Queue # Q62 - Saxton-Snake Spring 115 kV
Generation Interconnection

Network Impacts

The **#Q62 project was studied as 2 options. Option 1 considers the injection of 100 MW (20 MW of capacity) into a tap of the Saxton-Snake Spring 115 kV line. Option 2 considers the injection of 100 MW (20 MW of capacity) into the Bedford North 115 kV station.** Project #Q62 was evaluated for compliance with reliability criteria for summer peak conditions in 2011. Potential network impacts were as follows:

Option 1:

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

NOTE: For Feasibility Studies, only double circuit (tower) outages are evaluated – not line fault and stuck breaker.

1. The Curryville-Claysburg 115 kV line is overloaded at around 121% (221.6 MVA) of its emergency rating (184 MVA) for the **tower outage** of the two Muddy Run 230 kV lines. The Q62 project contributes approximately 69 MW to the **contingency** facility loading.

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

   Claysburg Substation:

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

2. The P48 Tap-P60 Tap 115 kV line is overloaded at around 106% (159 MVA) of its emergency rating (150 MVA) for the **tower outage** of the Juniata-Lewisburg 230 kV line and the Juniata-Dauphin 230 kV line. The Q62 project contributes approximately 31 MW to the **contingency** facility loading.

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

   Reconductor/upgrade of approximately 15 miles of the 21.76 miles of transmission line between Allegheny and Bedford North (estimated to cost approximately $4,500,000)

3. The Hilltop-Rosedale 115 kV line is overloaded at around 102% (182.6 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 Q62 project contributes approximately 25 MW to the **contingency** facility loading.

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

- **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**

4. The Philipsburg-Q36 Tap 115 kV line is overloaded at around 101% (147.5 MVA) of its emergency rating (146 MVA) for the **tower outage** of Lackawanna-Stanton 230 kV line and the Lackawanna-Mountain 230 kV line. The Q62 project contributes approximately 9 MW to the **contingency** facility loading.

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

   - **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**

5. The Juniata-Lewistown 230 kV line is overloaded at around 101% (623.2 MVA) of its emergency rating (617 MVA) for the **tower outage** of Brighton-Doubs 500 kV line and the Brighton-Conastone 500 kV line. The Q62 project contributes approximately 14 MW to the **contingency** facility loading.

   To mitigate this overload would require replacement/upgrade of the following:
   Reconductor/upgrade of approximately 24.69 miles of the 25.74 miles of transmission line between Juniata and Lewistown (estimated to cost approximately $11,750,000)

6. The Lewistown-Raystown 230 kV line is overloaded at around 100% of its emergency rating (554 MVA) for the **tower outage** of the two Muddy Run 230 kV lines. The Q62 project contributes approximately 13 MW to the **contingency** facility loading.

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

   - **Replacement/upgrade of line/wave trap (estimated to cost approximately $125,000)**
   - **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**

Contribution to Previously Identified Overloads

1. The Somerset-Pride 115 kV line is overloaded at around 225% (337.5 MVA) of its emergency rating (150 MVA) for the **tower outage** of the Juniata-Lewisburg 230 kV line and the Juniata-Dauphin 230 kV line. The Q62 project contributes approximately 31 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the P60, Q04, Q53 and Q56 projects and under **normal** conditions for the energy portion of the P48, P60 and Q04 projects.

   To mitigate this overload would require replacement/upgrade of the following:
   Somerset Substation:
   - **Replacement/upgrade of a disconnect switch (estimated to cost approximately $80,000)**
   - **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 substation section 1 conductor (estimated to cost approximately $100,000)**
   - **Replacement/upgrade of substation section 2 conductor (estimated to cost approximately $100,000)**
   - **Replacement/upgrade of a circuit breaker (estimated to cost approximately $425,000)**

   Reconductor/upgrade of approximately 6.6 miles of the 11.08 miles of transmission line between Somerset and Allegheny (estimated to cost approximately $1,700,000)

   Pride Substation:
   - **It is assumed that the new substation will not have equipment that will be a limiting component.**

2. The Garrett 138/115 kV transformer is overloaded at around 215% (193.5 MVA) of its emergency rating (90 MVA) for the **tower outage** of the Juniata-Lewisburg 230 kV line and the Juniata-Dauphin 230 kV line. The Q62 project contributes approximately 12 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the O17, P48, P60, Q04, Q34, Q36, Q53 and Q56 projects and under **normal** conditions for the energy portion of the P48, Q04 and Q56 projects.

   To mitigate this overload would require replacement/upgrade of the following:
   Garrett Substation:
   - **Replacement/upgrade of 138-115 kV transformer, circuit breaker and substation conductor (estimated to cost approximately $1,750,000)**

3. The Garrett-Garrett 115 kV line is overloaded at around 203% (254 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 Q62 project contributes approximately 16 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the O48, P60, Q04, Q34, Q36, Q53 and Q56 projects and under **normal** conditions for the energy portion of the P48, P60 and Q04 projects.

   To mitigate this overload would require replacement/upgrade of the following:
   Garrett Tap:
   - **Replacement/upgrade of substation conductor (estimated to cost approximately $125,000)**
   - **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**
   - **Replacement/upgrade of a disconnect switch (estimated to cost approximately $80,000)**
   - **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)

   Garrett Substation:
   - **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**
   - **Replacement/upgrade of substation conductor (estimated to cost approximately $125,000)**
   - **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**
   - **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**
   - **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**

4. The Allegheny-P60 Tap 115 kV line is overloaded at around 176% (264 MVA) of its emergency rating (150 MVA) for the **tower outage** of the Juniata-Lewisburg 230 kV line and the Juniata-Dauphin 230 kV line. The Q62 project contributes approximately 31 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the P60, Q04, Q53 and Q56 projects and under **normal** conditions for the energy portion of the P60 and Q04 projects.

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

Allegheny Substation:

- **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**

Reconductor/upgrade of approximately 5 miles of the 21.76 miles of transmission line between Allegheny and Bedford North (estimated to cost approximately $1,300,000)

5. The Allegheny-Pride 115 kV line is overloaded at around 170% (255 MVA) of its emergency rating (150 MVA) for the **tower outage** of the Juniata-Lewisburg 230 kV line and the Juniata-Dauphin 230 kV line. The Q62 project contributes approximately 31 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the Q04, Q53 and Q56 projects and under **normal** conditions for the energy portion of the P60 and Q04 projects.

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

   - **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**

   Reconductor/upgrade of approximately 4.48 miles of the 11.08 miles of transmission line between Allegheny and Somerset (estimated to cost approximately $1,550,000)

6. The Rockwood-Penn Mar 115 kV line is overloaded at around 164% (234.5 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 Q62 project contributes approximately 16 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the P48, P60, Q04, Q34, Q36, Q53 and Q56 projects.

