Generation Interconnection
Feasibility Study Report
W3-054A

The Interconnection Customer (IC) has proposed a 95 MWE (12.35 MWC) wind powered generating facility consisting of 64 1.5 MW turbines. The project is to be located in Accomack County, Virginia. PJM studied W3-054A as a 95 MW injection into the Delmarva Power and Light (DPL) system and evaluated the project for compliance with reliability criteria for summer peak conditions in 2014. The planned in-service date, as stated in the Attachment N, is June 1, 2013.

Point(s) of Interconnection

The Interconnection Customer requested a Primary and Secondary Point of Interconnection (POI) be evaluated for the W3-054A project. The Primary POI selected was a direct connection into the Oak Hall 138kV substation. The Secondary POI selected was a tap of the Oak Hall-Hallwood 69kV circuit.

Direct Connection Requirements

Primary Option

W3-054A will interconnect with the Delmarva Power and Light system at the Oak Hall 138kV substation.

Transmission Owner Scope of Direct Connection Work

The scope of work and estimated costs for the direct connection facilities is as follows:
Expand the Oak Hall 138kV substation, to allow for installation of one (1) 138kV bus position and add a riser with disconnect switches for cabling from the substation to the Point of Interconnection (POI) for the 138kV line to the W3-054A site.

The estimated cost to perform this work is **$2,750,000** and can be completed in **24 - 36 months** after receipt of a fully executed Interconnection Service Agreement (ISA) and Interconnection Construction Service Agreement (CSA).

Note (1): additional costs associated with Contribution in Aid of Construction (CIAC) tax will be included upon further study.

Note (2): cost/time associated with additional construction needs, environmental permitting, etc. will be included in future studies as determined (i.e. control house expansion, wetland permitting, etc.)

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 W3-054A with the DPL system via a 138kV circuit from their facility to the Oak Hall 138kV 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 DPL, the previously mentioned responsibility associated with planning and constructing the transmission line from the W3-054A to the Oak Hall 138kV substation may revert back to DPL. Ownership of the line would reside with DPL. The Interconnection Customer may be responsible for contributing to future O & M costs.

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 New Church-Piney Grove 138 kV line (from bus 232131 to bus 232128 ckt 1) loads from 96.40% to 101.01% (DC power flow) of its emergency rating (226 MVA) for the single contingency 'CKT 13787'. This project contributes approximately 10.41 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)

None

Short Circuit

None

Stability Analysis

Will be performed 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 (DP&L) New Church-Piney Grove 138 kV line (from bus 232131 to bus 232128 ckt overload will require the construction of 22 miles of a new 954 ACSR phase conductor for the 13764 Piney Grove – New Church line. A CPCN is expected to be required. The estimate cost to perform this work is **$16,850,000** and will take **36 months** to complete.

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. (DP&L) The Oak Hall-Pocomoke 138 kV line (from bus 232132 to bus 232130 ckt 1) loads from 103.51% to 130.84% (DC power flow) of its emergency rating (289 MVA) for the operational contingency 'CKT 13764'. This project contributes approximately 78.99 MW to the thermal violation.

2. (PECO/BG&E) The Cooper-Graceton 230 kV line (from bus 214089 to bus 220964 ckt 1) loads from 173.23% to 173.51% (DC power flow) of its emergency rating (485 MVA) for the

operational contingency 'PJM17'. This project contributes approximately 10.02 MW to the thermal violation.

3. (DP&L) The Kenney-Mount Olive 1 69 kV line (from bus 232277 to bus 232839 ckt 1) loads from 103.08% to 125.67% (DC power flow) of its emergency rating (70 MVA) for the operational contingency 'CKT 13764'. This project contributes approximately 15.81 MW to the thermal violation.

4. (DP&L) The Mount Olive 1-Piney Grove 69 kV line (from bus 232839 to bus 232274 ckt 1) loads from 93.21% to 115.8% (DC power flow) of its emergency rating (70 MVA) for the operational contingency 'CKT 13764'. This project contributes approximately 15.81 MW to the thermal violation.

5. (PJM/METED) The Three Mile Island-Three Mile Island 500/230 kV transformer (from bus 200016 to bus 204514 ckt 2) loads from 131.11% to 131.29% (DC power flow) of its emergency rating (1072 MVA) for the operational contingency 'PJM17'. This project contributes approximately 11.51 MW to the thermal violation.

6. (DP&L) The T-144 TAP-Costen 138 kV line (from bus 292497 to bus 232807 ckt 1) loads from 118.09% to 150.07% (DC power flow) of its emergency rating (247 MVA) for the operational contingency 'CKT 13764'. This project contributes approximately 78.99 MW to the thermal violation.

