Generation Interconnection
Feasibility Study Report
W3-172

The Interconnection Customer (IC) has proposed a 402 MWE (402 MWC) natural gas fueled generating facility consisting of two (2) combustion turbines. The project is to be located in Wilmington, Delaware. PJM studied W3-172 as a 402 MW injection into the Delmarva Power and Light system at the Hay Road 230kV substation. The project was evaluated for compliance with reliability criteria for summer peak conditions in 2014. The proposed in-service date, as stated in Attachment N, is June 1, 2013.

Point of Interconnection

W3-172 will interconnect with the Delmarva Power and Light transmission system at the Hay Road 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:

There is no Delmarva Power and Light direct connect work associated with W3-172.

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 W3-172 with the DPL system via the 230kV circuit from Red Lion substation to Hay Road substation.

Protective relaying and metering design and installation must comply with Delmarva Power'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. DPL 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 DPL 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 DPL 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. (DP&L) The Hay Road-Red Lion 230 kV line (from bus 231800 to bus 231004 ckt 1) loads from 64.40% to 108.87% (DC power flow) of its normal rating (901 MVA) for non contingency condition. This project contributes approximately 400.65 MW to the thermal violation.

2. (PECO) The Linwood-Chichester 2 230 kV line (from bus 213750 to bus 213490 ckt 2) loads from 98.83% to 99.59% (DC power flow) of its normal rating (753 MVA) for non contingency condition. This project contributes approximately 35.48 MW to the thermal violation.

3. (PECO) The Ridley Tap-Macdade 230 kV line (from bus 213925 to bus 213775 ckt 1) loads from 99.23% to 99.54% (DC power flow) of its emergency rating (1432 MVA) for the single contingency '220-23'. This project contributes approximately 28.04 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.*

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. (PECO/BG&E) The Cooper-Graceton 230 kV line (from bus 214089 to bus 220964 ckt 1) loads from 150.17% to 151.49% (DC power flow) of its emergency rating (485 MVA) for the single contingency 'PJM17'. This project contributes approximately 40.85 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 152.10% to 152.54% (DC power flow) of its emergency rating (674 MVA) for the tower contingency 'CNSTN_NWEST'. This project contributes approximately 25.66 MW to the thermal violation.

3. (PJM/METED) The Three Mile Island-Three Mile Island 500/230 kV transformer (from bus 200016 to bus 204514 ckt 2) loads from 121.33% to 125.92% (DC power flow) of its emergency rating (1072 MVA) for the single contingency 'PJM17'. This project contributes approximately 49.24 MW to the thermal violation.

4. (PL/BG&E) The Otter Creek Switchyard-Conastone 230 kV line (from bus 208048 to bus 220963 ckt 1) loads from 130.36% to 131.12% (DC power flow) of its emergency rating (531 MVA) for the single contingency 'PJM17'. This project contributes approximately 24.88 MW to the thermal violation.

5. (DP&L) The Glasgow-Cecil 138 kV line (from bus 231124 to bus 231130 ckt 1) loads from 114.50% to 116.37% (DC power flow) of its emergency rating (234 MVA) for the single

contingency 'CHIC125'. This project contributes approximately 27.09 MW to the thermal violation.

6. (PJM) The Peach Bottom-Conastone 500 kV line (from bus 200013 to bus 200004 ckt 1) loads from 142.22% to 143.36% (DC power flow) of its emergency rating (2815 MVA) for the single contingency 'PJM67'. This project contributes approximately 150.67 MW to the thermal violation.

7. (PJM) The Peach Bottom-Conastone 500 kV line (from bus 200013 to bus 200004 ckt 1) loads from 143.37% to 145.06% (DC power flow) of its normal rating (2490 MVA) for non contingency condition. This project contributes approximately 163.03 MW to the thermal violation.

8. (PECO) The Nottingham-Nottingham Reactor 230 kV line (from bus 213844 to bus 213846 ckt 1) loads from 118.54% to 119.56% (DC power flow) of its emergency rating (627 MVA) for the single contingency 'PJM17'. This project contributes approximately 40.85 MW to the thermal violation.

9. (PECO) The Linwood-Chichester 2 230 kV line (from bus 213750 to bus 213490 ckt 1) loads from 114.92% to 116.11% (DC power flow) of its emergency rating (904 MVA) for the single contingency '220-39'. This project contributes approximately 66.64 MW to the thermal violation.

10. (PECO) The Nottingham Reactor-Peach Bottom 230 kV line (from bus 213846 to bus 213869 ckt 1) loads from 118.53% to 119.54% (DC power flow) of its emergency rating (627 MVA) for the single contingency 'PJM17'. This project contributes approximately 40.85 MW to the thermal violation.

