P60 - New Baltimore 115 kV
Generation Interconnection

Network Impacts

The #P60 project was studied as an injection of 150 MW (30 MW of capacity) into a tap of Allegheny to P48 Tap 115 kV circuit. Project #P60 was evaluated for compliance with reliability criteria for summer peak conditions in 2010. Potential network impacts are as follows:

Generator Deliverability – at the 30 MW capacity value level

No problem identified.

Multiple Facility Contingency – Reliability Requirements at the 150 MW full output level

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

1. The Somerset - Pride line is overloaded to approximately 150% of its emergency rating (150 MVA) for the **tower outage** of the Juniata - Lewistown 230kV line and the Juniata – Dauphin 230kV line. The P60 project contributes approximately 105 MW to the contingency facility loading.
   To mitigate this overload condition would require upgrade/replacement of equipment at the Somerset substation (line trap, disconnect switch, current transformer circuit and substation conductor) and approximately 6.5 miles of the 11.1 miles of transmission line conductor between Somerset and Allegheny substations.

   Somerset Substation

   - line/wave trap – estimated to cost approximately $115,000
   - disconnect switch – estimated to cost approximately $80,000
   - CT circuit – estimated to cost approximately $125,000
   - substation conductor – estimated to cost approximately $100,000

   The upgrade/replacement of the transmission line conductor between Somerset and Pride substations (6.6 miles) is estimated to cost approximately $1,700,000

2. The Scalp Level – Hooversville 115 kV line is overloaded to approximately 125% of its emergency rating (179 MVA) for the **tower outage** of the Homer City - Quemahoning 230kV line and the Seward – Tower 51 115kV line. The P60 project contributes approximately 54 MW to the contingency facility loading.
   To mitigate this overload condition would require upgrade/replacement of equipment at the Hooversville substation (line trap, current transformer circuit and substation conductor) and 6.92 miles of transmission line conductor between Scalp Level and Hooversville substations.

   Hooversville Substation

   - line/wave trap - estimated to cost approximately $115,000
   - CT circuit - estimated to cost approximately $125,000
   - substation conductor - estimated to cost approximately $85,000

   The upgrade/replacement of the transmission line conductor between Scalp Level and Hooversville substations is estimated to cost approximately $1,750,000.

3. The Claysburg – Summit 115 kV line is overloaded to approximately 121% of its emergency rating (146 MVA) for the **tower outage** of the Homer City - Quemahoning 230kV line and the Seward – Tower 51 115 kV line. The P60 project contributes approximately 42 MW to the contingency facility loading.
   To mitigate this overload condition would require upgrade/replacement of the equipment at the Summit substation (a CT circuit and a disconnect switch) and the upgrade/replacement of equipment at Claysburg Substation (a disconnect switch).
   Summit Substation
   - CT circuit - estimated to cost approximately $125,000
   - disconnect switch - estimated to cost approximately $80,000

   Claysburg Substation
   - disconnect switch - estimated to cost approximately $80,000

4. The Scalp Level – Rachel Hill 115 kV line is overloaded to approximately 118% of its emergency rating (179 MVA) for the **tower outage** of the Homer City - Quemahoning 230kV line and the Seward – Tower 51 115 kV line. The P60 project contributes approximately 54 MW to the contingency facility loading.
   To mitigate this overload condition would require upgrade/replacement of the equipment at the Rachel Hill substation (line trap and current transformer circuit).
   Rachel Hill Substation
   - line/wave trap - estimated to cost approximately $115,000
   - CT circuit - estimated to cost approximately $125,000

5. The Bedford North – P48 Tap 115 kV line is overloaded to approximately 110% of its emergency rating (150 MVA) for the **tower outage** of the 220-06 line and the 220-07 line. The P60 project contributes approximately 45 MW to the contingency facility loading.
   To mitigate this overload condition would require upgrade/replacement of 12 miles of the 21.76 miles of transmission line conductor between Bedford North and Allegheny substations. The upgrade/replacement of the transmission line from Bedford North to P48 Tap (approximately 12 miles) is estimated to cost approximately $3,000,000.

