PJM Generator Interconnection
U1-067 Honey Brook 1.6 MW
Combined Feasibility and Impact Study

November 2008

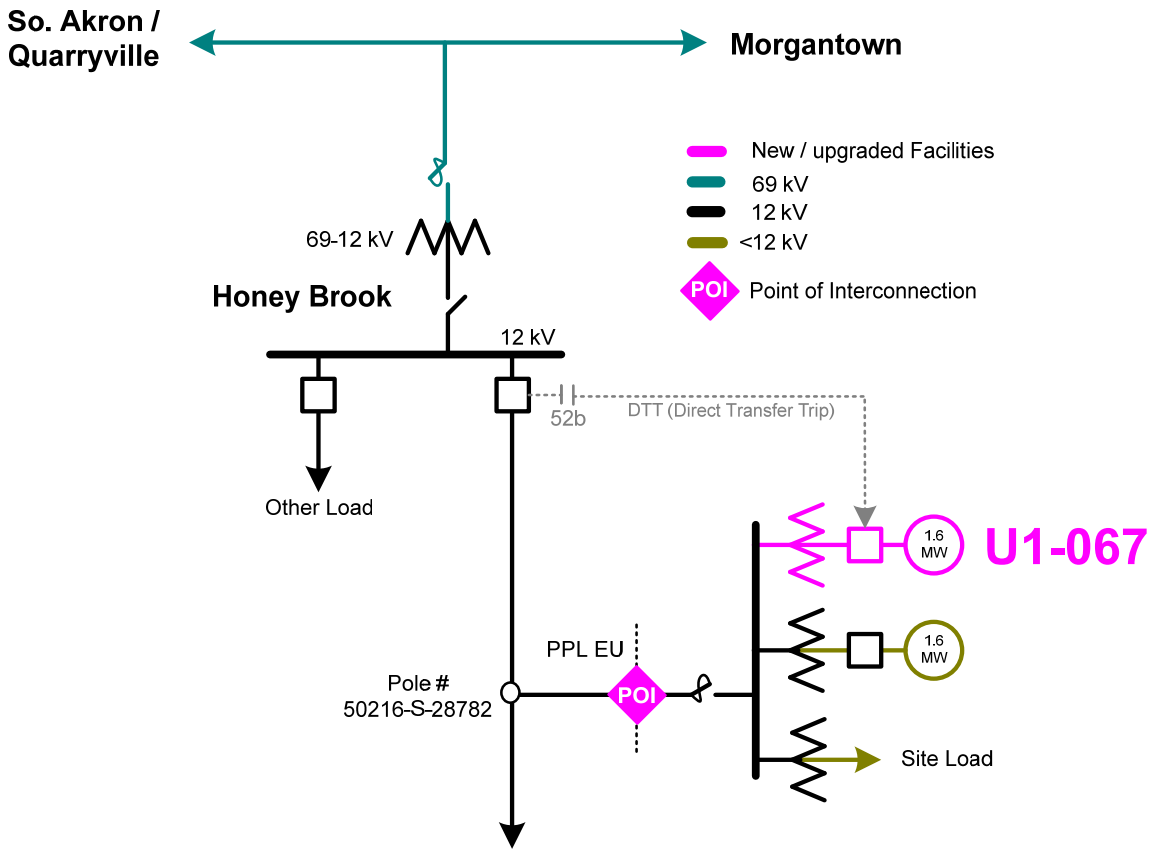
DMS #493222

General

Queue U1-067 is a Granger Energy, LLC request to interconnect a 1.6 MW (net energy and Capacity) methane gas–fired generator. Granger Energy, LLC currently has an existing 1.6 MW methane gas–fired generator connected at the same location with energy-only rights to inject 600 KW net into the PJM / PPL EU system. U1-067 is located in Honey Brook, Salisbury and Caernarvon Townships, Lancaster County, Pennsylvania. Queue U1-067 Capacity and energy is scheduled for commercial operation in December 2008.

Direct Connection Requirements

Queue U1-067 generation can be connected to the Honeybrook 12 kV substation as shown on the one line diagram below and described in the text that follows:



Queue U1-067 Interconnection Customer Scope of Direct Connection Work

Queue U1-067 Interconnection Customer is responsible for design, construction and costs for all facilities associated with the U1-067 generating station on the Interconnection Customer side of the POI (Point of Interconnection) as indicated on the one line diagram above. Protective relaying and metering design and installation must comply with PPL's Applicable Standards.