7. (DP&L) The Red Lion-Keeney 230 kV line (from bus 231004 to bus 231003 ckt 1) loads from 89.74% to 89.91% (DC power flow) of its emergency rating (924 MVA) for the operational contingency 'PJM64'. This project contributes approximately 10.02 MW to the thermal violation.

8. (DP&L) The Piney Grove-Mount Hermon 69 kV line (from bus 232274 to bus 232272 ckt 1) loads from 112.83% to 132.25% (DC power flow) of its emergency rating (143 MVA) for the operational contingency 'CKT 23002'. This project contributes approximately 27.78 MW to the thermal violation.

9. (DP&L) The Glasgow-Cecil 138 kV line (from bus 231124 to bus 231130 ckt 1) loads from 121.76% to 122.29% (DC power flow) of its emergency rating (234 MVA) for the operational contingency 'CHIC125'. This project contributes approximately 7.74 MW to the thermal violation.

10. (PJM) The Peach Bottom-Conastone 500 kV line (from bus 200013 to bus 200004 ckt 1) loads from 152.42% to 152.54% (DC power flow) of its emergency rating (2815 MVA) for the operational contingency 'PJM67'. This project contributes approximately 35.26 MW to the thermal violation.

11. (PJM) The Peach Bottom-Conastone 500 kV line (from bus 200013 to bus 200004 ckt 1) loads from 155.92% to 156.08% (DC power flow) of its normal rating (2490 MVA) for non contingency condition. This project contributes approximately 38.17 MW to the thermal violation.

12. (DP&L) The Pocomoke-T-144 TAP 138 kV line (from bus 232130 to bus 292497 ckt 1) loads from 114.15% to 146.13% (DC power flow) of its emergency rating (247 MVA) for the operational contingency 'CKT 13764'. This project contributes approximately 78.99 MW to the thermal violation.

13. (DP&L) The Wattsville-Stockton 69 kV line (from bus 232281 to bus 232278 ckt 1) loads from 117.60% to 144.87% (DC power flow) of its emergency rating (58 MVA) for the operational contingency 'CKT 13764'. This project contributes approximately 15.81 MW to the thermal violation.

14. (PECO) The Nottingham-Nottingham Reactor 230 kV line (from bus 213844 to bus 213846 ckt 1) loads from 134.85% to 135.07% (DC power flow) of its emergency rating (627 MVA) for the operational contingency 'PJM17'. This project contributes approximately 10.02 MW to the thermal violation.

15. (DP&L) The Costen-Kings Creek 138 kV line (from bus 232807 to bus 232129 ckt 1) loads from 81.24% to 103.87% (DC power flow) of its emergency rating (349 MVA) for the operational contingency 'CKT 13764'. This project contributes approximately 78.99 MW to the thermal violation.

16. (PECO) The Linwood-Chichester 2 230 kV line (from bus 213750 to bus 213490 ckt 1) loads from 120.66% to 120.96% (DC power flow) of its emergency rating (904 MVA) for the operational contingency '220-39'. This project contributes approximately 17.84 MW to the thermal violation.

17. (PECO) The Nottingham Reactor-Peach Bottom 230 kV line (from bus 213846 to bus 213869 ckt 1) loads from 134.84% to 135.06% (DC power flow) of its emergency rating (627 MVA) for the operational contingency 'PJM17'. This project contributes approximately 10.02 MW to the thermal violation.

18. (PECO) The Linwood-Chichester 2 230 kV line (from bus 213750 to bus 213490 ckt 2) loads from 121.08% to 121.38% (DC power flow) of its emergency rating (904 MVA) for the operational contingency '220-43'. This project contributes approximately 17.90 MW to the thermal violation.

19. (PECO) The Linwood-Chichester 2 230 kV line (from bus 213750 to bus 213490 ckt 2) loads from 102.59% to 102.78% (DC power flow) of its normal rating (753 MVA) for non contingency condition. This project contributes approximately 9.50 MW to the thermal violation.

20. (DP&L) The Stockton-Kenney 69 kV line (from bus 232278 to bus 232277 ckt 1) loads from 117.29% to 144.56% (DC power flow) of its emergency rating (58 MVA) for the operational contingency 'CKT 13764'. This project contributes approximately 15.81 MW to the thermal violation.

21. (DP&L) The New Church-Piney Grove 138 kV line (from bus 232131 to bus 232128 ckt 1) loads from 134.59% to 170.03% (DC power flow) of its emergency rating (226 MVA) for the operational contingency 'CKT 13787'. This project contributes approximately 80.09 MW to the thermal violation.

