Queue # Q34 - Garrett (Rockwood-Somerset) 115 kV

Generation Interconnection

Network Impacts

The **#Q34 project was studied as an injection of 100 MW (20 MW of capacity) into a tap of the Somerset-Rockwood 115 kV line.** Project #Q34 was evaluated for compliance with reliability criteria for summer peak conditions in 2011. Potential network impacts were as follows:

Generator Deliverability – at the 20 MW capacity value level

No problems identified.

New System Reinforcements

Multiple Facility Contingency – Reliability Requirements at the 100 MW full output level

1. The Hillclay-Hilltop 115 kV line is overloaded at around 116% (207.6 MVA) of its emergency rating (179 MVA) for the **tower outage** of the Homer City-Quemahoning 230 kV line and the Seward-Tower 115 kV line. The Q34 project contributes approximately 39 MW to the contingency facility loading.

   To mitigate this overload condition would require replacement/upgrade of the following:
   Hilltop Substation:
   Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)

2. The Rachel-Hillclay 115 kV line is overloaded at around 104% (191.4 MVA) of its emergency rating (184 MVA) for the **tower outage** of the Homer City-Quemahoning 230 kV line and the Seward-Tower 115 kV line. The Q34 project contributes approximately 43 MW to the contingency facility loading.

   To mitigate this overload condition would require replacement/upgrade of the following:
   Rachel Hill Substation:
   - **Replacement/upgrade of line/wave trap (estimated to cost approximately $115,000)**

3. The Somerset-Q34 Tap 115 kV line is overloaded at around 135% (214.6 MVA) of its emergency rating (159 MVA) for the **tower outage** of the two Muddy Run 230 kV lines. The Q34 project contributes approximately 70 MW to the contingency facility loading.

   To mitigate this overload condition would require replacement/upgrade of the following:
   Somerset Substation:
   - **Replacement/upgrade of a disconnect switch (estimated to cost approximately $90,000)**

- **Replacement/upgrade of 2 CT circuits (estimated to cost approximately $200,000)**
- **Replacement/upgrade of a line/wave trap (estimated to cost approximately $115,000)**
- **Replacement/upgrade of some substation conductor (estimated to cost approximately $125,000)**

Reconductor/upgrade of approximately 7.12 miles of the 8.12 miles of transmission line between Somerset and Rockwood (estimated to cost approximately $2,000,000)

Q34 Substation:

- **It is assumed that the new equipment to be installed will not be a limiting component.**

4. The Curryville-Saxton 115 kV line is overloaded at around 108% (193.3 MVA) of its emergency rating (179 MVA) for the **tower outage** of the Homer City-Quemahoning 230 kV line and the Seward-Tower 115 kV line. The Q34 project contributes approximately 14 MW to the contingency facility loading.

   To mitigate this overload condition would require replacement/upgrade of the following:
   Saxton Substation:
   - **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**
   - **Replacement/upgrade of a line/wave trap (estimated to cost approximately $115,000)**

Contribution to Previously Identified Overloads

5. The Penn Mar-Garrett 115 kV line is overloaded at around 114% (190.4 MVA) of its emergency rating (167 MVA) for the **tower outage** of the Homer City-Quemahoning 230 kV line and the Seward-Tower 115 kV line. The Q34 project contributes approximately 40 MW to the contingency facility loading. Overload was originally identified with the P60 project.

   To mitigate this overload condition would require replacement/upgrade of the following:
   Penn Mar Substation:
   - **Replacement/upgrade of line/wave trap (estimated to cost approximately $115,000)**

   Reconductor/upgrade of approximately 14.95 miles of transmission line between Penn Mar and Garrett (estimated to cost approximately $3,500,000)

6. The Hooversville-Tower 51 115 kV line is overloaded at around 101% (147.5 MVA) of its emergency rating (146 MVA) for the **tower outage** of the two Muddy Run 230 kV lines. The Q34 project contributes approximately 24 MW to the contingency facility loading. Overload was originally identified with the P60 project.

