

***Generation Interconnection
Feasibility Study Report
Web Version***

For

***PJM Generation Interconnection Request
Queue Position W2-095***

Guilford 34.5kV Project

Overview

Interconnection Customer (IC), has submitted an Attachment N to propose the interconnection of 10 MW of solar generation in Guilford Township, Franklin County, Pennsylvania for the purpose of selling up to 10 MW energy and 3.8 MW of Capacity into the PJM market via the Allegheny Power network. The Commercial Operation date for this project was requested to be October 1, 2011. The analysis was performed using a 2014 base year. By virtue of the developer's seeking QF status, this is a FERC jurisdictional interconnection and will result in the developer receiving a PJM Interconnection Service Agreement.

PJM Report on the Transmission System

This portion of the report addresses the impacts on and the required reinforcements to that part of the transmission system under PJM jurisdiction.

Network Impacts

Queue project W2-095 was studied as a 10.0MW (3.8MW of which was Capacity) injection into APS's system at two optional points of interconnection. The primary option was a direct connection at the Guilford 34.5kV substation, while the secondary option was a tap of the Guilford – St. Thomas 34.5kV line. Project W2-095 was evaluated for compliance with reliability criteria for summer peak conditions in 2014. Potential network impacts were as follows:

Option 1: Guilford 34.5kV

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

(Report Overdutied breakers here)

Not 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 problems identified.

Option 2: Guilford – St. Thomas 34.5kV line

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

(Report Overdutied breakers here)

Not 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 problems identified.

APS Feasibility Analysis Report

This portion of this Feasibility Study Report has been prepared for PJM queue project W1-095 by Allegheny Power. It addresses the impacts on and required reinforcements to that portion of the network at the distribution level, including the attachment and direct connection facilities.

Option 1: Injection into the Guilford 34.5kV Bus

Attachment Facilities and Related Network Upgrades

- At Guilford SS, replace 2-69kV bus support structures and relocate 69kV bus. Relocate the interior SS access road between the new structures to allow room for the new 34.5kV bay addition. Install 1-34.5kV additional bay, 1-2000A, 34.5kV breaker, 6-2000A, 34.5kV hookstick disconnects, 1-1200A, 34.5kV vertical break switch, 34.5kV arresters, 34.5kV metering, control panels and cables, grounding, and associated material. Install a 34.5kV UG line terminal. The IC is to install a fiber optic link to W2-095. Note: All property associated with this station must be obtained by the IC and conveyed to AP, at no cost, in the form of either a perpetual lease or direct ownership. All rights-of-way must be obtained by the IC and transferred, at no cost, to AP.

Estimated Cost: \$614,460 in 2011 dollars

The estimated project duration is **15 months** after the receipt of an executed interconnection Agreement and Construction Agreement.

While the information in this report is reasonable for the scope of work defined, it should, however, be noted that the cost figures are conceptual in nature at this stage, as an engineering team has not been assigned to the project. Obviously, any change to the scope of work will require that the estimates be revisited. The costs are a best estimate, but the IC will be charged for actual costs. Any under-runs or over-runs will be reconciled at the conclusion of the project. The estimates in this report do not include tax gross-up.

The developer will interconnect into Guilford substation via a new customer-owned overhead 34.5 kV line from a customer-owned substation. The above cost estimates do not include construction of that line. Route selection, line design, rights-of-way acquisition and construction of such lines will be entirely the responsibility of the IC. It is assumed that the IC's main step up transformer will conform to the AP standard with delta on the low side and grounded wye on the high side as illustrated in AP's Engineering Manual:

http://www.alleghenypower.com/PowerQuality/Attachments/e1936_00.pdf.

No breakers were identified as being over their maximum interrupting rating.

AP reserves the right to review the electrical protection design and relay settings for IC facilities to ensure that the protective relaying equipment will be compatible with that installed on AP

facilities. The relaying package will likely include both primary and backup protection. AP personnel must be present at the time of commissioning to inspect and witness proper function of the control scheme and related coordination. The estimated cost to perform this engineering review and field test effort is **\$5,000 in 2010 dollars**.

Note: The purchase and installation of protective relaying and associated equipment at the generation site is the responsibility of the IC and is not included in this scope of work.

It is assumed that a fiber optic interface will be used for the protection channel between the AP and IC stations. The IC will be required to install metering and telemetry equipment to provide revenue metering and real-time telemetry data to PJM. The requirements for this equipment are listed in Appendix 2, Section 8 of Attachment O to the PJM Tariff, as well as PJM Manuals 01 and 14D. Protective relaying and metering design and installation must comply with the AP applicable standards.

Overloads and Required Reinforcements

1. The voltage at Quincy Substation falls beyond limits for the loss of the QUINCY – W2-053 TAP 34.5kV line.

- **Reinforcement:** Install a 4.592 MVAR (effective) 34.5kV capacitor bank at Quincy substation and adjust the capacitor relay settings at Guilford substation.

- **Estimate Cost:** \$295,069 in 2011 dollars

- **Estimated Project Duration:** 15 months after receipt of an executed Interconnection Service Agreement and Construction Service Agreement

Other Supporting Facilities Charge

The Other Supporting Facilities Charge (OSFC) may include non-transmission facilities directly assigned and/or a general (rolled-in) facilities charge. The guidelines apply to all wholesale customers and all generators selling into or through the PJM market, regardless of capacity, not connected directly to the AP Transmission System.

The Other Supporting Facilities Charge for the W2-053 generator interconnection project has been estimated to be **\$5,400/month** in 2010 dollars. The estimate is based on an average (or rolled-in) rate for West Penn's sub-transmission system.

Option #2: Injection into the Guilford – Lemasters Jct. 34.5kV Line

Because the secondary POI is located electrically close to the primary POI, all overloads and reinforcements identified for the primary POI are valid for the secondary.