Generation Interconnection Impact Study Report

For

PJM Generation Interconnection Request Queue Position AE1-061

5.5 MW

Minotola 12kV

August 2019
Revised: November 2021

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 (IC). As a requirement for interconnection, the IC 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 IC 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 IC 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.

Revision History

This report was revised in November 2021 to correct the CIRs in the "General" section. The TO's metering language was updated and an "Environmental, Real Estate and Permitting" section was added.

General

The IC has proposed a 5.5 MW MFO (2.75 MWC) storage and generation facility to be located at 3039 Vine Rd, Vineland, NJ 08360. PJM studied AE1-061 as a 5.5 MW injection into the Atlantic City Electric (ACE) system at the Minotola 138/12 kV Substation and evaluated it for compliance with reliability criteria for summer peak conditions in 2022. The planned in-service date, as requested by the IC during the project kick-off call, is December 1, 2021. This date may not be attainable due to required PJM studies and the Transmission Owner construction schedule. **Note: In the absence of a PJM Facilities Study, an additional study may be required by ACE.**

Point of Interconnection

The IC requested a distribution level interconnection. As a result, AE1-061 will interconnect with the ACE distribution system at the Minotola Substation 138/12 kV T2 transformer as follows:

- The 5.5 MW generation facility will connect to the 138/12 kV T2 transformer at the Minotola Substation via a new express feeder.

Direct Connection Requirements

Criteria Limits for Distributed Energy Resource (DER) Connections to the ACE Distribution System (less than 69 kV)

1. Single Phase Limit

Any DER with a capacity that exceeds 100 kW shall be a balanced three-phase system.

2. Voltage Limits

DER's are permitted to cause a voltage fluctuation of up to 2% at the Point of Interconnection, ½ the bandwidth of any voltage regulator at its terminals, and ½ the net dead band of a switched capacitor bank at its connection point. When a DER is at maximum output, it shall not raise the feeder voltage above the ANSI C84.1 or state limit, whichever is more conservative.

3. Existing Distribution Circuit Capacity Limits

The aggregate limit of large (250 kW and over) generators running in parallel with a single, existing distribution circuit is 0.5 MW on the 4 kV, 3 MW on the 12 kV, 6 MW on the 25 kV, and 10 MW on the 34 kV.

4. Express Circuit Capacity Limits

Distributed generation installations which exceed the criteria limit for an existing circuit require an express circuit.

The maximum generator size for express circuits, depending on transformer capacity, shall be:

- 4 kV 0.5 MW
- 12 – 13.8 kV 10 MW
- 23 – 25 kV 10 MW
- 33.26 – 34.5 kV 15 MW

5. Distribution Power Transformer Limit

The aggregate limit of large (250 kW and over) generator injection to a single distribution transformer of 22.5 MVA nameplate or larger is 10 MW. Transformers with nameplate ratings lower than 22.5 MVA will be given lower ratings on an individual basis. If the transformer rating is significantly greater than 40 MVA it may be possible to consider a greater generation capacity.

Adding a new transformer will be considered if there is no availability on any of the existing transformers and space is available in an existing substation. Any proposed transformers would be ACE's standard distribution transformer.

6. Express Circuit Length Limit

If there is no space for an additional transformer at the closest substation, the next closest substation will be considered. The length of an express circuit is limited to 5 miles, or for the sake of the feasibility study, 3.8 straight line miles to the substation. This simplification is used because the feasibility study phase does not allow for the time and resources to examine routes in detail (including existing pole lines, easements, ROW, and environmental issues etc.)

7. When a New Substation is Required
If a distribution express circuit can't be built from an existing substation for a project, it will be necessary to construct a new distribution substation with a standard ring bus design. It will be supplied by extending existing transmission lines. It is the developer's responsibility to verify eligibility of this configuration for solar renewable energy certificates.

All limits, given above in MW, are subject to more detailed study to ensure feasibility.

Transmission Owner (T.O.) Scope of Work (Distribution Level)
Transmission Owner scope of work required to accommodate 5.5 MW of generation via a new express feeder from Minotola Substation T2:

1. Design and construct one new 12 kV feeder with 477 AAC from Minotola Substation the generation site – approximately 0.2 miles.
2. Construct one new 12 kV feeder terminal position.
3. Install and operate a utility-owned recloser equipped with the proper relaying and communications.
4. Install and operate utility grade primary metering.
5. Install a direct transfer trip scheme. Approximately 0.2 miles of 48SM ADSS fiber optic cable was estimated for this report to provide the communication channel from Minotola Substation to the storage site. (Secondary tree-trimming may also be required.)
6. Establish generation telemetry and remote trip capability to be provided to the control center via fiber.

High Level Estimates			
Minotola Substation T2			
Express Feeder	0.2	mi.	$144,000
Fiber Installation	0.2	mi.	$45,164
Substation Relaying			$461,300
Feeder Terminal			$575,000
Telecommunications Equipment			$154,905
Recloser & Metering			$92,000
SCADA Integration into EMS			$11,500
Miscellaneous Engineering Costs			$269,000
Approximate Total Cost			$1,752,869

The estimated time to complete this work is 18 - 24 months after receipt of a fully executed interconnection agreement.

