U1-038 Millheim
Generation Interconnection

General

The Interconnection Customer (IC) has proposed a 50 MW wind power generating facility to be located near Millheim, Centre County, Pennsylvania. U1-038 will interconnect with the APS system at either the existing Millheim 46kV substation (Option 1) or at the future Tollhouse 46kV substation (Option 2). The project was evaluated for compliance with reliability criteria for summer peak conditions in 2012. The planned in service date is December 2010.

Option 1

Point of Interconnection

U1-038 Option 1 will interconnect with the Allegheny Power distribution system at the existing Millheim 46kV substation. Option 1 was studied as a 50 MW injection into the Millheim 46kV substation.

Direct Connection Requirements

Transmission Owner Scope of Direct Connection Work

The Transmission Owner's scope of work for the direct connection facility includes:

1) Millheim Substation - Construct a new 3 breaker ring bus adjacent to the existing Millheim 46kV substation. Major equipment in the substation will include: three (3) 46kV bay structures, three (3) 46kV circuit breakers, one (1) 46kV vertical break air switch, 46kV potential and metering current transformers, and 46kV support structures and leads required to connect the transformers to the ring bus. Revenue metering will be located on the feed to the generator. The substation will also include a control building, which will house all protective relaying, metering and SCADA RTU communications equipment required to accommodate the electrical facilities. Site preparation and property purchase is included in the estimate. The assumption is made that sufficient property is available for this expansion.

   The estimated cost to perform this work is $1,724,000 in 2010 dollars.

2) Center Hall Substation - Install a redundant channel transfer trip scheme at Centre Hall substation on the Millheim 46kV line terminal. This will require installing two 69kV line traps, two 69kV CVTs, and power line carrier controls material.

   The estimated cost to perform this work is $179,000 in 2010 dollars

3) Pleasant Gap Substation – Install a redundant channel transfer trip scheme at Pleasant Gap substation on the Millheim 46kV line terminal. This will require installing two 69kV line traps, two 69kV CVTs, and power line carrier controls material.

The estimated cost to perform this work is $179,000 in 2010 dollars

Interconnection Customer Scope of Direct Connection Work

The Interconnection Customer (IC) has assumed full responsibility for the design and construction of all facilities associated with the U1-038 generating station and the 46kV direct connection line on the IC side of the POI. The IC will interconnect U1-038 with the AP system by constructing a customer-owned 46kV circuit (approximately 5.5 miles in length) from the generating station site to AP's Millheim substation. Route selection, line design, right-of-way acquisition and construction of such lines will be entirely the responsibility of the IC. Cost estimates do not include construction of that line. It is assumed that the ICs step up transformer will conform to the AP standard of delta on the low side and grounded wye on the high side. It is further assumed that a fiber optic interface will be used for the protection channel between the AP and developer's 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 Allegheny Power Applicable Standards.

Network Impacts

Generator Deliverability

*(Single or N-1 contingencies for the **full energy** output of the interconnection)*

1. The Brush Junction – Madisonburg Junction 46kV line loads from 31% to 210% for the loss of the Millheim-Spring Mills 46kV line.

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 System Impact Study)*

None

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)

None

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 expanded Millheim 46kV substation site with the GSU and generators OPEN.

Positive: (0.14001+j0.57787)
Zero: (0.37032+j2.56872)

While Allegheny Power can't mandate that their personnel install protective relaying and communications equipment at the generator site, they have the 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 substation. The relaying package will likely include both primary and backup protection. Allegheny Power 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 Allegheny Power 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**.

Steady-State Voltage Requirements

Will be performed during the Queue U1-038 System Impact Study.

Stability and Reactive Power Requirements

Will be performed during the Queue U1-038 System Impact Study.

New System Reinforcements

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

1. To mitigate the Brush Junction – Madisonburg Junction 46kV line overload would require the reconductoring of 10.01 miles of line with 556 AAC. The estimated cost to perform this work is **$1,027,000 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)

None

Option 2

Point of Interconnection

U1-038 Option 2 will interconnect with the Allegheny Power (AP) transmission system at the future Tollhouse 46kV substation located on the Millheim-Pleasant Gap 46kV line approximately 1.6 miles from the Millheim 46kV substation. Option 2 was studied as a 50 MW injection into the Pleasant Gap-Center Hall 46kV substation.

Direct Connection Requirements

Transmission Owner Scope of Direct Connection Work

The Transmission Owner's scope of work for the direct connection facility includes:

1) Tollhouse Substation - Construct the new Tollhouse 46kV substation on land furnished by the Developer. The new Tollhouse substation shall be situated adjacent to the existing Madisonburg Junction-Millheim 46kV line at a point approximately 1.6 miles from Millheim substation. The new substation will be configured in a ring bus design and include the following major equipment: three (3) 46kV bay structures, three (3) 46kV circuit breakers, one (1) 46kV vertical break air switch, 46kV potential and metering current transformers and 46kV support structures and leads required to connect the transformers to the ring bus. Revenue metering will be located on the feed o the generator. The substation will also include a control building, which will house all protective relaying, metering and SCADA RTU communications equipment required to accommodate the electrical facilities. Site preparation including grading and an access road is included in the estimate.

