Generation Interconnection Combined Feasibility/System Impact Study Report

For

PJM Generation Interconnection Request Queue Position X2-034

Laplume

December 2011

Preface

The intent of the Combined Feasibility/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, if any, is included in the System Impact Study.

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 associated with them will be addressed when seeking an Interconnection Agreement as outlined below. . Developer will also be responsible for providing and installing metering equipment in compliance with applicable PJM and Transmission Owner standards.

General

Raintree Farms, the Interconnection Customer (IC), has proposed a solar generating facility located at 5023 Sunset Road in Laplume, Pennsylvania. The installed facilities will have a total capability of 31.74 kW with 0 MW of this output being recognized by PJM as capacity. This means that the remaining 31.74 kW will be curtailable should a system reliability constraint occur. The proposed in-service date for this project is in early 2013. **This study does not imply a PPL Electric Utilities (PPL EU) commitment to this in-service date.**

Point of Interconnection

X2-078 will interconnect with the PPL EU distribution system at the 12kV circuit #66-3 from the Brookside substation.

Summary

The Queue X2-034 generation can be connected to the Brookside 12 kV line, Line # 66-3, as shown in Figure 1. The Brookside 66-3, 12kV line is normally supplied from Brookside 69/12kV Transformers #1 and #2 which are supplied from the Stanton – Brookside 69kV line. The estimated cost for PPL EU to construct the Queue X2-034 Direct Connection facilities is $9,276 and the estimated construction time is 3 months from the initial acceptance and execution of the interconnection agreement.

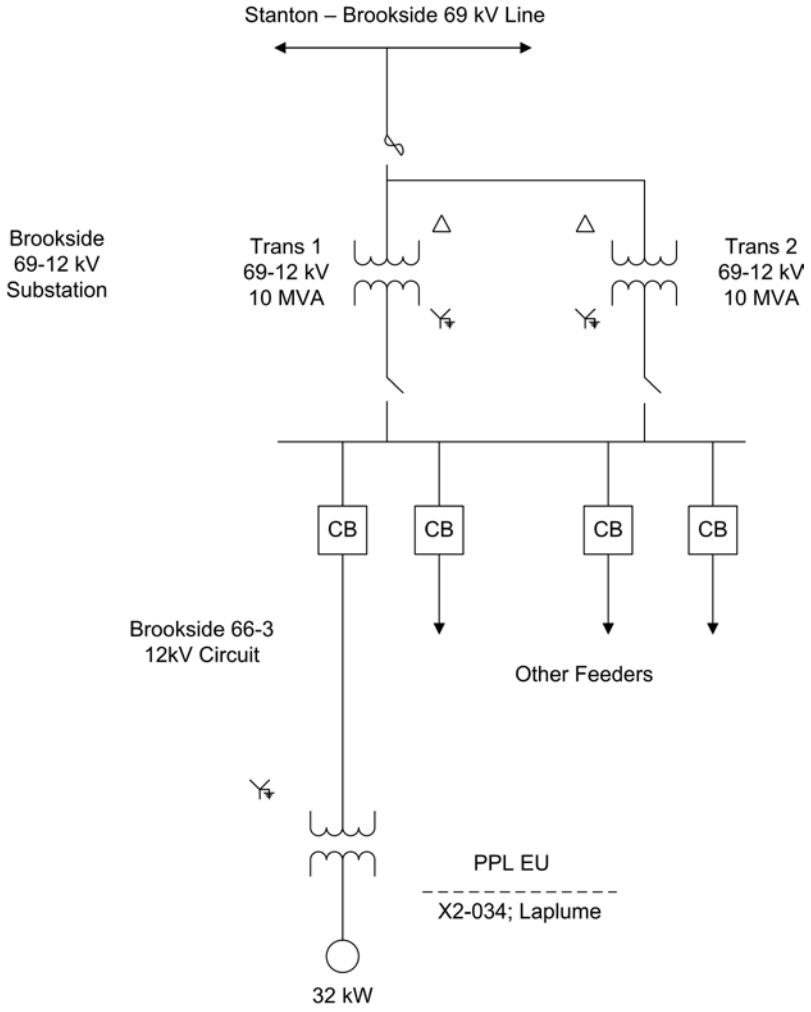

Figure 1. Single Line Diagram

Scope of Work

Queue X2-034 Interconnection Customer is responsible for design, construction and costs for all facilities associated with X2-034 on the Interconnection Customer side of the POI as shown in Figure 1.

Protection Equipment

The Interconnection Customer is required to install suitable protection and control equipment based on PPL EU's Applicable Standards for interconnection of parallel generation. The customer's generator's standard protection systems per IEEE 1547 & UL 1741 will suffice.

DTT Relaying Requirements

DTT (Direct Transfer Trip) equipment is NOT required. This is based on the inverters being UL 1741 and IEEE 1547 listed.

SCADA Requirements

SCADA is NOT required.

Inverters

All inverters used for connecting the generation to the PPL EU system are required to be UL 1741 and IEEE 1547 listed.

Metering and Telemetering Requirements for PJM

The Interconnection Customer will be required to install the equipment necessary to provide revenue metering (KWH and KVARH hourly data sent once per day) and real time data (telemetry) for the Interconnection Customer's generating resource in compliance with PJM Manuals M-01 and M-14B, and the PJM Tariff. Real time data (telemetry) is only required if Queue X2-034 is a Capacity Resource.

Metering and telemetering requirements for PPL EU

Although not anticipated, if new PPL EU metering equipment is required it will be provided by PPL EU at no cost to the Interconnection Customer.

Isolation Breaker Requirement

X2-034 Interconnection Customer will have its own isolation breaker that is capable of separating the X2-034 generation from the PPL EU system. The Interconnection Customer may also operate this breaker by its own protection and control equipment.

Voltage Regulation Requirements

As required by the PJM tariff, the Interconnection Customer shall design its facility to maintain a composite power factor delivery at continuous rated power output at the point of interconnection at a power factor of at least 0.95 leading (absorbing VARs) to 0.95 lagging (supplying VARs). The expected operation of the generation will be unity at the 12kV side of the inverters.

The maximum allowable harmonic disturbance on the PPL 12kV system is 3% THD. In addition, no single harmonic voltage is allowed to exceed 1.7% of the system voltage. If either of these levels is exceeded, it will be the Interconnection Customer's responsibility to take corrective action to reduce harmonic voltage levels. Also, if PPL EU receives flicker complaints due to the operation of the generators, the Interconnecting Customer will be responsible to mitigate the problem.

Point of Interconnection

The Point of Interconnection will be PPL's service meter.

Interconnected Transmission Owner (PPL EU) Direct Connection Scope of Work

The following distribution modifications will be required on the Brookside 66-3, 12kV line in order to accommodate the generation:

1. Provide secondary service to the customer's location. This will be the customer's second service at this location; therefore the customer is responsible for the cost.

Network Impacts

Queue project X2-034 was studied as a(n) 0.032 MW (0.0 MW of which was Capacity) injection into PPL's system at the 02BRKSID 69.0 kV substation. Project X2-034 was evaluated for compliance with reliability criteria for summer peak conditions in 2015.

Potential transmission network impacts are as follows:

Generator Deliverability

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

No violations identified.

Multiple Facility Contingency

(Double Circuit Tower Line contingencies only with full energy output. Stuck Breaker and Bus Fault contingencies will be applied during the Impact Study)

No violations 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.)

No violations identified.

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. "Network Impacts", initially caused by the addition of this project generation.)

None required.

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.)

None required.

Short Circuit

(Report over-dutied breakers.)

Not required

Energy Portion of Interconnection Request

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

No violations identified.