PJM Generator Interconnection Y1-022 Cooper 10MWe / 3.8MWc Feasibility/System Impact Study

May 2013

DMS # 752227v1

Preface

The intent of the System Impact Study is to determine a plan, with approximate cost and construction time estimates, to connect the subject generation interconnection project to the PJM network at a location specified by the Interconnection Customer. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system. All facilities required for interconnection of a generation interconnection project must be designed to meet the technical specifications (on PJM web site) for the appropriate transmission owner.

In some instances an Interconnection Customer may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection or merchant transmission upgrade, may also contribute to the need for the same network reinforcement. The possibility of sharing the reinforcement costs with other projects may be identified in the Feasibility Study, but the actual allocation will be deferred until the System Impact Study is performed.

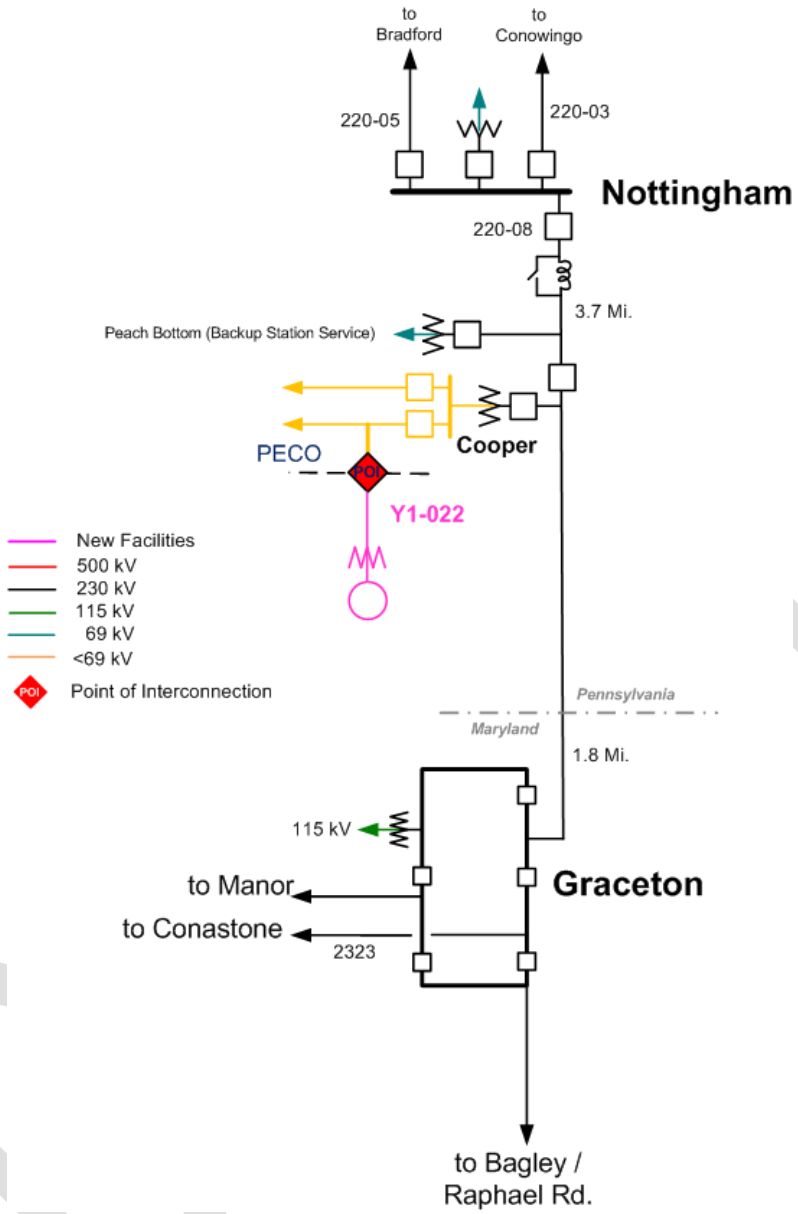
The System Impact Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The project developer is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by Transmission Owners, the costs may be included in the study.

General

Queue Y1-022 (Cooper) is a Community Energy Solar LLC. ("Interconnection Customer"), request to interconnect a new 10 MW ground mounted solar photovoltaic array facility and to obtain 3.8MW 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 Y1-022 generation is October 21, 2013.

Direct Connection Requirements

Queue Y1-022 will be connected to Cooper 34.5 kV circuit 372 as shown on the single line diagram below.



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) shown on the one line diagram above.