6. The Rockwood – Penn-Mar 115kV line loads to 109% of its emergency rating (143 MVA) for the **tower outage** of the Homer City - Quemahoning 230kV line and the Seward – Tower 51 115 kV line. The project P60 contributes approximately 39 MW to this condition.
   To mitigate this overload condition would require upgrade/replacement of the equipment at the Rockwood substation (disconnect switch) and equipment at the Penn Mar substation (current transformer circuit and a circuit breaker).
   Rockwood Substation
   - disconnect switch - estimated to cost approximately $80,000

   Penn Mar Substation
   - CT circuit - estimated to cost approximately 125,000
   - circuit breaker - estimated to cost approximately $225,000

7. The Saxton – Snake SP 115kV line loads to 107% of its emergency rating (124 MVA) for the **tower outage** of the Homer City - Quemahoning 230kV line and the Seward – Tower 51 115 kV line. The project P60 contributes approximately 53 MW to this condition.
   To mitigate this overload condition would require upgrade/replacement of the equipment at the Saxton substation (substation conductor).
   Saxton Substation
   - substation conductor - estimated to cost approximately $75,000

8. The Allegheny – P60 Tap 115kV line loads to 100.2% of its emergency rating (150 MVA) for the **tower outage** of the Juniata - Lewistown 230kV line and the Juniata – Dauphin 230kV line. The project P60 contributes approximately 105 MW to this condition.
   To mitigate this overload condition would require upgrade/replacement of approximately 5 miles of the 21.76 miles of transmission line between Allegheny and Bedford North substations. The upgrade/replacement of the transmission line conductor from Allegheny to P60 Tap (approximately 5 miles) is estimated to cost approximately $1,300,000.

Contribution to Previously Identified Overloads (prior projects in P queue)

1. The Garret 115 kV/138kV transformer is overloaded to approximately 166% of its emergency rating (92 MVA) for the **tower outage** of the Homer City - Quemahoning 230kV line and the Seward – Tower 51 115 kV line. The P60 project contributes approximately 39 MW to the contingency facility loading.
   To mitigate this overload condition would require upgrade/replacement of the equipment at the Garrett substation (transformer and possibly a breaker and substation conductor).
   Garrett Substation
   - transformer and breaker replacement - estimated to cost approximately $1,750,000

New System Reinforcements

Contribution to Previously Identified System Reinforcements (projects prior to P queue)

None.

Short Circuit

Under review by FirstEnergy. It will be completed in the Impact Study.

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 P60) of potential congestion issues (operational restrictions) that may occur and affect the P60 project's ability to operate at full output for certain system conditions. **The upgrades listed below are not required reliability upgrades for the Queue P60 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 P60 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 P60) at 100% energy output and Peak summer loading (80/20 load forecast).

P60 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 P60 generation to below its 100% energy output.

1. The P60 project contributes approximately 48 MW to the overloading of the Keystone 500/230kV transformer #4 (131% of its 465 MVA summer emergency rating) for the outage of the Keystone 500/230kV transformer #3, which was previously identified as a potential congestion issue for the energy portion of P22, P28, P45A, P47 and P48 projects. To mitigate this overload would require replacement of the existing 500-230 kV transformer rated at 436 MVA summer normal / 465 MVA summer emergency with a new transformer. It is estimated that this upgrade will cost $5,500,000 and take approximately 2 years to complete.
2. The P60 project contributes approximately 48 MW to the overloading of the Keystone 500/230kV transformer #3 (130% of its 471 MVA summer emergency rating) for the outage of the Keystone 500/230kV transformer #4, which was previously identified as a potential congestion issue for the energy portion of P22, P28, P45A, P47 and P48 projects. To mitigate this overload would require replacement of the existing 500-230 kV transformer rated at 440 MVA summer normal / 471 MVA summer emergency with a new transformer. It is estimated that this upgrade will cost $5,500,000 and take approximately 2 years to complete.
3. The P60 project contributes approximately 56 MW to the overloading of the Homer City-Shelocta 230 kV line for the outage of the Erie W. to Wayne 345 kV circuit, which was previously identified as a potential congestion issue for the energy portion of the O56, O72, P22, P28, P45A, P47 and P48 projects. The Homer City-Shelocta 230 kV line is rated at 694 MVA summer normal / 854 MVA summer emergency. The loading on this 230 kV line during the **contingency** condition reaches 1033 MVA (or 121% of its 854 MVA rating). To mitigate this overload would require replacement/upgrade of a disconnect switch at Shelocta (estimated to cost approximately $85,000), 10.73 miles of transmission line (estimated to cost approximately $4,800,000), a line/wave trap at Homer City (estimated to cost approximately $125,000), a CT circuit at Homer City (estimated to cost approximately $100,000) and a circuit breaker at Homer City (estimated to cost approximately $425,000)

