Generation Interconnection
Feasibility Study Report
Queue Position Y1-077

The Interconnection Customer (IC) has requested a 123 MW (123 MWC; 123 MW energy) upgrade to their existing BL England generating facility located in Beesley Point, Upper Township, Cape May County, New Jersey. The upgrade includes the addition of a new combustion turbine to be used in conjunction with existing steam turbines. PJM studied the Y1-077 project as a 123 MW injection into the Atlantic City Electric (ACE) system at the BL England 138kV substation and evaluated the project for compliance with reliability criteria for summer peak conditions in 2015. The planned in-service date for the new generator is June 1, 2015.

Point of Interconnection

Y1-077 will utilize the existing Point(s) of Interconnection.

Direct Connection Requirements

Transmission Owner Scope of Work

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

None

Interconnection Customer Scope of Work

The Interconnection Customer (IC) is responsible for all design and construction related to activities on their 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, and right-of-way acquisition of the direct connect facilities is not included in this report, and is 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 PHI'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)*

1. The SCULL#2-MILL #2 138 kV line (from bus 227906 to bus 227904 ckt 1) loads from 84.9% to 102.08% (DC power flow) of its normal rating (219 MVA) for non-contingency condition. This project contributes approximately 37.62 MW to the thermal violation.

2. The BLE-SCULL#2 138 kV line (from bus 228110 to bus 227906 ckt 1) loads from 95.13% to 112.31% (DC power flow) of its normal rating (219 MVA) for non-contingency condition. This project contributes approximately 37.62 MW to the thermal violation.

3. The SCULL#2-MILL #2 138 kV line (from bus 227906 to bus 227904 ckt 1) loads from 96.96% to 117.21% (DC power flow) of its emergency rating (287 MVA) for the single line contingency ('BLE-SC-ML1'). This project contributes approximately 58.1 MW to the thermal violation.

4. The MILL #1-LEWIS #1 138 kV line (from bus 227903 to bus 227902 ckt 1) loads from 96.6% to 117.44% (DC power flow) of its emergency rating (262 MVA) for the single line contingency ('BLE-SC-ML2'). This project contributes approximately 54.62 MW to the thermal violation.

5. The SCULL#1-MILL #1 138 kV line (from bus 227905 to bus 227903 ckt 1) loads from 96.76% to 117.61% (DC power flow) of its emergency rating (262 MVA) for the single line contingency ('BLE-SC-ML2'). This project contributes approximately 54.62 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.*

6. The CORSON 2-CORSON 3 138 kV line (from bus 228107 to bus 228108 ckt 1) loads from 87.67% to 102.1% (DC power flow) of its emergency rating (331 MVA) for the tower line contingency ('AE7TOWER'). This project contributes approximately 47.76 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. The (PSEG) GLOUCSTR-CUTHBERT 230 kV line (from bus 219110 to bus 219108 ckt 1) loads from 101.64% to 101.88% (DC power flow) of its normal rating (500 MVA) for non-contingency condition. This project contributes approximately 7.42 MW to the thermal violation.

2. The (ACE) LEWIS #3-MOSS MILL 69 kV line (from bus 227948 to bus 228032 ckt 1) loads from 105.72% to 107.05% (DC power flow) of its emergency rating (91 MVA) for the tower

line contingency ('AE3TOWER'). This project contributes approximately 7.47 MW to the thermal violation.

3. The (ACE) MNOTLA 2-LEWIS #2 138 kV line (from bus 228503 to bus 227945 ckt 1) loads from 108.22% to 108.82% (DC power flow) of its emergency rating (205 MVA) for the tower line contingency ('AE7TOWER'). This project contributes approximately 7.63 MW to the thermal violation.

4. The (PSE&G) CUTHBERT-CAMDEN 230 kV line (from bus 219108 to bus 219125 ckt 1) loads from 111.1% to 111.41% (DC power flow) of its emergency rating (700 MVA) for the single line contingency ('CAM_CUTH_NEW'). This project contributes approximately 13.4 MW to the thermal violation.

5. The BRIDGPRT-MCKLTON 230 kV line (from bus 228313 to bus 228401 ckt 1) loads from 114.76% to 115.02% (DC power flow) of its normal rating (650 MVA) for non-contingency condition. This project contributes approximately 10.47 MW to the thermal violation.