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

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

Transmission Owner (PECO Energy) Scope of Direct Connection Work

The Interconnection Customer submitted drawing SUS-OL-02RAwhich states: "Interconnect point to be where the 34.5 kV line crosses Booker Road (approximately 1 mile east/northeast of the intersection of state route 2043 (Flintville Road)) and Lay Road, York County." During the kickoff call, providing an interconnection point near the intersection of Wiley and Flinthill Roads was proposed. The Wiley and Flinthill Roads location was used for cost estimating and study purposes in responding to this request. The Interconnection Customer should submit a Service and Meter Application confirming the desired point of interconnection, if this was not completed previously. The application can be found at the following website, under 'Electric Service Application': https://www.peco.com/PartnersinBusiness/BuildersandContractors/ServiceRequest/Pages/ServiceOptions.aspx

Potential issues for this interconnection include:

- Possible incorrect operation of the Cooper 230-34 kV transformer automatic voltage control relay [AVC].
- High voltage on the distribution circuit, due to the generation, when connected to the alternate source for the area.
- Potential for islanding due to the capacity of the proposed generation compared to the area load

These issues will be investigated as part of the Facilities Study

Network Impacts

The queue Y1-022 project was studied as a 10.0MW (3.8MW of which was capacity) injection into PECO's system at the Cooper 35.0kV substation. Project Y1-022 was evaluated for compliance with reliability criteria for summer peak conditions in 2015. Potential network impacts were as follows:

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

No issues identified.

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

No issues identified.

Steady-State Voltage Requirements

(Results of the steady-state voltage studies should be inserted here)

None.

Stability and Reactive Power Requirement

None identified on the distribution system with the proposed Interconnection Customer operating at or near unity power factor.

Short Circuit

Short circuit studies have not yet been performed on the distribution system and will be completed as part of the Facilities Study upon confirmation on how the facility will be configured to meet PECO's requirement of providing an effectively grounded source to the distribution system.

New System Reinforcements

- During light load conditions, the proposed generation will be feeding into the 230 kV transmission system through the Cooper 230-34 kV transformer. The transformer manufacturer has indicated that the existing analog AVC relay may operate incorrectly in this situation and recommends the relay be replaced with a digital AVC relay.

- To address the islanding issue, Direct Transfer Trip [DTT] will be required between the Cooper 372 CB and the Interconnection Customer's main circuit breaker. This will result in the Interconnection Customers main CB being open whenever the Cooper 372 CB is open.

  The DTT installation will require:
    - Relay additions at Cooper Substation

- Interconnection Customer installed compatible relays at Interconnection Customer main CB [The cost estimate provided below does **not** include any costs for the work required at the Interconnection Customer's property.]

- A fiber optic cable will be required between Cooper Substation and the Interconnection Customer's main CB. [The estimate below includes the estimated cost for installing the fiber optic cable from Cooper to the Interconnection Point at the vicinity of Wiley and Flinthill Roads. The Interconnection Customer will be responsible for providing and installing the fiber optic cable from the Interconnection Point to their main CB.]

- The Interconnection Customer shall have provisions for monitoring its connection status, real power output, reactive power output, and voltage at the point of interconnection. PECO will have to make the necessary modifications to incorporate this information into its operating system. The Interconnection Customer is response for providing an acceptable communications path to deliver this information to PECO. PECO will have to make the necessary modifications to incorporate this information into its operating system.

- The Interconnection Customer will be connected to PECO system via a 34 kV Rate HT service. Requirements for Rate HT services are contained in Section 7 of PECO's Electric Service Requirements [ESR], which can be accessed at the website listed below. The Interconnection Customer should submit a single line drawing for approval before purchasing any equipment.

  https://www.peco.com/partnersinbusiness/buildersandcontractors/pages/guidelines.aspx.
- The Interconnection Customer will be responsible for providing 35 kV service cable meeting the requirements of the NEC and PECO's Electric Service Requirements [ESR]. The Interconnection Customer must extend the cable to the yet to be finalized Interconnection Point and leave sufficient slack for PECO to extend up the designated pole and terminate. See Sections 10 and 11 of the ESR, which can be found at the website listed above, for service assembly and cable specifications.

The total estimate for all PECO work identified above is $370,000. This includes the AVC and DTT relay work at Cooper, extending fiber optic cable from Cooper Substation to the Interconnection Point and terminating the Interconnection Customer provide cables at the Interconnection Point. The estimated time to design, schedule and complete this

work is approximately one and one-half years from the time the Interconnection Customer signs an agreement and submits payment for the work.

Contribution to Previously Identified System Reinforcements

None required.

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.

Only the most severely overloaded conditions are listed. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed, which will study all overload conditions associated with the overloaded element(s) identified.

None identified.