

#S31 Olive-Dequine 345kV **Generation Interconnection**

This analysis was completed to assess the reliability impact for the increase in generation interconnecting to the PJM system as a capacity resource.

Network 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 criterion was used to assess the impact of the proposed facility on the AEP System. The was studied as a 450 MW net energy injection (90 MW capacity) consistent with the interconnection application. The results are summarized below.

Normal System (2011 Summer Conditions)

- No problems identified.

Single Contingency (2011 Summer Conditions)

1. Outage of the S31 – Olive 345 kV circuit overloads the Dequine – Reynolds 345 kV circuit to 115% (1072 MVA) of its normal rating (932 MVA – present load flow rating)
2. Outage of Dequine – Olive 345 kV #2 circuit overloads the S31 – Olive 345 kV line to 104% (1009 MVA) of its normal rating (971 MVA)

Generator Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

No problems were identified.

Multiple Contingency (2011 Summer Conditions)

(Double Circuit Tower Line contingencies only for the full energy output. Stuck breaker and bus fault contingencies will be performed for the Impact Study)

- 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.

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)

3. Contribution of 10 MW further overloads to the Conastone – Peach Bottom 500 kV ckt#1 line from 133% to 134% of its emergency rating (2598 MVA) for the outage of Conastone – Peach Bottom 500 kV ckt#2.

The first project to cause this overload is Q90. Other projects which contribute to this overload are:

R03,R15,R14,R16,R17,R80,R77,R76,R44,R33,R29,R96,R88,R64,R30,R78,R35,R47,R61,R60, S12,S17,S18,S23,S29

4. Contribution of 10 MW further overloads to the Conastone – Peach Bottom 500 kV ckt#2 line from 133% to 134% of its emergency rating (2598 MVA) for the outage of Conastone – Peachbottom 500 kV ckt#1.

The first project to cause this overload is Q90. Other projects which contribute to this overload are:

R03,R15,R14,R16,R17,R77,R76,R44,R33,R29,R96,R88,R64,R30,R78,R35,R47,R61,R60, S12,S17,S18,S23,S29

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 932 MVA SN/SE rating for the Dequine – Reynolds 345 kV circuit is not correct. It is based on a relay limitation that has been eliminated. The present rating should be based on the conductor rating. However, the conductor for this circuit was installed following extensive ice storm damage and is not the original conductor. The original conductor was 1414 MCM ACSR (paper expanded), and this is what the transmission towers were designed for. However, the replacement conductor was 2303 MCM ACAR. Although similar in size, this conductor has different sag characteristics than the original conductor. Therefore, a sag study is required for the Dequine – Reynolds 345 kV circuit to determine the maximum conductor operating temperature(s), and the associated rating(s).

2. To address the S31 – Olive 345 kV circuit overload, structure & sag analyses will be required to determine if the circuit can be reconducted with a higher capacity conductor. If these analyses eliminate this alternative, then S31 – Olive 345 kV will need to be rebuilt. The cost of rebuilding this double circuit line will be approximately **\$1,700,000 per mile**. The Dequine – Olive 345 kV line is approximately 90 miles long; however, the length of the S31 – Olive 345 kV portion is indeterminate until the interconnection location can be determined with more accuracy. The cost of reconductoring will be less than rebuilding. However, the cost for reconductoring cannot be provided before the structure and sag studies are completed (some structures may still need to be replaced).

The structure & sag studies required for the S31 – Olive 345 kV overload and Dequine – Reynolds 345 kV possible overload can be performed in the Facility Study and is estimated to cost approximately \$350,000. It will require approximately 20 weeks from initiation. Most of the conductor lengths for the two circuits involved are located on the same towers. Therefore, a single study should be required to address both overload issues. The structure and sag evaluation can probably be advanced to the Impact Study phase of the analysis, but would require an additional security deposit of \$350,000 above the normal \$50,000 deposit.

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.

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)

Reinforcement if they are able to acquire Right of Way:

1. **Conastone – Peachbottom 500 kV Upgrade**

PECO Upgrade:

Substation work at Peach Bottom \$2.5M

Construct 6.25 miles of 500kV line \$10M

Construction of the new line will take approximately 30 months after the right of way is acquired.

These estimates do not include the cost of new Right of Way.

It should be noted that IPP project P04 also requires widening of about two miles of this right of way and that installation, if it moves forward, may complicate right of way acquisition and double the substation costs at Peach Bottom.

BGE Upgrade:

1. Build new 500 kV line adjacent to circuit 5012 from Conastone to PA line –
\$48M ~ 7 yrs.

Assumptions:

- Acquire 150 ft. wide R/W adjacent to existing R/W, mostly rural land at \$100,000 per acre
 - 2 - 3 year CPCN process prior to land acquisition
 - Length of line 9.6 miles
2. Install a 500kV breaker **\$1.5M**

Reinforcement if they are unable to acquire Right of Way:

The line from Graceton to Peach Bottom is about 7.5 miles long and has a normal rating of 528MVA. Assuming that we could maintain this rating with a single 230 kV pipe type cable (and we may not be able to do this), the new underground installation would cost about \$30M plus another \$1M for terminal modifications. I assume that the underground line will not have to cross any rivers or large creeks. If a cable rating of 450 MVA is insufficient, it will cost an additional \$30M.

Removal of the existing 230 kV tower line is about \$1.5M.

Construction of a double circuit 500kV line from Conastone to Peach Bottom would be about \$3.5M per mile. The line is 16.5 miles long. Total cost \$58M.

Substation additions and modifications at Peach Bottom would cost about \$10M.

Note: Future work is being done by the Transmission Owners to come up with reinforcements to further mitigate the overload.

Coordination with MISO

During the Impact Study evaluation, PJM will coordinate with MISO to determine if this project impacts upon any MISO facilities.