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 Erie South - Warren 230kV line

Network Impacts

Potential network impacts for the injection of 500 MW into the Erie South - Warren 230 kV line were evaluated for the PJM summer peak conditions of 2004. The analysis performed for this project included upgrades to the Shade Gap – Roxbury 115 kV line, a revised breaker configuration at the Erie West 345 kV substation as shown in Attachment 1, the addition of two line breakers at the Homer City 345 kV substation, an upgraded replacement for the existing Westfall 115/46 kV transformer, a new 350 MVAR SVC at the Juniata 500 kV substation, a new 500 kV substation at Homer City along with one 500/345 kV transformer connection to the existing Homer City 345 kV substation, series reactors on the Blairsville 138/115 kV transformer, terminal equipment upgrades on the Eclipse - Clark Summit and Ridgway - Whetstone 115 kV lines, and a second Seward 230/115 kV transformer. These enhancements were determined to be necessary for previously queued generator interconnection projects.

A summary of the results follows:

Normal System

- The new generator causes a 90 MW overload on the Forrest - Elko 230 kV circuit.
- The new generator contributes 74 MW to the overload on the Homer City – Shelocta 230 kV circuit.
- The new generator contributes 1 MW to the overload on the Westfall 115/46 kV transformer.
- The new generator contributes 8 MW to the overload on the Blairsville 115/138 kV transformer.

Generator Deliverability

- The new generator causes a 293 MW overload on the Glade - Glade Tap 230 kV circuit for the loss of the Erie South - Union City 230 kV circuit.

- The new generator causes a 51 MW overload on the Lewis Run - Farmers Valley 115 kV circuit for the loss of the Erie South - Union City 230 kV circuit.

- The new generator causes a 202 MW overload on the Warren 230/115 kV transformer for the loss of the Erie South - Union City 230 kV circuit.

- The new generator causes a 227 MW overload on the Forrest - Elko 230 kV circuit for the loss of the Erie South - Union City 230 kV circuit.

- The new generator causes a 36 MW overload on the Forrest - Ridgway 115 kV circuit for the loss of Forrest - Elko 230 kV circuit.

- The new generator causes a 41 MW overload on the Ridgway - Whetstone 115 kV circuit for the loss of Forrest - Elko 230 kV circuit.

- The new generator causes a 40 MW overload on the Whetstone - Harvey's Run 115 kV circuit for the loss of Forrest - Elko 230 kV circuit.

- The new generator causes a 415 MW overload on the Erie South - Union City 230 kV circuit for the loss of Glade - Glade Tap to Forrest 230 kV circuit.

- The new generator causes a 59 MW overload to the Warren - Falconer 115 kV circuit for the loss of the Glade - Glade Tap - Forrest 230 kV circuit.

- The new generator causes a 27 MW overload on the Utica Junction - Eclipse 115 kV circuit for the loss of the Erie West - Ashtabula - Perry 345 kV circuit.

- The new generator causes a 57 MW overload on the Shingletown - Lewistown 230 kV circuit for the loss of Altoona - Raystown 230 kV circuit.

- The new generator causes a 58 MW overload on the Oxbow - Lackawanna 230 kV circuit for the loss of Keystone - Juniata 500 kV circuit.

- The new generator causes a 7 MW overload on the Blairsville 230/115 kV transformer for the loss of the new Homer City 345/500 kV transformer.

- The new generator contributes 68 MW to the overload on the Keystone 500/230 kV transformer #1 for the loss of Keystone 500/230 kV transformer #2.

- The new generator contributes 129 MW to the overload on the Homer City – Shelocta 230 kV circuit for the loss of the Erie West – Ashtabula – Perry 345 kV circuit.

- The new generator contributes 30 MW to the overload on the Utica Junction – Eclipse 115 kV circuit for the loss of the Erie West – Ashtabula – Perry 345 kV circuit.

- The new generator contributes 15 MW to the overload on the Blairsville 138/115 kV transformer for the loss of the Homer City – Shelocta – Keystone 230 kV circuit.

- The new generator contributes 11 MW to the overload on the Garrett – Garrett Tap 115 kV circuit for the loss of the Homer City – Shelocta – Keystone 230 kV circuit.

- The new generator contributes12 MW to the overload on the Seward – Florence 115 kV circuit for the loss of the Homer City – Shelocta – Keystone 230 kV circuit.

- The new generator contributes 170 MW to the post-contingency voltage drop problem at Juniata 500 kV for the outage of Hunterstown – Conastone 500 kV circuit and Hunterstown 500/230 kV transformer #1.

- The new generator contributes 13 MW to the overload on the Seward 230/115 kV transformer for the loss of the Homer City – Shelocta – Keystone 230 kV circuit.

- The new generator contributes 18 MW to the overload on the Shade Gap – Roxbury 115 kV circuit for the loss of the Lewistown – Juniata 230 kV circuit.

Single Contingency (MAAC Criteria IIA)

- The new generator causes a 28MW overload on the Erie South #6 230/115kV transformer for loss of the Erie South #1 230/115kV transformer.

