#U2-074 Peach Bottom – Rock Springs 650 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 – Option #1

(Peach Bottom – Rock Springs 500 kV)

Queue U2-074 was studied as a 650 MW Capacity injection into the Peach Bottom – Rock Springs 500 kV line. Project U2-074 was evaluated for compliance with reliability criteria for summer peak conditions in 2012. Network impacts were as follows:

NETWORK IMPACTS – OPTION #1

Generator Deliverability

(Normal System with all facilities in-service and Single, or N-1, contingencies for the Capacity portion only of the interconnection)

No problems were identified.

Multiple Facility Contingency

(Double Circuit Tower, stuck breaker and bus fault Line contingencies for the full energy output)

No problems were identified.

Short Circuit

1. The additional system short circuit current provided by Queue U2-074 causes Peach Bottom 500 kV breaker #25 to exceed its short circuit interrupting rating.

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)

2. **(PECO)** The Queue U2-074 (Option #1) – Peach Bottom 500 kV line section loads from **103.13% to 121.21%** of its emergency rating (3112MVA) for the tower line outage (DBL_5NC). This project contributes approximately **562.8 MW** to the thermal violation.

3. **(BGE/BGE)** Conastone - Graceton 230kV ckt #1 loads from **183.13% to 189.43%** of its emergency rating (550MVA) for the single line contingency

outage (U_queue_reinforcement_76). This project contributes approximately **34.7 MW** to the thermal violation.

4. **(BGE/BGE)** Conastone – Graceton 230kV ckt #2 loads from **183.13% to 189.43%** of its emergency rating (550MVA) for the single line contingency outage (BG14). This project contributes approximately **34.7 MW** to the thermal violation.

5. **(BGE/BGE) C**onastone – North Northwest 500kV ckt #2 loads from **185.85% to 193.38%** of its emergency rating (2901MVA) for the single line contingency outage (PJM13B_NNWEST_A). This project contributes approximately **218.3 MW** to the thermal violation.

6. **(BGE/BGE)** Conastone – North Northwest 500kV ckt #1 loads from **185.85% to 193.38%** of its emergency rating (2901MVA) for the single line contingency outage (U_queue_reinforcement_60). This project contributes approximately **218.3 MW** to the thermal violation.

7. **(BGE/BGE)** Conastone – North Northwest 500kV ckt #1 loads from **160.88% to 167.20%** of its normal rating (2078MVA) for normal, non-contingency conditions. This project contributes approximately **131.3 MW** to the thermal violation.

8. **(BGE/BGE)** Conastone – North Northwest ckt #2 loads from **160.88% to 167.20%** of its normal rating (2078MVA) for normal, non-contingency conditions. This project contributes approximately **131.3 MW** to the thermal violation.

9. **(PECO/BGE)** Peach Bottom – Conastone 500kV ckt #1 loads from **159.23% to 166.20%** of its emergency rating (2598MVA) for the tower line outage (CONAS_PB_CKT3_4). This project contributes approximately **181.1 MW** to the thermal violation.

10. **(PECO/BGE)** Peach Bottom – Conastone 500 kV ckt #3 loads from **110.79% to 115.64%** of its emergency rating (3734MVA) for the tower line outage (CONAS_PB). This project contributes approximately **181.1 MW** to the thermal violation.

11. **(PECO/BGE)** Peach Bottom – Conastone 500kV ckt #4 loads from **110.79% to 115.64%** of its emergency rating (3734MVA) for the tower line outage (CONAS_PB). This project contributes approximately **181.1 MW** to the thermal violation.

12. **(PECO/BGE)** Peach Bottom – Conastone 500kV ckt #2 loads from **110.79% to 115.64%** of its emergency rating (3734MVA) for the tower line outage

(CONAS_PB_CKT3_4). This project contributes approximately **181.1 MW** to the thermal violation.