6. The (PSE&G) EAGLE PT-GLOUCSTR 230 kV line (from bus 219120 to bus 219110 ckt 2) loads from 115.64% to 115.82% (DC power flow) of its emergency rating (1250 MVA) for the single line contingency ('PS18'). This project contributes approximately 13.97 MW to the thermal violation.

7. The (PECO) RICHMOND-WANEETA3 230 kV line (from bus 213922 to bus 214012 ckt 1) loads from 116.93% to 117.17% (DC power flow) of its emergency rating (914 MVA) for the single line contingency ('CHIC125'). This project contributes approximately 24.94 MW to the thermal violation.

8. The (PSE&G) THOROFAR-EAGLE PT 230 kV line (from bus 219121 to bus 219120 ckt 1) loads from 117.3% to 117.49% (DC power flow) of its emergency rating (1000 MVA) for the single line contingency ('PS17B'). This project contributes approximately 12.07 MW to the thermal violation.

9. The (ACE) UNION-LINCOLN 138 kV line (from bus 228210 to bus 228709 ckt 1) loads from 108.95% to 118.29% (DC power flow) of its emergency rating (292 MVA) for the tower line contingency ('AE7TOWER'). This project contributes approximately 27.25 MW to the thermal violation.

10. The (ACE) BLE-SCULL#1 138 kV line (from bus 228110 to bus 227905 ckt 1) loads from 100.62% to 118.41% (DC power flow) of its emergency rating (307 MVA) for the single line contingency ('BLE-SC-ML2'). This project contributes approximately 54.62 MW to the thermal violation.

11. The (PSE&G) GLOUCSTR-CUTHBERT 230 kV line (from bus 219110 to bus 219108 ckt 1) loads from 118.95% to 119.23% (DC power flow) of its emergency rating (700 MVA) for the single line contingency ('GLO_CUTH_NEW'). This project contributes approximately 12.14 MW to the thermal violation.

12. The (PSE&G/PECO) CAMDEN-RICHMOND 230 kV line (from bus 219125 to bus 213922 ckt 1) loads from 119.96% to 120.17% (DC power flow) of its emergency rating (1037 MVA) for the single line contingency ('CHIC125'). This project contributes approximately 26 MW to the thermal violation.

13. The (PSE&G) DEPTFORD-EAGLE PT 230 kV line (from bus 219109 to bus 219120 ckt 2) loads from 120.07% to 120.28% (DC power flow) of its emergency rating (1000 MVA) for the single line contingency ('PS6A'). This project contributes approximately 12.71 MW to the thermal violation.

14. The (ACE/PSE&G) MCKLTON-THOROFAR 230 kV line (from bus 228401 to bus 219121 ckt 1) loads from 122.9% to 123.1% (DC power flow) of its emergency rating (1000 MVA) for the single line contingency ('PS17B'). This project contributes approximately 12.07 MW to the thermal violation.

15. The (ACE) BLE-SCULL#2 138 kV line (from bus 228110 to bus 227906 ckt 1) loads from 108.82% to 127.75% (DC power flow) of its emergency rating (307 MVA) for the single line contingency ('BLE-SC-ML1'). This project contributes approximately 58.1 MW to the thermal violation.

16. The (ACE/PSE&G) MCKLTON-DEPTFORD 230 kV line (from bus 228401 to bus 219109 ckt 2) loads from 132.22% to 132.42% (DC power flow) of its emergency rating (1000 MVA) for the single line contingency ('PS6A'). This project contributes approximately 12.71 MW to the thermal violation.

17. The (PSE&G) GLOUCSTR-CUTHBERT 230 kV line (from bus 219110 to bus 219108 ckt 2) loads from 133.82% to 134.14% (DC power flow) of its normal rating (380 MVA) for non-contingency condition. This project contributes approximately 7.42 MW to the thermal violation.

18. The (ACE) MDLE TP-CORSON 2 138 kV line (from bus 228111 to bus 228107 ckt 1) loads from 113.23% to 137.93% (DC power flow) of its emergency rating (287 MVA) for the tower line contingency ('AE7TOWER'). This project contributes approximately 70.89 MW to the thermal violation.