To mitigate this overload condition would require replacement/upgrade of the he following:
Hooversville Substation:

- **Replacement/upgrade of CT circuit (estimated to cost approximately $125,000)**

7. The Garrett 138/115 kV transformer is overloaded at around 176% (158.4 MVA) of its emergency rating (90 MVA) for the **tower outage** of the Juniata-Lewistown 230 kV line and the Juniata-Dauphin 230 kV line. The Q34 project contributes approximately 31 MW to the contingency facility loading. Overload was originally identified with the O17 project.

   To mitigate this overload condition would require replacement/upgrade of the following:

   Garrett substation:

   - **Replacement/upgrade of transformer, circuit breaker and substation conductor (estimated to cost approximately $1,750,000)**

8. The Garrett-Garrett 115 kV line is overloaded at around 164% (205 MVA) of its emergency rating (125 MVA) for the **tower outage** of the Homer City-Quemahoning 230 kV line and the Seward-Tower 115 kV line. The Q34 project contributes approximately 40 MW to the contingency facility loading. Overload was originally identified with the O48 project.

   To mitigate this overload condition would require replacement/upgrade of the following:
   Garrett Substation:

   - **Replacement/upgrade of substation conductor (estimated to cost approximately $175,000)**
   - **Replacement/upgrade of 4 CT circuits (estimated to cost approximately $400,000)**
   - **Replacement/upgrade of a disconnect switch (estimated to cost approximately $90,000)**
   - **Replacement/upgrade of a line/wave trap (estimated to cost approximately $115,000)**

   Reconductor/upgrade of approximately 1.9 miles of transmission line between Garrett tap and Garrett (estimated to cost approximately $450,000)

9. The Saxton-Snake Spring 115 kV line is overloaded at around 161% (199.6 MVA) of its emergency rating (124 MVA) for the **tower outage** of the two Muddy Run 230 kV lines. The Q34 project contributes approximately 9 MW to the contingency facility loading. Overload was originally identified with the P48 project.

   To mitigate this overload condition would require replacement/upgrade of the following:
   Saxton Substation:

- **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**
- **Replacement/upgrade of disconnect switch (estimated to cost approximately $80,000)**
- **Replacement/upgrade of a line/wave trap (estimated to cost approximately $115,000)**
- **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**

Reconductor/upgrade of approximately 18.1 miles of transmission line between Saxton and Snake Springs (estimated to cost approximately $4,600,000)

10. The Claysburg-Summit 115 kV line is overloaded at around 134% (195.6 MVA) of its emergency rating (146 MVA) for the **tower outage** of the two Muddy Run 230 kV lines. The Q34 project contributes approximately 8 MW to the contingency facility loading. Overload was originally identified with the P60 project.

    To mitigate this overload condition would require replacement/upgrade of the following:
    Claysburg Substation:
    - **Replacement/upgrade of a line/wave trap (estimated to cost approximately $115,000)**
    - **Replacement/upgrade of disconnect switch (estimated to cost approximately $80,000)**

    Summit Substation:
    - **Replacement/upgrade of a CT circuit (estimated to cost approximately $125,000)**
    - **Replacement/upgrade of a line/wave trap (estimated to cost approximately $115,000)**
    - **Replacement/upgrade of disconnect switch (estimated to cost approximately $80,000)**

11. The Scalp Level-Hooversville 115 kV line is overloaded at around 134% (239.8 MVA) of its emergency rating (179 MVA) for the **tower outage** of the Homer City-Quemahoning 230 kV line and the Seward-Tower 115 kV line. The Q34 project contributes approximately 43 MW to the contingency facility loading. Overload was originally identified with the P60 project.

