

T82 Cardiff 230kV **Generation Interconnection**

General

The Interconnection Customer has proposed a 350 MW (70 MW of which is capacity) wind power generating facility to be located offshore in the Atlantic Ocean approximately 15.0 miles southeast of Atlantic City, Atlantic County, New Jersey. T82 will connect to the Atlantic City Electric's (ACE) transmission system at either the Lewis 138kV substation (Option 1) or the Cardiff 230kV substation (Option 2).

Queue Project #T82 is in response to a Solicitation for Proposals to Develop Off-Shore Wind Renewable Energy Facilities Supplying Electricity to the Distribution System Serving New Jersey, New Jersey Board of Public Utilities, dated October 5, 2005. The proposed in-service date for the project is December 31, 2012.

Option 1

Point of Interconnection: T82 Option 1 will interconnect with the Atlantic City Electric's transmission system at the Lewis 138kV substation. Option 1 was studied as a 350 MW (70 Mw Capacity) injection into the Lewis 138kV substation. The project was evaluated for compliance with reliability criteria for summer peak conditions in 2012.

Direct Connection Requirements

Transmission Owner Scope of Direct Connection Work

The Transmission Owner's, (ACE), responsibility includes design and construction of all facilities associated with the Lewis 138kV substation on the Interconnected Transmission Owner's side of the Point of Interconnection (POI). ACE's direct connection work at the Lewis substation consists of adding one (1) 138kV circuit breaker and equipment required to provide a terminal position for the Interconnection Customer's 138 kV line to the T82 site. There is not adequate room for a second 138kV terminal. Revenue metering will be located on the feed to the generator.

The estimated cost to perform this work is **\$2,500,000** and can be completed in **24 to 36 months**. Note: the cost does not include the Contribution in Aid of Construction (CIAC) tax.

Interconnection Customer Scope of Direct Connection Work

The Interconnection Customer's off-shore facility is comprised of an array of wind turbine generators and a 34.5/138 kV collection substation. The collection substation will be connected to the ACE Lewis 138kV substation via a submarine/underground or overhead cable. The developer has assumed full responsibility for design and construction of all facilities associated

with the T82 generating station and the 138 kV direct connection line on the Interconnection Customer side of the POI. Site preparation including grading and an access road is assumed to be by the developer.

The Interconnection Customer will be required to install metering and telemetry equipment to provide revenue metering and real-time telemetry data to PJM. The requirements for this equipment are listed in Appendix 2, Section 8 of Attachment O to the PJM Tariff, as well as PJM Manuals 01 and 14D. Protective relaying and metering design and installation must comply with Atlantic City Electric's Applicable Standards.

Network Impacts

Potential network impacts are as follows:

Generator Deliverability

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

1. The RAR RVR-KILMER I 230kV (JCP&L/PSEG) line loads from 99.9% to 100.3% (DC power flow) of its emergency rating (742MVA) for the single line contingency outage (PS56C). This project contributes approximately 3.1 MW to cause this thermal violation.
2. The RL_230-KEEN_230 230kV (DP&L) line loads from 99.0% to 100.1% (DC power flow) of its emergency rating (932MVA) for the single line contingency outage (PJM64). This project contributes approximately 10.0 MW to cause this thermal violation.

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 System Impact Study)

No problems identified.

Short Circuit

The following breakers were found to be overstressed:

Lewis 138kV CB 'L' – 124.4%
Lewis 138kV CB 'P' - 114.6%
Ontario 69kV CB 'B' – 102.3%

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)

3. The MONROE-NEW FRDM 230kV (AE/PSEG) line loads from 105.46% to 106.56% (DC power flow) of its emergency rating (725 MVA) for the single line contingency outage (PS18). This project contributes approximately 8.0 MW to the thermal violation.

4. The MCKLTON-DELCOTAP 230kV (AE/PECO) line loads from 101.78% to 103.49% (DC power flow) of its emergency rating (725 MVA) for the single line contingency outage (PJM63). This project contributes approximately 12.4 MW to the thermal violation. T81 contributes to the loading by 7.4 MW.

5. The OXBOW-N.MESHPN 230kV (PENELEC) line loads from 179.35% to 181.92% (DC power flow) of its emergency rating (617 MVA) for the tower line outage (CONAS_PB). This project contributes approximately 15.9 MW to the thermal violation. T81 contributes to the loading by 16.8 MW.

6. The 3 MILE I-TMI 500/230kV (METED) transformer loads from 144.81% to 148.00% (DC power flow) of its emergency rating (1077 MVA) for the tower line outage (CONAS_PB). This project contributes approximately 34.4 MW to the thermal violation. T81 contributes to the loading by 32.5 MW.

7. The NOTTNGHM-NOTTREAC 230kV (PECO) line loads from 190.78% to 195.10% (DC power flow) of its emergency rating (627 MVA) for the tower line outage (CONAS_PB). This project contributes approximately 27.1 MW to the thermal violation. T81 contributes to the loading by 25.6 MW.

8. The PCHBTMTP-GRACETON 230kV (PECO/BG&E) line loads from 190.75% to 195.07% (DC power flow) of its emergency rating (627 MVA) for the tower line outage (CONAS_PB). This project contributes approximately 27.1 MW to the thermal violation. T81 contributes to the loading by 25.6MW.

9. The NOTTREAC-PCHBTMTP 230kV (PECO) line loads from 190.75% to 195.07% (DC power flow) of its emergency rating (627 MVA) for the tower line outage (CONAS_PB). This project contributes approximately 27.1 MW to the thermal violation. T81 contributes to the loading by 25.6MW.

10. The CNASTONE-N-NWEST 500kV (BG&E) line loads from 163.71% to 166.74% (DC power flow) of its emergency rating (2901 MVA) for the tower line outage (CNSTN_NWEST_NNWEST_A). This project contributes approximately 87.9 MW to the thermal violation. T81 contributes to the loading by 85.1 MW.

Stability and Reactive Power Requirements

Will be performed during the Queue T82 System Impact Study.

Steady State Voltage Requirements

Will be performed during the Queue T82 System Impact Study.

New System Reinforcements

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

1. To mitigate the RAR RVR-KILMER I 230kV (JCP&L/PSEG) line overload would require replacement of a 2000 amp wave trap with one rated for 3000 amps at the Raritan river substation. The estimated cost to perform this work is **\$117,000**.
2. To mitigate the RL_230-KEEN_230 230kV (DP&L) line overload would require the replacement of the 2000A wave trap. The estimated cost to perform this work is **\$300,000** with a **12 month** lead time.

