S122 Churchtown-Cumberland 230kV
Generation Interconnection

General

The Interconnection Customer (IC), has proposed a 478 MW (478 MW of which is capacity) natural gas and bio-diesel fueled combined cycle and reciprocating engine generating facility to be located in Vineland, New Jersey. S122 will connect to the Atlantic City Electric's (ACE) transmission system through a new substation on the Churchtown-Cumberland 230kV line. The project was evaluated for compliance with reliability criteria for summer peak conditions in 2012.

Point of Interconnection: A new 230kV substation will be constructed on the Churchtown-Cumberland line to interconnect the S122 project with the Atlantic City Electric's transmission system. S122 was studied as a 478 MW capacity injection into the Churchtown-Cumberland 230kV line.

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 new Churchtown-Cumberland 230kV substation on the Interconnected Transmission Owner's side of the Point of Interconnection (POI). ACE's direct connection work will consist of constructing a new 230 kV substation configured as a ring bus on a site provided, permitted and prepared by the IC. The substation will include 230kV metering and associated facilities. The new substation will be connected to the ACE system by cutting the Churchtown-Cumberland 230kV circuit and looping in the substation. Revenue metering will be located on the feed to the generator.

The estimated cost to perform this work is **$8,400,000** and includes the substation, transmission (.5 miles of double circuit) and relays. The work will take **24 to 36 months** from the time "Notice to Proceed" is given after the ISA and CSA are executed. Note: the cost does not include the Contribution in Aid of Construction (CIAC) tax.

Interconnection Customer Scope of Direct Connection Work

The IC has assumed full responsibility for design and construction of all facilities associated with the S122 generating station and the 230 kV direct connection line on the Interconnection Customer side of the POI. Site preparation including grading, right off way, and access roads 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 #2 Mill-Scull 138 kV line section will be loaded to 118% of emergency rating (268 MVA) for the outage of the #1 BL England-Mill-Lewis 138 kV line. The S122 project contributes 65 MW to the contingency facility loading.

2) The #2 BLE-Scull 138 kV line section will be loaded to 119% of emergency rating (307 MVA) for the outage of the #1 BL England-Mill-Lewis 138 kV line. The S122 project contributes 66 MW to the contingency facility loading.

3) The #1 Lewis-Mill 138 kV line section will be loaded to 111% of emergency rating (268 MVA) for the outage of the #2 BL England-Mill-Lewis 138 kV line. The S122 project contributes 61 MW to the contingency facility loading.

4) The #1 Mill-Scull 138 kV line section will be loaded to 112% of emergency rating (268 MVA) for the outage of the #2 BL England-Mill-Lewis 138 kV line. The S122 project contributes 62 MW to the contingency facility loading.

5) The #1 BLE-Scull 138 kV line section will be loaded to 115% of emergency rating (292 MVA) for the outage of the #2 BL England-Mill-Lewis 138 kV line. The S122 project contributes 63 MW to the contingency facility loading.

6) The Dennis 230/138 kV transformer will be loaded to 100.4% of emergency rating (435 MVA) for the outage of the Cumberland-Union 138 kV line. The S122 project contributes 87 MW to the contingency 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 System Impact Study)

None.

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)

7. The GLOUCSTR-GLOUCSTR 230/138 kV transformer loads from 117.38% to 123.72% (DC power flow) of its emergency rating (341MVA) for the single line contingency outage (PJM89_NF_LOOPB). This project contributes approximately 21.6MW to the overload.

8. The GLOUCSTR-CUTHBERT 138 kV line loads from 117.14% to 123.47% (DC power flow) of its emergency rating (341MVA) for the single line contingency outage (PJM89_NF_LOOPB). This project contributes approximately 21.6MW to the overload.

9. The GLOUCSTR-CUTHBERT 138 kV line loads from 120.17% to 127.00% (DC power flow) of its normal rating (239MVA) for non-contingency condition. This project contributes approximately 16.3MW to the overload.

10. The MCKLTON-THOROFAR 230 kV line loads from 139.76% to 145.21% (DC power flow) of its normal rating (451MVA) for non-contingency condition. This project contributes approximately 24.6 MW to the overload.

11. The GLOUCSTR-GLOUCSTR 230/138 kV transformer loads from 108.70% to 114.86% (DC power flow) of its normal rating (265MVA) for non-contingency condition. This project contributes approximately 16.3 MW to the overload.

12. The EAGLE PT-GLOUCSTR 230 kV line loads from 102.90% to 106.58% (DC power flow) of its normal rating (653 MVA) for non-contingency condition. This project contributes approximately 24.0MW to the overload.

