Generation Interconnection
Combined Feasibility/Impact Study Report

For

PJM Generation Interconnection Request
Queue Position Y2-075

Monocacy 12.47kV Worman Mill Feeder

February, 2013

Combined Feasibility/System Impact Study Report

Introduction

The intent of the Feasibility/Impact study is to determine a plan, with estimated costs and construction time estimates, to connect the subject generation to the PJM network at a location specified by the Interconnection Customer. The Interconnection Customer may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: (1) Direct Connections, which are new facilities and/or facilities upgrades needed to connect the generator to the PJM network, and (2) Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

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, 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 impact study is performed.

The 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

The Interconnection Customer (IC), Solar City, had submitted an Attachment Y for a proposed interconnection of a 500kW photovoltaic (PV) facility at 1845 Brookfield Court, Frederick , MD 21701 for the purpose of selling up to 500kW into the PJM market via the Potomac Edison (PE) network. Potomac Edison is a FirstEnergy (FE) company.

The IC later requested to change the interconnection from 500kW to 285kW of PV. In addition, Potomac Edison determined that the injection of 285kW at the named location exceeds the 15% maximum of the line section annual peak load as most recently measured at the substation. This is one criteria to qualify for attachment Y. Thus, Potomac Edison and PJM concluded that this project fails the Attachment Y criteria and is handling the project as an Attachment N project going forward.

Interconnection Customer's Attachment Y that was submitted and was used for the "Attachment N" information as no new information was provided by the IC.

The interconnection will generate 285 kW of energy and 0 kW of capacity.

The commercial operation date for this project was requested to be 4/5/2013. This study does not imply a Potomac Edison commitment to this in-service date.

The IC requested and it was agreed to combine the feasibility and impact studies for the PV installation.

PJM Interconnection Study Results

The following is the report describing the results of the analysis performed by PJM engineers with respect to the transmission system impacts.

Network Impacts

Network Impacts

The Queue Project #Y2-075 was studied as a 0.5MW (Capacity 0.5MW) injection at the Monocacy 230 kV substation in the APS area. Project #Y2-075 was evaluated for compliance with reliability criteria for summer peak conditions in 2016. Potential network impacts were as follows:

Generator Deliverability

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

None

Light Load Analysis

Light Load Studies to be conducted during later study phases (applicable to wind, coal, nuclear, and pumped storage projects).

Multiple Facility Contingency

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

None

Short Circuit

(Summary form of Cost allocation for breakers will be inserted here if any)

To be determined

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)

None

Steady-State Voltage Requirements

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

To be determined

Stability and Reactive Power Requirement
(Results of the dynamic studies should be inserted here)

To be determined

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)

None

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.

Not Applicable.

Interconnected Transmission Owner's Analysis Results

The following was generated by FirstEnergy (The Potomac Edison Company) the Interconnected Transmission Owner, based upon its analysis, as well as that of PJM, for mitigation of the project's impacts on the transmission and lower voltage system as applicable. It includes the costs and schedules for any system upgrades.
Costs for affected Transmission owners other than FirstEnergy are included and reported in the "New System Reinforcements" and "Contribution to Previously Identified System Reinforcements" sections of the "PJM Interconnection Study Results" above.

Electric Utility System

The PV will be installed on the Monocacy Substation 12.47 kV Wormans Mill feeder which is fed by the Monocacy Substation No. 5 230 delta /12kV grounded wye, 18/33.6MVA power transformer with LTC (load tap changer), 2000 amp No. 5 bank low side vacuum circuit breaker and substation 560 amp electronic recloser with Form 6 controller. The Wormans Mill radial distribution circuit has no line reclosers or line voltage regulators but does have (1) 450kVAR capacitor bank located on the main line at F1333 which is .91 miles from the substation.

The existing 300kVA 12.47/7.2kV grounded Y - 208/120v grounded wye transformer at location 2000298 that serves 1845 Brookfield Court, Frederick, MD also serves a second customer. Potomac Edison is requiring a separate 300kVA 12.47/7.2kV grounded Y - 208/120 v grounded wye transformer with Current Transformer (CT) metering be added for the PV installation. The existing distribution transformer has metering on the pad for one customer and the other customer has current transformer metering. The existing transformer set up is not compatible with the proposed PV installation which is not offsetting the existing customers' loads.

A three element, bi-directional, modem meter with pulse outputs is required for this PJM project. The meter will be owned by Potomac Edison.

