Generation Interconnection
Feasibility Study Report
Queue Position X3-047

The Interconnection Customer (IC), has proposed a 5 MWE (0.65 MWC; 5 MW MFO) wind powered generating facility to be located 3 miles west of Cape Charles, Virginia in the Chesapeake Bay. PJM studied X3-047 as a 5MW injection into the Old Dominion Electric Cooperative (ODEC) system at the Bayview 25kV substation. The project was evaluated for compliance with reliability criteria for summer peak conditions in 2015. The planned in-service date, as stated in the Attachment N, is December, 2012.

Attachment Facilities and local upgrades (if required) along with costs, schedule, terms and conditions to interconnect X3-047 will be specified in a separate two party interconnection agreement between the A & N Electric Cooperative (ANEC) and the Interconnection Customer.

Point(s) of Interconnection

X3-047 will interconnect with the Old Dominion Electric Cooperative transmission system at the Bayview 69kV substation through the ANEC distribution system.

Direct Connection Requirements

Transmission Owner Scope of Work

There is no direct connection scope of work for Old Dominion Electric Cooperative.

Interconnection Customer Scope of Work

The Interconnection Customer assumes full responsibility for design and construction of all facilities associated with the X3-047 generating station and the direct connection line on the IC side of the Point of Interconnection.

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.

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.*

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

No issues identified.

Stability Analysis

Not required due to project size.

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. "Network Impacts," initially caused by the addition of this project's generation)

None

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. The costs identified below represent the total to complete the reinforcement, not necessarily this project's cost. Actual cost allocations will be deferred until the System Impact Study is performed.

None

Transmission Owner Identifed Overloads

The following overloads were identified by the Old Dominion Electric Cooperative (ODEC):

New Overloads

X3-047 causes the following overload:

1. The (ODEC) Weirwood-Kendall Grove 69kV line loads from 98% to 106% of its normal rating (64 MVA) for non contingency condition.

Contribution to Existing Overloads

X3-047 further contributes to the overloading of the following circuits:

2. The (ODEC) Oak Hall-W3-054A tap 69kV line loads from 141% to 143% of its normal rating (86 MVA) for non-contingency condition.

3. The (ODEC) Tasley-W1-008 tap 69kV line loads from 149% to 156% of its normal rating (59 MVA) for non contingency condition.

4. The (ODEC) V4-064 tap-W1-008 tap 69kV line loads from 117% to 124% of its normal rating (59 MVA) for non-contingency condition.

   To mitigate the overloads in items #3 and 4 above will require rebuilding the V4-064-Tasley 69kV circuit (6721). The estimated cost to perform this work is **$7,000,000** and will take **48 months** to complete.

5. The (ODEC) Kellam-Weirwood 69kV line loads from 101% to 109% of its normal rating (64 MVA) for the loss of the Bayview–Kendall Grove 69kV line.

6. The (ODEC) Weirwood-Kendall Grove 69kV line loads from 107% to 108% of its normal rating (64 MVA) for the loss of the Bayview–Kendall Grove 69kV line.

   To mitigate the overloads in items #1, 5, and 6 above will require rebuilding the Kellam-Kendall Grove 69kV circuit (6750). The estimated cost to perform this work is **$7,000,000** and will take **48 months** to complete.

7. The (ODEC) Oak Hall-Perdue 69kV line loads from 136% to 140% of its normal rating (121 MVA) for the loss of the Oak Hall-W3-054 tap 69kV line.

8. The (ODEC) Tasley-Perdue 69kV line loads from 183% to 187% of its normal rating (93 MVA) for the loss of the Oak Hall-W3-054 tap 69kV line.

9. The (ODEC) Oak Hall-W3-054A tap 69kV line loads from 149% to 154% of its normal rating (113 MVA) for the loss of the Oak Hall-Perdue 69kV line.

   Note: The reinforcements, along with costs and schedule, for the above items 2,7,8, and 9 are currently under development and will be provided in the System Impact Study Report for X3-047. It is anticipated that queue project X3-047 will have cost allocation to these reinforcements.

