PJM Generator Interconnection Request
Queue #U2-062
Randolph (Darke County) 138kV
Feasibility Study

509090

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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,

U2-062 Randolph (Darke County) 138kV Feasibility Study Report

General

The Interconnection Customer (IC) proposes to install PJM Project #U2-062, a 187.5 MW generating facility comprised of 125 - 1.5 MW General Electric wind turbine generators with Option #1 connecting to the American Electric Power (AEP) Randolph-Bluff Point 138kV transmission line and Option #2 connecting to the Dayton Power & Light (DP&L) Rossburg 69kV substation. The proposed project will be located in Darke County, Ohio. The projected in-service date is scheduled for December 2010.

Attachment Facilities

Option #1

The U2-062 project proposes to connect via a new in-line switching station located between AEP's Bluff Point and Randolph stations. The new station would consist of three (3) 138 kV circuit breakers configured in a ring-bus arrangement with 138 kV metering (see Exhibit 2). AEP will retain ownership of the proposed in-line station facilities. In addition, relaying at remote stations will need to be upgraded. It is understood that IC will be responsible for all costs associated with this construction, as well as facilities associated with connecting the 187.5 MW of generation to the in-line facilities.

It is expected that a 200' x 200' (minimum) station site will be provided to AEP by IC. Note that the IC station facilities and any facilities outside the new station were not included in the cost estimate. These are assumed to be IC's responsibility.

The AEP construction scope includes:

- Constructing a new switching station connecting to the College Corner - Jay 138 kV line, including three (3) 138 kV circuit breakers, relays, 138 kV metering, SCADA, and associated equipment.

  Estimated Cost (2008 Dollars): **$4,000,000**

- Replacing relaying with AEP standard package at College Corner and Jay stations.

  Estimated Cost (2008 Dollars): **$1,000,000**

Total Attachment Facilities Cost[1]: **$5,000,000**

[1] The estimates are 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 one year after obtaining the authorization to construct the facilities as outlined above.

Option #2
The U2-062 project proposes to connect to a new position at the Dayton Power & Light Company (DP&L) Rossburg 69kV substation. DP&L will install a 69kV circuit breaker, disconnect switches and 69kV interconnection metering. DP&L has assumed that OPGW fiber static wire will be used on the transmission line from Rossburg to the U2-062 wind farm for line protection and bi-directional transfer trip.

The estimated cost for the termination is **$900,000.**

Local AEP Impacts

Option #1
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 performance criteria in accordance with the AEP FERC Form 715. Therefore, this set of criteria was used to assess the impact of the proposed facility on the AEP System. This project was studied as a 187.5 MW net energy injection consistent with the interconnection application. This project was studied with PJM project #R03 and S71 already in service at 100% output in the vicinity of U2-062. The results are summarized below.

Normal System (2012 Summer Conditions)

1. AEP Bluff Point – Portland[2] 69 kV line is overloaded to 101% (53.5 MVA) of its normal rating under system normal conditions. Without the addition of U2-062 Project, the same facilities are loaded to 78% (41.3 MVA) of normal rating. This circuit is not overload for only the Capacity portion of the unit output.

Single Contingency (2012 Summer Conditions)

- No problems identified

Multiple Contingency (2012 Summer Conditions)

2. AEP Jay – Bluff Point[3] 138 kV line gets overloaded to 113% (227 MVA) of its emergency rating for an outage of AEP Randolph – College Corner 138 kV line (a section of AEP Jay – College Corner 138 kV line) and AEP Randolph 138/69 kV transformer. Without the addition of U2-062 Project, the same facilities are loaded to 34% (68.3 MVA) of emergency rating under the same contingency.

Short Circuit Analysis

[2] Please note that because this facility is overloaded under normal conditions, the same overload issues may appear for several contingencies in the following sections but may not be discussed hereafter.
[3] The affected facility may appear in additional contingencies that are not mentioned.

