

# **U1-030 Sherman Ave** **Generation Interconnection**

## **General**

The Interconnection Customer (IC) has proposed a 110 MW simple cycle combustion turbine generating facility to be located in Atlantic City, New Jersey. The projected in service date of U1-030 is May 1, 2013. The project will interconnect with the Atlantic City Electric's system at either the 69kV side of the Higbee substation (Option 1), or to the 23kV side of the Higbee substation, (Option 2). PJM completed the load flow analysis for the U1-030 project. The study found no new violations, but several contributions, to existing violations on the transmission system. They are provided below. These studies were performed on the 115kV and above network.

## **Option 1**

**Point of Interconnection:** U1-030 Option 1 will interconnect with the Atlantic City Electric's transmission system at the Higbee 69kV substation. Option 1 was studied as a 110 MW injection into the Higbee 69kV 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 responsibility includes design and construction of all facilities associated with the Higbee 69kV substation on the Interconnected Transmission Owner's side of the Point of Interconnection (POI) should they be required.

### **Interconnection Customer Scope of Direct Connection Work**

The developer has assumed full responsibility for design and construction of all facilities associated with the U1-030 generating station and the 69kV direct connect line or bus work on the Interconnection Customer side of the POI.

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 MISSOURI-HIGBEE 69 kV (AE) line loads to 180% of its emergency rating (72 MVA). This project contributes 110 MW to the facility loading.
2. The HIGBEE 69 kV (AE) bus-tie 'D' loads to 120% of its emergency rating (146 MVA) for the outage of the Higbee #1 69/23 kV transformer. This project contributes 68 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)*

3. The UNION-CLAYVILL 138kV (AE) line loads from 117.52% to 120.40% (DC power flow) of its emergency rating (292 MVA) for the tower line outage (13AE\_WITH\_U1\_029OP1\_A). This project contributes approximately 8.4 MW to the thermal violation.
4. The CLAYVILL-SHRMAN#3 138kV line loads from 108.17% to 111.05% (DC power flow) of its emergency rating (292 MVA) for the tower line outage (13AE\_WITH\_U1\_029OP1\_A). This project contributes approximately 8.4 MW to the thermal violation.
5. The MCKLTON-DELCOTAP 230kV line loads from 129.85% to 131.85% (DC power flow) of its normal rating (605 MVA) for non-contingency condition. This project contributes approximately 12.1 MW to the thermal violation.
6. The MCKLTON-DELCOTAP 230kV line loads from 165.99% to 167.36% (DC power flow) of its emergency rating (725 MVA) for the tower line outage (4AE\_A19). This project contributes approximately 9.9 MW to the thermal violation.
7. The DELCOTAP-TRAINER2 230kV line loads from 155.42% to 156.63% (DC power flow) of its emergency rating (819 MVA) for the tower line outage (4AE\_A19). This project contributes approximately 9.9 MW to the thermal violation.

8. The TRAINER-CHIREACT 230kV line loads from 148.79% to 150.00% (DC power flow) of its emergency rating (819 MVA) for the tower line outage (4AE\_A19). This project contributes approximately 9.9 MW to the thermal violation.

9. The CHIREACT-CHICHST2 230kV line loads from 148.77% to 149.98% (DC power flow) of its emergency rating (819 MVA) for the tower line outage (4AE\_A19). This project contributes approximately 9.9 MW to the thermal violation.

10. The MONROE-NEW FREEDOM 230kV line loads from 167.05% to 168.51% (DC power flow) of its emergency rating (725 MVA) for the single line contingency outage (PS18). This project contributes approximately 10.6 MW to the thermal violation.

11. The PEACHBTM-CNASTONE 500kV line loads from 244.81% to 246.02% (DC power flow) of its emergency rating (2598 MVA) for the tower line outage (CONAS\_PB). This project contributes approximately 31.5 MW to the thermal violation.

12. The MICKLETON-THOROFARE 230 kV line loads to 215% of its emergency rating (566 MVA) for the outage of the Mickleton-Trainer 230 kV line. This project contributes 7 MW to the contingency facility loading.

13. The MONROE-NEW FREEDOM 230 kV line loads to 153% of its emergency rating (725 MVA) for the outage of the Mickleton-Trainer 230 kV line. This project contributes 18 MW to the contingency facility loading.

14. The ORCHARD-S122 Tap 230 kV line loads to 119% of its emergency rating (805 MVA) for the outage of the DENNIS-CORSON 138 kV line. This project contributes 14 MW to the contingency facility loading.

### **Short Circuit**

No new breakers were found to be over-duty.

### **Stability and Reactive Power Requirements**

Will be performed during the Queue U1-030 System Impact Study.

