

Generation Interconnection

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

The Queue R81 project was studied as a 180 MW increase in Capacity Interconnection Rights at Emilie 230 kV substation for the existing Fords Mills (Fairless) generation. Project R81 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 only of the interconnection)

1. The Burlington – Mt. Laurel 230 kV line is overloaded from 93% to 104% of its emergency rating (844 MVA) for the outage of Croydon to Eddington Tap 230 kV line (Cont Id. PE55). The R81 project contributes approximately 90 MW to cause the thermal violation.
2. The Neshaminy – Byberry 138 kV line is overloaded from 94% to 105% of its emergency rating (719 MVA) for the outage of Croydon to Eddington Tap 230 kV line (Cont Id. PE55). The R81 project contributes approximately 77 MW to cause the thermal violation.

Multiple Facility Contingency

(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 were identified.

Short Circuit

Short circuit analysis is not required since there is no change to electrical characteristics of units.

Stability Analysis

Will be performed for the R81 Impact Study.

Contribution to Previously Identified Overloads

(R81 contributes to the following contingency overloads, i.e. “Network Impacts”, identified for earlier generation or transmission interconnection projects in the PJM Queue)

3. The Holmesburg Tap – Richmond 230 kV line is overloaded at 137% of its emergency rating (374 MVA) for the outage of Croydon to Burlington 230 kV line (Cont Id. PS59). The R81 project contributes approximately 83 MW to this overload.
4. The Richmond – Richmond 230 kV line is overloaded at 137% of its emergency rating (374 MVA) for the outage of Croydon to Burlington 230 kV line (Cont Id. PS59). The R81 project contributes approximately 83 MW to this overload.
5. The Emilie – Neshaminy 138 kV line is overloaded at 112% of its normal rating (550 MVA). The R81 project contributes approximately 51 MW to this overload.

6. The Croydon – Burlington 230 kV line is overloaded at **125%** of its emergency rating (558 MVA) for the outage of Croydon to Eddington Tap 230 kV line (Cont Id. PE55). The R81 project contributes approximately 90 MW to this overload.
7. The Richmond – Camden 230 kV line is overloaded at **107%** of its emergency rating (874 MVA) for the outage of Croydon - Burlington - Mt. Laurel - Coscorsner 230 kV line (Cont Id. PS59). The R81 project contributes approximately 23 MW to this overload.
8. The Three Mile Island 500/230 kV transformer is overloaded at **122%** of its emergency rating (1077 MVA) for the outage of Conastone to Peachbottom 500 kV line (Cont Id. PJM17). The R81 project contributes approximately 16 MW to this overload.
9. The Conastone - Mt Carmel (2322 line) 230 kV line is overloaded at **175%** of its emergency rating (803 MVA) for the **tower** outage of Brighton to Doubs and Brighton to Conastone 500 kV line (Cont Id. AP5). The R81 project contributes approximately 10 MW to this overload.
10. The Conastone - Mt Carmel (2310 line) 230 kV line is overloaded at **155%** of its emergency rating (923 MVA) for the **tower** outage of Brighton to Doubs and Brighton to Conastone 500 kV line (Cont Id. AP5). The R81 project contributes approximately 10 MW to this overload.
11. The Mt Carmel – Northwest (2322 line) 230 kV line is overloaded at **172%** of its emergency rating (803 MVA) for the **tower** outage of Brighton to Doubs and Brighton to Conastone 500 kV line (Cont Id. AP5). The R81 project contributes approximately 10 MW to this overload.
12. The Mt Carmel – Northwest (2310 line) 230 kV line is overloaded at **153%** of its emergency rating (923 MVA) for the **tower** outage of Brighton to Doubs and Brighton to Conastone 500 kV line (Cont Id. AP5). The R81 project contributes approximately 10 MW to this overload.
13. The Graceton – Bagley 230 kV line is overloaded at **205%** of its emergency rating (659 MVA) for the **tower** outage of Brighton to Doubs and Brighton to Conastone 500 kV line (Cont Id. AP5). The R81 project contributes approximately 13 MW to this overload.
14. The Bagley – Raphael Road 230 kV line is overloaded at **193%** of its emergency rating (659 MVA) for the **tower** outage of Brighton to Doubs and Brighton to Conastone 500 kV line (Cont Id. AP5). The R81 project contributes approximately 13 MW to this overload.

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. “Network Impacts”, initially caused by the addition of this project generation)

1. Burlington – Mt. Laurel 230 kV upgrade – This upgrade will require to re-conductor the circuit with 1590ACSS and replace terminal equipment at an estimated cost of **\$25M** and 24 months to complete.
2. Neshaminy – Byberry 138 kV upgrade - This upgrade will require replacement of terminal equipment. Approximately **\$3,000,000** and 24 months to complete.

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)

3. Holmesburg Tap - Richmond 230kV upgrade - This line is limited to 374 MVA by induction on the railroad signal equipment. Upgrading this line will require a study of the Amtrak electrical system and may require replacement of the Amtrak signal system. This cost is unknown at this time. Ignoring possible costly upgrades of the Amtrak equipment, the line can be upgraded by replacing the terminal equipment at Richmond. Approximately **\$2,000,000** and 24 months to complete.
4. Richmond – Richmond 230 kV upgrade – This upgrade requires Richmond 230kV reactor to be replaced. To complete, the cost estimate is **\$500,000** and time estimate is 8 months.
5. Emilie - Neshaminy 138kV upgrade – This upgrade requires the replacement of terminal equipment. Approximately **\$3,000,000** and 24 months to complete.
6. Croydon – Burlington 230 kV upgrade – This upgrade requires the Croydon to Burlington 230kV line river crossing to be reconducted. Approximately **\$5,000,000** and 30 months to complete.
7. Richmond – Camden 230 kV upgrade –
PECO estimate: Richmond to Camden 230kV line must be reconducted across the Delair Bridge (railroad river crossing). Approximately \$3,500,000 including terminal equipment at Richmond and 30 months to complete.
PSEG Estimate: This upgrade requires to re-conductor the circuit with 1590ACSS and replaces terminal equipment at an estimated cost of **\$7M** and 24 months to complete.
8. TMI 500-230 kV transformer upgrade – The estimated cost to add a second 500-230 kV transformer is **\$11,800,000** and the time required is approximately 20 months.
9. 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 also suffice the overloads 10, 11 and 12).**
13. 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. **(Note: This upgrade will also suffice for overload 14.).**