Transmission Interconnection Facilities Study Report

For

PJM Transmission Interconnection Request Queue Position AE1-179

"South Millville - Newport 69kV"

November 2022

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A. Transmission Owner Facilities Study Summary

1. Description of Project

Buckshutem Solar I, LLC, the Interconnection Customer (IC), has proposed a 59.7 MW Energy (35.0 MW Capacity) solar generating facility to be located at Latitude: 39.3494000, Longitude: -75.0524000 in Millville, New Jersey. PJM studied the AE1-179 project as an injection into the Atlantic City Electric (ACE) transmission system as a tap of the Silica (PSSE # 228222) to South Millville (PSSE # 228228) 69kV 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 scope of this project is to build a new 69kV substation with a three-position ring bus off the right-of-way for Circuit #0762 in Cumberland County, New Jersey. This station will be constructed by the IC under ACE's oversight and will be owned by ACE. Two of the positions on the ring bus will be transmission line terminals for the tie-in of Circuit #0762 to the substation. The third position will be a terminal configured for the interconnection of the IC's generation facilities. A 69kV overhead transmission line must be constructed from this terminal to the IC's interface station.

This interface station will be constructed and owned by the IC. The Point of Interconnection (POI) will be located at the riser structure outside of the new ACE substation. The required revenue metering equipment will be located within this newly established station. See Attachment #1.

Additionally, the 69kV line relaying schemes at ACE's South Millville and Newport Substations will need to be adjusted to account for the proposed substation.

2. Amendments to the System Impact Study or System Impact Study Results

The scope of the project as stated in the System Impact Study, dated August 2019, has changed. Specifically, the updated System Reinforcement analysis performed by PJM now shows that network upgrade n6197 is no longer needed for AE1-179 to be placed into service. Due to the IC's Option to Build (OTB) election, a significant amount of work scope has also been reallocated to the IC.

In addition, the estimates provided herein were performed in more detail than those provided in the Impact Study. The project schedule has also changed due to anticipated start date, project lifecycle schedule and OTB.

3. Interconnection Customer's Milestone Schedule

The planned in-service date, as requested by the IC is September 30, 2021. This date is not attainable due to the need for additional studies, the Transmission Owner's construction schedule, and the required permitting process.

ACE's portion of the project is projected to be completed approximately 12-18 months following an executed Interconnection Service Agreement (ISA) and Construction Service Agreement (CSA). This is assuming a standard land use and environmental permitting and approval process.

The overall project lifecycle schedule, including OTB oversight by ACE for qualifying facilities, is estimated to be 36-60 months.

4. Customer's Scope of Work

Substation Direct Connection Scope

Construct a new 69kV substation for ACE, consisting of a three-position ring bus off the right-of-way for line #0762 in Cumberland County, New Jersey. Two of the positions on the ring bus will be transmission line terminals for the tie-in of line #0762 to the substation. The third position will be a terminal configured for the interconnection of the AE1-179 generator.

Fiber optic cable & control circuitry will be installed between the IC's switching station and the new ring bus substation's control enclosure to support any necessary status, control, and metering functions. This will be installed in underground conduit.

Major Equipment:

- Power Circuit Breaker, 69kV, 2000A, 40kA, 3-cycle
- Disconnect Switch, 3-Phase Group Operated, 69kV, 2000A, Manual Wormgear, Vertical Break with Standard Arcing Horns
- Disconnect Switch, 3-Phase Group Operated with Motor Operator, 69kV, 2000A, Vertical Break with Quick Break Whips
- Disconnect Switch, 1-Phase, 69kV, 1200A, Manual Wormgear
- Power Fuse Holder & Fuse, 69kV Class, Single-Phase
- Rigid bus, stranded bus and all required support structures and foundations
- Revenue Grade Meter
- CVTs, Single-Phase
- Surge Arrester, 69kV Station Class, Polymer
- Station Service Voltage Transformer (SSVT), Single-Phase, 100kVA
- Standard primary / backup transmission line protection panel (24")
- 69kV primary / backup bus protection panel (24")
- Standard 69kV breaker control panel (24")
- Standard RTU/Communications panel (24")
- Physical security panel (and related equipment such as card readers & cameras)
- New pre-fabricated metal control enclosure, 16.5' x 47' (complete with two AC panels, two DC panels, batteries, charger, 400A auto-transfer switch, HVAC, auxiliary systems, termination cabinet, all relay & control panels, etc.)
- Ground grid with 30' copper-clad steel ground rods
- Cable trench and conduit system
- Fencing, yard stone, interior driveways, and yard lighting

Substation Assumptions:

- Up to four (4) lightning masts are required. Exact quantity, height, and placement will be determined during detailed design.

