Generation Interconnection

System Impact Study Report

for

Queue Project AG1-251

MCDOWELL 12.47 KV

1.9 MW Capacity / 3.88 MW Energy

August 2021

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1 Introduction

This System Impact Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 205, as well as the System Impact Study Agreement between the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is ATSI.

2 Preface

The intent of the System Impact Study is to determine a plan, with approximate cost and construction time estimates, to connect the subject generation interconnection project to the PJM network at a location specified by the Interconnection Customer. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system. All facilities required for interconnection of a generation interconnection project must be designed to meet the technical specifications (on PJM web site) for the appropriate transmission owner.

In some instances an Interconnection Customer may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection or merchant transmission upgrade, 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 System Impact Study is performed.

The System Impact 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.

The Interconnection Customer seeking to interconnect a wind or solar generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per Schedule H to the Interconnection Service Agreement and Section 8 of Manual 14D.

3 General

The Interconnection Customer (IC), has proposed a Solar generating facility located in Delaware County, Pennsylvania. The installed facilities will have a total capability of 3.88 MW with 1.9 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is December 31, 2021. This study does not imply a TO commitment to this in-service date.

Queue Number	AG1-251
Project Name	MCDOWELL 12.47 KV
State	Pennsylvania
County	Delaware
Transmission Owner	ATSI
MFO	3.9
MWE	3.88
MWC	1.9
Fuel	Solar
Basecase Study Year	2024

Any new service customers who can feasibly be commercially operable prior to June 1st of the basecase study year are required to request interim deliverability analysis.

4 Point of Interconnection

The site is located on the 12.47kV Wye distribution circuit, W121, fed from McDowell Substation. The point of common coupling (PCC) is proposed to be located at Lee Road Apx 6,081' South of Mercer Grove City Road Mercer PN 16137.

5 Cost Summary

The AG1-251 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$488,889
Allocation towards System Network Upgrade Costs (PJM Identified - Summer Peak)*	$0
Allocation towards System Network Upgrade Costs (TO Identified)*	$0
Total Costs	$488,889

*As your project progresses through the study process and other projects modify their request or withdraw, then your cost allocation could change.

This cost excludes a Federal Income Tax Gross Up charges. This tax may or may not be charged based on whether this project meets the eligibility requirements of IRS Notice 88-129. If at a future date it is determined that the Federal Income Tax Gross charge is required, the Transmission Owner shall be reimbursed by the Interconnection Customer for such taxes.

Note 1: PJM Open Access Transmission Tariff (OATT) section 217.3A outline cost allocation rules. The rules are further clarified in PJM Manual 14A Attachment B. The allocation of costs for a network upgrade will start with the first Queue project to cause the need for the upgrade. Later queue projects will receive cost allocation contingent on their contribution to the violation and are allocated to the queues that have not closed less than 5 years following the execution of the first Interconnection Service Agreement which identifies the need for this upgrade.

Note 2: For customers with System Reinforcements listed: If your present cost allocation to a System Reinforcement indicates $0, then please be aware that as changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, the cost responsibilities can change and a cost allocation may be assigned to your project. In addition, although your present cost allocation to a System Reinforcement is presently $0, your project may need this system reinforcement completed to be deliverable to the PJM system. If your project comes into service prior to completion of the system reinforcement, an interim deliverability study for your project will be required.

6 Transmission Owner Scope of Work

The site is located on the 12.47kV Wye distribution circuit, W121, fed from McDowell Substation. The point of common coupling (PCC) is proposed to be located at Lee Road Apx 6,081' South of Mercer Grove City Road Mercer PN 16137.

The total physical interconnection costs is given in the table below:

Description	Total Cost
Company work requirement costs are the obligation of the IC modifications and upgrades are required at Penn Power's McDowell substation. **Add SCADA monitoring and direct transfer trip (DTT) installation at the substation circuit breaker including new potential transformer on secondary transformer bus.** **Install revenue metering at IC DER, perform SCADA tie-in and commissioning.**	$488,889
Total Physical Interconnection Costs	$488,889

7 Schedule

Based on the scope of work for the interconnection facilities, it is expected to take a minimum of **18 months** after the signing of an Interconnection Agreement and construction kickoff call to complete the installation of the physical connection work. This assumes 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 interconnection work, and that all system outages will be allowed when requested.

The schedule for any required Network Impact Reinforcements will be more clearly identified in future study phases. The estimated time to complete each of the required reinforcements is identified in the "System Reinforcements" section of the report.

8 Transmission Owner Analysis

FE performed an analysis of its underlying transmission <100 kV system. The AG1-251 project did not contribute to any overloads on the FE transmission <100 kV system.