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

   - **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**
   - **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 $3,500,000)

Penn Mar Substation:

- **Replacement/upgrade of a circuit breaker (estimated to cost approximately $325,000)**
- **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)**
- **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**

7. The Hillclay-Hilltop 115 kV line is overloaded at around 171% (306.1 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 Q62 project contributes approximately 32 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the Q34, Q36, Q53 and Q56 projects.

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

   - **Replacement/upgrade of one CT circuit (estimated to cost approximately $100,000)**
   - **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**
   - **Replacement/upgrade of a second CT circuit (estimated to cost approximately $100,000)**
   - **Replacement/upgrade of a line/wave trap (estimated to cost approximately $115,000)**
   - **Replacement/upgrade of a circuit breaker (estimated to cost approximately $425,000)**

   Reconductor/upgrade of approximately 4.73 miles of transmission line between Hilltop and Hillclay Jct (estimated to cost approximately $1,450,000)

8. The Penn Mar-Garrett 115 kV line is overloaded at around 143% (238.8 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 Q62 project contributes approximately 16 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the Q34, Q36, Q53 and Q56 projects.

   To mitigate this overload would require replacement/upgrade of the following:
   Penn Mar Substation:

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

- **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**

Reconductor/upgrade of approximately 14.95 miles of transmission line between Penn Mar and Garrett (estimated to cost approximately $4,500,000)

9. The Scalp Level-Hooversville 115 kV line is overloaded at around 139% (248.8 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 Q62 project contributes approximately 10 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the P60, Q04 and Q34 projects.

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

   Reconductor/upgrade of approximately 6.92 miles of transmission line between Scalp Level and Hooversville (estimated to cost approximately $2,100,000)

10. The Scalp Level-Rachel Hill 115 kV line is overloaded at around 132% (236.3 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 Q62 project contributes approximately 10 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the P60, Q04 and Q34 projects.

    To mitigate this overload 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 line/wave trap (estimated to cost approximately $115,000)**
    - **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**

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

11. The Shelocta-Keystone 230 kV line is overloaded at around 135% (1153 MVA) of its emergency rating (854 MVA) for the **tower outage** of the Juniata-Lewisburg 230 kV line and the Juniata-Dauphin 230 kV line. The Q62 project contributes approximately 45 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the P28, P45A, P47, P48, P60, Q04, Q24, Q34, Q36, Q53 and Q56 projects.

    To mitigate this overload would require replacement/upgrade of the following:
    Shelocta Substation:
    - **Replacement/upgrade of a disconnect switch (estimated to cost approximately $150,000)**
    - **Replacement/upgrade of substation section 1 conductor (estimated to cost approximately $100,000)**
    - **Replacement/upgrade of substation section 2 conductor (estimated to cost approximately $100,000)**

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

    Keystone Substation:
    - **Replacement/upgrade of a disconnect switch (estimated to cost approximately $150,000)**
    - **Replacement/upgrade of one CT circuit (estimated to cost approximately $140,000)**
    - **Replacement/upgrade of a second CT circuit (estimated to cost approximately $140,000)**
    - **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**

12. The Homer City-Shelocta 230 kV line is overloaded at around 126% (1076 MVA) of its emergency rating (854 MVA) for the **tower outage** of the Juniata-Lewisburg 230 kV line and the Juniata-Dauphin 230 kV line. The Q62 project contributes approximately 36 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the O56, O72, P22, P28, P45A, P47, P48, P60, Q04, Q24, Q34, Q36, Q53 and Q56 projects.

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

- **Replacement/upgrade of a disconnect switch (estimated to cost approximately $150,000)**
- **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**

Reconductor/upgrade of approximately 10.73 miles of transmission line between Homer City and Shelocta (estimated to cost approximately $5,500,000)

Homer City Substation:

- **Replacement/upgrade of a CT circuit (estimated to cost approximately $130,000)**
- **Replacement/upgrade of a line/wave trap (estimated to cost approximately $125,000)**
- **Replacement/upgrade of a circuit breaker (estimated to cost approximately $425,000)**
- **Replacement/upgrade of a disconnect switch (estimated to cost approximately $150,000)**

13. The Keystone 500/230 kV #4 transformer is overloaded at around 120% (558 MVA) of its emergency rating (465 MVA) for the **tower outage** of the Juniata-Lewisburg 230 kV line and the Juniata-Dauphin 230 kV line. The Q62 project contributes approximately 22 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the P22, P28, P45A, P47, P48, P60, Q04, Q36, Q53 and Q56 projects.

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

    - **Replacement/upgrade of the 500-230 kV transformer and substation conductor (estimated to cost approximately $5,500,000)**

14. The Keystone 500/230 kV #3 transformer is overloaded at around 120% (565.2 MVA) of its emergency rating (471 MVA) for the **tower outage** of the Juniata-Lewisburg 230 kV line and the Juniata-Dauphin 230 kV line. The Q62 project contributes approximately 22 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the P22, P28, P45A, P47, P48, P60, Q04, Q36, Q53 and Q56 projects.

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

    - **Replacement/upgrade of the 500-230 kV transformer and substation conductor (estimated to cost approximately $5,500,000)**

15. The Claysburg-Summit 115 kV line is overloaded at around 226% (330 MVA) of its emergency rating (146 MVA) for the **tower outage** of the two Muddy Run 230 kV lines. The Q62 project contributes approximately 42 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the P60, Q04, Q34 and Q56 projects and under **normal** conditions for the energy portion of the Q04 project.

    To mitigate this overload 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 substation conductor (estimated to cost approximately $100,000)**
    - **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**
    - **Replacement/upgrade of a disconnect switch (estimated to cost approximately $80,000)**

    Reconductor/upgrade of approximately 12.13 miles of transmission line between Claysburg and Summit (estimated to cost approximately $3,750,000)

    Summit 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)**
    - **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**
    - **Replacement/upgrade of a circuit breaker (estimated to cost approximately $425,000)**
    - **Replacement/upgrade of a disconnect switch (estimated to cost approximately $80,000)**

16. The Saxton-Q62 Tap 115 kV line is overloaded at around 217% (269.1 MVA) of its emergency rating (124 MVA) for the **tower outage** of the two Muddy Run 230 kV lines. The Q62 project contributes approximately 69 MW to the **contingency** facility loading. **NOTE:** The Snake Spring-Q62 Tap 115 kV line is previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the P60, Q04 and Q34 projects at around 161% of its emergency rating (124 MVA) for the **tower outage** of the two Muddy Run 230 kV lines. The Q62 project does not contribute to the contingency facility loading.

