P28 - Mahoopany 115 kV
Generation Interconnection

Network Impacts
The **#P28 project was studied as a total injection of 150 MW (30 MW of capacity) into a tap of the Mehoopany-N. Meshoppen 115 kV circui**t. Project #P28 was evaluated for compliance with reliability criteria for summer peak conditions in 2010. Potential network impacts were 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
No problem identified (no facility loading that exceeded the facility's emergency rating).
NOTE: For Feasibility Studies, only double circuit (tower) outages are evaluated – not line fault and stuck breaker.

Contribution to Previously Identified Overloads
None

New System Reinforcements – Generator Deliverability and Double Circuit Tower Line Contingency Reliability Requirements
None

Contribution to Previously Identified System Reinforcements
None

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

Potential Congestion Issues
PJM also studied the delivery of the energy portion of this interconnection request. The following analysis has been performed to inform the Interconnection Customer (Queue P28) of potential congestion issues (operational restrictions) that may occur and affect the P28 project's ability to operate at full output for certain system conditions. **The upgrades listed below are not required reliability upgrades for the Queue P28 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 P28 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 P28) at 100% energy output and Peak summer loading (80/20 load forecast).

P28 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 P28 generation to below its 100% energy output.

1. The P28 project contributes 13 MW to the overload of the Altoona to P22 Tap 230 kV line for the outage of the Juniata-Keystone 500 kV circuit, which was originally caused by the energy portion of the O38, O72 and P22 projects. The Altoona-P22 230 kV line is rated at 499 MVA summer normal / 617 MVA summer emergency. To mitigate this overload would require replacement/upgrade of the approximately 16 miles of transmission line conductor between P22 Tap and Altoona substations and is estimated to cost approximately $7,200,000.

2. The P28 project contributes to the overload of the Altoona-N39/O38/P22 230 kV transmission line under normal operating conditions. It loads the Altoona-N39/O38/P22 230 kV transmission line to 108%. It contributes an additional 15 MW to the overload previously identified for the energy portion of the P01 and P22 projects. The Altoona-P22 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 539 MVA (or 108% of its rating). To mitigate this overload would require replacement/upgrade of the approximately 16 miles of transmission line conductor between P22 Tap and Altoona substations and is estimated to cost approximately $7,200,000.
3. The Keystone 500/230kV transformer 4 loads to 103% of its emergency rating (465 MVA) for the outage of the Keystone 500/230kV transformer #3. The energy portion of P28 contributes approximately 13 MW to this condition which was previously identified for the energy portion of Project #P22. The upgrade is a replacement of 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.
4. The Keystone 500/230kV transformer #3 loads to 103% of its emergency rating (471 MVA) for the outage of the Keystone 500/230kV transformer 4. The energy portion of P28 contributes approximately13 MW to this condition which was previously identified for the energy portion of Project P22. The upgrade is a replacement of 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.
5. The P28 project contributes 16 MW to the overload at the Homer Ct-Shelocta 230 kV circuit for the outage of the Handsome Lake to Wayne 345 kV circuit, which was originally caused by the #O56 and #O72 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 898 MVA (or

105% of its rating). To mitigate this overload would require replacement/upgrade of the disconnect switch at Shelocta which is estimated to cost approximately $75,000.

6. The P28 project contributes 7 MW to the overload at the Lewistown to Juniata 230 kV line for the outage of Juniata to Keystone 500 kV line, which was originally caused by the O38 project.
   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 642 MVA (or 104% of its rating). To mitigate this overload would require replacement/upgrade of 24.69 miles of 230 kV transmission line conductor between Lewistown and Juniata which is estimated to be approximately $11,750,000 and the replacement/upgrade of the disconnect switch at Juniata which is estimated to cost approximately $75,000.
7. The Shelocta – Keystone 230 kV line is overloaded at around 100.4% of its emergency rating (854 MVA) for the outage of Homer city to WATRC 345 kV line. The P28 project contributes approximately 10 MW to the contingency facility loading. 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 857 MVA (or 100.4% of its 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.

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 P28) at 100% energy output and Peak summer loading (80/20 load forecast).

P28 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 P28 generation to below its 100% energy output.

8. The P28 project contributes 3 MW to the overload of the Glory-Dixonville 115 kV line for the outage of the Homer Ct-Shelocta-Keystone 230 kV circuit, which was originally caused by the energy portion of the O56 and P01 projects. The Glory-Dixonville 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 150 MVA (or 121% of its rating). To mitigate this overload would require replacement/upgrade of some substation conductor at Glory Substation and is estimated to cost approximately $125,000.
9. The P28 project contributes to the overload of the Huntingdon-OC1Tap 46 kV line. It contributes 4% (or 1.7 MW) to the overload condition for the loss of the Altoona-Raystown 230 kV line. It will require the replacement/upgrade of transmission line conductor. This overload was previously identified in PJM Queues N39, O38 and P01. The Huntingdon-OC1 Tap 46 kV line is rated at 42 MVA summer normal / 42 MVA summer emergency. To mitigate this overload would require rebuild/upgrade of approximately 0.129 mile of 46 kV transmission line and is estimated to cost approximately $20,000.

10. The P28 project contributes to the overload of the WRH Tap-OC1 Tap 46 kV line. It contributes 4% (or 1.68 MW) to the overload condition for the loss of the Altoona-Raystown 230 kV line. It will require the replacement/upgrade of transmission line conductor. This overload was previously identified in PJM Queues N39, O38 and P01. The WRH Tap-OC1 Tap 46 kV line is rated at 42 MVA summer normal / 42 MVA summer emergency. To mitigate this overload would require rebuild/upgrade of approximately 4.01 mile of 46 kV transmission line and is estimated to cost approximately $500,000.
11. The P28 project contributes to the overload of the Warrior Ridge-WRH Tap 46 kV line. It contributes 4% (or 1.68 MW) to the overload condition for the loss of the Altoona-Raystown 230 kV line. It will require the replacement/upgrade of transmission line conductor. This overload was previously identified in PJM Queues N39, O38 and P01. The Warrior Ridge-WRH Tap 46 kV line is rated at 42 MVA summer normal / 42 MVA summer emergency. To mitigate this overload would require rebuild/upgrade of approximately 0.167 mile of 46 kV transmission line and is estimated to cost approximately $30,000.

Category C – Underlying Transmission System Impacts (Facilities monitored and operated by Penelec). These contingency overloads were not possible prior to the Queue P28 project. The identified contingency overloads are caused directly by P28 and are likely to cause P28 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 P28) at 100% energy output and Peak summer loading (80/20 load forecast).

P28 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 P28 generation to below its 100% energy output.

12. The P28 project contributes to the loading of the Meadows-EH1 Tap 46 kV line. It contributes to the line loading to 100% of its emergency rating for the loss of the Altoona-N39/O38/P22 230 kV line. 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 36 MVA (or 100% of its rating).

Summary

The amount of construction required for the post-contingency overload conditions is fairly extensive. It is estimated that it would take approximately 2.5 years to complete the upgrades.

FirstEnergy is still reviewing the specifics for connection Option 1 – which is connecting directly into the Mehoopany substation. There is limited space available at this substation location for the equipment required for this project. Further review of the specifics required to accommodate this connection will be reviewed in the System Impact study.