U1-067 Interconnection Customer is also required to provide revenue metering and real-time telemetering data (if choosing to be a Capacity Resource) to PJM in conformance with the requirements contained in PJM Manuals M-01 and M-14, the PJM Tariff which are posted on the PJM Website.

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

The following relay and control upgrades will be required at the PPL EU Honey Brook substation in order to accommodate Queue U1-067 generation:

1. Direct Transfer Trip (phone line). Radio based DTT is NOT an option for this facility based on information from the Interconnection Customer (Granger Energy). A Fiber Optics option is also being considered by the Interconnection Customer.
2. Modifications to the controls of the 12 kV Honey Brook #34-1 circuit breaker
3. Modification to the Honeybrook SCADA due to reverse power flow on this line.

Direct transfer trip will be required between the 12.47 kV circuit breaker at Honey Brook and the generator to avoid islanding the generation on PPL EU load. Also, a voltage check & synchronous check relay is required to supervise reclosing of the 12.47 kV circuit breaker. This project was estimated both on the basis of a phone line based DTT.

Relaying will need to be reviewed due to the size of proposed ground bank transformation at the customer facility. The existing 1.6 MW unit step-up is 2 MVA, and a 7 MVA step-up is being proposed for the new 1.6 MW Queue U1-067 connection. If a 7 MVA transformer is chosen it could cause relay coordination issues requiring relay modifications at Honeybrook substation. This has not been factored into the cost for direct connection of U1-067.

The cost for the relay and control modifications at Honey Brook is estimated to be $250,000 (assuming phone line DTT, $300,000 if it is fiber DTT). To engineer and complete the above modifications under normal working conditions, PPL will require about 8-10 months from the time that the ISA and CSA agreements are executed and PPL receives authorization to proceed from PJM. Consequently, the requested in service date is in jeopardy. Please see the "Remarks" section on the next page for additional information.

This estimate does not include any metering or the required inter-tie protection equipment costs. Refer to the PPL interconnection requirements located at the PJM website. PPL considers Granger Energy of Honey Brook a "Type 3" generator. (Note: This is an existing installation, and most of the required protective equipment is already in place).

Interconnection Customer (Granger Energy) Scope of Direct Connection Work

The customer will be required to install the following equipment at the Queue U1-067 site:

- Phone line (or alternatively fiber optics) based DTT.

- Inter-tie protective relaying (Beckwith M-3520 preferred). Note that failure of the microprocessor-based relay will block all protective relaying. For this reason, we request a second relay be installed. If only one relay is installed, failure of the relay will require isolation of the generation from the PPL EU system. Use of a Delta High side connection would require additional relaying. This protection should already be in place from the installation of the existing 1.6 MW unit; however the existing CT's (current transformers) will need to be replaced with CTs of higher turns ratio due to the increased generation output.

- PPL EU SCADA remote Terminal Unit. PPL EU will supply suitable drawings and a material list for the generator to provide this equipment. The current PPL EU design uses commercially available PLC equipment, with the software provided by PPL EU.

- Metering equipment arrangements at the generator and at the Point of Interconnection will be determined and PPL EU will identify costs after sufficient one-lines, switchgear and system operating detail have been developed and reviewed.

- Phone lines for the above DTT and SCADA. Please note protective relay grade phone circuits are special, and may take 3 to 6 months to obtain.

- Suitable protection for the above phone lines, based on IEEE 487-2000.

Remarks:

- In order to have any chance of meeting the requested in service date, the following must occur immediately:

    1. The Interconnection Customer (Granger Energy) must sign the Queue U1-067 ISA and CSA immediately.

    2. The Interconnection Customer (Granger Energy) must accept the increased cost obligation of funding engineering and construction overtime to meet a compressed work schedule. The estimated overtime amount, assuming resources are available or can be made available to complete the work, could be 150% or more of the above-identified cost.

Network Impacts

Queue U1-067 was studied as a 1.6 MW (net energy and Capacity) injection into the Honey Brook 12 kV bus. Queue U1-067 was evaluated for compliance with reliability criteria for summer peak conditions in 2013. Potential network impacts were as follows:

NETWORK IMPACTS

Local Transmission System Impacts

(Normal system conditions with all facilities in service, and contingency analysis per documented Reliability Criteria, generally FERC Form 715, for Transmission Owner's underlying system)

No problems identified.

Generator Deliverability

(Normal System with all facilities in-service and 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 for the full energy output. Stuck breaker and bus fault contingencies will be performed for the Impact Study)

No problems identified.

Short Circuit Analysis

No problems identified.

Stability

Not required because of generator size and location.