To mitigate this overload would require replacement/upgrade of the following:
<u>Saxton Substation:</u>

- **Replacement/upgrade of substation section 1 conductor (estimated to cost approximately $125,000)**
- **Replacement/upgrade of a disconnect switch (estimated to cost approximately $85,000)**
- **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**
- **Replacement/upgrade of line/wave trap (estimated to cost approximately $115,000)**
- **Replacement/upgrade of substation section 2 conductor (estimated to cost approximately $100,000)**

Reconductor/upgrade of approximately 2 miles of the 18.1 miles of transmission line between Saxton and Snake Springs (estimated to cost approximately $600,000)

17. The Curryville-Saxton 115 kV line is overloaded at around 135% (241.6 MVA) of its emergency rating (179 MVA) for the **tower outage** of the two Muddy Run 230 kV lines. The Q62 project contributes approximately 69 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the Q04 and Q34 projects.

    To mitigate this overload would require replacement/upgrade of the following:
    <u>Saxton Substation:</u>

    - **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)**
    - **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**

    Reconductor/upgrade of approximately 1 mile of the 6.17 miles of transmission line between Curryville and Saxton (estimated to cost approximately $300,000)

18. The Rachel Hill-Hillclay 115 kV line is overloaded at around 109% (200.5 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 Q62 project contributes approximately 10 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the Q34 project.

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

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

19. The Westfall-Q53 Tap 115 kV line is overloaded at around 109% (249.6 MVA) of its emergency rating (229 MVA) for the **tower outage** of the two Muddy Run 230 kV lines. The Q62 project contributes approximately 12 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the Q53 and Q56 projects and under **normal** conditions for the energy portion of the Q56 project.

    To mitigate this overload would require replacement/upgrade of the following:
    <u>Westfall Substation:</u>

    - **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**

20. The Tower 51-Hooversville 115 kV line is overloaded at around 107% (156.2 MVA) of its emergency rating (146 MVA) for the **tower outage** of the two Muddy Run 230 kV lines. The Q62 project contributes approximately 10 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the Q34 project.

    To mitigate this overload would require replacement/upgrade of the following:
    <u>Hooversville Substation:</u>

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

21. The Glory-Dixonville 115 kV line is overloaded at around 106% (131.4 MVA) of its emergency rating (124 MVA) for the **tower outage** of the Juniata-Lewisburg 230 kV line and the Juniata-Dauphin 230 kV line. The Q62 project contributes approximately 6 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the O56, O72, P01, P22, P28, P48, P60, Q04 and Q56 projects and under **normal** conditions for the energy portion of the P60 and Q04 projects.

    To mitigate this overload would require replacement/upgrade of the following:
    <u>Glory Substation:</u>

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

22. The Raystown-Altoona 230 kV line is overloaded at around 103% (570.6 MVA) of its emergency rating (554 MVA) for the **tower outage** of the two Muddy Run 230 kV lines. The Q62 project contributes approximately 12 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the O72, P01, P22, P45A, P48, P60, Q04, Q34, Q36, Q53 and Q56 projects.

    To mitigate this overload would require replacement/upgrade of the following:
    Altoona Substation:
    - **Replacement/upgrade of a line/wave trap (estimated to cost approximately $125,000)**

Contribution to Previously Identified System Reinforcements

To be determined in the System Impact Study.

Short Circuit

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

There are several wind generation plants proposed in the general area of the Q62 project, each with only 20% of their peak output level considered as a Capacity Resource, and the remaining 80% as energy only resource. If all of the wind generation plants are at their maximum out put level simultaneously, a significant number of the 115 kV and 230 kV facilities, and many underlying system facilities are likely to be overloaded, restricting operation to a lower output level.

PJM and FirstEnergy studied the delivery of the energy portion of this interconnection request. The following analysis has been performed to inform the Interconnection Customer (Queue Q62) of potential congestion issues (operational restrictions) that may occur and affect the Q62 project's ability to operate at full output for certain system conditions. **The upgrades listed below are not required reliability upgrades for the Queue Q62 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 Q62 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 Q62) at 100% energy output and Peak summer loading (80/20 load forecast).

Q62 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 Q62 generation to below its 100% energy output.

1. The Raystown-Altoona 230 kV line loads to approximately 103% (570.6 MVA) of its emergency rating (554 MVA) for the outage of the Homer City-Keystone 230 kV line. The energy portion of Q62 contributes approximately 16 MW to this **contingency** overload condition which was previously identified as a potential congestion issue for the energy portion of the O72, P01, P22, P45A, P48, P60, Q04 and Q56 projects.

   To mitigate this overload would require replacement/upgrade of the following:
   Altoona Substation:
   - **Replacement/upgrade of line/wave trap (estimated to cost approximately $125,000)**

2. The Homer City-Shelocta 230 kV line loads to approximately 103% (879.6 MVA) of its emergency rating (854 MVA) for the outage of the Handsome Lake-Wayne 345 kV line. The energy portion of Q62 contributes approximately 30 MW to this **contingency** overload condition which was previously identified as a potential congestion issue for the energy portion of the O56, O72, P22, P28, P45A, P47, P48, P60, Q04 and Q24 projects.

   To mitigate this overload would require replacement/upgrade of the following:
   Shelocta Substation:
   Replacement/upgrade of a disconnect switch (estimated to cost approximately $80,000)

3. The Lewistown-Raystown 230 kV line loads to approximately 100% (554 MVA) of its emergency rating (554 MVA) for the outage of the Homer City-Keystone 230 kV line. The energy portion of Q62 contributes approximately 16 MW to this **contingency** overload condition which was previously identified as a potential congestion issue for the energy portion of the O72, P45A, P48, P60 and Q04 projects.

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

- **Replacement/upgrade of line/wave trap (estimated to cost approximately $125,000)**
- **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**

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 Q62) at 100% energy output and Peak summer loading (80/20 load forecast).

Q62 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 Q62 generation to below its 100% energy output.

4. The Garrett-Garrett 115 kV line loads to approximately 111% (99.9 MVA) of its normal rating (90 MVA). The energy portion of Q62 contributes approximately 9 MW to this **normal** overload condition which was previously identified as a potential congestion issue for the energy portion of the Q04 project.

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

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

5. The energy portion of Q62 contributes approximately 56 MW to the previously identified **normal** overload of the Saxton-Q62 Tap 115 kV line which was previously identified as a potential congestion issue (Saxton-Snake Spring 115 kV Line) for the energy portion of the P60, Q04 and Q34 projects.

