#U4-029 West End Fostoria-Chadwick 138kV

Generation Interconnection

This analysis was completed to assess the reliability impact for the new generation interconnecting to the PJM system as a capacity resource.

Local Network Impacts

Option #1

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 criterion was used to assess the impact of the proposed facility on the AEP System. The project U4-029 was studied at 100 MW full output, plus the 100 MW full output of U4-028, for a total output of 200 MW. The results are summarized below.

Normal System (2012 Summer Conditions)

- No problems identified.

Single Contingency (2012 Summer Conditions)

- No problems identified.

Short Circuit Analysis

- No problems identified.

Stability Analysis

- Stability studies were not performed as part of this Feasibility Study and are not normally performed as part of a Facility Study effort. The stability assessments are part of the System Impact Study. Based upon the results of this future System Impact Study, the extent of system upgrades could change and the associated costs could be significantly different.

Local Upgrades

- None required.

Option 2

Normal System (2012 Summer Conditions)

- No problems identified.

Single Contingency (2012 Summer Conditions)

- A 138 kV 600 A switch at Chatfield is overloaded to 106% of its summer emergency rating of 192 MVA for the outage on the U4-029 – South Tiffin 138 kV circuit.

- The Howard - West End Fostoria 138 kV circuit between Chatfield and South Tiffin is overloaded to approximately 120% of the normal rating of 167 MVA for an outage on either side of U4-029. A sag check will be needed to determine if the circuit can be operated above its normal rating. If the circuit can be operated above its normal rating, an upgrade may still be required if the U4-029 project is to operate at full output following the single-contingency circuit outage. Alternately, the U4-029 generation could be curtailed under this condition. A cost estimate for the sag study and possible circuit upgrade was not completed as part of the feasibility study.

Short Circuit Analysis

- No problems identified.

Stability Analysis

- Stability studies were not performed as part of this Feasibility Study and are not normally performed as part of a Facility Study effort. The stability assessments are part of the System Impact Study. Based upon the results of this future System Impact Study, the extent of system upgrades could change and the associated costs could be significantly different.

Local Upgrades

- Replace the 138 kV switch at Chatfield Station to avoid curtailment of the project under the single contingency condition described.
- Conduct a sag check of the 138 kV line between Chatfield – U4-029 – South Tiffin to avoid curtailment of the project under the single contingency condition described.

Network Impacts

Option #1
The queue project U4-029 was studied as a 100MW (13 MW capacity) injection into the AEP system at the 3 point tap of the tapping Howard-Fostoria Central- Greentown 138kV line. U4-029 was evaluated for compliance with reliability criteria for summer peak conditions in 2013. Potential network impacts were 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)

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)

No problems identified except for the local network problems identified above.

New System Reinforcements

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

None

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)
(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)

None

Delivery of Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of this interconnection request. Any 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 Merchant Transmission Interconnection request.
Note: Only the most severely overloaded conditions are listed below. 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 the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed that shall study all overload conditions associated with the overloaded element(s) identified.

There is the potential that the U4-028 project could have a cost allocation toward the network upgrades that alleviate the overloads listed below.

1. **(APS)** The Sammis-Wylie Ridge 345kV line (from bus 239092 to bus 20709 ckt 1) loads from 101.4% to 101.5% (DC power flow) of its emergency rating (1483MVA) for the single line contingency outage ('APS-SB-682'). This project contributes approximately 10.6MW to the thermal congestion.

The mitigation for this overload is to install 6.9 miles of high temperature conductor on the empty side of the Sammis-Wylie Ridge 345kV circuit. The cost of this upgrade as estimated by PJM is **$10.5 million.**

Option #2

The queue project U4-028 was studied as a 100MW (13 MW capacity) injection into the AEP system at the Howard-West End Fostoria Central 138kV line. U4-028 was evaluated for compliance with reliability criteria for summer peak conditions in 2013. Potential network impacts were 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)

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)

No problems identified except for the local network problems identified above.

New System Reinforcements

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

None

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)
(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)

None

Delivery of Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of this interconnection request. Any 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 Merchant Transmission Interconnection request.
Note: Only the most severely overloaded conditions are listed below. 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 the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed that shall study all overload conditions associated with the overloaded element(s) identified.

There is the potential that the U4-028 project could have a cost allocation toward the network upgrades that alleviate the overloads listed below.

1. **(AEP)** The Howard-Brookside 138kV line (from bus 23158 to bus 238586 ckt 1) loads from 93.6% to 106.3% (DC power flow) of its normal rating (133MVA) for non-

contingency condition. This project contributes approximately 16.8MW to the thermal congestion.

The mitigation for this overload is to reconductor the 21.73 mile line. The cost of this upgrade as estimated by PJM is **$21 million.**

2. (**APS**) The 02Sammis-Wylie Ridge 345kV line (from bus 239092 to bus 20709 ckt 1) loads from 101.4% to 101.5% (DC power flow) of its emergency rating (1483MVA) for the single line contingency outage ('APS-SB-682'). This project contributes approximately 10.3MW to the thermal congestion. Previous project(s) U4-028 contribute(s) to the loading by 10.3MW(.4%). It must be noted that the same thermal violation (DC power flow: 101.0%) already exists in the 2013 base case.

The mitigation for this overload is to install 6.9 miles of high temperature conductor on the empty side of the Sammis-Wylie Ridge 345kV circuit. The cost of this upgrade as estimated by PJM is **$10.5 million.**

MISO Impacts

Any impacts on the MISO transmission system will be identified in the Impact Study.