Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AC2-090

Losantville 345 kV

July 2017

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 install PJM Project #AC2-090, a 100.0 MW (38.0 MW Capacity) solar generating facility in Losantville, IN (see Figure 2). The point of interconnection will be a direct connection to AEP's Losantville 345 kV substation (see Figure 1).

The requested in service date is November 30, 2019.

Attachment Facilities

Point of Interconnection (Losantville 345 kV Substation)

To accommodate the interconnection at the Losantville 345 kV substation, the substation will have to be expanded requiring the installation of two (2) 345 kV circuit breakers and starting a new string (see Figure 1). Installation of associated protection and control equipment, 345 kV line risers, SCADA, and 345 kV revenue metering will also be required.

Losantville Station Work:

- Expand the Losantville 345 kV substation, start a new string, and install two (2) 345 kV circuit breakers (see Figure 1). Installation of associated protection and control equipment, 345 kV line risers, SCADA, and 345 kV revenue metering will also be required.
    - **Estimated Station Cost: $3,000,000**

Non-Direct Connection Cost Estimate

The total preliminary cost estimate for Non-Direct Connection work is given in the following tables below:

For AEP building Direct Connection cost estimates:

Description	Estimated Cost
345 kV Revenue Metering	**$350,000**
Upgrade line protection and control settings at the Desoto 345 kV substation to coordinate with the expanded Losantville 345 kV substation.	**$50,000**
Upgrade line protection and control settings at the Tanners Creek 345 kV substation to coordinate with the expanded Losantville 345 kV substation.	**$50,000**
Total	**$450,000**

Table 1

It is understood that IC is responsible for all costs associated with this interconnection. The cost of IC's generating plant and the costs for the line connecting the generating plant to the Losantville 345 kV substation are not included in this report; these are assumed to be IC'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.

Interconnection Customer Requirements

Requirement from the PJM Open Access Transmission Tariff:

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.

Revenue Metering and SCADA Requirements

PJM Requirements

The Interconnection Customer will be required to install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for IC's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Sections 24.1 and 24.2.

AEP Requirements

The Interconnection Customer will be required to comply with all AEP Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the "Requirements for Connection of New Facilities or Changes to Existing Facilities Connected to the AEP Transmission System" document located at the following link:

http://www.pjm.com/~/media/planning/plan-standards/private-aep/aep-interconnection-requirements.ashx

Network Impacts

The Queue Project AC2-090 was evaluated as a 100.0 MW (Capacity 38.0 MW) injection at the Losantville 345 kV substation in the AEP area. Project AC2-090 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC2-090 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Base Case Used

Summer Peak Analysis – 2020 Case

Contingency Descriptions

The following contingencies resulted in overloads:

Contingency Name	Description
8823	CONTINGENCY '8823' OPEN BRANCH FROM BUS 243218 TO BUS 243232 CKT 2 / 243218 05DESOTO 345 243232 05SORENS 345 2 OPEN BRANCH FROM BUS 243225 TO BUS 243232 CKT 1 / 243225 05KEYSTN 345 243232 05SORENS 345 1 END
8702_B2_TOR2543	CONTINGENCY '8702_B2_TOR2543' OPEN BRANCH FROM BUS 243218 TO BUS 243232 CKT 2 / 243218 05DESOTO 345 243232 05SORENS 345 2 END
P1-#..B2 TERMINAL-EAST BEND 4516	CONTINGENCY 'P1-#..B2 TERMINAL-EAST BEND 4516' OPEN BRANCH FROM BUS 249575 TO BUS 249565 CKT 1 END

Table 2

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)

Note: Please see Appendices for projects providing impacts to flowgate violations. The values in the Reference column correspond to the proper table in the Appendix.

AC2-090 Contribution to Previously Identified OVerloads														
	Contingency				Bus				Loading		Rating			
#	Type	Name	Affected Area	Facility Description	From	To	Cir.	PF	Initial	Final	Type	MVA	MW Con.	FG App.
1	DCTL	8823	AEP - AEP	05DESOTO-05JAY 138 kV line	243278	243319	1	DC	101.3	102.15	ER	393	7.43	

Table 3

Steady-State Voltage Requirements

None

Short Circuit

(Summary of impacted circuit breakers)

New circuit breakers found to be over-duty:

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.

