

Generation Interconnection Feasibility Study Report W3-028

The Interconnection Customer (IC) has proposed a 348 MWE (45 MWC) wind powered generating facility consisting of 60 turbines. The project is to be located in the Atlantic Ocean off the coast of New Jersey. PJM studied W3-028 as a 348 MW injection into the Atlantic City Electric (ACE) system at the Cedar 230kV substation and evaluated it for compliance with reliability criteria for summer peak conditions in 2014. The proposed in-service date, as stated in Attachment N, is September 30, 2015.

Point of Interconnection

W3-028 will interconnect with the Atlantic City Electric transmission system at the Cedar 230kV substation.

Direct Connection Requirements

Transmission Owner Scope of Direct Connection Work

The scope of work and estimated costs for the direct connection facilities is as follows:

At the Cedar 230kV substation, add one (1) 230kV terminal in the 230kV ring bus.

The estimated cost to perform this work is **\$2,800,000**. The estimated time to complete this work is **24 - 36 months** after receipt of a fully executed Interconnection Service Agreement (ISA) and Interconnection Construction Service Agreement (CSA).

Note: Additional costs upon further engineering review may result. Additionally, Contribution in Aid of Construction (CIAC) tax will be included upon further study.

Interconnection Customer Scope of Direct Connection Work

The Interconnection Customer (IC) is responsible for all design and construction related to activities on their side of the point of Interconnection. IC will interconnect W3-028 with the ACE system via a 230kV circuit from their facility to the Cedar 230kV substation. The above cost does not include construction of that line. Site preparation, including grading and an access road, as necessary, is assumed to be by the IC. At this time, route selection, line design, right-of-way acquisition, and construction of such lines will be entirely the responsibility of the Interconnection Customer.

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 require the capability to remotely trip the generator from its System Operations facility. The interconnected customer will grant its permission for PJM to send ACE all telemetry

that the Interconnection Customer sends to PJM. The Interconnection Customer will be required to make provisions for a voice quality phone line within approximately 3 feet of each ACE metering position to facilitate remote interrogation and data collection.

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, Line with Failed 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)

1. (JCP&L) The Van-Larrabee 230 kV line (from bus 206318 to bus 206294 ckt 1) loads from 102.66% to 105.1% (DC power flow) of its emergency rating (805 MVA) for the tower contingency 'C5_CNJ-DCT-#10'. This project contributes approximately 121.18 MW to the thermal violation.
2. (BG&E) The BAGLEY13-Raphael Road 230 kV line (from bus 220999 to bus 220980 ckt 1) loads from 150.36% to 150.72% (DC power flow) of its emergency rating (674 MVA) for the tower contingency 'CNSTN_NWEST'. This project contributes approximately 21.59 MW to the thermal violation.
3. (JCP&L) The Larrabee-U2-049 TAP 230 kV line (from bus 206294 to bus 292970 ckt 1) loads from 113.40% to 114.93% (DC power flow) of its emergency rating (805 MVA) for the single contingency 'PJM_NEWFREEDM_WINDSOR'. This project contributes approximately 12.28 MW to the thermal violation.
4. (JCP&L) The Larrabee-U2-049 TAP 230 kV line (from bus 206294 to bus 292970 ckt 1) loads from 115.27% to 117.16% (DC power flow) of its normal rating (650 MVA) for non contingency condition. This project contributes approximately 12.30 MW to the thermal violation.
5. (JCP&L) The U2-049 TAP-Atlantic 230 kV line (from bus 292970 to bus 206286 ckt 2) loads from 115.26% to 116.18% (DC power flow) of its emergency rating (805 MVA) for the tower

contingency 'C5_CNJ-DCT-#8_A'. This project contributes approximately 46.03 MW to the thermal violation.

6. (BG&E) The Graceton-BAGLEY13 230 kV line (from bus 220964 to bus 220999 ckt 1) loads from 133.68% to 133.99% (DC power flow) of its emergency rating (802 MVA) for the tower contingency 'CNSTN_NWEST'. This project contributes approximately 21.59 MW to the thermal violation.

Short Circuit

None

Stability Analysis

Will be conducted during the System Impact Study phase of the project.

New System Reinforcements

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

None

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project.)

