W3-005 Fostoria Central 345kV

Generation Interconnection

Network Impacts

Option #1 – Connection to Fostoria Central Station
Queue project W3-005 was studied as a(n) 500.0 MW (65.0 MW of which was Capacity) injection into AEP's system. Project W3-005 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)

No problems identified

Multiple Facility Contingency

(Double Circuit Tower Line, Line with Failed Breaker and Bus Fault contingencies for the full energy output)

1. The Lemoyne - Teco - West End Fostoria 138 kV line ckt 1 rated 239 MVA loads from 82.4% to 100.2% with an impact of 17.8% for contingency 517_C2 a double circuit tower line outage.

Short Circuit

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

2. PJM analysis found 1 new breaker, to be over-dutied. The new over-dutied breakers are listed below:

BUS_NO	BUS	BREAKER	Rating Type	Duty Percent With w3-005_opt2	Duty Percent Without w3-005_opt2	Duty Percent Difference	Note
0	05E LIMA 138.kV	A1	T	100.40%	99.60%	0.80%	New Over-duty

System Reinforcements

1. Section 1 and section 2 of the conductor are the limiting elements along with the West End Fostoria metering current transformer (CT) for the Lemoyne - Teco - West End Fostoria 138 kV line. Section 1 is a non-AEP conductor. PJM will coordinate with First Energy to get a cost estimate for this upgrade in the Impact Study. A sag study will be required By AEP for section 2 of the conductor which is 23.14 miles in length. The cost for the sag study is estimated to be

$92,000 ($4000 per mile) for the study only. If the Sag study does not show that the rating of the line can be raised to eliminate the overload, the conductor will need to be replaced. The cost to upgrade the metering Ctat West End station is estimated to be **$120,000**.

2. The over-dutied condition of the East Lima "A1" 138kV circuit breaker can be alleviated by replacing the circuit breaker. The estimated cost of the replacement is **$500,000.**

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.)

1. (AEP) The W3-011TAP1-Findlay 138 kV line (from bus 903300 to bus 243005 ckt 1) loads from 61.04% to 62.4% (DC power flow) of its normal rating (150 MVA) for non contingency condition. This project contributes approximately 12.63 MW to the thermal violation.

2. (AEP) The Melmore-V1-010 TAP 138 kV line (from bus 243039 to bus 292059 ckt 1) loads from 119.84% to 120.77% (DC power flow) of its emergency rating (179 MVA) for the operational contingency '5243_B2_TOR4783C_MOAB'. This project contributes approximately 10.27 MW to the thermal violation.

3. (AEP) The Melmore-V1-010 TAP 138 kV line (from bus 243039 to bus 292059 ckt 1) loads from 142.52% to 143.43% (DC power flow) of its normal rating (138 MVA) for non contingency condition. This project contributes approximately 7.74 MW to the thermal violation.

4. (AEP) The V1-010 TAP-Howard 138 kV line (from bus 292059 to bus 243024 ckt 2) loads from 135.93% to 137.18% (DC power flow) of its emergency rating (179 MVA) for the operational contingency '5147_B2_TOR707_V1-010B'. This project contributes approximately 13.95 MW to the thermal violation.

5. (AEP) The V1-010 TAP-Howard 138 kV line (from bus 292059 to bus 243024 ckt 2) loads from 100.26% to 101.24% (DC power flow) of its normal rating (138 MVA) for non contingency condition. This project contributes approximately 8.37 MW to the thermal violation.

6. (AEP) The V1-010 TAP-Howard 138 kV line (from bus 292059 to bus 243024 ckt 1) loads from 84.32% to 85.22% (DC power flow) of its emergency rating (179 MVA) for the operational contingency '911_B2'. This project contributes approximately 9.95 MW to the thermal violation.

7. (AEP) The V1-010 TAP-Howard 138 kV line (from bus 292059 to bus 243024 ckt 1) loads from 96.07% to 97.04% (DC power flow) of its normal rating (138 MVA) for non contingency condition. This project contributes approximately 8.27 MW to the thermal violation.

8. (AEP/FE) The Howard-Brookside 138 kV line (from bus 243024 to bus 238586 ckt 1) loads from 156.46% to 157.08% (DC power flow) of its emergency rating (173 MVA) for the operational contingency '911_B2'. This project contributes approximately 9.73 MW to the thermal violation.

9. (AEP/FE) The Howard-Brookside 138 kV line (from bus 243024 to bus 238586 ckt 1) loads from 170.93% to 171.76% (DC power flow) of its normal rating (133 MVA) for non contingency condition. This project contributes approximately 6.90 MW to the thermal violation.

Option #2 – Interconnection to the Fostoria Central-Galion 345kV circuit

Queue project W3-005 was studied as a(n) 500.0 MW (65.0 MW of which was Capacity) injection into AEP's system. Project W3-005 was evaluated for compliance with reliability criteria for summer peak conditions in 2014.

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

No problems identified

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)

PJM analysis found 1 new breaker, to be over-dutied. The new over-dutied breakers are listed below:

BUS_NO	BUS	BREAKER	Rating Type	Duty Percent With w3-005_opt2	Duty Percent Without w3-005_opt2	Duty Percent Difference	Note
0	05E LIMA 138.kV	A1	T	100.40%	99.60%	0.80%	New Over-duty

System Reinforcements

1. The over-dutied condition of the East Lima "A1" 138kV circuit breaker can be alleviated by replacing the circuit breaker. The estimated cost of the replacement is **$500,000.**

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.)

1. (AEP) The W3-011TAP1-Findlay 138 kV line (from bus 903300 to bus 243005 ckt 1) loads from 61.04% to 62.1% (DC power flow) of its normal rating (150 MVA) for non contingency condition. This project contributes approximately 9.81 MW to the thermal violation.