Generation Interconnection Feasibility Study Report (Web Version)

For

PJM Generation Interconnection Request Queue Position W3-072

St. Thomas-Guilford 34.5kV Project

January, 2011

Overview

The Interconnection Custom (IC) has submitted an Attachment N to propose the interconnection of 20 MW of solar powered generation 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 is July 1, 2012. The analysis was performed using a 2014 base year. This project will be FERC Jurisdictional and will receive 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 W3-072 was studied as a 20.0 MW (7.6 MW of which was Capacity) injection into APS's system between St. Thomas and Guilford 34.5 kV line. Project W3-072 was evaluated for compliance with reliability criteria for summer peak conditions in 2014.

Potential transmission network impacts are as follows:

Option 1: Tap between St. Thomas and Guilford 34.5 kV line

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

No violations 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 violations identified.

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 violations 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 required.

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 required.

Short Circuit
(Report over-dutied breakers.)

None 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 violations identified.

Option 2: Texas Eastern #6 138 kV substation

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

No violations 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 violations identified.

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 violations 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 required.

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 required.

Short Circuit
(Report over-dutied breakers.)

None required.

Energy Portion of Interconnection Request
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No violations identified.

APS Feasibility Analysis Report

This portion of this Feasibility Study Report has been prepared for PJM 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.

Injection into the future CNG 34.5kV Bus

Attachment Facilities and Related Network Upgrades

Obtain property from the developer at no cost to AP. Grade and install access road and expand the existing fenced area approximately 75' x 60'. Install ground grid, structures, foundations, and yard stone. Install 1-34.5kV initial bay, 1-34.5kV additional bay, 1-1200A, 34.5kV breaker, 6-1200A, 34.5kV hookstick disconnect switches, 1-600A, 34.5kV vertical break switch, 3-34.5kV VT's, 1-34.5kV station service transformer, 34.5kV metering, 34.5kV arresters and fuses. Install new 34.5kv LB switch and fuses on structure for the existing 34.5-4.16kV transformer. Install a 16' x 24' metal control building, battery and charger, AC and DC panels, SCADA, transfer trip, telephone service, control cables and panels, and associated equipment. The developer is to install a fiber optic link to W3-072. Note: All property associated with this station expansion 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: $1,375,118 in 2012 dollars

Install 34.5kV PLC anti-islanding (transfer trip) facilities at Guilford substation, including line trap and CVT.

Estimated Cost: $139,276 in 2012 dollars

Install 34.5kV PLC anti-islanding (transfer trip) facilities at (future) Grapevine substation, including line trap and CVT.

Estimated Cost: $139,276 in 2012 dollars

Install 34.5kV PLC anti-islanding (transfer trip) facilities at (future) Lemasters substation, including line trap and CVT.

Estimated Cost: $141,504 in 2012 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 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 existing CNG 34.5 kV substation 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 a 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 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.

The IC's inverters shall operate at a nominal power factor of unity. However, the IC shall also install sufficient reactive support (i.e. an SVC, STATCOM, etc.) to limit voltage flicker at the point of interconnection to no more than 3%.

Overloads and Required Reinforcements

1. The McConnellsburg – W3-008 Tap 34.5kV line loads from 104.0% to 109.9% of its emergency rating (50.3 MVA) for the loss of the Milnor – Route 16 34.5kV line. This project contributes approximately 2.97 MW to cause this thermal violation.

Reinforcement: Reconductor 6.8 miles of the McConnellsburg – W3-008 34.5kV line with 954 AAC conductor. Upgrade the terminal equipment at McConnellsburg SS.

Estimated Cost: $2,012,411 in 2012 dollars

Estimated Duration: 18 Months after receipt of an executed ISA and CSA

2. The Grove – Chambers 5 Jct. 34.5kV line loads from 100.6% to 122.1% of its emergency rating (25.3 MVA) for stuck breaker contingencies "AP_SB_268" and "AP_SB_270". This project contributes approximately 5.44 MW to cause the above thermal violation. This line also overloads for stuck breaker contingency "AP_SB_269".

Reinforcement: Reconductor 1.65 miles of the Grove – Chambers 5 Jct. 34.5kV line with 954 AAC conductor

Estimated Cost: $483,955 in 2012 dollars

Estimated Duration: 18 Months after receipt of an executed ISA and CSA

3. The Guilford – Chambers 5 Jct. 34.5kV line loads from 90.6% to 103.5% of its emergency rating (36.8 MVA) for stuck breaker contingencies "AP_SB_268" and "AP_SB_270". This project contributes approximately 4.76 MW to cause the above thermal violation. This line also overloads for stuck breaker contingency "AP_SB_269".

Reinforcement: Reconductor 0.01 miles of the Guilford – Chambers 5 Jct. 34.5kV line with 954 AAC conductor. Upgrade the terminal equipment at Guilford SS.

Estimated Cost: $20,863 in 2012 dollars

Estimated Duration: 18 Months after receipt of an executed ISA and CSA

4. The Grove – West Waynesboro 34.5kV line loads from 85.1% to 107.1% of its emergency rating (25.3 MVA) for stuck breaker contingencies "AP_SB_268" and "AP_SB_270". This project contributes approximately 5.57 MW to cause this thermal violation. This line also overloads for stuck breaker contingency "AP_SB_269".

Reinforcement: Reconductor 0.47 miles of the Grove – West Waynesboro 34.5kV line with 954 AAC conductor. Upgrade the terminal equipment at West Waynesboro SS.

Estimated Cost: $155,784 in 2012 dollars

Estimated Duration: 18 months after receipt of an executed ISA and CSA

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 W3-072 generator interconnection project has been estimated to be **$11,614/month** in 2011 dollars. The estimate is based on a direct assigned rate and an average (or rolled-in) rate for West Penn's sub-transmission system.

Option #2: Injection near the Texas Eastern 6 138kV Substation

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 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 Grove – Chambers 5 Jct. 34.5kV line loads from 89.7% to 101.6% of its emergency rating (25.3 MVA) for stuck breaker contingencies "AP_SB_268" and "AP_SB_270". This project contributes approximately 3.02 MW to cause the above thermal violation. This line also overloads for stuck breaker contingency "AP_SB_269".

Reinforcement: Reconductor 1.65 miles of the Grove – Chambers 5 Jct. 34.5kV line with 954 AAC conductor

Estimated Cost: $483,955 in 2012 dollars

Estimated Duration: 18 Months after receipt of an executed ISA and CSA

2. The Blue Ridge Summit – Raven Rock 34.5kV line loads from 69.1% to 104.3% for stuck breaker contingency "AP_SB_387" This project contributes approximately 2.50 MW to cause this thermal violation

Reinforcement: Reconductor 0.80 miles of the Blue Ridge Summit – Raven Rock 34.5kV line with 954 AAC conductor.

Estimated Cost: $252,575 in 2012 dollars

Estimated Duration: 18 months after receipt of an executed ISA and CSA.