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

   - **Replacement/upgrade of substation section 1 conductor (estimated to cost approximately $100,000)**
   - **Replacement/upgrade of a disconnect switch (estimated to cost approximately $85,000)**

- **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**
- **Replacement/upgrade of line/wave trap (estimated to cost approximately $115,000)**
- **Replacement/upgrade of substation section 2 conductor (estimated to cost approximately $125,000)**

Reconductor/upgrade of approximately 2 miles of the 18.1 miles of transmission line between Saxton and Snake Springs (estimated to cost approximately $600,000)

6. The energy portion of Q62 contributes approximately 56 MW to the previously identified **contingency** overload of the Saxton-Q62 Tap 115 kV line for the outage of the Johnstown-N39 Tap 230 kV line which was previously identified as a potential congestion issue for the energy portion of the P48 and Q04 projects.

   To mitigate this overload would require replacement/upgrade of the following:
   Saxton Substation:
   - **Replacement/upgrade of substation conductor (estimated to cost approximately $75,000)**
   - **Replacement/upgrade of a disconnect switch (estimated to cost approximately $80,000)**
   - **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**
   - **Replacement/upgrade of line/wave trap (estimated to cost approximately $115,000)**
   - **Replacement/upgrade of substation conductor (estimated to cost approximately $125,000)**

   Reconductor/upgrade of approximately 2 miles of the 18.1 miles of transmission line between Saxton and Snake Springs (estimated to cost approximately $600,000)

7. The energy portion of Q62 contributes approximately 33 MW to the previously identified **normal** overload of the Claysburg-Summit 115 kV line which was previously identified as a potential congestion issue for the energy portion of the Q04 project.

   To mitigate this overload 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 substation conductor (estimated to cost approximately $100,000)**

- **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**
- **Replacement/upgrade of a disconnect switch (estimated to cost approximately $80,000)**

Reconductor/upgrade of approximately 12.13 miles of transmission line between Claysburg and Summit (estimated to cost approximately $3,750,000)

Summit 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)**
- **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**
- **Replacement/upgrade of a circuit breaker (estimated to cost approximately $425,000)**
- **Replacement/upgrade of a disconnect switch (estimated to cost approximately $80,000)**

8. The energy portion of Q62 contributes approximately 33 MW to the previously identified **contingency** overload of the Claysburg-Summit 115 kV line for the outage of the Johnstown-N39 Tap 230 kV line which was previously identified as a potential congestion issue for the energy portion of the Q04 project.

To mitigate this overload 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 substation conductor (estimated to cost approximately $100,000)**
- **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**
- **Replacement/upgrade of a disconnect switch (estimated to cost approximately $80,000)**

Reconductor/upgrade of approximately 12.13 miles of transmission line between Claysburg and Summit (estimated to cost approximately $3,750,000)

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 substation conductor (estimated to cost approximately $100,000)**
- **Replacement/upgrade of a circuit breaker (estimated to cost approximately $425,000)**
- **Replacement/upgrade of a disconnect switch (estimated to cost approximately $80,000)**

9. The energy portion of Q62 contributes approximately 12 MW to the previously identified **contingency** overload of the Garrett-Garrett 115 kV line for the outage of the Homer City-Keystone 230 kV line which was previously identified as a potential congestion issue for the energy portion of the O48, P60, Q04 and Q56 projects.

   To mitigate this overload would require replacement/upgrade of the following:
   Garrett Tap Substation:
   - **Replacement/upgrade of substation conductor (estimated to cost approximately $125,000)**
   - **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**
   - **Replacement/upgrade of a disconnect switch (estimated to cost approximately $80,000)**
   - **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)

   Garrett Substation:
   - **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**
   - **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**
   - **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**
   - **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**
   - **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**

10. The energy portion of Q62 contributes approximately 9 MW to the previously identified **normal** overload of the Garrett 138/115 kV transformer which was previously identified as a potential congestion issue for the energy portion of the P48, Q04 and Q56 projects.

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

- **Replacement/upgrade of 138-115 kV transformer, circuit breaker and substation conductor (estimated to cost approximately $1,750,000)**

11. The energy portion of Q62 contributes approximately 10 MW to the previously identified **normal** overload of the Westfall-Q53 Tap 115 kV line which was previously identified as a potential congestion issue for the energy portion of the Q56 project.

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

    - **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**

12. The energy portion of Q62 contributes approximately 10 MW to the previously identified **contingency** overload of the Westfall-Q53 Tap 115 kV line for the outage of the Johnstown-N39 Tap 230 kV line which was previously identified as a potential congestion issue for the energy portion of the Q53 and Q56 projects.

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

    - **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**

13. The energy portion of Q62 contributes approximately 8 MW to the previously identified **contingency** overload of the Philipsburg-Q36 Tap 115 kV line for the outage of the Altoona-Lewistown 230 kV line which was previously identified as a potential congestion issue for the energy portion of the Q56 project.

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

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

14. The energy portion of Q62 contributes approximately 5 MW to the previously identified **contingency** overload of the Glory-Dixonville 115 kV line for the outage of the Handsome Lake-Wayne 345 kV line which was previously

identified as a potential congestion issue for the energy portion of the O56, O72, P01, P22, P28, P48, P60, Q04 and Q56 projects.

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

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

15. The Glory-Dixonville 115 kV line loads to approximately 101% (90.9 MVA) of its normal rating (90 MVA). The energy portion of Q62 contributes approximately 5 MW to this **normal** overload condition which was previously identified as a potential congestion issue for the energy portion of the P60 and Q04 projects.

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

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

16. The energy portion of Q62 contributes approximately 10 MW to the previously identified **contingency** overload of the Summit-Q53 Tap 115 kV line for the outage of the Johnstown-N39 Tap 230 kV line which was previously identified as a potential congestion issue for the energy portion of the Q56 project.

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

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

17. The Somerset-Pride 115 kV line loads to approximately 101% (116.1 MVA) of its normal rating (115 MVA). The energy portion of Q62 contributes approximately 25 MW to this **normal** overload condition which was previously identified as a potential congestion issue for the energy portion of the P48, P60 and Q04 projects.

    To mitigate this overload would require replacement/upgrade of the following:
    Reconductor/upgrade of approximately 6.5 miles of the 11.08 miles of transmission line between Somerset and Allegheny (estimated to cost approximately $1,700,000)

Category C – Underlying Transmission System Impacts (Facilities monitored and operated by Penelec). These contingency overloads were not possible prior to the Queue Q62 project. The identified contingency overloads are caused directly by Q62 and are likely to cause Q62 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 Q62) at 100% energy output and Peak summer loading (80/20 load forecast).

Q62 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 Q62 generation to below its 100% energy output.

18. The Philipsburg-Q36 Tap 115 kV line loads to approximately 100% (125 MVA) of its normal rating (125 MVA). The energy portion of Q62 contributes approximately 7 MW to this **normal** overload condition.

