Generation Interconnection System Impact Study Report

For

PJM Generation Interconnection Request Queue Position AB2-028

Desoto-Fall Creek 345 kV

February 2018

Preface

The intent of the System Impact Study is to determine a plan, with approximate cost and construction time estimates, to connect the subject generation interconnection project to the PJM network at a location specified by the Interconnection Customer. 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. All facilities required for interconnection of a generation interconnection project must be designed to meet the technical specifications (on PJM web site) for the appropriate transmission owner.

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 or merchant transmission upgrade, 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 System Impact Study is performed.

The System Impact 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

Big Blue River Wind Farm proposes to install a 200.0 MW (26.0 MW Capacity) wind generating facility near Middletown, Henry County, IN (see Figure 2). The generating facility will consist of one hundred (100) 2.0 MW Vesta wind turbine generators connected to a newly proposed three (3) breaker 345 kV switching station connecting to AEP's Desoto – Fall Creek 345 kV circuit via a three mile generator lead (See Figure 1).

Proposed Backfeed Date: April 30, 2018.

Proposed COD Date: October 31, 2018.

The objective of this System Impact Study is to determine budgetary cost estimates and approximate construction timelines for identified transmission facilities required to connect the proposed generating facilities to the AEP Transmission System. These reinforcements include the Attachment Facilities, Local Upgrades, and Network Upgrades required to maintain the reliability of the AEP Transmission System. Stability analysis is included as part of this study.

Attachment Facilities

Point of Interconnection (Desoto – Fall Creek 345 kV)

To accommodate the interconnection on the Desoto – Fall Creek 345 kV circuit a new three (3) circuit breaker 345 kV switching station physically configured in a breaker and half bus arrangement but operated as a ring-bus will be constructed approximately seven miles east of the Fall Creek 345 kV substation (see Figure 1). Installation of associated protection and control equipment, 345 kV line risers, SCADA, and 345 kV revenue metering will also be required. AEP reserves the right to specify the final acceptable configuration considering design practices, future expansion, and compliance requirements.

New Switching Station Work and Cost:

- Construct a new three (3) circuit breaker 345 kV switching station physically configured in a breaker and half bus arrangement but operated as a ring-bus. Installation of associated protection and control equipment, 345 kV line risers, SCADA, and 345 kV revenue metering will also be required.
- **Estimated 345 kV Station Cost: $5,000,000**
- **Estimated 345 kV Revenue Metering Cost: $250,000**

Protection and Relay Work and Cost:

- Install line protection and controls at the new 345 kV switching station.
- **Estimated Cost: $300,000**

- Upgrade line protection and controls at the Desoto 345 kV substation to coordinate with the new 345 kV switching station.

- **Estimated Cost: $300,000**

- Upgrade line protection and controls at the Fall Creek 345 kV substation to coordinate with the new 345 kV switching station.

- **Estimated Cost: $300,000**

Big Blue River Wind Farm is expected to obtain, at its cost, an 800' x 300' station site for the AEP facilities and all necessary permits. Ownership of the new 345 kV switching station and associated equipment shall be transferred from Big Blue River Wind Farm to AEP upon successful completion of the required work.

A 345 kV line extension is required to loop through the proposed 345 kV switching station. The proposed 345 kV switching station is assumed to be located immediately adjacent to the existing transmission lines. A supplemental line easement for the tap poles will be required. It is expected that Big Blue River Wind Farm will obtain the supplemental easement when the station property is purchased.

It is understood that Big Blue River Wind Farm is responsible for all costs associated with this interconnection. The cost of Big Blue River Wind Farm's generating plant and the costs for the line connecting the generating plant to Blue River Wind Farm's switching station are not included in this report; these are assumed to be Big Blue River Wind Farm'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 to determine if a local service agreement is required.

Local and Network 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 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 AB2-028 was evaluated as a 200.0 MW (Capacity 26.0 MW) injection into a tap of the Fall Creek - Desoto 345 kV line in the AEP area. Project AB2-028 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AB2-028 was studied with a commercial probability of 100%. Potential network impacts were as follows:

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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

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)

None

Short Circuit

(Summary of impacted circuit breakers)

None

Stability Analysis

No Mitigations required

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.

AB2-028														
		Contingency	Affected	Facility	Bus				Loading		Rating		MW
#	Type	Name	Area	Description	From	To	Cir.	PF	Initial	Final	Type	MVA	Contribution
1	N-1	P1-#..B2 TERMINAL-EAST BEND 4516	AEP - DEO&K	05TANNER-08M.FORT 345 kV line	243233	249567	1	AC	99.8	102	NR	1409	28.78
2	N-1	349_B2_TOR21	OVEC - AEP	06KYGER-05SPORN 345 kV line	248005	242528	2	AC	101	102	NR	971	13.66
3	N-1	363_B2_TOR1682	AEP - AEP	AB2-028 TAP-05DESOTO 345 kV line	923880	243218	1	AC	97	107	NR	1016	98.52

Additional Limitations of Concern

Numerous conditions were identified at full output that don't require mitigation per the PJM tariff, but may subject the AB2-028 project to curtailment in actual operation.

Light Load Analysis

No light load thermal impacts

System Reinforcements

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.

