Generation Interconnection

Feasibility Study Report

for

Queue Project AG1-049

COLLEGE CORNER 138 KV

17.6 MW Capacity / 0 MW Energy

January 2021

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1 Introduction

This Feasibility Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 36.2, as well as the Feasibility Study Agreement between the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is AEP.

2 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. Cost allocation rules for network upgrades can be found in PJM Manual 14A, Attachment B. 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 Interconnection Customer seeking to interconnect a wind or solar generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per Schedule H to the Interconnection Service Agreement and Section 8 of Manual 14D.

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.

3 General

The Interconnection Customer (IC) has proposed an uprate to a planned/existing Solar generating facility located in Preble, Ohio. This project is an increase to the Interconnection Customer's AC2-111 project, which will share the same point of interconnection. The AG1-049 queue position is a 0 MW uprate (17.6 MW Capacity uprate) to the previous project. The total installed facilities will have a capability of 80 MW with 48 MW of this output being recognized by PJM as Capacity.

The proposed in-service date for this uprate project is December 31, 2021. This study does not imply a TO commitment to this in-service date.

Queue Number	AG1-049
Project Name	COLLEGE CORNER 138 KV
State	Ohio
County	Preble
Transmission Owner	AEP
MFO	80
MWE	0
MWC	17.6
Fuel	Solar
Basecase Study Year	2024

Any new service customers who can feasibly be commercially operable prior to June 1st of the basecase study year are required to request interim deliverability analysis.

4 Point of Interconnection

AG1-049 will interconnect with the AEP transmission system via a direct connection to the College Corner 138 kV substation as an uprate to the PJM projects AC2-111 and AF1-071.

Note: These cost estimates assume that no relaying upgrades are required to accommodate this project. During later study phases, AEP/PJM may determine that relaying upgrades may be required depending on final project schedules for the existing project.

5 Cost Summary

The AG1-049 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$0
Total System Network Upgrade Costs	$600,000
Total Costs	**$600,000**

This cost excludes a Federal Income Tax Gross Up charges. This tax may or may not be charged based on whether this project meets the eligibility requirements of IRS Notice 2016-36, 2016-25 I.R.B. (6/20/2016). If at a future date it is determined that the Federal Income Tax Gross charge is required, the Transmission Owner shall be reimbursed by the Interconnection Customer for such taxes.

Cost allocations for any System Upgrades will be provided in the System Impact Study Report.

6 Transmission Owner Scope of Work

The total physical interconnection costs is given in the table below:

6.1 Attachment Facilities

The total preliminary cost estimate for the Attachment work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
None	$0
Total Attachment Facility Costs	**$0**

6.2 Direct Connection Cost Estimate

The total preliminary cost estimate for the Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
None	$0
Total Direct Connection Facility Costs	**$0**

6.3 Non-Direct Connection Cost Estimate

The total preliminary cost estimate for the Non-Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
None	$0
Total Non-Direct Connection Facility Costs	**$0**

7 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 generally be between 24 to 36 months after signing Agreement execution.

8 Interconnection Customer Requirements

It is understood that the Interconnection Customer (IC) is responsible for all costs associated with this interconnection. The costs above are reimbursable to the Transmission Owner. The cost of the IC's generating plant and the costs for the line connecting the generating plant to the Point of Interconnection are not included in this report; these are assumed to be the IC's responsibility.

The Generation Interconnection Agreement does not in or by itself establish a requirement for the Transmission Owner 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.

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.

9 Revenue Metering and SCADA Requirements

9.1 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 Section 8 of Attachment O.

9.2 Meteorological Data Reporting Requirements

The solar generation facility shall provide the Transmission Provider with site-specific meteorological data including:

- Back Panel temperature (Fahrenheit) - (Required for plants with Maximum Facility Output of 3 MW or higher)
- Irradiance (Watts/meter2) - (Required for plants with Maximum Facility Output of 3 MW or higher)
- Ambient air temperature (Fahrenheit) - (Accepted, not required)
- Wind speed (meters/second) - (Accepted, not required)
- Wind direction (decimal degrees from true north) - (Accepted, not required)

9.3 Interconnected Transmission Owner Requirements

The IC will be required to comply with all Interconnected Transmission Owner's revenue metering requirements for generation interconnection customers located at the following link:

http://www.pjm.com/planning/design-engineering/to-tech-standards/

10 Summer Peak - Load Flow Analysis

The Queue Project AG1-049 was evaluated as a 0.0 MW (Capacity 17.6 MW) injection as an uprate to AC1-111 which is a direct connection to College Corner 138 kV substation in the AEP area. Project AG1-049 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-049 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

10.1 Generation Deliverability

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

None

10.2 Multiple Facility Contingency

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

None

10.3 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)

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
1642030 12	243262	05COLLEGE C	138.0	AEP	250001	08COLINV	138.0	DEO&K	1	DEOK_P1_TODHUNTER-TRENTON 3284	single	167.0	105.12	106.49	DC	2.29
1642030 13	243262	05COLLEGE C	138.0	AEP	250001	08COLINV	138.0	DEO&K	1	DEOK_P1_TODHUNTER JCT 138	single	167.0	103.14	105.82	DC	4.47
1642030 14	243262	05COLLEGE C	138.0	AEP	250001	08COLINV	138.0	DEO&K	1	AEP_P1-2_#6372_12497	single	167.0	103.14	105.82	DC	4.47

10.4 Potential Congestion due to Local Energy Deliverability

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.

