W3-128 Sporn-Waterford 345kV

Generation Interconnection

AEP Local Network Impacts

The impact of the proposed generating facility on the AEP System was assessed for adherence with applicable reliability criteria. AEP planning criteria require that the transmission system meet single contingency performance criteria in accordance with the AEP FERC Form 715. Therefore, this set of criteria was used to assess the impact of the proposed facility on the AEP System. This project was studied as a 790MW net energy injection consistent with the interconnection application. The interconnection project was studied at full capacity. The results are summarized below.

Categories A Contingency (no disturbance):

The project has a significant impact (> 1%) on about 30 elements. The following shows the element in EHV transmission system (345 kV and above).

- The 05MUSKNG - 05WATERF 345 kV line (from bus 242940 to bus 242947 ckt 1) loads from 82.8% to 101.3% of its normal rating (1409 MVA)

- The 05KEYSTN - 05SORENS 345 kV line (from bus 243225 to bus 243232 ckt 1) loads from 114.5% to 115.8% of its normal rating (897 MVA)

Categories B Contingency:

The project has a significant impact (> 1%) on over 200 elements. The following shows the top 5 EHV elements (345kV and above) on which the Project has the largest impact.

- The 05MUSKNG - 05WATERF 345 kV line (from bus 242940 to bus 242947 ckt 1) loads from 56.5% to 109.7% of its rating (1409 MVA) for the contingency 'W3-128_B2_2'.

- The 05KAMMER - 05MUSKNG 345 kV line (from bus 242937 to bus 242940 ckt 1) loads from 106.5% to 116.5% of its rating (972 MVA) for the contingency 'OPEN LINE FROM BUS 242516 [05MOUNTN 765.00] TO BUS 242920 [05BELMON 765.00] CKT 1 '.

- The 05CLOVRD - 05CLOVRD 500/345 kV transformer (from bus 242519 to bus 242524 ckt 6A) loads from 137.9% to 147.7% of its rating (765 MVA) for the contingency 'OPEN LINE FROM BUS 242519 [05CLOVRD 500.00] TO BUS 242524 [05CLOVRD 345.00] CKT 6B'.

- The 05CLOVRD - 05CLOVRD 500/345 kV transformer (from bus 242519 to bus 242524 ckt 6B) loads from 137.7% to 147.4% of its rating (765 MVA) for the contingency 'OPEN LINE FROM BUS 242519 [05CLOVRD 500.00] TO BUS 242524 [05CLOVRD 345.00] CKT 6A'.

- The 05BEVERL - 05TIDD 345 kV line (from bus 242931 to bus 242946 ckt 1) loads from 93.0 % to 100.9% of its rating (972 MVA) for the contingency '37_B2_TOR12'.

The Project has significant voltage impact on about 50 buses. The following shows the EHV buses (345 kV and above) impacted by the Project.

- The 765 kV bus 242512 05CLOVRD drops from 0.9127 pu to 0.9007 pu for the contingency '37_B2_TOR12'.

- The 765 kV bus 242515 05JOSHUA drops from 0.9233 pu to 0.9115 pu for the contingency '6361_B3_05BE'.

- The 765 kV bus 242925 05KAMMER drops from 0.9306 pu to 0.9135 pu for the contingency '1589_B3_05CL'.

- The 765 kV bus 242930 05SCANTO drops from 0.9304 pu to 0.9160 pu for the contingency '1589_B3_05CL'.

Categories C3 Contingency:

The project has a significant impact (> 1%) on over 200 elements. The following shows the top 5 EHV elements (345kV and above) on which the Project has the largest impact.

- The 05MUSKNG - 05WATERF 345 kV line (from bus 242940 to bus 242947 ckt 1) loads from 105.4% to 125.1% of its rating (1846 MVA) for the contingency '1886'.

- The 05KAMMER - 05MUSKNG 345 kV line (from bus 242937 to bus 242940 ckt 1) loads from 159.9% to 178.0% of its rating (972 MVA) for the contingency '1886'.

- The 05BEVERL - 05TIDD 345 kV line (from bus 242931 to bus 242946 ckt 1) loads from 118.1% to 131.2% of its rating (972 MVA) for the contingency '1886'.

- The 05TIDD - 05WBELLA 345 kV line (from bus 242946 to bus 242948 ckt 1) loads from 139.5% to 149.1% of its rating (971 MVA) for the contingency '4831'.

- The 05CLOVRD - 8LEXNGTN 500 kV line (from bus 242519 to bus 314912 ckt 1) loads from 105.3% to 114.2% of its rating (1764 MVA) for the contingency '1886'.

The Project has significant voltage impact on over 600 buses. The following shows the top 5 EHV buses (345 kV and above) on which the Project has the largest impacts.