4. The P60 project contributes 18 MW to the overloading of the Lewistown - Juniata 230 kV line (105% of its normal rating of 499 MVA) under base case (normal rating) conditions. The Lewistown-Juniata 230 kV line is rated at 499 MVA summer normal / 617 MVA summer emergency. The loading on this 230 kV line during the **normal** condition reaches 524 MVA (or 105% of its 499 MVA rating). To mitigate this overload would require replacement/upgrade of 24.69 miles of transmission line between Lewistown and Juniata (estimated to cost approximately $11,750,000) and replacement of a disconnect switch at Juniata (estimated to cost approximately $100,000).

5. The P60 project contributes 19 MW to the overloading of the Lewistown - Juniata 230 kV line (112% of its emergency rating of 617 MVA) for the outage of Juniata to Keystone 500 kV line, which was previously identified as a potential congestion issue for the O38, O72, P45A, P47 and P48 projects. The Lewistown-Juniata 230 kV line is rated at 499 MVA summer normal / 617 MVA summer emergency. The loading on this 230 kV line during the **contingency** condition reaches 691 MVA (or 112% of its 617 MVA rating). To mitigate this overload would require replacement/upgrade of 24.69 miles of 230 kV transmission line between Lewistown and Juniata (estimated to cost approximately $11,750,000), 1.05 miles of transmission line between Lewistown and Juniata (estimated to cost approximately $500,000) and the upgrade/replacement of a disconnect switch at Juniata (estimated to cost approximately $100,000).

6. The P60 project contributes 60 MW to the overloading of the Shelocta – Keystone 230 kV line (108% of its normal rating of 694MVA) under base case (normal rating) conditions. The Shelocta-Keystone 230 kV line is rated at 694 MVA summer normal / 854 MVA summer emergency. The loading on this 230 kV line during the **normal** condition reaches 749 MVA (or 108% of its 694 MVA rating). To mitigate this overload would require replacement/upgrade of the disconnect switches at Shelocta and Keystone substations and is estimated to cost approximately $150,000, replacement of CTs at Keystone (estimated to cost approximately $140,000) and reconductoring approximately 2.26 miles of transmission line between Shelocta and Keystone (estimated to cost approximately $1,400,000).

7. The P60 project contributes 66 MW to the overloading of the Shelocta – Keystone 230 kV line (120% of its emergency rating of 854 MVA) for the outage of the Erie W. to Wayne 115 kV circuit, which was previously identified as a potential congestion issue for the energy portion of the P28, P45A, P47 and P48 projects. The Shelocta-Keystone 230 kV line is rated at 694 MVA summer normal / 854 MVA summer emergency. The loading on this 230 kV line during the **contingency** condition reaches 1025 MVA (or 120% of its 854 MVA rating). To mitigate this overload would require replacement/upgrade of the disconnect switches at Shelocta and Keystone substations and is estimated to cost approximately $150,000, replacement of CTs at Keystone (estimated to cost approximately $140,000) and reconductoring approximately 2.26 miles of transmission line between Shelocta and Keystone (estimated to cost approximately $1,400,000).

