

**#U4-038 Mullin-Greentown Tap 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 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 with PJM project #U3-002 already in service at 100% output in the vicinity of U4-038. The results are summarized below.

**Normal System – Capacity Output (2013 Summer Conditions)**

- No problems identified.

**Single Contingency – Capacity Output (2013 Summer Conditions)**

- No problems identified.

**Multiple Contingency – Full Output (2013 Summer Conditions)**

- No problems identified.

**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.

**Local/Network Upgrades**

- None required

**Contributions to Previously Identified Local/Network Overloadss**

None

## **Contribution to Previously identified Local Network Upgrades**

None

## **Contributions to Previously Identified Local Network Limitations – Full Output**

- AEP Alexandria – Mullin<sup>1</sup> 34.5 kV line is overloaded to beyond 127% (30.5 MVA) of its emergency rating for an outage of the AEP Deer Creek – Fisher Body – U4-038 138 kV line. Without the addition of U4-038 Projects, the same facilities are loaded to 112% (26.9 MVA) of emergency rating.

## **Additional Limitations of Concern – Full Output**

- AEP U4-038 – Deer Creek – Fisher Body<sup>1</sup> 138 kV line is overloaded to 107% (204 MVA) of its normal rating under normal conditions. Without the addition of U4-038 Project, the same facilities are loaded to 50% (95.5 MVA) of normal rating.
- AEP U3-002 – Mullin<sup>1</sup> 138 kV line is overloaded to 118% (295 MVA) of its emergency rating for an outage of the AEP Deer Creek – Fisher Body – U4-038 138 kV line. Without the addition of U4-038 Project, the same facilities are loaded to 78% (195 MVA) of emergency rating.
- AEP South Elwood – Mullin<sup>1</sup> 138 kV line is overloaded to 100% (250 MVA) of its emergency rating for an outage of the AEP Deer Creek – Fisher Body – U4-038 138 kV line. Without the addition of U4-038 Project, the same facilities are loaded to 63% (158 MVA) of emergency rating.
- AEP South Summitville – Mullin<sup>1</sup> 34.5 kV line is overloaded to 101% (17.2 MVA) of its emergency rating for an outage of the AEP Deer Creek – Fisher Body – U4-038 138 kV line. Without the addition of U4-038 Project, the same facilities are loaded to 85% (14.4 MVA) of emergency rating.
- AEP Mullin 138/34.5 kV transformer<sup>1</sup> is overloaded to 102% (51 MVA) of its emergency rating for an outage of the AEP Mullin – Pendleton 138 kV circuit. Without the addition of U4-038 Project, the same facilities are loaded to 96% (48 MVA) of emergency rating.

## **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 EC&R Midwest will adhere to this standard.

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<sup>1</sup> The affected facility may appear in additional contingencies that are not mentioned.

## **Network Impacts**

The queue project U4-038 was studied as a 100MW (13 MW capacity) injection into the AEP system tapping Deer Creek – Fisher Body – Mullin 138 kV line. U4-038 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. The Conastone-Peach Bottom 500kV line (from bus 4 to bus 13 ckt 1 ) loads from 250.61% to 251.34% (DC power flow) of its emergency rating (2598MVA) for the single line contingency outage of the Juniata-Keystone 500kV circuit. This project contributes approximately 13MW to the thermal congestion.
2. The Mountaineer-Belmont 765kV line (from bus 22568 to bus 22610 ckt 1 ) loads from 102.1% to 102.15% (DC power flow) of its emergency rating (4253MVA) for the single line contingency outage of the Amos-Bedington 765kV circuit. This project contributes approximately 12.15MW to the thermal congestion.
3. The Convoy-R60\_TAP 345kV line (from bus 22605 to bus 96566 ckt 1 ) loads from 108.77% to 108.86% (DC power flow) of its emergency rating (1022MVA) for the single line contingency outage of the Dumont- Marysville 765kV circuit. This project contributes approximately 5.7MW to the thermal congestion.
4. The Dumont-Marysville 765kV line (from bus 22660 to bus 22615 ckt 1 ) loads from 128.14% to 128.2% (DC power flow) of its emergency rating (4465MVA) for the single line contingency outage of the Hanging Rock-Jefferson 765kV circuit. This project contributes approximately 18.1MW to the thermal congestion.
5. The R60\_TAP-East Lima 345kV line (from bus 96566 to bus 22603 ckt 1 ) loads from 144.05% to 144.14% (DC power flow) of its emergency rating (4465MVA) for the single line contingency outage of the Dumont-Marysville 765kV circuit. This project contributes approximately 5.7MW to the thermal congestion.
6. The Sammis-Wylie Ridge 345kV line (from bus 239092 to bus 20709 ckt 1 ) loads from 125.93% to 125.98% (DC power flow) of its emergency rating (14.83MVA) for the

single line contingency outage ('APS-SB-682'). This project contributes approximately 5.1MW to the thermal congestion.

### **MISO Impacts**

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