11. (PECO) The Linwood-Chichester 2 230 kV line (from bus 213750 to bus 213490 ckt 2) loads from 115.32% to 116.52% (DC power flow) of its emergency rating (904 MVA) for the single contingency '220-43'. This project contributes approximately 66.87 MW to the thermal violation.

12. (BG&E) The Graceton-BAGLEY13 230 kV line (from bus 220964 to bus 220999 ckt 1) loads from 135.15% to 135.52% (DC power flow) of its emergency rating (802 MVA) for the tower contingency 'CNSTN_NWEST'. This project contributes approximately 25.66 MW to the thermal violation.

13. (PECO) The Printz-Ridley Tap 230 kV line (from bus 213912 to bus 213925 ckt 1) loads from 106.32% to 106.6% (DC power flow) of its emergency rating (1505 MVA) for the single contingency '220-23'. This project contributes approximately 26.19 MW to the thermal violation.

14. (PL/BG&E) The Safe Harbor Units 3-4 Tap-Graceton 230 kV line (from bus 208071 to bus 220964 ckt 1) loads from 104.80% to 105.49% (DC power flow) of its emergency rating (485 MVA) for the single contingency 'PJM17'. This project contributes approximately 20.82 MW to the thermal violation.

15. (PECO) The Peach Bottom-Cooper 230 kV line (from bus 213869 to bus 214089 ckt 1) loads from 153.24% to 154.56% (DC power flow) of its emergency rating (485 MVA) for the single contingency 'PJM17'. This project contributes approximately 40.85 MW to the thermal violation.

Short Circuit

No problems identified.

Stability Analysis

Will be performed during the System Impact Study phase of W3-172.

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 (DP&L) Hay Road-Red Lion 230 kV line (from bus 231800 to bus 231004 ckt 1) overload will require the rerate of 15 miles of 1590 ACSR to approximately 3264A and the construction of 7.58 miles of conductor with a rating in excess of 3500A. The estimated cost to perform this work is **$16,000,000** and will take **30-36 months** to complete.

2. To mitigate the (PECO) Linwood-Chichester 2 230 kV line (from bus 213750 to bus 213490 ckt 2) overload will require the installation of a 3rd Chichester-Linwood 230kV line underground circuit with a minimum summer normal and emergency rating of 831/983 MVA. This line is approximately 1.6 miles long. Install new 230kV bus position and breaker at Chichester and Linwood Substations for this new line. The estimated cost to perform this work is **$25,000,000** and will take **4 years** to complete.

3. To mitigate the (PECO) Ridley Tap-Macdade 230 kV line (from bus 213925 to bus 213775 ckt 1) overload will require the replacement of the appropriate terminal equipment. The estimated cost to perform this work is **$5,000,000** and will take **30 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 (PECO/BG&E) Cooper-Graceton 230 kV line (from bus 214089 to bus 220964 ckt 1) overloads will require the following:

   PECO portion: Reconductor Line 220-93 from Cooper Substation to Graceton Substation to get a minimum summer emergency rating of 725 MVA. The line is approximately 4 miles long. This

cost is for the PECO portion only. The estimated cost to perform this work is **$2,800,000** and will require **24 months** to complete.

BGE Portion: Rebuild Cooper to Graceton 230 kV line 1.85 miles to PA border. New rating is 648N/802E MVA. The estimated cost to perform this work is **$7,500,000** and will require **54 months** to complete.

2. To mitigate the (BG&E) BAGLEY13-Raphael Road 230 kV line (from bus 220999 to bus 220980 ckt 1) overload will require the 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 (PJM/METED) Three Mile Island-Three Mile Island 500/230 kV transformer (from bus 200016 to bus 204514 ckt 2) overload will require the addition of a second 500/230kV transformer at TMI as well as transmission line upgrades between the 230kV and 500kV substations. The estimated cost to perform this work is **$15,000,000** and will take **36 months** to complete.

4. To mitigate the (PL/BG&E) Otter Creek Switchyard-Conastone 230 kV line (from bus 208048 to bus 220963 ckt 1) overload is as follows:

   PPL Portion: PPL has recently submitted plans to PJM to rebuild the Otter Creek - Conastone 230kV line as part of a modernization project (submitted to PJM as supplemental project S0233). This project is tentatively scheduled to be complete by May 2013 (prior to the IPP's 2014 requested in-service date). The magnitude cost estimate to rebuild PPL's portion of the Otter Creek - Conastone 230kV line is **$0**.