The above estimates and scope of work are contingent on the completion of the work for the interconnection of AE1-046.

High Voltage Warning

Typically, voltage received at the meter from the utility can be up to 105% of nominal (without generation on). Normal operating procedures dictate that voltage at the substation be raised to the higher end of an acceptable bandwidth in order to provide adequate supply to distant customers. It is recommended that transformers with no load taps should be used to adjust secondary voltage to avoid the possibility of inverter trips. Failure to account for this may result in lost energy production.

Additional Operating Requirements:

1. ACE will require the capability to remotely disconnect the generator from the grid by communication from its System Operations facility. This will be accomplished with a line recloser.
2. It is the IC's responsibility to send the data that PJM and ACE requires directly to PJM (or in some cases to ACE directly). The IC will grant permission for PJM to send ACE the following telemetry that the IC sends to PJM: real time MW, MVAR, volts, amperes, generator/status, and interval MWh and MVARh.
3. ACE reserves the right to charge the IC operation and maintenance expenses to maintain the IC attachment facilities, including metering and telecommunications facilities, owned by ACE.

Interconnection Customer Scope of Work

The IC is responsible for all design and construction related to activities on their side of the Point of Interconnection. Site preparation, including grading and an access road, as necessary, is assumed to be by the IC. Route selection, line design, and right-of-way acquisition of the direct connect facilities is not included in this report and is the responsibility of the IC.

Protective relaying and metering design and installation must comply with ACE's applicable standards. The IC is also required to provide revenue metering and real-time telemetering data to PJM in conformance with the requirements contained in PJM Manuals M-01 and M-14 and the PJM Tariff.

ACE will supply a wireless modem for MV90 interrogation. In the event that a wireless modem is unable to reliably communicate, the Interconnection Customer will be required to make provisions for a POTS (Plain Old Telephone Service) line or equivalent technology approved by ACE within approximately three feet of the ACE metering position to facilitate remote interrogation and data collection.

The Interconnection Customer will provide 120V power to the meter cabinet from an uninterruptable power source.

The IC shall provide a protection and interrupting device deemed acceptable by ACE to protect the Facility. The protection and interrupting device shall be located at a mutually agreeable location on the Interconnection Customer side of the Point of Interconnection.

A mutually acceptable means of interrupting and disconnecting the generator with a visible break, able to be tagged and locked out, shall be worked out with ACE Distribution Engineering.

Power Factor Requirement

The generators used for this project shall be capable of operating at a power factor (or schedule) specified by ACE in the range of 0.95 leading to 0.95 lagging. It is the responsibility of the developer/customer to obtain equipment that can operate with these requirements while also meeting all applicable requirements of IEEE and UL standards such as, but not limited to, IEEE 1547 and UL 1741.

For this project, operate inverters at a unity power factor of (**1.0**) not impacting volt-ampere reactive ("VAR") continuously.

Inverter Requirements (if applicable):

The inverter at the DG location shall have the following capabilities:

- Voltage flicker reduction through dynamic VAR or fixed power factor response
- Ramp rate control
- SCADA communications
- Curtailment or other mitigation ability if high voltage were to occur
- Disturbance Ride through for both Voltage and Frequency
- Ability to receive and respond to a transfer trip signal
- Ability to adjust power factor or VAR based on utility signal
- Ability to Adjust Real Power Output based on utility signal
- Ability to operate on a Volt/VAR schedule
- Ability to maintain a voltage schedule

The inverter(s) shall operate in accordance with both the IEEE 1547 and UL 1741 series of standards that have been approved and use default settings except when specified otherwise by ACE. While inverters should be capable of voltage stabilization through dynamic VAR response and capable of low voltage and system disturbance ride through, neither of these capabilities will be implemented until such time that the IEEE 1547 series of standards are revised and approved to include standards for these capabilities. At such time as these revised standards become available, the generation owner/operator shall cooperate with ACE to implement these capabilities with settings acceptable to ACE. Until such time, the inverters shall operate with a fixed power factor value between 0.95 lead and 0.95 lag as specified by ACE.

Security Requirements

It is the responsibility of the owner to secure the generator or inverter from any unauthorized access (including physical and remote access) which could alter settings or adversely affect its ability to operate as required. Security measures should include utilizing secure password settings and/or physical locks on cabinet doors.

Environmental, Real Estate and Permitting

Permitting and Real Estate

All work to accommodate the interconnection of AE1-061 is dependent upon the IC obtaining all necessary permits. Moreover, the IC shall be responsible for acquiring all necessary real property rights and acquisitions, including but not limited to: rights of way, easements, and fee simple, in a form approved by ACE. Any setbacks in obtaining the necessary real property rights, acquisitions and permits required for this interconnection may delay the construction schedule. Road crossing permits may be required at several locations for the new express feeder.

Environmental

Environmental permits may need to be secured in order to rebuild the existing pole line. In particular, additional tree trimming or clearing may be needed. This estimate assumes that all the applicable permitting will be obtained for the generating facility by the IC.

AE1-061
Minotola 138/12 kV Sub
5.5 MW PV Solar Generator