Generation Interconnection Feasibility Study Report Web Version

For

PJM Generation Interconnection Request Queue Position Y2-088

Garards Fort 25kV Project

February, 2013

Feasibility Study Report

Garards Fort kV Generation Project

Introduction

This Feasibility Study report provides the documentation of an assessment that has been performed by FirstEnergy (FE) in response to a request made by Interconnection Customer (IC) for the connection of a 19.9 MW Natural Gas Generation facility to the West Penn Power Company System at the Garards Fort 25 kV Switching Station. The IC has proposed a commercial operation date of March 2014 for the proposed facility. As per the PJM RTEP study process, the project assessment was accomplished by: 1. Evaluating the reliability impact of the proposed facilities and connection on the interconnected transmission system by the performance of a power flow study; 2. Ensuring compliance with the NERC, ReliabilityFirst, PJM and FE Reliability Standards by identifying the system reinforcements that will need to be installed for an interconnection of the proposed project; 3. Coordinating and cooperating with the PJM staff and Interconnection Customer by participating in project meetings and issuing this report as a part of the RTEP study process; 4. Performing a Steady State, Short-Circuit and Dynamics Study as necessary; 5. Conducting all studies in accordance with the PJM Manuals, the "FE Requirements for Transmission Connected Facilities", and the "FE Study Guide".

Connection Facilities

In compliance with the Regional Transmission Expansion Planning (RTEP) protocol, Interconnection Customer has submitted a "Form of Generation Interconnection Feasibility Study Agreement" to PJM (see Attachment 8) that identifies its plan to construct a natural gas generation installation with two reciprocating engines connected to a common bus with a total capability of 19.9 MW (19.9 MW capacity.) For purposes of this report, it has been designated as the Garards Fort 25kV Y2-088 Project (hereinafter, the "Project") to reflect its interconnection voltage and its proximity to the Garards Fort Substation (see Attachment 1.) The IC has requested the study of a Primary Point of Interconnection (POI) for the Project. This report contains detailed connection requirements, direct connection costs and schedule, power flow analysis, short circuit analysis, and a cost and schedule for any associated system reinforcements for the Primary POI.

Primary Point of Interconnection: Garards Fort 25 kV Substation

The Primary POI for the Project will be accomplished by building a new 25 kV terminal at Garards Fort and providing a 25 kV meter package. Interconnection Customer will be responsible for acquiring all easements, properties and permits that may be required to construct both the new 25kV line and the associated attachment facilities. A summary of the Project direct connection facilities that will be required for the Primary POI and their estimated costs are shown on Attachment 3. The one-line for the Primary POI is shown in Attachment 2.

PJM Interconnection Study Results

The following is the report describing the results of the analysis performed by PJM engineers with respect to the transmission system impacts.

Network Impacts

The Queue Project #Y2-088 was studied as a 19.9MW (Capacity 19.9MW) injection at the Gates Hill 138 kV substation in the APS area. Project #Y2-088 was evaluated for compliance with reliability criteria for summer peak conditions in 2016. Potential network impacts were as follows:

Generator Deliverability

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

None

Light Load Analysis

Light Load Studies to be conducted during later study phases (applicable to wind, coal, nuclear, and pumped storage projects).

Multiple Facility Contingency

(Double Circuit Tower Line, Line with Failed Breaker and Bus Fault contingencies for the full energy output)

None

Short Circuit

(Summary form of Cost allocation for breakers will be inserted here if any)

To be determined

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

Steady-State Voltage Requirements

(Results of the steady-state voltage studies should be inserted here)

To be determined

Stability and Reactive Power Requirement

(Results of the dynamic studies should be inserted here)

To be determined

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)

(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)

None

Delivery of Energy Portion of Interconnection Request

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.

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 will study all overload conditions associated with the overloaded element(s) identified.

Not Applicable

Interconnected Transmission Owner's Analysis Results

The following was generated by FirstEnergy (Pennsylvania Electric Company or "Penelec") the Interconnected Transmission Owner, based upon its analysis, as well as that of PJM, for mitigation of the project's impacts on the transmission and lower voltage system as applicable. It includes the costs and schedules for any system upgrades.
Costs for affected Transmission owners other than FirstEnergy are included and reported in the "New System Reinforcements" and "Contribution to Previously Identified System Reinforcements" sections of the "PJM Interconnection Study Results" above.

Power Flow Analysis

A Power Flow study was conducted to determine the reliability impact of the proposed Project on the FE Transmission System. This included the performance of a contingency analysis to identify any facility overload or voltage condition that violates the FE Planning Criteria. Any such violation that is either directly attributable to this project or for which it will have a shared responsibility is included in this report with a least cost plan identified to mitigate them.

The Power Flow Analysis was performed using a 2015 summer peak load base case provided by the PJM staff. This base case included a detailed representation of the West Penn 25 kV system in the area of the Garards Fort 25kV line. A simulation of all possible contingencies within the NERC and FE Planning Standards that are impacted by the Project was conducted to test for criteria compliance. The direct connection of the Garards Fort 25 kV (Y2-088) Project to the West Penn transmission system was studied at the Primary POI.

