Generation Interconnection System Impact Study Report

For

PJM Generation Interconnection Request Queue Position AE1-229

“Deepwater-Upper Pittsgrove 138 kV”

August 2019

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 Interconnection Customer 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

Pilesgrove Solar I, LLC, the Interconnection Customer (IC), has proposed a 149.3 MW Energy (89.0 MW Capacity) solar generating facility to be located coordinates: Latitude: 39.6465420, Longitude: -75.3626530. PJM studied the AE1-229 project as an injection into the Atlantic City Electric Company (ACE) transmission system at a tap of the Churchtown (PSSE bus #228314) to Upper Pittsgrove (PSSE bus #228211) 138 kV circuit and evaluated it for compliance with reliability criteria for summer peak conditions in 2022. The project was studied at a commercial probability of 100%. The planned in-service date, as requested by the IC, is September 30, 2021. This date may not be attainable due to required PJM studies (Facilities) and the Transmission Owner's construction schedule.

Point of Interconnection

The Interconnection Customer requested a transmission Point of Interconnection (POI) be evaluated for the AE1-229 project. The POI will be located at an IC owned breaker within 500 feet of the newly constructed substation which will connect to the existing ACE Churchtown – Upper Pittsgrove 138 kV circuit (see Attachment 1).

NOTE: Due to the Deepwater Substation retirement, 138 kV loads have been routed to Churchtown 138 kV substation. PJM was notified of Deepwater substation retirement prior to queue AE1.

Transmission Owner Scope of Attachment Facilities Work

Substation Interconnection Estimate

Scope: Build a new 138 kV substation with a 3-position ring bus. Two of the positions on the ring bus will be transmission line terminals for the tie-in of existing ACE Line 1405. The other position will be a terminal configured for the interconnection of the AE1-229 generation.

Estimate: $7,300,000
Construction Time: 32-48 months

Major Equipment Included in Estimate:

- Control Enclosure, 47' x 16' Qty. 1
- Power Circuit Breaker, 138 kV, 2000A, 40kA, 3 cycle Qty. 3
- Line Switch, 138 kV, 2000A, Manual, Arcing horns Qty. 2
- Disconnect Switch, 138 kV, 2000A, Manual Wormgear, Arcing Horns Qty. 6
- CT/VT Combination Units, 138 kV Qty. 3
- CVT, 138 kV Qty. 9
- Disconnect Switch Stand, High, 138 kV, Steel Qty. 8
- CT/VT Stand, Single Phase, High, 138 kV, Steel Qty. 3
- CVT Stand, Single Phase, High, 138 kV, Steel Qty. 9
- SSVT, 138 kV/240-120 V Qty. 1
- Relayed Bus Differential Panel Qty. 1
- Relay Panel, Transmission Line, FL/BU (20") Qty. 2
- Control Panel, 138 kV Circuit Breaker (10") Qty. 3
- Take-off structure, 138 kV Qty. 3
- Bus Support Structure, 3 phase, 138 kV, Steel Qty. 8
- 138 kV Al tub bus Lot

Estimate Assumptions:

- The required land is available for use.
- Developer responsible for land purchase for the substation, price is not included.
- Site clearing and grading performed by Developer.

Required Relaying and Communications

New protection relays are required for the new terminals.

Front line and back-up line protection will be required. A relay panel for the generator bus will be required with front line and back-up protection.

New protection relays are required for the new line terminals. Frontline and Backup line protection will be required. A relay panel will be required for each transmission line (2 total).

A breaker control relay on a breaker control panel will be required for the control and operation of each new 138 kV circuit breaker (3 total).

The project will require re-wiring and adjustment of existing relay schemes at Churchtown and Upper Pittsgrove to accommodate the new 138 kV substation.

Metering

Three phase 138 kV revenue metering points will need to be established. ACE will purchase and install all metering instrument transformers as well as construct a metering structure. The secondary wiring connections at the instrument transformers will be completed by ACE's metering technicians. The metering control cable and meter cabinets will be supplied and installed by ACE. ACE will install conduit for the control cable between the instrument transformers and the metering enclosure. The location of the metering enclosure will be determined in the construction phase. ACE will provide both the Primary and the Backup meters. ACE's meter technicians will program and install the Primary & Backup solid state multi-function meters for each new metering position. Each meter will be equipped with load profile, telemetry, and DNP outputs. The IC will be provided with one meter DNP output for each meter. ACE will own the metering equipment for the interconnection point, unless the IC asserts its right to install, own, and operate the metering system.

The IC will be required to make provisions for a voice quality phone line within approximately 3 feet of each Company metering position to facilitate remote interrogation and data collection.

It is the IC's responsibility to send the data that PJM and ACE requires directly to PJM. 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.
The estimate for ACE to design, purchase, and install metering as specified in the aforementioned scope for metering is included in the Substation Interconnection Estimate.

