

Generation Interconnection Feasibility Study Report Orchard 230kV

The Interconnection Customer (IC), has proposed a 100 MWE (38 MWC) solar powered generating facility consisting of ground mounted fixed panel solar arrays to be located in Upper Pittsgrove Township, Salem County, New Jersey. PJM studied W1-011 as a 100 MW injection into the Atlantic City Electric (ACE) system at the Orchard 230kV substation. The project was evaluated for compliance with reliability criteria for summer peak conditions in 2014. The planned in-service date, as stated in the Attachment N, is the 3rd quarter of 2011.

Point of Interconnection

W1-011 will interconnect with the ACE transmission system at the Orchard 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:

Provide a 230kV terminal position in the Orchard 230kV substation.

The estimated cost to perform this work is **\$3,200,000** and will take an estimated **24 – 36 months** to complete after receipt of a fully executed Interconnection Service Agreement (ISA) and Interconnection Construction Service Agreement (CSA).

Note: the above cost does not include the Contribution in Aid of Construction (CIAC) tax.

Interconnection Customer Scope of Direct Connection Work

The Interconnection Customer (IC) assumes full responsibility for design and construction of all facilities associated with the W1-011 generating station and the 230kV direct connection line on the IC's 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, right-of-way acquisition and construction of lines will be entirely the responsibility of the IC.

The IC will be required to install metering and telemetry equipment to provide revenue metering and real-time telemetry data to PJM. The requirements for this equipment are listed in Appendix 2, Section 8 of Attachment O to the PJM Tariff, as well as PJM Manuals 01 and 14D. Protective relaying and metering design and installation must comply with Atlantic City Electric's Applicable Standards.

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 contingencies only with full energy output. Stuck Breaker and Bus Fault contingencies will be applied during the System Impact Study.)

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. The UNION-LINCOLN 138 kV line (from bus 228210 to bus 228709 ckt 1) loads from 106.31% to 106.63% (DC power flow) of its emergency rating (292 MVA) for the tower line contingency ('AE7TOWER'). This project contributes approximately 5.81 MW to cause the thermal violation.
2. The MCKLTON-THOROFAR 230 kV line (from bus 228401 to bus 219121 ckt 1) loads from 142.33% to 142.5% (DC power flow) of its emergency rating (566 MVA) for the tower line contingency ('AE1TOWER'). This project contributes approximately 6.4 MW to cause the thermal violation.

Short Circuit

None

Stability Analysis

Will be performed during the System Impact Study phase of W1-011.

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 UNION-LINCOLN 138 kV line overload will require the replacement of 5.15 miles of the UNION-LINCOLN 138kV line with a conductor that has the capability of at least a 1650 A emergency rating. The estimated cost to perform this work is **\$4,000,000** and will take **24 to 36 months** to complete following receipt of a fully executed Interconnection Service Agreement and Interconnection Construction Service Agreement.
2. To mitigate the Mickleton-Thorofare 230kV (AE portion) line overload will require the reconductor of the Mickleton-Thorofare 230 kV line with an ACSS/TW conductor. The estimated cost to perform this work is **\$1,000,000** and will take **30 months** to complete following receipt of a fully executed Interconnection Service Agreement and Interconnection Construction Service Agreement.

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. The GLOUCSTR 230/138 kV transformer (from bus 219110 to bus 219117 ckt 1) loads from 101.92% to 102.18% (DC power flow) of its emergency rating (341 MVA) for the single line contingency ('PJM89_A'). This project contributes approximately 5.4 MW to cause the thermal violation.
2. The CUMB-UNION 138 kV line (from bus 228262 to bus 228210 ckt 1) loads from 102.97% to 103.28% (DC power flow) of its emergency rating (483 MVA) for the single line contingency ('DENN XFR'). This project contributes approximately 9.25 MW to cause the thermal violation.
3. The DENNIS-CORSON 2 138 kV line (from bus 228216 to bus 228107 ckt 1) loads from 104.18% to 104.4% (DC power flow) of its normal rating (390 MVA) for non-contingency condition. This project contributes approximately 5.32 MW to cause the thermal violation.
4. The DENNIS-CORSON 2 138 kV line (from bus 228216 to bus 228107 ckt 1) loads from 104.57% to 104.8% (DC power flow) of its emergency rating (478 MVA) for the single line

contingency ('CUMB-UNION'). This project contributes approximately 6.77 MW to cause the thermal violation.

