Generation Interconnection
Facilities Study Report

PJM Generation Interconnection Request
Queue Position AE1-104 "B.L. England 138 kV"

June 2021

Table of Contents

Transmission Owner Facilities Study Summary

1.0 Description of Project

Ocean Wind LLC, the Interconnection Customer (IC), has proposed a 432.0 MW (121.4 MW Capacity) offshore wind generating facility to be located in the Atlantic Ocean east of Ocean City, New Jersey, at Latitude: 39.2314082, Longitude: -74.2913980. PJM studied the AE1-104 project as an injection into the Transmission Owner, Atlantic City Electric Company (ACE), transmission system at the B.L. England 138kV substation (PSSE bus#228110) 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 current planned in-service date, as requested by the IC, is October 1, 2024.

The proposed 432 MWs of generation will require one (1) new Transmission level Point of Interconnection (POI). The POI will be at an IC owned interface breaker near the ACE 138kV B.L. England substation.

To accommodate this interconnection, the existing 138 kV B.L. England substation will be upgraded with two (2) replacement 138kV breakers with a 3000A continuous current rating along with related equipment. Utility grade primary metering, generation telemetry and remote trip capability will also be required as part of this interconnection. The POI will be located at an IC owned interface circuit breaker located at or near the point of the IC's property nearest to ACE's 138 kV B.L. England substation where it will connect to an existing available 138kV bus position. In accordance to the Impact Study report, this study assumes that the IC interface breaker connects to 138 kV B.L. England substation via approximately 0.12 miles of a 138-kV transmission line. Once the exact location of the IC's interface breaker is provided by the IC, the length of the transmission line extension from 138 kV B.L. England substation to the POI will be determined.

2.0 Amendments to the System Impact Study or System Impact Study Results

The scope of the project as stated in the Impact Study dated December 2019 has been modified to utilize an available bus position in the 138 kV B.L. England substation in lieu of substation expansion.

3.0 Interconnection Customer's Milestone Schedule

Site Work Complete:	May 1, 2024
Commercial Operation:	October 1, 2024

4.0 Interconnection Customer's Scope of Work

The IC assumes full responsibility for the design, permitting and construction of all facilities associated with the AE1-104 generating station on their side of the POI. The IC interface breaker shall be located as close as reasonably possible to the ACE 138 kV B.L. England substation to facilitate the relay protection scheme between ACE and the IC at the POI. The IC shall conform to Transmission Owner's engineering and construction standards and coordinate all work directly with Transmission Owner to ensure minimal interruption to the electric system. The IC also assumes responsibility for the permitting and construction of the service road(s) to the generating site.

Protective relaying and metering design and installation must comply with Transmission Owner'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. It is critical that the IC also provides 120 VAC uninterruptible power source to the primary meter installed by Transmission Owner.

Transmission Owner will require the capability to remotely disconnect the generator from the grid by communication from its System Operations facility. Such disconnection will be performed by IC circuit breaker. When the trip command is sent to IC equipment the customer shall have a circuit breaker capable of locking out. The IC is responsible for calling Transmission Owner System Operations before manually reconnecting with the grid. The phone number to System Operations should be clearly displayed next to the circuit breaker and out of general public view.

Transmission Owner Facilities Study Results

5.0 Transmission Owner Scope of Work

This section describes upgrades to existing direct connection facilities required to accommodate the interconnection of AE1-104. It also delineates the attachment facilities necessary to support the interconnection to the IC's generating site from the designated POI. The facilities identified to be installed, replaced, and/or upgraded by Transmission Owner to accommodate the project are listed in the subsequent sections. During detailed design and analysis other components may be identified for installation or replacement due to this interconnection.

Following the IC's request for an *Option to Build,* ACE is delineating the scope of work for the Attachment Facilities to include the work activities for which ACE will be accountable. Under the PJM Tariff the Option to Build generally means that the generator has the right to construct certain of the transmission owner interconnection facilities and network upgrades, including the switching station where the generator interconnects to the transmission system. Specifically, to queue AE1-104, the *Option to Build* refers to all work related to extend a transmission line from the POI to a position right outside the BL England station. All work to be performed within the fence of BL England shall be conducted solely by ACE; this includes the bus work and relay changes for the interconnection of AE1-104.

The scope of work for the installation of IC's interconnection and generation facilities are not included in this study nor are they the responsibility of the Transmission Owner.

5.1 Attachment Facilities

Option to Build

Under the 'Option to Build', the IC will be responsible to install a transmission line from the IC's POI interface breaker to a pole located just outside the fence of BL England. (The specific configuration, location and specifications for this pole will be further defined with the commencement of engineering activities.) ACE will be responsible for the last span, from the pole outside the fence to the take-off structure within the BL England substation. Coordination will be required among parties accordingly.