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.

NETWORK UPGRADE REQUIREMENTS

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 *(This project contributes to the Network Impact causing the need for these Network Upgrades. This project will be allocated a cost to be determined during the Impact Study)*

None required.

PJM Generator Interconnection
U1-067 Honey Brook 1.6 MW
Combined Feasibility and Impact Study

July 2008

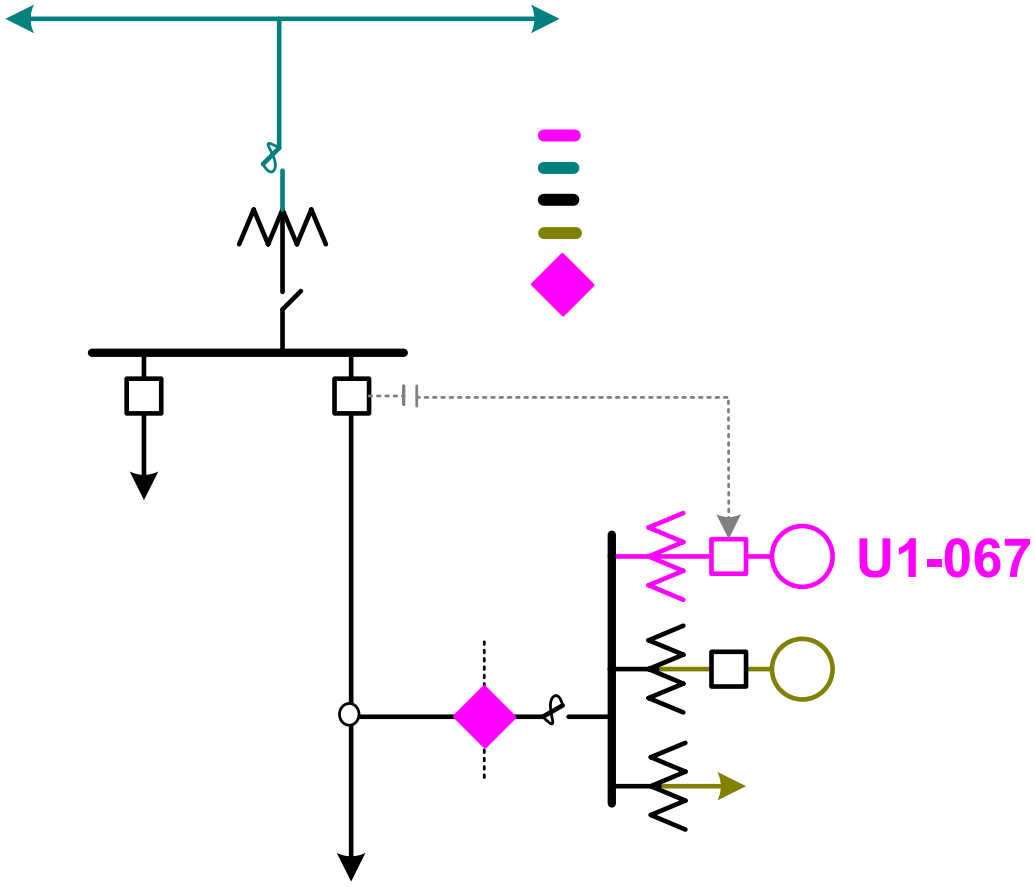
DMS #493222

General

Queue U1-067 is a Granger Energy, LLC request to interconnect a 1.6 MW (net energy and Capacity) methane gas–fired generator. Granger Energy, LLC currently has an existing 1.6 MW methane gas–fired generator connected at the same location. U1-067 is located in Honey Brook, Salisbury and Caernarvon Townships, Lancaster County, Pennsylvania. Queue U1-067 Capacity and energy is scheduled for commercial operation in December 2008.

Direct Connection Requirements

Queue U1-067 generation can be connected to the Honeybrook 12 kV substation as shown on the one line diagram below and described in the text that follows:



Queue U1-067 Interconnection Customer Scope of Direct Connection Work

Queue U1-067 Interconnection Customer is responsible for design, construction and costs for all facilities associated with the U1-067 generating station on the Interconnection Customer side of the POI (Point of Interconnection) as indicated on the one line diagram

above. Protective relaying and metering design and installation must comply with PPL's Applicable Standards.

U1-067 Interconnection Customer is also required to provide revenue metering and real-time telemetering data (if choosing to be a Capacity Resource) to PJM in conformance with the requirements contained in PJM Manuals M-01 and M-14, the PJM Tariff which are posted on the PJM Website.

