

#R02 Susquehanna 800 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 R02 project was studied as an 800 MW (capacity) injection at the Susquehanna 500 kV substation. Project R02 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)

1. The Alburdis – Branchburg 500 kV line is overloaded from 99% at 100% of its emergency rating (3734 MVA) for the outage of Branchburg to Elroy 500 kV line. The R02 project contributes approximately 65 MW to this overload.

Note: 100% loading is not an overload or a Planning Reliability Criteria violation and does not require upgrades. It is shown above because any change to increase loading will result in an upgrade requirement. Typically future studies (Impact, Facilities) for Queued projects will produce lower facility loadings.

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

No problems identified

Short Circuit

Will be performed for the Queue R02 Impact Study.

Stability Analysis

Will be performed for the Queue R02 Impact Study.

Contribution to Previously Identified Overloads

(Queue R02 contributes to the following contingency overloads, i.e. Network Impacts”, identified for earlier generation or transmission interconnection projects in the PJM Queue)

1. The Hosensack – Elroy 500 kV line is overloaded to 106% of its emergency rating (3734 MVA) for the outage of Alburdis – Branchburg 500 kV line. The R02 contributes approximately 177 MW to the overload.

2. The Conastone - Mt Carmel (line 2322) 230 kV line is overloaded at 133% of its emergency rating (803 MVA) for the **tower** outage of Brighton to Doubs and Brighton to Conastone 500 kV line. The R02 project contributes approximately 38 MW to this overload.
3. The Conastone - Mt Carmel (line 2310) 230 kV line is overloaded at 116% of its emergency rating (923 MVA) for the **tower** outage of Brighton to Doubs and Brighton to Conastone 500 kV line. The R02 project contributes approximately 38 MW to this overload.
4. The Mt Carmel – Northwest (line 2322) 230 kV line is overloaded at 130% of its emergency rating (803 MVA) for the **tower** outage of Brighton to Doubs and Brighton to Conastone 500 kV line. The R02 project contributes approximately 38 MW to this overload.
5. The Mt Carmel – Northwest (line 2310) 230 kV line is overloaded at 113% of its emergency rating (923 MVA) for the **tower** outage of Brighton to Doubs and Brighton to Conastone 500 kV line. The R02 project contributes approximately 38 MW to this overload.
6. The Graceton – Bagley – Raphael Road 230 kV line is overloaded at 143% of its emergency rating (659 MVA) for the **tower** outage of Brighton to Doubs and Brighton to Conastone 500 kV line. The R02 project contributes approximately 47 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 R02 generation)

1. Alburdis – Branchburg 500kV line upgrade.

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

The estimated magnitude cost to upgrade for 21 miles of PPL EU owned line including the terminal cost at Alburdis, is **\$140,000,000**.

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 Alburdis 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 Alburdis – Branchburg 500kV circuit (5016), including terminal equipment, is **\$85,000,000**. It will be re-conducted.

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.

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by Queue R02. Queue R02 may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)

1. 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.

2. 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 4, 5 and 6 as well).**
3. 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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