#U4-003 Olive-Dequine 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.

Network Impacts

The queue project U4-003 was studied as a 200MW (26 MW capacity) injection into the AEP system tapping Olive-Dequine 345 kV line. U4-003 was evaluated for compliance with reliability criteria for summer peak conditions in 2013. Potential network impacts were as follows:

Note: This analysis assumes all of the overloads identified for generation projects evaluated using the 2012 have been alleviated by the addition of network upgrades. This project could still have cost allocation for those upgrades according to the Tariff cost allocation procedure. The overloads that could potentially result in cost allocation are listed below.

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

1. The **(BGE-PECO)** Conastone-Peach Bottom 500kV line (from bus 4 to bus 13 ckt 1) loads from 249.9% to 250.1% (DC power flow) of its emergency rating (2598MVA) for the single line contingency outage of the Juniata-Keystone 500kV circuit. This project contributes approximately 25.8MW to the thermal congestion.

2. The **(AEP)** Mountaineer-Belmont 765kV line (from bus 22568 to bus 22610 ckt 1) loads from 101.9% to 102.0% (DC power flow) of its emergency rating (4253MVA) for the single line contingency outage of the Amos-Bedington 765kV circuit. This project contributes approximately 23.5MW to the thermal congestion.

3. The **(AEP)** CONVOY-R60_TAP 345kV line (from bus 22605 to bus 96566 ckt 1) loads from 108.6% to 108.7% (DC power flow) of its emergency rating (1022MVA) for the single line contingency outage of the Dumont-Marysville 765kV circuit. This project contributes approximately 11.0MW to the thermal congestion.

4. The **(AEP-AEP)** Dequine-Reynolds 345kV line (from bus 22656 to bus 22669 ckt 1) loads from 132.3% to 138.7% (DC power flow) of its emergency rating (932MVA) for the single line contingency outage of the 'S06-Olive circuit. This project contributes approximately 59.1MW to the thermal congestion.

5. The **(AEP-AEP)** Dumont-Marysville 765kV line (from bus 22660 to bus 22615 ckt 1) loads from 127.9% to 128.1% (DC power flow) of its emergency rating (4465MVA) for

the single line contingency outage Hanging Rock-Jefferson 765kV circuit. This project contributes approximately 42.3MW to the thermal congestion.

6. The **(AEP-AEP)** Olive-Dumont 345kV line (from bus 22668 to bus 22659 ckt 2) loads from 112.2% to 115.2% (DC power flow) of its emergency rating (1272MVA) for the single line contingency outage Dumont-Wilton Center 345kV circuit. This project contributes approximately 38.9MW to the thermal congestion.

7. **(AEP-AEP)** The Reynolds-Olive 345kV line (from bus 22669 to bus 22668 ckt 1) loads from 100.8% to 105.9% (DC power flow) of its emergency rating (961MVA) for the single line contingency outage of the S06-Olive 345kv ciecuit. This project contributes approximately 48.6MW to the thermal congestion.

8. The **(AEP-AEP)** S06_TAP-Dequine 345kV line (from bus 90214 to bus 22656 ckt 1) loads from 117.4% to 141.0% (DC power flow) of its emergency rating (848MVA) for the single line contingency outage of the S06-Olive 345kV circuit. This project contributes approximately 200.0MW to the thermal congestion.

9. **(AEP-AEP)** The S06_TAP-Olive 345kV line (from bus 90214 to bus 22668 ckt 1) loads from 137.1% to 145.8% (DC power flow) of its emergency rating (848MVA) for the single line contingency outage of the Dequine-Reynolds-Olive circuit. This project contributes approximately 73.8MW to the thermal congestion.

10. The **(AEP-AEP)** R60_TAP-East Lima 345kV line (from bus 96566 to bus 22603 ckt 1) loads from 143.8% to 144.0% (DC power flow) of its emergency rating (1022MVA) for the single line contingency outage of the Dumont-Marysville 765kv circuit. This project contributes approximately 11.0MW to the thermal congestion.

11. The **(APS)** Sammis-Wylie Ridge 345kV line (from bus 239092 to bus 20709 ckt 1) loads from 125.5% to 125.6% (DC power flow) of its emergency rating (1483MVA) for the single line contingency outage ('APS-SB-682'). This project contributes approximately 10.2MW to the thermal congestion.

12. **(APS-BGE)** The 01Kempton-Conastone 500kV line (from bus 20632 to bus 4 ckt 1) loads from 170.23% to 170.34% (DC power flow) of its emergency rating (2815MVA) for the single line contingency outage of the Hunterstown-Conastone 500kV circuit. This project contributes approximately 20.5MW to the thermal congestion.

Contribution to Previously Identified Overloads (From T184 using 2012 basecase)

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

Overloads for which the U4-003 project may have a cost allocation based upon the Tariff defined cost allocation methodology.