- 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

1. The overload on the Bluff Point-Portland 69kV circuit can be alleviated by rebuild and reconductor the 7.4 mile long line. The estimated cost (2008 Dollars) is **$7,400,000.**

2. The overload on the Jay-Bluff Point 138kV circuit can be alleviated by replacing the circuit breaker and wave trap at Jay Station. The estimated cost (2008 Dollars) is **$700,000.**

Option #2
There are no Local AEP Impacts connecting to Dayton Power & Lights Rossburg 69kV substation.

Reactive Requirements

PJM requires a power factor correction to 95% lead/lag at the point of interconnection for wind generating facilities. It is expected that Great Lakes will adhere to this standard.

Network Impacts

Option #1
The Queue Project U2-062 was studied as a(n) 187.5 MW (Capacity = 24.4MW) injection at the Randolph 138kV substation. Project U2-062 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, Line with Failed Breaker and Bus Fault contingencies for the full energy output)

1. **(AEP/AEP)** The Pennville-Adams 138kV line (from bus 23498 to bus 23406 ckt 1) loads from 94.67% to 105.66% (DC power flow) of its emergency rating (205MVA) for the tower line outage (AEP_TOWER36). This project contributes approximately 22.5MW to cause this thermal violation.

2. **(AEP/AEP)** The S71C-Jay 138kV line (from bus 90787 to bus 23469 ckt 1) loads from 67.16% to 113.45% (DC power flow) of its emergency rating (201MVA) for the tower line outage (AEP_TOWER37). This project contributes approximately 93.0MW to cause this thermal violation.

Short Circuit
(Summary form of Cost allocation for breakers will be inserted here if any)

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)

1. The overload on the Pennsville-Adams 138kV circuit can be alleviated by replacing the wavetrap and associated equipment at Adams Station. The estimate cost (2008 Dollars) is **$200,000.**

2. The overload on the Jay-Bluff Point 138kV circuit can be alleviated by replacing the circuit breaker and wave trap at Jay Station. The estimated cost (2008 Dollars) is **$700,000.**

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)
(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)

None

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. **These are not required reliability upgrades.**

Note: Only the most severely overloaded conditions are listed below. 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 the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which shall study all overload conditions associated with the overloaded element(s) identified.

As a result of the aggregate energy resources in the area, the following potential congestion was identified

3. **(AEP/AEP)** The Randolph-Bluff Point 138kV line (from bus 23500 to bus 23415 ckt 1) loads from 41.1% to 104.9% (DC power flow) of its normal rating (156MVA) for non-contingency condition. This project contributes approximately 99.5MW to the thermal congestion.

- The overload on the Randolph-Bluff Point 138kV circuit can be alleviated by replacing the 600 amp. switch at Randolph Station. The estimated cost (2008 Dollars) is **$100,000**.

MISO Impacts

Any impacts on the MISO transmission system will be identified in the Impact Study.

Option #2

The Queue Project U2-062 was studied as a(n) 187.5MW (Capacity = 24.4MW) injection at the Rossberg 69kV substation. Project U2-062 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, Line with Failed Breaker and Bus Fault contingencies for the full energy output)

None

Short Circuit
(Summary form of Cost allocation for breakers will be inserted here if any)

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. **(DPL/DPL)** The Covington-Piqua 3 69kV line (from bus 26587 to bus 26709 ckt 1) loads from 116.86% to 130.66% (DC power flow) of its emergency rating (72MVA) for the tower line outage (OUTAGE_38). This project contributes approximately 9.9MW to the thermal violation.

2. **(AEP/AEP)** The Eastown Road-Rock Hill 138kV line (from bus 23137 to bus 23202 ckt 1) loads from 115.69% to 121.21% (DC power flow) of its emergency rating (184MVA) for the tower line outage (AEP_TOWER44_T142B). This project contributes approximately 10.2MW 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)

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)
(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)

1. The overload on the Covington-Piqua 3 69kV line can be alleviated by reconductoring the 7.21 mile line with 795 ACSR conductor and by upgrading the circuit breaker and disconnect switch at Covington and the line drops at both ends to achieve an emergency rating of 110MVA.