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 System Impact Study)

3. To mitigate the MONROE-NEW FRDM 230kV (AE/PSEG) line overload will require a rebuild and reconductor of the 6.91 mile Monroe-New Freedom 230 kV line with a bundled conductor. The estimated cost to perform this work is **\$16,600,000** and will take **36 months** to complete from the time "Notice to Proceed" is given after the ISA and CSA are executed.
4. To mitigate the MCKLTON-DELCOTAP 230kV (AE/PECO) overload would require upgrading the 220-53 and 220-38 circuit by reconductoring. These circuits are scheduled to be reconducted in 2008. The estimated cost to perform this work is **\$0 dollars**.
5. To mitigate the OXBOW-N.MESHPN 230kV (PENELEC) line overload would require the upgrade of approximately 10.16 miles of transmission line, a CT circuit, and substation conductor at the North Meshoppen substation. The estimated cost to perform this work is **\$5,345,000**.
6. To mitigate the 3 MILE I-TMI 500/230kV (METED) transformer overload would require the addition of a second 500/230kV transformer at TMI as well as transmission line upgrades between the 230kV and 500kV substations. The estimated cost to perform this work is **\$15,000,000** and will take **36 months** to complete.
7. To mitigate the NOTTINGHAM-NOTTREAC 230kV (PECO) overload would require upgrading the circuit by replacing line reactors. The estimate to perform this work is **\$200,000** and will take **18 months** to complete.
8. To mitigate the PCHBTMTP-GRACETON 230kV (PECO & BGE) overload would require the replacement of existing lines with three (3) 230kV underground circuits (BGE), and double 230kV underground circuits (PECO). The estimate to perform this work is **\$61,000,000** and will take **48 months** to complete.

9. To mitigate the NOTTREAC-PCHBTMTP 230kV (PECO) overload would require a teardown and rebuild to 1243/1410 MVA along with replacement of terminal equipment. The estimate to perform this work is **\$42,500,000** and will take **48 months** to complete.

10. To mitigate the CNASTONE-N-NWEST 500kV (BG&E) overload would require:

1 new single circuit line with the following assumptions:

A new 200 ft. wide ROW paralleling the existing Conastone to Northwest ROW
Total ROW length = 19.6 miles
3 - bundle 1,590 kcm conductor
North Northwest substation is located 4 miles north of Northwest substation

The estimated cost to perform this work, which includes breakers and terminations, is **\$110,000,000** and will take **10 years** to complete.

Additional substation work to include:

At the Conastone 500kV substation – install a 1 breaker bay
At the NNW 500kV substation – install a 3 breaker bay.

The estimated cost to perform this work is **\$9,200,000** with a **10 year** lead time to complete.

Delivery of Energy Portion of Interconnection Request

(PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with Network Upgrades to eliminate the operational restriction at their discretion by submitting a Transmission Interconnection Request). These are not required reinforcements.

As a result of the aggregate energy resources in the area, the following violations were identified:

1. The RED OAKA-RAR RVR 230kV (JCP&L) line loads from 205.4% to 207.4% (DC power flow) of its emergency rating (805 MVA) for the single line contingency outage (JC31A_Q08OP1A). This project contributes approximately 16.1 MW to the thermal congestion. T81 contributes to the loading by 41.7 MW.
2. The RED OAKB-RAR RVR 230kV (JCP&L) line loads from 205.3% to 207.3% (DC power flow) of its emergency rating (805MVA) for the single line contingency outage (JC30A_Q08OP1A). This project contributes approximately 16.1 MW to the thermal congestion. T81 contributes to the loading by 41.6 MW.

To mitigate the overloads in items 1 and 2 would require upgrading by reconductoring the double circuit tower line from 1590 Kcmil 45/7 ACSR (2.58 mile) to 1590 Kcmil 54/19 ACSS/AW (2.58 mile) for 869/1068 MVA summer normal/emergency ratings. It

would also require a bundled conductor at Raritan River substation and at Red Oak substation at an estimated cost of **\$8,251,000**. Bundled drop loop conductors at Raritan River and Red Oak substations would also be required on the G1047 line. The estimated cost to perform this work is **\$80,000**.

3. The OYSTER C-MANITOU 230kV (JCP&L) line loads from 96.1% to 103.2% (DC power flow) of its emergency rating (805MVA) for the single line contingency outage (JC14). This project contributes approximately 56.4MW to the thermal congestion. The mitigation of this overload is currently under development. It is expected to be available during the System Impact Study phase of T82.

4. The OYSTER C-MANITOU 230kV (JCL&L) line loads from 96.1% to 103.2% (DC power flow) of its emergency rating (805MVA) for the single line contingency outage (JC15). This project contributes approximately 56.4MW to the thermal congestion. The mitigation of this overload is currently under development. It is expected to be available during the System Impact Study phase of T82.

5. The PRINTZ-RIDLEY 230kV (PECO) line loads from 117.4% to 118.5% (DC power flow) of its emergency rating (1432MVA) for the single line contingency outage (PE4). This project contributes approximately 16.0MW to the thermal congestion. To mitigate this overload would require the replacement of terminal equipment. The estimated cost to perform this work is **\$5,000,000** and will require **30 months** to complete.

6. The RAR RVR-KILMER I 230kV (JCP&L/PSEG) line loads from 112.8% to 114.9% (DC power flow) of its emergency rating (742 MVA) for the single line contingency outage (JC29). This project contributes approximately 16.0 MW to the thermal congestion. T81 contributes to the loading by 35 MW. To mitigate the overload would require replacement of a 2000 amp wave trap with one rated for 3000 amps at the Raritan river substation. The estimated cost to perform this work is **\$117,000**.

7. The R39OPT1-RED OAKA 230kV (JCP&L) line loads from 116.4% to 118.6% (DC power flow) of its emergency rating (805 MVA) for the single line contingency outage (JC31B_Q08OP1B_Q11A). This project contributes approximately 17.9 MW to the thermal congestion. T81 contributes to the loading by 44.3 MW. To mitigate this overload would require rebuilding the double circuit tower line (0.2 miles) with bundled 1590 kcmil 54/19 ACSS/AW and adding bundled drop loop conductors at Red Oak A and R39. The estimated cost is to perform this work is **\$200,000**.

8. The Q11OP3-RED OAKB 230kV (JCP&L) line loads from 113.6% to 115.8% (DC power flow) of its emergency rating (805MVA) for the single line contingency outage (JC30B_Q08OP1B_R39OP1A). This project contributes approximately 17.6MW to the thermal congestion. T81 contributes to the loading by 43.7 MW. To mitigate this overload would require rebuilding the double circuit tower line (0.2 miles) with bundled 1590 kcmil 54/19 ACSS/AW and adding bundled drop loop conductors at Red Oak B. The estimated cost to perform this work is **\$160,000**.