Note: The time between the Backfeed Date and Commercial Operation Date requested is longer than AEP has normally experienced for similar queue requests. Also, the time provided between anticipated normal completion of System Impact, Facilities Studies, subsequent execution of ISA and ICSA documents, and the proposed Backfeed Date is shorter than usual and may be difficult to achieve.

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.

Conclusion

Based upon the results of this System Impact Study, the construction of the 200.0 MW (26.0 MW Capacity) wind generating facility of Big Blue River Wind Farm (PJM Project #AB2-028) 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 Big Blue River Wind Farm generating facility.

Cost Breakdown for Point of Interconnection (Desoto – Fall Creek 345 kV)			
	Network Upgrade Number	**Description**	**Estimated Cost**
Attachment Facility	**n5417**	New 345 kV Switching Station	**$5,000,000**
Non-Direct Connection Network Upgrade	**n5528**	Desoto-Fall Creek 345 kV T-Line Cut In	**$2,200,000**
	n5529	345 kV Revenue Metering	**$250,000**
	n5530	Install line protection and controls at the new 345 kV switching station.	**$300,000**
	n5419	Upgrade line protection and controls at the Desoto 345 kV substation to coordinate with the new 345 kV switching station.	**$300,000**
	n5418	Upgrade line protection and controls at the Fall Creek 345 kV substation to coordinate with the new 345 kV switching station.	**$300,000**
		Total Estimated Cost for Project AB2-028	**$8,350,000**

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.

Figure 1: Point of Interconnection (Desoto – Fall Creek 345 kV)

Single-Line Diagram

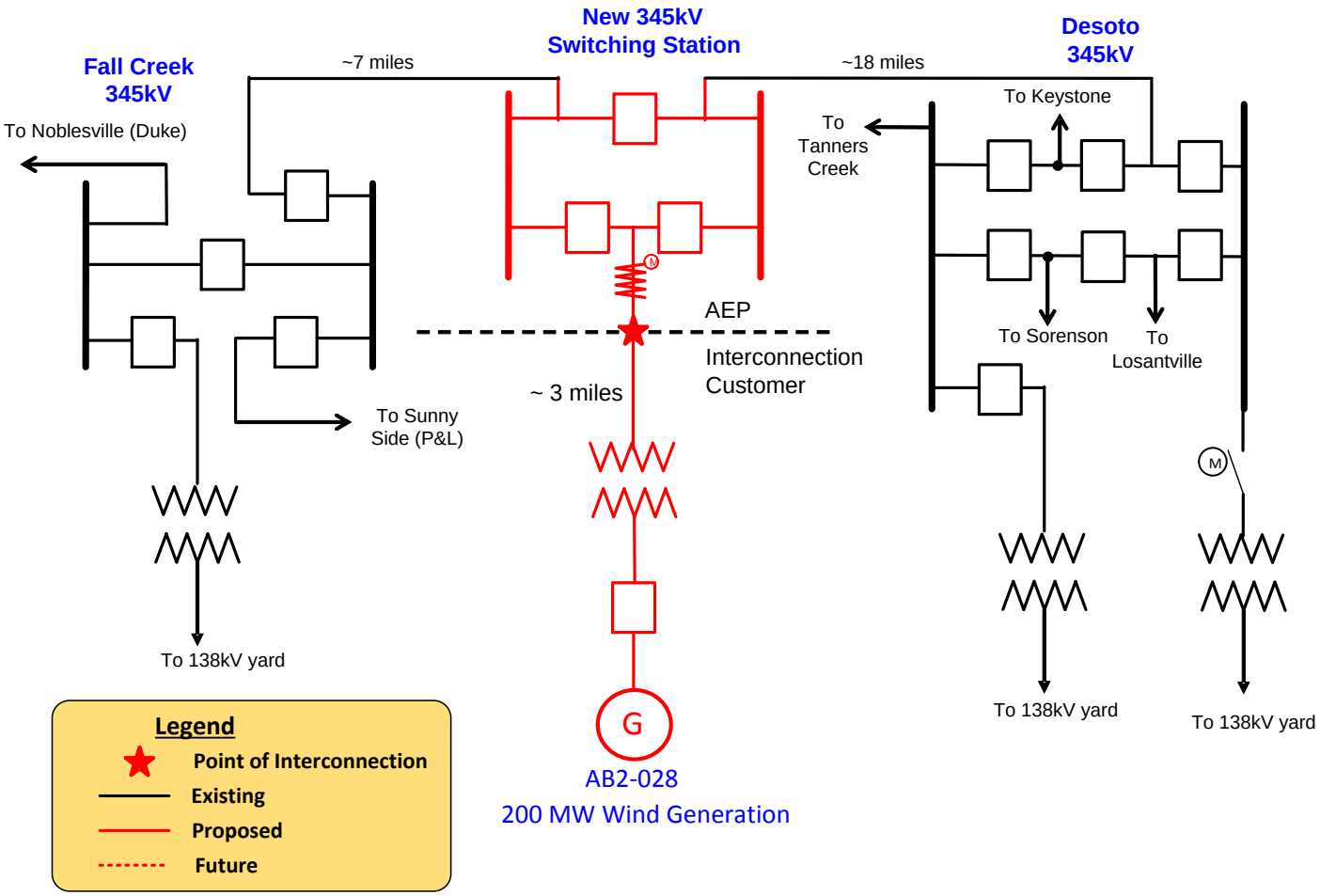

Figure 2: Point of Interconnection (Desoto – Fall Creek 345 kV)