    To mitigate this overload would require replacement/upgrade of the following:
    Philipsburg Substation:
    - **Replacement/upgrade of substation conductor (estimated to cost approximately $125,000)**

19. The Summit-Q53 Tap 115 kV line loads to approximately 102% (179.5 MVA) of its normal rating (176 MVA). The energy portion of Q62 contributes approximately 10 MW to this **normal** overload condition.

    To mitigate this overload would require replacement/upgrade of the following:
    Summit Substation:
    - **Replacement/upgrade of substation conductor (estimated to cost approximately $125,000)**

Option 2:

Generator Deliverability – at the 20 MW capacity value level
No problems identified.

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

NOTE: For Feasibility Studies, only double circuit (tower) outages are evaluated – not line fault and stuck breaker.

1. The Curryville-Claysburg 115 kV line is overloaded at around 110% (202.4 MVA) of its emergency rating (184 MVA) for the **tower outage** of the two Muddy Run 230 kV lines. The Q62 project contributes approximately 49 MW to the **contingency** facility loading.

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

2. The P48 Tap-P60 Tap 115 kV line is overloaded at around 119% (178.5 MVA) of its emergency rating (150 MVA) for the **tower outage** of the Juniata-Lewisburg 230 kV line and the Juniata-Dauphin 230 kV line. The Q62 project contributes approximately 50 MW to the **contingency** facility loading.

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

   Reconductor/upgrade of approximately 15 miles of the 21.76 miles of transmission line between Allegheny and Bedford North (estimated to cost approximately $4,500,000)

3. The Hilltop-Rosedale 115 kV line is overloaded at around 104% (186.2 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 Q62 project contributes approximately 27 MW to the **contingency** facility loading.

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

4. The Hooversville-Somerset 115 kV line is overloaded at around 108% (193.3 MVA) of its emergency rating (179 MVA) for the **tower outage** of the two Muddy Run 230 kV lines. The Q62 project contributes approximately 10 MW to the **contingency** facility loading.

   To mitigate this overload would require replacement/upgrade of the following:
   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 $100,000)**

Somerset Substation:

- **Replacement/upgrade of CT circuit (estimated to cost approximately $100,000)**

5. The Philipsburg-Q36 Tap 115 kV line is overloaded at around 100% (146 MVA) of its emergency rating (146 MVA) for the **tower outage** of Lackawanna-Stanton 230 kV line and the Lackawanna-Mountain 230 kV line. The Q62 project contributes approximately 8 MW to the **contingency** facility loading.

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

6. The Juniata-Lewistown 230 kV line is overloaded at around 100% (617 MVA) of its emergency rating (617 MVA) for the **tower outage** of Brighton-Doubs 500 kV line and the Brighton-Conastone 500 kV line. The Q62 project contributes approximately 13 MW to the **contingency** facility loading.

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

   Reconductor/upgrade of approximately 24.69 miles of the 25.74 miles of transmission line between Juniata and Lewistown (estimated to cost approximately $11,750,000)

7. The Lewistown-Raystown 230 kV line is overloaded at around 100% of its emergency rating (554 MVA) for the **tower outage** of the two Muddy Run 230 kV lines. The Q62 project contributes approximately 12 MW to the **contingency** facility loading.

   To mitigate this overload would require replacement/upgrade of the following:
   Lewistown Substation:
   - **Replacement/upgrade of a line/wave trap (estimated to cost approximately $125,000)**
   - **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**

8. The North Bedford-Snake Spring 115 kV line is overloaded at around 130% (195 MVA) of its emergency rating (150 MVA) for the **tower outage** of the two Muddy Run 230 kV lines. The Q62 project contributes approximately 50 MW to the **contingency** facility loading.

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

   Reconductor/upgrade of approximately 7.05 miles of transmission line between Bedford North and Snake Springs (estimated to cost approximately $1,600,000)

   Bedford North 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

1. The Somerset-Pride 115 kV line is overloaded at around 238% (357 MVA) of its emergency rating (150 MVA) for the **tower outage** of the Juniata-Lewisburg 230 kV line and the Juniata-Dauphin 230 kV line. The Q62 project contributes approximately 50 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the P60, Q04, Q53 and Q56 projects and under **normal** conditions for the energy portion of the P48, P60 and Q04 projects.

   To mitigate this overload would require replacement/upgrade of the following:
   Somerset Substation:
   - **Replacement/upgrade of a disconnect switch (estimated to cost approximately $80,000)**
   - **Replacement/upgrade of a CT circuit (estimated to cost approximately $125,000)**
   - **Replacement/upgrade of line/wave trap (estimated to cost approximately $115,000)**
   - **Replacement/upgrade of substation section 1 conductor (estimated to cost approximately $100,000)**
   - **Replacement/upgrade of substation section 2 conductor (estimated to cost approximately $100,000)**
   - **Replacement/upgrade of a circuit breaker (estimated to cost approximately $425,000)**

Reconductor/upgrade of approximately 6.6 miles of the 11.08 miles of transmission line between Allegheny and Somerset (estimated to cost approximately $1,700,000)

2. The Garrett 138/115 kV transformer is overloaded at around 218% (196.2 MVA) of its emergency rating (90 MVA) for the **tower outage** of the Juniata-Lewisburg 230 kV line and the Juniata-Dauphin 230 kV line. The Q62 project contributes approximately 15 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the O17, P48, P60, Q04, Q34, Q36, Q53 and Q56 projects and under **normal** conditions for the energy portion of the P48, Q04 and Q56 projects.

   To mitigate this overload would require replacement/upgrade of the following:
   Garrett Substation:
   - **Replacement/upgrade of the 138-115 kV transformer, circuit breaker and substation conductor (estimated to cost approximately $1,750,000)**

3. The Garrett-Garrett 115 kV line is overloaded at around 207% (258.8 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 Q62 project contributes approximately 21 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the O48, P60, Q04, Q34, Q36, Q53 and Q56 projects and under **normal** conditions for the energy portion of the P48, P60 and Q04 projects.

   To mitigate this overload would require replacement/upgrade of the following:
   Garrett Tap Substation:
   - **Replacement/upgrade of substation conductor (estimated to cost approximately $125,000)**
   - **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**
   - **Replacement/upgrade of disconnect switch (estimated to cost approximately $80,000)**
   - **Replacement/upgrade of 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)

   Garrett Substation:
   - **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**

- **Replacement/upgrade of substation conductor (estimated to cost approximately $125,000)**
- **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**
- **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**
- **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**

4. The Allegheny-P60 Tap 115 kV line is overloaded at around 189% (283.5 MVA) of its emergency rating (150 MVA) for the **tower outage** of the Juniata-Lewisburg 230 kV line and the Juniata-Dauphin 230 kV line. The Q62 project contributes approximately 50 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the P60, Q04, Q53 and Q56 projects and under **normal** conditions for the energy portion of the P60 and Q04 projects.

