Generation Interconnection Feasibility Study Report W3-018

The Interconnection Customer (IC) has proposed a 60 MWE (22.8 MWC) solar powered generating facility consisting of ground mounted, fixed panel, solar photovoltaic arrays. The project is to be located in Pilesgrove Township, Salem County, New Jersey. PJM studied W3-018 as a 60 MW injection into the Atlantic City Electric (ACE) system as a tap of the Deepwater-Woodstown 69kV circuit 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 December 31, 2011.

Point of Interconnection

W3-018 will interconnect with the Atlantic City Electric transmission system at the Woodstown 69kV 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 Woodstown 69kV substation, create one (1) 69kV bus position and add a riser with disconnect switches for cabling from the substation to the Point of Interconnection (POI) for the 69kV line to the W3-018 site.

The estimated cost to perform this work is **$1,600,000**. 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 W3-018 with the ACE system via a 69kV circuit from their facility to the Woodstown 69kV 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. Pending determination by ACE, the previously mentioned responsibility associated with planning and constructing the transmission line from the W3-018 to the Woodstown 69kV substation may revert back to ACE. Ownership of the line would reside with ACE. The Interconnection Customer may be responsible for contributing to future O & M costs.

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)*

1. (AE) The Pedricktown-Bridgeport 230 kV line (from bus 228312 to bus 228313 ckt 1) loads from 37.18% to 38.32% (DC power flow) of its emergency rating (552 MVA) for the single contingency 'CHUR-ORCH'. This project contributes approximately 6.32 MW to the thermal violation.

2. (PSEG) The Gloucester-Gloucester 230/138 kV transformer (from bus 219110 to bus 219117 ckt 1) loads from 99.87% to 100.29% (DC power flow) of its emergency rating (341 MVA) for the single contingency 'PJM_NEWFREEDM_WINDSOR'. This project contributes approximately 1.44 MW to the thermal violation.

3. (AE) The Chambers-Pedricktown 230 kV line (from bus 228311 to bus 228312 ckt 1) loads from 17.44% to 18.59% (DC power flow) of its emergency rating (552 MVA) for the single contingency 'CHUR-ORCH'. This project contributes approximately 6.33 MW to the thermal violation.

Multiple Facility Contingency

*(Double Circuit Tower Line, Line with Failed Breaker and, Bus Fault contingencies for the **Full** energy output.*

4. (AE) The Carneys Point Tap-Pennsgrove 69 kV line (from bus 228320 to bus 228328 ckt 1) loads from 97.43% to 105.46% (DC power flow) of its emergency rating (77 MVA) for the tower contingency 'AE12TOWER'. This project contributes approximately 6.18 MW to the thermal violation.

5. (AE) The W3-016TAP1-Beckett 69 kV line (from bus 903350 to bus 228321 ckt 1) loads from 98.75% to 105.94% (DC power flow) of its emergency rating (97 MVA) for the tower contingency 'AE12TOWER'. This project contributes approximately 6.97 MW to the thermal violation.

6. (AE) The Pennsgrove-Oldman 69 kV line (from bus 228328 to bus 228327 ckt 1) loads from 93.95% to 102.19% (DC power flow) of its emergency rating (75 MVA) for the tower contingency 'AE12TOWER'. This project contributes approximately 6.18 MW to the thermal violation.

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. (AE/PSEG) The Mickleton-Thorofare 230 kV line (from bus 228401 to bus 219121 ckt 1) loads from 142.71% to 142.87% (DC power flow) of its emergency rating (566 MVA) for the tower contingency 'AE1TOWER'. This project contributes approximately 5.92 MW to the thermal violation.

2. (AE) The Woodstown #1-Clayton 69 kV line (from bus 228332 to bus 228405 ckt 1) loads from 140.70% to 158.82% (DC power flow) of its emergency rating (54 MVA) for the tower contingency 'AE12TOWER'. This project contributes approximately 9.78 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)

1. To mitigate the (AE) Pedricktown-Bridgeport 230 kV line (from bus 228312 to bus 228313 ckt 1) overload will require at Pedricktown sub an upgrade to the Bridgeport 230 kV 1590 AL strand bus to 2-1590 AL. The estimated cost to perform this work is $200,000 and will take 18 to 24 months to complete.

2. To mitigate the (PSEG) Gloucester-Gloucester 230/138 kV transformer (from bus 219110 to bus 219117 ckt 1) overload will require an upgrade to the transformer. The estimated cost to perform this work is $13,000,000 and will take 36 months to complete.

3. To mitigate the (AE) Chambers-Pedricktown 230 kV line (from bus 228311 to bus 228312 ckt 1) overload will require the installation of a second 230/69 kV transformer at the Churchtown substation and convert the 69 kV side to ring bus. The estimated cost to perform this work is $8,600,000 and will take 24 to 36 months to complete.

4. To mitigate the (AE) Carneys Point Tap-Pennsgrove 69 kV line (from bus 228320 to bus 228328 ckt 1) overload will require the upgrade of the Deepwater 477 Al strand bus at Pennsgrove to 1200 amp minimum. The estimated cost to perform this work is **$120,000** and will take **12 to 18 months** to complete.

5. To mitigate the W3-016TAP1-Beckett 69 kV line (AE) overload will require either a relay setting adjustment or replacement. The cost and duration to complete this work will be determined during the System Impact Study.