13. The PEACHBTM-CNASTONE 500 kV line circuit #1 loads from 161.76% to 167.81% (DC power flow) of its emergency rating (2598MVA) for the single line contingency outage (PJM17_2). This project contributes approximately 157.2 MW to the overload.

14. The PEACHBTM-CNASTONE 500 kV line circuit #2 loads from 161.76% to 167.81% (DC power flow) of its emergency rating (2598MVA) for the single line contingency outage (PJM17). This project contributes approximately 157.2 MW to the overload.

15. The CNASTONE-N-NWEST 500 kV line loads from 167.01% to 172.21% (DC power flow) of its normal rating (2078 MVA) for non-contingency condition. This project contributes approximately 107.9 MW to the overload.

16. The RAPHAEL-NEAST339 230 kV line loads from 131.23% to 134.08% (DC power flow) of its emergency rating (758 MVA) for the single line contingency outage (BG8). This project contributes approximately 21.6 MW to the overload.

17. The NWEST311-GRANITE1 230 kV line loads from 172.46% to 177.18% (DC power flow) of its emergency rating (641 MVA) for the single line contingency outage (PJM13B_NNWEST_B). This project contributes approximately 30.2 MW to the overload.

18. The RAPHAEL-NEAST317 230 kV line loads from 129.40% to 132.21% (DC power flow) of its emergency rating (758 MVA) for the single line contingency outage (BG18). This project contributes approximately 21.3 MW to the overload.

19. The ROXBURY-01GREENE 138 kV line loads from 114.95% to 119.41% (DC power flow) of its emergency rating (142 MVA) for the single line contingency outage (PJM13B_NNWEST_A). This project contributes approximately 6.3 MW to the overload.

20. The CONASTON-MT CAR22 230 kV line loads from 145.34% to 149.16% (DC power flow) of its emergency rating (923 MVA) for the single line contingency outage (PJM13B_NNWEST_A). This project contributes approximately 35.3 MW to the overload.

21. The CONASTON-MT CAR10 230 kV line loads from 145.34% to 149.16% (DC power flow) of its emergency rating (923 MVA) for the single line contingency outage (PJM13B_NNWEST_A). This project contributes approximately 35.3 MW to the overload.

22. The MT CAR10-N-NWEST 230 kV line loads from 143.05% to 146.87% (DC power flow) of its emergency rating (923 MVA) for the single line contingency outage (PJM13B_NNWEST_A). This project contributes approximately 35.3 MW to the overload.

23. The MT CAR22-N-NWEST 230 kV line loads from 143.05% to 146.87% (DC power flow) of its emergency rating (923 MVA) for the single line contingency outage (PJM13B_NNWEST_A). This project contributes approximately 35.3 MW to the overload.

24. The MCKLTON-THOROFAR 230 kV line loads from 171.56% to 176.11% (DC power flow) of its emergency rating (566 MVA) for the tower line outage (4AE_A19). This project contributes approximately 25.7 MW to the overload.

25. The EAGLE PT-GLOUCSTR 230 kV line loads from 134.64% to 138.00% (DC power flow) of its emergency rating (752 MVA) for the tower line outage (4AE_A19). This project contributes approximately 25.3 MW to the overload.

26. The THOROFAR-DEPTFORD 230 kV line loads from 135.17% to 138.98% (DC power flow) of its emergency rating (676 MVA) for the tower line outage (4AE_A19). This project contributes approximately 25.7 MW to the overload.

27. The DEPTFORD-EAGLE PT 230 kV line loads from 109.78% to 113.20% (DC power flow) of its emergency rating (752 MVA) for the tower line outage (4AE_A19). This project contributes approximately 25.7 MW to the overload.

28. The 3 MILE I-TMI 500/230 kV transformer loads from 142.45% to 146.98% (DC power flow) of its emergency rating (1077 MVA) for the tower line outage (Conas_PB). This project contributes approximately 48.8 MW to the overload.

29. The NOTTNGHM-NOTTREAC 230 kV line loads from 167.00% to 172.99% (DC power flow) of its emergency rating (627 MVA) for the tower line outage (Conas_PB). This project contributes approximately 37.5 MW to the overload.

30. The PCHBTMTP-GRACETON 230 kV line loads from 166.94% to 172.93% (DC power flow) of its emergency rating (627 MVA) for the tower line outage (Conas_PB). This project contributes approximately 37.5 MW to the overload.

31. The NOTTREAC-PCHBTMTP 230 kV line loads from 166.94% to 172.93% (DC power flow) of its emergency rating (627 MVA) for the tower line outage (Conas_PB). This project contributes approximately 37.5 MW to the overload.