8. The P60 project contributes 28 MW to the previously identified overload of the Lewistown -Raystown 230 kV line for the outage of the Homer City-Shelocta-Keystone 230 kV circuit, which was previously identified as a potential

congestion issue for the energy portion of the O72 project. The Lewistown-Raystown 230 kV line is rated at 478 MVA summer normal / 554 MVA summer emergency. The loading on this 230 kV line during the **contingency** condition reaches 609 MVA (or 110% of its 554 MVA rating). To mitigate this overload would require replacement/upgrade of the line/wave trap at Lewistown (estimated to cost approximately $125,000), a CT circuit at Lewistown (estimated to cost approximately $100,000), and a circuit breaker at Lewistown (estimated to cost approximately $425,000).

9. The P60 project contributes 22 MW to the overloading of the Altoona - Raystown 230 kV line (113% of its 554 MVA summer emergency rating) for the outage of the Homer-Shelocta-Keystone 230 kV circuit, which was previously identified as a potential congestion issue for the energy portion of the #O72, P01, P45A and P48 projects. The Altoona-Raystown 230 kV line is rated at 488 MVA summer normal / 554 MVA summer emergency. The loading on this 230 kV line during the **contingency** condition reaches 626 MVA (or 113% of its emergency rating of 554 MVA). To mitigate this overload would require replacement/upgrade of the line/wave trap at Altoona substation (estimated to cost approximately $125,000) and the upgrade/reconductor of 17.01 miles of transmission line between Altoona and Raystown substations (estimated to cost approximately $7,500,000).
10. The P60 project contributes 9 MW to the overloading of the Altoona–N39/O38/P22 Tap 230 kV line (101% of its 617 MVA summer emergency rating) for the outage of the Juniata-Keystone 500 kV circuit, which was previously identified as a potential congestion issue for the energy portion of the O38, O72, P22 and P28 projects. The Altoona-N39/O38/P22 230 kV line is rated at 499 MVA summer normal / or 617 MVA summer emergency. The loading on this 230 kV line during the **contingency** condition reaches 620 MVA (or 101% of its 617 MVA rating). To mitigate this overload would require replacement/upgrade of the approximately 16 miles of 230 kV transmission line conductor between Altoona substation and N39/O38/P22 Tap (estimated to cost approximately $7,200,000).

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 P60) at 100% energy output and Peak summer loading (80/20 load forecast).

P60 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 P60 generation to below its 100% energy output.

11. The P60 project contributes 13 MW to the previously identified overload of the Glory-Dixonville 115 kV line for the outage of the Homer City-Shelocta-Keystone 230 kV circuit, which was previously identified as a potential congestion issue for the energy portion of the O56, O72, P01, P22, P28 and P48 projects. The Glory-Dixonville East 115 kV line is rated at 90 MVA summer normal / 124 MVA summer emergency. The loading on this 115 kV line during the **contingency** condition reaches 171 MVA (or 138% of its 124 MVA rating). To mitigate this

overload would require replacement/upgrade of the substation conductor at Glory Substation and is estimated to cost approximately $125,000 and the replacement of a disconnect switch at Glory Substation (estimated to cost approximately $80,000).

12. The energy portion of the P60 project contributes 104 MW to the previously identified overload of the Somerset – Pride 115 kV line, which was originally caused by the capacity portion of the P60 project. The Somerset-Pride 115 kV line is rated at 115 MVA summer normal / 150 MVA summer emergency. The loading on this 115 kV line during the **normal** condition reaches 181 MVA (or 157% of its 115 MVA rating). To mitigate this overload would require replacement/upgrade of the line/wave trap at Somerset Substation (estimated to cost approximately $115,000), replacement of disconnect switch at Somerset substation (estimated to cost approximately $80,000), replacement of CT circuit at Somerset substation (estimated to cost approximately $125,000), and replacement/upgrade of transmission line between Somerset and Pride substations (6.6 miles – estimated to cost $1,700,000).