9. The EAGLE PT-GLOUCSTR 230kV (PSE&G) line loads from 114.9% to 117.2% (DC power flow) of its emergency rating (752 MVA) for the single line contingency outage (PS4A). This project contributes approximately 17.3 MW to the thermal congestion. To mitigate this overload would require reconductoring 3 miles of line and the replacement of two wave traps and two line disconnects for a new rating of A=800 MVA, B=1000 MVA. The estimated cost to perform this work is **\$6,750,000**.

10. The CHICHST1-EDDYSTN4 230kV (PECO) line loads from 128.8% to 130.9% (DC power flow) of its emergency rating (1235 MVA) for the single line contingency outage (PE4). This project contributes approximately 25.4 MW to the thermal congestion. To mitigate this overload would require the replacement of terminal equipment. The estimated cost to perform this work is **\$5,000,000** and will require **30 months** to complete.

11. The THOROFAR-DEPTFORD 230kV (PSEG) line loads from 113.8% to 116.4% (DC power flow) of its emergency rating (676 MVA) for the single line contingency outage (PS4A). This project contributes approximately 17.7 MW to the thermal congestion. To mitigate this overload would require the replacement of one load-break disconnect and one wave trap for a new rating of A=734 MVA, B=870 MVA. The estimated cost to perform this work is **\$500,000**.

12. The GRAYSF71-TUNNEL2 230kV (PECO) line loads from 111.1% to 112.3% (DC power flow) of its emergency rating (1395 MVA) for the single line contingency outage (PE69). This project contributes approximately 17.3 MW to the thermal congestion. To mitigate this overload would require the teardown and rebuild to 1700 MVA emergency rating along with the replacement of terminal equipment. The estimated cost to perform this work is **\$5,800,000** and will require **42 months** to complete.

13. The MONROE-NEW FRDM 230kV (AE/PSEG) line loads from 102.9% to 108.4% (DC power flow) of its emergency rating (725 MVA) for the single line contingency outage (PS18). This project contributes approximately 39.9 MW to the thermal congestion. To mitigate the overload would require a rebuild and reconductor the 6.91 mile Monroe-New Frdm 230 kV line with a bundled conductor. The estimated cost to perform this work is **\$16,600,000** and will take **36 months** to complete from the time "Notice to Proceed" is given after the ISA and CSA are executed.

14. TUNNEL-PARRISH9 230kV (PECO) line loads from 108.8% to 110.1% (DC power flow) of its emergency rating (1395 MVA) for the single line contingency outage (PE69). This project contributes approximately 17.3 MW to the thermal congestion. To mitigate this overload would require the teardown and rebuild to 1700 MVA emergency rating along with the replacement of terminal equipment. The estimated cost to perform this work is **\$11,500,000** and will require **48 months** to complete.

15. The CHICHST1-FOULK8 230kV (PECO) line loads from 117.5% to 119.4% (DC power flow) of its emergency rating (1335MVA) for the single line contingency outage (PE36). This project contributes approximately 25.5MW to the thermal congestion. To mitigate this overload would require the replacement of terminal equipment. The estimated cost to perform this work is **\$5,000,000** and will require **30 months** to complete.

16. The FOULK-CONCORD6 230kV (PECO) line loads from 114.7% to 116.6% (DC power flow) of its emergency rating (1335MVA) for the single line contingency outage (PE36). This project contributes approximately 25.5MW to the thermal congestion. To mitigate this overload would require the replacement of terminal equipment. The estimated cost to perform this work is **\$5,000,000** and will require **30 months** to complete.

17. The MCKLTON-DELCOTAP 230kV (AE/PECO) line loads from 104.6% to 113.2% (DC power flow) of its emergency rating (725 MVA) for the single line contingency outage (PJM63). This project contributes approximately 62.1 MW to the thermal congestion. T81 contributes to the loading by 37.2 MW. To mitigate this overload would require upgrading the 220-53 and 220-38 circuit by reconductoring. These circuits are scheduled to be reconducted in 2008. The estimated cost to perform this work is **\$0 dollars**.

18. The DELCOTAP-TRAINER2 230kV (PECO) line loads from 101.1% to 108.6% (DC power flow) of its emergency rating (819 MVA) for the single line contingency outage (PJM63). This project contributes approximately 62.0 MW to the thermal congestion. T81 contributes to the loading by 37.1 MW. To mitigate this overload would require the teardown and rebuild to 1243/1410 MVA rating along with the replacement of terminal equipment. The estimated cost to perform this work is **\$7,100,000** and will require **48 months** to complete.

19. The TRAINER-CHIREACT 230kV (PECO) line loads from 94.4% to 102.0% (DC power flow) of its emergency rating (819 MVA) for the single line contingency outage (PJM63). This project contributes approximately 62.0 MW to the thermal congestion. To mitigate this overload would require upgrading the 220-53 and 220-38 circuit by reconductoring. These circuits are scheduled to be reconducted in 2008 to a new anticipated rating of 720/840 MVA. The estimated cost to perform this work is **\$0 dollars**.

20. The CHIREACT-CHICHST2 230kV (PECO) line loads from 94.4% to 102.0% (DC power flow) of its emergency rating (819 MVA) for the single line contingency outage (PJM63). This project contributes approximately 62.0 MW to the thermal congestion. To mitigate this overload would require upgrading the circuit by replacing line reactors. The estimate to perform this work is **\$100,000** and will take **18 months** to complete.

21. The EDDYSTN4-PRINTZ 230kV (PECO) line loads from 100.3% to 101.7% (DC power flow) of its emergency rating (1193 MVA) for the single line contingency outage (PE4). This project contributes approximately 16.9 MW to the thermal congestion. To mitigate this overload would require the replacement of terminal equipment. The estimated cost to perform this work is **\$5,000,000** and will require **30 months** to complete.

22. The CHICHST1-FOULK8 230kV (PECO) line loads from 98.5% to 100.1% (DC power flow) of its normal rating (1036MVA) for non-contingency condition. This project contributes approximately 16.9 MW to the thermal congestion. To mitigate this overload would require the replacement of terminal equipment. The estimated cost to perform this work is **\$2,000,000** and will require **30 months** to complete.

