Generation Interconnection

This analysis was completed to assess the reliability impact for a new generator interconnecting to the PJM system as a capacity resource.

Network Impacts -500 MW Injection into the Hooversville 230kV substation (H25)

Network Impacts

The **#H25 project was studied as total of 500 MW capacity** injection into the Hooversville 230kV substation with the H09 project. Project # H25 was evaluated for compliance with reliability criteria for summer peak conditions in 2006. Potential network impacts were as follows:

Generator Deliverability

1. The Seward – Tower 115 kV circuit is contingency overloaded at **248.2%** of the emergency rating (159MVA) for the outage of the Homer City - Quemahoning -Hooversville 230kV circuit and Hooversville 230/115 kV transformer. The H25 project contributes approximately **249**MW to the loading on this circuit.
2. The Glory - Dixonvlle 115kV circuit is contingency overloaded at **120.3%** of the emergency rating (124 MVA) for the outage of the Homer City – Shelocta - Keystone 230kV circuit. The H25 project contributes approximately **32**MW to the loading on this circuit.
3. The Hooversville – Quemahoning 230 kV circuit is overloaded at **103%** of the normal rating (478 MVA). The Hooversville – Quemahoning 230 kV circuit is also contingency overloaded at **107%** of the emergency rating (478 MVA) for the outage of the Johnstown – G31 230kV circuit. The H25 project contributes approximately **298**MW to the normal and contingency loading on this circuit.
4. The Homer City - Quemahoning 230kV circuit is overloaded at **105.7%** of its normal rating (454 MVA). It is also contingency overloaded at **104.5%** of the emergency rating (535 MVA) for the outage of the Johnstown - G31 230kV circuit. The H25 contributes approximately **298** MW to the normal and **301** MW to the contingency loading on this circuit.
5. The Scalp Level - Hooversville 115kV circuit is contingency overloaded at **167.1%** of the emergency rating (179 MVA) for the outage of the Homer City – Quemahoning - Hooversville 230kV circuit and Hooversville 230/115 kV transformer. The H25 project contributes approximately **152** MW to the loading on this circuit.
6. The Scalp Level - Rachel 115kV circuit is contingency overloaded at **161.2%** of the emergency rating (179 MVA) for the outage of the Homer City – Quemahoning - Hooversville 230kV circuit and Hooversville 230/115 kV transformer. The H25 project contributes approximately **152** MW to the loading on this circuit.
7. The Rachel - Hillclay Junction 115kV circuit is contingency overloaded at **142.2%** of the emergency rating (184 MVA) for the outage of the Homer City - Quemahoning - Hooversville 230kV circuit and Hooversville 230/115 kV transformer. The H25 project contributes approximately **152** MW to the loading on this circuit.
8. The Rosedale-Cooper 115kV is contingency overloaded at **101.9%** of the emergency rating (180 MVA) for the outage of the Johnstown-G31 230KV circuit. The H25 contributes approximately **14** MW to the loading on this circuit.
9. The Johnstown - G31 230kV is contingency overloaded at **104.1%** of the emergency rating (574 MVA) for the outage of the Homer City - Quemahoning - Hooversville 230kV circuit and

Hooversville 230/115 kV transformer. The H25 project contributes approximately **59** MW to the loading on this circuit.

10. The Rosedale - Prospect 115kV circuit is contingency overloaded at **106.3%** of the emergency rating (184 MVA) for the outage of the Johnstown-G31 230kV circuit. The H25 contributes approximately **28** MW to the loading on this circuit.
11. The Prospect - Johnstown 115kV circuit is contingency overloaded at **103.5%** of the emergency rating (184 MVA) for the outage of the Johnstown-G31 230kV circuit. The H25 contributes approximately **28** MW to the loading on this circuit.
12. The Lewistown - Raystown 230kV circuit is contingency overloaded at **103.5%** of the emergency rating (554 MVA) for the outage of the Homer City - Keystone 230kV circuits. The H25 contributes approximately **72** MW to the loading on this circuit.