   BGE Portion: rebuild the Otter Creek to Conastone 230 kV 4.7 mile line (2302) to PA border. New rating is 648N/802E MVA. The estimated cost to perform this work is **$19,000,000** and will require **60 months** to complete.

5. To mitigate the (DP&L) Glasgow-Cecil 138 kV line (from bus 231124 to bus 231130 ckt 1) overload will require the rerate of the conductor to 1214A. The estimated cost o perform this work is **$1,400,000** and will take **30-36 months** to complete.

6. To mitigate the Peach Bottom-Conastone 500 kV line (from bus 200013 to bus 200004 ckt 1) overload will require the following:

   PECO Portion: build a new 2nd PB-Conastone 500 kV line with a minimum normal and emergency rating of 2,920 / 3,707 MVA, respectively. The line is approximately 6 miles long. Replace the 5012 terminal equipment at PB substation to achieve the conductor normal and emergency rating of 2,920 / 3,707 MVA, respectively. This cost is for the PECO portion only, and does not include right-of-way costs for new line**.** The estimated cost to perform this work is **$25,000,000** and will require **60 months** to complete.

BGE Portion: build a new 500 kV line adjacent to circuit 5012 from Conastone to PA line. The estimated cost to perform this work is **$56,700,000** and will require **7 years** to complete.

7. To mitigate the Peach Bottom-Conastone 500 kV line (from bus 200013 to bus 200004 ckt 1) overload will require (see item #6 above for reinforcement).

8. To mitigate the (PECO) Nottingham-Nottingham Reactor 230 kV line (from bus 213844 to bus 213846 ckt 1) overload will require the replacement of the line 220-08 reactor and by-pass circuit switcher at Nottingham substation to get a minimum summer emergency rating of 741 MVA. The estimated cost to perform this work is **$1,700,000** and will require **24 months** to complete.

9. To mitigate the (PECO) Linwood-Chichester 2 230 kV line (from bus 213750 to bus 213490 ckt 1) overload will require the installation of a 3rd Chichester-Linwood 230kV line underground circuit with a minimum summer normal and emergency rating of 831/983 MVA. This line is approximately 1.6 miles long. Install new 230kV bus position and breaker at Chichester and Linwood Substations for this new line. The estimated cost to perform this work is **$25,000,000** and will take **4 years** to complete after receipt of a fully executed Interconnection Service Agreement (ISA) and Interconnection Construction Service Agreement (CSA). This cost does not include any right-of-way costs which may be required.

10. To mitigate the (PECO) Nottingham Reactor-Peach Bottom 230 kV line (from bus 213846 to bus 213869 ckt 1) overload will require reconductoring line 220-08 from Nottingham Reactor to PB Tap to get a minimum summer emergency rating of 741 MVA. The line is approximately 14 miles long. The estimated cost to perform this work is **$10,000,000** and will require **48 months** to complete.

11. To mitigate the (PECO) Linwood-Chichester 2 230 kV line (from bus 213750 to bus 213490 ckt 2) overload will require the installation of a 3rd Chichester-Linwood 230kV line underground circuit with a minimum summer normal and emergency rating of 831/983 MVA. This line is approximately 1.6 miles long. Install new 230kV bus position and breaker at Chichester and Linwood Substations for this new line. The estimated cost to perform this work is **$25,000,000** and will take **4 years** to complete after receipt of a fully executed Interconnection Service Agreement (ISA) and Interconnection Construction Service Agreement (CSA). This cost does not include any right-of-way costs which may be required.

12. To mitigate the (BG&E) Graceton-BAGLEY13 230 kV line (from bus 220964 to bus 220999 ckt 1) overload will require the 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.

13. To mitigate the (PECO) Printz-Ridley Tap 230 kV line (from bus 213912 to bus 213925 ckt 1) overload will require the reconductoring of the Printz to Ridley portion of 220-46 line (3.15 miles

on railroad right of way) with ACSS/TW conductor and replace terminal equipment at Printz and Ridley. The estimated cost is **$7,700,000,** and it will take **36 months** to complete.

14. To mitigate the (PL/BG&E) Safe Harbor Units 3-4 Tap-Graceton 230 kV line (from bus 208071 to bus 220964 ckt 1) overload will require the following: There are substation limitations at Graceton that will be removed with project b0497.

15. To mitigate the (PECO) Peach Bottom-Cooper 230 kV line (from bus 213869 to bus 214089 ckt 1) overload will require reconductoring line 220-08 from PB Tap to Cooper Substation to get a minimum summer emergency rating of 741 MVA. The line is approximately 1.4 miles long. The estimated cost to perform this work is **$1,000,000** and will require **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.

None