Moreover, ACE will need to review and approve the design, material selection and construction package for the transmission line to be installed by the IC under the *Option to Build* arrangement. This will necessitate a level of effort for project management, engineering, QA/QC, construction, and safety oversight from ACE in support of the IC's work activities.

The attachment facilities work to be performed by ACE under the *Option to Build* arrangement is noted in Section 5.1.1.

5.1.1 Attachment Facilities – Transmission Lines (Option to Build ACE Work)

Install a 138kV transmission line – "span of wire" - from the existing available bus position between breakers 452A and 452B at B.L. England to a pole right outside the substation, this is assumed to be a 100ft span.

Material/Equipment	*Quantity*
▪ 138kV Dead-end/Take-off Structure	1
▪ 138kV Dead-end Insulators + Misc. Hardware*	6
▪ 1590kcmil ACSR Conductor	350 ft

* *Excludes insulators/taps at the substation take-off.*

Major Labor Activities

- Engineering and QA/QC for the IC's transmission line extension
- Install dead-end foundation, structure, and insulators.
- Run conductor from the pole outside the fence to the substation take-off structure.

Should the IC decide not to pursue the Option to Build, ACE will then install the transmission line attachment from the POI to B.L. England Substation as delineated in Section 5.1.2.

5.1.2 Attachment Facilities – Transmission Lines

Install a new 138kV transmission line from the existing available bus position between breakers 452A and 452B at B.L. England to the IC's POI interface breaker. The quantities shown below assume that the POI interface breaker is approximately 500ft away from the B.L. England bus position. Once the exact placement of the POI interface breaker is determined, Transmission owner will re-estimate for the transmission line attachment facilities.

Material/Equipment	*Quantity*
▪ 138kV Dead-end/Take-off Structure	2
▪ 138kV Dead-end/Take-off Structure Foundation (group of piers)	2
▪ 138kV Dead-end Insulators	12
▪ 1590kcmil ACSR Conductor	2,500 ft
▪ Fiber optic cable	1050 ft

Major Labor Activities

- Install dead-end foundation, structures, and insulators.
- Run conductor and ADSS from the available bus position at ACE's 138 kV B.L. England substation to the IC's POI interface breaker.

5.2 Attachment Facilities- Substations

Work performed within the B.L. England substation is to be performed by ACE, even if the IC decides on pursing the *Option to Build.*

The interconnection of AE1-104 will require modifications to the existing B.L. England station bus. This includes replacing two (2) 138kV circuit breakers (A & B) to upgrade them to a 3000A rating and installing a 138kV line disconnect switch. No new relaying is required. Upon determining the location of the POI, new line primary and backup relays (SEL-411L/SEL-311C) may be required; these are currently excluded from the scope. Rewiring and settings development will be required. Existing 138kVBusP-SEL487 relay output will be utilized to directly trip the IC interface breaker under fault conditions. Additionally, relay outputs will be wired to remotely control IC interface breaker for operational switching and for breaker failure initiation. Ground grid study will be required to ensure the original station design is adequate with the new source. Impacts for the ground grid study are assumed to be minimal but need to be confirmed during detailed design.

5.2.1 Major Substation Equipment to be Installed

Material/Equipment	*Quantity*
▪ 138kV Circuit Breaker, 3000A, 40kA, 3 cycle	2
▪ 138kV Line Disconnect Switch, 3000A, Manual, Quick Break Whips	1
▪ 138kV CB Disconnect Switch, 3000A, Manual, with Arcing Horns	4
▪ 138kV Surge Arresters, 1-Phase (hung on take-off structure)	3
▪ 138kV Line Disconnect Switch Stand	1
▪ 138kV Dead-end/Take-off Structure	1
▪ 138kV Line Disconnect Switch Stand Foundation (group of piers)	1
▪ 138kV Dead-end/Take-off Structure Foundation (group of piers)	1
▪ 138kV Insulators	21
▪ Control Cable 4C#12AWG	2,000 ft
▪ Serial/Fiber Optic Transceiver (SEL-2830)	1
▪ Multimode (62.5um) Fiber-Optic Cable	100 ft
▪ Single-Mode (1300nm) Fiber-Optic Patch Cable	1000 ft

5.2.2 Major Labor Activities

- Disassemble the existing 138kV bus affected by this scope (approx. 90 linear ft).
- Remove two (2) existing 138kV breakers.

- Install two (2) new 138kV breakers.
- Install Dead-end structure.
- Install 138kV Line & CB Switches.
- Install surge arresters.
- Install two 3-inch conduits from new breaker to existing trench.
- Install three 3-inch conduits from existing trench to IC yard.
- Install four 4C#10 cables between POI interface breaker and control house termination cabinet, and panels.
- Install two 12C#12 cables between POI interface breaker and control house termination cabinet, and panels.
- Install eight 4C#10 cables between two (2) new 138kV breaker and control house termination cabinet, and panels.
- Install four 12C#12 cables between two (2) new breakers and control house termination cabinet, and panels.
- Install two 4C#12 cables between new PT and control house termination cabinet, and panels.
- Rewire CT/PT connections for existing equipment in the termination cabinet to reflect new breaker installment.
- Review/update settings for existing adjacent relays.
- RTU points list updates and configurations for existing Orion RTU & ethernet switch.
- Testing and commissioning.