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

   Reconductor/upgrade of approximately 5 miles of the 21.76 miles of transmission line between Allegheny and Bedford North (estimated to cost approximately $1,300,000)

5. The Allegheny-Pride 115 kV line is overloaded at around 183% (274.5 MVA) of its emergency rating (150 MVA) for the **tower outage** of the Juniata-Lewisburg 230 kV line and the Juniata-Dauphin 230 kV line. The Q62 project contributes approximately 50 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the Q04, Q53 and Q56 projects and under **normal** conditions for the energy portion of the P60 and Q04 projects.

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

   Reconductor/upgrade of approximately 6.6 miles of the 11.08 miles of transmission line between Allegheny and Somerset (estimated to cost approximately $1,550,000)

6. The Rockwood-Penn Mar 115 kV line is overloaded at around 167% (238.8 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 Q62 project contributes approximately 21 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the P48, P60, Q04, Q34, Q36, Q53 and Q56 projects.

   To mitigate this overload would require replacement/upgrade of the following:
   Rockwood Substation:
   - **Replacement/upgrade of a disconnect switch (estimated to cost approximately $80,000)**
   - **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**

   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 circuit breaker (estimated to cost approximately $325,000)**
   - **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)**
   - **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**

7. The Hillclay-Hilltop 115 kV line is overloaded at around 174% (311.5 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 Q62 project contributes approximately 36 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the Q34, Q36, Q53 and Q56 projects.

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

- **Replacement/upgrade of a line/wave trap (estimated to cost approximately $115,000)**
- **Replacement/upgrade of a circuit breaker (estimated to cost approximately $425,000)**

Reconductor/upgrade of approximately 4.73 miles of transmission line between Hilltop and Hillclay Jct (estimated to cost approximately $1,450,000)

8. The Penn Mar-Garrett 115 kV line is overloaded at around 146% (243.8 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 Q62 project contributes approximately 21 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the Q34, Q36, Q53 and Q56 projects.

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

   Reconductor/upgrade of approximately 14.95 miles of transmission line between Penn Mar and Garrett (estimated to cost approximately $4,500,000)

9. The Scalp Level-Hooversville 115 kV line is overloaded at around 146% (261.3 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 Q62 project contributes approximately 23 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the P60, Q04 and Q34 projects.

   To mitigate this overload 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 $2,100,000)

   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 $100,000)**

- **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**

10. The Scalp Level-Rachel Hill 115 kV line is overloaded at around 139% (248.8 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 Q62 project contributes approximately 23 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the P60, Q04 and Q34 projects.

    To mitigate this overload 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)**
    - **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**

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

11. The Shelocta-Keystone 230 kV line is overloaded at around 135% (1153 MVA) of its emergency rating (854 MVA) for the **tower outage** of the Juniata-Lewisburg 230 kV line and the Juniata-Dauphin 230 kV line. The Q62 project contributes approximately 44 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the P28, P45A, P47, P48, P60, Q04, Q24, Q34, Q36, Q53 and Q56 projects.

    To mitigate this overload would require replacement/upgrade of the following:
    Shelocta Substation:
    - **Replacement/upgrade of a disconnect switch (estimated to cost approximately $150,000)**
    - **Replacement/upgrade of substation section 1 conductor (estimated to cost approximately $100,000)**
    - **Replacement/upgrade of substation section 2 conductor (estimated to cost approximately $100,000)**

    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 one CT circuit (estimated to cost approximately $140,000)**
- **Replacement/upgrade of a disconnect switch (estimated to cost approximately $150,000)**
- **Replacement/upgrade of a second CT circuit (estimated to cost approximately $140,000)**
- **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**

12. The Homer City-Shelocta 230 kV line is overloaded at around 126% (1076 MVA) of its emergency rating (854 MVA) for the **tower outage** of the Juniata-Lewisburg 230 kV line and the Juniata-Dauphin 230 kV line. The Q62 project contributes approximately 36 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the O56, O72, P22, P28, P45A, P47, P48, P60, Q04, Q24, Q34, Q36, Q53 and Q56 projects.

    To mitigate this overload would require replacement/upgrade of the following:
    Shelocta Substation:
    - **Replacement/upgrade of a disconnect switch (estimated to cost approximately $150,000)**
    - **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**

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

    Homer City Substation:
    - **Replacement/upgrade of a line/wave trap (estimated to cost approximately $125,000)**
    - **Replacement/upgrade of a CT circuit (estimated to cost approximately $130,000)**
    - **Replacement/upgrade of a circuit breaker (estimated to cost approximately $425,000)**
    - **Replacement/upgrade of a disconnect switch (estimated to cost approximately $150,000)**

13. The Keystone 500/230 kV #4 transformer is overloaded at around 120% (558 MVA) of its emergency rating (465 MVA) for the **tower outage** of the Juniata-Lewisburg 230 kV line and the Juniata-Dauphin 230 kV line. The Q62 project contributes approximately 22 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the P22, P28, P45A, P47, P48, P60, Q04, Q36, Q53 and Q56 projects.

To mitigate this overload would require replacement/upgrade of the following:
<u>Keystone Substation:</u>

- **Replacement/upgrade of 500-230 kV transformer, a circuit breaker and substation conductor (estimated to cost approximately $5,500,000)**

14. The Keystone 500/230 kV #3 transformer is overloaded at around 120% (565 MVA) of its emergency rating (471 MVA) for the **tower outage** of the Juniata-Lewisburg 230 kV line and the Juniata-Dauphin 230 kV line. The Q62 project contributes approximately 22 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the P22, P28, P45A, P47, P48, P60, Q04, Q36, Q53 and Q56 projects.

    To mitigate this overload would require replacement/upgrade of the following:
    <u>Keystone Substation:</u>

    - **Replacement/upgrade of 500-230 kV transformer, a circuit breaker and substation conductor (estimated to cost approximately $5,500,000) and will take approximately 2 years to complete.**

15. The Claysburg-Summit 115 kV line is overloaded at around 219% (319.7 MVA) of its emergency rating (146 MVA) for the **tower outage** of the two Muddy Run 230 kV lines. The Q62 project contributes approximately 31 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the P60, Q04, Q34 and Q56 projects and under **normal** conditions for the energy portion of the Q04 project.

    To mitigate this overload would require replacement/upgrade of the following:
    <u>Claysburg Substation:</u>

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

    Reconductor/upgrade of approximately 12.13 miles of transmission line between Claysburg and Summit (estimated to cost approximately $3,750,000)

    <u>Summit Substation:</u>

- **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)**
- **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**
- **Replacement/upgrade of a circuit breaker (estimated to cost approximately $425,000)**

16. The Saxton-Snake Spring 115 kV line is overloaded at around 201% (249.2 MVA) of its emergency rating (124 MVA) for the **tower outage** of the two Muddy Run 230 kV lines. The Q62 project contributes approximately 50 MW to the contingency facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the P60, Q04 and Q34 projects.