Interconnection Customer Scope of Direct Connection 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 requires that an IC circuit breaker is located within 500 feet of the ACE substation to facilitate the relay protection scheme between ACE and the IC at the Point of Interconnection (POI).

Inverter Requirements

- The Interconnection Customer shall design is non-synchronous generation facility with the ability to maintain a power factor of at least 0.95 leading to 0.95 lagging measured at the Point of Interconnection.

Special Operating Requirements

1. ACE will require the capability to remotely disconnect the generator from the grid by communication from its System Operations facility. Such disconnection may be facilitated by a generator breaker, or other method depending upon the specific circumstances and the evaluation by ACE.

2. ACE reserves the right to charge the Interconnection Customer operation and maintenance expenses to maintain the Interconnection Customer attachment facilities, including metering and telecommunications facilities, owned by ACE.

Summer Peak Analysis - 2022

Transmission Network Impacts

Potential transmission network impacts are as follows:

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

Summer Peak Load Flow Analysis Reinforcements

System Reinforcements
(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)

None

Short Circuit

No issues identified.

Stability Analysis

In progress. To be completed during the Facilities Study phase.

Light Load Analysis - 2022

Not required.

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.

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
594586	219110	GLOUCSTR	PSE&G	219755	CUTHBERT_4	PSE&G	1	PS_P1-2_C-2308_LT	operation	758.0	99.64	102.09	AC	22.52

Atlantic City Electric Costs

Cost estimates will further be refined as a part of the Facilities Study for this project. The Interconnection Customer will be responsible for all costs incurred by ACE in connection with the AE1-229 project.

Incremental Capacity Transfer Rights (ICTRs)

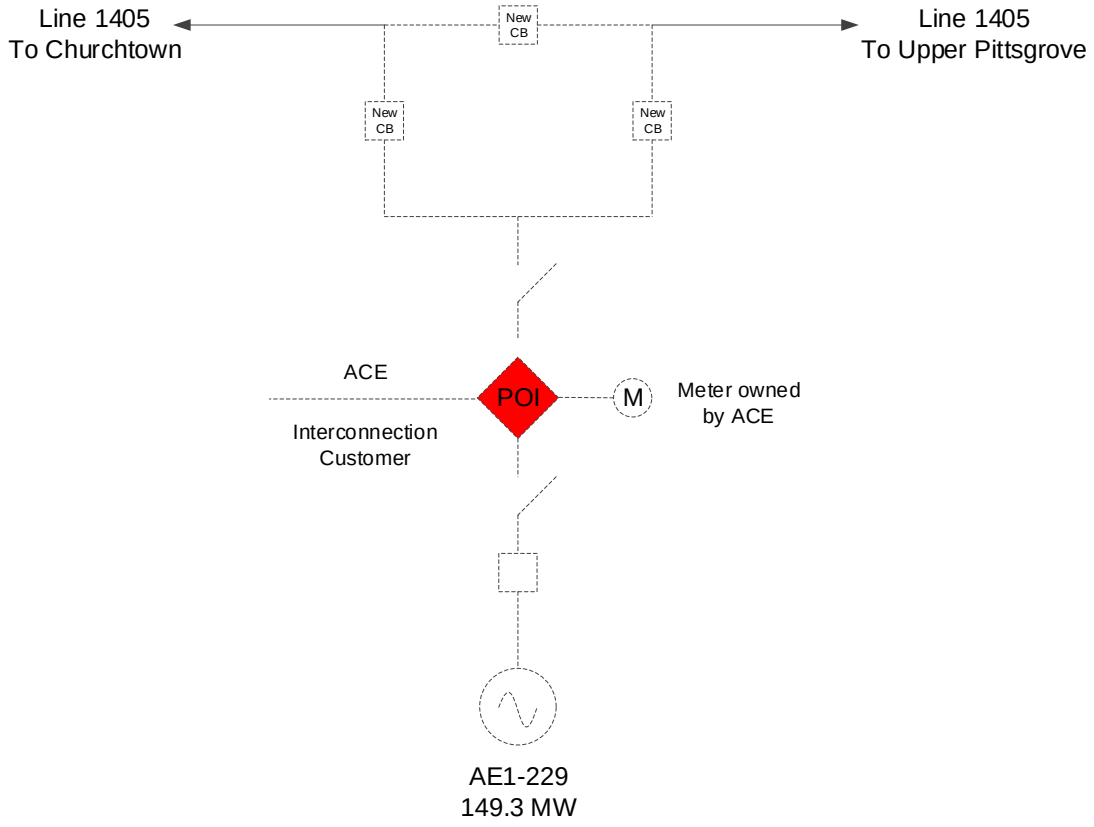
Will be determined at a later study phase.

Attachment 1

AE1-229

Churchtown – Upper Pittsgrove 138 kV

New 138 kV Substation



An Interconnection Customer circuit breaker will be required no more than 500 feet from the ACE substation.

POI Point of Interconnection

POI Flow Gate Details

The following appendices contain additional information about each flowgate presented in the body of the report. For each appendix, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact. It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

None