Generation Interconnection Feasibility Study Report Web Version

For

PJM Generation Interconnection Request Queue Position W1-044

Mont Alto Project

PJM DOCS No. 605673 v1
July, 2010

Overview

Interconnection Customer (IC) has submitted an Attachment N to propose the interconnection of a 20 MW of PV solar generation in Franklin County, Pennsylvania for the purpose of selling up to 20 MW energy and 7.6 MW of Capacity into the PJM market via the Allegheny Power network. The Commercial Operation date for this project was requested to be July 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.

PJM Feasibility Analysis Report

Network Impacts

Queue project W1-044 was studied as a 20.0MW (7.6MW of which was Capacity) injection into APS's system at two points of interconnection (POI). From the transmission system perspective, the primary POI was modeled as a tap of the Quincy – Guilford 34.5kV line. This corresponds to the location of the Fayetteville substation discussed in the APS portion of this report below. The secondary POI was also a tap of the Quincy – Guilford 34.5kV line, but the tap point is located closer to the Quincy substation. Project W1-044 was evaluated for compliance with reliability criteria for summer peak conditions in 2014. Potential network impacts were as follows:

Primary POI: Tap of Quincy – Guilford 34.5kV (43% of distance from Quincy to Guilford)

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.

Secondary POI: Tap of Quincy – Guilford 34.5kV (28% of distance from Quincy to Guilford)

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.

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 W1-044 by Allegheny Power.

Primary POI: Injection into the Existing 34.5kV Fayetteville SS

Attachment Facilities and Related Network Upgrades

- At Fayetteville SS, install 1-34.5kV line breaker, 6-34.5kV hookstick disconnects, 34.5kV arresters, 34.5kV metering, 1-600A, 34.5kV vertical break switch, structures

and foundations. Install grounding, control panels and cables, and associated material. Assume no additional property or fence expansion is required for this work. The IC shall enter Fayetteville SS via a customer-owned underground 34.5kV line. A fiber optic link is required between Fayetteville substation and the IC.

Estimated Cost: $223,841 in 2011 dollars

The estimated project duration is **15 months** after the receipt of an executed interconnection Agreement and Construction Agreement. As such, the requested April 2011 probably cannot be met. Any time to complete the impact study must also be taken into account.

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 IC will interconnect with the Allegheny Power (AP) system via a customer owned line from a customer owned substation located approximately two (2) miles from the existing Fayetteville SS. 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 the AP Engineering Manual:

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

Short Circuit(APS)

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 at the new switching station. 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 2011 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 the QUINCY 34.5kV bus drops 6.01 p.u. for the loss of the QUINCY – W.WAYNES 34.5kV line.
   - **Reinforcement:** Install a 2.041 MVAr (effective) 34.5kV capacitor, vacuum switch, and fuses at Fayetteville substation.
   - **Estimated Cost:** $200,451 in 2011 dollars
   - **Estimated Project Duration:** 15 months after receipt of an executed Interconnection Agreement and Construction Agreement.

2. The voltage at the RAVENROC 34.5kV bus drops 5.57 p.u. for the loss of the RAVENROC – WT4 JCT 34.5kV line.
   - **Reinforcement:** Increase the size of the existing capacitor bank at BLUERIDG to 8.164 MVAr and increase the size of the existing capacitor bank at E.WAYNES to 9.694 MVAr.
   - **Estimated Cost:** $68,211 in 2011 dollars
   - **Estimated Project Duration:** 15 months after receipt of an executed Interconnection Agreement and Construction 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 W1-044 generator interconnection project has been estimated to be **$10,800/month** in 2010 dollars. The estimate is based on an average (or rolled-in) rate for West Penn's sub-transmission system.

Secondary POI: Injection into the Fayetteville – Quincy 34.5kV line

Short Circuit

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 at Lime Kiln substation. 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 2011 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 the QUINCY 34.5kV bus drops 6.01 p.u. for the loss of the QUINCY – W.WAYNES 34.5kV line.

2. The voltage at the RAVENROC 34.5kV bus drops 5.57 p.u. for the loss of the RAVENROC – WT4 JCT 34.5kV line.

Please note, during the impact study AP will perform a study of the effect of harmonics from solar inverters on its system, as well as a "time-based study" to determine any loading effects on its system (i.e. a passing cloud causing a change in area generation resulting in a voltage deviation). These studies may require the use of an external consultant.