Stability Analysis
Will be performed for the Impact Study

NETWORK UPGRADE REQUIREMENTS – OPTION #1

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

1. Replace Peach Bottom 500 kV circuit breaker #25 at an estimated cost of **$800,000** and a construction lead time of **12 -18 months**.

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)

2. **U2-074 – Peach Bottom 500 kV circuit overload.**

   Upgrade: Construct a second Queue U2-074 to Peach Bottom 500 kV circuit

   $20,000,000 Construct a second 500 kV line across Susquehanna river ($20M)
   $10,000,000 Expand Peach Bottom 500 kV substation to add new line
   $ 2,000,000 Expand U2-074 500 kV ring bus to add new line

   $32,000,000 Total Cost (Approx. **8 years** to complete.)

3. **Conastone – Graceton 230kV ckt #1 overload.**

   Upgrade: Add two new 230 kV underground circuits from Conastone to Graceton*. This also satisfies number 4 below.

   ***** Assumes RTEP baseline project b0497 (add second Conastone to Graceton 230 kV circuit is completed)

   Estimated cost is $**245,000,000**. Constuction leadtime is **8 years**.

4. **Conastone – Graceton 230kV ckt #2 overload.**

   The upgrade for impact number 3 above also satisfies impact number 4.

5-8 **Conastone – North Northwest 500kV ckts #1 and #2 overloads.**

Upgrade: Add 2 new single circuit 500 kV lines with the following assumptions:

Add a new 200 ft. wide R/W paralleling the existing Conastone to Northwest line, total R/W length is 19.6 miles. Use a bundle of three 1590 ACSR conductors per phase for the new lines.

$202,000,000	Two new 500 kV single circuit lines as described above
$ 10,000,000	Expand North Northwest* sub to add 2 new line terminals
$ 8,000,000	Expand Conastone sub to add 2 new line terminals
$220,000,000	Total Cost. Construction will take approximately **10 years**.

- North Northwest substation does not yet exist, it is planned for a site located 4 miles north of Northwest substation

9-12 **Peach Bottom – Conastone 500 kV ckts 1 thru 4 Overloads.**

Upgrade: Construct a 5th Peach Bottom – Conastone 500 kV line at a total cost of **$90,000,000**. Estimated construction time is **6 – 8 years.**

BG& E portion: (Conastone to the Maryland / Pennsylvania state line)

$61,800,000	500 kV line (200 ft R/W)
$ 3,200,000	Conastone terminal breakers and line position

PECO portion: (Peach Bottom to the Pennsylvania / Maryland state line)

$15,000,000	500 kV line (R/W cost not included)
$ 10,000,000	Peach Bottom terminal breakers and line position

Option #2

(Peach Bottom Tap – Nottingham, and
Peach Bottom - Cochranville / Newlinville 230 kV lines)

Network Impacts – Option #2

(Peach Bottom Tap – Nottingham, and Peach Bottom – Cochranville / Newlinville 230 kV lines)

Queue U2-074 was studied as a 650 MW Capacity injection into the Peach Bottom Tap – Nottingham and Peach Bottom – Cochranville / Newlinville 230 kV lines. Project U2-074 was evaluated for compliance with reliability criteria for summer peak conditions in 2012. Network impacts were as follows:

NETWORK IMPACTS – OPTION #2

Generator Deliverability

(Normal System with all facilities in-service and Single, or N-1, contingencies for the Capacity portion only of the interconnection)

1. **(PECO/PECO)** The Nottingham – Daleville / Bradford 230 kV line loads from **93.4% to 102.9%** of its emergency rating (631MVA) for the single line contingency outage (PE34). This project contributes approximately **59.9 MW** to cause this thermal violation.

Multiple Facility Contingency

(Double Circuit Tower, stuck breaker and bus fault Line contingencies for the full energy output)

No problems were identified.

Short Circuit

TBD

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)

2. (**PECO/PECO)** The Bradford – Planebrook 230 kV line loads from **111.97% to 121.87%** of its emergency rating (621MVA) for the single line contingency outage (PE31). This project contributes approximately **61.5 MW** to the thermal violation.