- The 345 kV bus 242527 05M FUNK drops from 0.9078 pu to 0.8579 pu for the contingency '1886'.

- The 345 kV bus 242524 05CLOVRD drops from 0.8988 pu to 0.8514 pu for the contingency '1886'.

- The 500 kV bus 242519 05CLOVRD drops from 0.9250 pu to 0.8787 pu for the contingency '1886'.

- The 765 kV bus 242515 05JOSHUA drops from 0.8869 pu to 0.8444 pu for the contingency '1886'.

- The 765 kV bus 242512 05CLOVRD drops from 0.8768 pu to 0.8361 pu for the contingency '1886'.

Categories C1, 2 and 5 Contingency:

The project has a significant impact (> 1%) on about 200 elements. The following shows the top 5 EHV elements (345kV and above) on which the Project has the largest impact.

- The 05MUSKNG - 05WATERF 345 kV line (from bus 242940 to bus 242947 ckt 1) loads from 97.9 % to 114.1% of its rating (1846 MVA) for the contingency '2942_C2_05KA'.

- The 05KAMMER - 05MUSKNG 345 kV line (from bus 242937 to bus 242940 ckt 1) loads from 89.6 % to 100.3% of its rating (972 MVA) for the contingency '6343_C2_05MU'.

- The 05MUSKNG - 05MUSKNG 345/135 kV transformer (from bus 242940 to bus 243045 ckt A) loads from 112.1% to 122.4% of its rating (543 MVA) for the contingency '474'.

- The 05TIDD - 05WBELLA 345 kV line (from bus 242946 to bus 242948 ckt 1) loads from 139.5% to 149.1% of its rating (971 MVA) for the contingency '4831_C2_05KA'.

- The 05MUSKNG - 05MUSKNG 345/135 kV transformer (from bus 242940 to bus 243045 ckt B) loads from 104.1% to 113.6% of its rating (190 MVA) for the contingency '474'.

The Project has significant voltage impact on over 400 buses. The following shows the top 5 EHV buses (345 kV and above) on which the Project has the largest impacts.

- The 345 kV bus 242527 05M FUNK drops from 0.9158 pu to 0.8829 pu for the contingency '5031_C2_05KA'.

- The 500 kV bus 242519 05CLOVRD drops from 0.9341 pu to 0.9021 pu for the contingency '5031_C2_05KA'.

- The 345 kV bus 242524 05CLOVRD drops from 0.9077 pu to 0.8756 pu for the contingency '5031_C2_05KA'.

- The 765 kV bus 242515 05JOSHUA drops from 0.8954 pu to 0.8667 pu for the contingency '5031_C2_05KA'.

- The 765 kV bus 242512 05CLOVRD drops from 0.8850 pu to 0.8574 pu for the contingency '5031_C2_05KA'.

Network Upgrades

Normal System At Full Output

1. Replace Newcomerstown 138 kV bus:

    - Estimated Cost (2011 Dollars): **$50,000**

- Replace South Millersburg 138 kV switch:

    - Estimated Cost (2011 Dollars): **$50,000**

Capacity Portion of Interconnection Request Upgrades Under Contingency

2. Sag check the Newcomerstown – South Coshocton 138 kV circuit (14.3 miles):

    3. Estimated Cost (2011 Dollars): **$57,200**

4. Reconductor the Lick – Rio Tap section (18.30 miles) of the Addison – Lick - Sporn 138 kV circuit:

    - Estimated Cost (2011 Dollars): **$22,000,000**

5. Reconductor the Sporn A – Rio Tap section (23.80 miles) of the Addison – Lick - Sporn 138 kV circuit:

    - Estimated Cost (2011 Dollars): **$29,000,000**

6. Replace Somerton transformer 138/69 kV:

    - Estimated Cost (2011 Dollars): **$600,000**

Capacity Portion Previously Identified Upgrades Under Contingency

The following upgrades were previously submitted to PJM to be fixed when the overloads were identified previously for a PJM RTEP 2015 study. These upgrades will be funded by AEP but the in service date will be advanced from 2015 to 2014 as requested, which will have a carrying charge of 13% of the total cost below.