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

The following relay and control upgrades will be required at the PPL EU Honey Brook substation in order to accommodate Queue U1-067 generation:

1. Direct Transfer Trip (phone line). Radio based DTT is NOT an option for this facility based on information from the Interconnection Customer (Granger Energy). A Fiber Optics option is also being considered by the Interconnection Customer.
2. Modifications to the controls of the 12 kV Honey Brook #34-1 circuit breaker
3. Modification to the Honeybrook SCADA due to reverse power flow on this line.

Direct transfer trip will be required between the 12.47 kV circuit breaker at Honey Brook and the generator to avoid islanding the generation on PPL EU load. Also, a voltage check & synchronous check relay is required to supervise reclosing of the 12.47 kV circuit breaker. This project was estimated both on the basis of a phone line based DTT.

Relaying will need to be reviewed due to the size of proposed ground bank transformation at the customer facility. The existing 1.6 MW unit step-up is 2 MVA, and a 7 MVA step-up is being proposed for the new 1.6 MW Queue U1-067 connection. If a 7 MVA transformer is chosen it could cause relay coordination issues requiring relay modifications at Honeybrook substation. This has not been factored into the cost for direct connection of U1-067.

The cost for the relay and control modifications at Honey Brook is estimated to be $250,000 (assuming phone line DTT). To engineer and complete the above modifications under normal working conditions, PPL will require about 8-10 months from the time that the ISA and CSA agreements are executed and PPL receives authorization to proceed from PJM. Consequently, the requested in service date is in jeopardy. Please see the "Remarks" section on the next page for additional information.

This estimate does not include any metering or the required inter-tie protection equipment costs. Refer to the PPL interconnection requirements located at the PJM website. PPL considers Granger Energy of Honey Brook a "Type 3" generator. (Note: This is an existing installation, and most of the required protective equipment is already in place).

Interconnection Customer (Granger Energy) Scope of Direct Connection Work

The customer will be required to install the following equipment at the Queue U1-067 site:

- Phone line (or alternatively fiber optics) based DTT.

- Inter-tie protective relaying (Beckwith M-3520 preferred). Note that failure of the microprocessor-based relay will block all protective relaying. For this reason, we request a second relay be installed. If only one relay is installed, failure of the relay will require isolation of the generation from the PPL EU system. Use of a Delta High side connection would require additional relaying. This protection should already be in place from the installation of the existing 1.6 MW unit; however the existing CT's (current transformers) will need to be replaced with CTs of higher turns ratio due to the increased generation output.

- PPL EU SCADA remote Terminal Unit. PPL EU will supply suitable drawings and a material list for the generator to provide this equipment. The current PPL EU design uses commercially available PLC equipment, with the software provided by PPL EU.

- Metering equipment arrangements at the generator and at the Point of Interconnection will be determined and PPL EU will identify costs after sufficient one-lines, switchgear and system operating detail have been developed and reviewed.

- Phone lines for the above DTT and SCADA. Please note protective relay grade phone circuits are special, and may take 3 to 6 months to obtain.

- Suitable protection for the above phone lines, based on IEEE 487-2000.

Remarks:

- In order to have any chance of meeting the requested in service date, the following must occur immediately:

    1. The Interconnection Customer (Granger Energy) must sign the Queue U1-067 ISA and CSA immediately.

    2. The Interconnection Customer (Granger Energy) must accept the increased cost obligation of funding engineering and construction overtime to meet a compressed work schedule. The estimated overtime amount, assuming resources are available or can be made available to complete the work, could be 150% or more of the above-identified cost.

Network Impacts

Queue U1-067 was studied as a 1.6 MW (net energy and Capacity) injection into the Honey Brook 12 kV bus. Queue U1-067 was evaluated for compliance with reliability criteria for summer peak conditions in 2013. Potential network impacts were as follows:

NETWORK IMPACTS

Local Transmission System Impacts

(Normal system conditions with all facilities in service, and contingency analysis per documented Reliability Criteria, generally FERC Form 715, for Transmission Owner's underlying system)

No problems identified.

Generator Deliverability

(Normal System with all facilities in-service and 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 for the full energy output. Stuck breaker and bus fault contingencies will be performed for the Impact Study)

No problems identified.

Short Circuit Analysis

No problems identified.

Stability

Not required because of generator size and location.

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.

NETWORK UPGRADE REQUIREMENTS

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 *(This project contributes to the Network Impact causing the need for these Network Upgrades. This project will be allocated a cost to be determined during the Impact Study)*

None required.