    To mitigate this overload would require replacement/upgrade of the following:
    Saxton Substation:
    - **Replacement/upgrade of substation section 1 conductor (estimated to cost approximately $125,000)**
    - **Replacement/upgrade of a disconnect switch (estimated to cost approximately $85,000)**
    - **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)**
    - **Replacement/upgrade of substation section 2 conductor (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 $5,500,000)

    Snake Springs Substation:
    - **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**

17. The Curryville-Saxton 115 kV line is overloaded at around 124% (222 MVA) of its emergency rating (179 MVA) for the **tower outage** of the two Muddy Run 230 kV lines. The Q62 project contributes approximately 49 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the Q04 and Q34 projects.

    To mitigate this overload 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)**

18. The Rachel Hill-Hillclay 115 kV line is overloaded at around 116% (213.4 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 Q62 project contributes approximately 23 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the Q34 project.

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

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

19. The Westfall-Q53 Tap 115 kV line is overloaded at around 108% (247.3 MVA) of its emergency rating (229 MVA) for the **tower outage** of the two Muddy Run 230 kV lines. The Q62 project contributes approximately 10 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the Q53 and Q56 projects and under **normal** conditions for the energy portion of the Q56 project.

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

    - **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**

    Westfall Substation:

    - **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**

20. The Tower 51-Hooversville 115 kV line is overloaded at around 112% (163.5 MVA) of its emergency rating (146 MVA) for the **tower outage** of the two Muddy Run 230 kV lines. The Q62 project contributes approximately 16 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the Q34 project.

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

Tower 51 Substation:

- **Replacement/upgrade of a disconnect switch (estimated to cost approximately $80,000)**
- **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**

Hooversville Substation:

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

21. The Glory-Dixonville 115 kV line is overloaded at around 106% (131.4 MVA) of its emergency rating (124 MVA) for the **tower outage** of the Juniata-Lewisburg 230 kV line and the Juniata-Dauphin 230 kV line. The Q62 project contributes approximately 6 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the O56, O72, P01, P22, P28, P48, P60, Q04 and Q56 projects and under **normal** conditions for the energy portion of the P60 and Q04 projects.

    To mitigate this overload would require replacement/upgrade of the following:
    Glory Substation:
    - **Replacement/upgrade of substation conductor (estimated to cost approximately $125,000)**

22. The Raystown-Altoona 230 kV line is overloaded at around 103% (570.6 MVA) of its emergency rating (554 MVA) for the **tower outage** of the two Muddy Run 230 kV lines. The Q62 project contributes approximately 12 MW to the **contingency** facility loading which was previously identified as a potential congestion issue under **contingency** conditions for the energy portion of the O72, P01, P22, P45A, P48, P60, Q04, Q34, Q36, Q53 and Q56 projects.

    To mitigate this overload would require replacement/upgrade of the following:
    Altoona Substation:
    - **Replacement/upgrade of a line/wave trap (estimated to cost approximately $125,000)**

Contribution to Previously Identified System Reinforcements

To be determined in the System Impact Study.

Short Circuit

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

There are several wind generation plants proposed in the general area of the Q62 project, each with only 20% of their peak output level considered as a Capacity Resource, and the remaining 80% as energy only resource. If all of the wind generation plants are at their maximum out put level simultaneously, a significant number of the 115 kV and 230 kV facilities, and many underlying system facilities are likely to be overloaded, restricting operation to a lower output level.

PJM and FirstEnergy studied the delivery of the energy portion of this interconnection request. The following analysis has been performed to inform the Interconnection Customer (Queue Q62) of potential congestion issues (operational restrictions) that may occur and affect the Q62 project's ability to operate at full output for certain system conditions. **The upgrades listed below are not required reliability upgrades for the Queue Q62 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 Q62 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 Q62) at 100% energy output and Peak summer loading (80/20 load forecast).

Q62 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 Q62 generation to below its 100% energy output.

1. The Raystown-Altoona 230 kV line loads to approximately 103% (570.6 MVA) of its emergency rating (554 MVA) for the outage of the Homer City-Keystone 230 kV line. The energy portion of Q62 contributes approximately 15 MW to this **contingency** overload condition which was previously identified as a potential congestion issue for the energy portion of the O72, P01, P22, P45A, P48, P60, Q04 and Q56 projects.

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

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

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 Q62) at 100% energy output and Peak summer loading (80/20 load forecast).

Q62 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 Q62 generation to below its 100% energy output.

2. The energy portion of Q62 contributes approximately 40 MW to the previously identified **normal** overload of the Saxton-Snake Spring 115 kV line which was previously identified as a potential congestion issue for the energy portion of the P60, Q04 and Q34 projects.

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

- **Replacement/upgrade of substation section 1 conductor (estimated to cost approximately $125,000)**
- **Replacement/upgrade of a disconnect switch (estimated to cost approximately $85,000)**
- **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)**
- **Replacement/upgrade of substation section 2 conductor (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 $5,500,000)

Snake Springs Substation:

- **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**

3. The Saxton-Snake Spring 115 kV line loads to approximately 133% (165 MVA) of its emergency rating (124 MVA) for the **contingency** outage of the Johnstown-N39 Tap 230 kV line. The energy portion of Q62 contributes approximately 40 MW to this condition which was previously identified as a potential congestion issue for the energy portion of the P48 and Q04 projects.

   To mitigate this overload would require replacement/upgrade of the following:
   Saxton Substation:
   - **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**
   - **Replacement/upgrade of a disconnect switch (estimated to cost approximately $85,000)**

   Reconductor/upgrade of approximately 18.1 miles of transmission line between Saxton and Snake Springs (estimated to cost approximately $5,500,000)

4. The energy portion of Q62 contributes approximately 25 MW to the previously identified **normal** overload of the Claysburg-Summit 115 kV line which was previously identified as a potential congestion issue for the energy portion of the Q04 project.

   To mitigate this overload 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 substation conductor (estimated to cost approximately $100,000)**
   - **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**

   Reconductor/upgrade of approximately 12.13 miles of transmission line between Claysburg and Summit (estimated to cost approximately $3,750,000)

   Summit 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)**
   - **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**
   - **Replacement/upgrade of a circuit breaker (estimated to cost approximately $425,000)**

5. The energy portion of Q62 contributes approximately 25 MW to the previously identified **contingency** overload of the Claysburg-Summit 115 kV line for the outage of the Johnstown-N39 Tap 230 kV line which was previously identified as a potential congestion issue for the energy portion of the Q04 project.

