PJM Generator Interconnection Request
Queue W3-012
East Lima-Fostoria Central (Arcadia 2)
345kV
Feasibility Study Report

February 2012
#685388

Preface

The intent of the feasibility study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation to the PJM network at a location specified by the Interconnection Customer. The Interconnection Customer may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: (1) Direct Connections, which are new facilities and/or facilities upgrades needed to connect the generator to the PJM network, and (2) Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

In some instances a generator interconnection may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection, may also contribute to the need for the same network reinforcement. The possibility of sharing the reinforcement costs with other projects may be identified in the feasibility study, but the actual allocation will be deferred until the impact study is performed.

The Feasibility Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The project developer is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by Transmission Owners, the costs may be included in the study.

W3-012 East Lima-Fostoria Central (Arcadia 2) 345kV Feasibility Study

General

Iberdrola has proposed a 300 MW wind project, utilizing 150 2MW Gamesa turbines, to be located west of Fostoria Central station in Hancock County, Ohio. Two interconnection options were evaluated. Option #1 is for the project to connect to a new substation that will include connections from both the Fostoria Central – North Findlay and Fostoria Central – Findlay Center 138kV circuits located at 50% of the line length. Option # 2 is interconnection to the East Lima-Fostoria Central 345kV circuit, approximately 4.5 miles from Fostoria Central station via a new 3-breaker ring bus. The in-service date for the project is 12/31/14.

Direct Connection

Option #1

Interconnection option #1 a new substation at the 50% point of both circuits of Fostoria Central – North Findlay and Fostoria Central – Findlay Center 138 kV as shown in Figure #1. It is understood that Iberdrola will be responsible for all the construction costs, as well as facilities associated with connecting their 300 MW generation to the new interconnection station. Note that the Iberdrola station facilities and any facilities outside of the new interconnection station were not included in the cost estimates. These are assumed to be Iberdrola's responsibility. Iberdrola is responsible for all costs associated with the connection.

AEP Work:

1. Construction of a new switching station connecting to the Fostoria Central – North Findlay and Fostoria Central – Findlay Center 138 kV circuits, including five (5) 138 kV circuit breakers, relays, 138 kV metering, SCADA, and associated equipment.

   Estimated Cost (2011 Dollars): **$7,200,000**

2. Modify line relaying with AEP standard package at Fostoria Central, North Findlay, Northeast Findlay, Findlay Center, and New Liberty stations.

   Estimated Cost (2011 Dollars): **$1,300,000**

   Total Estimated Attachment Facilities Cost: **$8,500,000**

The requested in-service date is December 31, 2014. The standard time for construction is 12 to 18 months from the signing of the Interconnection Service Agreement and Interconnection Construction Service Agreement

Figure #1

Option #2

The W3-012 project will be interconnected to the East Lima-Fostoria Central 345kV circuit via a new 345kV, 3-breaker ring bus station that will include associated disconnect switches, relay and controls, SCADA, telemetering and 345kV revenue metering. See Figure #2.

AEP work:

- Construction of a new switching station connecting to the Fostoria Central – East Lima 345 kV circuit, including three (3) 345 kV circuit breakers, relays, 345 kV metering, SCADA, and associated equipment. Estimated cost **$7,500,000.**
- Looping of the East Lima-Fostoria Central 345kV line into the new interconnection station. Estimated cost **$500,000**
- Modification of relaying at Fostoria Central Station. Estimated cost **$200,000**
- Modification of relaying at East Lima Station. Estimated cost **$200,000**

Figure #2

Network Impacts

Option #1

Queue project W3-012 was studied as a(n) 300.0 MW (39.0 MW of which was Capacity) injection into AEP's system at the 50.0% tap between Fostoria Central and Findlay 138.0

kV line. Project W3-012 was evaluated for compliance with reliability criteria for summer peak conditions in 2014.

System Normal

- The Fostoria Central – West End Fostoria circuit is overloaded above its normal rating of 296 MVA.

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)

- The Greenlawn-Melmore 138 kV ckt 1 line rated 143 MVA loads from 92.8% to 105.8% with an impact of 12.95% for contingency category C2 '517_C2'

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

No problems identified

System Reinforcements

- The overload on the Fostoria Central – West End Fostoria circuit may be alleviated by a sag check to determine if the line sections can be operated above their normal rating. The results of the sag study could prove that no additional upgrades are necessary, that some upgrades on the circuit are necessary, or that the entire 1.54 mile section of line would need to be rebuilt.

