

U1-056 Lewis 138kV **Generation Interconnection**

General

The Interconnection Customer has proposed a 350 MW (45.5 MW of which is capacity) wind power generating facility to be located approximately seven (7) miles off shore in the Atlantic Ocean, southeast of the Great Egg Harbor Inlet, between Atlantic City and Ocean City, New Jersey.

Queue Project #U1-056 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 is the 2nd quarter of 2104.

Point of Interconnection: U1-056 will interconnect with the Atlantic City Electric's transmission system at the Lewis 138kV substation. The project was studied as a 350 MW 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 creating one (1) 138kV terminal position for the Interconnection Customer's 138 kV line to the U1-056 site.

The estimated cost to perform this work is **\$1,400,000** and can be completed in **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 or land acquisition.

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 collection substation. The collection substation will be connected to ACE's 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 U1-056 generating station and the 138 kV direct connection line on the Interconnection Customer side of the POI. Site preparation including grading, right of way, and access roads as necessary 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)*

None

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)*

1. The CLAYVILL-SHRMAN#3 138kV (AE) line loads from 99.42% to 108.81% (DC power flow) of its emergency rating (292 MVA) for the tower line outage (13AE_WITH_U1_029OP1_B). This project contributes approximately 27.4 MW to cause this thermal violation.

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. The UNION-CLAYVILL 138kV (AE) line loads from 108.77% to 118.17% (DC power flow) of its emergency rating (292 MVA) for the tower line outage (13AE_WITH_U1_029OP1_B). This project contributes approximately 27.4 MW to the thermal violation.

3. The EAGLE PT-GLOUCSTR 230kV (PSEG) line loads from 162.31% to 164.84% (DC power flow) of its emergency rating (752 MVA) for the tower line outage (4PS). This project contributes approximately 19.1 MW to the thermal violation.

4. The THOROFAR-DEPTFORD 230kV (PSEG) line loads from 166.77% to 169.64% (DC power flow) of its emergency rating (676 MVA) for the tower line outage (4PS). This project contributes approximately 19.4 MW to the thermal violation.

5. The MCKLTON-DELCOTAP 230kV (AE/PECO) line loads from 165.57% to 170.05% (DC power flow) of its emergency rating (725 MVA) for the tower line outage (4AE_A19). This project contributes approximately 32.5 MW to the thermal violation.

6. The DELCOTAP-TRAINER2 230kV (PECO) line loads from 155.05% to 159.00% (DC power flow) of its emergency rating (819 MVA) for the tower line outage (4AE_A19). This project contributes approximately 32.4 MW to the thermal violation.
7. The DEPTFORD-EAGLE PT 230kV (PSEG) line loads from 138.18% to 140.76% (DC power flow) of its emergency rating (752 MVA) for the tower line outage (4PS). This project contributes approximately 19.4 MW to the thermal violation.
8. The TRAINER-CHIREACT 230kV (PECO) line loads from 148.41% to 152.37% (DC power flow) of its emergency rating (819 MVA) for the tower line outage (4AE_A19). This project contributes approximately 32.4 MW to the thermal violation.
9. The CHIREACT-CHICHST2 230kV (PECO) line loads from 148.39% to 152.35% (DC power flow) of its emergency rating (819 MVA) for the tower line outage (4AE_A19). This project contributes approximately 32.4 MW to the thermal violation.
10. The MONROE-NEW FRDM 230kV (AE/PSEG) line loads from 109.23% to 116.65% (DC power flow) of its emergency rating (725 MVA) for the tower line outage (14AE). This project contributes approximately 53.8 MW to the thermal violation.
11. The NEW FREE-WINDSOR 500kV (PSEG/JCPL) line loads from 102.64% to 105.07% (DC power flow) of its emergency rating (3040MVA) for the tower line outage (21JC). This project contributes approximately 74.2MW to the thermal violation.
12. The CHICHST1-FOULK8 230kV (PECO) line loads from 103.41% to 104.75% (DC power flow) of its emergency rating (1335 MVA) for the tower line outage (PE500). This project contributes approximately 17.8 MW to the thermal violation.
13. The FOULK-CONCORD6 230kV (PECO) line loads from 100.63% to 101.97% (DC power flow) of its emergency rating (1335 MVA) for the tower line outage (PE500). This project contributes approximately 17.8 MW to the thermal violation.
14. The PEACHBTM-CNASTONE 500kV (PECO/BGE) line loads from 244.55% to 248.42% (DC power flow) of its emergency rating (2598 MVA) for the tower line outage (CONAS_PB). This project contributes approximately 100.5 MW to the thermal violation.
15. The CNASTONE-N-NWEST 500kV (BGE) line loads from 215.13% to 218.10% (DC power flow) of its emergency rating (2901 MVA) for the tower line outage (CNSTN_NWEST_NNWEST_A). This project contributes approximately 86.2 MW to the thermal violation.
16. The ROCKSPGS-PEACHBTM 500kV (PECO) line loads from 111.18% to 114.38% (DC power flow) of its emergency rating (3112 MVA) for the tower line outage (1PS). This project contributes approximately 99.6 MW to the thermal violation.