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 V3-061 TAP-WEIRWOOD 69 kV line (from bus 894820 to bus 232847 ckt 1) loads from 95.63% to 102.94% (AC power flow) of its normal rating (64 MVA) for non-contingency condition. This project contributes approximately 5 MW to the thermal violation.

2. The OAKHL_69-WATTSVIL 69 kV line (from bus 232280 to bus 232281 ckt 1) loads from 106.01% to 108.27% (AC power flow) of its normal rating (68 MVA) for non-contingency condition. This project contributes approximately 1.57 MW to the thermal violation.

3. The M HERMON-NSALSBRY 69 kV line (from bus 232272 to bus 232271 ckt 1) loads from 116.15% to 117.29% (DC power flow) of its emergency rating (140 MVA) for the single line contingency outage of CONTINGENCY DESCRIPTION ('CKT 23002'). This project contributes approximately 1.59 MW to the thermal violation.

4. The TASLEY-PARKSLEY 69 kV line (from bus 232284 to bus 232845 ckt 1) loads from 112.88% to 118.59% (AC power flow) of its emergency rating (79 MVA) for the single line contingency outage of CONTINGENCY DESCRIPTION ('CKT 6778'). This project contributes approximately 5 MW to the thermal violation.

5. The PINEY GR 230/138 kV transformer (from bus 232128 to bus 232007 ckt 1) loads from 120.99% to 121.98% (DC power flow) of its emergency rating (424 MVA) for the single line contingency outage of CONTINGENCY DESCRIPTION ('CKT 13713'). This project contributes approximately 4.18 MW to the thermal violation.

6. The W1-008 TAP-TASLEY 69 kV line (from bus 901040 to bus 232284 ckt 1) loads from 121.51% to 129.56% (AC power flow) of its normal rating (59 MVA) for non-contingency condition. This project contributes approximately 5 MW to the thermal violation.

7. The W3-054A TAP-OAKHL_69 69 kV line (from bus 903690 to bus 232280 ckt 1) loads from 127.9% to 130.6% (AC power flow) of its normal rating (86 MVA) for non-contingency condition. This project contributes approximately 2.5 MW to the thermal violation.

8. The W3-054A TAP-OAKHL_69 69 kV line (from bus 903690 to bus 232280 ckt 1) loads from 140.07% to 144.13% (AC power flow) of its emergency rating (113 MVA) for the single line contingency outage of CONTINGENCY DESCRIPTION ('CKT 6778'). This project contributes approximately 5 MW to the thermal violation.

9. The OAKHL_69-WATTSVIL 69 kV line (from bus 232280 to bus 232281 ckt 1) loads from 154.2% to 155.83% (AC power flow) of its emergency rating (89 MVA) for the single line

contingency outage of CONTINGENCY DESCRIPTION ('CKT 137AC'). This project contributes approximately 1.58 MW to the thermal violation.

10. The PINEY_69-M HERMON 69 kV line (from bus 232274 to bus 232272 ckt 1) loads from 159.48% to 160.59% (DC power flow) of its emergency rating (143 MVA) for the single line contingency outage of CONTINGENCY DESCRIPTION ('CKT 23002'). This project contributes approximately 1.59 MW to the thermal violation.

11. The N_CHURCH-PINEY138 138 kV line (from bus 232131 to bus 232128 ckt 1) loads from 165.37% to 166.46% (DC power flow) of its emergency rating (226 MVA) for the single line contingency outage of CONTINGENCY DESCRIPTION ('CKT 13713'). This project contributes approximately 2.48 MW to the thermal violation.

12. The WEIRWOOD-KELLAM 69 kV line (from bus 232847 to bus 232286 ckt 1) loads from 185.34% to 200.94% (AC power flow) of its normal rating (30 MVA) for non-contingency condition. This project contributes approximately 5 MW to the thermal violation.