19. The (ACE) MERION-CORSON 1 138 kV line (from bus 228197 to bus 228106 ckt 1) loads from 118.81% to 141.43% (DC power flow) of its emergency rating (219 MVA) for the tower line contingency ('AE7TOWER'). This project contributes approximately 49.55 MW to the thermal violation.

20. The (ACE) MILL #2 138/69 kV transformer (from bus 227904 to bus 227946 ckt 1) loads from 128.52% to 142.79% (DC power flow) of its emergency rating (166 MVA) for the tower line contingency ('AE5TOWER'). This project contributes approximately 23.69 MW to the thermal violation.

21. The (PSE&G) CUTHBERT-CAMDEN 230 kV line (from bus 219108 to bus 219125 ckt 2) loads from 151.24% to 151.65% (DC power flow) of its emergency rating (500 MVA) for the single line contingency ('CAM_CUTH'). This project contributes approximately 12.64 MW to the thermal violation.

22. The (ACE) TUCKAHOE-MILL#2 69 kV line (from bus 228130 to bus 227946 ckt 1) loads from 138.36% to 152.88% (DC power flow) of its emergency rating (146 MVA) for the tower line contingency ('AE7TOWER'). This project contributes approximately 21.19 MW to the thermal violation.

23. The (ACE) CORSON#1-TUCKAHOE 69 kV line (from bus 228185 to bus 228130 ckt 1) loads from 143.96% to 158.48% (DC power flow) of its emergency rating (146 MVA) for the tower line contingency ('AE7TOWER'). This project contributes approximately 21.19 MW to the thermal violation.

24. The (PSE&G) GLOUCSTR-CUTHBERT 230 kV line (from bus 219110 to bus 219108 ckt 2) loads from 165.87% to 166.26% (DC power flow) of its emergency rating (500 MVA) for the single line contingency ('GLO_CUTH'). This project contributes approximately 12.14 MW to the thermal violation.

25. The (ACE) BLE-MERION 138 kV line (from bus 228110 to bus 228197 ckt 1) loads from 155.71% to 178.34% (DC power flow) of its emergency rating (219 MVA) for the tower line contingency ('AE7TOWER'). This project contributes approximately 49.55 MW to the thermal violation.

26. The (ACE) BLE-MDLE TP 138 kV line (from bus 228110 to bus 228111 ckt 1) loads from 191.64% to 225.06% (DC power flow) of its emergency rating (219 MVA) for the tower line contingency ('AE7TOWER'). This project contributes approximately 73.18 MW to the thermal violation.

Short Circuit

No issues identified.

Stability Analysis

To be completed during System Impact Study.

Other Charges

ACE reserves the right to charge the Interconnection Customer Operation and Maintenance expenses to maintain the Interconnection Customer's Attachment Facilities, including metering and telecommunications facilities which are owned by ACE.

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&3. To mitigate the (ACE) SCULL#2-MILL #2 138 kV line (from bus 227906 to bus 227904 ckt 1) overloads will require reconductoring approximately 6.5 miles of the existing 795 ACSR circuit with a larger conductor. The estimated cost to perform this work is **$4,800,000**.

2. To mitigate the (ACE) BLE-SCULL#2 138 kV line (from bus 228110 to bus 227906 ckt 1) overload will require completing the reconductor project currently planned by ACE. The estimated completion date is 2015.

4&5. To mitigate the (ACE) MILL #1-LEWIS #1 138 kV line (from bus 227903 to bus 227902 ckt 1) and the SCULL#1-MILL #1 138 kV line (from bus 227905 to bus 227903 ckt 1) overloads will require upgrading the strand bus at the Mill substation. The estimated cost to perform this work is **$100,000**.

6. To mitigate the (ACE) CORSON 2-CORSON 3 138 kV line (from bus 228107 to bus 228108 ckt 1) overload will require upgrading the strand bus at the Corson substation. The estimated cost to perform this work is **$25,000.**

Contribution to Previously Identified System Reinforcements

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

1,4,11,17,21,24. To mitigate the (PSE&G) GLOUCSTR-CUTHBERT-CAMDEN 230 kV line overloads will require looping in the Gloucester-Camden cable to Cuthbert and installing forced cooling of the Gloucester-Cuthbert-Camden cables. The estimated cost to perform this work is **$55,000,000** and will take **24 months** to complete.

