PJM Generator Interconnection Request
Queue AB2-065
Madison-Tanners Creek 345 kV
Feasibility Study Report

August 2016

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, the costs may be included in the study.

General

The Interconnection Customer (IC) proposes to connect Project #AB2-065, a 124.2 MW (16.0 Capacity) wind generating facility to the American Electric Power (AEP) Transmission system at the in-line switching station (Rushmay 138 kV) proposed to be built as an attachment facility for PJM queue positions W4-004 (see Figure 1). The new switching station is located between Madison and Tanners Creek 138 kV substations (see Figure 2). The location of the proposed wind generating facility is in Rush County, IN.

The requested Backfeed date is September 1, 2019.
The requested in service date is December 31, 2019.

Attachment Facilities

Point of Interconnection (Expand the new proposed Rushmay 138 kV Switching Station)

To accommodate the interconnection at the Rushmay 138 kV switching station, the substation will have to be expanded requiring the installation of a new 138 kV breaker, starting a new string, associated protection and control equipment, SCADA, and 138 kV revenue metering

Direct Connection to the new Rushmay 138 kV Switching Station Work and Cost:

- Expand the substation, install one new 138 kV circuit breaker, and start a new string (see Figure 1). Installation of associated protection and control equipment, SCADA, and 138 kV revenue metering will also be required.
- **Estimated Station Cost: $2,000,000**

Protection and Relay Work and Cost:

- Install line protection and controls at the new Rushmay 138 kV switching station.
- **Estimated Cost: $200,000**

It is understood that Flat Rock Wind is responsible for all these connection costs associated with interconnecting the PJM project #AB2-065 to AEP transmission system. The costs above are reimbursable to AEP. The cost of Flat Rock Wind's generating plant and the costs for the line connecting the generating plant to the Rushmay 138 kV switching station are not included in this report; these are assumed to be Flat Rock Wind's responsibility.

The Generation Interconnection Agreement does not in or by itself establish a requirement for American Electric Power to provide power for consumption at the developer's facilities. A separate agreement may be reached with the local utility that

provides service in the area to ensure that infrastructure is in place to meet this demand and proper metering equipment is installed. It is the responsibility of the developer to contact the local service provider utility to determine if a local service agreement is required.

Local and Network Impacts

The impact of the proposed wind generating facility on the AEP System was assessed for adherence with applicable reliability criteria. AEP planning criteria require that the transmission system meet performance parameters prescribed in the AEP FERC Form 715[1] and Connection Requirements for AEP Transmission System[2]. Therefore, these criteria were used to assess the impact of the proposed facility on the AEP System. The Queue Project AB2-065 was evaluated as a 124.2 MW (Capacity 16.0 MW) injection at the new Rushmay 138 kV switching substation (tapping the Madison-Tanners Creek 138 kV line) in the AEP area. Project AB2-065 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AB2-065 was studied with a commercial probability of 53%.

Potential network impacts were as follows:

Summer Peak Analysis - 2020

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

None

Multiple Facility Contingency
(Double Circuit Tower Line, Fault with a Stuck Breaker, and Bus Fault contingencies for the full energy output)

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)

1 https://www.aep.com/about/codeofconduct/OASIS/TransmissionStudies/GuideLines/AEP_East_FERC_715_2016_Final_Part_4.pdf

2 https://www.aep.com/about/codeofconduct/OASIS/TransmissionStudies/Requirements/AEP_Interconnection_Requirements_rev1.pdf

None

Short Circuit
(Summary of impacted circuit breakers)

None

Stability Analysis

To be determined in the System Impact Study

Voltage Variations

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.
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 will study all overload conditions associated with the overloaded element(s) identified.

1. (AEP - DEO&K) The 05TANNER-08M.FORT 345 kV line (from bus 243233 to bus 249567 ckt 1) loads from 109.35% to 110.13% (**DC power flow**) of its normal rating (1409 MVA) for the single line contingency outage of 'P1-#..B2 TERMINAL-EAST BEND 4516'. This project contributes approximately 24.39 MW to the thermal violation.

