shown on Attachment 4, the estimated cost of these facilities is $21,200. This cost includes a CIAC (Contribution in Aid of Construction) Federal Income Tax Gross Up charge of $5,200. This tax may or may not be charged based on whether or not this project meets the eligibility requirements of IRS Notice 88-129.

Based on the extent of the FE direct connection and system upgrades required to support this project, it is estimated that it will take one (1) year from the date of a fully executed Interconnection Construction Service Agreement to complete the upgrades required for the X3-029 Project. Full payment of the estimated cost of the project will be required upon execution of the Interconnection Service Agreement/Interconnection Construction Service Agreement (ISA/CSA). True up of the actual cost versus estimated cost of the project will be performed by FE at the end of the project. As a requirement, the Interconnection Customer must provide the property for the attachment and right-of-way facilities that will be needed at the project initiation. It is also assumed 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 all 34.5 kV transmission system outages can be scheduled when needed.

Note that the FE findings were made from a conceptual review of this project. A more detailed review of the connection facilities and their cost will be identified in the Impact Study. Further note that the cost estimate data contained in this document should be considered as only ballpark since it was produced without a detailed engineering review. The applicant will be responsible for the actual cost of construction. FE herein reserves the right to return to any issues in this document and, upon appropriate justification, request additional monies to complete any connections to the transmission system.

Attachment 1
Site View

Attachment 2
Aerial View

Attachment 3
Single Line Diagram

Attachment 4
Estimated Costs

Item	Description		
1	EMS/SCADA integration		
	Cost:	**$**	**16,000**
	Taxes (if applicable):	**$**	**5,200**
	Total:	**$**	**21,200**