Generation Interconnection Feasibility Study Report Web Version

For

PJM Generation Interconnection Request Queue Position W2-092

Hunterstown 115kV II Project

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Feasibility StudyReport

Hunterstown 115kV II (W2-092) Generation Project

Introduction

This Feasibility Study report provides the documentation of a system assessment performed by PJM Interconnection LLC and FirstEnergy (FE) in response to a request made by the Interconnection Customer (IC) for the connection of a solar power project with a total capability of 20 MW to the Met-Ed Transmission network. This 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 conducting meetings and issuing this report as a part of the Interconnection Planning study process; 4. Performing a Steady State, Short-Circuit and Dynamics Study as necessary; 5. Conducting all studies in accordance with the PJM Manuals and the "FE Requirements for Transmission Connected Facilities" documents to assure that the assessment performed incorporates study assumptions, follows the documented system performance procedures, considers alternative connection and reinforcement plans, and jointly coordinates the study recommendations.

Connection Facilities

In compliance with the PJM Interconnection Planning protocol, Interconnection Customer has submitted a "Form of Generation Interconnection Feasibility Study Agreement" to PJM that identifies its plan to construct a Hunterstown 115 kV II (W2-092) Generation Project comprised of photo-voltaic solar panels and inverters on a plot of land along Hunterstown Hampton Road near Gettysburg, PA (see Attachments 1A and 1B). The installed facilities will have a total capability of 20 MW with 7.6 MW of this output being recognized by PJM as capacity. This means that the remaining 12.4 MW will be subject to curtailment should a system reliability constraint occur. The proposed in-service date for this Hunterstown 115 kV II (W2-092) Project is June 1, 2013.

As defined by the Interconnection Customer and shown on Attachment 1B, the proposed Hunterstown 115 kV II (W2-092) Project site will be located about 1 mile east of the Hunterstown 115 kV substation. The requested primary point of connection (POI) is chosen to be at a point on the Hunterstown – Gardners (991) 115 kV line, with an alternate connection chosen to be at a point on the Hunterstown - North Hanover (960) 115 kV line. The Interconnection Customer will be responsible for constructing a radial attachment line from the W2-092 115 kV solar collector bus to the chosen point of interconnection. 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 Interconnection Customer will also be responsible for constructing as a minimum requirement, a three breaker ring bus substation either along the Hunterstown – Gardners (991) 115 kV line if the primary POI option is chosen, or along the Hunterstown - North Hanover (960) 115 kV line for the project attachment if the secondary POI option is chosen.

Attachment 2A shows a conceptual one-line diagram of the three breaker ring bus interconnection substation to accommodate the attachment of the Hunterstown 115 kV II (W2-092) Project as the primary option. Note that the three breaker ring bus is common to four separate Interconnection Customer 20 MW solar projects; Hunterstown 115 kV (W1-075), Hunterstown 115 kV II (W2-092), Hunterstown 115 kV III (W2-093), and Hunterstown 115 kV IV (W2-098).

Interconnection Customer will be responsible for constructing all of the facilities on its side of the point of interconnection including the attachment line. A summary of the FE facilities required for the primary Hunterstown 115 kV II (W2-092) connection and their cost estimate is shown on Attachment 3.

Attachment 2B shows a conceptual one-line diagram of the three breaker ring bus interconnection substation to accommodate the attachment of the Hunterstown 115 kV II (W2-092) Project as the secondary option. Note that the three breaker ring bus is common to three separate Interconnection Customer 20 MW solar projects; Hunterstown 115 kV II(W2-092), Hunterstown 3 (W2-093), and Hunterstown 4 (W2-098). No cost estimate is furnished for the secondary interconnection option.

Power Flow Analysis

A Power Flow study was conducted to determine the reliability impact of the proposed Hunterstown 115 kV II (W2-092) Project on the FE Transmission System. This study was completed using a 2014 summer peak load power flow that contains a detailed representation of the Met-Ed transmission networks in the area of the proposed Hunterstown 115 kV II (W2-092) Project. 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 ReliabilityFirst, PJM or FE Planning Criteria and are attributable to this project. Note that in accordance with PJM Interconnection Planning study procedures, this Hunterstown 115 kV II (W2-092) queue project under study and earlier active queue projects are considered to be in service. Therefore, all active queue projects after (W2-092) are considered not in service, including the Hunterstown 3 (W2-093) and Hunterstown 4 (W2-098) projects.

For the primary choice interconnection option (see Attachment 2A), the 20 MW Hunterstown 1 (W1-075) and the 20 MW Hunterstown 115 kV II (W2-092) projects are both in service for a total of 40 MW (15.2 MW capacity) connected to the three breaker ring bus along the Hunterstown – Gardners (991) 115 kV line. The results of the FE analysis show that there are no network upgrades required for the deliverability of the Hunterstown 115 kV II (W2-092) Project generation to the Met-Ed transmission system. The results from the study Power Flow Analysis showing a comparison of the FE and PJM contingency study results is detailed on Attachment 4. As shown, there also are no reinforcements defined for previous projects for which this project will have an impact, and there are no new upgrades required for the Hunterstown 115 kV II (W2-092) Project.