### **Steady State Voltage Requirements**

Will be performed during the Queue U1-030 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 MISSOURI-HIGBEE 69 kV (AE) line overload would require resetting relay limits. The current limit of 39 MVA will be increased to a new limit of 143 MVA. The estimated cost to perform this work is under review and is expected to be available during the System Impact Study.

2. To mitigate the HIGBEE 69 kV (AE) bus-tie 'D' overload would require an upgrade of the bus-tie to 2000 amps. The estimated cost to perform this work is **\$400,000** 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)*

3. To mitigate the UNION-CLAYVILL 138kV (AE) line overload would require the circuit to be reconductored 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.

4. To mitigate the CLAYVILL-SHRMAN#3 138kV (AE) line overload would require the circuit to be reconductored 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.

5. and 6. 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.

7. 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.

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. and 13. To mitigate the MONROE-NEW FRDM 230kV (AE/PSEG) line overload would 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. 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.**

12. To mitigate the MCKLTON-THOROFAR 230 kV (AE/PSEG) line overloads 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.

14. 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.

## **Option 2**

**Point of Interconnection:** U1-030 Option 2 proposed to interconnect with the Atlantic City Electric's distribution system at the Higbee 23kV substation. Option 2 was studied as a 110 MW injection into the Higbee 23kV 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 Higbee 23kV substation on the ACE side of the Point of Interconnection (POI).

### **Interconnection Customer Scope of Direct Connection Work**

The developer has assumed full responsibility for design and construction of all facilities associated with the U1-030 generating station and the 23kV direct connection line on the Interconnection Customer side of the POI.

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 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, Line with Failed Breaker and Bus Fault contingencies for the full energy output)*

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)*

1. The UNION-CLAYVILL 138kV line loads from 117.52% to 120.40% (DC power flow) of its emergency rating (292 MVA) for the tower line outage (13AE\_WITH\_U1\_029OP1\_A). This project contributes approximately 8.4 MW to the thermal violation.

2. The MONROE-NEW FRDM 230kV line loads from 105.44% to 106.93% (DC power flow) of its normal rating (650 MVA) for non-contingency condition. This project contributes approximately 9.7 MW to the thermal violation.
3. The CLAYVILL-SHRMAN#3 138kV line loads from 108.17% to 111.05% (DC power flow) of its emergency rating (292 MVA) for the tower line outage (13AE\_WITH\_U1\_029OP1\_A). This project contributes approximately 8.4 MW to the thermal violation.
4. The MCKLTON-DELCOTAP 230kV line loads from 129.78% to 131.78% (DC power flow) of its normal rating (605 MVA) for non-contingency condition. This project contributes approximately 12.1 MW to the thermal violation.
5. The MCKLTON-DELCOTAP 230kV line loads from 157.49% to 159.14% (DC power flow) of its emergency rating (725 MVA) for the tower line outage (10APECO\_A57). This project contributes approximately 11.9 MW to the thermal violation.
6. The DELCOTAP-TRAINER2 230kV line loads from 155.38% to 156.59% (DC power flow) of its emergency rating (819 MVA) for the tower line outage (4AE\_A19). This project contributes approximately 9.9 MW to the thermal violation.
7. The TRAINER-CHIREACT 230kV line loads from 148.75% to 149.96% (DC power flow) of its emergency rating (819 MVA) for the tower line outage (4AE\_A19). This project contributes approximately 9.9 MW to the thermal violation.
8. The CHIREACT-CHICHST2 230kV line loads from 148.73% to 149.94% (DC power flow) of its emergency rating (819 MVA) for the tower line outage (4AE\_A19). This project contributes approximately 9.9 MW to the thermal violation.
9. The MONROE-NEW FRDM 230kV line loads from 167.14% to 168.60% (DC power flow) of its emergency rating (725 MVA) for the single line contingency outage (PS18). This project contributes approximately 10.6 MW to the thermal violation.
10. The PEACHBTM-CNASTONE 500kV line loads from 244.81% to 246.02% (DC power flow) of its emergency rating (2598 MVA) for the tower line outage (CONAS\_PB). This project contributes approximately 31.5 MW to the thermal violation.

### **Short Circuit**

No new breakers were found to be over-duty.

### **Stability and Reactive Power Requirements**

Will be performed during the Queue U1-030 System Impact Study.

### Steady State Voltage Requirements

Will be performed during the Queue U1-030 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)*

None

### 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)*

1. 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.
2. and 9. To mitigate the MONROE-NEW FRDM 230kV (AE/PSEG) line overload would 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.
3. 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.
4. and 5. 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 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.

8. 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. 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.**