T27 Hyndman 34kV
Generation Interconnection

General

The Interconnection Customer (IC) has proposed a 60 MW wind generating facility to be located in Somerset County, Pennsylvania. The project will connect with Allegheny Power (AP) at a new 34.5kV station (Option 1) or at the existing Corriganville 34.5kV station (Option 2). The proposed in-service date for the project is 1st quarter of 2010.

Option 1

Point of Interconnection: A new 34kV switching station to be constructed on the Allegheny Power Hyndman – Corriganville 34.5 kV line section.

Direct Connection Requirements

Transmission Owner Scope of Direct Connection Work

Construct a new 34.5 kV switching station on property to provide a service point for the proposed generation facility. The new switching station will be situated on the existing Hyndman – Corriganville sub transmission line. Major equipment in the new station will include a wood pole bay, one 34.5kV circuit breaker, six 34.5kV hook stick switches and 34.5kV interconnection metering. A dual transfer trip scheme requiring the installation of CVTs and traps is included. The station will also include a control building which will house all protective relaying, metering and SCADA RTU communications equipment required to accommodate the electric facilities. Revenue metering will be located on the feed to the generator. Site preparation including grading and an access road is included.

Estimated Cost: $821,000 in 2010 dollars

Interconnection Customer Scope of Direct Connection Work

The IC's station will be remote from the AP SS and interconnection is assumed to be overhead. The assumption is made that the IC's step up transformer is delta on the low side and grounded wye on the high side

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.

While we can't mandate that our personnel install protective relaying and communications equipment at the generator site, AP has responsibility for designing the protection scheme and providing specifications for all relays to be employed on the interconnection breaker terminal at the generation site to assure that the protective relaying equipment will be compatible with that installed on the interconnection breaker terminal at the new switching station. The relaying package will likely include both primary and backup protection. AP is also responsible for testing and calibrating all relays and performing all tests to assure that relaying at the generator site is properly installed and functional.

The estimated total cost of this engineering and field test effort is **$5,000 in 2010 dollars**.

Note: Purchase and installation of protective relaying and associated equipment at the generation site is not included in this scope of work. This phase of work is the responsibility of the customer.

The estimated cost for Controls Engineering to complete a coordination review of the area, develop new relay settings, and implement the required changes is approximately **$5,000 in 2010 dollars**.

Network Impacts

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 for the full energy output. Stuck breaker and bus fault contingencies will be performed for the Impact Study)

No problems identified.

Short Circuit

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

Listed below are the positive and zero sequence source equivalent impedance at the proposed T27 site with the GSU and generators OPEN.

Positive: (0.43051+j0.90544)
Zero: (0.94712+j3.15515)

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)

1. The 01ALBRIG-01RUTHBL 138kV line loads from 112.57% to 116.36% (DC power flow) of its emergency rating (176MVA) for the tower line outage (31). The tower contingency results in all lines being disconnected from the following buses: 01BRANDN 138kV, 01 106 J 138kV, 01NEC T 138kV, 01NECEST 138kV, 01TEX E5 138kV, 01NU TP1 138kV, and 01NU 61 138kV. This project contributes approximately 6.7MW to the thermal violation.

2. The 01RUTHBL-01CHEATL 138kV line loads from 110.18% to 113.97% (DC power flow) of its emergency rating (176MVA) for the tower line outage (31). The tower contingency results in all lines being disconnected from the following buses: 01BRANDN 138kV, 01 106 J 138kV, 01NEC T 138kV, 01NECEST 138kV, 01TEX E5 138kV, 01NU TP1 138kV, and 01NU 61 138kV. This project contributes approximately 6.7MW to the thermal violation.

3. The 01CHEATL-01LKLYNN 138kV line loads from 104.29% to 108.07% (DC power flow) of its emergency rating (176MVA) for the tower line outage (31). The tower contingency results in all lines being disconnected from the following buses: 01BRANDN 138kV, 01 106 J 138kV, 01NEC T 138kV, 01NECEST 138kV, 01TEX E5 138kV, 01NU TP1 138kV, and 01NU 61 138kV. This project contributes approximately 6.7MW to the thermal violation.

