#Q74 Linden 230kV

Generation Interconnection

This analysis was completed to assess the reliability impact for the increase in generation interconnecting to the PJM system as a capacity resource.

Network Impacts

The #Q74 project was studied as an injection of 600 MW (capacity) into the Linden 230 kV station. Project #Q74 was evaluated for compliance with reliability criteria for summer peak conditions in 2011. Potential network impacts were as follows:

Generator Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

1. The G22 Sub-Warinanco 230 kV line loads from 89.1% to 113.9% of its emergency rating (752 MVA) for the single line outage of Deans-Westfield 230 kV line. The Q74 project contributes approximately 99.5 MW to cause the contingency facility loading.

2. The Tosco-G22 Sub 230 kV line is overloaded at 112.3% of its normal rating (1150 MVA). The Q74 project contributes approximately 187 MW to cause the facility loading.

Multiple Facility Contingency

(Double Circuit Tower Line contingencies only for the full energy output. Stuck breaker and bus fault contingencies will be performed for the Impact Study)

3. The Warinanco-Aldene 230 kV line loads from 53.5% to 102.2% of its emergency rating (865 MVA) for the outage of the Linden-Sewaren & Linden-Deans 230KV tower line. The Q74 project contributes approximately 431 MW to cause the contingency facility loading.

4. The G22 Sub-Warinanco 230 kV line loads from 67.5% to 123.9% of its emergency rating (752 MVA) for the outage of the Linden-Sewaren and Linden-Deans 230KV tower line. The Q74 project contributes approximately 431.9 MW to cause the contingency facility loading.

Short Circuit

5. The Linden terminal breaker (50,000 amp rating) at Tosco substation will need to interrupt 51,897 amps asymmetrical due to the addition of the Q74 project.

6. The Warinanco terminal breaker (50,000 amp rating) at Tosco substation will need to interrupt 51,897 amps asymmetrical due to the addition of the Q74 project.

7. The Linden substation 11H breaker (63,000 amp rating) will need to interrupt 63,759 amps due to the addition of project Q74.

8. The Linden substation 21H breaker (63,000 amp rating) will need to interrupt 63,759 amps due to the addition of project Q74.

9. The Linden substation 22H breaker (63,000 amp rating) will need to interrupt 63,759 amps due to the addition of project Q74.

Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

10. Project #Q74 causes the Graceton – Bagley 230 kV #1 line to load from 106.6% to 111.6% of its emergency rating (659MVA) for the outage of the Conastone-Northwest Ckts #2310 & #2322 tower line. The Q74 contributes 33.5 MW to the flow on this line. Project Q42 is the first to cause this thermal violation.

11. The Sewaren-Woodbridge "O" 138 kV line is overloaded to 120% of its emergency rating (873 MVA) for the outage of the Deans-Aldene 230 kV and the Sewaren-Roseland 138 kV tower line. The Q74 project contributes approximately 33 MW to the contingency facility loading. Project O66 is the first to cause this overload.

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. "Network Impacts", initially caused by the addition of this project generation)

1 & 2 & 3 & 4. The overloads on the Tosco-G22 Sub, G22 Sub-Warinanco 230kV and Warinanco-Aldene line sections can be alleviated by constructing a new 5.5 mile, overhead 230kV circuit between Tosco and Aldene substations. The estimated cost is **$20 million.** If during design it is determined that the overhead circuit is infeasible, two underground 230kV circuits, two are required to provide the required capacity, will alleviate the overload at an estimated cost of **$100 million**.

5. The overdutied condition of the Linden terminal 230kV circuit breaker at Tosco can be alleviated by replacing the circuit breaker. The estimated cost of the replacement is **$0.5 million.**

6. The overdutied condition of the Warinanco terminal 230kV circuit breaker at Tosco can be alleviated by replacing the circuit breaker. The estimated cost of the replacement is **$0.5 million.**

7. The overdutied condition of the Linden 11H 230kV circuit breaker can be alleviated by replacing the circuit breaker. The estimated cost of the replacement is **$0.5 million.**

8. The overdutied condition of the Linden 21H 230kV circuit breaker can be alleviated by replacing the circuit breaker. The estimated cost of the replacement is **$0.5 million.**

9. The overdutied condition of the Linden 12H 230kV circuit breaker can be alleviated by replacing the circuit breaker. The estimated cost of the replacement is **$0.5 million.**

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)

10. The overload on the Graceton-Bagley 230kV #1 circuit can be alleviated by reconductoring the circuit with 1,590kcmil 45/7 ACSR at 125°C (rating: 650/805MVA SN/SE). This will require significant rebuild of the towers to support the larger wire at higher tensions. The larger wire and taller structures will require a CPCN. The work will take an estimated 42-48 months to complete. Estimated costs are **$13.4Million**. Project Q42 is the first project to cause this overload.

11. The recommended solution to alleviate the overload on the Sewaren-Woodbridge "O" 138kV circuit is to re-conductor the circuit. The cost is estimated at **$5.25 million**. (Upgrade n0629). Project O66 is the first to cause this overload.