

***PJM Generator Interconnection Request
Queue #N31
Freemansburg 12.47 kV
Feasibility/Impact Study Report***

332035
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N31 Freemansburg (Bethlehem Landfill) Feasibility/Impact Study

General

Bethlehem Renewable Energy, LLC proposes to install 5.5 MW Solar Taurs combustion turbine generator at the Bethlehem Landfill located in Lower Saucon Township, Lehigh County near Bethlehem, Pennsylvania. Considering parasitic load at this customer facility, between 4.75 MW and 5 MW will be delivered to the PPL Electric Utilities system when the generation-facility is operating at peak generation. The 12.47 kV feeder tap location is near grid coordinates 67710-S-47850. The customer has requested an in-service date of March 31, 2006.

The intent of the feasibility/Impact study is to determine cost and construction time estimates of system reinforcements required to facilitate the addition of the new generating plant to the PJM system. The reinforcements include the direct connection of the generator to the system and any network upgrades necessary to maintain the reliability of the PPL Electric Utilities system.

Direct Connection

The generation will be interconnected to the distribution system as shown in Figure 1. The nearest distribution facility to the proposed generation is an existing 12.47 kV three-phase distribution line. No 12.47 kV line reinforcements are required for connection at this time.

The following relay and control upgrades will be required at Freemansburg substation in order to accommodate the generation:

1. Direct Transfer Trip Transmitter (radio based DTT)
2. Voltage Check and Synchronism check relay functions
3. Modification to the Freemansburg substation SCADA due to reverse power flow on this line

Direct transfer trip will be required between the 12.47 kV circuit breaker at Freemansburg and the generator to avoid islanding the generation on PPL Electric Utilities load. In addition a voltage check and synchronism check relay is required to supervise reclosing of the 12.47 kV circuit breaker.

The PPL Electric Utilities Supervisory Control And Data Acquisition (SCADA), at Freemansburg substation, is designed with the premise that power flow is always out of the substation. The installation of generation greater than load will cause this power flow to reverse. Additional SCADA transducers and programming of the installation are required to obtain correct indication for this situation.

The cost for the relay and control modifications at Freemansburg is estimated to be **\$228,000**. In order to engineer and complete the above modifications under normal working conditions, PPL will require 10 months from the time that the ISA agreement is executed and PPL receives authorization to proceed from PJM. Consequently, the requested in service date is in jeopardy. Please see the "Remarks" section at the end of this document for additional information.

Metering typically consisting of type JBM-5 voltage transformers, JEM-5 current transformers and a Siemens 2510 meter, or equivalent, will be installed at the customer facility at an estimated cost of **\$7,500**.

The total estimated direct connection cost is **\$235,500**.

This estimate does not include the required inter-tie protection equipment and PPL Electric Utilities SCADA that must be installed by the Interconnection customer at the Interconnection Customer's location. Refer to the PPL Electric Utilities interconnection requirements located at the PJM website. PPL Electric Utilities considers the customer a "Type 2" generator.

The customer will be required to install the following equipment at the site:

- Radio based Direct Transfer Trip equipment (matching PPL Electric Utilities equipment). This is not going to be a standard application of this equipment, and a reflection point will be used to reach the signal to the site of the generator's transceiver. A site survey will be required to determine if the radio-based equipment can be used. If the site survey determines that the currently proposed configuration is unacceptable, then a phone line application of DTT will be required. Installation of a phone line meeting the requirements of PPL Electric Utilities will be required of the Interconnection Customer, who would also assume all costs of maintaining and operating the phone line. This equipment could require a long lead time to acquire and is not PPL EU's preferred mode of DTT.
- Inter-tie protective relaying (Beckwith M-3520 preferred). Note that failure of the microprocessor-based relay will block all protective relaying. For this reason, we request a backup relay be installed. If only one relay is installed, failure of the relay will require isolation of the generation from the PPL Electric Utilities system.
- CTs and PTs for the above relays
- PPL Electric Utilities SCADA remote Terminal Unit. PPL Electric Utilities will supply suitable drawings and a material list for the generator to provide this equipment. The current PPL Electric Utilities design uses commercially available PLC equipment, with the software provided by PPL Electric Utilities.
- Metering, typically consisting of type JBM-5 voltage transformers, JEM-5 current transformers and a Siemens 2510 meter, or equivalent, will be provided by PPL Electric Utilities to be installed at the customer facility
- Radio Antenna for the above DTT and SCADA. Due to the topography of the land between Freemansburg substation and the site of generation, an intermediate antenna will be installed to send the signal around obstacles.
- Suitable protection for the above phone lines, based on IEEE 487-2000.