2. To mitigate the (ACE) LEWIS #3-MOSS MILL 69 kV line (from bus 227948 to bus 228032 ckt 1) overload will require rebuilding approximately 12 miles of 477 AA circuit. The estimated cost to perform this work is **$9,000,000** and will take **24-36 months** to complete.

3. To mitigate the (ACE) MNOTLA 2-LEWIS #2 138 kV line (from bus 228503 to bus 227945 ckt 1) overload will require reconductoring approximately 24 miles of 397.5 ACSR circuit. The estimated cost to perform this work is **$36,000,000** and will take **30-42 months** to complete.

5. To mitigate the (ACE) BRIDGPRT-MCKLTON 230 kV line (from bus 228313 to bus 228401 ckt 1) overload will require reconductoring approximately 9.1 miles of ACSR circuit.

The estimated cost to perform this work is **$5,500,000** and will take **24-36 months** to complete.

6. To mitigate the (PSE&G) EAGLE PT-GLOUCSTR 230 kV line (from bus 219120 to bus 219110 ckt 2) overload will require reconductoring the Eagle Point-Gloucester 230kV circuits #1 and #2 with a higher rated conductor (1500 MVA E) and bypassing the existing series reactor at Chireshire. The estimated cost to perform this work is **$25,000,000** and will take **24 months** to complete.

7. To mitigate the (PECO) RICHMOND-WANEETA3 230 kV line (from bus 213922 to bus 214012 ckt 1) overload will require reconductoring the aerial portion of the line which meets the minimum rating requirement of 2882A. This will result in a 249A = 99 MVA margin when compared to the new aerial conductor rating. Using the Pecos conductor avoids the need to rebuild the line. The total aerial mileage per the PECO 230 kV line length spreadsheet is 2.23 miles. Replace with 2-2000 kcmil AAC 127 Str (Cowslip) with emergency rating of 4130. Remove the existing two UG cables (2-3-1x3000 KCMIL CU HPOFP) and replace with two dielectric (XLPE - cross link polyethylene) cables. The estimated cost to perform this work is **$15,000,000** and will take **36 months** to complete.

8&13. To mitigate the (PSE&G) THOROFAR-EAGLE PT 230 kV line (from bus 219121 to bus 219120 ckt 1) and the DEPTFORD-EAGLE PT 230 kV line (from bus 219109 to bus 219120 ckt 2) overloads will require the following:

- Bypass the existing series reactor at Chireshire.
- Reconductor the Mickleton to Thorofare circuit to 1200 MVA Emergency Rating.
- Reconductor the Thorofare to Eagle Point circuit to 1200 MVA Emergency Rating.
- Reconductor the Mickleton to Deptford circuit to 1200 MVA Emergency Rating.
- Reconductor the Deptford to Eagle Point circuit to 1200 MVA Emergency Rating.

The estimated cost to perform this work is **$155,000,000** and will take **24 months** to complete.

9. To mitigate the (ACE) UNION-LINCOLN 138 kV line (from bus 228210 to bus 228709 ckt 1) overload will require reconductoring approximately 5.2 miles of ACSR circuit. The estimated cost to perform this work is **$5,200,000** and will take **24-36 months** to complete.

10. To mitigate the (ACE) BLE-SCULL#1 138 kV line (from bus 228110 to bus 227905 ckt 1) overload will require rebuilding and reconductoring the #1 BLE-Scull 138 kV line with a larger conductor. The estimated cost to perform this work is **$2,000,000** and will take **30 months** to complete.

12. To mitigate the (PSEG/PECO) CAMDEN-RICHMOND 230 kV line (from bus 219125 to bus 213922 ckt 1) overload will require the following:

    PSE&G Portion
    Upgrade the PSEG portion of the Camden - Richmond 230 kV circuit to six wire conductor and replace terminal equipments at Camden. This work has been previously identified as a 2016 RTEP project b1590 with an in-service date of June 1, 2015.