17. The MONROE-NEW FRDM 230kV (AE/PSEG) line loads from 132.24% to 133.33% (DC power flow) of its emergency rating (725 MVA) for the single line contingency outage (U_queue_reinforcement_44). This project contributes approximately 7.9 MW to the thermal violation.

18. The MICKLETON-DELCO TAP 230 kV line loads to 148% of its emergency rating (725 MVA) for the outage of the MONROE-NEW FREEDOM 230 kV line. This project contributes 54 MW to the contingency facility loading.

19. The MICKLETON-THOROFARE 230 kV line loads to 222% of its emergency rating (566 MVA) for the outage of the MICKLETON-TRAINER 230 kV line. This project contributes 26 MW to the contingency facility loading.

20. The MONROE-NEW FREEDOM 230 kV line loads to 162% of its emergency rating (725 MVA) for the outage of the MICKLETON-TRAINER 230 kV line. This project contributes 62 MW to the contingency facility loading.

21. The ORCHARD-S122 Tap 230 kV line loads to 125% of its emergency rating (805 MVA) for the outage of the DENNIS-CORSON 138 kV line. This project contributes 47 MW to the contingency facility loading.

22. The MILL 69 kV bus tie loads to 116% of its emergency rating (239 MVA) for the outage of the ORCHARD-S122 Tap 230 kV line. This project contributes 26 MVA to the contingency facility loading.

Short Circuit

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

Stability and Reactive Power Requirements

Will be performed during the Queue U1-056 System Impact Study.

Steady State Voltage Requirements

Will be performed during the Queue U1-056 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 CLAYVILL-SHRMAN#3 138kV (AE) line overload would require the circuit to be reconducted 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.

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)

2. To mitigate the UNION-CLAYVILL 138kV (AE) line overload would require the circuit to be reconducted with an ACSS conductor. 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.

3. To mitigate the EAGLE PT-GLOUCSTR 230kV (PSEG) line overload would require reconducting 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 **\$3,800,000**.

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

5. and 18. To mitigate the MCKLTON-DELCOTAP 230kV (AE/PECO) line overloads would require the rebuild and reconductor of the line section with bundled conductor. The Delaware River crossing section of this line will also require a rebuild and reconductor. The estimated cost to perform this work is **\$108,100,000** and will take **36 months** to complete from the time "Notice to Proceed" is given after the ISA and CSA are executed.

6. To mitigate the DELCOTAP-TRAINER2 230kV (PECO) overload would require a teardown and rebuild to 1243/1410 MVA along with replacement of terminal equipment. The estimated cost to perform this work is **\$7,100,000** and will take **42 months** to complete.

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

8. To mitigate the TRAINER-CHIREACT 230kV (PECO) overload would require a teardown and rebuild of the circuit to a new 1243/1410 MVA rating along with replacement of the terminal equipment. The estimated cost to perform this work is **\$9,200,000** and will take **48 months** to complete.