The PJM and FE analysis show that the Project does not cause additional overloads or criteria violations (see Attachment 4.) As such, no new network upgrades are required for the Project.

Short Circuit and Dynamics Analysis

A short circuit analysis has been performed by PJM and the findings were confirmed by FE. The findings show that no circuit breakers are newly over-dutied with the addition of the Project. The study also showed no significant fault current contribution to the breakers which are near the over-duty limit.

Fault Current

Three Phase: 6,798 Amps
Line to Ground: 4,029 Amps

Z+: 0.1568 + j0.3014 PU
Z0: 0.2466 + j1.023 PU

System Protection Analysis

A System Protection Analysis will be performed during the System Impact Study.

Metering

Interconnection Customer will be required to comply with all FE revenue metering requirements for generation interconnection customers. These FE requirements are detailed on Attachment 7 of this report.

Compliance Issues

Interconnection Customer will be responsible for meeting all FE criteria as defined in the FE Requirements for Distribution Connected Facilities document:

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

While the voltage analysis is not performed for the feasibility study, any voltage criteria violations that would require the plant to provide reactive power, that determination of reactive power requirements will be determined in the system impact study, which will include the low voltage ride through analysis.

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 links.

Interconnection Customer must also meet all PJM, ReliabilityFirst and NERC reliability criteria and operating procedures required for standards compliance. For example, the Interconnection Customer 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 ReliabilityFirst 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

Results from the PJM and FE Power Flow Analysis (Attachment 4) show that there are no FE criteria violations directly attributable to the capacity of the Project. Therefore in accordance with the RTEP procedures defined in the PJM Open Access Transmission Tariff and PJM Manuals, Interconnection Customer is not responsible for network upgrades (see Attachments 5 and 6.)

Note that all cost estimates contained in this document were produced without a detailed engineering review and are therefore subject to revision. More accurate estimates will be determined as a part of the System Impact Study. Interconnection Customer will be responsible for the actual cost of the direct connection that is implemented. FE herein reserves the right to return to any issues in this document and, upon appropriate justification, request additional monies to complete any reinforcements to the transmission system.

Interconnection Customer Requirements

In addition to the FE facilities, 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 including:

1. The purchase and installation of a fully rated circuit breaker on the high side of the Y2-088 step-up transformer.

2. The purchase and installation of a lockable load-break switch at the point of interconnection. This switch must be accessible by First Energy.

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 purchase and installation of a 25kV interconnection metering instrument transformer. FE will provide the ratio and accuracy specifications based on the customer load and generation levels.

5. The purchase and installation of a 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. The RTU, the communications channel and all related equipment will be furnished and maintained by Interconnection Customer. The RTU must communicate with the FirstEnergy EMS via DNP 3.0 protocol.

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 execution of a back-up service agreement to serve the customer load supplied from the Y2-088 25kV interconnection substation when the units are out-of-service. This assumes the intent of Interconnection Customer is to net the generation with the load.

10. The rough grade of the property for the Y2-088 25kV interconnection substation and an access road for the delivery of equipment to this site.

The above requirements are in addition to any metering required by PJM.

Summary

The Project direct connection will require the facility upgrades defined in Attachment 3. As shown, the total estimated cost of the 25kV line and meter package is $506,300. This cost includes a CIAC (Contribution in Aid of Construction) Federal Income Tax Gross Up charge of $130,500. This tax may or may not be charged based on whether or not this project meets the eligibility requirements of IRS Notice 88-129. The Project does not have any required network upgrades.

Based on the scope of the direct connection, it is expected to take a minimum of eighteen (18) months from the signing of an Interconnection Service Agreement/Construction Service Agreement to complete the installation required for the Project. Full payment of the estimated cost of the project will be required upon execution of the Construction Service Agreement (CSA). A true up of the actual cost versus estimated cost of the project will be performed by FE at the end of the project. It also assumes that the Interconnection Customer will provide the property for the Y2-088 25kV interconnection substation and all right-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 network upgrades, and that PJM will allow all transmission system outages when requested.

Attachment 3
Garards Fort 25kV (Y2-088) Project
Direct Connection Requirements

Estimate No.	Description	Total with Tax	Tax	Total Cost
WP-S-128	Install new 25kV line terminal, breaker and SCADA for 19.9MW GIP. @ Garards Fort	418,300	107,800	310,500
EOC	Engineering Oversight & Commissioning	88,000	22,700	65,300
	Totals	**506,300**	**130,500**	**375,800**

Attachment 4
Contingency Analysis

No Criteria Violations Identified

Attachment 5
Garards Fort 25kV (Y2-088) Project
FE Network Facility Reinforcement Conceptual Costs Estimates

No Criteria Violations Identified

Attachment 6
Garards Fort 25kV (Y2-088) Project
FE Network Facility Reinforcement Conceptual One Line Diagrams

No Criteria Violations Identified

Attachment 7
FE Revenue Metering Requirements

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