Multiple Facility Contingency – Tower Line Outages (MAAC Criteria IIC)

13. The Garrett-Garrett Tap 115KV circuit is overloaded at **162.5%** of the emergency rating (125 MVA) for the Homer City - Quemahoning 230kV and Tower – Seward 115kV tower line outage. The H25 project contributes approximately 114 MW to the loading on this circuit.
14. The Garrett 138/115 KV transformer is overloaded at **181.3%** of the emergency rating (112 MVA) for the Homer City - Quemahoning 230kV and Tower – Seward 115kV tower line outage. The H25 project contributes approximately 114 MW to the loading on this circuit.
15. The Rockwood – Penn Mar 115 kV circuit is overloaded at **147.2%** of the emergency rating (143 MVA) for the Homer City - Quemahoning 230kV and Tower – Seward 115kV tower line outage. The H25 project contributes approximately 114 MW to the loading on this circuit.
16. The Rachel Hill -Hillclay Junction 115 kV circuit is overloaded at **217.6%** of the emergency rating (184 MVA) for the Homer City - Quemahoning 230kV and Tower – Seward 115kV tower line outage. The H25 project contributes approximately 270 MW to the loading on this circuit
17. The Somerset - Rockwood 115 kV circuit is overloaded at **108%** of the emergency rating (159 MVA) the Homer City - Quemahoning 230kV and Tower – Seward 115kV tower line outage. The H25 project contributes approximately 114 MW to the loading on this circuit.
18. The Garrett – Pen Mar 115 kV circuit is overloaded at **129.8%** of the emergency rating (168 MVA) the Homer City - Quemahoning 230kV and Tower – Seward 115kV tower line outage. The H25 project contributes approximately 114 MW to the loading on this circuit
19. The Hooversville - Somerset 115 kV circuit is overloaded at **118.4%** of the emergency rating (179 MVA) for the Homer City - Quemahoning 230kV and Tower – Seward 115kV tower line outage. The H25 project contributes approximately 91 MW to the loading on this circuit
20. The Hooversville - Ralphton115 kV circuit is overloaded at **102.9%** of the emergency rating (179MVA) for the Homer City - Quemahoning 230kV and Tower – Seward 115kV tower line outage. The H25 project contributes approximately 77 MW to the loading on this circuit

Short Circuit

Short circuit analysis was not performed due to the magnitude of reinforcements required to eliminate the identified problem. Any required breaker replacements are not expected to materially alter the total network reinforcement cost.

New System Reinforcements

A specific system reinforcement to resolve each of the overloads #1 through #20 was not developed, however, PJM expects that, the cost estimate to resolve the identified problems to **exceed $50 million with a lead time of over 5 years.**

A complete analysis of the underlying system was not completed due to the number and severity of the identified bulk system problems.

If this project proceeds to the Impact Study stage, a complete analysis of the underlying system along with all cost estimates will be provided.

Contribution to Previously Identified System Reinforcements

The H25 project will share the cost of the reinforcements to correct the following previously identified problems.

1. The Hooversville 230/115 kV transformer is overloaded at **237%** of the normal rating (232 MVA). The Hooversville 230/115 kV transformer is also overloaded for several contingencies and the worst is **226%** of the emergency rating (263 MVA) for the outage of the Homer City – Shelocta – Keystone 230kV circuit. The H25 project contributes approximately **202**MW to the normal and **192**MW to the contingency loading on this circuit.
2. The Hooversville – Tower 51 115 kV circuit is overloaded at **122%** of the normal rating (125 MVA). The Hooversville – Tower 51 115 kV circuit is also contingency overloaded at **289%** of the emergency rating (146 MVA) for the outage of the Homer City – Quemahoning – Hooversville 230 kV circuit and Hoversville 230/115kV transformer. The H25 project contributes approximately **96**MW to the normal and **253**MW to the contingency loading on this circuit.
3. The Homer City – Shelocta 230 kV circuit is overloaded at **159%** of the normal rating (694 MVA). The Homer City – Shelocta 230kV circuit is also overloaded for several contingencies and the worst was at **152%** of the emergency rating (854 MVA) for the outage of the Homer City – Watercure Road 345 kV circuit. The H25 project contributes approximately **177**MW to the normal and **186**MW to the contingency loading on this circuit.
4. The Keystone – Shelocta 230 kV circuit is overloaded at **150%** of the normal rating (694 MVA). The Keystone – Shelocta 230 kV circuit is also contingency overloaded at **149%** of the emergency rating (854 MVA) for the outage of Homer City – Watercure Road 345 kV circuit. The H25 project contributes approximately **195**MW to the normal and **204M**W to the contingency loading on this circuit.
5. Both Keystone 500/230 kV transformers are overloaded at **130%** of the normal rating (430 MVA). Both Keystone 500/230 kV transformers are also overloaded for several contingencies the worst is at **163%** of the emergency rating (499 MVA) for the outage of the other Keystone 500/230kV transformer. The H25 project contributes approximately **97**MW to the normal and **152**MW to the contingency loading on this circuit.
6. The Keystone – G09 500 kV circuit is contingency overloaded at **115%** of the emergency rating (3013 MVA) for the outage of Juniata – Keystone 500 kV circuit. The H25 project contributes approximately **94**MW to the loading on this circuit.