9. To mitigate the CHIREACT-CHICHST2 230kV (PECO) line overload would require removal of the line reactor. The estimated cost to perform this work is **\$100,000** and will take **6 months** to complete.

10. 17. and 20. To mitigate the MONROE-NEW FRDM 230kV (AE/PSEG) line overloads 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.

11. The NEW FREE-WINDSOR 500kV (PSEG/JCPL) line loads from 102.64% to 105.07% (DC power flow) of its emergency rating (3040 MVA) for the tower line outage (21JC). This project contributes approximately 74.2 MW to the thermal violation. The JCPL reinforcement to mitigate this overload would require the replacement of two East Windsor line wave traps with ones rated for 4000 amps. The estimated cost to perform this work is **\$350,000** and will take **24 months** to complete. The PSEG reinforcement is currently under development and is expected to be available during the System Impact Study phase of the U1-056 project.

12. To mitigate the CHICHST1-FOULK8 230kV (PECO) line overload would require the replacement of terminal equipment. The estimated cost to perform this work is **\$5,000,000** and will take **30 months** to complete.

13. To mitigate the FOULK-CONCORD6 230kV (PECO) line overload would require the replacement of terminal equipment. The estimated cost to perform this work is **\$2,000,000** and will take **30 months** to complete.

14. To mitigate the PEACHBTM-CNASTONE 500kV line overload 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
- 2 - UG 230 kV circuits from Conastone - Graceton *
- 3 - UG 230 kV circuits from Graceton - MD line
- 1 - UG 115 kV circuit from Graceton - Five Forks
- Acquire additional 50 ft. wide R/W Graceton - MD line
- Remove existing OH lines/structures

* 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.

15. 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.

16. To mitigate the ROCKSPGS-PEACHBTM 500kV (PECO) line overload would require the replacement of terminal equipment. The estimated cost to perform his work is **\$8,000,000** and will take **36 months** to complete. This is also the reinforcement for the overload in items #15 and #16 under the “Delivery of Energy Portion of Interconnection Request” section of this report.

19. To mitigate the MICKLETON-THOROFARE 230kV (AE/PSEG) line overload would require rebuilding and 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.

21. To mitigate to ORCHARD-S122 230kV (AE) line overload would require the reconductor of the line 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.

22. To mitigate the MILL 69 kV (AE) bus tie overload would require the upgrade of the bus-tie to 3000 amps. The estimated cost to perform this work is **\$300,000** and will take **30 months** to complete from the time "Notice to Proceed" is given after the ISA and CSA are executed.

Delivery of Energy Portion of Interconnection Request

*(PJM also studied the delivery of the **Full** 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 (JCPL) line loads from 191.8% to 193.8% (DC power flow) of its emergency rating (805 MVA) for the single line contingency outage (JC31A_Q08OP1A). This project contributes approximately 16.0 MW to the thermal congestion.

2. The RED OAKB-RAR RVR 230kV (JCPL) line loads from 191.8% to 193.7% (DC power flow) of its emergency rating (805 MVA) for the single line contingency outage (JC30A_Q08OP1A). This project contributes approximately 16.0 MW to the thermal congestion.

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 (JCPL) line loads from 128.4% to 135.4% (DC power flow) of its emergency rating (805 MVA) for the single line contingency outage (JC15). This project contributes approximately 56.4 MW to the thermal congestion.

4. The OYSTER C-MANITOU 230kV (JCPL) line loads from 128.4% to 135.4% (DC power flow) of its emergency rating (805 MVA) for the single line contingency outage (JC14). This project contributes approximately 56.4 MW to the thermal congestion.

The reinforcement necessary to mitigate the overloads in items 3 and 4 is currently under development and is expected to be available during the System Impact Study phase of U1-056.

5. The MERION-CORSON 1 138kV (AE) line loads from 102.1% to 114.4% (DC power flow) of its normal rating (199 MVA) for non-contingency condition. This project contributes approximately 24.5 MW to the thermal congestion. To mitigate the overload would require the reconductor of a section of the line with an ACSS conductor. The estimated cost to perform this work is **\$2,400,000** and will take **30 months** to complete from the time "Notice to Proceed" is given after the ISA and CSA are executed.

