PJM Generator Interconnection Request
Queue #U2-024
Wyoming-Jacksons Ferry 765kV
Feasibility Study

514536

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Preface

The intent of the feasibility study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation to the PJM network at a location specified by the Interconnection Customer. The Interconnection Customer may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: (1) Direct Connections, which are new facilities and/or facilities upgrades needed to connect the generator to the PJM network, and (2) Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

In some instances a generator interconnection may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection, may also contribute to the need for the same network reinforcement. The possibility of sharing the reinforcement costs with other projects may be identified in the feasibility study, but the actual allocation will be deferred until the impact study is performed.

The Feasibility Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The project developer is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by Transmission Owners,

U2-024 Wyoming-Jacksons Ferry 765kV Feasibility Study Report

General

The Interconnection Customer (IC) proposes to install PJM Project #U2-024, a 900 MW combined cycle generating facility consisting of three (3) General Electric 7FA combustion turbine generators and one steam turbine generator connected to the American Electric Power (AEP) system. Transmission interconnection option #1 is a connection to the Wyoming-Jacksons Ferry 765kV transmission line and transmission interconnection option #2 is connection to the Baileysville – Tazewell 138 kV (double circuit) & Wyoming – Jim Branch 138kV transmission lines. The proposed location of the generating facility and switching station is near Welch, West Virginia (See Exhibit 1 & 3). The projected in-service date for project U2-024, is December 2011.

Attachment Facilities

Interconnection Option #1 - Wyoming-Jackson's Ferry 765kV

Interconnection to the Wyoming-Jackson's Ferry 765kV transmission line will require a new in-line switching station located adjacent to the customer generation facilities, approximately 0.625 miles from AEP's Jackson's Ferry - Wyoming 765kV circuit in West Virginia. AEP's switching station will include three (3) 765kV circuit breakers configured in a ring-bus arrangement with 765kV metering (See Exhibit 2). AEP will retain ownership of the proposed in-line station facilities. IC will be responsible for all costs associated with this construction, as well as local and network upgrades associated with connecting the 900 MW of generation to the AEP system.

In addition, any right-of-way for line extensions, as well as the 1100' x 750' (minimum) station site will be provided to AEP by IC. Note that the customer owned station facilities are not included in the cost estimate; these are the responsibility of IC.

The AEP construction scope for the attachment facilities:

- Construction of a new switching station connecting to the Jackson's Ferry - Wyoming 765kV circuit, which includes 3-765kV circuit breakers, relays, 765kV metering, SCADA, and associated equipment.
  Estimated Cost (2008 Dollars)*: **$41,000,000***

- Jackson's Ferry - Wyoming 765kV line will need to be tapped to build in and out of the new AEP switching station. Approximately 1.5 miles of 765kV lines will need to be constructed and associated right-of-way will need to be obtained. AEPs estimates 3.5 to 4 years to complete construction.
  Estimated Cost (2008 Dollars)*: **$4,650,000***

*Estimates are intended to be preliminary in nature, as they were determined without the benefit of detailed engineering studies. Final estimates will require an on-site review and coordination to determine final construction requirements. It will take approximately 3.5 to 4 years after obtaining authorization to construct the facilities as outlined above.

Interconnection Option #2 - Baileysville-Tazewell & Wyoming-Jim Branch 138kV

Attachment Facilities will consist of a new in-line switching station located adjacent to the customer generation facilities, approximately .625 miles from AEP's Baileysville - Tazewell 138kV double circuit and 3.5 miles from the Wyoming – Jim Branch 138kV circuit in West Virginia. AEP's switching station will include six (6) 138kV circuit breakers configured in a ring-bus arrangement with 138kV metering (See Exhibit 4). AEP will retain ownership of the proposed in-line station facilities. IC will be responsible for all costs associated with this construction, as well as local and network upgrades associated with connecting the 900 MW of generation to the AEP system.

In addition, any right-of-way for line extensions, as well as the 350' x 350' (minimum) station site will be provided to AEP by IC. Note that the customer-owned station facilities are not included in the cost estimate; these are the responsibility of IC.

