Generation Interconnection Combined Feasibility/System Impact Study Report

For

PJM Generation Interconnection Request Queue Position W2-059

Strasburg 12kV

December 2010

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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

Queue W2-059 is a request by Sight and Sound Theatres to interconnect a 2.4 MW Energy Resource consisting of two 640 kW and one 1,200 kW Diesel synchronous generator sets. The generation will be located at 300 Hartman Bridge Road, Strasburg, Lancaster County, Pennsylvania. Queue W2-059 has requested a June 1, 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 W2-059 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

Queue W2-059 generation can be connected to the Strasburg 67-3, 12 kV line as shown on the single line in Attachment 1. The total estimated cost for PPL EU to construct the Queue W2-059 Direct Connection facilities is $76,000 and the estimated construction time is 6 months.

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Interconnection Customer Scope of Work

1. Queue W2-059 Interconnection Customer is responsible for design, construction and costs for all facilities associated with W2-059 on the Interconnection Customer side of the POI (Point of Interconnection) shown on the single line diagram of the previous page.

2. 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 W2-059 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:
   The existing metering equipment at the Sight and Sound Theatres' facility will need to be reviewed. If any new metering equipment is required, it will be provided by PPL EU at no cost to the Interconnection Customer.

3. 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.

   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

   The Interconnection Customer is also required to install, operate and maintain DTT (Direct Transfer Trip) communication, relay and control equipment at the W2-059 Customer Facility. Based on our preliminary review, we are assuming that an SEL radio based communication package will work. See item 1 under the Interconnected Transmission Owner (PPL EU) Direct Connection Scope of Work on the following pages for related work.

4. Isolation Breaker Requirement:
   W2-059 Interconnection Customer will have its own isolation breaker that is capable of separating the W2-059 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

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design requirements, sharing of IPR/POC equipment within the IPR cabinet with the Interconnection Customer is not allowed. The W2-059 Interconnection Customer already has IPR protection (Beckwith M3520), so no further protection should be necessary. The Interconnection Customer will need to submit a final set of 'as built' drawings for PPL EU review so this can be confirmed.

5. SCADA
   The existing W2-059 Interconnection Customer SCADA is dialup. This will need to be converted to dedicated telephone line. This connection will be a 4-wire dedicated FDDA-type phone line. The W2-059 Interconnection Customer will need to supply a new modem, new telephone line, new SCADA PAS (Point Assignment Sheet) and new PLC (Programmable Logic Controller) software.

   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.

Interconnected Transmission Owner Direct Connection Scope of Work

The following distribution modifications will be required on the Strasburg 67-3, 12 kV line in order to accommodate the generation:

1. Direct Transfer Trip will be required between the 12kV circuit breaker at the Strasburg substation and the generator to avoid islanding the generation on PPL load. This equipment will provide a primary trip signal from PPL EU to Sight and Sound Theatres to clear the customer's generation from the PPL line whenever the PPL Strasburg 67-3, 12 kV line breaker is tripped. The same DTT equipment will be used to permit reclosing of the Strasburg 67-3 line breaker after the generation at Sight and Sound Theatres is isolated from the PPL system.

2. PPL EU will need to replace the existing MW transducer at the Strasburg substation 67-3 line with a new MW/MVAR transducer as well as revise the Strasburg sub SCADA elementaries and SCADA PAS.

3. PPL EU will need to revise and reprogram its existing SCADA system.

4. It should be noted that no reinforcements of the 12 kV distribution system are required for Queue W2-059.

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Network Impacts

Queue project W2-059 was studied as a(n) 2.4MW (1.0MW of which was Capacity) injection into PPL's system at the Strasburg 12kV substation. The project was studied on a combined feasibility-impact basis which utilizes an AC analysis, and incorporates all contingency types. Project W2-059 was evaluated for compliance with reliability criteria for summer peak conditions in 2014. Potential network impacts were as follows:

Local System Impacts

(Impacts to PPL EU's lower voltage distribution system based on reliability criteria commonly applied to these facilities)

There are no overloads expected as a result of the W2-059 connection. PPL EU studies found that voltage remained within acceptable limits for the operation of W2-059's generators. However, if customers on the Strasburg 67-3 12 kV line begin to experience unacceptable voltage fluctuations due to Sight and Sound Theatres' operations, Sight and Sound Theatres will be required to take all necessary corrective action to mitigate the problem. An instantaneous voltage variation of greater than 5% at the Point of Interconnection is generally not acceptable. In addition, the frequency and severity of voltage variations are also considered when determining compliance with PPL EU's flicker guidelines. These guidelines are based upon the General Electric flicker-irritation curve and will be used to determine if the system is operating within acceptable limits.