Required Relaying:

At the proposed substation, new protective relays are required for the new IC terminal. Two (2) differential relays will be required for primary and back-up protection. These relays will wrap the IC's breaker and the two breakers for the IC's line position at the proposed Substation. In addition, three (3) relays will be required for the control and breaker failure protection of the new 69kV circuit breakers, and two (2) line relays will be required for each of the new ACE 69kV terminals.

ACE reserves the right to review the electrical protection design and relay settings for interconnecting customer facilities to ensure that the protective relaying equipment will be compatible with that installed at the remote substations. All interface settings and protection equipment shall be reviewed and approved by ACE. ACE personnel must be present at the time of commissioning to witness proper function of the protection schemes and related coordination.

Transmission Line Attachment Facility Scope

Install a short 69kV overhead transmission line to connect the IC's POI station to the proposed substation. The POI station must be located such that the IC owned circuit breaker is within 500 feet of the new ring bus substation.

Major Equipment:

- 69kV Dead-End Insulator Assemblies, Toughened Glass
- 69kV Surge Arresters
- 69kV Aerial Conductor (795 ACSR Drake 26/7 or equivalent)
- OPGW (type unknown at this time)
- Static wire (type unknown at this time)

Transmission Line Assumptions:

- The new 69kV stub line between the New Substation and the IC's POI station will be of overhead construction. It is assumed that water and public road crossings are not necessary.
- The IC is responsible for obtaining any new ROW and permits for routing the transmission line between the New Substation and the IC's POI station.
- The IC is responsible for constructing the 69kV line between their interface station and their generation facilities, including obtaining all necessary permitting and rights-of-way.

In addition to the above scopes of work, the Interconnection Customer (IC) is responsible for all design and construction related to activities on their side of the Point of Interconnection (POI). Site preparation, including clearing, grading and an access road, as necessary, is assumed to be by the IC. The access road design must be approved by ACE to ensure it provides adequate access to the substation to support construction and maintenance activities. Route selection, line design, and right-of-way acquisition for the IC's facilities are not included in this report and are 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 Interconnection Customer Scope of Direct Connection Work Requirements:

- 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 its 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 high side of the facility transformer.

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 but not limited to metering and telecommunications facilities, owned by ACE.

Additional Interconnection Customer Responsibilities:

1. An Interconnection Customer entering the New Services Queue on or after October 1, 2012 with a proposed new Customer Facility that has a Maximum Facility Output equal to or greater than 100 MW shall install and maintain, at its expense, phasor measurement units (PMUs). See Section 8.5.3 of Appendix 2 to the Interconnection Service Agreement as well as section 4.3 of PJM Manual 14D for additional information.

5. Description of Facilities Included in the Facilities Study (ACE's Scope of Work)

"Option to Build" Oversight Estimate

Scope: ACE will provide engineering, design and construction approval & oversight for all Direct Connect Substation and Transmission Line Attachment Facility work detailed above. A separate line item has been included in section A.6 of this report to capture this cost based on an assumed overall project timeline of 36-60 months.

Substation Interconnection Estimate

Scope: At South Millville & Newport Substations, reconfigure the existing line #0762 relays to incorporate the proposed substation.

Major Equipment Included in Estimate:

- N/A

Required Relaying:

New Line #0762 protective relays are planned to be installed by ACE at South Millville and Newport Substation prior to the projected ISD of this project. Therefore, only relay scheme adjustments and drawing name/number updates will be required at these locations. Should AE1-179 complete construction prior to ACE's planned upgrades going into service, the IC will inherit the cost of replacing the 0762 line and breaker relaying at both of these remote end substations prior to energization.

Transmission Line Estimate

Scope: Modify Line #0762 near the new substation to loop it in and out of the new ring bus. The line from the new ring bus to South Millville will remain as #0762, while the line from the new ring bus to Newport will be named #06XX. The exact location of this new ring bus substation is not yet known, but it is assumed to be adjacent to or very close to the Line #0762 ROW. Two new dead-end monopoles will be installed to allow the line to be broken and routed into the two new ring bus positions. Relabeling of the pole numbers / circuit numbers for the New Substation – Newport segment will also be required since its line number will change.