23. The RL_230-KEEN_230 230kV (DP&L) line loads from 106.3% to 111.6% (DC power flow) of its emergency rating (932 MVA) for the single line contingency outage (PJM64). This project contributes approximately 49.9 MW to the thermal congestion. T81 contributes to the loading by 35.5 MW. To mitigate the overload would require the replacement of the 2000A wave trap. The estimated cost to perform this work is **\$300,000** and will require **12 months** to complete.

24. The RAPHAEL-NEAST339 230kV (BG&E) line loads from 146.9% to 148.9% (DC power flow) of its emergency rating (758 MVA) for the single line contingency outage (BG8). This project contributes approximately 15.8 MW to the thermal congestion. T81 contributes to the loading by 15.7MW.

25. The RAPHAEL-NEAST317 230kV (BG&E) line loads from 144.0% to 146.1% (DC power flow) of its emergency rating (758 MVA) for the single line contingency outage (BG18). This project contributes approximately 15.6 MW to the thermal congestion. T81 contributes to the loading by 15.5 MW.

To mitigate the overloads in items #24 and #25 would require increasing the rated conductor temp to 160°C, which attains 1153 MVA. The existing conductor is 2,167 ACSR @ 125°C. The transmission line is 3.9 miles long. Approximately 7 spans have ground clearance of less than 35 feet. Assume replacement of 5 double circuit steel poles to increase ground clearance. The estimated cost to perform the line and substation work is **\$6,000,000** and will require **5 years** to complete.

26. The CNASTONE-N-NWEST 500kV (BG&E) line loads from 195.7% to 199.4% (DC power flow) of its normal rating (2078 MVA) for non-contingency condition. This project contributes approximately 77.0 MW to the thermal congestion. T81 contributes to the loading by 74.3 MW. To mitigate the overload would require:

1 new single circuit line with the following assumptions:

A new 200 ft. wide ROW paralleling the existing Conastone to Northwest ROW
Total ROW length = 19.6 miles
3 - bundle 1,590 kcm conductor
North Northwest substation is located 4 miles north of Northwest substation

The estimated cost to perform this work, which includes breakers and terminations, is **\$110,000,000** and will take **10 years** to complete.

Additional substation work to include:

At the Conastone 500kV substation – install a 1 breaker bay
At the NNW 500kV substation – install a 3 breaker bay.

The estimated cost to perform this work is **\$9,200,000** with a **10 year** lead time to complete. This reinforcement also mitigates the overloads in items 30 through 35 below.

27. The PEACHBTM-CNASTONE 500kV (PECO/BG&E) line loads from 188.0% to 192.3% (DC power flow) of its emergency rating (2598 MVA) for the single line contingency outage (PJM17_2). This project contributes approximately 110.3 MW to the thermal congestion. T81 contributes to the loading by 103.7 MW.

28. The PEACHBTM-CNASTONE 500kV (PECO/BG&E) line loads from 188.0% to 192.3% (DC power flow) of its emergency rating (2598 MVA) for the single line contingency outage (PJM17). This project contributes approximately 110.3 MW to the thermal congestion. T81 contributes to the loading by 103.7 MW. To mitigate the overloads in #27 and #28 would require the following:

BG&E portion of the Conastone – Peach Bottom line:

Conastone Substation - 3 - 4 years to complete – total estimate for this work is **\$39,000,000**

- Rebuild 3 existing bays to 4000A (also add breaker in one of the existing bays)
- Build new 4000A bay and install 3 breakers
- Relocate Hunterstown 500kV line
- Replace 4 inch bus with 5 inch

Transmission Line Component - 7 years to build after notice to proceed - total estimate for this work is **\$320,200,000**

- 2 - Double Circuit 500 kV OH lines from Conastone - Graceton - MD line (\$136)
- 2 - UG 230 kV circuits from Conastone - Graceton (\$122.4)*
- 3 - UG 230 kV circuits from Graceton - MD line (\$30.6)
- 1 - UG 115 kV circuit from Graceton - Five Forks (\$9.0)
- Acquire additional 50 ft. wide R/W Graceton - MD line (\$2.2)
- Remove existing OH lines/structures (\$2.0)

* assumes RTEP project b0497 Install a second Conastone - Graceton 230 kV circuit

PECO portion of the Conastone – Peach Bottom line:

Assumes 500 kV lines with ratings equal to the rating of the 4 inch diameter aluminum bus work at Peach Bottom, i.e. 3366 MVA normal and 4183 MVA emergency are able to be built.

- Relocate Peach Bottom to Graceton 220-08 line to underground to facilitate construction of additional 500kV lines in the Conastone to Peach Bottom right of way. The estimated cost to perform this work is **\$29,600,000**
- The underground line will require parallel pipe type cables to achieve a rating of 800MVA. The estimated cost to perform this work is **\$61,000,000** and **36 months** to complete.

Note: the 220-08 line is an offsite source for the Peach Bottom Atomic Power Station and its integrity must be maintained.

- Remove existing 220-08 line towers to clear the north side of the right of way for 500kV construction. The estimated cost to perform this work is **\$1,500,000** and **6 months** to complete.
- Construct new double circuit 500kV line on the north side of the 300 foot wide Peach Bottom to Maryland state line right of way. The estimated cost to perform this work is **\$17,000,000** and **30 months** to complete after the removal of the existing 230 kV tower line.
- Remove existing 5012 line towers to clear the south side of the right of way for new higher capacity 500kV lines. The estimated cost to perform this work is **\$1,500,000** and **6 months** to complete.
- Construct second new double circuit 500kV line on the south side of the Peach Bottom to Maryland state line right of way. The estimated cost to perform this work is **\$17,000,000** and **30 months** to complete after the removal of the existing 500 kV tower line.
- Upgrade 5012 line substation equipment to achieve the new higher rating. The estimated cost to perform this work is **\$3,000,000** and **18 months** to complete.
- Expand the 500kV substations (North and South) at Peach Bottom to accommodate three additional 500kV lines. The estimated cost to perform this work is **\$18,000,000** (\$6M per new line) and **30 months** to complete.

Note: The substation work may have to be coordinated with refueling outages at the Peach Bottom Atomic Power Station and that the overall project may overstress several 500 kV circuit breakers.

29. The NWEST311-GRANITE1 230kV (BG&E) line loads from 191.9% to 195.3% (DC power flow) of its emergency rating (641 MVA) for the single line contingency outage (PJM13B_NNWEST_B). This project contributes approximately 21.5 MW to the thermal congestion. T81 contributes to the loading by 20.9 MW. To mitigate the overload would require the building of a double circuit transmission line to attain two (2) 1033 ACSR @ 125 °C, attaining 1240 MVA SE. The existing conductor is 1590 45/7 ACSR which is rated at 160°C. The line is 8.7 miles long. The estimated cost to perform the substation and transmission line work is **\$27,000,000** and will take **6 years** to complete.