7. The Conemaugh – G09 500 kV circuit is contingency overloaded at **138%** of the emergency rating (3013 MVA) for the outage of Juniata – Keystone 500 kV circuit. The H25 project contributes approximately **94**MW to the loading on this circuit.
8. The Juniata – Keystone 500 kV circuit is overloaded for several contingencies and the worst is at **121%** of the emergency rating (3013 MVA) for the outage of the Conemaugh – G09 500 kV circuit. The H25 project contributes approximately **88**MW to the loading on this circuit.
9. The Altoona – Johnstown 230 kV circuit is overloaded at **111%** of the normal rating (499 MVA). The Altoona – Johnstown 230 kV circuit is also overloaded at **118%** of the emergency rating (617 MVA) for outage of the Homer City – Shelocta – Keystone 230kV circuit. The H25 project contributes approximately **37**MW to the normal and **59**MW to the contingency loading on this circuit.
10. The Hilltop –Rosedale 115 kV circuit is contingency overloaded at **213%** of the emergency rating (179 MVA) for the outage of Johnstown – G31 230 kV circuit and G31 – Bon Air 230/115 kV transformer. The H25 project contributes approximately **41** MW to the loading on this circuit.
11. The Carlisle Pike – Gardners 115kV circuit is contingency overloaded at **162%** of the emergency rating (109 MVA) for the outage of the Juniata – Lewistown 230 kV circuit. The H25 project contributes approximately **13**MW to the loading on this circuit.
12. The Roxbury – Shade Gap 115kV circuit is contingency overloaded at **150%** of the emergency rating (151 MVA) for the outage of the Juniata – Lewistown 230 kV circuit. The H24 circuit contributes approximately **13**MW to the loading on this circuit.
13. The Carlisle Pike – Roxbury 115kV circuit is contingency overloaded at **138%** of the emergency rating (146 MVA) for the outage of the Juniata – Lewistown 230 kV circuit. The H25 project contributes approximately **12**MW to the loading on this circuit.
14. The Lewistown – Shingletown 230 kV circuit is contingency overloaded at **137%** of the emergency rating (512 MVA) for the outage of the Altoona – Raystown – Lewistown 230 kV circuit. The H25 circuit project contributes approximately **26**MW to the loading on this circuit.
15. The Lewistown – Juniata 230kV circuit is overloaded at **145%** of the normal rating (499 MVA). The Lewistown – Juniata 230 kV circuit is also contingency overloaded at **151%** of the emergency rating (617 MVA) for the outage of the Juniata – Keystone 500kV circuit. The H25 circuit project contributes approximately **153**MW to the normal and **58**MW to the contingency loading on this circuit.
16. The Altoona – Raystown 230 kV circuit is contingency overloaded at **106%** of the emergency rating (554 MVA) for the outage of the Lewistown – Shingletown 230 kV circuit. The H25 project contributes approximately **69** MW to the loading on this circuit.
17. The North Meshoppen 230/115 kV transformer 1 is contingency overloaded at **128%** of the emergency rating (155 MVA) for the outage of the East Towanda – North Meshoppen 230 kV circuit and North Meshoppen 230/115 kV transformer 2. The H25 project contributes approximately **17** MW to the loading on this circuit.

The main network reinforcement will be to build a new 500 kV west to east circuit (or comparable alternative). The details of the new 500 kV circuit will be identified during Impact studies but the cost **is estimated at over $100 million with a lead time exceeding 5 years.** This upgrade will, most likely, not relieve all of the individual overloads described above. Some of those overloads will require specific system reinforcements.

There is also a potential that an SVC will be required for voltage support at the Juniata 500kV substation. This will be determined in the Impact Study evaluation. **The cost is estimated at $24.5 million with a lead-time of 2 years.**

If the developer requests an Impact Study, individual system upgrades will be identified and construction estimates defined in the Impact Study report. Cost allocation will also be completed during the Impact Study.