Generation Interconnection
Feasibility Study Report
Queue Position W1-103

The Interconnection Customer (IC) has proposed a 20 MWE (7.6 MWC) solar powered generating facility consisting of ground mounted fixed panel solar arrays to be located in Millville, New Jersey. PJM studied W1-103 as a 20 MW injection into the Atlantic City Electric (ACE) system at a tap point along the South Millville-US Silica Tap 69kV circuit. The project was evaluated for compliance with reliability criteria for summer peak conditions in 2014.

Point of Interconnection

W1-103 will interconnect to the Atlantic City Electric distribution system at the Second Street 69/12kV and the South Millville 69/12kV substations (the closest available substations to the project site) as follows:

7.6 MWs will connect to the existing T2 transformer at the Second Street substation; 9.5 MWs will connect to the existing T3 transformer at the Second Street substation; 2.9 MWs will connect to the existing T1 transformer at the South Millville 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:

1. Second Street 69/12kV substation
   a. Install a new feeder terminal on the T2 transformer. The estimated cost to perform this work is **$322,000.**
   b. Install a new feeder terminal on the T3 transformer. The estimated cost to perform this work is **$322,000.**
   c. Install two (2) new 12kV feeders approximately 5.34 miles in length from the Second Street substation to the generating site using PAC overhead cable. The estimated cost to perform this work is **$4,272,000.**
   d. Install a utility operated recloser with relaying and communication equipment on each new feeder. The estimated cost to perform this work is **$100,000.**
   e. Install utility grade metering on each new feeder. The estimated cost to perform this work is **$40,000.**
   f. Install SCADA to Control Center for each new feeder. The estimated cost to perform this work is **$20,000.**

   The estimated cost to perform the work at the **Second Street** substation is **$5,076,000.**

2. South Millville 69/12kV substation

a. Install a new feeder terminal on the T1 transformer. The estimated cost to perform this work is **$436,000.**
b. Install one (1) new 12kV feeder approximately 5.53 miles in length from the South Millville substation to the generating site using PAC overhead cable. The estimated cost to perform this work is **$2,212,000.**
c. Install a utility operated recloser with relaying and communication equipment. The estimated cost to perform this work is **$50,000.**
d. Install utility grade metering. The estimated cost to perform this work is **$20,000.**
e. Install SCADA to Control Center. The estimated cost to perform this work is **$10,000.**

The estimated cost to perform the work at the **South Millville** substation is **$2,728,000.**

3. Perform Dynamic Study. The estimated cost to perform this work is **$30,000.**

4. Perform system protection planning, engineering, and transfer trip work. Transfer trip to be installed in locations where a generator installation could be islandized with a minimum load that is less than 3 times the size of generator capacity. The estimated cost to perform this work is **$20,000.**

The total estimated cost to perform this work is **$7,854,000** and will take an estimated **6 – 12 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 W1-103 generating station. Site preparation including grading and an access road, as necessary, is assumed to be by 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.

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.*

1. The V4-036TAP1-W1-085TAP1 69 kV line (from bus 900350 to bus 901640 ckt 1) loads from 56.31% to 73.19% (DC power flow) of its emergency rating (89 MVA) for the tower line contingency ('AE11TOWER'). This project contributes approximately 15.02 MW to cause 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)

None

Short Circuit

None

Stability Analysis

Not required due to project size.

Dynamic Analysis

A time-based dynamic study will be completed during the System Impact Study phase of W1-103.

AC injection into the grid must follow a ramp up rate that does not negatively affect the distribution system. An inverter capable of dynamic VAR output with Droop and Time Delay settings will be required. Further study will be required to review the impact to the grid under all output scenarios and grid load profiles. The proposed project will be reviewed for protection and coordination issues and any other required upgrades will be identified in future studies.

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 V4-036TAP1-W1-085TAP1 69 kV line (from bus 900350 to bus 901640 ckt 1) overload will require the reconductor of this line segment with 795 ACSR conductor. The estimated cost to perform this work is **$300,000** and will take **12-24 months** to complete

following receipt of a fully executed Interconnection Services Agreement (ISA) and Interconnection Construction Services Agreement (CSA). See PJM Tariff Section 217.3a for cost allocation requirements.

Contribution to Previously Identified System Reinforcements

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

None

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 BALFSTNT-WHTN A T 69 kV line (from bus 228215 to bus 228233 ckt 1) loads from 70.98% to 82.18% (DC power flow) of its normal rating (77 MVA) for non-contingency condition. This project contributes approximately 8.62 MW to cause the thermal violation.

2. The LAUREL#2-LAUREL 69 kV line (from bus 228259 to bus 228218 ckt 1) loads from 85.87% to 93.79% (DC power flow) of its emergency rating (149 MVA) for the single line contingency ('USLC-SM_V4-036B_WITH_W1-085B'). This project contributes approximately 16.23 MW to cause the thermal violation.

