

#U4-039 Greentown 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.

Option #1

Network Impacts

The Queue Project #U4-039 was studied as a(n) 800.0MW (Capacity 104.0MW) injection into Greentown 138 kV substation in the AEP area. Project #U4-039 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)

1. **(APS- BGE)** The Kemptown-Conastone 500 kV line (from bus 20632 to bus 4 ckt 1) loads from 178.68% to 179.17% (DC power flow) of its emergency rating (2815 MVA) for the tower line outage of the Granite-High Ridge 230kV circuits. This project contributes approximately 85.44MW to cause this 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)

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)

1. **(APS- BGE)** The overload on the Kemptown-Conastone 500kV circuit can be alleviated by adding another Kemptown-Conastone circuit.

Estimate of the Conastone to Kemptown Reinforcement

Total Cost **\$349Million**

- the total mileage from Conastone to Kemptown, 47.9 miles
- estimate in 2009 dollars of \$333.65M
- estimated time to complete of 10 yrs

Assumptions for the new circuit:

- New 200 ft. wide R/W Total R/W length = 47.9 miles
- 3 - bundle 1,590 kcm conductor
- 2009 dollars

Substation Termination Estimates

Conastone - Install a 2 breaker bay **\$7.7Million**

Kemptown - Install a 2 breaker bay **\$7.7Million**

PJM is currently investigating whether reinforcement of the Bedington-Hunterstown 500kV circuit at an estimated cost of \$300 million is an acceptable alternative.

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 U4-039 project could have a cost allocation toward the network upgrades that alleviate the overloads listed below.

1. **(AEP)** The R60_Tap-East Lima 345kV line (from bus 96566 to bus 22603 ckt 1) loads from 144.0% to 144.7% (DC power flow) of its emergency rating (1022MVA) for the single line contingency outage of the Dumont-Marysville 765kV circuit. This project contributes approximately 44.8MW to the thermal congestion.
2. **(AEP)** The Dumont-Marysville 765kV line (from bus 22660 to bus 22615 ckt 1) loads from 128.3% to 128.9% (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 176.9MW to the thermal congestion.
3. **(APS-BGE)** The Kemptown-Conastone 500kV line (from bus 20632 to bus 4 ckt 1) loads from 120.52% to 120.88% (DC power flow) of its emergency rating (3710MVA) for the single line contingency outage ('PJM13B_2'). This project contributes approximately 82.42MW to the thermal congestion.
4. **(APS-BGE)** The Kemptown-Conastone 500kV line (from bus 20632 to bus 4 ckt 2) loads from 120.52% to 120.88% (DC power flow) of its emergency rating (3710MVA) for the single line contingency outage ('PJM13B'). This project contributes approximately 82.42MW to the thermal congestion.
5. **(AEP)** The 05Convoy-R60_TAP 345/345kV line (from bus 22605 to bus 96566 ckt 1) loads from 108.7% to 109.4% (DC power flow) of its emergency rating (1022MVA) for the single line contingency outage Dumont-Marysville 765kVcircuit. This project contributes approximately 44.8MW to the thermal congestion.
6. **(AEP-APS)** The Kammer 765/500kV transformer (from bus 22611 to bus 20117 ckt 1) loads from 105.7% to 106.2% (DC power flow) of its emergency rating (3040MVA) for the single line contingency outage of the Amos-Bedington 765765kV circuit. This project contributes approximately 83.7MW to the thermal congestion.
7. **(AEP)** The Mountaineer-Belmont 765kV line (from bus 22568 to bus 22610 ckt 1) loads from 101.9% to 102.3% (DC power flow) of its emergency rating (4253MVA) for the single line contingency outage of the Amos-Bedington 765kV circuit. This project contributes approximately 97.3MW to the thermal congestion.

Additional Limitations of Concern – Full Output

- AEP Alexandria – Mullin¹ 34.5 kV line is overloaded to 112% (25.8 MVA) of its emergency rating for an outage of the AEP Deer Creek – Fisher Body – U3-002 138 kV line. Without the addition of U3-002 Project, the same facilities are loaded to 72% (16.6 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 Interconnection Customer will adhere to this standard.

MISO Impacts

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

Option #2

Network Impacts

The Queue Project #U4-039 was studied as a(n) 800.0MW (Capacity104.0MW) injection into Greentown 138 kV substation in the AEP area. Project #U4-039 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.

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

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)

8. **(APS- BGE)** The Kemptown-Conastone 500 kV line (from bus 20632 to bus 4 ckt 1) loads from 178.68% to 179.17% (DC power flow) of its emergency rating (2815 MVA) for the tower line outage of the Granite-High Ridge 230kV circuits. This project contributes approximately 87.62MW to cause this 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)

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)

2. **(APS- BGE)** The overload on the Kemptown-Conastone 500kV circuit can be alleviated by adding another Kemptown-Conastone circuit.

Estimate of the Conastone to Kemptown Reinforcement

Total Cost **\$349Million**

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Assumptions for the new circuit:

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Conastone - Install a 2 breaker bay **\$7.7Million**

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There is the potential that the U4-039 project could have a cost allocation toward the network upgrades that alleviate the overloads listed below.

1. **(AEP)** The Dumont-Marysville 765kV line (from bus 22660 to bus 22615 ckt 1) loads from 128.3% to 128.9% (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 161.7MW to the thermal congestion.
2. **(APS-BGE)** The Kemptown-Conastone 500kV line (from bus 20632 to bus 4 ckt 2) loads from 120.52% to 120.89% (DC power flow) of its emergency rating (3710MVA) for the single line contingency outage ('PJM13B'). This project contributes approximately 84.48MW to the thermal congestion.
3. **(APS-BGE)** The Kemptown-Conastone 500kV line (from bus 20632 to bus 4 ckt 1) loads from 120.52% to 120.89% (DC power flow) of its emergency rating (3710MVA) for the single line contingency outage ('PJM13B_2'). This project contributes approximately 84.48MW to the thermal congestion.
4. **(AEP-APS)** The KAMMER 765/500kV transformer (from bus 22611 to bus 20117 ckt 1) loads from 105.7% to 106.2% (DC power flow) of its emergency rating (3040MVA) for the single line contingency outage of the Amos-Bedington 765kV circuit. This project contributes approximately 82.8MW to the thermal congestion.
5. **(AEP)** The Mountaineer-Belmont 765kV line (from bus 22568 to bus 22610 ckt 1) loads from 101.9% to 102.3% (DC power flow) of its emergency rating (4253MVA) for the

single line contingency outage of the Amos-Bedington 765 kV circuit. This project contributes approximately 110.6MW to the thermal congestion.

Additional Limitations of Concern – Full Output

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Reactive Requirements

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