# Generation Interconnection

# Feasibility Study Report

# for

# Queue Project AG1-251

# MCDOWELL 12.47 KV

# 1.84 MW Capacity / 4 MW Energy

January 2021

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# 1 Introduction

This Feasibility Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 36.2, as well as the Feasibility 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 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. Cost allocation rules for network upgrades can be found in PJM Manual 14A, Attachment B. 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 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.

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.

## 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 5 MW with 2.3 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 | 5 |
| MWE | 5 |
| MWC | 2.3 |
| 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

## 4.1 For 5 MW Output:

For an output of 5 MW, AG1-251 will interconnect with the ATSI transmission system as an express feed to a new 69-12 kV Substation next to the existing McDowell substation.

## 4.2 For reduced output:

For a reduced output (3.984 MW), the customer can remain on the McDowell W121 12.47 kV circuit.

# 5 Cost Summary

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

## 5.1 For 5 MW Output:

| Description | Total Cost |
|---|---|
| **Total Physical Interconnection Costs** | $5,002,500 |
| **Total System Network Upgrade Costs** | $0 |
| **Total Costs** | $5,002,500 |

## 5.2 For reduced output:

| Description | Total Cost |
|---|---|
| **Total Physical Interconnection Costs** | $440,000 |
| **Total System Network Upgrade Costs** | $0 |
| **Total Costs** | $440,000 |

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 2016-36, 2016-25 I.R.B. (6/20/2016). 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.

Cost allocations for any System Upgrades will be provided in the System Impact Study Report.

# 6 Transmission Owner Scope of Work

## 6.1 For 5 MW Output

Construct a new 12.5 kV Mod Substation and express circuit to the proposed DER near McDowell substation.

In order to install the proposed system size requires a new 69kV-12.5kV, 14MVA mod substation located next to the existing McDowell substation along with the construction of a new dedicated 12.5 feeder to the DER.

Company Work Requirements:

- Construct new 69/12.5kV mod Substation (estimated cost $3,250,000)
- Construct new 69kV tap to sub (estimated cost $725,000)
- Transmission tap protection may require either of
    - 69kV line sectionalizing scheme on Tx tap to sub (estimate not available at the feasibility level)
    - Transmission terminal to terminal DTT scheme with dedicated fiber (estimate not available at the feasibility level)
- Construct new 1.8 mile dedicated 12.5kV feeder to DER from substation ($975,000)
- Primary metering costs, SCADA tie-in, and commissioning (estimated cost $52,500).
- Total estimated cost: $5,002,500
- Planning estimates only. Excludes transmission loading and protection studies.

IC Work requirements:

- Install dedicated communications channel fiber optic or approved point to point radio as required 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 breaker control (trip only).
- Total estimated cost: Determined by IC

| Description | Total Cost |
|---|---|
| **Construct new 69/12.5kV mod Substation** | $3,250,000 |
| **Construct new 69kV tap to sub** | $725,000 |
| **Construct new 1.8 mile dedicated 12.5kV feeder to DER from substation** | $975,000 |
| **Primary metering costs, SCADA tie-in, and commissioning** | $52,500 |
| **Total Physical Interconnection Costs** | $5,002,500 |

## 6.2 For Reduced Output[1]

Reduce system size to 3,948 kW and remain on the McDowell 121. 4 MW – 52kW (DER already on the circuit) yields 3,948 kW available.

Using the allowable 3948 kW option at all power factor levels (80-100% absorbing) of the proposed DER, the Voltage, Load Protection and Power flow category criteria passed.

Company Work Requirements:

- Add SCADA monitoring and direct transfer trip (DTT) installation at the substation circuit breaker including cost of new potential transformer(s) on secondary transformer bus (estimated cost $370,000)
- Install revenue metering at IC DER, SCADA tie-in, and commissioning (estimated cost $70,000).
- Total estimated cost: $440,000
- All estimates are planning level only for feasibility.

IC Work requirements:

- Install dedicated communications channel fiber 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 breaker control (trip only).

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

| Description | Total Cost |
|---|---|
| **Add SCADA monitoring and direct transfer trip (DTT) installation at the substation circuit breaker including cost of new potential transformer(s) on secondary transformer bus** | $370,000 |
| **Install revenue metering at IC DER, SCADA tie-in, and commissioning** | $70,000 |
| **Total Physical Interconnection Costs** | $440,000 |

[1] Per FirstEnergy Engineering Standards 02-280 the maximum allowable DER allowed to be connected to a 12.47 kV circuit is 4 MW. The proposed 5 MW addition to the circuit is not allowed. If the customer were to reduce their output to 3.984 MW for the System Impact phase, they would need to be studied for a material modification.

# 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. 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 work and that any system outages will be allowed when requested.

# 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 <100 kV FE transmission system.

# 9 Interconnection Customer Requirements

## 9.1 General

In addition to the IC requirements identified in various options described in this report, the IC'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 IC 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.

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

2) 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 Appendix A. (From EP 02-280 DEP Review and Analysis of Interconnection Applications)

# 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 - Load Flow Analysis

The Queue Project AG1-251 was evaluated as a 5.0 MW (Capacity 1.84 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 53.0 %. 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 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

## 11.5 System Reinforcements - Summer Peak Load Flow - Primary POI

None

## 11.6 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

## 11.7 Queue Dependencies

The Queue Projects below are listed in one or more indices for the overloads identified in your report. These projects contribute to the loading of the overloaded facilities identified in your report. The percent overload of a facility and cost allocation you may have towards a particular reinforcement could vary depending on the action of these earlier projects. The status of each project at the time of the analysis is presented in the table. This list may change as earlier projects withdraw or modify their requests.

None

## 11.8 Contingency Descriptions

None

## 12 Short Circuit Analysis

The following Breakers are overdutied:

None

# 13 Affected Systems

## 13.1 NYISO

NYISO Impacts to be determined during later study phases (as applicable).

## 13.2 MISO

MISO Impacts to be determined during later study phases (as applicable).

# 14 Attachment 1: One Line Diagram

## 14.1 3,948 kW option Single-line Diagram Showing Key Circuit Facility Information

## 14.2 5 MW option Single-line Diagram Showing Key Circuit Facility Information