# *Generation Interconnection*
# *System Impact Study Report*

# *For*

# *PJM Generation Interconnection Request*
# *Queue Position AC2-053*

# *Germantown 115 kV*

***February 2017***

# 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.

# General

Brookview Solar 1, LLC ("Interconnection Customer") has proposed an incremental increase **(uprate)** to prior queue request AC1-048 which is a solar generating facility located approximately 0.1 miles from Germantown substation in Adams County, Pennsylvania. The increased capability associated with this queue position AC2-053 is achieved through additional solar panels and associated equipment. The following table summarizes the MW contributions of each queue request to the Maximum Facility Output (MFO) and Capacity Interconnection Rights (CIR):

| PJM Queue Position | Requested MW Energy | Requested MWs Capacity | MFO | CIRs |
|---|---|---|---|---|
| AC1-048 | 35.0 | 13.3 | 35.0 | 13.3 |
| AC2-053 | 20.0 | 7.6 | 55.0 | 20.9 |

The installed facilities will have total capability of 55.0 MW (MFO) with 20.9 MW of this output being recognized by PJM as Capacity Interconnection Rights (CIR). The expected in-service date for this facility is June 1, 2019. **This study does not imply a Mid-Atlantic Interstate Transmission ("MAIT" or "Transmission Owner") commitment to this in-service date.** The facilities of this queue request AC2-053 will be studied together with queue project AC1-048 for same Interconnection Customer.

## Point of Interconnection

The facilities of this project (AC2-053 and AC1-048) will interconnect with the MAIT transmission system by direct injection into the Germantown Substation 115 kV bus via an overhead line dead-ending inside the substation. Please refer to the one line diagram in Appendix 2 for system configuration.

## Cost Summary and Transmission Owner Scope of Work

The additional 20.0 MWs of the AC2-053 queue request will be combined with the 35.0 MWs of prior queue project AC1-048, and will interconnect to FirstEnergy's transmission system via the same circuit. There are no network upgrades required for this AC2-053 queue project. All costs associated with the AC2-053 and AC1-048 project will be provided in the Facilities Study Report of AC1-048 upon its completion.

Therefore, MAIT facilities and network upgrades required to support AC2-053 project are:

(a) Attachment Facilities: $0.0

(b) Direct Connection Network Upgrades: $ 0.0

(c) Non-Direct Connection Network Upgrades: $0.0

(d) Direct Connection Local Upgrades: $ 0.0

(e) Non-Direct Connection Local Upgrades: $ 0.0

(f) Option to Build Upgrades: $ 0.0

***Estimated Total Costs (a) to (f): ..... $ 0.00***

Above net amounts are in 2016 Dollars. Contribution in Aid of Construction (CIAC) Federal Income Tax Gross Up charge will be added to above amounts if this project does not meet the eligibility requirements of IRS Notice 88-129.

## Interconnection Customer Requirements

In addition to the MAIT facilities, Interconnection Customer is also responsible for meeting all criteria as specified in the applicable sections of the FirstEnergy "Requirements for Transmission Connected Facilities" document, effective 10-3-2016, which can be found under this link: http://www.pjm.com/~/media/planning/plan-standards/private-fe/fcr-facilities-connection-requirements.ashx, including:

1. The purchase and installation of a fully rated circuit breaker on the high side of the AC1-048 and AC2-053 115/34.5 kV step-up transformer.
2. The purchase and installation of the minimum required FirstEnergy generation interconnection relaying and control facilities. This includes over/under voltage protection, over/under frequency protection, and zero sequence voltage protection relays.
3. The purchase and installation of a 115 kV interconnection metering instrument transformer. FirstEnergy will provide the ratio and accuracy specifications based on the customer load and generation levels.
4. The purchase and installation of supervisory control and data acquisition (SCADA) equipment to provide information in a compatible format to the FirstEnergy Transmission System Control Center.
5. The establishment of dedicated communication circuits for SCADA report to the FirstEnergy Transmission System Control Center.
6. A compliance with the FirstEnergy and PJM generator power factor and voltage control requirements.
7. The execution of a back-up service agreement to serve the customer load supplied from the AC1-048 and AC2-053 115 kV interconnection substation when the units are out-of-service. This assumes the intent of the Interconnection Customer is to net the generation with the load.
8. The rough grade of the property for the AC1-048 and AC2-053 115 kV interconnection substation and an access road for the delivery of equipment to this site.
9. Interconnection Customer shall 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 FirstEnergy system.
10. Interconnection Customer shall design its non-synchronous Customer Facility with the ability to maintain a power factor of at least 0.95 leading (absorbing VARs) to 0.95 lagging (supplying VARs) measured at the high-side of the facility substation transformer(s) connected to the FirstEnergy transmission system.

11. For system protection requirements, Interconnection Customer shall design its facilities to be in compliance with FirstEnergy's Transmission System protection practices. As part of the Facilities Study, FirstEnergy will develop a preliminary protection specification for the Interconnection Customer's interconnection facilities. A detailed protection specification will be developed after the execution of an Interconnection Construction Service Agreement.

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

## Revenue Metering and SCADA Requirements

### 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 Sections 24.1 and 24.2.

### FirstEnergy Requirements

The Interconnection Customer will be required to comply with all FE Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the "FirstEnergy Requirements for Transmission Connected Facilities" document located at the following links:

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

# Network Impacts

The Queue Project AC2-053 was evaluated as a 20.0 MW (Capacity 7.6 MW) uprate to prior queue project AC1-048 which is a solar generating facility located approximately 0.1 miles from Germantown substation in Adams County, Pennsylvania in the MAIT area. Project AC2-053 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC2-053 was studied with a commercial probability of 100%. Potential network impacts were as follows:

**Summer Peak Analysis - 2020**

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

None

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

None

**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**

None

**Short Circuit**

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

**Light Load Analysis - 2020**

Not Required

# System Reinforcements

**Short Circuit:** None

**Stability and Reactive Power Requirement:** None

**Summer Peak Load Flow Analysis Reinforcements**

**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)*

None

**Light Load Load Flow Analysis Reinforcements**

**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)*

*Not Applicable*

# Appendix 1

## Facility Location
## PJM Queue Position: AC2-053

# Appendix 2

## Interconnection One-Line Diagram
## PJM Queue Position: AC2-053