   To mitigate this overload 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 substation conductor (estimated to cost approximately $100,000)**
   - **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**

   Reconductor/upgrade of approximately 12.13 miles of transmission line between Claysburg and Summit (estimated to cost approximately $3,600,000)

   Summit 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)**
   - **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**
   - **Replacement/upgrade of a circuit breaker (estimated to cost approximately $425,000)**

6. The energy portion of Q62 contributes approximately 14 MW to the previously identified **contingency** overload of the Garrett-Garrett 115 kV line for the outage of the Homer City-Keystone 230 kV line which was previously identified as a potential congestion issue for the energy portion of the O48, P60, Q04 and Q56 projects.

   To mitigate this overload would require replacement/upgrade of the following:
   Garrett Tap Substation:
   - **Replacement/upgrade of substation conductor (estimated to cost approximately $125,000)**
   - **Replacement/upgrade of a CT circuit (estimated to cost approximately $100,000)**
   - **Replacement/upgrade of a disconnect switch (estimated to cost approximately $80,000)**
   - **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)

Garrett Substation:

- **Replacement/upgrade of one CT circuit (estimated to cost approximately $100,000)**
- **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**
- **Replacement/upgrade of a second CT circuit (estimated to cost approximately $100,000)**
- **Replacement/upgrade of a third CT circuit (estimated to cost approximately $100,000)**
- **Replacement/upgrade of a fourth CT circuit (estimated to cost approximately $100,000)**

7. The Garrett-Garrett 115 kV line loads to approximately 114% (102.6 MVA) of its normal rating (90 MVA). The energy portion of Q62 contributes approximately 11 MW to this **normal** overload condition which was previously identified as a potential congestion issue for the energy portion of the Q04 project.

   To mitigate this overload would require replacement/upgrade of the following:
   Garrett Substation:
   - **Replacement/upgrade of substation conductor (estimated to cost approximately $125,000)**

8. The energy portion of Q62 contributes approximately 11 MW to the previously identified **normal** overload of the Garrett 138/115 kV transformer which was previously identified as a potential congestion issue for the energy portion of the P48, Q04 and Q56 projects.

   To mitigate this overload would require replacement/upgrade of the following:
   Garrett Substation:
   - **Replacement/upgrade of 138-115 kV transformer, circuit breaker and substation conductor (estimated to cost approximately $1,750,000)**

9. The energy portion of Q62 contributes approximately 8 MW to the previously identified **normal** overload of the Westfall-Q53 Tap 115 kV line which was previously identified as a potential congestion issue for the energy portion of the Q56 project.

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

- **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**

Westfall Substation:

- **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**

10. The energy portion of Q62 contributes approximately 9 MW to the previously identified **contingency** overload of the Westfall-Q53 Tap 115 kV line for the outage of the Johnstown-N39 Tap 230 kV line which was previously identified as a potential congestion issue for the energy portion of the Q53 and Q56 projects.

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

    - **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**

    Westfall Substation:

    - **Replacement/upgrade of substation conductor (estimated to cost approximately $100,000)**

11. The energy portion of Q62 contributes approximately 7 MW to the previously identified **contingency** overload of the Philipsburg-Q36 Tap 115 kV line for the outage of the Altoona-Lewistown 230 kV line which was previously identified as a potential congestion issue for the energy portion of the Q56 project.

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

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

12. The energy portion of Q62 contributes approximately 8 MW to the previously identified **contingency** overload of the Glory-Dixonville 115 kV line for the outage of the Handsome Lake -Wayne 345 kV line which was previously identified as a potential congestion issue for the energy portion of the O56, O72, P01, P22, P28, P48, P60, Q04 and Q56 projects.

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

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

13. The Glory-Dixonville 115 kV line loads to approximately 101% (90.9 MVA) of its normal rating (90 MVA). The energy portion of Q62 contributes approximately 5 MW to this **normal** overload condition which was previously identified as a potential congestion issue for the energy portion of the P60 and Q04 projects.

    To mitigate this overload would require replacement/upgrade of the following:
    Glory Substation:
    - **Replacement/upgrade of substation conductor (estimated to cost approximately $125,000)**

14. The Allegheny-P60 Tap 115 kV line loads to approximately 111% (127.7 MVA) of its normal rating (115 MVA). The energy portion of Q62 contributes approximately 40 MW to this **normal** overload condition which was previously identified as a potential congestion issue for the energy portion of the P60 and Q04 projects.

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

    Reconductor/upgrade of approximately 5 miles of the 21.76 miles of transmission line between Allegheny and Bedford North (estimated to cost approximately $1,500,000)

15. The Allegheny-Pride 115 kV line loads to approximately 104% (120 MVA) of its normal rating (115 MVA). The energy portion of Q62 contributes approximately 40 MW to this **normal** overload condition which was previously identified as a potential congestion issue for the energy portion of the P60 and Q04 projects.

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

    Reconductor/upgrade of approximately 4.48 miles of the 11.08 miles of transmission line between Allegheny and Somerset (estimated to cost approximately $1,550,000)

16. The energy portion of Q62 contributes approximately 9 MW to the previously identified **contingency** overload of the Summit-Q53 Tap 115 kV line for the outage of the Johnstown-N39 Tap 230 kV line which was previously identified as a potential congestion issue for the energy portion of the Q56 project.

    To mitigate this overload would require replacement/upgrade of the following:
    Summit Substation:
    - **Replacement/upgrade of substation conductor (estimated to cost approximately $125,000)**

17. The Somerset-Pride 115 kV line loads to approximately 118% (135.7 MVA) of its normal rating (115 MVA). The energy portion of Q62 contributes approximately 40 MW to this **normal** overload condition which was previously identified as a potential congestion issue for the energy portion of the P48, P60 and Q04 projects.

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

    Reconductor/upgrade of approximately 6.6 miles of the 11.08 miles of transmission line between Somerset and Allegheny (estimated to cost approximately $1,700,000)

Category C – Underlying Transmission System Impacts (Facilities monitored and operated by Penelec). These contingency overloads were not possible prior to the Queue Q62 project. The identified contingency overloads are caused directly by Q62 and are likely to cause Q62 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 Q62) at 100% energy output and Peak summer loading (80/20 load forecast).

Q62 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 Q62 generation to below its 100% energy output.

18. The Summit-Q53 Tap 115 kV line loads to approximately 101% (of its normal rating (176 MVA). The energy portion of Q62 contributes approximately 8 MW to this **normal** overload condition.

    To mitigate this overload would require replacement/upgrade of the following:
    Summit Substation:
    - **Replacement/upgrade of substation conductor (estimated to cost approximately $125,000)**