The AEP construction scope for the attachment facilities:

- Construction of a new switching station connecting to the Baileysville – Tazewell 138 kV (double circuit) & Wyoming – Jim Branch 138kV lines, which will include 5-138kV circuit breakers, relays, 138kV metering, SCADA, and associated equipment.
  Estimated Cost (2008 Dollars)*: **$5,650,000***

- Baileysville – Tazewell (six-wired single circuit) & Wyoming – Jim Branch 138kV lines will each need to be tapped to build in and out of the new AEP switching station. Approximately 4 miles of double circuit 138kV would need to be constructed on new right of way from the Wyoming – Jim Branch 138 kV circuit. Two approximately .75 mile single circuits would need to be built from the Baileysville – Tazewell 138 kV circuit. One of these two circuits would ultimately be built as a double circuit tower line, though the cost of only a single circuit tower line is reflected here. The difference in cost between a single circuit tower line and double circuit tower line is reflected in the Local/Network Upgrades section. AEP estimates 2.5 years to complete line construction.
  Estimated Cost (2008 Dollars)*: **$14,750,000***

*Estimates are intended to be preliminary in nature, as they were determined without the benefit of detailed engineering studies. Final estimates will require an on-site review and coordination to determine final construction requirements. It will take approximately 2.5 years after obtaining authorization to construct the facilities as outlined above.

Interconnection Option #1 - Wyoming-Jackson's Ferry 765kV

Local AEP Impacts

The impact of the proposed generating facility on the AEP System was assessed for adherence with applicable reliability criteria. AEP planning criteria require that the transmission system meet double contingency performance criteria in accordance with the AEP FERC Form 715. Therefore, this criterion was used to assess the impact of the proposed facility on the AEP System. The IC project was studied as a 900 MW injection of generation into the AEP Transmission System. The results are summarized

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Normal System (2012 Summer Conditions)

- No problems identified

Single Contingency (2012 Summer Conditions)

- No problems identified

Multiple Contingency (2012 Summer Conditions)

- No problems identified

Short Circuit Analysis

- No problems identified

Stability Analysis

- Stability studies were not performed as part of this Feasibility Study and are not normally performed as part of a Facility Study effort. The stability assessments are part of the System Impact Study. Based upon the results of this future System Impact Study, the extent of system upgrades could change and the associated costs could be significantly different.

Local Upgrades

- None

Network Impacts

The queue project U2-024 was studied as a 900MW (825MW capacity) injection into the AEP system at the Wyoming-Jackson Ferry 765kV line. U2-024 was evaluated for compliance with reliability criteria for summer peak conditions in 2012. Potential network impacts were as follows:

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

None

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)

None

Short Circuit

No problems 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)

None

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.

Interconnection Option #2 - Baileysville-Tazewell & Wyoming-Jim Branch 138kV

Local AEP Impacts

The impact of the proposed generating facility on the AEP System was assessed for adherence with applicable reliability criteria. AEP planning criteria requires that the transmission system meet contingency performance criteria in accordance with the AEP FERC Form 715. Therefore, this criterion was used to assess the impact of the proposed facility on the AEP System. The IC project was studied as a 900 MW of generation into the AEP Transmission System. The results are summarized below.

Normal System (2012 Summer Conditions)

1. 2 miles of 138kV circuit from U2-024 to the M&B Coal Tap is overloaded to 146% of its emergency rating.

2. 8 miles of 138kV circuit from the M&B Coal Tap to Baileysville Station is overloaded to 148% of its emergency rating.

3. 138kV bus tie breaker at Baileysville station (between Bus #1 & Bus #2) is overloaded to 148% of its emergency rating.

Single Contingency (2012 Summer Conditions)

4. 2 miles of 138kV circuit from U2-024 to the M&B Coal Tap is overloaded to 184% of its emergency rating (under single contingency).

5. 8 miles of 138kV circuit from the M&B Coal Tap to Baileysville Station is overloaded to 184% of its emergency rating (under single contingency).

6. 138kV bus tie breaker at Baileysville station (between Bus #1 & Bus #2) is overloaded to 180% of its emergency rating (under single contingency).

7. 23 miles of 138kV circuit from U2-024 to Wyoming Station is overloaded to 108% of its emergency rating (under single contingency).

8. 1.41 miles of 46kV circuit from Slab Fork Station to Tams Mountain Station is overloaded to 119% of its emergency rating (under single contingency).

9. 2.81 miles of 46kV circuit from Glen White Station to Tams Mountain Station is overloaded to 104% of its emergency rating (under single contingency).