   The estimated cost to perform this work is $1,626,000 in 2010 dollars.

2) Center Hall Substation - Centre Hall substation – Install a redundant channel transfer trip scheme at Centre Hall substation on the Millheim 46kV line terminal. This will require installing two 69kV line traps, two 69kV CVTs, and power line carrier controls material.

   The estimated cost to perform this work is $179,000 in 2010 dollars

3) Pleasant Gap Substation – Install a redundant channel transfer trip scheme at Pleasant Gap substation on the Millheim 46kV line terminal. This will require installing two 69kV line traps, two 69kV CVTs, and power line carrier controls material.

The estimated cost to perform this work is $179,000 in 2010 dollars

Interconnection Customer Scope of Direct Connection Work

The Interconnection Customer (IC) has assumed full responsibility for the design and construction of all facilities associated with the U1-038 generating station and the 46kV direct connection line on the IC side of the POI. The IC will interconnect U1-038 with the AP system by constructing a customer-owned 46kV circuit (approximately 4 miles in length) from the generating station site to AP's new Tollhouse substation. Route selection, line design, right-of-way acquisition and construction of such lines will be entirely the responsibility of the IC. Cost estimates do not include construction of that line. It is assumed that the ICs step up transformer will conform to the AP standard of delta on the low side and grounded wye on the high side. It is further assumed that a fiber optic interface will be used for the protection channel between the AP and developer's 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 Allegheny Power Applicable Standards.

Cost and Timing Summary

While the information in this transmittal is reasonable for the scope of work defined, it should be noted however, that the cost figures are conceptual in nature at this stage, and that an engineering team has not yet 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 developer will be charged for actual costs. Any under-runs or over-runs will be reconciled at the conclusion of the project.

The cost estimates in this report do not include tax gross-up or any network upgrades which may have been identified and required by this project.

The estimated time to provide for the interconnection of this project is **24 months** after the receipt of a signed Interconnection Service Agreement and Construction Service Agreement.

Network Impacts

Generator Deliverability

*(Single or N-1 contingencies for the **full energy** output of the interconnection request)*

1) The Brush Junction – Madisonburg Junction 46kV Line loads from 0% to 239% under Base Case conditions.

2) The voltage at the following buses drops from 0.94 to 0.89 for a loss of the Lewistown-Shingletown 230kV line: Shingletown (230kV), Milesburg (230kV), and Dale Summit (230kV).

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 System Impact Study)*

None

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)

None

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 Tollhouse substation site with the GSU and generators OPEN.

Positive: (0.48726+j0.68950)
Zero: (0)

While Allegheny Power can't mandate that their personnel install protective relaying and communications equipment at the generator site, they have the 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 substation. The relaying package will likely include both primary and backup protection. Allegheny Power 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 Allegheny Power 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**.

Steady-State Voltage Requirements

Will be performed during the Queue U1-038 System Impact Study.

Stability and Reactive Power Requirements

Will be performed during the Queue U1-038 System Impact Study.

New System Reinforcements

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

1. To mitigate the Brush Junction – Madisonburg Junction 46kV Line overload would require the reconductoring of 10.01 miles of line with 556 AAC. The estimated cost to perform this work is **$1,027,000 in 2010 dollars**.

2. To mitigate the voltage drop at the Lewistown-Shingletown 230kV line; Shingletown (230kV), Milesburg (230kV), and Dale Summit (230kV) buses would require the installation of a 15.6 MVAR rated (13.266 MVAR effective) switched capacitor bank at the Boalsburg 46kV substation. The estimated cost to perform this work is **$540,000 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)

None

Common Issues

Cost and Timing Summary

While the information in this transmittal is reasonable for the scope of work defined, it should be noted however, that the cost figures are conceptual in nature at this stage, and that an engineering team has not yet 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 developer will be charged for actual costs. Any under-runs or over-runs will be reconciled at the conclusion of the project.

The cost estimates in this report do not include tax gross-up or any network upgrades which may have been identified and required by this project.

The estimated time to provide for the interconnection of this project, regardless of the Option selected, is **24 months** after the receipt of a signed Interconnection Service Agreement and Construction Service Agreement.

Other Supporting Facility Charges

The Other Supporting Facilities Charges 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 U1-038 generator interconnection project has been estimated to be **$27,000/month in 2008 dollars**. The estimate is based on an average (or rolled-in) rate for West Penn's sub-transmission system, which may or may not reflect the charge determined under a direct assignment methodology for radial facilities.