30. The CNASTONE-CONASTON 500/230kV transformer circuit #1 (BG&E) loads from 108.8% to 110.9% (DC power flow) of its emergency rating (1500 MVA) for the single line contingency outage (PJM13B_NNWEST_A). This project contributes approximately 32.5 MW to the thermal congestion. T81 contributes to the loading by 30.7 MW.

31. The CNASTONE-CONASTON 500/230kV transformer circuit #2 (BG&E) loads from 108.8% to 110.9% (DC power flow) of its emergency rating (1500 MVA) for the single line

contingency outage (PJM13B_NNWEST_A). This project contributes approximately 32.5 MW to the thermal congestion. T81 contributes to the loading by 30.7 MW.

32. The CONASTON-MT CAR10 230kV (BG&E) line loads from 163.2% to 165.9% (DC power flow) of its emergency rating (923 MVA) for the single line contingency outage (PJM13B_NNWEST_A). This project contributes approximately 25.4 MW to the thermal congestion. T81 contributes to the loading by 24.8 MW.

33. The CONASTON-MT CAR22 230kV line (BG&E) loads from 163.2% to 165.9% (DC power flow) of its emergency rating (923 MVA) for the single line contingency outage (PJM13B_NNWEST_A). This project contributes approximately 25.4 MW to the thermal congestion. T81 contributes to the loading by 24.8 MW.

34. The MT CAR10-N-NWEST 230kV (BG&E) line loads from 160.9% to 163.6% (DC power flow) of its emergency rating (923 MVA) for the single line contingency outage (PJM13B_NNWEST_A). This project contributes approximately 25.4 MW to the thermal congestion. T81 contributes to the loading by 24.8 MW.

35. The MT CAR22-N-NWEST 230kV (BG&E) line loads from 160.9% to 163.6% (DC power flow) of its emergency rating (923 MVA) for the single line contingency outage (PJM13B_NNWEST_A). This project contributes approximately 25.4 MW to the thermal congestion. T81 contributes to the loading by 24.8 MW.

The reinforcement in #26 above also mitigates the overloads in #30, 31, 32, 33, 34 and 35.

Option 2

Point of Interconnection: T82 Option 2 will interconnect with the Atlantic City Electric's transmission system at the Cardiff 230kV substation. Option 2 was studied as a 350 MW (70 MW Capacity) injection into the Cardiff 230kV substation. The project was evaluated for compliance with reliability criteria for summer peak conditions in 2012.

Direct Connection Requirements

Transmission Owner Scope of Direct Connection Work

The Transmission Owner's, (ACE), responsibility includes design and construction of all facilities associated with the Cardiff 230kV substation on their side of the Point of Interconnection (POI). ACE's direct connection work at the Cardiff substation consists of reconfiguring the substation to include the addition of equipment necessary to provide a terminal position for the Interconnection Customer's 230kV line to the T82 site. Revenue metering will be located on the feed to the generator.

The estimated cost to perform this work is **\$2,400,000** and can be completed in **24 to 36**

months. Note: the cost does not include the Contribution in Aid of Construction (CIAC) tax.

Interconnection Customer Scope of Direct Connection Work

The Interconnection Customer's off-shore facility is comprised of an array of wind turbine generators and a 34.5/138 kV collection substation. The collection substation will be connected to the ACE Cardiff 230kV substation via a submarine/underground or overhead cable. The developer has assumed full responsibility for design and construction of all facilities associated with the T82 generating station and the 230kV direct connection line on the Interconnection Customer side of the POI. Site preparation including grading and an access road if required is assumed to be by the developer.

The Interconnection Customer will be required to install metering and telemetry equipment to provide revenue metering and real-time telemetry data to PJM. The requirements for this equipment are listed in Appendix 2, Section 8 of Attachment O to the PJM Tariff, as well as PJM Manuals 01 and 14D. Protective relaying and metering design and installation must comply with Atlantic City Electric's Applicable Standards.

Network Impacts

The potential network impacts were as follows:

Generator Deliverability

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

1. **(JCP&L/PSEG)** The RAR RVR-KILMER I 230kV line loads from 99.9% to 100.4% (DC power flow) of its emergency rating (742 MVA) for the single line contingency outage (PS56C). This project contributes approximately 3.8 MW to cause this thermal violation.
2. **(DP&L)** The RL_230-KEEN_230 230kV line loads from 99.0% to 100.1% (DC power flow) of its emergency rating (932 MVA) for the single line contingency outage (PJM64). This project contributes approximately 9.5 MW to cause this thermal violation.

Multiple Facility Contingency

(Double Circuit Tower Line, Line with Failed Breaker and Bus Fault contingencies for the full energy output)

None

Short Circuit

(Summary form of Cost allocation for breakers will be inserted here if any)

There were no additional overstressed breakers identified as a result of the project.

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)

3. The MCKLTON-DELCOTAP 230kV (AE/PECO) line loads from 101.78% to 103.30% (DC power flow) of its emergency rating (725 MVA) for the single line contingency outage (PJM63). This project contributes approximately 11.1 MW to the thermal violation. T81 contributes to the loading by 7.4 MW.

4. The Q11OP3-RED OAKB 230kV (JCP&L) line loads from 125.81% to 127.88% (DC power flow) of its emergency rating (805 MVA) for the tower line outage (31JCB_Q08OP1B_Q11A_R39OP1). This project contributes approximately 16.7 MW to the thermal violation. T81 contributes to the loading by 29.2 MW.

5. The OXBOW-N.MESHNP 230kV (PENELEC) line loads from 179.35% to 181.96% (DC power flow) of its emergency rating (617 MVA) for the tower line outage (CONAS_PB). This project contributes approximately 16.1 MW to the thermal violation. T81 contributes to the loading by 16.8 MW.

6. The 3 MILE I-TMI 500/230kV (METED) transformer loads from 144.81% to 147.97% (DC power flow) of its emergency rating (1077 MVA) for the tower line outage (CONAS_PB). This project contributes approximately 34.0MW to the thermal violation. T81 contributes to the loading by 32.5 MW.

7. The NOTTINGHAM-NOTTREAC 230kV (PECO) line loads from 190.78% to 195.04% (DC power flow) of its emergency rating (627 MVA) for the tower line outage (CONAS_PB). This project contributes approximately 26.7 MW to the thermal violation. T81 contributes to the loading by 25.6 MW.