13. The Rockwood – Penn-Mar 115kV line loads to 127% of its emergency rating (143 MVA) for the outage of the Homer City-Shelocta-Keystone 230 kV circuit. The energy portion of P60 contributes approximately 31 MW to this condition which was previously identified as a potential congestion issue for the energy portion of the P48 project. The Rockwood-Penn Mar 115 kV line is rated at 124 MVA summer normal / 143 MVA summer emergency. The loading on this 115 kV line during the **contingency** condition reaches 181 MVA (or 127% of its rating). To mitigate this overload would require replacement/upgrade of the CT circuit at Penn Mar substation (estimated to cost approximately $100,000), upgrade/replacement of the circuit breaker at Penn Mar substation (estimated to be approximately $325,000), replacement of a disconnect switch at Penn Mar substation (estimated to cost approximately $80,000) and the upgrade/reconductor of 14.7 miles of transmission line between Rockwood and Penn Mar substations (estimated to cost approximately $3,350,000)

14. The Tower 51-Hooversville 115kV line loads to 101% of its emergency rating (146 MVA) for the outage of the Homer City–Hooversville 230kV circuit. The energy portion of P60 contributes approximately 41 MW to this condition. The Tower 51-Hooversville 115 kV line is rated at 125 MVA summer normal / 146 MVA summer emergency. The loading on this 115 kV line during the **contingency** condition reaches 147.5 MVA (or 101% of its rating). To mitigate this overload would require replacement/upgrade of at CT at Hooversville substation (estimated to cost approximately $90,000).

15. The P60 project contributes 150 MW to the overloading of the Bedford North-P48 115 kV line (239% of its emergency rating of 358 MVA) for the outage of the O17-Somerset 115 kV line, which was previously identified as a potential congestion issue for the P48 project. The Bedford North-P48 115 kV line is rated at 115 MVA summer normal / 150 MVA summer emergency. The loading on this 115 kV line during the **contingency** condition reaches 358 MVA (or 239% of its 150 MVA rating). To mitigate this overload would require replacement/upgrade of the line/wave trap at Bedford North (estimated to cost approximately $115,000), a CT circuit at Bedford North (estimated to cost approximately $100,000), replacement/upgrade of substation conductor at Bedford North substation (estimated to cost approximately $125,000), replacement of a

disconnect switch at Bedford North substation (estimated to cost approximately $80,000), replacement of a circuit breaker at Bedford North substation (estimated to cost approximately $325,000) and approximately 20 miles of transmission line between Bedford North and P48 (estimated to cost approximately $4,500,000).

16. The P60 project contributes 2.58 MW (or 4.1%) to the overloading of the Eldorado-Park Plaza 46 kV line (117% of its emergency rating of 63 MVA) for the outage of the Altoona-N39/O38/P22 230 kV line, which was previously identified as a potential congestion issue for the O17 project. The Eldorado-Park Plaza 46 kV line is rated at 63 MVA summer normal / 63 MVA summer emergency. The loading on this 46 kV line during the **contingency** condition reaches 73.7 MVA (or 117% of its rating). To mitigate this overload would require replacement/upgrade of 1.87 miles of transmission line conductor (estimated to cost approximately $240,000).

17. The P60 project contributes 1.26MW (or 3.5%) to the overloading of the Meadws-EH1 Tap 46 kV line (105.2% of its emergency rating of 36 MVA) for the outage of the Altoona-N39/O38/P22 230 kV line, which was previously identified as a potential congestion issue for the P22 and P48 projects. The Meadows-EH1 Tap 46 kV line is rated at 36 MVA summer normal / 36 MVA summer emergency. The loading on this 46 kV line during the **contingency** condition reaches 37.9 MVA (or 105.2% of its rating). To mitigate this overload would require replacement/upgrade of 1 mile of transmission line conductor (estimated to cost approximately $125,000).

