

***Generation Interconnection
Combined Feasibility/System
Impact Study Report***

For

***PJM Generation Interconnection Request
Queue Position Y2-037***

Tuscarora #1 12kV

February 2013

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

Blythe Township Solar 1, the Interconnection Customer (IC), has proposed a solar generating facility located Middleport, Pennsylvania. The installed facilities will have a total capability of 3.00 MW with 1.14 MW of this output being recognized by PJM as capacity. This means that the remaining 1.86 MW will be curtailable should a system reliability constraint occur. The proposed in-service date for this project is December 31, 2012. **This study does not imply a PPL Electric Utilities (PPL EU) commitment to this in-service date.**

Point of Interconnection

Y2-037 will interconnect with the PPL EU distribution system at a 12kV circuit from the Tuscarora substation.

Cost Summary

The Y2-037 project will be responsible for the following costs:

Description	Total Cost
Transmission Owner facilities	\$ 100,000
Transmission Upgrades	\$ 0
Total Costs	\$ 100,000

Attachment Facilities

The proposed Queue Y2-037 solar park facility is located approximately 5.5 miles from PPL EU owned Tuscarora 69/12kV substation and will be connected to the Tuscarora 26-1 feeder – 12 kV line.

Breakdown of estimated costs for the 12 kV connection (**\$100,000**)

Description	Total Cost
Distribution modifications	\$ 0
Relay and Control Upgrades (voltage sensing on line breaker)	\$ 60,000
Replace Recloser including addition of voltage sensing	\$ 40,000
Total Costs	\$ 100,000

Distribution Direct Connection Work (\$0)

The following distribution modifications will be required on PPL EU's Tuscarora area distribution system in order to accommodate Blythe Township Solar 1, LLC generation:

1. Construct a 12 kV line from a tap point on the 26-1 line, to the Y2-037 Point of Interconnection, at Blythe Township Solar 1, LLC Customer facility.
 - Y2-037 must submit a request for electric service for the service extension. Y2-037 can contact PPL's ICS department at 1-888-220-9991 or: <http://www.pplelectric.com/Commercial+and+Industrial/Service+Center/Building+or+Renovating/>
 - The cost for the extension will be engineered and direct billed separate from this feasibility/impact study and is not included in the PPL scope of work.

Relay and Control Modifications (\$100,000)

The following relay and control upgrades will be required at Tuscarora 69/12 kV substation in order to accommodate Blythe Township Solar 1, LLC generation:

1. Voltage check relay functions: A three-phase voltage check relay will be installed at Tuscarora Substation to supervise the closing of the 12 kV breaker which supplies this customer facility. 12 kV potential devices must be added to the Tuscarora Substation 26-1 12 kV line to provide potential for this check. The cost for the relay and control modifications at the Tuscarora Substation is estimated to be \$60,000.
2. Replace recloser with an electronic recloser with voltage check functionality. The estimated cost is \$40,000

Transmission Owner Scope of Work

Queue Y2-037 generation can be connected to the Tuscarora 26-1 line as shown on the single line diagram on Attachment 1.

The total estimated cost for PPL EU to construct the Queue Y2-037 Direct Connection facilities is **\$100,000**.

Interconnection Customer Requirements

Protection equipment

The Interconnection Customer will need to install suitable protection and control equipment based on PPL EU parallel generation requirements. This includes both Intertie Protective Relaying (IPR) and Point of Contact (POC) relaying. Please refer to the PPL EU web site for the IPR and POC requirements. The website addresses are shown below:

IPR Requirements:

<http://www.pplelectric.com/Business+Partners/Tools+and+Reference+Center/Customer-Owned+Generation/>

POC Requirements:

http://www.pplelectric.com/NR/rdonlyres/B0937C7E-B6E9-40AD-AE8C-ED3C9558E528/0/point_of_contact.pdf

Telephone Circuit Requirements--

PPL EU will require a communication path for SCADA and voice. PPL EU anticipates that telephone circuits will be required to establish these paths.

The Interconnection Customer will be responsible to procure the following:

1. A 4-wire dedicated FDDA-type phone line for SCADA.
2. A normal dialup telephone line for voice communication. This may be an extension telephone.

Phone lines tend to be long lead-time items and must be in place and operational for equipment testing. The Interconnection Customer should investigate with the local phone company the possibility of obtaining this type of service at their facility.

All installation, maintenance, and monthly lease or billing charges for communications facilities are the responsibility of the Interconnection Customer.

Isolation Breaker and Disconnect Switch Requirement

Queue Y2-037 will have its own electrically controlled Fault Interrupting Device (FID) that is capable of separating the IPP generation from the PPL EU system. This FID will be operated by the PPL EU Controlled POC and/or IPR relaying. The IPP may also operate this FID by IPP owned protection and control equipment. As per PPL EU design requirements, sharing of IPR/POC equipment within the IPR cabinet with the IPP is not allowed.

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). In order to maintain acceptable voltage regulation on the 12 kV system fed from Tuscarora Substation, the Y2-037 generation must operate at 0.98 leading power factor (absorbing Vars) at the point of interconnection as shown on the single line diagram. If conditions change on PPL's distribution system in the future, Y2-037 may be required to operate at a different power factor as specified by PPL.

Revenue Metering and SCADA Requirements

PJM Requirements

The Interconnection Customer will be required to install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for IC's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Sections 24.1 and 24.2.

PPL Electric Utilities Requirements

SCADA Requirements

PPL EU published requirements state that a PPL EU SCADA RTU is required for generation installation of 2.5 MW and above. PPL EU will require the installation of PPL EU approved SCADA equipment that will connect to its existing SCADA system. This connection will be a 4-wire dedicated FDDA-type phone line. PPL EU will provide detailed specifications and design drawings for this equipment.

Metering Equipment Installation at the Point of Interconnection

PPL EU will be responsible for providing metering for the new customer location to suit its revenue resolving purposes. Questions about metering should be directed to Metering Support.

Note: PPL does not require any additional metering charges unless the customer requests special metering requirements that are beyond PPL's metering services provided for PPL's billing needs.

This is a preliminary study and does not include any 12 kV service extension or relocation of facility that the customer might require to complete the work.

Network Impacts

The Queue Project #Y2-037 was studied as a 3.0MW (Capacity 1.1MW) injection at the Tuscarora 12.47 kV substation in the PPL area. Project #Y2-037 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

Multiple Facility Contingency

(Double Circuit Tower Line contingencies were studied for the full energy output. The contingencies of Line with Failed Breaker and Bus Fault will be performed for the Impact Study.)

None

Short Circuit

(Summary of impacted circuit breakers)

None

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

(Summary of the VAR requirements based upon the results of the steady-state voltage studies)

None

Stability and Reactive Power Requirement for Low Voltage Ride Through

(Summary of the VAR requirements based upon the results of the dynamic studies)

None

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)

None

Potential Congestion due to Local Energy Deliverability

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.

Note: Only the most severely overloaded conditions are listed below. 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 shall study all overload conditions associated with the overloaded element(s) identified.

None

Attachment 1. Single Line Diagram