- The new generator causes a 31 MW overload on the Lewis Run - Farmers Valley 115kV line for a bus fault at Forest.

Multiple Facility Contingency (MAAC Criteria IIC)

- The new generator contributes 76 MW to the overload on the Homer City 345/230 kV transformer #2 for the line fault with stuck breaker condition involving the outage of the Homer City – Watercure 345 kV line and Homer City 345/230 kV transformer #1.

- The new generator contributes 69 MW to the overload on the Homer City 345/230 kV transformer #2 for the line fault with stuck breaker condition involving the outage of the Homer City – Stolle Road 345 kV line and Homer City 345/230 kV transformer #1.

- The new generator causes a 12 MW overload on the Lewistown-Juniata 230kV line for the line fault with stuck breaker condition involving the outage of the Keystone - Juniata 500kV line and the Juniata 500/230kV transformer.

Short Circuit Analysis

- No problems identified.

System Reinforcements

To eliminate the overloads identified above, the following system upgrades are required. The new Homer City 500 kV substation and 500/345 kV transformer reinforcements are required to eliminate the Keystone 500/230 kV transformer and Homer City – Shelocta – Keystone 230 kV circuit overloads. The new generator can expect to either pay a portion or the entire cost for the following system upgrades:

1) Build a 500 kV substation at Homer City and install four breakers. Estimated Cost = $9 million.

2) Re-route the Keystone – Conemaugh 500 kV line through Homer City 500 kV substation. Estimated Cost = $1.8 million.

3) Install one 345/500 kV transformer and connections at Homer City. Estimated Cost = $5 million.

4) Replace the 800 amp disconnect switch and wave trap on the Ridgway terminal of the Whetstone-Ridgway 115kV line with 1200 amp equipment and increase the current transformer ratio on both line terminals at Ridgway to 1200/5. Estimated Cost = $ 0.175 million.

5) Replace the 800 amp disconnect switch on the Whetstone terminal of the Ridgway-Whetstone 115 kV line with a 1200 amp switch. Estimated cost = $0.055 million.

6) Replace the Westfall 115/46 kV transformer. Estimated Cost = $0.7 million.

7) Install a breaker at the Homer City end of the Homer City – Watercure 345 kV line. Estimated Cost = $1.75 million.

8) Install a 350 MVAR SVC at Juniata 500 kV substation. Estimated Cost = $14.5 million.

9) Install a 0.04 pu reactor in series with the Blairsville 138/115 kV transformer. Estimated Cost = $1.5 million.

10) Upgrade the Shade Gap - Roxbury 115 kV line. Estimated Cost = $5.5 million.

11) Install a second 230/115 kV transformer at Seward. Estimated Cost = $4.1 million.

12) Replace the two existing 230 kV breakers at Seward with new 40 kA circuit breakers. Estimated Cost = $.58 million.

13) Change the tap of the current transformer on the Lewistown terminal of the Lewistown-Shingletown 230 kV line from 1000/5 to 1200/5. Estimated cost = $0.06 million.

14) Upgrade the Squab Hollow-Elko 230kV transmission line conductor to a 140 degrees centigrade rating, which will require the replacement of 5 line structures. Replace the 1200 amp wave trap at Elko with 2000 amp wave trap and replace one 1200 amp current transformer at Elko with a 200 amp current transformer. Estimated total cost = $0.195 million.

15) Upgrade the 1.7 mile Glade - Glade Tap 230 kV transmission line conductor to a 140 degrees centigrade rating. This will require a replacement of 4 line structures. Estimated cost = $0.1 million.

16) Rebuild the 12.5 mile Lewis Run - Farmers Valley 115kV line and replace two 600 amp current transformers at the Lewis Run substation end and one current transformer at the Farmers Valley end of the Lewis Run - Farmers Valley 115kV line with 1200 amp current transformers. Estimated cost = $3.725 million.

17) Upgrade the Erie South - Gen Location 230kV transmission line to a 150 degree centigrade rating, which will require the replacement of 1 line structure. Replace one 1200 amp current transformer at the Erie South terminal with a 2000 amp current transformer. Estimated cost = $0.1 million.

18) Replace the 800 amp wave trap on the Eclipse terminal of the Eclipse-Utica Junction 115kV line with a 1200 amp wave trap. Estimated cost = .06 million

19) Replace two disconnect switches and change the tap of one current transformer from 600/5 to 1200/5 on the Whetstone terminal of the Whetstone - Harveys Run 115kV line. Estimated cost = $0.17 million.

20) Rebuild the Lewistown - Juniata 230kV circuit with 1590 Kcmil, 45/7 ACSR conductor. Estimated cost $13.1 million.

21) Replace the 230/115kV transformer #6 at Erie South with a new unit rated at 224 MVA. Estimated cost = $3.5 million

Total cost estimate for network reinforcements = $65.67 million. It is estimated that it will take at least 4 years to complete the network reinforcements listed above.

Cost allocation percentages are not provided as part of the Feasibility Study analysis, however, cost allocation will be provided in the Impact Study report.