18. The P60 project contributes 1.76 MW (or 4%) to the overloading of the Raystown-Huntingdon 46 kV line (109.4% of its emergency rating of 44 MVA) for the outage of the Altoona-Raystown 230 kV line, which was previously identified as a potential congestion issue for the P22 and P48 projects. The Raystown-Huntingdon 46 kV line is rated at 44 MVA summer normal / 44 MVA summer emergency. The loading on this 46 kV line during the **contingency** condition reaches 48.1 MVA (or 109.4% of its rating). To mitigate this overload would require replacement/upgrade of 3.132 miles of transmission line (estimated to cost approximately $400,000).

19. The P60 project contributes 1.13 MW (or 2.7%) to the overloading of the Westfall-S21 Tap 46 kV line (105% of its emergency rating of 42 MVA) for the outage of the Altoona-N39/O38/P22 230 kV line, which was previously identified as a potential congestion issue for the P01 and P48 projects. The Westfall-S21 Tap 115 kV line is rated at 42 MVA summer normal / 42 MVA summer emergency. The loading on this 46 kV line during the **contingency** condition reaches 44.1 MVA (or 105% of its rating). To mitigate this overload would require reconductoring of 2.07 miles of transmission line (estimated to cost approximately $250,000).

20. The P60 project contributes 2.1 MW (or 5%) to the overloading of the WRH Tap-OC1Tap 46 kV line (152.8% of its emergency rating of 42 MVA) for the outage of the Altoona-Raystown 230 kV line, which was previously identified as a potential congestion issue for the N39, O17 and P48 projects. The WRH Tap-OC1 Tap 46 kV line is rated at 42 MVA summer normal / 42 MVA summer emergency. The loading on this 46 kV line during the **contingency** condition reaches 64.2 MVA (or 152.8% of its 42 MVA rating). To mitigate this overload would require a further upgrade of the conductor from what was identified in previous queue

projects (previous projects assumed we would utilize our next standard conductor size – this project would require the use of another increment in size) and is estimated to be approximately $250,000 in incremental cost as compared to the previous estimate.

Category C – Underlying Transmission System Impacts (Facilities monitored and operated by Penelec). These contingency overloads were not possible prior to the Queue P60 project. The identified contingency overloads are caused directly by P60 and are likely to cause P60 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 P60) at 100% energy output and Peak summer loading (80/20 load forecast).

P60 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 P60 generation to below its 100% energy output.

21. The energy portion of the P60 project contributes 45 MW to the overloading of the Saxton – Snake Springs115kV line (113% of its normal rating of 90 MVA) under base case (normal rating) conditions. The Saxton-Snake Springs 115 kV line is rated at 90 MVA summer normal / 124 MVA summer emergency. The loading on this 115 kV line during the **normal** condition reaches 102 MVA (or 113% of its 90 MVA rating). To mitigate this overload would require replacement/upgrade of some substation conductor at Saxton substation (estimated to cost approximately $125,000).
22. The energy portion of the P60 project contributes 8 MW to the overloading of the Glory-Dixonville East 115 kV line (108.9% of its normal rating of 90 MVA) under base case (normal rating) conditions. The Glory-Dixonville East 115 kV line is rated at 90 MVA summer normal / 124 MVA summer emergency. The loading on this 115 kV line during the **normal** condition reaches 98 MVA (or 108.9% of its 90 MVA rating). To mitigate this overload would require replacement/upgrade of the substation conductor at Glory Substation and is estimated to cost approximately $125,000. **NOTE:** Overloading of the Glory-Dixonville 115 kV line was previously identified as a potential congestion issue under **contingency** conditions for the O56, O72, P01, P22, P28 and P48 projects.
23. The energy portion of the P60 project contributes approximately 45 MW to the overloading of the Bedford N – P48 Tap 115kV line (133% of its normal rating of 115 MVA) under base case (normal rating) conditions. The energy portion of the P60 project also contributes approximately 45 MW to overloading of the Bedford N – P48 Tap 115kV line (108% of its emergency rating of 150 MVA) for the outage of the N39 Tap – Johnstown 230kV line.
    The Bedford North-P48 Tap 115 kV line is rated at 115 MVA summer normal / 150 MVA summer emergency. The loading on this 115 kV line during the **normal** condition reaches 153 MVA (or 133% of its normal 115 MVA rating). To mitigate this overload would require replacement/upgrade of approximately 20

miles of transmission line between Bedford North and P48 (estimated to cost approximately $4,500,000).
The Bedford North-P48 Tap 115 kV line is rated at 115 MVA summer normal / 150 MVA summer emergency. The loading on this 115 kV line during the **contingency** condition reaches 162 MVA (or 108% of its emergency 150 MVA rating). To mitigate this overload would require replacement/upgrade of approximately 20 miles of transmission line between Bedford North and P48 (estimated to cost approximately $4,500,000).

