#U2-072 East Lima-Marysville 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 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 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 a 300 MW net energy injection consistent with the interconnection application. This project was studied with PJM projects #P55, R48, R49, S072, S073, T130, T131, T142, U1-059, U1-060, U2-026, U2-041, U2-042, and U2-066 already in service at 100% output in the vicinity of U2-072. The interconnection project was studied at full capacity. The results are summarized below.

Option #1

(East Lima – Marysville 345 kV)

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

- 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.

Option #2

(Southwest Lima – Marysville 345 kV)

Normal System (2012 Summer Conditions)

- No problems identified.

Single Contingency (2012 Summer Conditions)

- No problems identified.

Multiple Contingency (2012 Summer Conditions)

- AEP Eastown Road – Rockhill[1] 138 kV line gets overloaded to 103% (190 MVA) of its emergency rating for an outage of AEP Marysville – T142 138 kV line and AEP Southwest Lima – East Lima 138 kV line. Without the addition of U2-072 Project, the same facilities are loaded to 85% (156 MVA) of emergency rating under the same contingency.

Short Circuit Analysis

- No problems identified.

Stability Analysis

- Stability analysis was not performed as part of this Feasibility Study. 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.

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 Great Lakes will adhere to this standard.

Network Impacts

Option #1
The Queue Project U2-072 was studied as a(n) 300MW (Capacity = 39MW) injection at the East Lima – Marysville 345 kV lines in the AEP area. Project U2-041 was evaluated for

[1] The affected facility may appear in additional contingencies that are not mentioned.

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)

None

New System Reinforcements

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

1. The overload on the Eastown Rd-Rock Hill 138kV circuit can be alleviated by replacing the 138 kV risers at Rockhill station terminal. The estimated Cost (2008 dollars): **$75,000.**

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)
(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. **These are not required reliability upgrades.**

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 which shall study all overload conditions associated with the overloaded element(s) identified.

As a result of the aggregate energy resources in the area, the following potential congestion was identified

1. **(AEP/AEP)** The R60C-Robison Park 345kV line loads from 140.3% to 142.6% (DC power flow) of its normal rating (897MVA) for non-contingency condition. This project contributes approximately 20.5MW to the thermal congestion

2. **(AEP/AEP)** The R60C-Robison Park 345kV line loads from 103.5% to 105.0% (DC power flow) of its emergency rating (1301MVA) for the single line contingency outage (AEP21). This project contributes approximately 20.2MW to the thermal congestion.

MISO Impacts

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

Option #2

The Queue Project U2-072 was studied as a(n) 300MW(Capacity = 39MW) injection at the SW Lima- Marysville 345 kV lines in the AEP area. Project U2-041 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)

None

Multiple Facility Contingency

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

1. **(AEP/AEP)** The Southwest Lima-Shawnee Road 138kV line loads from 97.74% to 112.75% (DC power flow) of its emergency rating (384MVA) for the tower line outage (AEP_TOWER44_T142B). This project contributes approximately 57.6MW to cause this thermal violation.

2. **(AEP/AEP)** The Southwest Lima-West Lima 138kV line loads from 96.26% to 113.25% (DC power flow) of its emergency rating (413MVA) for the tower line outage (AEP_TOWER44_T142B). This project contributes approximately 70.2MW to cause this thermal violation.

3. **(AEP/AEP)** The Northwest Lima-East Lima 138kV line loads from 88.25% to 103.45% (DC power flow) of its emergency rating (255MVA) for the tower line outage (AEP_TOWER44_T142B). This project contributes approximately 38.8MW to cause this thermal violation.

Short Circuit

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)

4. **(AEP/AEP)** The Eastown Road-Rock Hill 138kV line loads from 135.10% to 155.95% (DC power flow) of its emergency rating (184MVA) for the tower line outage (AEP_TOWER44_T142B). This project contributes approximately 38.4MW to the thermal violation.

5. **(AEP/AEP)** The West Lima-Woodlawn 138kV line loads from 109.09% to 124.60% (DC power flow) of its emergency rating (250MVA) for the tower line outage (AEP_TOWER44_T142B). This project contributes approximately 38.8MW to the thermal violation.

6. **(AEP/AEP)** The West Lima-Eastown Road 138kV line loads from 108.22% to 123.56% (DC power flow) of its emergency rating (250MVA) for the tower line outage (AEP_TOWER44_T142B). This project contributes approximately 38.4MW 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)

2. The overload on the Southwest Lima-Shawnee Road 138kV circuit can be alleviated by by replacing the 1200 ampere rated switch at Shawnee Road and the risers at Southwest Lima. The estimated cost is **$130,000.**

3. The overload on the Southwest Lima-West Lima 138kV circuit can be alleviated by replacing the West Lima bus and the Southwest Lima risers. The estimated cost is **$100,000.**

4. The overload on the Northwest Lima-East Lima 138kV circuit can be alleviated by replacing the bus at Northwest Lima. The estimated cost is **$100,000.**

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

5. The overload on the Eastown Rd-Rock Hill 138kV circuit can be alleviated by replacing the 138 kV risers at Rockhill station terminal. The estimated Cost (2008 dollars): **$75,000.**

6. The overload on the West Lima-Woodlawn 138kV circuit can be alleviated by replacing the bus and risers at West Lima ($100,000) and replacing the 1 mile of conductor between West Lima and Woodlawn ($1,500,000). The estimated cost us **$1,600,000.**

7. The overload on the West Lima-Eastown Road can be alleviated by replacing the risers at West Lima ($100,000) and replacing the the 3.5 miles of conductor between West Lima and Eastown Road ($5,250,000). The estimated cost is **$5,350,000.**

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. **These are not required reliability upgrades.**

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 which shall study all overload conditions associated with the overloaded element(s) identified.

As a result of the aggregate energy resources in the area, the following potential congestion was identified

7. **(AEP/AEP)** The R60C-Robison Park 345kV line loads from 139.0% to 140.6% (DC power flow) of its normal rating (897MVA) for non-contingency condition. This project contributes approximately 14.0MW to the thermal congestion.

8. **(AEP/AEP)** The R60C-Robison Park 345kV line loads from 102.6% to 103.7% (DC power flow) of its emergency rating (1301MVA) for the single line contingency outage (AEP21). This project contributes approximately 13.8MW to the thermal congestion.

MISO Impacts

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