3. The WHTN A T-2ND ST#1 69 kV line (from bus 228233 to bus 228225 ckt 1) loads from 82.81% to 95.88% (DC power flow) of its normal rating (66 MVA) for non-contingency condition. This project contributes approximately 8.62 MW to cause the thermal violation.

4. The SO MVLLE-BUTLER 69 kV line (from bus 228228 to bus 228703 ckt 1) loads from 87.37% to 99.22% (DC power flow) of its emergency rating (89 MVA) for the single line contingency ('SS-SMLVIL'). This project contributes approximately 13.48 MW to cause the thermal violation.

5. The SO MVLLE-BALFSTNT 69 kV line (from bus 228228 to bus 228215 ckt 1) loads from 85.4% to 98.87% (DC power flow) of its normal rating (64 MVA) for non-contingency condition. This project contributes approximately 8.62 MW to cause the thermal violation.

6. The BALFSTNT-WHTN A T 69 kV line (from bus 228215 to bus 228233 ckt 1) loads from 93.4% to 103.72% (DC power flow) of its emergency rating (94 MVA) for the single line contingency ('LAUR-FAIR'). This project contributes approximately 11.55 MW to cause the thermal violation.

7. The US SLC T-NEWPORT 69 kV line (from bus 228222 to bus 228219 ckt 1) loads from 87.42% to 97.41% (DC power flow) of its normal rating (50 MVA) for non-contingency condition. This project contributes approximately 5 MW to cause the thermal violation.

8. The V4-036TAP1-W1-085TAP1 69 kV line (from bus 900350 to bus 901640 ckt 1) loads from 65.5% to 88.33% (DC power flow) of its normal rating (65.7 MVA) for non-contingency condition. This project contributes approximately 15 MW to cause the thermal violation.

9. The WHTN A T-2ND ST#1 69 kV line (from bus 228233 to bus 228225 ckt 1) loads from 118.64% to 131.75% (DC power flow) of its emergency rating (74 MVA) for the single line contingency ('LAUR-FAIR'). This project contributes approximately 11.55 MW to cause the thermal violation.

10. The SO MVLLE-BALFSTNT 69 kV line (from bus 228228 to bus 228215 ckt 1) loads from 121.94% to 135.41% (DC power flow) of its emergency rating (72 MVA) for the single line contingency ('LAUR-FAIR'). This project contributes approximately 11.55 MW to cause the thermal violation.

11. The V4-036TAP1-US SLC T 69 kV line (from bus 900350 to bus 228222 ckt 1) loads from 166.5% to 199.83% (DC power flow) of its emergency rating (60 MVA) for the single line contingency ('USLC-SM_V4-036B_WITH_W1-085B'). This project contributes approximately 20 MW to cause the thermal violation.

12. The FAIRTON-LAUREL#2 69 kV line (from bus 228214 to bus 228259 ckt 1) loads from 164.08% to 182.39% (DC power flow) of its emergency rating (93 MVA) for the single line contingency ('USLC-SM_V4-036B_WITH_W1-085B'). This project contributes approximately 20 MW to cause the thermal violation.

13. The CRLS CR2-SHRMAN#2 69 kV line (from bus 228252 to bus 228226 ckt 1) loads from 183.84% to 199.98% (DC power flow) of its emergency rating (56 MVA) for the single line contingency ('USLC-SM_V4-036B_WITH_W1-085B'). This project contributes approximately 9.04 MW to cause the thermal violation.

14. The W1-085TAP1-SO MVLLE 69 kV line (from bus 901640 to bus 228228 ckt 1) loads from 158.35% to 181.18% (DC power flow) of its normal rating (65.7 MVA) for non-contingency condition. This project contributes approximately 15 MW to cause the thermal violation.

15. The W1-085TAP1-SO MVLLE 69 kV line (from bus 901640 to bus 228228 ckt 1) loads from 121.65% to 144.12% (DC power flow) of its emergency rating (89 MVA) for the single line contingency ('NEWPRT-USLC'). This project contributes approximately 20 MW to cause the thermal violation.

16. The US SLC T-NEWPORT 69 kV line (from bus 228222 to bus 228219 ckt 1) loads from 196.87% to 233.24% (DC power flow) of its emergency rating (55 MVA) for the single line contingency ('USLC-SM_V4-036B_WITH_W1-085B'). This project contributes approximately 20 MW to cause the thermal violation.

17. The NEWPORT-FAIRTON 69 kV line (from bus 228219 to bus 228214 ckt 1) loads from 203.07% to 243.58% (DC power flow) of its emergency rating (48 MVA) for the single line contingency ('USLC-SM_V4-036B_WITH_W1-085B'). This project contributes approximately 20 MW to cause the thermal violation.