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 - 750MW Injection

Injection of 750 MW into the Indian River 138kV substation was evaluated for network impacts. The following potential impacts were identified:

Generator Deliverability

1. The Indian River – Milford 230 kV circuit is overloaded at 103% of the normal rating (535 MVA). The G29 project contributes approximately 357 MW to the loading on this circuit.
2. The Indian River – North Seaford 138 kV circuit is contingency overloaded at 160% of the emergency rating (243 MVA) for the outage of the Indian River – Milford 230 kV circuit. The G29 project contributes approximately 256 MW to the loading on this circuit.
3. The North Seaford – South Harrington 138 kV circuit is contingency overloaded at 132% of the emergency rating (243 MVA) for the outage of the Indian River – Milford 230 kV circuit. The G29 project contributes approximately 247 MW to the loading on this circuit.
4. The Indian River – Nelson 138kV circuit is contingency overloaded at 127% of the emergency rating (192 MVA) for the outage of the Indian River – Milford 230 kV circuit. The G29 project contributes approximately 220 MW to the loading on this circuit. (**Also required for project #G28**)
5. The Vienna – Steele 230 kV circuit is contingency overloaded at 125% of the emergency rating (551 MVA) for the outage of the second **new** (**required for project #G28**) Vienna – Steele 230 kV circuit. The G29 project contributes approximately 186 MW to the loading on this circuit.
6. The Church – Steele 138 kV circuit is contingency overloaded at 120% of the emergency rating (159 MVA) for the outage of the Keeney – Steele 230 kV circuit. (**Also required for project #G28**) The G29 project contributes approximately 70 MW to the loading on this circuit.
7. The Loretto – Piney Grove 138 kV circuit is contingency overloaded at 116% of the emergency rating (159 MVA) for the outage of the Indian River – Milford 230 kV circuit. The G29 project contributes approximately 128 MW to the loading on this circuit. (**Also required for project #G28**)
8. The Indian River – Robinsonville 138 kV circuit is contingency overloaded at 101% of the emergency rating (126 MVA) for the outage of the Indian River – Milford 230 kV circuit. The G29 project contributes approximately 20 MW to the loading on this circuit.
9. The North Seaford – South Harrington 138 kV circuit is contingency overloaded at 102% of the emergency rating (243 MVA) for the outage of the Indian River – Milford 230 kV circuit. The G29 project contributes approximately 189 MW to the loading on this circuit.
10. The Sussex – Harbeson 69 kV circuit is contingency overloaded at 123% of the emergency rating (60 MVA) for the outage of the Indian River – Milford 230 kV circuit. The limiting element for this circuit is the protective relays. The G29 project contributes approximately 50 MW to the loading on this circuit.
11. The Maridel – Ocean City 69 kV circuit is contingency overloaded at 105% of the emergency rating (93 MVA) for the outage of the Pocomoke – Oak Hall 138 kV circuit. The G29 project contributes approximately 21 MW to the loading on this circuit.
12. The Kent – New Meredith 69 kV circuit is contingency overloaded at 104% of the emergency rating (93 MVA) for the outage of the Steele – Church 138 kV circuit. The G29 project contributes approximately 29 MW to the loading on this circuit.

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

13. The Steele – Church 138 kV circuit is contingency overloaded at 188% of the emergency rating (159 MVA) for the 230kV Steele – Keeney tower line outage. The G29 project contributes approximately 138 MW to the loading on this circuit.
14. The Church – Townsend 138 kV circuit is contingency overloaded at 141% of the emergency rating (223 MVA) for the 230kV Steele – Keeney tower line outage. The G29 project contributes approximately 183 MW to the loading on this circuit.
15. The Townsend – Mt. Pleasant Tap 138 kV circuit is contingency overloaded at 139% of the emergency rating (223 MVA) for the 230kV Steele – Keeney tower line outage. The G29 project contributes approximately 183 MW to the loading on this circuit.
16. The Mt. Pleasant Tap – Glasgow 138 kV circuit is contingency overloaded at 121% of the emergency rating (223 MVA) for the 230kV Steele – Keeney tower line outage. The G29 project contributes approximately 183 MW to the loading on this circuit.
17. The Red Lion – Cedar Creek 230 kV circuit is contingency overloaded at 108% of the emergency rating (729 MVA) for the 230kV Steele – Keeney tower line outage. The G29 project contributes approximately 550 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 overloads. Any required breaker replacements are not expected to materially alter the total network reinforcement cost.