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
1642030 06	243262	05COLLEGE C	138.0	AEP	250001	08COLINV	138.0	DEO&K	1	DEOK_P1_TODHUNTER JCT 138	operation	167.0	139.21	141.88	DC	4.47
1642030 07	243262	05COLLEGE C	138.0	AEP	250001	08COLINV	138.0	DEO&K	1	AEP_P1-2_#6372_12497	operation	167.0	139.21	141.88	DC	4.47
1642030 11	243262	05COLLEGE C	138.0	AEP	250001	08COLINV	138.0	DEO&K	1	Base Case	operation	167.0	108.09	110.4	DC	3.85

10.5 System Reinforcements - Summer Peak Load Flow - Primary POI

ID	Idx	Facility	Upgrade Description	Cost
164203012,164202697,161409372,164203014,164203013	1	05COLLCO 138.0 kV - 08COLINV 138.0 kV Ckt 1	**AEP** **AEPI0005a (122) : A Sag Study will be required on the 0.15 mile section of line to mitigate the overload . New Rating after the Sag Study: S/N: 167 MVA S/E: 245 MVA. Depending on the sag study results, cost for this upgrade is expected to be between $600 (no remediations required just sag study) and $0.3 million (complete line reconductor/rebuild required). Time Estimate: a) Sag Study: 6-12 months b) Rebuild: The standard time required for construction differs from state to state. An approximate construction time would be 24 to 36 months after signing an interconnection agreement.** **Project Type : FAC** **Cost : $600** **Time Estimate : 6-12 Months** **DEOK** **Not a violation for DEOK portion (769) : Not a violation for DEOK portion** **Project Type : FAC** **Cost : $0** **Time Estimate : 0.0 Months**	$600,000
			TOTAL COST	**$600,000**

10.6 Queue Dependencies

The Queue Projects below are listed in one or more indices for the overloads identified in your report. These projects contribute to the loading of the overloaded facilities identified in your report. The percent overload of a facility and cost allocation you may have towards a particular reinforcement could vary depending on the action of these earlier projects. The status of each project at the time of the analysis is presented in the table. This list may change as earlier projects withdraw or modify their requests.

Queue Number	Project Name	Status
AC2-111	College Corner 138kV	Active
AD1-128	Modoc-Delaware 138 kV	Active
AE2-219	Bluff Point-Randolph 138 kV	Active
AF1-071	College Corner 138 kV	Active
AF1-221	College Corner-Drewersburg 138 kV	Active
AF2-211	College Corner 138 kV	Active
AG1-049	College Corner 138 kV	Active

10.7 Contingency Descriptions

Contingency Name	Contingency Definition
AEP_P1-2_#6372_12497	CONTINGENCY 'AEP_P1-2_#6372_12497' OPEN BRANCH FROM BUS 243262 TO BUS 250106 CKT 1 / 243262 05COLLEGE C 138 250106 08TODHJT 138 1 END
AEP_P4_#14920_05TANNER 345_T	CONTINGENCY 'AEP_P4_#14920_05TANNER 345_T' OPEN BRANCH FROM BUS 243233 TO BUS 249565 CKT 1 / 243233 05TANNER 345 249565 08EBEND
DEOK_P7_4504MFTANNERS4512EBTANNERS	CONTINGENCY 'DEOK_P7_4504MFTANNERS4512EBTANNERS' OPEN BRANCH FROM BUS 243233 TO BUS 249567 CKT 1 OPEN BRANCH FROM BUS 243233 TO BUS 249565 CKT 1 END
DEOK_P1_TODHUNTER-TRENTON 3284	CONTINGENCY 'DEOK_P1_TODHUNTER-TRENTON 3284' OPEN BRANCH FROM BUS 250105 TO BUS 250116 CKT 1 END
DEOK_P1_TODHUNTER JCT 138	CONTINGENCY 'DEOK_P1_TODHUNTER JCT 138' OPEN BUS 250106 END
Base Case	

11 Short Circuit Analysis

The following Breakers are overdutied

None.

12 Affected Systems

12.1 TVA

TVA Impacts to be determined during later study phases (as applicable).

12.2 Duke Energy Progress

Duke Energy Progress Impacts to be determined during later study phases (as applicable).

12.3 MISO

MISO Impacts to be determined during later study phases (as applicable).

12.4 LG&E

LG&E Impacts to be determined during later study phases (as applicable).