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 Request, a subsequent analysis will be performed which shall study all overload conditions associated with the overloaded element(s) identified.

AC2-090 Delivery of Energy Portion of Interconnection Request														
	Contingency				Bus				Loading		Rating			
#	Type	Name	Affected Area	Facility Description	From	To	Cir.	PF	Initial	Final	Type	MVA	MW Con.	FG App.
1	N-1	8702_B2_TOR2543	AEP - AEP	05KEYSTN-05SORENS 345 kV line	243225	243232	1	DC	105.36	107.77	NR	897	21.59	
2	N-1	P1-#..B2 TERMINAL-EAST	AEP - DEO&K	05TANNER-08M.FORT 345	243233	249567	1	DC	115.93	116.57	NR	1409	19.95	

AC2-090 Delivery of Energy Portion of Interconnection Request															
		Contingency			Bus				Loading		Rating				
#	Type	Name	Affected Area	Facility Description	From	To	Cir.	PF	Initial	Final	Type	MVA	MW Con.	FG App.
		BEND 4516		kV line										

Table 4

Previous System Reinforcements

#	Overloaded Facility	Upgrade Description	Schedule	Estimated Cost
#1	05DESOTO-05JAY 138 kV line	Replace the Jay breaker G (1200A) Replace the Jay Switch (1200A) Replace Jay Riser (1590 AAC 61 Str.) Replace the Jay Bus (1590 AAC 61 Str.) Replace the Desoto Switch (1200A) The Jay Area Improvements project will replace the limiting elements identified above.	Work to be completed May 2017	**N/A**
			Total New Network Upgrades	**N/A**

Table 5

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 provided between anticipated normal completion of System Impact, Facilities Studies, subsequent execution of ISA and ICSA documents, and the proposed In-Service Date is shorter than usual and may be difficult to achieve.

Conclusion

Based upon the results of this Feasibility Study, the construction of the IC's 100.0 MW (38.0 MW Capacity) solar generating facility (PJM Project #AC2-090) will require the following additional interconnection charges. This plan of service will interconnect the proposed solar generating facility in a manner that will provide operational reliability and flexibility to both the AEP system and the IC's generating facility.

Cost Breakdown for Point of Interconnection (Losantville 345 kV Substation)		
Attachment Cost	Expand Losantville 345 kV Substation	**$3,000,000**
Non-Direct Connection Cost Estimate	345 kV Revenue Metering	**$350,000**
	Upgrade line protection and control settings at the Desoto 345 kV substation to coordinate with the expanded Losantville 345 kV substation.	**$50,000**

	Upgrade line protection and control settings at the Tanners Creek 345 kV substation to coordinate with the expanded Losantville 345 kV substation.	**$50,000**
	Total Estimated Cost for Project AC2-090	**$3,450,000**

Table 6

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 (Losantville 345 kV Substation)

Single-Line Diagram

Appendices

The following appendices contain additional information about each flowgate presented in the body of the report. For each appendix, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact.

It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

Appendix 1

(AEP - AEP) The 05DESOTO-05JAY 138 kV line (from bus 243278 to bus 243319 ckt 1) loads from 101.3% to 102.15% (**DC power flow**) of its emergency rating (393 MVA) for the tower line contingency outage of '8823'. This project contributes approximately 7.43 MW to the thermal violation.

CONTINGENCY '8823'
OPEN BRANCH FROM BUS 243218 TO BUS 243232 CKT 2 / 243218 05DESOTO 345 243232 05SORENS 345 2
OPEN BRANCH FROM BUS 243225 TO BUS 243232 CKT 1 / 243225 05KEYSTN 345 243232 05SORENS 345 1
END

Bus Number	*Bus Name*	*Full Contribution*
247967	*05HDWTR1G E*	*12.92*
931681	*AC2-090 C*	*2.82*
931682	*AC2-090 E*	*4.6*
247543	*V3-007 C*	*1.93*
247935	*V3-007 E*	*12.92*
247568	*V3-015 C*	*3.31*
247949	*V3-015 E*	*22.17*
923881	*AB2-028 C*	*1.62*
923882	*AB2-028 E*	*10.83*
926871	*AC1-174 C*	*2.82*
926872	*AC1-174 E*	*4.6*
926881	*AC1-175 C*	*2.82*
926882	*AC1-175 E*	*4.6*
927181	*AC1-212 C*	*0.21*