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. "Network Impacts", initially caused by the addition of this project's generation)

1. T27 Tap – Corriganville 34.5kV line – Rebuild approximately 9 miles of line using 954 ACSR. This line is a radial line out of the Corriganville substation with a 12kV underbuild.

   Estimated Cost: $4,000,000 in 2010 dollars

   Note: This option will constitute a rebuild of the line due to the size of the conductor needed for the interconnection. This estimate also includes the price of working the line hot due to the Hyndman – Corriganville being a radial line out of Corriganville and therefore cannot be taken out of service for reconductoring. Scheduled outages have to be taken to tie the line into the station once reconductoring is complete. This may impact the project's in-service date due to system conditions.

2. Corriganville – Lavale 34.5kV line – Reconductor 3.60 miles of line using 795 ACSR.

Estimated Cost: $540,000 in 2010 dollars

3. Corriganville – Wills Mtn. Jct. 34.5kV line – Reconductor 1.99 miles of line using 795 ACSR.

Estimated Cost: $345,000 in 2010 dollars

4. Corriganville – Install dual transfer trip on the Hyndman 34.5kV terminal.

Estimated Cost: $173,000 in 2010 dollars

5. Corriganville Substation – Install interstate metering. If done in conjunction with dual transfer trip on the Hyndman 34.5kV terminal.

Estimated Cost: $61,000 in 2010 dollars

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 System Impact Study)

1. To mitigate the 01ALBRIG-01RUTHBL 116% overload would require upgrading the circuit by reconductoring 1.46 miles with 954 ACSR and upgrading terminal equipment at Albright SS including disconnects leads, line trap, line risers, relay circuitry, and RTU units. Due to the age of the line it is assumed that a complete rebuild of the circuit will be required. The estimate to perform this work is **$486,000 in 2009 dollars** with 30 months lead time.

2. To mitigate the 01RUTHBL-01CHEATL 114% overload would require upgrading the circuit by reconductoring approximately 18.25 miles with 954 ACSR. Due to the age of the line it is assumed that a complete rebuild of the circuit will be required. The estimate to perform this work is $**6,069,000 in 2009 dollars** with 30 months lead-time.

3. To mitigate the 01CHEATL-01LKLYNN 108% overload would require upgrading the circuit by reconductoring approximately 2.00 miles with 954 ACSR. Due to the age of the line it is assumed that a complete rebuild of the circuit will be required. The estimate to perform this work is **$740,000 in 2009 dollars** with 30 months lead time.

Delivery of Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of this interconnection request. Any 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 Merchant Transmission Interconnection request.

As a result of the aggregate energy resources in the area, the following violations were identified:

No problems identified.

Option 2

Point of Interconnection: The project will connect to the existing AP Corriganville 34.5 kV Station.

Direct Connection Requirements

Transmission Owner Scope of Direct Connection Work

Corriganville 34.5kV Substation – Extend substation yard grading, ground grid and fence. Add a 34.5kV steel bay for termination of T27. Major equipment in the new station will include one 34.5kV circuit breaker, six 34.5kV hook stick switches and 34.5kV interconnection metering. Protective relaying, metering and SCADA RTU communications equipment required to accommodate the electrical facilities are included.

Estimated Cost: $333,000 in 2010 dollars

Interconnection Customer Scope of Direct Connection Work

The IC will also 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.

While we can't mandate that our personnel install protective relaying and communications equipment at the generator site, AP has responsibility for designing the protection scheme and providing specifications for all relays to be employed on the interconnection breaker terminal at the generation site to assure that the protective relaying equipment will be compatible with that installed on the interconnection breaker terminal at the new switching station. The relaying package will likely include both primary and backup protection. AP is also responsible for testing and calibrating all relays and performing all tests to assure that relaying at the generator site is properly installed and functional. The estimated total cost of this engineering and field test effort is **$5,000 in 2010 dollars**.

Note: Purchase and installation of protective relaying and associated equipment at the generation site is not included in this scope of work. This phase of work is the responsibility of the customer.

The estimated cost for AP Controls Engineering to complete a coordination review of the area, develop new relay settings, and implement the required changes is approximately **$5,000 in 2010 dollars**.