1. To mitigate the (JCP&L) Van-Larrabee 230 kV line (from bus 206318 to bus 206294 ckt 1) overload will require the following: *this reinforcement remains under development by the Transmission Owner and will be provided when it becomes available.*
2. To mitigate the (BG&E) BAGLEY13-Raphael Road 230 kV line (from bus 220999 to bus 220980 ckt 1) overload will require Graceton station to add 6-230kV breakers with an estimated cost of **\$10,000,000** and Raphael Road station to add 6-230kV breakers at an estimated cost of **\$10,000,000**. It also requires rebuilding Graceton to Raphael Rd to double circuit 2-conductor bundled with an estimated cost of **\$30,000,000**. This work would take an estimate of 2-3 years for the substation work concurrently with 5-6 years for the line work.
3. To mitigate the (JCP&L) Larrabee-U2-049 TAP 230 kV line (from bus 206294 to bus 292970 ckt 1) overload will require the reconductoring of the Larrabee-Atlantic 230kV line. The estimated cost to perform this work is \$7,420,000. Once reconducted, the rating of the line would be SN: 946 and SE: 1043 MVA.

4. To mitigate the (JCP&L) Larrabee-U2-049 TAP 230 kV line (from bus 206294 to bus 292970 ckt 1) overload will require (see reinforcement 3 above)
5. To mitigate the (JCP&L) U2-049 TAP-Atlantic 230 kV line (from bus 292970 to bus 206286 ckt 2) overload will require (see reinforcement 3 above).
6. To mitigate the (BG&E) Graceton-BAGLEY13 230 kV line (from bus 220964 to bus 220999 ckt 1) overload will require (see reinforcement for item 2 above).

Potential Congestion due to Local Energy Deliverability

(PJM also studied the delivery of the energy portion of the surrounding generation. Any potential 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 Transmission Interconnection Request. Note: Only the most severely overloaded conditions are listed below. There is no guarantee of full deliverability for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which analyzes all overload conditions associated with the identified overloaded element(s). As a result of the aggregate energy resources in the area, the following violations were identified:

These are **not** required reliability upgrades.

1. (JCP&L) The Oyster Creek-Manitou 230 kV line (from bus 206302 to bus 206297 ckt 2) loads from 83.99% to 108.77% (DC power flow) of its emergency rating (805 MVA) for the operational contingency 'B_CNJ2-SX-#29'. This project contributes approximately 200.35 MW to the thermal violation.
2. (PECO/BG&E) The Cooper-Graceton 230 kV line (from bus 214089 to bus 220964 ckt 1) loads from 171.01% to 171.82% (DC power flow) of its emergency rating (485 MVA) for the operational contingency 'PJM17'. This project contributes approximately 29.80 MW to the thermal violation.
3. (JCP&L) The Lakewood 230-Larrabee 230 kV line (from bus 206323 to bus 206294 ckt 2) loads from 106.64% to 109.56% (DC power flow) of its emergency rating (805 MVA) for the operational contingency 'B_CNJ2-SX-#20'. This project contributes approximately 145.80 MW to the thermal violation.
4. (PJM/METED) The Three Mile Island-Three Mile Island 500/230 kV transformer (from bus 200016 to bus 204514 ckt 2) loads from 129.72% to 130.27% (DC power flow) of its emergency rating (1072 MVA) for the operational contingency 'PJM17'. This project contributes approximately 36.57 MW to the thermal violation.
5. (PL/BG&E) The Otter Creek Switchyard-Conastone 230 kV line (from bus 208048 to bus 220963 ckt 1) loads from 128.08% to 128.25% (DC power flow) of its emergency rating (531

MVA) for the operational contingency 'PJM17'. This project contributes approximately 22.18 MW to the thermal violation.

