Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position W1-105

Reamstown

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 5 MW (1.9 MW capacity) solar generating facility. The new generation will be located Lancaster County, Pennsylvania. Queue W1-105 has requested an October 1, 2011 in-service date. **This study does not imply a PPL Electric Utilities (PPL EU) commitment to this in-service date.**

Point of Interconnection

W1-105 will interconnect with the PPL Electric Utilities distribution system on a Reamstown 12kV circuit, as shown in Attachment 1.

Overview

The total estimated cost for PPL EU to construct the Queue W1-105 Direct Connection facilities is as follows:

1. $400,000: Reconductor 0.5 miles of existing distribution line to 477 AL, replace existing Oil Circuit Recloser (OCR), and install voltage sensing equipment and DTT at substation, or

2. $150,000: Replace existing OCR and install voltage sensing equipment and DTT at substation. This option is available only if the Interconnection Customer can maintain a 0.98 leading power factor (absorbing VARs) at the point of interconnection (POI). See Voltage Regulation Requirements section below for more details.

Interconnection Customer Scope of Work

Queue W1-105 Interconnection Customer is responsible for design, construction and costs for all facilities associated with W1-105 on the Interconnection Customer side of the POI as shown on the single line diagram on the previous page and on 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

DTT Relaying Requirements:

DTT (Direct Transfer Trip) equipment is required. PPL EU will require either a radio based or telephone line based DTT. PPL EU assumes that a radio based communication scheme will be the most cost effective and therefore the preferred DTT communication technology.

If it is determined that radio is not a viable communication path between W1-105 Interconnection and PPL EU's Reamstown 69/12 kV Substation then telephone will be the most cost effective solution. The telephone based path is a special dedicated 4 wire analog telephone line, type PRDA which would originate from W1-105 and end at the Reamstown 69/12 kV substation. A fiber based DTT scheme would be feasible but this would increase the scope of work to include 2.0 miles of a new fiber between W1-105 and the Reamstown 69/12 kV substation.

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 Reamstown 12 kV line breaker to trip. The DTT scheme provides a block-closing signal to the breakers at PPL EU Reamstown 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.

Telephone Circuit Requirements:

PPL EU will require a communication path for DTT, 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:

a) A 4-wire dedicated FDDA-type phone line for SCADA.

b) A normal dialup telephone line for voice communication. This may be an extension telephone.

c) A protective relay-grade telephone circuit for the DTT communication requirements, type PRDA. This phone line needs to communicate between the Interconnection Customer's control house and PPL EU's Reamstown Substation.

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.

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

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 W1-105 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:

W1-105 Interconnection Customer will have its own isolation breaker that is capable of separating the W1-105 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 Reamstown substation, studies indicate the W1-105 generation MUST either 1) operate with a 0.98 leading power factor (absorbing VARs) at the point of interconnection as shown on the single line diagram, or 2) the Interconnection Customer must pay PPL EU approximately $250,000 to reconductor one half mile of 1/0 ACSR to 477 AL.

Interconnected Transmission Owner Direct Connection Scope of Work

The following distribution modifications will be required on the Reamstown 12 kV line in order to accommodate the generation:

1. Reconductor 0.5 miles of 1/0 ACSR to 477 AL, if necessary.

2. Replace existing OCR with a voltage sensing OCR.

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

4. Modifications at the Reamstown Substation to include installation of DTT equipment, associated wiring, cables and conduit, in conjunction with other work at the Reamstown Substation.

Network Impacts

Queue project W1-105 was studied as a(n) 5.0MW (1.9MW of which was Capacity) injection into PPL's system at the Reamstown 12kV substation. Project W1-105 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.

Short Circuit

Not required for the transmission level protection system.

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.

Attachment 1
Single Line Diagram