Operating Instructions

In order to maintain acceptable voltage regulation on the 12kV system the generator must operate at a .95 leading power factor.

Remarks:

- Based on preliminary information, if a suitable location can be found for the antenna, the radio based DTT communication is expected to function properly at this location. However, a detailed line-of-sight survey will be completed to confirm this as part of the Impact Study phase of the project.
- As discussed above, the customer's requested in-service date of 12/31/05 will be difficult to achieve. For a normal schedule PPL expects the installation work to be completed 8 months after signing of the ISA and CSA. In order to have any chance of meeting the requested date, the following must occur as soon as possible:
 1. The Interconnection Customer must sign the ISA and PJM must authorize PPL EU to proceed with actual engineering and physical construction.
 2. The Interconnection Customer must accept the increased cost obligation of funding engineering and construction overtime to meet a compressed work schedule. The estimated overtime amount could be 150% of the above-identified cost.

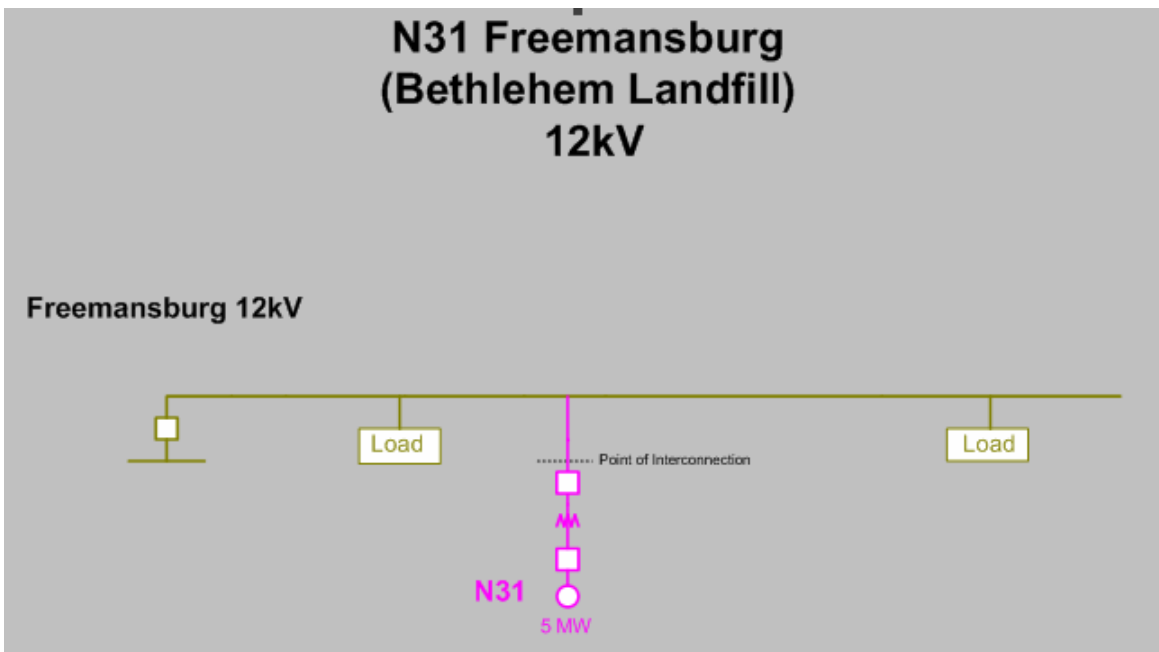


Figure 1
Bethlehem Renewable Energy Connection Plan

Network Impacts

The #N31 project was studied as an energy resource injecting 5 MW into the Freemansburg 69 kV substation. Project #N31 was evaluated for compliance with reliability criteria for summer peak conditions in 2008. Potential network impacts were as follows:

Generator Deliverability

No identified problems

Multiple Facility Contingency – Tower Line Outages

No identified problems

Short Circuit

No identified problems

Stability

No analysis required.

Contribution to Previously Identified Overloads

None

New System Reinforcements

To be determined

Cost Allocation

The N31 project is responsible for 100% of the Direct Connection costs estimated to be **\$235,500**.