    To mitigate this overload condition would require replacement/upgrade of the following:

    Reconductor/upgrade of approximately 6.92 miles of transmission line between Hooversville and Scalp Level (estimated to cost approximately $1,750,000)

Hooversville Substation:

- **Replacement/upgrade of a line/wave trap (estimated to cost approximately $115,000)**
- **Replacement/upgrade of a CT circuit (estimated to cost approximately $125,000)**
- **Replacement/upgrade of substation conductor (estimated to cost approximately $85,000)**

12. The Scalp Level-Rachel 115 kV line is overloaded at around 127% (227.3 MVA) of its emergency rating (179 MVA) for the **tower outage** of the Homer City-Quemahoning 230 kV line and the Seward-Tower 115 kV line. The Q34 project contributes approximately 43 MW to the contingency facility loading. Overload was originally identified with the P60 project.

    To mitigate this overload condition would require replacement/upgrade of the following:
    Rachel Hill Substation:

    - **Replacement/upgrade of a CT circuit (estimated to cost approximately $125,000)**
    - **Replacement/upgrade of a line/wave trap (estimated to cost approximately $115,000)**

    Reconductor/upgrade of approximately 2.7 miles of transmission line between Rachel Hill and Scalp Level (estimated to cost approximately $850,000)

13. The Rockwood-Penn Mar 115 kV line is overloaded at around 129% (184.5 MVA) of its emergency rating (143 MVA) for the **tower outage** of the Homer City-Quemahoning 230 kV line and the Seward-Tower 115 kV line. The Q34 project contributes approximately 40 MW to the contingency facility loading. Overload was originally identified with the P60 project.

    To mitigate this overload condition would require replacement/upgrade of the following:
    Rockwood Substation:

    - **Replacement/upgrade of a disconnect switch (estimated to cost approximately $80,000)**

    Reconductor/upgrade of approximately 14.7 miles of transmission line between Rockwood and Penn Mar (estimated to cost approximately $3,350,000)

    Penn Mar Substation:

    - **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**
    - **Replacement/upgrade of a circuit breaker (estimated to cost approximately $325,000)**
    - **Replacement/upgrade of line/wave trap (estimated to cost approximately $115,000)**

14. The Bedford North-P48 Tap 115 kV line is overloaded at around 115% (172.5 MVA) of its emergency rating (150 MVA) for the **tower outage** of the two Muddy Run 230 kV lines. The Q34 project contributes approximately 9 MW to the contingency facility loading. Overload was originally identified with the P48 project.

    To mitigate this overload condition would require replacement/upgrade of the following:

    Reconductor/upgrade of approximately 12.0 miles of the 21.76 miles of transmission line between Allegheny and Bedford North (estimated to cost approximately $3,000,000)

    P48 Substation:

    - **It is assumed that the equipment at this substation will not be a limiting component on this circuit.**

15. The Shelocta-Keystone 230 kV line is overloaded at around 111% (948 MVA) of its emergency rating (854 MVA) for the **tower outage** of the Juniata-Lewistown 230 kV line and the Juniata-Dauphin 230 kV line. The Q34 project contributes approximately 37 MW to the contingency facility loading. Overload was originally identified with the P28 project.

    To mitigate this overload condition would require replacement/upgrade of the following:
    Shelocta Substation:

    - **Replacement/upgrade of disconnect switch (estimated to cost approximately $150,000)**

    Reconductor/upgrade of approximately 2.26 miles of transmission line between Keystone and Shelocta (estimated to cost approximately $1,400,000)

    Keystone Substation:

    - **Replacement/upgrade of 2 CT circuits (estimated to cost approximately $280,000)**
    - **Replacement/upgrade of disconnect switch (estimated to cost approximately $150,000)**

16. The Homer City-Shelocta 230 kV line is overloaded at around 107% (913.8 MVA) of its emergency rating (854 MVA) for the **tower outage** of the Juniata-Lewistown 230 kV line and the Juniata-Dauphin 230 kV line. The Q34 project contributes approximately 30 MW to the contingency facility loading. Overload was originally identified with the O56 project.