6. (DP&L) The Red Lion-Keeney 230 kV line (from bus 231004 to bus 231003 ckt 1) loads from 78.56% to 79.25% (DC power flow) of its emergency rating (924 MVA) for the operational contingency 'PJM64'. This project contributes approximately 39.57 MW to the thermal violation.
7. (PJM) The Peach Bottom-Conastone 500 kV line (from bus 200013 to bus 200004 ckt 1) loads from 151.37% to 151.76% (DC power flow) of its emergency rating (2815 MVA) for the operational contingency 'PJM67'. This project contributes approximately 112.48 MW to the thermal violation.
8. (PJM) The Peach Bottom-Conastone 500 kV line (from bus 200013 to bus 200004 ckt 1) loads from 154.60% to 155.09% (DC power flow) of its normal rating (2490 MVA) for non contingency condition. This project contributes approximately 119.87 MW to the thermal violation.
9. (PECO) The Nottingham-Nottingham Reactor 230 kV line (from bus 213844 to bus 213846 ckt 1) loads from 133.07% to 133.72% (DC power flow) of its emergency rating (627 MVA) for the operational contingency 'PJM17'. This project contributes approximately 29.80 MW to the thermal violation.
10. (JCP&L) The Larrabee-U2-049 TAP 230 kV line (from bus 206294 to bus 292970 ckt 1) loads from 135.47% to 137.38% (DC power flow) of its emergency rating (805 MVA) for the operational contingency 'PJM89_A'. This project contributes approximately 95.00 MW to the thermal violation.
11. (JCP&L) The Larrabee-U2-049 TAP 230 kV line (from bus 206294 to bus 292970 ckt 1) loads from 138.62% to 140.98% (DC power flow) of its normal rating (650 MVA) for non contingency condition. This project contributes approximately 95.12 MW to the thermal violation.
12. (JCP&L) The East Windsor-Windsor 230 kV line (from bus 206326 to bus 206316 ckt 1) loads from 101.53% to 102.38% (DC power flow) of its emergency rating (772 MVA) for the operational contingency 'PJM68A'. This project contributes approximately 40.72 MW to the thermal violation.
13. (PECO) The Nottingham Reactor-Peach Bottom 230 kV line (from bus 213846 to bus 213869 ckt 1) loads from 133.05% to 133.71% (DC power flow) of its emergency rating (627 MVA) for the operational contingency 'PJM17'. This project contributes approximately 29.80 MW to the thermal violation.
14. (JCP&L) The Red Oak A Bus-Raritan River 230 kV line (from bus 206314 to bus 206305 ckt 1) loads from 119.39% to 120.25% (DC power flow) of its emergency rating (805 MVA) for the operational contingency 'B_CNJ2-SX-#36_R11A'. This project contributes approximately 42.87 MW to the thermal violation.

15. (JCP&L) The Red Oak B Bus-Raritan River 230 kV line (from bus 206315 to bus 206305 ckt 1) loads from 124.38% to 125.23% (DC power flow) of its emergency rating (805 MVA) for the operational contingency 'B_CNJ2-SX-#37'. This project contributes approximately 42.78 MW to the thermal violation.
16. (JCP&L) The Lakewood 230-Larrabee 230 kV line (from bus 206323 to bus 206294 ckt 1) loads from 107.49% to 110.42% (DC power flow) of its emergency rating (805 MVA) for the operational contingency 'B_CNJ2-SX-#19'. This project contributes approximately 145.90 MW to the thermal violation.
17. (PL/BG&E) The Safe Harbor Units 3-4 Tap-Graceton 230 kV line (from bus 208071 to bus 220964 ckt 1) loads from 115.53% to 115.74% (DC power flow) of its emergency rating (485 MVA) for the operational contingency 'PJM17'. This project contributes approximately 19.60 MW to the thermal violation.
18. (PECO) The Peach Bottom-Cooper 230 kV line (from bus 213869 to bus 214089 ckt 1) loads from 172.03% to 172.87% (DC power flow) of its emergency rating (485 MVA) for the operational contingency 'PJM17'. This project contributes approximately 29.80 MW to the thermal violation.
19. (PL/METED) The Brunner Island Bus-Yorkana 230 kV line (from bus 207922 to bus 204515 ckt 1) loads from 125.33% to 125.79% (DC power flow) of its emergency rating (617 MVA) for the operational contingency 'PJM17'. This project contributes approximately 17.63 MW to the thermal violation.
20. (JCP&L) The Oyster Creek-Manitou 230 kV line (from bus 206302 to bus 206297 ckt 1) loads from 83.97% to 108.75% (DC power flow) of its emergency rating (805 MVA) for the operational contingency 'B_CNJ2-SX-#30'. This project contributes approximately 200.32 MW to the thermal violation.