Electrical Isolation of Generator

Small generator facilities shall be capable of being isolated from PE's distribution system. The isolation shall be by means of a lockable, visible break isolation device accessible by PE. The isolation device shall be installed, owned, and maintained by the owner of the PV and located electrically between the PV and the point of interconnection. See Appendix 1 for one line diagram.

Photovoltaic System

The IC is installing (3) 95kW Solectria Renewables PVI 95KW, 208 volt, 60 Hz, Interverters with 261 amp rated current. The inverters are compliant under UL 1741 and

IEEE Std 1547 according to the literature provided by the IC. The PV is injecting only into the electric distribution system and none of the output is being utilized by the customer at 1845 Brookfield Court, Frederick, MD. The IC has requested to sell the PV output power to PJM.

Power Flow & Voltage Analysis

A power flow study was performed to determine the impact of the proposed Y2-075 project on Potomac Edison system. The study was performed at peak and light loads, without the generators, with one generator on, with two generators on and with all three generators on. No loading or voltage problems were found for all the different scenarios.

Short Circuit Analysis

A short circuit analysis was performed with and without the 3 generators in-service. No problems were determined.

System Protection

System Protection was reviewed and no problems were determined.

Grounding Requirements

Since the IC will be connecting to a 3 phase, 4 wire primary utility distribution system, the generators must be connected line to neutral and must be effectively grounded.

Direct Connection Cost Estimate

The following preliminary cost estimate does not include trenching, conduit and the distribution transformer pad ***which are the customer's responsibility***.

Description	**Cost**
300kVA12.47/7.2kV-208/120v transformer	
Metering Package	
Direct Costs	**$12,147**
Indirect Costs	**$2,659**
Engineering Oversight and Commissioning	**$3,000**
Total Costs without Taxes	**$17,806**
Taxes	**$2,703**
Total Costs with Taxes	**$20,509**

Note – the above estimate is based on similar work orders previously worked by PE for the types of work described in the analysis above. It is accurate to within plus or minus 50 percent. Should the customer decide to proceed with the connection of this facility, a contract with PE will be developed based on these costs and a true-up of actual charges will be made at the completion of the project.

Network Upgrade

No network upgrades are required due to the PV.

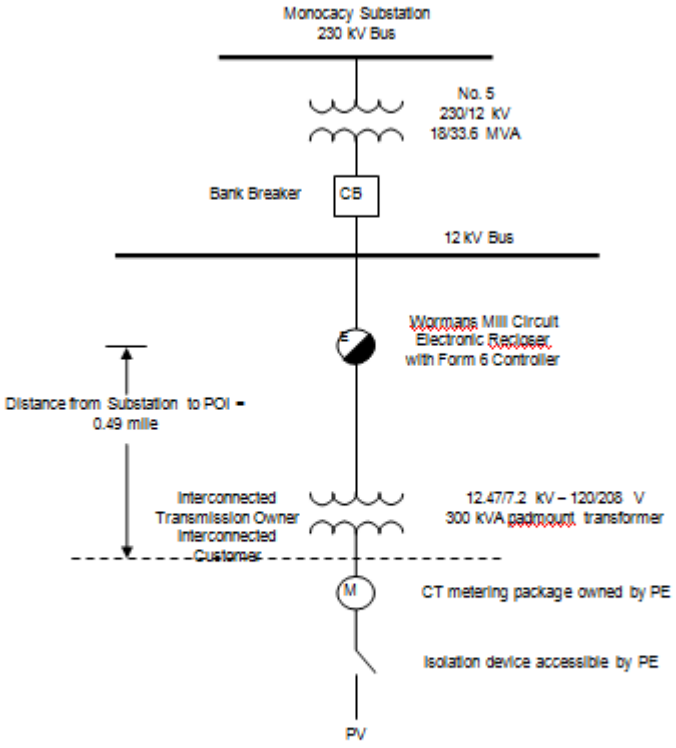
Substation/Relay Upgrade

No substation or relay work is required due to the PV.

Timetable for Construction

Total time to complete this project is 6 months from receipt of "Interconnect Agreement" and "Construction Agreement". After receipt of the "Interconnect Agreement" and Construction Agreement", PE estimates 2 month for design work and detailed engineering to be completed. PE estimates it will require an additional 4 months to complete the identified infrastructure upgrades.

APPENDIX 1



One-Line Diagram