



**Generation Interconnection
Feasibility Study Report
for
Queue Project AF2-162
KEYSTONE-DESOTO 345 KV
30 MW Capacity / 45 MW Energy**

July 2020

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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.

An Interconnection Customer 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.

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 Blackford, Indiana. This project is an increase to the Interconnection Customer's AF1-119 project, which will share the same point of interconnection. The AF2-162 queue position is a 45 MW uprate (30 MW Capacity uprate) to the previous project. The total installed facilities will have a capability of 245 MW with 170 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this uprate project is June 01, 2023. This study does not imply a TO commitment to this in-service date.

Queue Number	AF2-162
Project Name	KEYSTONE-DESOTO 345 KV
State	Indiana
County	Blackford
Transmission Owner	AEP
MFO	245
MWE	45
MWC	30
Fuel	Solar
Basecase Study Year	2023

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

AF2-162 will interconnect additional solar generation and storage with the AEP transmission system via the station cut into the Keystone – Desoto 345 kV Circuit for the AF1-119 request. AF2-162 will utilize the same interconnection station and generator lead as the earlier PJM queue position. The storage will be connected behind the inverters, and only charge directly from the solar panels.

Note: It is assumed that the 345 kV revenue metering system, gen lead and Protection & Control Equipment that will be installed for AF1-119 will be adequate for the additional solar facility connection requested in AF2-162. Depending on the timing of the completion of the AF2-162 interconnection construction relative to the AF1-119 completion, there may (or may not) be a need to review and revise relay settings for the increased generation of AF2-162.

5 Cost Summary

The AF2-162 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	\$50,000
Total System Network Upgrade Costs	\$0
Total Costs	\$50,000

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 88-129. 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.

The estimates provided in this report 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. In addition, Stability analysis will be completed during the Facilities Study stage. It is possible that a need for additional upgrades could be identified by these studies.

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 tables 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
Review and revise Protection and Control settings for the increased generation of AF2-162	\$50,000
Total Non-Direct Connection Facility Costs	\$50,000

7 Incremental Capacity Transfer Rights (ICTRs)

Will be determined at a later study phase

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

Solar generation facilities shall provide the Transmission Provider with site-specific meteorological data including:

- Back Panel temperature (Fahrenheit)
- Irradiance (Watts/meter²)
- Ambient air temperature (Fahrenheit) – (Accepted, not required)
- Wind speed (meters/second) – (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 AF2-162 was evaluated as a 45.0 MW (Capacity 30.0 MW) injection as an uprate to AF1-119 which taps the Keystone to Desoto 345 kV line in the AEP area. Project AF2-162 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-162 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)

None

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	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC/D C	MW IMPACT
95313240	243218	05DESOTO	345.0	AEP	958860	AF2-177 TAP	345.0	AEP	2	AEP_P1-2_#4817	operation	971.0	111.91	113.04	DC	11.0
95313244	243225	05KEYSTN	345.0	AEP	243232	05SORENS	345.0	AEP	1	AEP_P1-2_#8702-C	operation	1301.0	104.96	106.46	DC	19.65
95313245	243225	05KEYSTN	345.0	AEP	243232	05SORENS	345.0	AEP	1	Base Case	operation	897.0	106.21	108.22	DC	18.05
95313118	944530	AF1-118 TAP	345.0	AEP	243232	05SORENS	345.0	AEP	2	AEP_P1-2_#4817	operation	971.0	143.06	144.19	DC	11.0
95313154	944540	AF1-119 TAP	345.0	AEP	243225	05KEYSTN	345.0	AEP	1	AEP_P1-2_#8702-C	operation	897.0	130.46	132.65	DC	19.7
95313160	944830	AF1-148 TAP	345.0	AEP	944530	AF1-118 TAP	345.0	AEP	2	AEP_P1-2_#4817	operation	971.0	121.34	122.47	DC	11.0
95313208	958860	AF2-177 TAP	345.0	AEP	960970	AF2-388 TAP	345.0	AEP	2	AEP_P1-2_#4817	operation	971.0	111.9	113.03	DC	11.0
95313172	960970	AF2-388 TAP	345.0	AEP	944830	AF1-148 TAP	345.0	AEP	2	AEP_P1-2_#4817	operation	971.0	111.91	113.04	DC	11.0

10.5 System Reinforcements

None

10.6 Contingency Descriptions

Contingency Name	Contingency Definition
Base Case	
AEP_P1-2_#4817	CONTINGENCY 'AEP_P1-2_#4817' OPEN BRANCH FROM BUS 243225 TO BUS 243232 CKT 1 / 243225 05KEYSTN 345 243232 05SORENS 345 1 END
AEP_P1-2_#8702-C	CONTINGENCY 'AEP_P1-2_#8702-C' OPEN BRANCH FROM BUS 944530 TO BUS 243232 CKT 2 / 944530 AF1-118 TAP 345 243232 05SORENS 345 2 END

11 Light Load Analysis

Light Load Studies (As applicable).

Not applicable

12 Short Circuit Analysis

The following Breakers are overdutied

To be determined during later study phases.

13 Stability and Reactive Power Assessment

(Summary of the VAR requirements based upon the results of the dynamic studies)

To be determined during later study phases.

14 Affected Systems

14.1 TVA

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

14.2 Duke Energy Progress

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

14.3 MISO

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

14.4 LG&E

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