7. (PJM Upgrade ID: B-1460) Replace Muskingum 345 kV line riser:

   - Estimated Cost (2011 Dollars): **$60,000**

8. (PJM Upgrade ID: B-1453) Sag check the Ohio Central – Powelson and the North Zanesville sections of the Ohio Central – Zanesville 138 kV circuit (7.60 miles) and replace terminal equipment:

   - Estimated Cost (2011 Dollars): **$130,000**

9. (PJM Upgrade ID: B-1457) Sag check the Tiltonsville – Windsor section of the West Bellaire – Windsor 138 kV circuit :

   - Estimated Cost (2011 Dollars): **$20,000**

10. (PJM Upgrade ID: B-1448) Sag check the Dexter – Meig 1 Tap section and the Rutland – Meig 1 Tap section of the Dexter Switch – Rutland 138 kV circuit (7 miles):

    - Estimated Cost (2011 Dollars): **$28,000**

11. (PJM Upgrade ID: B-1447) Sag check the Dexter – Elliot Tap section of the Dexter – Poston 138 kV circuit (16.7 miles):

    - Estimated Cost (2011 Dollars): **$67,000**

12. (PJM Upgrade ID: B-1473) Sag check the East New Concord – Muskingum River section of the Muskingum River – West Cambridge 138 kV circuit (23.25 miles):

    - Estimated Cost (2011 Dollars): **$93,000**

13. (PJM Upgrade ID: B-1480) Sag check the Corner – Layman section of the Corners – Muskingum River 138 kV circuit (7.13 miles):

    - Estimated Cost (2011 Dollars): **$29,000**

Network Impacts

Queue project W3-128 was studied as a(n) 790.0 MW (790.0 MW of which was Capacity) injection into AEP's system at the 13.23% tap between Waterford and Sporn345.0 kV line. Project W3-128 was evaluated for compliance with reliability criteria for summer peak conditions in 2014.

Potential transmission network impacts are as follows:

Generator Deliverability
(Single or N-1 contingencies for the Capacity portion only of the interconnection)

1. (AEP) The Waterford-Muskingum River 345 kV line (from bus 242947 to bus 242940 ckt 1) loads from 70.82% to 109.13% (DC power flow) of its emergency rating (2045 MVA) for the single contingency '735_B2_A'. This project contributes approximately 783.44 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)

No problems identified

Short Circuit
(Summary form of Cost allocation for breakers will be inserted here if any)

No problems identified.

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.)

2. (AEP) The Elliot Tap-Poston 138 kV line (from bus 243503 to bus 243555 ckt 1) loads from 109.87% to 111.31% (DC power flow) of its emergency rating (245 MVA) for the single contingency '734_B2'. This project contributes approximately 21.92 MW to the thermal violation.

3. (AEP) The Elliot Tap-Poston 138 kV line (from bus 243503 to bus 243555 ckt 1) loads from 110.39% to 111.3% (DC power flow) of its normal rating (195 MVA) for non contingency condition. This project contributes approximately 10.97 MW to the thermal violation.

4. (AEP) The Sporn A-Lakin 138 kV line (from bus 242807 to bus 242698 ckt 1) loads from 100.79% to 101.96% (DC power flow) of its emergency rating (168 MVA) for the single contingency '5881_B2_TOR188'. This project contributes approximately 12.25 MW to the thermal violation.

5. (AEP) The West Millersport-Millersport 138 kV line (from bus 243150 to bus 243043 ckt 1) loads from 102.51% to 103.34% (DC power flow) of its emergency rating (245 MVA) for the tower contingency '470'. This project contributes approximately 12.58 MW to the thermal violation.

6. (AEP) The Millersport-West Hebron 138 kV line (from bus 243043 to bus 243146 ckt 1) loads from 102.19% to 103.02% (DC power flow) of its emergency rating (245 MVA) for the tower contingency '470'. This project contributes approximately 12.58 MW to the thermal violation.
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New System Reinforcements

1. The overload on the Waterford-Muskingum River 345kV circuit can be alleviated by rebuilding the Muskingum River – Waterford 345 kV line to upgrade the conductor to bundled (2) 1,590,000 CM ACSR (54/19), from the existing bundled (2) 954,000 CM ACSR and 6-wired 1,414,000/1,275,000 CM ACSR conductors. Estimated cost is **$18,200,000.**

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study.)

2&3. The overload on the Elliot Tap-Poston 138kV circuit can be alleviated by rebuilding the Elliot Tap – Poston 138 kV line, to upgrade the conductor from the existing 636,000 CM ACSR (26/7) to 1,272,000 CM ACSR (54/19). The estimated cost is **$2,800,000.**

4. The overload on the Sporn A-Lakin 138kV circuit can be mitigated by reconductoring the line. Estimated cost is **$22,000,000.**

5. The overload on the Millersport-West Millersport 138kV circuit can be alleviated by reconductoring the circuit. Estimated cost is **$3,000,000**

6. The overload on the Millersport-West Hebron 138kV circuit can be alleviated by reconductoring the circuit. Estimated cost is **$6,000,000.**

Energy Portion of Interconnection Request

(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. There is no guarantee of full delivery of energy 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 overloaded element(s) identified. As a result of the aggregate energy resources in the area, the following violations were identified.)

None