6. To mitigate the (AE) Pennsgrove-Oldman 69 kV line (from bus 228328 to bus 228327 ckt 1) overload will require the upgrade of the Oldmans 477 Al strand bus at Pennsgrove to 1200 amp minimum. The estimated cost to perform this work is **$120,000** and will take **12 to 18 months** to complete.

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 (AE/PSEG) Mickleton-Thorofare 230 kV line (from bus 228401 to bus 219121 ckt 1) overload will require the rebuild of 1.69 miles of circuit with a conductor that has capability of at least 2500 A emergency. The estimated cost to perform this work is **$3,500,000** and will take **24 – 36 months** to complete.

2. To mitigate the (AE) Woodstown #1-Clayton 69 kV line (from bus 228332 to bus 228405 ckt 1) overload will require reconductoring from the intersection of Route 77 and the Woodstown-Clayton 69 kV line to the Clayton substation (a distance of 9.5 miles) with 795 ACSR. The estimated cost to perform this work is **$3,300,000** and will take an estimated **18 to 24 months** to complete.

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. (AE) The Pedricktown-Bridgeport 230 kV line (from bus 228312 to bus 228313 ckt 1) loads from 60.87% to 62.55% (DC power flow) of its emergency rating (552 MVA) for the operational contingency 'Q90GENB _419'. This project contributes approximately 9.26 MW to the thermal violation.

2. (AE) The Bridgeport-Mickleton 230 kV line (from bus 228313 to bus 228401 ckt 1) loads from 68.03% to 69.17% (DC power flow) of its emergency rating (805 MVA) for the operational contingency 'Q90GENB _419'. This project contributes approximately 9.19 MW to the thermal violation.

3. (AE) The Bridgeport-Mickleton 230 kV line (from bus 228313 to bus 228401 ckt 1) loads from 72.43% to 73.84% (DC power flow) of its normal rating (650 MVA) for non contingency condition. This project contributes approximately 9.19 MW to the thermal violation.

4. (PECO/BG&E) The Cooper-Graceton 230 kV line (from bus 214089 to bus 220964 ckt 1) loads from 170.45% to 170.6% (DC power flow) of its emergency rating (485 MVA) for the operational contingency 'PJM17'. This project contributes approximately 5.68 MW to the thermal violation.

5. (DP&L) The Red Lion-Keeney 230 kV line (from bus 231004 to bus 231003 ckt 1) loads from 78.38% to 78.55% (DC power flow) of its emergency rating (924 MVA) for the operational contingency 'PJM64'. This project contributes approximately 9.86 MW to the thermal violation.

6. (AE/PSEG) The Mickleton-Thorofare 230 kV line (from bus 228401 to bus 219121 ckt 1) loads from 119.22% to 119.43% (DC power flow) of its normal rating (451 MVA) for non contingency condition. This project contributes approximately 5.80 MW to the thermal violation.

7. (AE) The Churchtown-Orchard 230 kV line (from bus 228310 to bus 228002 ckt 1) loads from 48.57% to 50.61% (DC power flow) of its emergency rating (800 MVA) for the operational contingency 'MICK-BRIDG'. This project contributes approximately 16.32 MW to the thermal violation.

8. (AE) The Carlls Corner-Sherman 69 kV line (from bus 228252 to bus 228226 ckt 1) loads from 222.26% to 234.48% (DC power flow) of its emergency rating (56 MVA) for the operational contingency 'USLC-SM_V4-036B_WITH_W1-085A'. This project contributes approximately 6.84 MW to the thermal violation.

9. (AE) The Upper Pittsgrove-Landis 138 kV line (from bus 228211 to bus 228500 ckt 1) loads from 90.12% to 95.5% (DC power flow) of its emergency rating (205 MVA) for the operational contingency 'D/W-MON-DOR'. This project contributes approximately 11.02 MW to the thermal violation.

10. (AE) The Woodstown-Woodstown #1 69 kV line (from bus 228360 to bus 228332 ckt 1) loads from 103.48% to 155.77% (DC power flow) of its emergency rating (74 MVA) for the operational contingency 'D/W-WOOD 2_W3-018A'. This project contributes approximately 38.70 MW to the thermal violation.

11. (AE) The Woodstown #1-Clayton 69 kV line (from bus 228332 to bus 228405 ckt 1) loads from 110.77% to 129.34% (DC power flow) of its normal rating (44 MVA) for non contingency condition. This project contributes approximately 8.17 MW to the thermal violation.

12. (AE) The Chambers-Pedricktown 230 kV line (from bus 228311 to bus 228312 ckt 1) loads from 26.49% to 29.51% (DC power flow) of its emergency rating (552 MVA) for the operational contingency 'CHUR-ORCH'. This project contributes approximately 16.67 MW to the thermal violation.

13. (AE) The Laurel-Carlls Corner #1 69 kV line (from bus 228218 to bus 228212 ckt 1) loads from 93.79% to 99.07% (DC power flow) of its emergency rating (130 MVA) for the operational contingency 'USLC-SM_V4-036B_WITH_W1-085B'. This project contributes approximately 6.87 MW to the thermal violation.

14. (PECO) The Peach Bottom-Cooper 230 kV line (from bus 213869 to bus 214089 ckt 1) loads from 171.45% to 171.61% (DC power flow) of its emergency rating (485 MVA) for the operational contingency 'PJM17'. This project contributes approximately 5.68 MW to the thermal violation.