    To mitigate this overload condition would require replacement/upgrade of the following:
    Shelocta Substation:

    - **Replacement/upgrade of a disconnect switch (estimated to cost approximately $85,000)**

Reconductor/upgrade of approximately 10.73 miles of transmission line between Homer City and Shelocta (estimated to cost approximately $4,800,000)

Contribution to Previously Identified System Reinforcements

To be determined in the System Impact Study.

Short Circuit

FirstEnergy completed a screening analysis of the Penelec 115kV circuit breaker interrupting duties in the area. This screening found that the Q34 project contributed to 21 breakers exceeding the screening criteria and therefore possibly exceeding their fault interrupting capability

Detailed studies will be performed during the System Impact Study and the results will be included in the System Impact Study report.

Potential Congestion Issues

PJM and FirstEnergy also studied the delivery of the energy portion of this interconnection request. The following analysis has been performed to inform the Interconnection Customer (Queue Q34) of potential congestion issues (operational restrictions) that may occur and affect the Q34 project's ability to operate at full output for certain system conditions. **The upgrades listed below are not required reliability upgrades for the Queue Q34 interconnection.** Please note that the number of facilities identified below as requiring upgrades is quite extensive – with a number of these facilities requiring reconductoring/rebuilding of transmission lines. Some of the reconductoring/rebuilding projects can be done in a "short" time frame while others are quite extensive and will require a "long" time to complete. In general, the time necessary to design and rebuild an extensive facility upgrade will take approximately 2-3 years to complete. If the Q34 Interconnection Customer wants to pursue construction of any of these upgrades, a separate "Transmission Interconnection" request must be submitted and the upgrades must be performed as merchant transmission projects.

Category A – Transmission System Impacts (Facilities monitored and operated by PJM)

Load flow model used for analysis: Generator Deliverability dispatch with all generators (in-service or active Queue generators preceding Q34) at 100% energy output and Peak summer loading (80/20 load forecast).

Q34 Operational considerations: The facilities below (potentially overloaded) are monitored and operated by PJM. PJM rules and methods for readjusting pre-contingency (N-1) dispatch will be followed if this system condition occurs. This may or may not cause curtailment of Q34 generation to below its 100% energy output.

None.

Category B – Underlying Transmission System Impacts (Facilities monitored and operated by Penelec)

Load flow model used for analysis: Generator Deliverability dispatch with all generators (in-service or active Queue generators preceding Q34) at 100% energy output and Peak summer loading (80/20 load forecast).

Q34 Operational considerations: The facilities below (potentially overloaded) are not monitored and operated by PJM. Penelec monitors these facilities in real time and will readjust the system according to Penelec's rules and methods if this system condition occurs. This may or may not cause curtailment of Q34 generation to below its 100% energy output.

1. The energy portion of #Q34 contributes approximately 7 MW to the previously identified **normal** overload on the Saxton – Snake Spring 115kV line (normal rating 90 MVA). Overload was originally identified with the P60 project.

   To mitigate this overload condition would require replacement/upgrade of the following:
   Saxton Substation:
   - **Replacement/upgrade of some substation conductor (estimated to cost approximately $100,000)**

Category C – Underlying Transmission System Impacts (Facilities monitored and operated by Penelec). These contingency overloads were not possible prior to the Queue Q24 project. The identified contingency overloads are caused directly by Q24 and are likely to cause Q24 curtailment to less than 100% energy output during summer and possibly winter operation.

Load flow model used for analysis: Generator Deliverability dispatch with all generators (in-service or active Queue generators preceding Q24) at 100% energy output and Peak summer loading (80/20 load forecast).

Q24 Operational considerations: The facilities below (potentially overloaded) are not monitored and operated by PJM. Penelec monitors these facilities in real time and will readjust the system according to Penelec's rules and methods if this system condition occurs. This may or may not cause curtailment of Q24 generation to below its 100% energy output.

None.