Queue W2-059 Interconnection Customer should also be aware of PPL EU's harmonic distortion guidelines. PPL EU allows up to a 3% total harmonic voltage distortion level. In addition, no single harmonic is allowed to exceed 1.7% of the system fundamental voltage. If PPL EU discovers that objectionable harmonics in excess of the stated limits are being injected into the system from W2-059's equipment, Queue W2-059 Interconnection Customer will be responsible for taking corrective measures to mitigate harmonic currents and may be required to curtail operation until such corrective measures are implemented.

Preliminary studies indicate that operating the W2-059 synchronous machines at unity power factor over all output conditions will not adversely affect system voltage. PPL EU reserves the right to change the power factor requirement for W2-059 as system conditions change.

Generator Deliverability

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

No problems identified.

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Multiple Facility Contingency

(Double Circuit Tower Line, Stuck breaker and Bus Fault contingencies for the full energy output)

No problems identified.

Short Circuit Analysis

No problems identified.

Stability Analysis

Not required.

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 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 below. There is no guarantee of full deliverability 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

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all overload conditions associated with the identified overloaded element(s). As a result of the aggregate energy resources in the area, the following violations were identified:

No problems identified.

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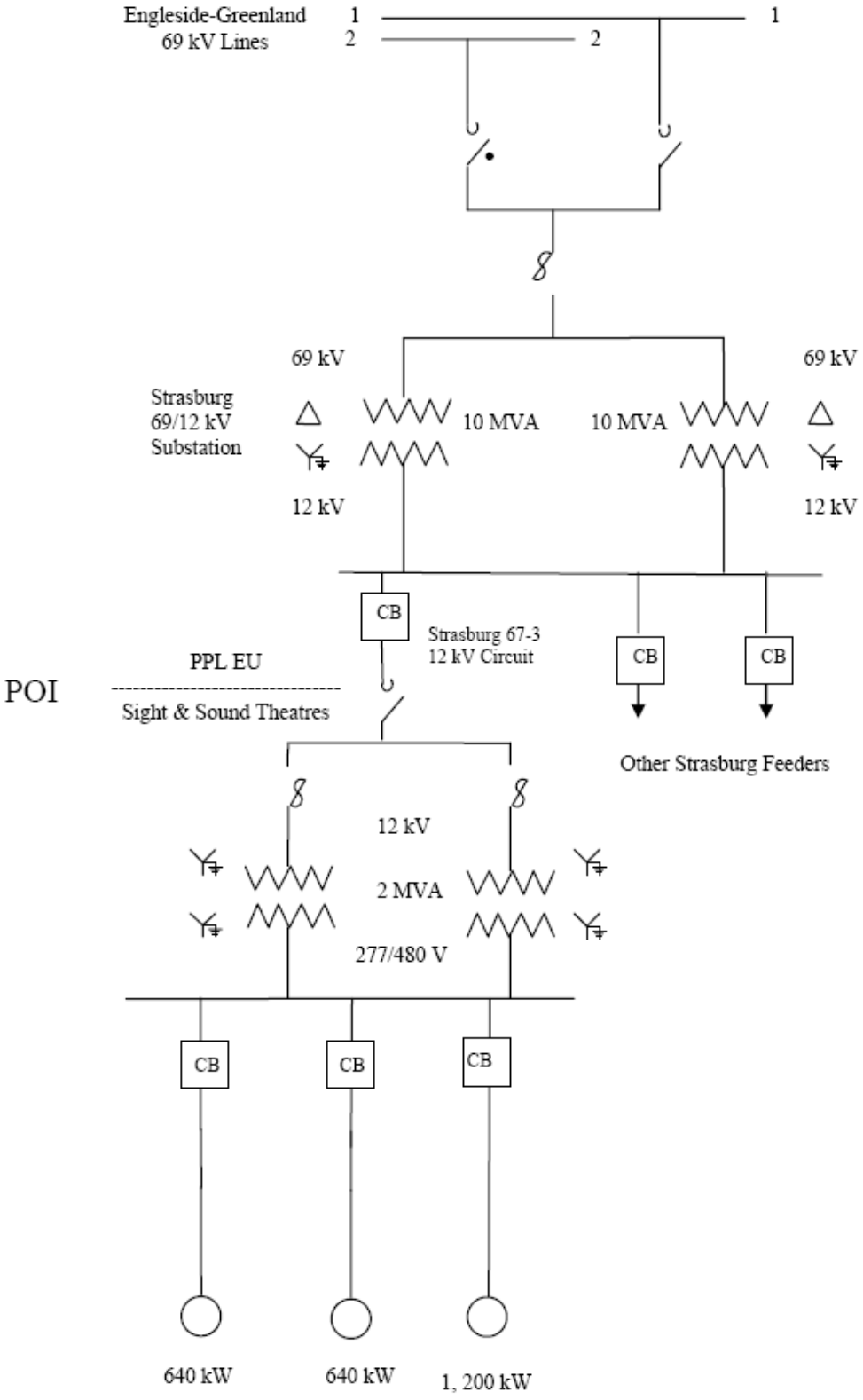
Attachment 1

W2-059 Interconnection Single Line Diagram



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