22. (DP&L) The New Church-Piney Grove 138 kV line (from bus 232131 to bus 232128 ckt 1) loads from 95.16% to 118.99% (DC power flow) of its normal rating (172 MVA) for non contingency condition. This project contributes approximately 40.98 MW to the thermal violation.

23. (PECO) The Peach Bottom-Cooper 230 kV line (from bus 213869 to bus 214089 ckt 1) loads from 174.33% to 174.61% (DC power flow) of its emergency rating (485 MVA) for the operational contingency 'PJM17'. This project contributes approximately 10.02 MW to the thermal violation.

24. (PJM) The New Freedom-Windsor 500 kV line (from bus 200012 to bus 200028 ckt 1) loads from 99.39% to 99.57% (DC power flow) of its emergency rating (2982 MVA) for the operational contingency 'PJM27B_U2-74B'. This project contributes approximately 31.79 MW to the thermal violation.

Secondary Option

W3-054A was studied as a 95 MW injection at a tap of the Oak Hall-Hallwood 69kV circuit.

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 New Church-Piney Grove 138 kV line (from bus 232131 to bus 232128 ckt 1) loads from 96.40% to 100.89% (DC power flow) of its emergency rating (226 MVA) for the single contingency 'CKT 13787'. This project contributes approximately 10.14 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)

None

Short Circuit

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. (DP&L) The Oak Hall-Pocomoke 138 kV line (from bus 232132 to bus 232130 ckt 1) loads from 103.51% to 130.16% (DC power flow) of its emergency rating (289 MVA) for the operational contingency 'CKT 13764'. This project contributes approximately 77.01 MW to the thermal violation.

2. (PECO/BG&E) The Cooper-Graceton 230 kV line (from bus 214089 to bus 220964 ckt 1) loads from 173.27% to 173.55% (DC power flow) of its emergency rating (485 MVA) for the operational contingency 'PJM17'. This project contributes approximately 10.02 MW to the thermal violation.

3. (DP&L) The Kenney-Mount Olive 1 69 kV line (from bus 232277 to bus 232839 ckt 1) loads from 103.08% to 128.5% (DC power flow) of its emergency rating (70 MVA) for the operational contingency 'CKT 13764'. This project contributes approximately 17.79 MW to the thermal violation.

4. (DP&L) The Mount Olive 1-Piney Grove 69 kV line (from bus 232839 to bus 232274 ckt 1) loads from 93.21% to 118.63% (DC power flow) of its emergency rating (70 MVA) for the operational contingency 'CKT 13764'. This project contributes approximately 17.79 MW to the thermal violation.

5. (PJM/METED) The Three Mile Island-Three Mile Island 500/230 kV transformer (from bus 200016 to bus 204514 ckt 2) loads from 131.11% to 131.29% (DC power flow) of its emergency rating (1072 MVA) for the operational contingency 'PJM17'. This project contributes approximately 11.51 MW to the thermal violation.

6. (DP&L) The T-144 TAP-Costen 138 kV line (from bus 292497 to bus 232807 ckt 1) loads from 118.09% to 149.27% (DC power flow) of its emergency rating (247 MVA) for the operational contingency 'CKT 13764'. This project contributes approximately 77.01 MW to the thermal violation.

7. (DP&L) The Red Lion-Keeney 230 kV line (from bus 231004 to bus 231003 ckt 1) loads from 89.74% to 89.91% (DC power flow) of its emergency rating (924 MVA) for the operational contingency 'PJM64'. This project contributes approximately 10.03 MW to the thermal violation.

8. (DP&L) The Piney Grove-Mount Hermon 69 kV line (from bus 232274 to bus 232272 ckt 1) loads from 112.83% to 132.7% (DC power flow) of its emergency rating (143 MVA) for the operational contingency 'CKT 23002'. This project contributes approximately 28.41 MW to the thermal violation.

9. (DP&L) The Glasgow-Cecil 138 kV line (from bus 231124 to bus 231130 ckt 1) loads from 121.76% to 122.29% (DC power flow) of its emergency rating (234 MVA) for the operational contingency 'CHIC125'. This project contributes approximately 7.74 MW to the thermal violation.

10. (PJM) The Peach Bottom-Conastone 500 kV line (from bus 200013 to bus 200004 ckt 1) loads from 152.53% to 152.64% (DC power flow) of its emergency rating (2815 MVA) for the operational contingency 'PJM67'. This project contributes approximately 35.26 MW to the thermal violation.

11. (PJM) The Peach Bottom-Conastone 500 kV line (from bus 200013 to bus 200004 ckt 1) loads from 156.06% to 156.21% (DC power flow) of its normal rating (2490 MVA) for non contingency condition. This project contributes approximately 38.17 MW to the thermal violation.