9 Interconnection Customer Requirements

9.1 General

In addition to the IC requirements identified in various options described in this report, the CG's interconnection must conform with all the requirements identified in IEEE Std. 1547-2018, unless a requirement has been specifically waived or altered, in writing, by The Company. The IC is advised to review all of the interconnection guidance provided in the document titled, *Customer Guide for Retail Interconnection of Electric Power Producing and Storage Facilities, Commercial/Industrial* located on the FirstEnergy/Company website for any additional requirements beyond those provided in IEEE-1547-2018.

9.2 Power Factor

The CG shall design its facility to maintain a power factor as defined and specified by The Company for all real power export levels as measured at the POC or PCC, as specified by The Company. The specified power factor requirements may vary between 85% lagging to 90% leading and may be fixed, or variable. DER power factor requirements specified by The Company will be defined in the Interconnection Agreement.

9.3 Metering and Communications

A bi-directional revenue meter and the metering current transformers will need to be installed. All costs incurred by The Company associated with the meter upgrades shall be the responsibility of the IC.

The IC must provide Scada Control and Telemetry for the proposed installation.

Provide trip capability to support circuit reconfigurations in distribution automation or manual reconfiguration scenarios.

Provide key locational production, voltage and var data to assist in circuit management and planning.

FirstEnergy has standardized on DNP3 as the communications interface protocol and developed a common set of DNP3 points to be communicated between the Customer's remote terminal unit (RTU) and FirstEnergy for distribution connected DER. Additional information regarding customer SCADA is provided in Attachment 1. (From EP 02-280 DEP Review and Analysis of Interconnection Applications).

9.4 IC Work Requirements

- Install dedicated communications channel fiber optic cable or approved point to point radio with demarcation enclosures to SEL 2505 remote I/O module from DER to the McDowell substation breaker for DTT scheme.
- Install DER SCADA monitoring and IC breaker control (trip only).

10 Revenue Metering and SCADA Requirements

10.1 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 Section 8 of Attachment O.

10.2 Meteorological Data Reporting Requirements

The solar generation facility shall provide the Transmission Provider with site-specific meteorological data including:

- Back Panel temperature (Fahrenheit) - (Required for plants with Maximum Facility Output of 3 MW or higher)
- Irradiance (Watts/meter^2) - (Required for plants with Maximum Facility Output of 3 MW or higher)
- Ambient air temperature (Fahrenheit) - (Accepted, not required)
- Wind speed (meters/second) - (Accepted, not required)
- Wind direction (decimal degrees from true north) - (Accepted, not required)

10.3 Interconnected Transmission Owner Requirements

The IC will be required to comply with all Interconnected Transmission Owner's revenue metering requirements for generation interconnection customers located at the following link:

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

11 Summer Peak Analysis

The Queue Project AG1-251 was evaluated as a 3.88 MW (Capacity 1.90 MW) injection at the McDowell 69 kV substation in the ATSI area. Project AG1-251 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-251 was studied with a commercial probability of 100.0 %. Potential network impacts were as follows:

11.1 Generation Deliverability

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

None

11.2 Multiple Facility Contingency

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

None

11.3 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

11.4 Steady-State Voltage Requirements

To be determined

11.5 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

11.6 System Reinforcements

None

11.7 Flow Gate Details

The following indices contain additional information about each facility presented in the body of the report. For each index, a description of the flowgate and its contingency was included for convenience. The intent of the indices is to provide more details on which projects/generators have contributions to the flowgate in question. All New Service Queue Requests, through the end of the Queue under study, that are contributors to a flowgate will be listed in the indices. Please note that there may be contributors that are subsequently queued after the queue under study that are not listed in the indices. Although this information is not used "as is" for cost allocation purposes, it can be used to gage the impact of other projects/generators. It should be noted the project/generator MW contributions presented in the body of the report are Full MW Impact contributions which are also noted in the indices column named "Full MW Impact", whereas the loading percentages reported in the body of the report, take into consideration the PJM Generator Deliverability Test rules such as commercial probability of each project as well as the ramping impact of "Adder" contributions. The MW Impact found and used in the analysis is shown in the indices column named "Gendeliv MW Impact".

None

11.8 Queue Dependencies

None

11.9 Contingency Descriptions

None

12 Light Load Analysis

Not Required

13 Short Circuit Analysis

The following Breakers are overdutied:

None

14 Stability and Reactive Power

Not Required

15 Affected Systems

15.1 NYISO

None

15.2 MISO

None

16 Attachment 1: One Line Diagram