For the second choice interconnection option (see Attachment 2B), the 20 MW Hunterstown 115 kV II (W2-092) project is connected to the three breaker ring bus along the Hunterstown - North Hanover (960) 115 kV line. However, the 20 MW Hunterstown 1 (W1-075) is connected to a point along the Hunterstown – Gardners (991) 115 kV line. The results of the FE analysis show that there are no network upgrades required for the deliverability of the Hunterstown 115 kV II (W2-092) Project generation to the Met-Ed transmission system. The results from the study Power Flow Analysis showing a comparison of the FE and PJM contingency study results is detailed on Attachment 4. As shown, there also are no reinforcements defined for previous projects for which this project will have an impact, and there are no new upgrades required for the Hunterstown 115 kV II (W2-092) Project.

Short Circuit and Dynamics Analysis

A short circuit analysis has been performed by PJM and confirmed by FE. The findings show that no circuit breakers are newly over dutied with the addition of the Hunterstown 115 kV II (W2-092) 115 kV Project. The study also showed no significant fault current contribution to the breakers which have already been identified as over-duty.

Stability studies will be conducted by the PJM staff should this project proceed to the Facilities Study stage of the Interconnection Planning process.

System Protection Analysis

An analysis was conducted to assess the impact of the Hunterstown 115 kV II (W2-092) Project on the system protection requirements in the area. The results of this review have identified the following:

Under the assumption that the Hunterstown 115 kV II (W2-092) Project generation will not supply fault current to the Met-Ed transmission system, there will be no protection upgrades needed due to short circuit duty for the proposed project primary connection to the Hunterstown – Gardners (991) 115 kV line.

Typical relaying will be required at the Hunterstown 115 kV substation, the Gardners 115kV substation, the three breaker ring bus interconnecting substation, and for the radial attachment line to Interconnection Customer's facilities. The specific detailed relaying requirements will be included in the Facilities Study; however, the typical cost of this relaying is included in the cost estimate for this Feasibility Study.

The cost estimate for the required FE system protection facilities is included on Attachment 3.

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

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 6.6 MVAR) and .90 lagging (producing 9.7 MVAR). If this capability cannot be provided by the solar units, a 9.7 MVAR STATCOM or SVC device must be installed at the Hunterstown 115 kV II (W2-092) Project substation at Interconnection Customer's cost.

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.

Interconnection Customer will also be required to meet all PJM, ReliabilityFirst 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 ReliabilityFirst audits. Also, the developer will need to provide documentation that its inverters meet the requirements of UL1741 and IEEE Standard 929. 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 Hunterstown 115 kV II (W2-092) Project for the conditions studied. Therefore the conclusion is that no transmission or distribution reinforcements will be required to provide the requested service.

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 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. The purchase and installation of a 115 kV interconnection metering instrument transformer. FE will provide the ratio and accuracy specifications based on the customer load and generation levels.

3. The purchase and installation of a revenue class meter for the Hunterstown 115 kV II (W2-092) interconnection to measure the power delivered in compliance with the FE standards.

4. A compliance with the FE and PJM generator power factor and voltage control requirements. However, the generators will need to supply their output at a unity power factor at the point of interconnection during normal conditions.

5. The execution of a back-up service agreement to serve the customer load supplied from the Hunterstown 115 kV II (W2-092) 115 kV interconnection substation when the units are out-of-service. This assumes the intent of Interconnection Customer is to net the generation with the station load.

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

7. 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.

8. The following status and metering points will be required:
   a. Interconnection breaker position.
   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.

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

The above requirements are in addition to any metering or other requirements imposed by PJM and are applicable to both the primary choice and second choice

Generation Connection Requirements

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

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.

Summary

The connection of the Hunterstown 115 kV II (W2-092) Project to the FE transmission system will require no network upgrades regardless of whether the primary POI or alternate POI is chosen. Therefore Interconnection Customer will only have a cost responsibility for the Direct Connection of the Hunterstown 115 kV II (W2-092) Project to the Met-Ed transmission system. As shown on Attachment 5, the estimated cost of the facilities for the primary connection to the Hunterstown – Gardners (991) 115 kV line is $4,729,700. No cost estimate is provided for the second choice POI, the Hunterstown - North Hanover (960) 115 kV line.

Based on the extent of the FE direct connection and system upgrades required to support this project, it is estimated that it will take two (2) years from the date of a fully executed Interconnection Construction Service Agreement to complete the upgrades required for the Hunterstown 115 kV II (W2-092) Project. This includes the requirement for Interconnection Customer to make a preliminary payment to FE 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 the property for the attachment and right-of-way facilities 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 115 kV transmission system outages when requested.

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 Facilities 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.