

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

***For***

***PJM Generation Interconnection Request  
Queue Position W4-070***

***Morgantown***

**April 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

Hankin Solar L.P., the Interconnection Customer (IC), has proposed a 2.0 MW (0.76 MW capacity) solar generating facility. The facility will be located at 851 Hemlock Road in Morgantown, Berks County, Pennsylvania. The Interconnection Customer has requested a September 2011 in-service date. **This study does not imply a PPL Electric Utilities (PPL EU) commitment to this in-service date.**

Attachment facilities and local upgrades (if required) along with terms and conditions to interconnect W4-070 will be specified in a separate two party Interconnection Agreement (IA) between the Transmission Owner and the Interconnection Customer as this project is considered FERC non-jurisdictional per the PJM Open Access Transmission Tariff (OATT). From the transmission system perspective, no network impacts were identified as detailed below.

## Point of Interconnection

W4-070 generation can be connected to the Morgantown 12 kV line, Line # 32-2, as shown on Attachment 1.

## **Overview**

The Morgantown 32-2, 12kV line is normally supplied from Morgantown 69/12kV Transformer #2 which is supplied from the South Akron – Morgantown #2 69kV line. In an abnormal system arrangement, the Morgantown 32-2, 12kV line can be transferred to Morgantown 69/12kV Transformer #1, which is supplied from the South Akron – Morgantown #1 69kV line. The estimated cost for PPL EU to construct the Queue W4-070 Direct Connection facilities is \$68,800 and the estimated construction time is 6 months from the initial acceptance and execution of the interconnection agreement.

## **Scope of Work**

The Interconnection Customer is responsible for design, construction and costs for all facilities associated with W4-070 on the Interconnection Customer side of the POI as shown on the single line diagram on Attachment 1.

It should be noted that if the need arises to transfer W4-070 to an alternate source, for maintenance, restoration of service, or for any other reason, W4-070 will be required to temporarily isolate from PPL EU's system until service can once again be supplied from the Morgantown 32-2, 12kV line. This is required since only the Morgantown 32-2, 12kV circuit breaker is being modified with voltage sensing capabilities to accept the W4-070 generation.

## **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 Intertie Protective Relaying (IPR). The PPL EU website link for the IPR requirements is shown below. The preferred IPR relay is the Beckwith M3520. It should be noted that this is an existing facility with existing Point of Contact (POC) protection.

IPR Requirements:

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

## **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 Telemetry 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.

## **Metering and telemetry 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**

W4-070 Interconnection Customer will have its own isolation breaker that is capable of separating the W4-070 generation from the PPL EU system. This breaker will be operated by the PPL EU Controlled 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 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). 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.

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

The following distribution modifications will be required on the Morgantown 32-2, 12kV line in order to accommodate the generation:

1. Voltage sensing capability will need to be installed on the Morgantown 32-2, 12kV substation circuit breaker. This includes the IPP drawing review, commissioning work at the IPP site, etc.

## **Network Impacts**

Queue project W4-070 was studied as a(n) 2.0 MW (0.76 MW of which was Capacity) injection into PPL's system at the MGTN 1 69.0 kV substation. Project W4-070 was evaluated for compliance with reliability criteria for summer peak conditions in 2014.

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.)*

None 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.

# Attachment 1

## Single Line Diagram