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Multiple Contingency (2012 Summer Conditions)

10. 138kV bus tie breaker at Baileysville station (between Bus #1 & Bus #2) is overloaded to 298% of its emergency rating (for the tower line outage of U2-024 to the Wyoming-Jim Branch 138 kV circuit)

Short Circuit Analysis

(Circuit Breakers with interrupting duty greater than 100% for 1LG faults)

- 05BAILS1 138.kV P 62.0% 103.0%
- 05WYOMIN 138.kV G 94.2% 103.1%
- 05WYOMIN 138.kV G1 94.2% 103.1%
- 05WYOMIN 138.kV G2 94.2% 103.1%
- 05WYOMIN 138.kV H 94.2% 103.1%
- 05WYOMIN 138.kV H1 94.2% 103.1%
- 05WYOMIN 138.kV H2 94.2% 103.1%
- 05WYOMIN 138.kV J 94.2% 103.1%
- 05WYOMIN 138.kV J1 94.2% 103.1%
- 05WYOMIN 138.kV J2 94.2% 103.1%

(Circuit Breakers with interrupting duty greater than 100% for 3LG faults)

- 05WYOMIN 138.kV G 96.6% 108.6%
- 05WYOMIN 138.kV G1 96.6% 108.6%
- 05WYOMIN 138.kV G2 96.6% 108.6%
- 05WYOMIN 138.kV H 96.6% 108.6%
- 05WYOMIN 138.kV H1 96.6% 108.6%
- 05WYOMIN 138.kV H2 96.6% 108.6%
- 05WYOMIN 138.kV J 96.6% 108.6%
- 05WYOMIN 138.kV J1 96.6% 108.6%
- 05WYOMIN 138.kV J2 96.6% 108.6%
- 05WYOMIN 138.kV R1 87.1% 100.8%

Local/Network Upgrades

- Rebuild 9 miles of 138kV six-wired single circuit from U2-024 to Baileysville Station to accommodate a double circuit configuration with larger 1590 ACSS conductor. New towers will be needed to accommodate the 1590 ACSS conductor. Add additional breakers at Baileysville and U2-024 to accommodate second circuit. Estimated cost is **$9,900,000*.** (This alleviates overloads 1,2,4,5, & 7)

- Difference of building one of the two single circuit lines from U2-024 to the Baileysville-Tazewell 138 kV circuit. Estimated cost is **$600,000.** (This alleviates overloads 1,2,4,5, & 7)

- Bus tie breaker at Baileysville Station will need to be replaced to eliminate overloads during normal and contingency conditions. Estimated cost is **$550,000***. (Includes: circuit breaker, conductor, switches, and some bus modifications) (This alleviates overloads 3,6 &10)

- 1.41 miles of 46kV line from Slab Fork to Tams Mountain needs to be replaced (or rebuilt) to eliminate overloads under contingency conditions. Estimated cost is **$1,050,000***. (Note: a more detailed tower study will have to be done to determine exact cost) (This alleviates overload 8)

- 2.81 miles of 46kV line from Glen White to Tams Mountain needs to be replaced (or rebuilt) to eliminate overloads under contingency conditions. Estimated cost is **$2,100,000*.** (Note: a more detailed tower study will have to be done to determine exact cost) (This alleviates overload 9)

- Replace 10- 138kV circuit breakers due to interrupting capability being exceeded by the addition of U2-024. Replacement of 10 138kV circuit breakers at Wyoming Station is estimated to cost **$7,000,000***. (Note: Baileysville CB "P" needs to be replaced due to an overload under single contingency conditions and is not included in this cost)

*Estimates are intended to be preliminary in nature, as they were determined without the benefit of detailed engineering studies. Final estimates will require an on-site review and coordination to determine final construction requirements.

Network Impacts

The queue project U2-024 was studied as a 900MW (825MW capacity) injection into the AEP system at the Baileysville-Tazewell and 138kV and Wyoming-Jim Branch 138kV lines. U2-024 was evaluated for compliance with reliability criteria for summer peak conditions in 2012. Potential network impacts were as follows:

Generator Deliverability

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

None

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)

None

Short Circuit

No problems 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)

1. **(AEP)** The North Bristol- Wolf Hills 138kV line loads from 112.64% to 121.53% (DC power flow) of its normal rating (153MVA) for non-contingency condition. This project contributes approximately 13.6MW to the thermal violation. It must be noted that the same thermal violation (DC power flow: 112.6%) already exists in the 2012 base case.

New System Reinforcements

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

See list under Local/Network Upgrades.

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)

1. North Bristol to Wolf Hills 138 kV Line:

On the existing right-of-way construct a double circuit 138 kV steel lattice tower line– a distance of about 5.4 miles to alleviate the overload on the existing single circuit.

Estimated Cost [1,] **$ 7,290,000**

[1] The estimates are preliminary in nature, as they were determined without detailed engineering and design studies..

Exhibit 1: Approximate interconnection location of the proposed facilities

765kV Station Configuration

Exhibit 2: Simplified diagram of proposed 765kV switching station.

Exhibit 3: Approximate interconnection location of the proposed facilities

138kV Station Configuration

Exhibit 4: Simplified diagram of proposed 138kV switching station.