# W1-010 Cooper 20MWe / 7.6MWc
# Feasibility Study

***General***

Queue W1-010 Cooper is a request to interconnect a new 20 MW ground mounted solar photovoltaic array facility and to obtain 7.6MW of CIRs (Capacity Interconnection Rights). The Customer Facility will be located in Peach Bottom Township, York County, Pennsylvania. The Interconnection Customer's planned in-service date for Queue W1-010 generation is December 1, 2010.

***Direct Connection Requirements***

Queue W1-010 will be connected to Cooper 34.5 kV circuit 372.

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

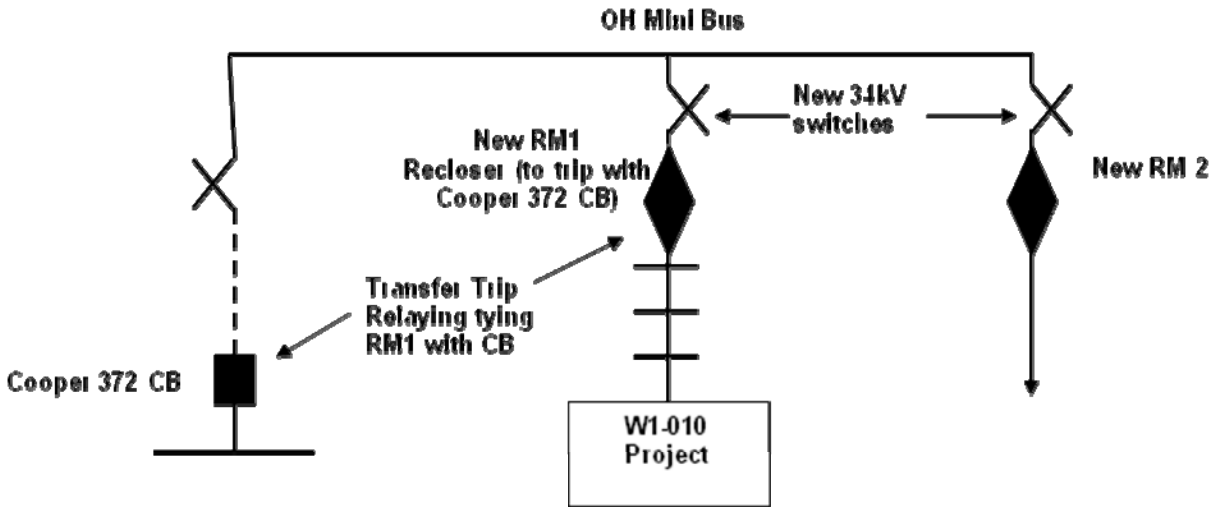
The Interconnection Customer is responsible for construction of all facilities on its side of the POI (Point of Interconnection).

Metering / telemetering

PJM requires instantaneous (real time) KW and KVAR data for generation that is a Capacity Resource. PJM also requires Interval Revenue Metering (Hourly KW & KVAR) provided daily. See the PJM Open Access Transmission Tariff and the PJM Manuals M-01 and M-14D available at http://www.pjm.com

***Transmission Owner (PECO Energy) Scope of Direct Connection Work***

PECO will create a 34kV mini bus outside Cooper Substation fence installing two 34kV modified reclosers, one for W1-010 Project and other for circuit loads.




Queue W1-010 will be required to install Direct Transfer Trip equipment (primary and backup) at Cooper and RM1 Recloser for W1-010 Project to open recloser RM1 when the Cooper 372 CB trips (loss of transmission, loss of Cooper PDM or for downstream circuit faults). PJM and IEEE 1547 standards require that the customer generation should be no more than 50 % of the isolated load. The new recloser RM2 for Cooper 372 would normally clear downstream faults allowing generation to continue operating. However, both RM1 & RM2 will open upon loss of supply. It is also required that recloser RM1 be opened when the Cooper transformer or Cooper 372 feeder are out of service for maintenance or other work.

The Point of Interconnection with W1-010 is to be adjacent to or near Cooper Substation with 750 kcmil Al aerial cable to be installed a nominal distance, not to exceed 500 feet, between the new recloser RM1 and the interconnection point with the W-1-010 Project.

See PJM Manual 14A Attachment E – "Small Generator (10 MW and Below) Applicable Technical Requirements and Standards" page 65, paragraph 12 which can be obtained at link http://www.pjm.com/documents/manuals.aspx

Conceptual estimate for distribution portion is $500,000 including two 34kV reclosers, relaying and 34kV circuit rearrangements.