Network Impacts

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 for the full energy output. Stuck breaker and bus fault contingencies will be performed for the Impact Study)

No problems identified.

Short Circuit

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

Listed below are the positive and zero sequence source equivalent impedance at the Corriganville 34.5kV site with the GSU and generators OPEN.

Positive: (0.09520+j0.29579)
Zero: (0.21771+j0.80221)

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)

1. The 01ALBRIG-01RUTHBL 138kV line loads from 112.57% to 116.36% (DC power flow) of its emergency rating (176MVA) for the tower line outage (31). The tower contingency results in all lines being disconnected from the following buses: 01BRANDN 138kV, 01 106 J 138kV, 01NEC T 138kV, 01NECEST 138kV, 01TEX E5 138kV, 01NU TP1 138kV, and 01NU 61 138kV. This project contributes approximately 6.7MW to the thermal violation.

2. The 01RUTHBL-01CHEATL 138kV line loads from 110.18% to 113.97% (DC power flow) of its emergency rating (176MVA) for the tower line outage (31). The tower contingency results in all lines being disconnected from the following buses: 01BRANDN 138kV, 01 106 J 138kV, 01NEC T 138kV, 01NECEST 138kV, 01TEX E5 138kV, 01NU TP1 138kV, and 01NU 61 138kV. This project contributes approximately 6.7MW to the thermal violation.

3. The 01CHEATL-01LKLYNN 138kV line loads from 104.29% to 108.07% (DC power flow) of its emergency rating (176MVA) for the tower line outage (31). The tower contingency results in all lines being disconnected from the following buses: 01BRANDN 138kV, 01 106 J 138kV, 01NEC T 138kV, 01NECEST 138kV, 01TEX E5 138kV, 01NU TP1 138kV, and 01NU 61 138kV. This project contributes approximately 6.7MW to the thermal violation.

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. "Network Impacts", initially caused by the addition of this project generation)

1. Corriganville – Lavale 34.5kV line – Reconductor 3.60 miles of line using 795 ACSR.

Estimated Cost: $540,000 in 2010 dollars

2. Corriganville – Wills Mtn. Jct. 34.5kV line – Reconductor 1.99 miles of line using 795 ACSR.

Estimated Cost: $345,000 in 2010 dollars

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 System Impact Study)

1. To mitigate the 01ALBRIG-01RUTHBL 116% overload would require upgrading the circuit by reconductoring 1.46 miles with 954 ACSR and upgrading terminal equipment at Albright SS including disconnects leads, line trap, line risers, relay circuitry, and RTU units. Due to the age of the line it is assumed that a complete rebuild of the circuit will be required. The estimate to perform this work is **$486,000 in 2009 dollars** with 30 months lead time.

2. To mitigate the 01RUTHBL-01CHEATL 114% overload would require upgrading the circuit by reconductoring approximately 18.25 miles with 954 ACSR. Due to the age of the line it is assumed that a complete rebuild of the circuit will be required. The estimate to perform this work is $**6,069,000 in 2009 dollars** with 30 months lead-time.

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Delivery of Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of this interconnection request. Any 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 Merchant Transmission Interconnection request.

As a result of the aggregate energy resources in the area, the following violations were identified:

No problems identified.

Issues Common to Both Options

Wholesale Distribution Charges

The charges below are the wholesale distribution charges. This charge is a rough estimate based on a rolled-in rate methodology, which assumes sub transmission facilities between AP's transmission system and the interconnection point are integrated network facilities.

Estimated Cost: $41,400/month in 2010 dollars

Interstate Metering

The IC may have interstate metering issues due to the generator connection in Pennsylvania and flow into Maryland. The cost of this has not been included in this report.

Cost and Timing Summary

The estimates in this report do not include tax gross-up. Note that the figures above do not include construction of the line required to interconnect the IC's proposed new generating facility with the AP substation. Route selection, line design, right-of-way acquisition and construction of such lines will be entirely the responsibility of the IC. It also does not include the cost of the network upgrades which have been identified as required by this project

The estimated time to provide for the interconnection of this project is 32 months after the receipt of a signed Interconnection Service Agreement and Interconnection Construction Service Agreement.

While the information in this transmittal 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.