1. The S06Tap – Dequine 345 kV line loads from 123.62% to 132.52% (DC power flow) of its emergency rating (848 MVA) for the outage of S06Tap-Olive 345 kV line and Olive – University Park 345 kV line with the breaker failure at Olive 345 kV station. This project contributes approximately 200 MW to the thermal congestion.

2. The S06Tap - Olive 345 kV line loads from 123.62% to 132.52% (DC power flow) of its emergency rating (848 MVA) for the outage of Reynolds - Dequine – Westwood 345 kV line, Olive – Reynolds 345 kV line, Reynolds 345/138 kV transformer, Westwood 345/138 kV transformer with the breaker failure at Dequine 345 kV station. This project contributes approximately 75.51 MW to the thermal congestion.

3. The Mountaineer – Belmont 765 kV line loads from 104.45% to 104.7% (AC power flow) of its emergency rating (4253 MVA) for the outage of Bedington – Amos 765 kV line and Amos 765/345 kV transformer #5 with the breaker failure at Amos 765 kV station. This project contributes approximately 23.69 MW to the thermal congestion.

4. The Belmont 765/500 kV transformer loads from 111.03% to 111.47% (AC power flow) of its emergency rating (2094 MVA) for the outage of Kammer – South Canton 765 kV line, Kammer 765/500 kV transformer, South Canton 765/345 kV transformer #3, Kammer – 502 Junction 500 kV line, and South Canton 345/138 kV transformer #4 for the breaker failure at Kammer 765 kV station. This project contributes approximately 20.35 MW to the thermal congestion.

5. The Dumont – Marysville 765 kV line loads from 125% to 125.46% (DC power flow) of its emergency rating (4465 MVA) for the outage of Hanging Rock - Jefferson 765 kV line and Jefferson- Clifty Creek 765/345 kV transformer with the breaker failure at Jefferson 765 kV station ('05HANG R-05JEFRSO-06CLIFTY-765-345'). This project contributes approximately 45.41 MW to the thermal congestion.

6. The Olive - Dumont 345 kV ckt #2 loads from 121.71% to 130.16% (DC power flow) of its emergency rating (1272 MVA) for the outage of Wilton Center – Dumont 765 kV line and Wilton Center 765/345 kV transformer and Wilton – Wilton 345 kV lines with the breaker failure at Wilton 765 kV substation. This project contributes approximately 38.91 MW to the thermal congestion.

7. The R60_TAP – East Lima 345 kV line loads from 160.5% to 160.98% (AC power flow) of its emergency rating (1022 MVA) for the outage of Dumont - Marysville – Flatlick 765 with the breaker failure at Maryville 765 kV station. This project contributes approximately 10.84 MW to the thermal congestion.

8. The Convoy - R60 Tap 345 kV line loads from 127.15% to 127.52% (AC power flow) of its emergency rating (1022 MVA) for the outage of Dumont - Marysville – Flatlick 765 with the breaker failure at Maryville 765 kV station. This project contributes approximately 10.84 MW to the thermal congestion.

9. The Conastone – Peach Bottom 500 kV line (from bus 4 to bus 13 ckt 1) loads from 217.91% to 218.33% (AC power flow) of its emergency rating (2598 MVA) for the bus contingency outage of Nottingham 230 kV bus ('PE402'). This project contributes approximately 24.53 MW to the thermal congestion.

10. The Kemptown - Conastone 500 kV line (from bus 20632 to bus 4 ckt 1) loads from 173.25% to 173.6% (AC power flow) of its emergency rating (2815 MVA) for the outage of Conemaugh – Keystone 500 kV line, Conemaugh 500/22 kV transformer for the breaker failure at Conemaugh station ('PJM53'). This project contributes approximately 21.98 MW to the thermal congestion.

11. The Sammis – Wylie Ridge 345 kV line (from bus 239092 to bus 20709 ckt 1) loads from 118.65% to 118.97% (AC power flow) of its emergency rating (1483 MVA) for the outage of Belmont – Kammer 765 kV line, Mountaineer – Belmont 765 kV line, Belmont 765/500 kV transformer, Kammer 765/500 kV transformer and Kammer – 502 Junction 500 kV line for the breaker failure at station. This project contributes approximately 10.73 MW to the thermal congestion.

12. The Dequine - Reynolds 345 kV line (from bus 22656 to bus 22669 ckt 1) loads from 116.23% to 122.6% (DC power flow) of its emergency rating (932 MVA) for the breaker contingency outage of S06 – Olive 345 kV line. This project contributes approximately 59.12 MW to the thermal congestion.

PJM estimates that remediation of all of the upgrades described in this section could cost approximately **$750 million**.

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 BP Alternative Energy will adhere to this standard.

MISO Impacts

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