6. The PRINTZ-RIDLEY 230kV (PECO) line loads from 152.2% to 153.4% (DC power flow) of its emergency rating (1432MVA) for the single line contingency outage (PE4). This project contributes approximately 17.3MW to the thermal congestion. To mitigate the overload would require the construction of a second underground 230kV line and an expansion of the substations. The estimated cost is to perform this work is **\$55,000,000** and it will take **48 months** to complete.

7. The GLOUCSTR-CUTHBERT 138kV (PSEG) line loads from 141.3% to 145.7% (DC power flow) of its normal rating (239 MVA) for non-contingency condition. This project contributes

approximately 10.4 MW to the thermal congestion. To mitigate the overload would require reconductoring approximately 5 miles of line and upgrading terminal equipment. The estimated cost to perform this work is **\$20,800,000**.

8. The RAR RVR-KILMER I 230kV (JCPL/PSEG) line loads from 99.3% to 101.4% (DC power flow) of its emergency rating (742MVA) for the single line contingency outage (JC29). This project contributes approximately 15.8MW to the thermal congestion. 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**.

9. The R39OPT1-RED OAKA 230kV (JCPL) line loads from 106.6% to 108.8% (DC power flow) of its emergency rating (805 MVA) for the single line contingency outage (JC31B_Q08OP1B_Q11A). This project contributes approximately 17.7 MW to the thermal congestion. 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**.

10. The Q11OP3-RED OAKB 230kV (JCPL) line loads from 104.1% to 106.3% (DC power flow) of its emergency rating (805 MVA) for the single line contingency outage (JC30B_Q08OP1B_R39OP1A). This project contributes approximately 17.5 MW to the thermal congestion. 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**.

11. The GRAYSF71-TUNNEL2 230kV (PECO) line loads from 151.9% to 153.1% (DC power flow) of its emergency rating (1395 MVA) for the single line contingency outage (PE69). This project contributes approximately 17.5 MW to the thermal congestion. To mitigate this overload would require the construction of a second aerial line and expansion of the substations. The estimated cost to perform this work is **\$20,000,000** and will take **48 months** to complete.

12. The TUNNEL-PARRISH9 230kV (PECO) line loads from 149.6% to 150.9% (DC power flow) of its emergency rating (1395 MVA) for the single line contingency outage (PE69). This project contributes approximately 17.5 MW to the thermal congestion. To mitigate this overload would require the construction of a second underground line. The estimated cost to perform this work is **\$33,000,000** and will take **48 months** to complete.

13. The PEDRKTWN-BRIDGPRT 230kV (AE) line loads from 122.2% to 130.2% (DC power flow) of its emergency rating (552 MVA) for the single line contingency outage (PJM90). This project contributes approximately 44.1 MW to the thermal congestion. The reinforcement necessary to mitigate this overload is under development and is expected to be available during the U1-056 System Impact Study.

14. The RL_230-KEEN_230 230kV (DPL) line loads from 130.7% to 135.4% (DC power flow) of its emergency rating (1036MVA) for the single line contingency outage (PJM64). This project contributes approximately 48.7MW to the thermal congestion. To mitigate the overload would

require the replacement of the 2000A wave trap with one rated for 3000A. The estimated cost to perform this work is **\$400,000** and will take **12 to 18 months** to complete.

15. The ROCKSPGS-PEACHBTM 500kV line loads from 125.6% to 129.5% (DC power flow) of its emergency rating (3112MVA) for the single line contingency outage (PJM89A). This project contributes approximately 120.4MW to the thermal congestion.

16. The ROCKSPGS-PEACHBTM 500kV line loads from 121.6% to 125.2% (DC power flow) of its normal rating (2707MVA) for non-contingency condition. This project contributes approximately 97.5MW to the thermal congestion.

For items #15 and #16, see item #15 above in the “Contribution to Previously Identified Overloads’ section above for the reinforcement necessary to mitigate this overload.