

#Q42 Indian River 630 MW
Generator 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

The Queue Q42 project was studied as a **630 MW (Net) Capacity injection into the Indian River 230 kV substation**. Q42 was evaluated for compliance with reliability criteria for summer peak conditions in 2011. Potential network impacts were as follows:

Generator Deliverability (Single Contingency)

1. Indian River 230kV bus ties #1 and #2 are contingency overloaded at **106% (2124 Amps or 846 MVA)** for loss of one bus tie on the other. The bus ties are rated (summer emergency) for 2000Amps (**796 MVA**).
2. The segment of 230kV line 220-46 from Ridley to Printz contingency loading increases from 99% (prior to Q42) to **102%** (after the addition of Q42) of its emergency rating (**1432 MVA**) for the outage of the Eddystone to Island Rd 230 kV line 220-23. Q42 generation contributes **41 MW** to the contingency loading of line 220-46.

Multiple Facility Contingency

(Double Circuit Towerline contingencies only. Stuck breaker and bus fault contingencies will be performed for the Impact Study)

No problems identified.

Short Circuit

No problems identified for the PJM transmission system or the Delmarva underlying system.

NRG circuit breaker “Indian River 69kV CB7060” was identified as being overstressed at 104.2% of short circuit interrupting rating as a result of adding Q42. NRG should consider replacement of CB7060.

New System Reinforcements

1. The estimated cost to upgrade Indian River 230 kV bus ties #1 and #2 is **\$414,000**. Estimated construction time is **12 months**.
2. The segment of 230kV line 220-46 from Ridley to Printz is limited by terminal equipment at Printz. The estimated upgrade cost is **\$800,000**. Estimated construction time is **18 months**.

Contribution to Previously Identified Overloads

(Overloads initially caused by prior Queue positions with additional contribution to overloading by Queue Q42. Queue 42 will have a % allocation cost responsibility which will be calculated and reported for the Impact Study)

3. Queue Q42 contributes approximately 39 MW, or approximately 4% of the 1000 MVA emergency rating, to the contingency loading of the Bridgewater-Sommerville-Flagtown-Branchburg 230 kV line for the tower outage of 230 kV lines Atlantic-Larrabee and Atlantic-Smithburg. At Q42 position in the Queue the contingency loading of the Bridgewater-Sommerville-Flagtown-Branchburg 230 kV line is at 119% of its emergency rating (1000 MVA after PSE&G required baseline upgrades b169 and b170 are performed).

This thermal reliability criteria violation was originally caused by queue position O66 and additional contributions to the overload were added by Queues P04, P06, and Q26 prior to Queue Q42. To date additional contributions to the overload were also determined for Q47, Q73 and Q74.

Bridgewater-Sommerville-Flagtown-Branchburg 230kV

Queue Project	MW Contribution	Final Loading
Up to O66	60 (above 1000MVA)	106%
P04	29	109%
P06	25	111%
Q26	37	115%
Q42	39	119%
Q47	7	118%
Q73	1	118%
Q74	55	125%

PSE&G is responsible for the Bridgewater-Sommerville-Flagtown-Branchburg 230 kV baseline upgrades b169 and b170 to increase the circuit emergency rating to 1000 MVA. This involves reconductoring of this 12.5 mile circuit with 1590 KCMIL ACSS conductor at an estimated cost of \$22M. To increase the circuit rating to 1255 MVA (necessary to accommodate projects up to Q74) will require reconductoring the circuit with a bundle of two 1033 KCMIL ACSS conductors and rebuild (extent not determined at this time) of some structures. The estimated additional cost to upgrade from 1000 MVA to 1255 MVA is estimated to cost **\$25.0M. Queue Q42 may have a cost allocation responsibility.**

4. Queue Q42 contributes 17 MW to the contingency loading of the English 230/115 kV transformer for the tower outage of 230 kV lines Atlantic-Larrabee and Atlantic-Smithburg. At Q42 position in the Queue the contingency loading of the English 230/115 kV transformer is at 125% of its emergency rating (292 MVA).

This thermal reliability criteria violation was originally caused by queue position O66 and additional contributions to the overload were added by Queues P06 and Q26 prior to Queue Q42. To date additional contributions to the overload was also determined for Q74.

English 230/115 kV Transformer Contingency Loading

Queue Project	MW Contribution	Final Loading
Up to O66	26 (above 292 MVA)	109%
P06	13	113%
Q26	18	120%
Q42	17	125%
Q74	17	131%

The estimated total cost to replace the English 230/115 kV 292 MVA (emergency rating) transformer with a 385 MVA (emergency rating) is **\$ 4.0M. Queue Q42 may have a cost allocation responsibility.**

There are a number of network reinforcements required to mitigate thirty separate thermal overloads identified for the Queue O66 project in New Jersey. Project Q42 contributes (in excess of the threshold for cost allocation – see PJM Tariff) to only two of the thirty thermal overloads as described above; however, as the reinforcements for the thirty overloads have not yet been determined, an assessment of the impact of Q42 on the reinforcements required by Queue O66 was not able to be performed. Evaluation of Queue Q42’s impacts on the O66 reinforcements will be performed during the Q42 Impact Study if Queue O66 and Q42 remain in the PJM Generation Interconnection Queue at that time. It is unlikely, but possible, that Queue Q42 will have an impact on the reinforcements for Queue O66.

Potential Issues

Prior to the addition of Q42 the Island Road to Eddystone 230 kV line 220-23 was contingency loaded to 96% of its emergency rating (1411 MVA) for the outage of the Mc Dade-Ridley-Morton 230 kV line 22046. After the addition of Queue Q42 the Island Road to Eddystone 230 kV line 220-23 was contingency loaded to 99% of its emergency rating. Queue Q42 contributes 43 MW to the increased loading of this facility.

5. The limiting elements for 220-23 line are 230kV circuit breakers and terminal equipment. If required, the upgrade cost is estimated at **\$800,000**. Estimated construction time is **18 months**.