2. The overload on the Eastown Rd-Rock Hill 138kV circuit can be alleviated by replacing the 138 kV risers at Rockhill station terminal. The estimated Cost (2008 dollars): **$75,000.**

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. **These are not required reliability upgrades.**

Note: Only the most severely overloaded conditions are listed below. 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 the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which shall study all overload conditions associated with the overloaded element(s) identified.

As a result of the aggregate energy resources in the area, the following potential congestion was identified

3. **(DPL/DPL)** The Hurst Orchard-West Manchester 69kV line (from bus 26453 to bus 26658 ckt 1) loads from 94.1% to 106.2% (DC power flow) of its emergency rating (98MVA) for the single line contingency outage (OUTAGE_69KV_02). This project contributes approximately 11.9MW to the thermal congestion.

4. **(DPL/DPL)** The Rossburg-Rose Hill 69kV line (from bus 26638 to bus 26713 ckt 1) loads from 67.1% to 124.6% (DC power flow) of its normal rating (80MVA) for non-contingency condition. This project contributes approximately 46.0MW to the thermal congestion.

5. **(DPL/DPL)** The Greenville-Hurst Orchard 69kV line (from bus 26599 to bus 26453 ckt 1) loads from 90.2% to 101.0% (DC power flow) of its emergency rating (110MVA) for the single line contingency outage (OUTAGE_69KV_02). This project contributes approximately 11.9MW to the thermal congestion.

6. **(DPL/DPL)** The Rossburg-Rose Hill 69kV line (from bus 26638 to bus 26713 ckt 1) loads from 61.6% to 134.5% (DC power flow) of its emergency rating (98MVA) for the single line contingency outage (OUTAGE_69KV_32). This project contributes approximately 71.5MW to the thermal congestion.

7. **(DPL/DPL)** The Rose Hill-FT. Recovery 69kV line (from bus 26713 to bus 26361 ckt 1) loads from 54.6% to 127.6% (DC power flow) of its emergency rating (98MVA) for the single line contingency outage (OUTAGE_69KV_32). This project contributes approximately 71.5MW to the thermal congestion.

8. **(DPL/DPL)** The T48C-Coldwater 69kV line (from bus 92162 to bus 26586 ckt 1) loads from 64.5% to 121.9% (DC power flow) of its normal rating (80MVA) for non-contingency condition. This project contributes approximately 46.0MW to the thermal congestion.

9. **(DPL/DPL)** The T48C-Coldwater 69kV line (from bus 92162 to bus 26586 ckt 1) loads from 62.5% to 135.4% (DC power flow) of its emergency rating (98MVA) for the single line contingency outage (OUTAGE_69KV_32). This project contributes approximately 71.5MW to the thermal congestion.

10. **(DPL/DPL)** The Rossburg-Versaille 69kV line (from bus 26638 to bus 26741 ckt 1) loads from 43.4% to 133.4% (DC power flow) of its emergency rating (98MVA) for the single line contingency outage (OUTAGE_69KV_99_WITH_T48_A). This project contributes approximately 88.2MW to the thermal congestion.

11. **(DPL/DPL)** The FT Recovery-T48C 69kV line (from bus 26361 to bus 92162 ckt 1) loads from 27.8% to 100.7% (DC power flow) of its emergency rating (98MVA) for the single line contingency outage (OUTAGE_69KV_32). This project contributes approximately 71.5MW to the thermal congestion.

12. **(DPL/DPL)** The Versaille-Russia 69kV line (from bus 26741 to bus 26714 ckt 1) loads from 28.5% to 118.5% (DC power flow) of its emergency rating (98MVA) for the single line contingency outage (OUTAGE_69KV_99_WITH_T48_A). This project contributes approximately 88.2MW to the thermal congestion.

MISO Impacts

Any impacts on the MISO transmission system will be identified in the Impact Study.

Exhibit 1: Approximate interconnection location of the proposed facilities