8. The PCHBTMTP-GRACETON 230kV (PECO/BG&E) line loads from 190.75% to 195.01% (DC power flow) of its emergency rating (627 MVA) for the tower line outage (CONAS_PB). This project contributes approximately 26.7 MW to the thermal violation. T81 contributes to the loading by 25.6 MW.

9. The NOTTREAC-PCHBTMTP 230kV (PECO) line loads from 190.75% to 195.01% (DC power flow) of its emergency rating (627 MVA) for the tower line outage (CONAS_PB). This project contributes approximately 26.7 MW to the thermal violation. T81 contributes to the loading by 25.6 MW.

10. The CNASTONE-N-NWEST 500kV (BG&E) line loads from 163.71% to 166.72% (DC power flow) of its emergency rating (2901 MVA) for the tower line outage (CNSTN_NWEST). This project contributes approximately 87.3 MW to the thermal violation. T81 contributes to the loading by 85.1 MW.

Stability and Reactive Power Requirements

Will be performed during the Queue T82 System Impact Study.

Steady State Voltage Requirements

Will be performed during the Queue T82 System Impact Study.

New System Reinforcements

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

1. To mitigate the RAR RVR-KILMER I 230kV (JCP&L/PSEG) line overload would require replacement of a 2000 amp wave trap with one rated for 3000 amps at the Raritan river substation. The estimated cost to perform this work is **\$117,000**.
2. To mitigate the RL_230-KEEN_230 230kV (DP&L) line overload would require the replacement of the 2000A wave trap. The estimated cost to perform this work is **\$300,000** and will take **12 months** 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) (Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)

3. To mitigate the MCKLTON-DELCOTAP 230kV (AE/PECO) overload would require upgrading the 220-53 and 220-38 circuit by reconductoring. These circuits are scheduled to be reconducted in 2008. The estimated cost to perform this work is **\$0 dollars**.
4. To mitigate the Q11OP3-RED OAKB 230kV (JCP&L) overload would require rebuilding the double circuit tower line (0.2 miles) with bundled 1590 kcmil 54/19 ACSS/AW and adding bundled drop loop conductors at Red Oak B. The estimated cost to perform this work is **\$160,000**.
5. To mitigate the OXBOW-N.MESHNP 230kV (PENELEC) line overload would require the upgrade of approximately 10.16 miles of transmission line, a CT circuit, and substation conductor at the North Meshoppen substation. The estimated cost to perform this work is **\$5,345,000**.
6. To mitigate the 3 MILE I-TMI 500/230kV (METED) transformer overload would require the addition of a second 500/230kV transformer at TMI as well as transmission line upgrades between the 230kV and 500kV substations. The estimated cost to perform this work is **\$15,000,000** and will take **36 months** to complete.

7. To mitigate the NOTTINGHAM-NOTTREAC 230kV (PECO) overload would require upgrading the circuit by replacing line reactors. The estimate to perform this work is **\$200,000** and will take **18 months** to complete.

8. To mitigate the PCHBTMTP-GRACETON 230kV (PECO & BGE) overload would require the replacement of existing lines with three (3) 230kV underground circuits (BGE), and double 230kV underground circuits (PECO). The estimate to perform this work is **\$61,000,000** and will take **48 months** to complete.

9. To mitigate the NOTTREAC-PCHBTMTP 230kV (PECO) overload would require a teardown and rebuild to 1243/1410 MVA along with replacement of terminal equipment. The estimate to perform this work is **\$42,500,000** and will take **48 months** to complete.

10. To mitigate the CNASTONE-N-NWEST 500kV (BG&E) overload would require:

1 new single circuit line with the following assumptions:

A new 200 ft. wide ROW paralleling the existing Conastone to Northwest ROW

Total ROW length = 19.6 miles

3 - bundle 1,590 kcm conductor

North Northwest substation is located 4 miles north of Northwest substation

The estimated cost to perform this work, which includes breakers and terminations, is **\$110,000,000** and will take **10 years** to complete.

Additional substation work to include:

At the Conastone 500kV substation – install a 1 breaker bay

At the NNW 500kV substation – install a 3 breaker bay.

The estimated cost to perform this work is **\$9,200,000** with a **10 year** lead time to complete.

Delivery of Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request. As a result of the aggregate energy resources in the area, the following violations were identified:

1. The RED OAKA-RAR RVR 230kV (JCP&L) line loads from 205.4% to 207.9% (DC power flow) of its emergency rating (805 MVA) for the single line contingency outage (JC31A_Q08OP1A). This project contributes approximately 19.8 MW to the thermal congestion. T81 contributes to the loading by 41.7 MW.

2. The RED OAKB-RAR RVR 230kV (JCP&L) line loads from 205.3% to 207.8% (DC power flow) of its emergency rating (805 MVA) for the single line contingency outage (JC30A_Q08OP1A). This project contributes approximately 19.8 MW to the thermal congestion. T81 contributes to the loading by 41.6 MW.

To mitigate the overloads in items 1 and 2 would require upgrading by reconductoring the double circuit tower line from 1590 Kcmil 45/7 ACSR (2.58 mile) to 1590 Kcmil 54/19 ACSS/AW (2.58 mile) for 869/1068 MVA summer normal/emergency ratings. It would also require a bundled conductor at Raritan River substation and at Red Oak substation at an estimated cost of **\$8,251,000**. Bundled drop loop conductors at Raritan River and Red Oak substations would also be required on the G1047 line. The estimated cost to perform this work is **\$80,000**.

3. The OYSTER C-MANITOU 230kV (JCP&L) line loads from 96.1% to 107.4% (DC power flow) of its emergency rating (805 MVA) for the single line contingency outage (JC15). This project contributes approximately 90.4 MW to the thermal congestion. The mitigation of this overload is currently under development. It is expected to be available during the System Impact Study phase of T82.

4. The OYSTER C-MANITOU 230kV (JCP&L) line loads from 96.1% to 107.4% (DC power flow) of its emergency rating (805 MVA) for the single line contingency outage (JC14). This project contributes approximately 90.4 MW to the thermal congestion. The mitigation of this overload is currently under development. It is expected to be available during the System Impact Study phase of T82.

5. The RAR RVR-KILMER I 230kV (JCP&L/PSEG) line loads from 112.8% to 115.4% (DC power flow) of its emergency rating (742 MVA) for the single line contingency outage (JC29). This project contributes approximately 19.6 MW to the thermal congestion. T81 contributes to the loading by 35 MW. To mitigate this overload would require replacement of a 2000 amp wave trap with one rated for 3000 amps at the Raritan river substation. The estimated cost to perform this work is **\$117,000**.