32. The CNASTONE-N-NWEST 500 kV line loads from 152.14% to 156.38% (DC power flow) of its emergency rating (2901 MVA) for the tower line outage (CNSTN_NWEST_NNWEST_A). This project contributes approximately 122.9 MW to the overload.

Short Circuit

The following 4 breakers were found to be overstressed as a result of S122.

Corson 69kV CB A (128.7%)
Corson 69kV CB C (125.9%)
Corson 69kV CB J (135.2%)
Corson 69kV CB M (141.5%)

Stability and Reactive Power Requirements

Will be performed during the Queue S122 System Impact Study.

Steady State Voltage Requirements

Will be performed during the Queue S122 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 SCULL #2-MILL #2 138kV (AE) line overload would require the reconductor of the line section with an ACSS conductor. The estimated cost to perform this work is **$4,000,000** and will take **30 months** to complete from the time "Notice to Proceed" is given after the ISA and CSA are executed. The costs include reconfiguring the Scull substation to facilitate the outage of the #2 Mill-Scull 138kV line section without causing a total outage to the substation. This is because the #1 and #2 lines will both need to be out of service at the same time, one for reconductoring and the other for clearance.

2. To mitigate the BLE-SCULL#2 138kV (AE) line overload would require the reconductor of the line section with an ACSS conductor. The estimated cost to perform this work is **$800,000** and will take **30 months** to complete from the time "Notice to Proceed" is given after the ISA and CSA are executed.

3. To mitigate the MILL #1-LEWIS #1 138kV (AE) line overloads would require the reconductor of the line section with an ACSS conductor. The estimated cost to perform this work is **$1,900,000** and will take **30 months** to complete from the time "Notice to Proceed" is given after the ISA and CSA are executed.

4. To mitigate the SCULL#1-MILL #1 138kV (AE) line overloads would require the reconductor of the line section with an ACSS conductor. The estimated cost to perform this work is **$2,000,000** and will take **30 months** to complete from the time "Notice to Proceed" is given after the ISA and CSA are executed.

5. To mitigate the BLE-SCULL#1 138kV (AE) line overloads would require the reconductor of the line section with an ACSS conductor. The estimated cost to perform this work is **$800,000** and will take **30 months** to complete from the time "Notice to Proceed" is given after the ISA and CSA are executed.

6) To mitigate the Dennis 230/138 kV transformer (AE) overload would require the installation of a 336 MVA 230/69 kV transformer at the Dennis substation along with a 1590 ACSS 69 kV line from Dennis to the Corson substation. The estimated cost to perform this work is $**10,000,000** and will take **40 months** to complete from the time "Notice to Proceed" is given after the ISA and CSA are executed.

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)

7. and 11. To mitigate the GLOUCSTR-GLOUCSTR 230/138kV (PSEG) transformer overloads would require the replacement of the transformer. The estimated cost to perform this work is **$3,975,000**.

8. and 9. To mitigate the GLOUCSTR-CUTHBERT 138kV (PSEG) line overloads would require reconductoring approximately 5 miles of line and upgrading terminal equipment. The estimated cost to perform this work is **$20,800,000.**

10. and 24. To mitigate the MCKLTON-THOROFAR 230 kV (AE/PSEG) line overloads would require reconductoring the line with an ACSS/TW conductor and upgrading terminal equipment. The estimated cost to perform this work is **$1,500,000** and will take **30 months** to complete from the time "Notice to Proceed is given after the ISA and CSA are executed.

12. and 25. To mitigate the EAGLE PT-GLOUCSTR 230kV (PSEG) line overloads would require the reconductoring of approximately 5 miles of line and upgrading of terminal equipment. The estimated cost to perform this work is **$3,800,000.**

13. and 14. To mitigate the PEACHBTM-CNASTONE 500kV (BGE/PECO) overload would require a second 500kV circuit to be built.

If right of way <u>CAN</u> be acquired, following is the reinforcement and cost estimates:

<u>PECO portion of the Conastone – Peach Bottom line:</u>

Substation work at Peach Bottom	$ 2,500,000
Construct 6.25 miles of 500kV line	<u>$10,000,000</u>
	$12,500,000

This estimate does not include the cost of new right of way.

Construction of the new line will take approximately **30 months** after the right of way is acquired.

<u>Note</u>: It should be noted that PJM Queue P04 project also requires widening of about two miles of this right of way for their direct connection line and would use the last remaining terminal position that exists at Peach Bottom substation. If Queue P04 proceeds with their project it may complicate right of way acquisition and double the substation costs at Peach Bottom.