Major Equipment Included in Estimate:

- 69kV Dead-End Monopole Structures, weathered steel, tapered tube construction
- 69kV Dead-End Insulator Assemblies, Toughened Glass
- 69kV Aerial Conductor (795 ACSR Drake 26/7 or equivalent)
- OPGW (type unknown at this time)
- Static wire (type unknown at this time)
- ADSS (type unknown at this time)

Transmission Line Estimate Assumptions:

- The new ring bus substation will be constructed close enough to the Line #0762 ROW such that only two new dead-end monopole structures will be needed; no other structures will be required between these dead-end structures and the substation's take-off towers.
- The conductors will be in a vertical configuration at the monopoles and roll to a horizontal configuration to attach to the new substation's take-off towers.
- The IC is responsible for obtaining any new ROW and permits for routing the transmission lines to the new substation.
- The substation is being constructed in an open area with minimal trees, so substantial tree clearing to route the transmission lines to the new substation is not required. Any required clearing will be the responsibility of the IC.
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6. Total Cost of Transmission Owner Facilities Included in the Facilities Study

Item	*Total Cost*
Non-Direct Connection Facilities	$873,032
Network Upgrade Facilities	$9,099,102
"Option to Build" Oversight	$1,440,000
Total Cost	**$11,412,134**

7. Summary of the Schedule for Completion of Work for the Facilities Study

The estimated timeline for engineering, procurement and construction will be approximately 12-18 months following receipt of a fully executed interconnection agreement. ACE's schedule for completion of work will be dependent on the IC's construction schedule, availability of required outages, TO resources and optimal electric system conditions. In some cases, cut in construction may not begin until Direct Connection Facilities are deemed suitable for final tie in.

Non-Direct Connection Facilities	*Timeframe*
Engineering, Procurement, and Construction	12-18 months
Network Upgrade Facilites	
Engineering, Procurement, and Construction	36-48 months

B. Transmission Owner Facilities Study Results

This section describes facilities identified by ACE to be installed (attachment facilities), replaced, and/or upgraded (upgrade facilities) to accommodate the project. During detailed design and analysis other components may be identified for installation or replacement due to this interconnection.

1. Transmission Lines –New

- Install all required phase conductors, static wire, and fiber between the New Substation and the IC's interface station.

2. Transmission Lines – Upgrade

Partial Rebuild of Line #0762

- Rebuild approximately 3.5 miles of the 0762 South Millville to Newport 69kV line from South Millville to the POI substation utilizing steel monopoles, 795 ACSR conductor and OPGW

Modifications to Line #0762

- Install two (2) drilled piers, each estimated to be 7 feet in diameter and 30 feet long.

- Install two (2) weathered steel dead-end monopoles, of tapered tube construction. The precise location for this structure will be determined based on the final location of the IC's interface station.
- Install all required transmission insulator assemblies and hardware.
- Remove the phase and static/OPGW wires between the dead-end monopoles after attaching the incoming Line 0762 phase and static/OPGW wires.
- Install phase conductors and static wire between each dead-end monopole and its associated substation take-off tower.

3. New Substation/Switchyard Facilities

- Install Power Circuit Breakers, 69kV, 2000A, 40kA, 3-cycle
- Install Disconnect Switches, 3-Phase Group Operated, 69kV, 2000A, Manual Wormgear, Vertical Break with Standard Arcing Horns
- Install Disconnect Switches, 3-Phase Group Operated, 69kV, 2000A, Motor Operated, Vertical Break with Quick Break Whips
- Install Disconnect Switches, 1-Phase, 69kV, 1200A, Manual Wormgear
- Install Power Fuse Holders & Fuses, 69kV Class, Single-Phase
- Install Revenue Grade Meters
- Install CVTs, Single-Phase, 69kV
- Install Surge Arresters, 69kV Station Class, Polymer
- Install Station Service Voltage Transformers (SSVT), Single-Phase, 100kVA
- Install HS20 rated precast concrete cable trench and yard conduit system
- Install rigid bus, stranded bus and all required support structures and foundations
- Install Standard primary / backup transmission line protection panels (24")
- Install 69kV primary / backup bus protection panel (24")
- Install Standard 69kV breaker control panels (24")
- Install Standard RTU/Communications panel (24")
- Install Physical security panel (and related equipment such as card readers & cameras)
- Install New pre-fabricated metal control enclosure, 16.5' x 47' (complete with two AC panels, two DC panels, batteries, charger, 400A auto-transfer switch, HVAC, auxiliary systems, termination cabinet, all relay & control panels, etc.)
- Install ground grid with 30' copper-clad steel ground rods
- Install fencing, yard stone, interior driveways, and yard lighting

4. Substation/Switchyard Facility Upgrades

None.

