#R27 Frackville 52 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 R27 project was studied as a 52 MW (capacity) injection at the Frackville 69 kV substation. Project R27 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 Analysis
Will be performed for the Queue R27 Impact Study.

Stability Analysis
Will be performed for the Queue R27 Impact Study.

Contribution to Previously Identified Overloads

(Queue R27 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 123% of its emergency rating (3734 MVA) for the outage of Alburtis – Branchburg 500 kV line (Cont Id. PJM5). The R27 contributes approximately 7 MW to this overload.
2. The Alburtis – Branchburg 500 kV line is overloaded at 110% of its emergency rating (3734 MVA) for the outage of Hosensak - Elroy 500 kV line (Cont Id: PJM22). The R27 project contributes approximately 5 MW to this overload.
3. The R24 - Wescosville 500 kV line is overloaded at 142% of its emergency rating (3113 MVA) for the outage of Sunbury to Juniata 500 kV line (Cont Id. PJM69_WITH_R26A). The R27 project contributes approximately 13 MW to this overload.
4. The Susquehanna – R24 500 kV line is overloaded at 117% of its emergency rating (3113 MVA) for the outage of Sunbury to Juniata 500 kV line (Cont Id. PJM69_WITH_R26A). The R27 project contributes approximately 13 MW to this overload.

5. The Wescosville - Alburtis 500 kV line is overloaded at 142% of its emergency rating (3113 MVA) for the outage of Sunbury to Juniata 500 kV line (Cont Id. PJM69_WITH_R26A). The R27 project contributes approximately 17 MW to this overload.
6. The Alburtis - Hosensak 500 kV line is overloaded to 108% of its emergency rating (3145 MVA) for the outage of Alburtis – Branchburg 500 kV line (Cont Id. PJM5). The R27 contributes approximately 8 MW to the overload.
7. The R26 - Sunbury 500 kV line is overloaded at 117% of its emergency rating (3015 MVA) for the outage of Alburtis to Wescosville to Susquehanna ckt. (Cont Id. PJM66_WITH_R24A). The R27 project contributes approximately 5 MW to this overload.
8. The Sunbury - Juniata 500 kV line is overloaded at141% of its emergency rating (3113 MVA) for the outage of Alburtis to Wescosville to Susquehanna ckt. (Cont Id. PJM66_WITH_R24A). The R27 project contributes approximately 22 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 R27 generation)

None identified.

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by Queue R27. Queue R27 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 500 kV line and Hosensack terminal
   The PPL EU magnitude cost estimate to upgrade the Hosensack 500kV switchyard is **$3,000,000.**

   PECO portion of 500 kV line (18 mi.) 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. 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.

3. Queue R24 – Wescosville 500kV line Upgrade - The estimated magnitude cost for this upgrade including terminal equipment is $**287,000,000.**

   Description of Work:
   In order to provide additional capacity on the Queue R24 - Wescosville 500kV line, PPL EU is proposing to rebuild the Queue R24-Wescosville 500kV line from a single circuit to a double circuit 500kV line between the two substations. The total line length is approximately 42 miles and all owned by PPL EU. PPL EU will construct the new double circuit line 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 upgrades at Wescosville and R24 substation are also included in the cost. Wescosville 500kV substation is an existing GIS substation and its expansion poses some challenges due to the space limitation. Therefore additional expansion cost is added for the Wescosville 500kV substation. Cost also includes construction of a temporary 500kV line at the edge of the right of way during the double circuit 500kV construction.

4. Susquehanna – Queue R24 500kV line Upgrade - The estimated magnitude cost for this upgrade including the substation terminal equipment is $**169,000,000.**

   Description of Work:
   In order to provide additional capacity on the Susquehanna-R24 500kV line, PPL EU is proposing to rebuild the existing Susquehanna-R24 500kV line from a single circuit to a double circuit 500kV line between the two substations. The total line length is approximately 25 miles and owned by PPL EU. PPL EU will construct the new double circuit line 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 upgrades at Susquehanna and R24 substation are 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.

5. Wescosville – Alburtis 500kV line Upgrade - The estimated magnitude cost for this upgrade including the substation terminal equipment is $**85,000,000.**

   Description of Work:
   In order to provide additional capacity on the Wescosville-Alburtis 500kV line, PPL EU is proposing to rebuild the existing Wescosville-Alburtis 500kV line from a single circuit to a double circuit 500kV line between the two substations. The total line length is approximately 11 miles and owned by PPL EU. PPL EU will construct the new double circuit line 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 upgrades at Alburtis and Wescosville substation are also included in the cost. Wescosville 500kV substation is an existing GIS substation and its expansion poses some challenges due to space limitations. Therefore additional expansion cost is added for the Wescosville substation. Cost also includes construction of a temporary 500kV line at the edge of the right of way during the double circuit 500kV construction.

6. Alburtis – Hosensack 500kV line Upgrade - The estimated magnitude cost including the substation terminal equipment for this upgrade is $**39,000,000**.

   Description of work:
   In order to provide additional capacity on the Alburtis-Hosensack 500kV line, PPL EU is proposing to rebuild the existing Alburtis-Hosensack 500kV line from a single circuit to a double circuit 500kV line between the two substations. The total line length is approximately 5 miles and all owned by PPL EU. PPL EU will construct the new double circuit line 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. Cost also includes construction of a temporary 500kV line at the edge of the right of way during the double circuit 500kV construction.

7. R26 – Sunbury 500kV line Overload - The estimated magnitude cost for this upgrade including the substation terminal equipment is $**58,000,000**.

   Description of Work:
   In order to provide additional capacity on the R26-Sunbury 500kV line, PPL EU is proposing to rebuild the existing Sunbury-Susquehanna 230kV line from a single circuit to a double circuit 500kV line between the two substations. One Circuit of this will be operated at 230kV and the other at 500kV. The line will be approximately 8 miles long and will be constructed 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. Cost also includes construction of a temporary 500kV line at the edge of the right of way during the double circuit 500kV construction.

8. Sunbury – Juniata 500kV line Upgrade - The estimated magnitude cost for this upgrade including the substation terminal equipment is $**261,000,000**.

   Description of Work:
   In order to provide additional capacity on the Sunbury-Juniata 500kV line, PPL EU is proposing to rebuild the existing Sunbury-Juniata 500kV line from a single circuit to a double circuit 500kV line between the two substations. The total line length is approximately 38 miles and owned by PPL EU. PPL EU will construct the new double circuit line 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 upgrades at Sunbury and Juniata substation are also included in the cost. Sunbury 500kV substation expansion poses some challenges due to space limitations. Therefore additional expansion cost is added for the Sunbury 500kV substation. Cost also includes construction of a temporary 500kV line at the edge of the right of way during the double circuit 500kV construction.

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