  Estimated Cost (2011 Dollars) for the sag study: **$7,000**

  Risers at West End Fostoria are overload above their emergency rating of 337 MVA.

  Estimated Cost (2011 Dollars) for the riser replacement: **$50,000**

- The relay thermal limit at Greenlawn station is overloaded above its emergency rating of 143 MVA.

  Estimated Cost (2011 Dollars) for the relay replacement: **$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 Melmore-V1-010 Tap 138 kV line (from bus 243039 to bus 292059 ckt 1) loads from 120.77% to 122.67% (DC power flow) of its emergency rating (179 MVA) for the operational contingency '5243_B2_TOR4783C_MOAB'. This project contributes approximately 21.02 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 143.43% to 144.78% (DC power flow) of its normal rating (138 MVA) for non contingency condition. This project contributes approximately 11.61 MW to the thermal violation.

3. (AEP) The V1-010 Tap-Howard 138 kV line (from bus 292059 to bus 243024 ckt 2) loads from 137.18% to 139.28% (DC power flow) of its emergency rating (179 MVA) for the operational contingency '5147_B2_TOR707_V1-010B'. This project contributes approximately 23.24 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 101.24% to 102.88% (DC power flow) of its normal rating (138 MVA) for non contingency condition. This project contributes approximately 13.94 MW to the thermal violation.

5. (AEP) The V1-010 Tap-Howard 138 kV line (from bus 292059 to bus 243024 ckt 1) loads from 85.22% to 86.53% (DC power flow) of its emergency rating (179 MVA) for the operational contingency '911_B2'. This project contributes approximately 14.58 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 97.04% to 98.65% (DC power flow) of its normal rating (138 MVA) for non contingency condition. This project contributes approximately 13.79 MW to the thermal violation.

7. (AEP/FE) The Howard-Brookside 138 kV line (from bus 243024 to bus 238586 ckt 1) loads from 157.08% to 158.04% (DC power flow) of its emergency rating (173 MVA) for the operational contingency '911_B2'. This project contributes approximately 15.02 MW to the thermal violation.

8. (AEP/FE) The Howard-Brookside 138 kV line (from bus 243024 to bus 238586 ckt 1) loads from 171.76% to 173.43% (DC power flow) of its normal rating (133 MVA) for non contingency condition. This project contributes approximately 13.68 MW to the thermal violation.

9.The Maple Grove - Riverview 69 kV Line ckt 1 rated 31 MVA loads from 99.5 % to 110.4% with an impact of 10.88% for contingency 517

10.The East Lima – New Liberty 138 kV Line ckt 1 rated 150 MVA loads from 91.5% to 100% MVA with an impact of 8.55% for contingency W3-012_B2_2.

11. The Convoy - Robison Park 345 kV Line ckt 1 rated 897 MVA loads from 98.3% to 104.1% with an impact of 5.8% for contingency W3-012_B2_2.

12. The Lynn - U1-060 138 kV Line ckt 1 rated 184 MVA loads from 97% to 100.7% with an impact of 3.77% for contingency W3-012_B2_2.

13. The Holran – Maple Grove 69 kV Line ckt 1 rated 31 MVA loads from 99.2% to 102.6% with an impact of 3.4 for contingency 5150_B2_TOR7

Option #2
Queue project W3-012 was studied as a(n) 300.0 MW (39.0 MW of which was Capacity) injection into AEP's system at the 50.0% tap between Fostoria Central and East Lima 345.0 kV line. Project W3-012 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)

BUS_NO	BUS	BREAKER	Rating Type	Duty Percent With w3-012_opt2	Duty Percent Without w3-012_opt2	Duty Percent Difference	Note
0	05E LIMA 138.kV	C2	T	100.30%	99.30%	1.00%	New Over-duty
0	05E LIMA 138.kV	D2	T	100.30%	99.20%	1.10%	New Over-duty

System Reinforcements

The overdutied condition of the East Lima 138kV C2 and D2 circuit breakers can be alleviated by replacing the circuit breakers at an estimated cost of **$500,000 each**.

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.)

- (AEP) The Convoy-Robison Park 345 kV line (from bus 242933 to bus 243231 ckt 1) loads from 119.08% to 119.38% (DC power flow) of its normal rating (897 MVA) for non contingency condition. This project contributes approximately 16.73 MW to the thermal violation.