

## 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 -1200 MW Injection into the Erie West-Ashtabula 345kV transmission line (I02)

The #I02 project was studied as 1200 MW capacity injection into the Erie West -Ashtabula 345kV circuit. Project # I02 was evaluated for compliance with MAAC reliability criteria for summer peak conditions in 2006. Potential network impacts were as follows:

#### Generator Deliverability

1. Each Keystone 500/230 kV transformer is contingency overloaded at **114%** of its emergency rating (499 MVA) for the outage of the other Keystone transformer. The I02 project contributes approximately 99MW to the loading on this circuit.
2. The Keystone – Shelocta 230 kV circuit is overloaded at **105%** of its normal rating (694 MVA). The Keystone – Shelocta 230 kV circuit is also contingency overloaded at **116%** of its emergency rating (854 MVA) for the outage of the I02 – Ashtabula 345 kV circuit. The I02 project contributes approximately 126 MW to the normal and 332MW to the contingency loading on this circuit.
3. The Altoona – Johnstown 230 kV circuit is overloaded at **101%** of its normal rating (488 MVA). The Altoona – Johnstown 230 kV circuit is also overloaded at **106%** of the emergency rating (554 MVA) for outage of the Homer City – Shelocta – Keystone 230kV circuit. The I02 project contributes approximately 26 MW to the normal and 40MW to the contingency loading on this circuit.
4. The Glade – Glade Tap 230kV circuit is overloaded at **101%** of its normal rating (499 MVA). The Glade – Glade Tap 230kV circuit is also contingency overloaded at **111%** of its emergency rating (617 MVA). The I02 project contributes approximately 97 MW to the normal and 214MW to the contingency loading on this circuit.
5. The Utica JCT. – Eclipse 115kV circuit is contingency overloaded at **111%** of its emergency rating (184 MVA) for the outage of the I02 – Ashtabula 345 kV circuit. The I02 project contributes approximately 121MW to the loading on this circuit.
6. The Piney – Burma 115kV circuit is contingency overloaded at **107%** of its emergency rating (256 MVA) for the outage of the I02 – Ashtabula 345 kV circuit. The I02 project contributes approximately 135MW to the loading on this circuit.
7. The Burma 138/115kV transformer is contingency overloaded at **107%** of its emergency rating (254 MVA) for the outage of the I02 – Ashtabula 345 kV circuit. The I02 project contributes approximately 135MW to the loading on this circuit.

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

No identified problems.

### **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**

1. Install a third Keystone 500/230kV transformer. The Keystone transformers are contingency overloaded for an outage of the other Keystone transformer. The cost to add a third transformer is estimated at **\$8 million** and will take 2 years to complete.
2. Rebuild the Keystone-Shelocta and Shelocta-Homer City 230kV circuits. These circuits are overloaded for both normal and contingency conditions with the latter occurring during an outage of the I02-Ashtabula 345kV circuit. The cost is estimated at **\$11.3 million** and will take 2 years to complete.
3. Rebuild the Altoona-Johnstown 230kV circuit. This circuit is overloaded for both normal and contingency conditions with the latter occurring during an outage of the Homer City - Shelocta – Keystone 230kV circuit. The cost is estimated at **\$13.1 million** and will take 2 years to complete.
4. Rebuild the Glade-Glade Tap 230 kV circuit. This circuit is overloaded for both normal and contingency conditions with the latter occurring during an outage of the I02-Ashtabula 345kV circuit. The cost is estimated at **\$0.6 million** and will take 1.5 years to complete.
5. Rebuild the Utica Jct-Eclipse 115kV circuit. This circuit is overloaded for contingency conditions during an outage of the I02-Ashtabula 345kV circuit. The cost is estimated at **\$0.1 million** and will take 1 year to complete.
6. Rebuild the Piney-Burma 115kV circuit. This circuit is overloaded for contingency conditions during an outage of the I02-Ashtabula 345kV circuit. The cost is estimated at **\$1.6 million** and will take 1.5 years to complete.
7. Replace the Burma 138/115kV transformer with a higher rated transformer. This circuit is overloaded for contingency conditions during an outage of the I02-Ashtabula 345kV circuit. This transformer is not owned by Penelec and therefore no cost estimate is provided. The cost is estimated at **\$1.5 million** and will take 2 years to complete.

Other additional 115kV network reinforcements may be necessary and will be identified during the Impact Study.

### **Contribution to Previously Identified System Reinforcements**

The I02 project will contribute to the cost of the following previously identified network reinforcements:

8. The I02 project contributes approximately 27MW to the Black Oak 500/138kV transformer overload. The I02 project contributes approximately 27MW to the loading on this circuit. The cost to add a 500/138kV transformer at Black Oak substation is estimated to cost **\$5.19 million**.

9. Rebuilding the Warren-Falconer 115 kV line (15.56 miles of the 19.54-mile circuit) with 795 Kcmil 26/7 ACSR conductor, and replace a 115 kV disconnect switch at Warren and a 115 kV circuit breaker at Falconer. The I02 project contributes approximately 18MW. The cost is estimate at **\$8.9 million** and it will take minimum of two years to complete.
10. Build a new 230kV circuit from the new switching station at Doubs substation to PEPCO's station H substation. The I02 project contributes approximately 7MW. The cost is estimated at **\$14.71 million** and it will take 3 years to complete.
11. Install a second Seward 230/115 kV transformer. The I02 project contributes approximately 32MW. The cost is estimated at **\$4.54 million** and it will take two years to complete.

Cost allocation for the reinforcements listed above will be fully described in the Impact Study report.

First Energy completed a reliability analysis of their system in the immediate vicinity of the new generating facility interconnection point using ECAR reliability criteria and have identified that the following reinforcements are required.

#### ECAR REINFORCEMENT PROJECTS

1. Expand the Ashtabula 345-138kV substation into a four ring bus breaker arrangement to accommodate two 448 MVA transformers and two 345kV lines (Perry-Ashtabula and Ashtabula-I02). The existing single transformer at Ashtabula is contingency overloaded at **202%** of its emergency rating for an outage of the Perry-Ashtabula 345kV circuit. The cost is estimated at **\$11.5 million** and will take two years to complete.
2. Build a second 345kV line at the Ashtabula 345kV tap point and extend it 1.35 miles north into an expanded Ashtabula 345-138kV substation. The cost is estimated at **\$1.5 million** and will take two years to complete.
3. Rebuild the four existing Ashtabula-Mayfield 138kV circuits from with 795 ACSR conductor. The Ashtabula-Mayfield 138kV circuits are contingency overloaded at **154%, 138%, 156% and 152%** for an outage of the Perry-Ashtabula 345kV circuit. The cost is estimated at **\$13 million** and will take two years to complete.
4. Upgrade the four Leroy Center and four Mayfield 138 kV buses to allow for the full rating of the reconductored 795 ACSR Ashtabula-Mayfield 138kV circuits to be utilized. Two new 138kV circuit breakers will be required at Mayfield substation. The cost is estimated at **\$1.0 million** and will take one year to complete.
5. Replace 19 overdutied 138kV breakers (7 @ Ashtabula 138kV and 12 @ Eastlake 138kV). The cost is estimated at **\$3.2 million** and will take one and a half years to complete.

The time durations listed above are based on "stand-alone work". Due to the magnitude and number of transmission reinforcement projects identified, the overall construction time may be longer than the longest time listed due to system conditions and outage requirements.