#U2-066 Marysville-Southwest Lima 345kV

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 AEP 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. The project was studied as an 200 MW net energy injection consistent with the interconnection application. The results are summarized below.

Option #1

Normal System (2012 Summer Conditions)

- No problems identified.

Single Contingency (2012 Summer Conditions)

- No problems identified.

Multiple Contingency (2012 Summer Conditions)

- No problems identified.

Short Circuit Analysis

- The East Lima 138kV circuit breaker A2 is overdutied to 100.1% with the addition of the new generating facility and will need to be replaced.

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 A2 138kV circuit breaker and associated equipment at East Lima station.

Estimated Cost (2008 Dollars) **$500,000***

***The estimates are preliminary in nature as they were determined without the benefit of detailed engineering studies. Final estimates will require an on-site review and coordination to determine final construction requirements. It will take approximately 18 months after obtaining authorization to construct the facilities outlined above.

Contributions to Previously Identified Local/Network Overloadss

- No problems identified

Contribution to Previously identified Local Network Upgrades

- None

Option #2

Normal System (2012 Summer Conditions)

- No problems identified.

Single Contingency (2012 Summer Conditions)

- No problems identified.

Multiple Contingency (2012 Summer Conditions)

- The North Findlay-North Woodcock 138kV line is overloaded to morethan 100% of its summer emergency rating of 245MVA for an outage of the East Lima-Fostoria Central 345kV circuit and the Fostoria Central 345/138kV transformer.
  - Until a sag study is completed on this 138kV line it will be rated at 167MVA.
  - Depending upon the area load, AEP may follow an operating procedure for an outage of the East Lima-Fostoria Central 345kV line. When the operating procedure is implemented, the North Findlay-North Woodcock 138kV line overload is alleviated.

Short Circuit Analysis

- The East Lima 138kV circuit breakers A2 and AA2 are overdutied to 100.7% and 100% respectively with the addition of the new generating facility and will need to be replaced.

  It should be noted that the new generating facility contributes 1-2% to the short circuit duty of several 138kV circuit breakers at East Lima station.

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 A2 and AA2 138kV circuit breakers and associated equipment at East Lima station.
  Estimated Cost (2008 Dollars) **$1,000,000***

***The estimates are preliminary in nature as they were determined without the benefit of detailed engineering studies. Final estimates will require an on-site review and coordination to determine final construction requirements. It will take approximately 18 months after obtaining authorization to construct the facilities outlined above.

Contributions to Previously Identified Local/Network Overloadss

- No problems identified

Contribution to Previously identified Local Network Upgrades

- None

Reactive Requirements

PJM requires a power factor correction to 95% lead/lag at the point of interconnection for wind generating facilities. It is expected that the customer will adhere to this standard.

Option #1

Network Impacts

The Queue Project U2-066 was studied as a(n) 200MW (Capacity = 26MW) injection into the Marysville-Southwest Lima 345 kV transmission line in the AEP area. Project U2-066 was evaluated for compliance with reliability criteria for summer peak conditions in 2012. 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.

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 the 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 Transmission Interconnection Request. Note: Only the most severly 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 Request, a subsequent analysis will be performed that will study all overload conditions associated with the overloaded system element(s) identified)

- **(AEP/AEP)** The R60C-Robison Park 345kV circuit loads from 139.28% to 140.32% (DC power flow) of its normal rating (897MVA) for non-contingency condition. This project contributes approximately 9.4MW to the thermal congestion

Option #2

Network Impacts

The Queue Project U2-066 was studied as a(n) 200MW (Capacity = 26MW) injection into the Marysville-East Lima 345 kV transmission line in the AEP area. Project U2-066 was evaluated for compliance with reliability criteria for summer peak conditions in 2012. 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)

- **(AEP/AEP)** The West Lima-Woodlawn 138kV circuit loads from 98.75% to 109.09% (DC power flow) of its emergency rating (250MVA) for the tower line outage (AEP_TOWER44_T142B). This project contributes 25.8MW to cause this thermal violation.

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)

- **(AEP/AEP)** The Eastown Road-Rockhill 138kV circuit loads from 121.21% to 135.10% (DC power flow) of its emergency rating (184MVA) for the tower line outage (AEP_TOWER44_T142B). This project contributes approximately 25.6MW to the thermal violation.

New System Reinforcements

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

- The overload on the West Lima-Woodlawn 138kV circuit can be alleviated by replacing the risers and the bus sub-conductor at the West Lima 138kv station.
  Estimated Cost (2008 Dollars) **$100,000***

  ***The estimates are preliminary in nature as they were determined without the benefit of detailed engineering studies. Final estimates will require an on-site review and coordination to determine final construction requirements. It will take approximately 18 months after obtaining authorization to construct the facilities outlined above.

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)

- The overload on the Eastown Rd-Rock Hill 138kV circuit can be alleviated by replacing the 138 kV risers at Rockhill station terminal.

  Estimated Cost (2008 dollars): **$75,000**

Delivery of Energy Portion of Interconnection Request

(PJM also studied the delivery of the energy portion of the 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 Transmission Interconnection Request. Note: Only the most severly 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 Request, a subsequent analysis will be performed that will study all overload conditions associated with the overloaded system element(s) identified)

- **(AEP/AEP)** The R60C-Robison Park 345kV circuit loads from 138.0% to 139.0% (DC power flow) of its normal rating (897MVA) for non-contingency condition. This project contributes approximately 9.4MW to the thermal congestion

MISO Impacts

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