3. **(PECO/BGE)** Peach Bottom -Graceton 230 kV ckt #1 loads from **122.50% to 152.30%** of its emergency rating (1226MVA) for the single line contingency outage (PE8). This project contributes approximately **365.4 MW** to the thermal violation.

4. **(PECO/BGE)** Peach Bottom - Graceton 230kV ckt #2 loads from **122.50% to 152.30%** of its emergency rating (1226MVA) for the single line contingency

outage (U_queue_reinforcement_56). This project contributes approximately **365.4 MW** to the thermal violation.

5. **(BGE/BGE)** Conastone – North Northwest 500kV ckt #2 loads from **180.1% to 183.94%** of its emergency rating (2901MVA) for the single line contingency outage (U_queue_reinforcement_60). This project contributes approximately **111.4 MW** to the thermal violation.

6. **(BGE/BGE)** Conastone – North Northwest 500kV ckt #1 loads from **180.1% to 183.94%** of its emergency rating (2901MVA) for the single line contingency outage (PJM13B_NNWEST_A). This project contributes approximately **111.4 MW** to the thermal violation.

7. **BGE/BGE) C**onastone – North Northwest 500kV ckt #1 loads from **156.11% to 159.35%** of its normal rating (2078MVA) for normal, non-contingency conditions. This project contributes approximately **67.2 MW** to the thermal violation.

8. **(BGE/BGE)** Conastone – North Northwest ckt #2 loads from **156.11% to 159.35%** of its normal rating (2078MVA) for normal, non-contingency conditions. This project contributes approximately **67.2 MW** to the thermal violation.

Stability Analysis

Will be performed for the Impact Study

NETWORK UPGRADE REQUIREMENTS – OPTION #2

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

1. Nottingham – Daleville / Bradford 230 kV line overload.

   Upgrade: Reconductor the Nottingham – Daleville / Bradford 230 kV line and perform miscellaneous upgrades at Daleville. Note: There is no 230 kV substation at Daleville, it is a 230 – 34.5 kV transformer tap on the line with a 34.5 kV substation.

   $16,200,000 Reconductor 24.8 miles of 230 kV line
   $ 500,000 Miscellaneous substation work

   $16,700,000 Total Cost (Approx. **3 years** to complete.)

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)

2. **Bradford - Planebrook 230 kV overload.**

   Upgrade: Construct a second Queue U2-074 to Peach Bottom 500 kV circuit

   $ 4,200,000 Reconductor Bradford to Planebrook
   $ 500,000 Miscellaneous substation work

   $ 4,700,000 Total Cost (Approx. **3 years** to complete.)

3-4 **Peach Bottom - Graceton 230kV ckts #1 and #2 overload.**

   Upgrade: Add two new 230 kV underground circuits from Peach Bottom to Graceton.

   Estimated cost is **$112,000,000**. Constuction time estimate is **4 years**.

   BGE work: (Graceton to the Maryland / Pennsylvania border)

   $60,000,000 Reconductor both 230 kV lines with UG cable (3 cables per phase)

   PECO work: (Peach Bottom to the Maryland / Pennsylvania border)

   $42,000,000 6 miles of 230 kV double pipe-type UG cable

   $10,000,000 Miscellaneous substation work

5-8 **Conastone – North Northwest 500kV ckt #1 and #2 overloads.**

Upgrade: Add 2 new single circuit 500 kV lines with the following assumptions:

Add a new 200 ft. wide R/W paralleling the existing Conastone to Northwest line, total R/W length is 19.6 miles. Use a bundle of three 1590 ACSR conductors per phase for the new lines.

$202,000,000	Two new 500 kV single circuit lines as described above
$ 10,000,000	Expand North Northwest* sub to add 2 new line terminals
$ 8,000,000	Expand Conastone sub to add 2 new line terminals
$220,000,000	Total Cost. Construction will take approximately **10 years**.

- North Northwest substation does not yet exist, it is planned for a site located 4 miles north of Northwest substation