24. The energy portion of the P60 project contributes approximately 45 MW to the overloading of the Bedford N – Snake Springs 115kV line (111% of its normal rating of 115 MVA) under base case (normal rating) conditions. The Bedford North-Snake Springs 115 kV line is rated at 115 MVA summer normal / 150 MVA summer emergency. The loading on this 115 kV line during the **norma**l condition reaches 128 MVA (or 111% of its normal 115 MVA rating). To mitigate this overload would require replacement/upgrade of 7.05 miles of transmission line between Bedford North and Snake Springs (estimated to cost approximately $1,600,000).

25. The energy portion of the P60 project contributes approximately 84 MW to the overloading of the Allegheny – P60 Tap 115kV line (which is part of the Allegheny-Bedford North 115 kV line) to 135% of its normal rating of 115 MVA under base case (normal rating) conditions. The energy portion of the P60 project also contributes approximately 104MW to the overloading of the Allegheny – P60 Tap115kV line (128% of its emergency rating of 150 MVA) for the outage of the Altoona – Lewistown 230kV line.
The Allegheny-P60 Tap 115 kV line is rated at 115 MVA summer normal / 150 MVA summer emergency. The loading on this 115 kV line during the **normal** condition reaches 155 MVA (or 135% of its rating). To mitigate this overload would require replacement/upgrade of an estimated 3 miles of transmission line between Allegheny Substation and P60 (estimated to cost approximately $630,000).
The Allegheny-P60 Tap 115 kV line is rated at 115 MVA summer normal / 150 MVA summer emergency. The loading on this 115 kV line during the **contingency** condition reaches 192 MVA (or 128% of its rating). To mitigate this overload would require replacement/upgrade of an estimated 3 miles of transmission line between Allegheny Substation and P60 (estimated to cost approximately $630,000)

26. The energy portion of the P60 project contributes approximately 104 MW to the overloading of the Allegheny – Pride 115kV line (128% of its normal rating of 115 MVA) under base case (normal rating) conditions. The energy portion of the P60 project also contributes approximately 104MW to the overloading of the Allegheny – Pride 115kV line (128% of its emergency rating of 150 MVA) for the outage of the Altoona – Lewistown 230kV line.
The Allegheny-Pride 115 kV line is rated at 115 MVA summer normal / 150 MVA summer emergency. The loading on this 115 kV line during the **normal** condition reaches 147 MVA (or 128% of its normal rating). To mitigate this overload would require replacement/upgrade of the approximately 7 miles of transmission line from Allegheny to Pride substation and is estimated to cost approximately $1,550,000.

The Allegheny-Pride 115 kV line is rated at 115 MVA summer normal / 150 MVA summer emergency. The loading on this 115 kV line during the **contingency** condition reaches 192 MVA (or 128% of its emergency rating). To mitigate this overload would require replacement/upgrade of the approximately 6.6 miles of transmission line from Allegheny to Pride substation and is estimated to be approximately $1,550,000.

27. The energy portion of the P60 project contributes approximately 31 MW to the overloading of the Penn-Mar – Garrett 115kV line (110% of its emergency rating of 167 MVA) for the outage of the Homer-Shelocta-Keystone 230 kV circuit. The Penn Mar-Garrett 115 kV line is rated at 129 MVA summer normal / 167 MVA summer emergency. The loading on this 115 kV line during the **contingency** condition reaches 184 MVA (or 110% of its 167 MVA rating). To mitigate this overload would require replacement/upgrade of the line/wave trap at Penn Mar substation (estimated to cost approximately $115,000) and reconductor/upgrade of 14.95 miles of transmission line between Penn Mar and Garrett substations (estimated to cost approximately $3,500,000.

