

Generation Interconnection

Feasibility Study Report

Web Version

For

PJM Generation Interconnection Request

Queue Position W2-053

West Waynesboro 34.5 kV I Project

Overview

Interconnection Customer (IC) has submitted an Attachment N to propose the interconnection of 20 MW of solar generation on a tract 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, 2012. 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 W2-053 was studied as a 20.0MW (7.6MW of which was Capacity) injection into APS's system at two optional points of interconnection. The primary option was a tap of the West Waynesboro - Quincy 34.5kV line, while the secondary option was a tap of the Fayetteville - West Waynesboro 138kV line. Project W2-053 was evaluated for compliance with reliability criteria for summer peak conditions in 2014. Potential network impacts were as follows:

Option 1: West Waynesboro - Quincy 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: Fayetteville – West Waynesboro 138kV 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 W1-053 by Allegheny Power. It addresses the impacts on and required reinforcements, if any, found in the PJM analysis of the Transmission System and provides the results of a similar analysis at the distribution level, including the attachment and direct connection facilities.

Injection into the Quincy – West Waynesboro 34.5kV Line

Attachment Facilities and Related Network Upgrades

- Construct the Round Top 34.5kV switching station. Grade and install access road for a fenced area of approximately 200' x 150'. Install ground grid, structures, foundations, and yard stone. Install 1-34.5kV initial bay, 2-34.5kV additional bays, 4-34.5kV breakers in a ring bus configuration, 24-34.5kV hookstick disconnect switches, 1-34.5kV vertical break switch, 34.5kV metering, 9-34.5kV VT's and fuses, 34.5kV arresters, line traps, and CVTs. Install 2-34.5kV station service transformers and fuses. Install a 16' x 28' metal control building, battery, SCADA, telephone service, control cables and panels, transfer trip, and associated equipment. Loop the Quincy - West Waynesboro 34.5kV line into the station. The IC is to install a fiber optic link between the Round Top switching station and W2-053. 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: \$2,393,908 in 2011 dollars

- Install anti-islanding (transfer trip) at West Waynesboro substation.

Estimated Cost: \$127,139 in 2011 dollars

- Install anti-islanding (transfer trip) at Fayetteville substation.

Estimated Cost: \$127,139 in 2011 dollars

The estimated project duration is **18 months** after the receipt of an executed interconnection Agreement and Construction Agreement. Permitting issues may delay this estimated project duration and 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 developer will interconnect into the new Round Top 34.5 kV switching station via a new customer-owned 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. During several contingencies, the local area experiences high voltage.
 - **Reinforcement:** Install a +/- 25 MVar 34.5kV SVC at the new Round Top switching station.
 - **Estimated Cost:** \$7,530,335 in 2012 dollars
 - **Estimate Project Duration:** 21 months after receipt of an executed Interconnection Service Agreement and Construction Service Agreement.

Please note: the cost of this reinforcement will be shared with the W2-054 project.

2. The voltage at several buses falls beyond limits for the loss of the East Waynesboro – Highfield or Landis – West Waynesboro 34.5kV lines.
 - **Reinforcement:** Install a 7.143 MVar (effective) 34.5kV capacitor bank at Highfield substation, reduce the size of the capacitor at East Waynesboro substation, and revise the capacitor relay settings at Huyetts substation.

- **Estimated Cost:** \$300,997 in 2011 dollars
- **Estimated Project Duration:** 15 months after receipt of an executed Interconnection Service Agreement and Construction Service Agreement

Please note: the cost of this reinforcement will be shared with the W2-054 project.

3. The W.WAYNES – W2-053 TAP 34.5kV line loads to 110.3% (AC power flow) of its emergency rating (36.9 MVA) for the loss of the GUILFORD-FAYETV 34.5kV line. This project contributes approximately 1.90 MW to cause this thermal violation.

- **Reinforcement:** Reconductor 3.8 miles of the W.WAYNES – W2-053 TAP 34.5kV line with 954 AAC conductor. Upgrade the terminal equipment at West Waynesboro substation.
- **Estimated Cost:** \$1,506,647 in 2011 dollars
- **Estimated Project Duration:** 18 months after receipt of an executed Interconnection Service Agreement and Construction Service Agreement.

4. The W2-053 TAP – QUINCY 34.5kV line loads to 101.3% (AC power flow) of its emergency rating (36.9 MVA) for the loss of the W.WAYNES – W2-053 TAP 34.5kV line. This project contributes approximately 0.24 MW to cause this thermal violation.

- **Reinforcement:** Reconductor 1.5 miles of the W2-053 TAP – QUINCY 34.5kV line with 954 AAC conductor. Upgrade the terminal equipment at Quincy substation.
- **Estimated Cost:** \$643,806 in 2011 dollars
- **Estimated Project Duration:** 18 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 **\$10,800/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 West Waynesboro – Fayetteville 138kV line

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 **\$10,000 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. During contingency, 3-34.5kV buses experience a voltage drop or rise that exceeds limits

Please note: Dynamic reactive support that was identified during the study of W1 queue project was included in this model. Withdraw of projects in the W1 queue may eliminate the need for this reactive support, yielding a different number of affected buses for W2 queue projects.