New System Reinforcements

Overloads 1, 7 and 8 can be relieved by converting the 138 kV circuit from Vienna – Loretto – Piney Grove to 230 kV. The cost of this upgrade may be shared with Project #G28 (estimated cost: $7 million)

Overload 5 can be relieved by reconductoring the existing 230 kV circuit from Vienna to Steele. . The cost of this upgrade may be shared with Project #G28 (estimated cost: $7 million)

Overload 4 can be relieved by reconductoring the 138 kV circuit from Indian River to Nelson. (estimated cost: $4.41 million)

Overload 2 and 3 can be relieved by reconductoring the 138 kV circuit from Indian River - North Seaford - South Harrington. (estimated cost: $8.61 million)

Overload 10 can be relieved by upgrading a relay. (estimated cost: $.05 million)

Overload 11 can be relieved by reconductoring the 69 kV circuit from Maridel to Ocean City and replacing disconnect switch. (estimated cost: $0.4719 million)

Overload 12 can be relieved by reconductoring the 69 kV circuit from Kent to New Meredith circuit and replacing disconnect switch. (estimated cost: $1.035 million)

Overloads 6, 13, 14, 15, 16 and 17 can be relieved by converting the 138 kV circuit from Church – Townsend – Mt. Pleasant Tap – Glagow – Keeney to 230 kV circuit. (estimated cost: $29.263 million)

In addition, a bus upgrade on the Mt. Herman to Piney Grove 69kV circuit will be required. (estimated cost: $0.03 million)

The total **new Network Upgrades** are estimated to cost **$57.88 Million**. The construction cost for network upgrades may be subject to a CIAC (Contribution in Aid to Construction) state and federal tax gross up, which can add as much as **$18.78 Million**.

The estimated time required to construct the new network upgrades is **24-36 months**. This estimate is highly dependent upon the ability to secure the required facility outages.

Contribution to Previously Identified System Reinforcements

The G29 project will contribute to the cost of the following previously identified network reinforcements:

18. The project contributes approximately 80 MW to the overload on the Graysferry – Parrish 230 kV circuit. The overload can be relieved by reconductoring the 230 kV circuit from Graysferry to Parrish. (estimated cost: $3.444 million).

19. The project contributes approximately 55 MW to the overload on the Eddystone – Morton Tap 230 kV circuit. The overload can be relieved by replacing some of the circuit's terminal equipment. (estimated cost: $0.06 million).

20. The project contributes approximately 38 MW to the Master – North Phila. 230 kV circuit. The overload can be relieved by reconductoring the 230 kV circuit from Master to North Philadelphia. (estimated cost: $4.68 million).

21. The project contributes approximately 52 MW to the A27 – Graysferry 230 kV circuit. The project also contributes approximately 47 MW to the A19 – Morton Tap 230kV circuit. The overloads can be relieved by constructing a new 230kV line from A27 to Parrish. (estimated cost: $65 million).

22. The project contributes approximately 41 MW to the B48 – Graceton 230 kV circuit. The overload can be relieved by reconductoring the 230 kV circuit from B48 to Graceton. (estimated cost: $1.8 million).

The total estimated cost for **previously identified network upgrades** is **$74.984 Million**. This estimate already includes CIAC (Contribution in Aid to Construction) state and federal tax gross up. Project #G29 will be required to share the cost of these upgrades. Project #G29's cost allocation will be determined as part of the #G29 Impact Study.

The estimated time required to construct the new network upgrades is **36-48 months**. This estimate is highly dependent upon the ability to secure the required facility outages.