Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position W1-106

West Carlisle

July 2010

Preface

The intent of the Feasibility Study is to determine a plan, with ballpark cost 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 a generator interconnection 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 Feasibility 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), has proposed a 7.2 MW (2.7 MW capacity) solar generating facility. The new generation will be located near the intersection of S.R. 641 and Meadowbrook Rd, Cumberland County, Township of West Pennsboro, Pennsylvania. The Interconnection Customer has requested an October 1, 2011 in-service date. **This study does not imply a PPL EU commitment to this in-service date.**

Point of Interconnection

Queue W1-106 generation can be connected to a new 12 kV line at the West Carlisle 69/12 kV substation as shown on the single line diagrams shown in Attachment 1.

Estimated Costs

The total estimated cost for PPL EU to construct the Queue W1-106 Direct Connection facilities is **$1,350,000.00** and the estimated construction time is **9 months**.

Interconnection Customer Scope of Work

Queue W1-106 Interconnection Customer is responsible for design, construction and costs for all facilities associated with W1-106 on the Interconnection Customer side of the POI (Point of Interconnection) shown on the single line diagram in Attachment 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. This includes both Intertie Protective Relaying (IPR) and Point of Contact (POC) relaying. The PPL EU web site links for the IPR and POC requirements are shown below. NOTE: the preferred IPR relay is the Beckwith M3520.

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_r1.pdf

Direct Transfer Trip

DTT (Direct Transfer Trip) equipment is required. PPL EU anticipates that radio is not a viable communication path between W1-106 Interconnection and PPL EU's West Carlisle 69/12 kV Substation. Therefore fiber optic based communication scheme will be the preferred DTT communication technology.

The DTT scheme will provide a trip signal to the Interconnection Customer for any line fault, or any other condition that will cause the source West Carlisle 12 kV line breaker to trip. The DTT scheme provides a block-closing signal to the breakers at PPL EU West Carlisle Substation from the IPP.

SCADA Requirements:

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 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 W1-106 is a Capacity Resource.**

For additional information regarding PJM metering requirements and the PJM internet-based telemetry alternative (Arcom Director) contact Ryan Nice at 610-666-4777 or nicer@pjm.com

Metering and telemetering requirements for PPL EU:

New metering equipment is required, it will be provided by PPL EU at no cost to the Interconnection Customer.

Isolation Breaker Requirement:

W1-106 Interconnection Customer will have its own isolation breaker that is capable of separating the W1-106 generation from the PPL EU system. This breaker will be operated by the PPL EU Controlled POC and/or IPR relaying. The Interconnection Customer may also operate this breaker by its own protection and control equipment. As per PPL EU design requirements, sharing of IPR/POC equipment within the IPR cabinet with the Interconnection Customer 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 West Carlisle Substation, studies indicate the W1-106 generation must operate with a 0.98 leading power factor (absorbing Vars) at the point of interconnection as shown on the single line diagram.

Interconnected Transmission Owner Direct Connection Scope of Work

The following distribution modifications will be required at the West Carlisle 69/12 kV substation in order to accommodate the generation:

1. New 12 kV line and terminal
   Construct a 12 kV line from West Carlisle Substation to the W1-106 Point of Interconnection, at interconnection Customer facility.

2. Voltage check capability will need to be installed on West Carlisle Substation circuit breaker. This includes the IPP drawing review, commissioning work at the IPP sight, etc.

3. Modifications at West Carlisle substation to include installation of DTT equipment, associated wiring, cables and conduit, in conjunction with other work at West Carlisle Substation.

Network Impacts

Queue project W1-106 was studied as a(n) 7.2MW (2.7MW of which was Capacity) injection into PPL's system at the West Carlisle 69kV substation. Project W1-106 was evaluated for compliance with reliability criteria for summer peak conditions in 2014. Potential network impacts were as follows:

Generator Deliverability

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

No problems 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 problems identified.

Contribution to Previously Identified Overloads

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have % allocation of cost responsibility which will be calculated and reported for the Impact Study.)

No problems 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.

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.

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 problems identified.

Short Circuit

Not required.

Stability Analysis

Not required.

Attachment 1
Single Line Diagram