12. (DP&L) The Pocomoke-T-144 TAP 138 kV line (from bus 232130 to bus 292497 ckt 1) loads from 114.15% to 145.33% (DC power flow) of its emergency rating (247 MVA) for the operational contingency 'CKT 13764'. This project contributes approximately 77.01 MW to the thermal violation.

13. (DP&L) The Wattsville-Stockton 69 kV line (from bus 232281 to bus 232278 ckt 1) loads from 117.60% to 148.28% (DC power flow) of its emergency rating (58 MVA) for the operational contingency 'CKT 13764'. This project contributes approximately 17.79 MW to the thermal violation.

14. (DP&L) The W3-055TAP1-Oak Hall 69 kV line (from bus 903740 to bus 232280 ckt 1) loads from 28.82% to 112.87% (DC power flow) of its emergency rating (113 MVA) for the operational contingency 'CKT 6778'. This project contributes approximately 94.98 MW to the thermal violation.

15. (DP&L) The W3-055TAP1-Oak Hall 69 kV line (from bus 903740 to bus 232280 ckt 1) loads from 7.28% to 110.68% (DC power flow) of its normal rating (86 MVA) for non contingency condition. This project contributes approximately 88.93 MW to the thermal violation.

16. (PECO) The Nottingham-Nottingham Reactor 230 kV line (from bus 213844 to bus 213846 ckt 1) loads from 134.84% to 135.05% (DC power flow) of its emergency rating (627 MVA) for the operational contingency 'PJM17'. This project contributes approximately 10.02 MW to the thermal violation.

17. (DP&L) The Costen-Kings Creek 138 kV line (from bus 232807 to bus 232129 ckt 1) loads from 81.24% to 103.3% (DC power flow) of its emergency rating (349 MVA) for the operational contingency 'CKT 13764'. This project contributes approximately 77.01 MW to the thermal violation.

18. (PECO) The Linwood-Chichester 2 230 kV line (from bus 213750 to bus 213490 ckt 1) loads from 120.66% to 120.96% (DC power flow) of its emergency rating (904 MVA) for the operational contingency '220-39'. This project contributes approximately 17.84 MW to the thermal violation.

19. (PECO) The Nottingham Reactor-Peach Bottom 230 kV line (from bus 213846 to bus 213869 ckt 1) loads from 134.82% to 135.04% (DC power flow) of its emergency rating (627 MVA) for the operational contingency 'PJM17'. This project contributes approximately 10.02 MW to the thermal violation.

20. (PECO) The Linwood-Chichester 2 230 kV line (from bus 213750 to bus 213490 ckt 2) loads from 121.08% to 121.38% (DC power flow) of its emergency rating (904 MVA) for the operational contingency '220-43'. This project contributes approximately 17.90 MW to the thermal violation.

21. (PECO) The Linwood-Chichester 2 230 kV line (from bus 213750 to bus 213490 ckt 2) loads from 102.59% to 102.78% (DC power flow) of its normal rating (753 MVA) for non contingency condition. This project contributes approximately 9.50 MW to the thermal violation.

22. (DP&L) The Stockton-Kenney 69 kV line (from bus 232278 to bus 232277 ckt 1) loads from 117.29% to 147.97% (DC power flow) of its emergency rating (58 MVA) for the operational contingency 'CKT 13764'. This project contributes approximately 17.79 MW to the thermal violation.

23. (DP&L) The New Church-Piney Grove 138 kV line (from bus 232131 to bus 232128 ckt 1) loads from 134.59% to 169.1% (DC power flow) of its emergency rating (226 MVA) for the operational contingency 'CKT 13787'. This project contributes approximately 77.99 MW to the thermal violation.

24. (DP&L) The New Church-Piney Grove 138 kV line (from bus 232131 to bus 232128 ckt 1) loads from 95.16% to 118.23% (DC power flow) of its normal rating (172 MVA) for non contingency condition. This project contributes approximately 39.68 MW to the thermal violation.

25. (PECO) The Peach Bottom-Cooper 230 kV line (from bus 213869 to bus 214089 ckt 1) loads from 174.31% to 174.59% (DC power flow) of its emergency rating (485 MVA) for the operational contingency 'PJM17'. This project contributes approximately 10.02 MW to the thermal violation.

26. (PJM) The New Freedom-Windsor 500 kV line (from bus 200012 to bus 200028 ckt 1) loads from 99.39% to 99.57% (DC power flow) of its emergency rating (2982 MVA) for the operational contingency 'PJM27B_U2-74B'. This project contributes approximately 31.79 MW to the thermal violation.