5. Telecommunications Facilities – Upgrades

- New racks of communications equipment will be required at the new ring bus substation (multiplexers, fiber optic termination panels, routers, firewall, VOIP equipment, etc.). Communications with the ACE control center must be established for the new ring bus substation.
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- Fiber optic cable will be installed between the IC's switching station and the new ring bus substation's control enclosure to support any necessary status, control, and metering functions. This will be installed in underground conduit.

6. Metering & Communications

A three-phase 69kV revenue metering point will need to be established within the IC's facility at the POI. The IC will purchase and install all metering instrument transformers (including one spare to be kept on site) as well as construct a metering structure per ACE's specifications. The secondary wiring connections both at the instrument transformers and at the metering enclosure will be completed by ACE's metering technicians. The metering control cable and meter cabinets will be supplied by ACE and installed by the IC's contractors. The IC 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. The IC will provide 120V power to the meter cabinet. ACE will provide both the Primary and Backup meters. ACE's meter technicians will program and install the Primary & Backup solid state multi-function meters for the new metering position.

The Primary meter will be equipped with load profile, telemetry, and DNP outputs. The IC will be provided with the Primary meter's DNP output via RS-485. Transmission Owner will supply a wireless modem for MV90 interrogation. In the event that a wireless modem is unable to reliably communicate, the IC 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. It is the IC's responsibility to send the data that PJM and ACE require 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 Interconnected Transmission Owner's revenue meters will be the official meters and must be the source for reporting generation output to PJM. The Interconnection Customer is responsible for installing telemetry equipment necessary to obtain the revenue meter data and submitting the data to PJM.

7. Environmental, Real Estate and Permitting

Construction of the proposed substation will require environmental permitting and tree clearing. The extent of clearing required can be determined once the location of the IC' substation has been set. The IC is responsible for obtaining all permits (such as road crossings, railroad crossings, water crossings, or environmental permits if necessary), so those costs are not included in this estimate; however, permitting must be factored into the project's schedule.

All work to accommodate the interconnection of AE1-179 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. Based on Google Earth imagery, the permitting required for the construction of all items included in this report will be extensive.

8. Summary of Results of Study

Project Name: AE1-179 South Millville - Newport 69kV	**Indirect Cost ($)**		**Direct Cost ($)**		**Total Cost ($)**
Non-Direct Connection Facilities	**Material**	**Labor/Fees/Equip.**	**Material**	**Labor/Fees/Equip.**	
Project Planning, Permits, Approvals, Post-Construction & Close-Out				$120,600	$120,600
Detailed Engineering & Design, Material Procurement				$40,264	$40,264
Construction Planning, Prep, and Oversight				$90,136	$90,136
Construction			$171,494	$374,148	$545,642
Project Oversight & Overhead Costs		$76,391			$76,391
Total Cost	$0	$76,391	$171,494	$625,147	$873,032
Network Upgrade Facilities	**Material**	**Labor/Fees/Equip.**	**Material**	**Labor/Fees/Equip.**	
Project Planning, Permits, Approvals, Post-Construction & Close-Out				$1,256,157	$1,256,157
Detailed Engineering & Design, Material Procurement				$419,808	$419,808
Construction Planning, Prep, and Oversight				$937,567	$937,567
Construction			$1,788,067	$3,901,020	$5,689,087
Project Oversight & Overhead Costs		$796,483			$796,483
Total Cost		$796,483	$1,788,067	$6,514,552	$9,099,102 +

Generation projects meeting IRS "Safe Harbor" provisions generally do not incur "CIAC" (Contribution in Aid to Construction), a tax collected by the utility for the state or federal government. ACE does not expect to collect CIAC for this project. If for any reason, "CIAC" would be required for this project, it would be the responsibility of the party owning the generator to pay this cost.

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

9. Schedules and Assumptions

The estimated timeline for ACE to place its non-direct connect facilities in service for this project is approximately 12-18 months after receipt of a fully executed Interconnection Service Agreement (ISA) and Construction Service Agreement (CSA).

Storm damage and restoration, time of year limitations, permitting issues, outage scheduling, system emergencies, and contractor and equipment availability could also impact the schedule. It is important to note that this project will be incorporated into the existing project work load at ACE at the time of contract execution. If the work load of existing projects is extensive, resource constraints may cause this project to be delayed beyond the projected in-service date.

Attachment #1