    PECO Portion
    Upgrade the PECO portion of the line to a six wire conductor and replace terminal equipment at Richmond. This work has been previously identified as a 2016 RTEP project b1590 with an in-service dtae of Junee 1, 2015.

    If Y1-077 project's in-service date precedes the RTEP project's in service date the Interconnection Customer may elect to accelerate the RTEP project through the use of an Attachment S, "Transmission Interconnection Feasibility Study Agreement. Costs associated with accelerating this project will be determined during a later study phase. The total cost for the RTEP project is **$43.5M** with a lead time of **36-48 months**.

14. To mitigate the (ACE/PSEG) MCKLTON-THOROFAR 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 the capability of at least 2500 Amps (emergency), The estimated cost to perform this work **$3,500,000** and will take **34 – 36 months** to complete.

15. To mitigate the (ACE) BLE-SCULL#2 138 kV line (from bus 228110 to bus 227906 ckt 1) overload will require a rebuild and reconductor of the #2 BLE-Scull 138 kV line with a larger conductor. The estimated cost to perform this work is **$2,000,000** and will take **30 months** to complete.

16. To mitigate the (ACE/PSE&G) MCKLTON-DEPTFORD 230 kV line (from bus 228401 to bus 219109 ckt 2) overload will require the following:

    ACE Portion
    Reconductor the existing Mickleton – Gloucester 230 kV circuit (ACE portion). This work has been previously identified as a 2015 RTEP project b1398.5 with an in-service date of June 1, 2015.

    PSE&G Portion
    Reconductor the existing Mickleton – Gloucester 230 kV circuit (PSE&G portion). This work has been previously identified as a 2015 RTEP project b1398.4 with an in-service date of June 1, 2015.

    If Y1-077 project's in-service date precedes the RTEP project's in service date the Interconnection Customer may elect to accelerate the RTEP project through the use of an Attachment S, "Transmission Interconnection Feasibility Study Agreement. Costs associated with accelerating this project will be determined during a later study phase.

18. To mitigate the (ACE) MDLE TP-CORSON 2 138 kV line (from bus 228111 to bus 228107 ckt 1) overload will require upgrading the Corson terminal and reconductoring of the cut-in to the substation. The estimated cost to perform this work is **$500,000** and will take **24-36 months** to complete.

19. To mitigate the (ACE) MERION-CORSON 1 138 kV line (from bus 228197 to bus 228106 ckt 1) overload will require reconductoring approximately 10 miles of 138kV circuit and upgrade the Corson terminal. The estimated cost to perform this work is **$16,000,000** and will take **24-36 months** to complete.

20. To mitigate the (ACE) MILL #2 138/69 kV transformer (from bus 227904 to bus 227946 ckt 1) overload will require completing the already identified PJM RTEP project b1600 to upgrade the #2 transformer at Mill. The estimated in-service date of this RTEP project is June 1, 2016.

    If Y1-077 project's in-service date precedes the RTEP project's in service date the Interconnection Customer may elect to accelerate the RTEP project through the use of an Attachment S, "Transmission Interconnection Feasibility Study Agreement. Costs associated with accelerating this project will be determined during a later study phase. The estimated cost to perform this work is **$5,500,000.**

22&23. To mitigate the (ACE) TUCKAHOE-MILL#2 69 kV line (from bus 228130 to bus 227946 ckt 1) and the CORSON#1-TUCKAHOE 69 kV line (from bus 228185 to bus 228130 ckt 1) overloads will require the rebuild of the Corson-Tuckahoe-Mill 69kV circuit and upgrade the terminals at Corson, Tuckahoe, and Mill substations. The estimated cost to perform this work is **$15,000,000** and will take **24-36 months** to complete.

25. To mitigate the (ACE) BLE-MERION 138 kV line (from bus 228110 to bus 228197 ckt 1) overload will require reconductoring approximately 5 miles of 138kV circuit and upgrade the BL England terminals. The estimated cost to perform this work is **$8,000,000** and will take **24-36 months** to complete.

26. To mitigate the (ACE) BLE-MDLE TP 138 kV line (from bus 228110 to bus 228111 ckt 1) overload will require reconductoring the BLE Middle Tap 138 kV line with an ACSS conductor. The estimated cost to perform this work is **$3,000,000** and will take **30 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.

None