Estimated completion time: 9 to 12 months after all contracts are signed and full payment received

***Network Impacts***

The queue W1-010 project was studied as a 20.0MW (7.6MW of which was capacity) injection into PECO's system at the Cooper 35.0kV substation. The project was studied on a combined feasibility-impact basis which utilizes an AC analysis, and incorporates all contingency types. Project W1-010 was evaluated for compliance with reliability criteria for summer peak conditions in 2014. Potential network impacts were as follows:

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

No problems identified.

**Multiple Facility Contingency**
*(Double Circuit Tower Line, Stuck breaker and Bus Fault contingencies for the full energy output)*

No problems identified.

**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 COOPER-V4-002TAP1 230 kV line (from bus 214089 to bus 900010 ckt 1) loads from 122.9% to 124.1% (AC power flow) of its emergency rating (485 MVA) for the single line contingency ('PJM17'). This project contributes approximately 6.17 MW to cause the thermal violation.

2. The COOPER-V4-002TAP1 230 kV line (from bus 214089 to bus 900010 ckt 1) loads from 150.28% to 153.61% (AC power flow) of its emergency rating (485 MVA) for the single line contingency ('PJM17'). This project contributes approximately 16.25 MW to cause the thermal violation.

3. The V4-002TAP1-GRACETON 230 kV line (from bus 900010 to bus 220964 ckt 1) loads from 167.9% to 169.51% (AC power flow) of its normal rating (379 MVA) for non-contingency condition. This project contributes approximately 6.28 MW to cause the thermal violation.

4. The V4-002TAP1-GRACETON 230 kV line (from bus 900010 to bus 220964 ckt 1) loads from 224.94% to 226.13% (AC power flow) of its emergency rating (485 MVA) for the single line contingency ('PJM17'). This project contributes approximately 6.17 MW to cause the thermal violation.

5. The V4-002TAP1-GRACETON 230 kV line (from bus 900010 to bus 220964 ckt 1) loads from 253.64% to 256.9% (AC power flow) of its emergency rating (485 MVA) for

the single line contingency ('PJM17'). This project contributes approximately 16.25 MW to cause the thermal violation.

**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)*

1. To mitigate the overload on the Cooper – V4-002 tap 230kV line segment, the line segment must be reconductored with a higher rated conductor. This work is estimated to take approximately 12 months, and would cost $0.5M. This upgrade also mitigates Network Impact #2.

3. PECO portion: To mitigate the overload on the V4-002 – Graceton 230kV line segment, a rebuild of the line is required. This work is estimated to take approximately 48 months, and cost $8.0M. This upgrade also mitigates Network Impact #4 and 5.

BGE portion: a double circuit line will be built with 1033.5kcmil ACSR creating one circuit by connecting the two lines into one. Rating for 2 – 1033.5kcmil 45/7 ACSR (Ortolan) at 125°C = 968/1227MVA SN/SE. BGE ownership is for 1.85 miles and the rebuild of 11 structures. It would be built as a double circuit line with the conductors jumpered across at the terminal ends. The line construction is estimated at $3,000,000. Two breakers ($400,000/breaker) would need to be replaced at Graceton for a cost of $800,000. An additional cost of $200,000 would also be incurred for 4 breaker disconnects and line connections to cover thermal. The project is estimated to take 30 months to complete: 12 months for the CPCN process & design and an additional 18 months for construction. The total cost of the project is estimated at $4.0M.

**Short Circuit**

Not required.

**Potential Congestion due to Local Energy Deliverability**
*(PJM also studied the delivery of the energy portion of the surrounding generation. Any potential 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. Note: Only the most severely overloaded conditions are listed below. There is no guarantee of full deliverability for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be*

*performed which analyzes all overload conditions associated with the identified overloaded element(s). As a result of the aggregate energy resources in the area, the following violations were identified:*

6. The COOPER-V4-002TAP1 230 kV line (from bus 214089 to bus 900010 ckt 1) loads from 150.12% to 153.43% (AC power flow) of its emergency rating (485 MVA) for the single line contingency ('PJM17'). This project contributes approximately 16.25 MW to cause the thermal violation.

7. The V4-002TAP1-GRACETON 230 kV line (from bus 900010 to bus 220964 ckt 1) loads from 252.03% to 255.31% (AC power flow) of its emergency rating (485 MVA) for the single line contingency ('PJM17'). This project contributes approximately 16.25 MW to cause the thermal violation.