5.2.3 Assumptions

- Existing conduits/trench are adequate for newly installed cables.
- Final design and engineering will depend upon the actual location of the IC owned POI interface breaker.

6.0 Harmonics Study

At the IC's request, ACE provided a proposal which the IC accepted to provide 12 months of data for the IC to complete a harmonic study. The harmonic data equipment and labor has an estimated cost of $132,085 which has been invoiced and paid under this Facilities Study as agreed by ACE, PJM, and the IC. The scope of work shall be carried into the Interconnection Service Agreement and/or the Interconnection Construction Service Agreement to allow for the ongoing study work and any final cost true-up.

7.0 Metering

A three phase 138 kV revenue metering point will need to be established within the Interconnection Customer Facilities at the Point of Interconnection. The Interconnection Customer will purchase and install all metering instrument transformers as well as construct a metering structure per the ACE's specifications. The secondary wiring connections at the instrument transformers will be completed by the Interconnection Customer. The secondary wiring connection at the metering enclosure will be completed by the ACE. The metering control cable and meter cabinets will be supplied and installed by the ACE. The Interconnection Customer will install conduit for the control cable between the instrument transformers and the metering enclosure. The location of the metering enclosure will be determined during construction. The Interconnection Customer will provide 120V AC uninterruptible power source to the meter cabinet. The ACE will provide both the primary and

backup meters. The ACE will program, install, and own the primary & backup solid-state multi-function meters for the new metering position.

Each meter will be equipped with load profile, telemetry, and DNP outputs. The Interconnection Customer will be provided with a single DNP output for each meter. ACE will supply a wireless modem for remote meter 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 Interconnection Customer's responsibility to send the data that PJM and ACE require directly to PJM. The Interconnection Customer will grant permission for PJM to send ACE the following telemetry that the Interconnection Customer sends to PJM: real time MW, MVAR, volts, amperes, generator status, and interval MWH and MVARH.

The ACE'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.

8.0 Telemetry

It is the IC's responsibility to send the data that PJM and Transmission Owner requires directly to PJM. The IC will grant permission for PJM to send Transmission Owner the following telemetry that the IC sends to PJM: real time MW, MVAR, volts, amperes, generator status, and generator interface breaker position.

9.0 Environmental, Real Estate and Permitting

All work to accommodate the interconnection of AE1-104 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 Transmission Owner. Any setbacks in obtaining the necessary real property rights, acquisitions and permits required for this interconnection may delay the construction schedule.

Environmental permits may need to be secured. Additional tree trimming/clearing may be needed. This estimate assumes that all the applicable permitting will be obtained by the IC for the generating facility and the service road(s).

10.0 Proposed Schedule for Completion of Work

The Transmission Owner project schedule is based on an 24-36-month lead-time from receipt of a fully executed interconnection agreement; this timeline is subject to storm damage and restoration efforts that may impact the resources and/or the geographic area of this project, time of year limitations, permitting issues, outage scheduling, system emergencies, and contractor and equipment availability.

It is important to note that this project will be incorporated into the existing project workload at the Transmission Owner at the time of contract execution. If the workload of existing projects is extensive, resource constraints may cause this project to be delayed beyond the planned in-service date.

Attachment/Upgrade Facilities	*Timeframe*
AE1-104 Direct Connection Facilities	24-36 months
AE1-104 Non Direct Connection Facilities	24-36 months

Note: The estimated timeline does not account for any potential delays due to the IC's Option to Build construction Schedule.

11.0 Total Cost of Transmission Owner Facilities

The overall cost of interconnecting AE1-104 into PJM/ACE service territory, including network upgrades, amounts to approximately $1.46 million for the non- Option to Build arrangement. Exact figures and cost breakdowns are presented in the table below.

Non-Direct Connection Facilities for AE1-104	*Costs ($)*		*Total Cost ($)*
	Material/Equip.	Labor	
Planning/Engineering & Design		$339,754	$339,754
Execution/Construction	$506,731	$620,746	$1,127,477
Total Cost	$506,731	$960,500	$1,467,231

The cost of interconnection for attachment facilities with the Option to Build arrangement will be as follows.

Direct Connection Facilities for AE1-104 – Option to Build	*Costs ($)*		*Total Cost ($)*
	Material/Equip.	Labor	
ACE Construction Oversight		$6,400	$6,400
Execution/Construction	$34,200	$29,200	$63,400
Total Cost	$34,200	$35,600	$68,000

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. Transmission Owner 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.

Transmission Owner 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 Transmission Owner.

Attachment #1
AE1-104 B.L. England 138kV Interconnection One-Line