5. The CNASTONE-01KEMPTOWN 500 kV line (from bus 200004 to bus 235632 ckt 1) loads from 101.46% to 101.67% (DC power flow) of its normal rating (2338 MVA) for non-contingency condition. This project contributes approximately 26.19 MW to cause the thermal violation.
6. The SAHA34TP-GRACETON 230 kV line (from bus 208071 to bus 220964 ckt 1) loads from 101.97% to 102.15% (DC power flow) of its emergency rating (485 MVA) for the single line contingency ('PJM17'). This project contributes approximately 5.42 MW to cause the thermal violation.
7. The GLOUCSTR-CUTHBERT 138 kV line (from bus 219117 to bus 219108 ckt 1) loads from 106.8% to 107.05% (DC power flow) of its emergency rating (338 MVA) for the single line contingency ('PJM89_A'). This project contributes approximately 5.4 MW to cause the thermal violation.
8. The E WINDSR-WINDSOR 230 kV line (from bus 206326 to bus 206316 ckt 1) loads from 110.13% to 110.3% (DC power flow) of its emergency rating (772 MVA) for the single line contingency ('PJM68A'). This project contributes approximately 7.91 MW to cause the thermal violation.
9. The 3 MILE I 500/230 kV transformer (from bus 200016 to bus 204514 ckt 2) loads from 112.63% to 112.8% (DC power flow) of its emergency rating (1072 MVA) for the single line contingency ('PJM17'). This project contributes approximately 11.51 MW to cause the thermal violation.
10. The MCKLTON-THOROFAR 230 kV line (from bus 228401 to bus 219121 ckt 1) loads from 116.39% to 116.56% (DC power flow) of its normal rating (451 MVA) for non-contingency condition. This project contributes approximately 5.33 MW to cause the thermal violation.
11. The DENNIS 230/138 kV transformer (from bus 228213 to bus 228216 ckt 1) loads from 117.63% to 117.88% (DC power flow) of its emergency rating (425 MVA) for the single line contingency ('CUMB-UNION'). This project contributes approximately 6.77 MW to cause the thermal violation.
12. The NOTTNGHM-NOTTREAC 230 kV line (from bus 213844 to bus 213846 ckt 1) loads from 119.9% to 120.14% (DC power flow) of its emergency rating (627 MVA) for the single line contingency ('PJM17'). This project contributes approximately 9.34 MW to cause the thermal violation.
13. The NOTTREAC-PCHBTMTP 230 kV line (from bus 213846 to bus 213869 ckt 1) loads from 119.9% to 120.14% (DC power flow) of its emergency rating (627 MVA) for the single line contingency ('PJM17'). This project contributes approximately 9.34 MW to cause the thermal violation.

14. The PEACHBTM-CNASTONE 500 kV line (from bus 200013 to bus 200004 ckt 1) loads from 141.4% to 141.67% (DC power flow) of its normal rating (2490 MVA) for non-contingency condition. This project contributes approximately 37.9 MW to cause the thermal violation.
15. The PEACHBTM-CNASTONE 500 kV line (from bus 200013 to bus 200004 ckt 1) loads from 142.5% to 142.73% (DC power flow) of its emergency rating (2815 MVA) for the single line contingency ('PJM67'). This project contributes approximately 35.26 MW to cause the thermal violation.
16. The COOPER-V4-002TAP1 230 kV line (from bus 214089 to bus 900010 ckt 1) loads from 154.02% to 154.33% (DC power flow) of its emergency rating (485 MVA) for the single line contingency ('PJM17'). This project contributes approximately 9.34 MW to cause the thermal violation.
17. The PCHBTMTP-COOPER 230 kV line (from bus 213869 to bus 214089 ckt 1) loads from 155.02% to 155.33% (DC power flow) of its emergency rating (485 MVA) for the single line contingency ('PJM17'). This project contributes approximately 9.34 MW to cause the thermal violation.
18. The V4-002TAP1-GRACETON 230 kV line (from bus 900010 to bus 220964 ckt 1) loads from 257.94% to 258.25% (DC power flow) of its emergency rating (485 MVA) for the single line contingency ('PJM17'). This project contributes approximately 9.34 MW to cause the thermal violation.