#R04 Sunbury 950 MW

Generator Interconnection

This analysis was completed to assess the reliability impact for a new generator interconnecting to the PJM System as a Capacity Resource.

Network Impacts

The #R04 project was studied as a 950 MW (capacity) injection at Sunbury 500 kV substation in the PPL territory. Project #R04 was evaluated for compliance with reliability criteria for summer peak conditions in 2011. Potential network impacts were as follows:

Generator Deliverability

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

No problems were identified.

Multiple Facility Contingency

(Double Circuit Towerline contingencies only. Stuck breaker and bus fault contingencies will be performed for the Impact Study)

No problems were identified

Short Circuit

Will be performed for the Queue R04 Impact Study.

Stability Analysis

Will be performed for the Queue R04 Impact Study.

Contribution to Previously Identified Overloads

(Queue R04 contributes to the following contingency overloads, i.e. Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

1. The Alburtis – Branchburg 500 kV line is overloaded at 102% of its emergency rating (3734 MVA) for the outage of Branchburg to Elroy 500 kV line. The R04 project contributes approximately 65 MW to this overload.
2. The Hosensack – Elroy 500 kV line is overloaded to 111% of its emergency rating (3734 MVA) for the outage of Alburtis – Branchburg 500 kV line. The R04 contributes approximately 172 MW to this overload.
3. The Frackville - Siegfried 230 kV line is overloaded to 108% of its emergency rating (616 MVA) for the **tower** outage of Susquehanna to East Palmerton 230kV line and Harwood to Siegfried 230kV line. The R04 contributes approximately 36 MW to this overload.

4. The Conastone - Mt Carmel (line 2322) 230 kV line is overloaded at 138% of its emergency rating (803 MVA) for the **tower** outage of Brighton to Doubs and Brighton to Conastone 500 kV line. The R04 project contributes approximately 43 MW to this overload.
5. The Conastone - Mt Carmel (line 2310) 230 kV line is overloaded at 121% of its emergency rating (923 MVA) for the **tower** outage of Brighton to Doubs and Brighton to Conastone 500 kV line. The R04 project contributes approximately 44 MW to this overload.
6. The Mt Carmel – Northwest (line 2322) 230 kV line is overloaded at 135% of its emergency rating (803 MVA) for the **tower** outage of Brighton to Doubs and Brighton to Conastone 500 kV line. The R04 project contributes approximately 43 MW to this overload.
7. The Mt Carmel – Northwest (line 2310) 230 kV line is overloaded at 118% of its emergency rating (923 MVA) for the **tower** outage of Brighton to Doubs and Brighton to Conastone 500 kV line. The R04 project contributes approximately 43 MW to this overload.
8. The Graceton – Bagley – Raphael Road 230 kV line is overloaded at 151% of its emergency rating (659 MVA) for the **tower** outage of Brighton to Doubs and Brighton to Conastone 500 kV line. The R04 project contributes approximately 53 MW to this overload.

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e."Network Impacts", initially caused by the addition of Queue R04 generation)

None

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by Queue R04. Queue R04 may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)

1. Alburtis – Branchburg 500kV line upgrade.

   PPL portion of the line (21 miles) and Alburtis terminal

   The estimated magnitude cost to upgrade for 21 miles of PPL EU owned line including the terminal cost at Alburtis, is **$140,000,000**.
   In order to provide additional capacity on the Alburtis-Branchburg 500kV line, PPL EU is proposing to rebuild the existing Alburtis-Branchburg 500kV line from a single circuit to a double circuit 500kV line between the two substations.

PPL EU will construct its portion of 21 miles with 1590 Kcmil ACSR triple bundle conductors for a 3000/3700 MVA summer normal/emergency ratings. The ratings are based on the conductor ratings and may be lower when the line is actually built. Additionally terminal equipment upgrade at Alburtis is also included in the cost. Cost also includes construction of a temporary 500kV line at the edge of the right of way during the double circuit 500kV construction.

PSE&G portion of the line (26 miles) and Branchburg terminal
The estimated cost to upgrade PSE&G's portion (26 miles) of the Alburtis – Branchburg 500kV circuit (5016), including terminal equipment, is **$85,000,000.** It will be re-conductored.

This estimate assumes no significant property, license or permitting issues, and no temporary 500kV line construction. Because no detailed engineering analysis has been performed, it also assumes no significant structural reinforcements and a sustained outage feasibility schedule.

2. Hosensack – Elroy 500kV line upgrade.

   PPL portion of line (Hosensack 500 kV terminal)
   The PPL EU magnitude cost estimate to expand the Hosensack 500kV switchyard is **$3,000,000.**

   PECO portion of line (18 mi. 500kV line and Elroy terminal)
   A new line must be constructed. The cost for a new 18 mile long 500kV line and the associated work at Elroy substation will be about **$40,000,000** not including right of way costs. Acquisition of new right of way could take up to seven years. If right of way was available the project would take 42 months to complete.

3. Frackville - Siegfried 230kV line upgrade - The estimated magnitude cost for this upgrade including substation terminal equipment cost is **$106,000,000**.

   In order to provide additional capacity on the Siegfried-Frackville 230kV line, PPL EU is proposing to rebuild the existing single circuit 230kV line to a double-circuit 230kV line between the two substations. The new line will be 41 miles long and will travel the existing right of way. The 230kV lines will be constructed with 1590 Kcmil ACSR conductors for a 653/793 MVA, summer normal/emergency ratings. The ratings are based on the conductor ratings and may be lower when the line is actually built.

4. Northwest - Mt Carmel - Conastone upgrade – This upgrade requires the construction of a new 500kV substation slightly north of the existing Northwest 230 kV station. This station will cut into the nearby Brighton – Conastone 500 kV line and consist of two 500/230kV transformers, four 500 kV circuit breakers, seven 230 kV circuit breakers, related substation equipment and land at a cost of **$70,000,000**. It also requires the reconductoring of the Conastone to Northwest #2322 line from the existing 1,272 kcmil ACSR to new 1,590kcmil ACSR with

an estimated cost of **$8,210,000**. This work would take 3-4 years to build the substation and 18-24 months (concurrently) for the line work**. (Note: This upgrade will suffice for overloads 5, 6 and 7 as well).**

5. Graceton - Bagley - Raphael upgrade – This upgrade requires Graceton station to add 6-230kV breakers with an estimated cost of **$10,000,000** and Raphael Road station to add 6-230kV breakers **$10,000,000**. It also requires rebuilding Graceton to Raphael Rd to double circuit 2-conductor bundled with an estimated cost of **$30,000,000**. This work would take an estimate of 2-3 years for the substation work concurrently with 5-6 years for the line work.

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