CONTINGENCY 'P1-#..B2 TERMINAL-EAST BEND 4516'
OPEN BRANCH FROM BUS 249575 TO BUS 249565 CKT 1
END

2. (AEP - AEP) The W4-004 C-05MADISO 138 kV line (from bus 247588 to bus 243333 ckt 1) loads from 161.21% to 217.66% (**DC power flow**) of its emergency rating (220 MVA) for the single line contingency outage of '8181_B2_TOR13901756'. This project contributes approximately 124.19 MW to the thermal violation.

CONTINGENCY '8181_B2_TOR13901756'
OPEN BRANCH FROM BUS 243382 TO BUS 247588 CKT 1 / 243382 05TANNER 138 247588 W4-004 C 138 1
END

3. (AEP - AEP) The W4-004 C-05MADISO 138 kV line (from bus 247588 to bus 243333 ckt 1) loads from 136.03% to 179.16% (**DC power flow**) of its normal rating (191 MVA) for non-contingency condition. This project contributes approximately 82.39 MW to the thermal violation.

4. (AEP - AEP) The W4-004 C-05TANNER 138 kV line (from bus 247588 to bus 243382 ckt 1) loads from 161.21% to 217.66% (**DC power flow**) of its emergency rating (220 MVA) for the single line contingency outage of '8182_B2_TOR14001756'. This project contributes approximately 124.19 MW to the thermal violation.

CONTINGENCY '8182_B2_TOR14001756'
OPEN BRANCH FROM BUS 243333 TO BUS 247588 CKT 1 / 243333 05MADISO 138 247588 W4-004 C 138 1
END

5. (OVEC - AEP) The 06KYGER-05SPORN 345 kV line (from bus 248005 to bus 242528 ckt 2) loads from 103.71% to 104.17% (**DC power flow**) of its normal rating (971 MVA) for the single line contingency outage of '349_B2_TOR21'. This project contributes approximately 9.78 MW to the thermal violation.

CONTINGENCY '349_B2_TOR21'
OPEN BRANCH FROM BUS 242528 TO BUS 248005 CKT 1 / 242528 05SPORN 345 248005 06KYGER 345 1
END

6. (AEP - AEP) The AB2-028 TAP-05DESOTO 345 kV line (from bus 923880 to bus 243218 ckt 1) loads from 105.28% to 106.56% (**DC power flow**) of its normal rating (1016 MVA) for the single line contingency outage of '363_B2_TOR1682'. This project contributes approximately 13.02 MW to the thermal violation.

CONTINGENCY '363_B2_TOR1682'
OPEN BRANCH FROM BUS 243208 TO BUS 243209 CKT 1 / 243208 05JEFRSO 765 243209 05ROCKPT 765 1
END

Additional Limitations of Concern

Numerous conditions were identified at full output that don't require mitigation per the PJM tariff, but may subject the AB2-065 project to curtailment in actual operation.

Local/Network Upgrades

None

Schedule

It is anticipated that the time between receipt of executed agreements and Commercial Operation may range from 12 to 18 months if no line work is required. If line work is required, construction time would be between 24 to 36 months after signing an interconnection agreement.

Conclusion

Based upon the results of this Feasibility Study, the construction of the 124.2 MW (16.0 MW Capacity) wind generating facility of IC (PJM Project #AB2-065) will require the following additional interconnection charges. This plan of service will interconnect the proposed wind generating facility in a manner that will provide operational reliability and flexibility to both the AEP system and the IC generating facility.

Estimated Cost to connect to the proposed Rushmay 138 kV Switching Station: $2,000,000
Estimated Protection and Relaying Cost: $200,000

Total Estimated Cost for Project AB2-065: $2,200,000

These 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.

Additional Interconnection Customer Responsibilities:

1. An Interconnection Customer entering the New Services Queue on or after October 1, 2012 with a proposed new Customer Facility that has a Maximum Facility Output equal to or greater than 100 MW shall install and maintain, at its expense, phasor measurement units (PMUs). See Section 8.5.3 of Appendix 2 to the Interconnection Service Agreement as well as section 4.3 of PJM Manual 14D for additional information.

2. The Interconnection Customer may be required to install and/or pay for metering as necessary to properly track real time output of the facility as well as installing metering which shall be used for billing purposes. See Section 8 of Appendix 2 to the Interconnection Service Agreement as well as Section 4 of PJM Manual 14D for additional information.

3. The Interconnection Customer seeking to interconnect a wind generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per item 5.iv. of Schedule H to the Interconnection Service Agreement.