6. The R39OPT1-RED OAKA 230kV (JCP&L) line loads from 116.4% to 119.0% (DC power flow) of its emergency rating (805 MVA) for the single line contingency outage (JC31B_Q08OP1B_Q11A). This project contributes approximately 21.6 MW to the thermal congestion. Previous project(s) T81 contribute(s) to the loading by 44.3 MW. To mitigate this overload would require rebuilding the double circuit tower line (0.2 miles) with bundled 1590 kcmil 54/19 ACSS/AW and adding bundled drop loop conductors at Red Oak A and R39. The estimated cost is to perform this work is **\$200,000**.

7. The CHICHST1-EDDYSTN4 230kV (PECO) line loads from 128.8% to 130.5% (DC power flow) of its emergency rating (1235 MVA) for the single line contingency outage (PE4). This project contributes approximately 21.3 MW to the thermal congestion. To mitigate this overload would require the replacement of terminal equipment. The estimated cost to perform this work is **\$5,000,000** and will require **30 months** to complete

8. The CHICHST1-FOULK8 230kV (PECO) line loads from 117.5% to 119.1% (DC power flow) of its emergency rating (1335 MVA) for the single line contingency outage (PE36). This project contributes approximately 21.7 MW to the thermal congestion. To mitigate this overload would require the replacement of terminal equipment. The estimated cost to perform this work is **\$5,000,000** and will require **30 months** to complete.

9. The FOULK-CONCORD6 230kV (PECO) line loads from 114.7% to 116.3% (DC power flow) of its emergency rating (1335 MVA) for the single line contingency outage (PE36). This project contributes approximately 21.7 MW to the thermal congestion. To mitigate this overload would require the replacement of terminal equipment. The estimated cost to perform this work is **\$5,000,000** and will require **30 months** to complete.

10. The MCKLTON-DELCOTAP 230kV (AE/PECO) line loads from 104.6% to 112.2% (DC power flow) of its emergency rating (725 MVA) for the single line contingency outage (PJM63). This project contributes approximately 55.3 MW to the thermal congestion. T81 contributes to the loading by 37.2 MW. To mitigate this overload would require upgrading the 220-53 and 220-38 circuit by reconductoring. These circuits are scheduled to be reconductored in 2008. The estimated cost to perform this work is **\$0 dollars**.

11. The DELCOTAP-TRAINER2 230kV (PECO) line loads from 101.1% to 107.8% (DC power flow) of its emergency rating (819 MVA) for the single line contingency outage (PJM63). This project contributes approximately 55.1 MW to the thermal congestion. Previous project(s) T81 contribute(s) to the loading by 37.1 MW. To mitigate this overload would require the teardown and rebuild to 1243/1410 MVA rating along with the replacement of terminal equipment. The estimated cost to perform this work is **\$7,100,000** and will require **48 months** to complete.

12. The TRAINER-CHIREACT 230kV (PECO) line loads from 94.4% to 101.2% (DC power flow) of its emergency rating (819 MVA) for the single line contingency outage (PJM63). This project contributes approximately 55.1 MW to the thermal congestion. To mitigate this overload would require upgrading the 220-53 and 220-38 circuit by reconductoring. These circuits are scheduled to be reconductored in 2008 to a new anticipated rating of 720/840 MVA. The estimated cost to perform this work is **\$0 dollars**.

13. The CHIREACT-CHICHST2 230kV (PECO) line loads from 94.4% to 101.1% (DC power flow) of its emergency rating (819 MVA) for the single line contingency outage (PJM63). This project contributes approximately 55.1 MW to the thermal congestion. To mitigate this overload would require upgrading the circuit by replacing line reactors. The estimate to perform this work is **\$100,000** and will take **18 months** to complete.

14. The TUNNEL-PARRISH9 230kV (PECO) line loads from 98.7% to 100.1% (DC power flow) of its emergency rating (1395 MVA) for the single line contingency outage (PJM27B). This project contributes approximately 18.7 MW to the thermal congestion. To mitigate this overload would require the replacement of terminal equipment. The estimated cost to perform this work is **\$1,000,000** and will require **30 months** to complete.

15. The RL_230-KEEN_230 230kV (DP&L) line loads from 106.3% to 111.4% (DC power flow) of its emergency rating (932 MVA) for the single line contingency outage (PJM64). This project contributes approximately 47.6 MW to the thermal congestion. T81 contributes to the loading by 35.5 MW. To mitigate the overload would require the replacement of the 2000A wave trap. The estimated cost to perform this work is **\$300,000** and will require **12 months** to complete.

16. The RAPHAEL-NEAST339 230kV (BG&E) line loads from 146.9% to 148.9% (DC power flow) of its emergency rating (758 MVA) for the single line contingency outage (BG8). This project contributes approximately 15.7 MW to the thermal congestion. T81 contributes to the loading by 15.7 MW.

17. The RAPHAEL-NEAST317 230kV (BG&E) line loads from 144.0% to 146.1% (DC power flow) of its emergency rating (758 MVA) for the single line contingency outage (BG18). This project contributes approximately 15.6 MW to the thermal congestion. T81 contributes to the loading by 15.5 MW.

To mitigate the overloads in items #16 and #17 would require increasing the rated conductor temp to 160°C, which attains 1153 MVA. The existing conductor is 2,167 ACSR @ 125°C. The transmission line is 3.9 miles long. Approximately 7 spans have ground clearance of less than 35 feet. Assume replacement of 5 double circuit steel poles to increase ground clearance. The estimated cost to perform the line and substation work is **\$6,000,000** and will require **5 years** to complete.

18. The CNASTONE-N-NWEST 500kV (BG&E) line loads from 195.7% to 199.4% (DC power flow) of its normal rating (2078 MVA) for non-contingency condition. This project contributes approximately 76.4 MW to the thermal congestion. T81 contributes to the loading by 74.3 MW. To mitigate the overload would require:

1 new single circuit line with the following assumptions:

A new 200 ft. wide ROW paralleling the existing Conastone to Northwest ROW
Total ROW length = 19.6 miles
3 - bundle 1,590 kcm conductor
North Northwest substation is located 4 miles north of Northwest substation

The estimated cost to perform this work, which includes breakers and terminations, is **\$110,000,000** and will take **10 years** to complete.

Additional substation work to include:

At the Conastone 500kV substation – install a 1 breaker bay
At the NNW 500kV substation – install a 3 breaker bay.

The estimated cost to perform this work is **\$9,200,000** with a **10 year** lead time to complete. This reinforcement also mitigates the overloads in items 22 through 27 below.