<u>BGE portion of the Conastone – Peach Bottom line:</u>
Build new 500 kV line adjacent to existing circuit 5012 from Conastone to Pennsylvania State Line at an estimated cost of **$48,000,000** and a construction time of approximately **84 months.**

Assumptions:

- Acquire 150 ft. wide R/W adjacent to existing R/W, mostly rural land at $100,000 per acre
- 2 to 3 year CPCN process prior to land acquisition
- Length of line 9.6 miles

Install one 500kV breaker at Conastone **$1,500,000**. Breaker installation can be completed concurrently with the line construction.

If right of way <u>CANNOT</u> be acquired, following is the reinforcement and cost estimates:

The line from Graceton to Peach Bottom is about 7.5 miles long and has a normal rating of 528MVA. Assuming that we could maintain this rating with a single 230 kV pipe type cable, the new underground installation would cost about **$30,000,000** plus another **$1,000,000** for terminal modifications. The assumption is made that the underground line

will not have to cross any rivers or large creeks. If a cable rating of 450 MVA is insufficient, it will cost an additional **$30,000,000**.

Removal of the existing 230 kV tower line is approximately **$1,500,000.**

Construction of a double circuit 500kV line from Conastone to Peach Bottom would be approximately $3,500,000 per mile. The line is 16.5 miles long. Total cost is estimated to be **$58,000,000.**

Substation additions and modifications at Peach Bottom would are estimated to cost approximately **$10,000,000.**

Note: Future work is being done by the BGE and PECO to come up with reinforcements to further mitigate the overload.

15. and 32. To mitigate the CNASTONE-N-NWEST 500kV (BG&E) overloads 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.

16. and 18. To mitigate the RAPHAEL-NEAST339 and 317 230kV (BGE) line overloads would require the replacement of the 230kV circuit breaker in each line. The total estimated cost to perform this work is **$766,000.**

17. To mitigate the NWEST311-GRANITE1 230kV (BGE) line overload would require the replacement of the 230 kV circuit breaker at Northwest. The estimated cost to perform this work is **$383,000.**

19. To mitigate the ROXBURY-01GREENE 138 kV (PENELEC) line overload would require the replacement/upgrade of the Roxbury 138/115 kV transformer. This overload would require the upgrade of the transmission transformer and associated equipment (circuit breaker, substation conductor, CT circuits). The estimated cost to perform this work is **$2,250,000** and will take **24 months** to complete.

20. 21. 22. and 23. To mitigate the CONASTON- MT CARMEL - NORTHWEST 230kV (BGE) line overloads would require the installation of the North Northwest substation including; two (2) 500/230kV transformers, four (4) 500 kV circuit breakers, seven (7) 230 kV circuit breakers and related substation equipment and land. The estimated cost to perform this work is **$70,000,000**. It also requires to reconductor Conastone to Northwest #2322 with 1,272kcmil ACSR 1,590kcmil ACSR. The estimated cost to perform this work is **$8,210,000**. This work would take **36 to 48 months** to build the substation and **18 to 24 months** for the line work.

26. To mitigate the THOROFAR-DEPTFORD 230kV (PSEG) line overload would require the reconductoring of approximately 3.5 miles of line and upgrading of terminal equipment. The estimated cost to perform this work is **$4,700,000.**

27. To mitigate the DEPTFORD-EAGLE PT 230kV (PSEG) line overload would require the reconductoring of approximately 1 mile of line and upgrading of terminal equipment. The estimated cost to perform this work is **$1,200,000.**

28. To mitigate the 3 MILE I-TMI 500/230kV (METED) transformer would require the installation of a second 500/230kV transformer. The estimated cost to perform this work is **$11,800,000** and will take **20 months** to complete after an ISA and CSA are executed.

29. To mitigate the NOTTNGHM-NOTTREAC 230kV (PECO) line overload would require the replacement of the line reactor. The estimated cost to perform this work is **$200,000** and will take **18 months** to complete after an ISA and CSA are executed.

30. and 31. To mitigate the NOTTREAC-PCHBTMTP-GRACETON 230kV (PECO/BGE) line overloads would require the following: A portion of this line must be relocated to underground to facilitate the construction of additional 500 kV lines between Peach Bottom and Conastone. The estimated cost to perform this work is **$61,000,000** and will take **36 months** to complete. The Peach Bottom to Nottingham portion (13.6 miles) must be rebuilt as a high capacity 230 kV line, (1243MVAn/1411MVAe) which includes a Susquehanna River crossing. The estimated cost to perform this work is **$42,500,000** and will take **48 months** to complete.