28. The energy portion of the P60 project contributes approximately 13 MW to the overloading of the Summit – Westfall 115kV line (104% of its emergency rating of 229 MVA) for the outage of the N39/O38/P22 Tap – Johnstown 230kV circuit. The Summit-Westfall 115 kV line is rated at 176 MVA summer normal / 229 MVA summer emergency. The loading on this 115 kV line during the **contingency** condition reaches 238 MVA (or 104% of its 229 MVA rating). To mitigate this overload would require replacement/upgrade of some substation conductor at Summit substation (estimated to cost approximately $100,000) and the replacement/upgrade of some substation conductor at Westfall substation (estimated to cost approximately $100,000).

29. The energy portion of the P60 project contributes approximately 14 MW to the overloading of the Timblin-Trade City 115kV line (100.5% of its emergency rating of 146 MVA) for the outage of the Homer City – Shelocta – Keystone 230kV circuit. The Timblin-Trade City 115 kV line is rated at 125 MVA summer normal / 146 MVA summer emergency. The loading on this 115 kV line during the **contingency** condition reaches 146.7 MVA (or 100.5% of its rating). To mitigate this overload would require replacement/upgrade of a couple of CTs at Timblin substation (estimated to cost approximately $130,000).

30. The P60 project contributes 142 MW (or 95%) to the overloading of the Allegheny-P60 115 kV line (178% of its emergency rating of 150 MVA) for the outage of the P48-Bedford North 115 kV line. The Allegheny-P60 115 kV line is rated at 115 MVA summer normal / 150 MVA summer emergency. The loading on this 115 kV line during the **contingency** condition reaches 267 MVA (or 178% of its rating). To mitigate this overload condition would require upgrade/replacement of approximately 5 miles of the 21.76 miles of transmission line between Allegheny and Bedford North substations (estimated to cost approximately $1,300,000) and upgrade/replacement of substation conductor at Allegheny substation (estimated to cost approximately $125,000).

31. The P60 project contributes 31.7 MW (or 21%) to the overloading of the Garrett-01Garret 115 kV line (120% of its emergency rating of 151 MVA) for the outage of the Homer City-Shelocta 230 kV line. The Garrett-01Garret 115 kV line is rated at 115 MVA summer normal / 151 MVA summer emergency. The loading

on this 115 kV line during the **contingency** condition reaches 181.2 MVA (or 120% of its rating). To mitigate this overload would require replacement/upgrade of 1.9 miles of transmission line (estimated to cost approximately $450,000) and the replacement of some substation conductor at Garrett substation (estimated to cost approximately $125,000).

32. The P60 project contributes 2.77 MW (or 6.6%) to the overloading of the HCR Tap-Hollidaysburg 46 kV line (112% of its emergency rating of 42 MVA) for the outage of the Altoona-N39/O38/P22 230 kV line. The HCR Tap-Hollidaysburg 46 kV line is rated at 42 MVA summer normal / 42 MVA summer emergency. The loading on this 46 kV line during the **contingency** condition reaches 47.9 MVA (or 112% of its 42 MVA rating). To mitigate this overload would require replacement/upgrade of 6.16 miles of transmission line (estimated to cost approximately $1,000,000).
33. The P60 project contributes 4.4 MW to the overload of the Saxton 115-23 kV transformer #6 (104.4% of its 29.7 MVA emergency rating of 29.7 MVA) for the outage of the Claysburg-Curryville 115 kV line. The Saxton 115-23 kV transformer #6 is rated at 27 MVA summer normal / 29.7 MVA summer emergency. The loading on this 115-23 kV transformer during the **contingency** condition reaches 31 MVA (or 104.4% of its rating). To mitigate this overload would require replacement/upgrade of the transformer to a larger size (estimated to cost approximately $1,300,000).