19. The PEACHBTM-CNASTONE 500kV (PECO/BG&E) line loads from 188.0% to 192.2% (DC power flow) of its emergency rating (2598 MVA) for the single line contingency outage (PJM17_2). This project contributes approximately 109.0 MW to the thermal congestion. T81 contributes to the loading by 103.7 MW.

20. The PEACHBTM-CNASTONE 500kV (PECO/BG&E) line loads from 188.0% to 192.2% (DC power flow) of its emergency rating (2598 MVA) for the single line contingency outage (PJM17). This project contributes approximately 109.0 MW to the thermal congestion. Previous project(s) T81 contribute(s) to the loading by 103.7 MW.

To mitigate the overloads in #19 and #20 would require the following:

BG&E portion of the Conastone – Peach Bottom line:

Conastone Substation - 3 - 4 years to complete – total estimate for this work is **\$39,000,000**

- Rebuild 3 existing bays to 4000A (also add breaker in one of the existing bays)
- Build new 4000A bay and install 3 breakers
- Relocate Hunterstown 500kV line
- Replace 4 inch bus with 5 inch

Transmission Line Component - 7 years to build after notice to proceed - total estimate for this work is **\$320,200,000**

- 2 - Double Circuit 500 kV OH lines from Conastone - Graceton - MD line (\$136)
- 2 - UG 230 kV circuits from Conastone - Graceton (\$122.4)*
- 3 - UG 230 kV circuit from Graceton - MD line (\$30.6)
- 1 - UG 115 kV circuit from Graceton - Five Forks (\$9.0)
- Acquire additional 50 ft. wide R/W Graceton - MD line (\$2.2)
- Remove existing OH lines/structures (\$2.0)

* assumes RTEP project b0497 Install a second Conastone - Graceton 230 kV circuit

PECO portion of the Conastone – Peach Bottom line:

Assumes 500 kV lines with ratings equal to the rating of the 4 inch diameter aluminum bus work at Peach Bottom, i.e. 3366 MVA normal and 4183 MVA emergency are able to be built.

- Relocate Peach Bottom to Graceton 220-08 line to underground to facilitate construction of additional 500kV lines in the Conastone to Peach Bottom right of way. The estimated cost to perform this work is **\$29,600,000**
- The underground line will require parallel pipe type cables to achieve a rating of 800MVA. The estimated cost to perform this work is **\$61,000,000** and 36 months to complete.

Note: the 220-08 line is an offsite source for the Peach Bottom Atomic Power Station and its integrity must be maintained.

- Remove existing 220-08 line towers to clear the north side of the right of way for 500kV construction. The estimated cost to perform this work is **\$1,500,000** and **6 months** to complete.
- Construct new double circuit 500kV line on the north side of the 300 foot wide Peach Bottom to Maryland state line right of way. The estimated cost to perform this work is **\$17,000,000** and **30 months** to complete after the removal of the existing 230 kV tower line.
- Remove existing 5012 line towers to clear the south side of the right of way for new higher capacity 500kV lines. The estimated cost to perform this work is **\$1,500,000** and **6 months** to complete.
- Construct second new double circuit 500kV line on the south side of the Peach Bottom to Maryland state line right of way. The estimated cost to perform this work is **\$17,000,000** and **30 months** to complete after the removal of the existing 500 kV tower line.
- Upgrade 5012 line substation equipment to achieve the new higher rating. The estimated cost to perform this work is **\$3,000,000** and **18 months** to complete.
- Expand the 500kV substations (North and South) at Peach Bottom to accommodate three additional 500kV lines. The estimated cost to perform this work is **\$18,000,000** (\$6M per new line) and **30 months** to complete.

Note: The substation work may have to be coordinated with refueling outages at the Peach Bottom Atomic Power Station and that the overall project may overstress several 500 kV circuit breakers.

21. The NWEST311-GRANITE1 230kV (BG&E) line loads from 191.9% to 195.3% (DC power flow) of its emergency rating (641 MVA) for the single line contingency outage (PJM13B_NNWEST_B). This project contributes approximately 21.4 MW to the thermal congestion. T81 contributes to the loading by 20.9 MW. To mitigate the overload would require the building of a double circuit transmission line to attain two (2) 1033 ACSR @ 125 °C, attaining 1240 MVA SE. The existing conductor is 1590 45/7 ACSR which is rated at 160°C. The line is 8.7 miles long. The estimated cost to perform the substation and transmission line work is **\$27,000,000** and will take **6 years** to complete.

22. The CNASTONE-CONASTON 500/230kV (BG&E) transformer circuit #1 loads from 108.8% to 110.9% (DC power flow) of its emergency rating (1500 MVA) for the single line contingency outage (PJM13B_NNWEST_A). This project contributes approximately 32.2 MW to the thermal congestion. T81 contributes to the loading by 30.7W.

23. The CNASTONE-CONASTON 500/230kV (BG&E) transformer circuit #2 loads from 108.8% to 110.9% (DC power flow) of its emergency rating (1500 MVA) for the single line

contingency outage (PJM13B_NNWEST_A). This project contributes approximately 32.2 MW to the thermal congestion. T81 contributes to the loading by 30.7 MW.

24. The CONASTON-MT CAR10 230kV (BG&E) line loads from 163.2% to 165.9% (DC power flow) of its emergency rating (923 MVA) for the single line contingency outage (PJM13B_NNWEST_A). This project contributes approximately 25.2 MW to the thermal congestion. T81 contributes to the loading by 24.8 MW.

25. The CONASTON-MT CAR22 230kV (BG&E) line loads from 163.2% to 165.9% (DC power flow) of its emergency rating (923 MVA) for the single line contingency outage (PJM13B_NNWEST_A). This project contributes approximately 25.2 MW to the thermal congestion. T81 contributes to the loading by 24.8 MW.

26. The MT CAR10-N-NWEST 230kV (BG&E) line loads from 160.9% to 163.6% (DC power flow) of its emergency rating (923 MVA) for the single line contingency outage (PJM13B_NNWEST_A). This project contributes approximately 25.2 MW to the thermal congestion. T81 contributes to the loading by 24.8 MW.

27. The MT CAR22-N-NWEST 230kV (BG&E) line loads from 160.9% to 163.6% (DC power flow) of its emergency rating (923 MVA) for the single line contingency outage (PJM13B_NNWEST_A). This project contributes approximately 25.2 MW to the thermal congestion. T81 contributes to the loading by 24.8 MW

The reinforcement in #18 above also mitigates the overloads in #22, 23, 24, 25, 26, and 27.