



**Generation Interconnection
System Impact Study Report
for**

Queue Project AF1-141

VARNER 138 KV

62.8 MW Capacity / 96 MW Energy

August, 2020

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1 Introduction

This System Impact Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 205, as well as the System Impact 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 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: 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 an Interconnection Customer 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.

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.

3 General

The Interconnection Customer (IC), has proposed a Solar generating facility located in DeKalb, Indiana. The installed facilities will have a total capability of 96 MW with 62.8 MW of this output being recognized by PJM as Capacity.

The proposed in-service date for this project is May 31, 2022. This study does not imply a TO commitment to this in-service date.

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 ITO transmission system. These reinforcements include the Attachment Facilities, Local Upgrades, and Network Upgrades required for maintaining the reliability of the ITO transmission system.

Queue Number	AF1-141
Project Name	VARNER 138 KV
State	Indiana
County	DeKalb
Transmission Owner	AEP
MFO	96
MWE	96
MWC	62.8
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

AF1-141 will interconnect with the AEP transmission system via a direct connection to the proposed Varner 138 kV substation.

To accommodate the interconnection to the proposed Varner 138 kV substation, five (5) new 138 kV circuit breakers will be installed (Figure 1). Installation of associated protection and control equipment, 138 kV line risers, SCADA, and 138 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.

Installation of the generator lead first span exiting the POI station, including the first structure outside the AEP fence, will also be included in AEP's scope. In the case where the generator lead is a single span, the structure in the customer station will be the customer's responsibility.

The Varner 138 kV substation is part of a proposed AEP Indiana transmission project, associated with PJM baseline upgrade b2779. The PJM database presently identifies the Varner station as SDI Wilmington. Other information regarding this project can be found at the following link:

<https://www.aeptransmission.com/indiana/DeKalbCountyAreaImprovements/>

5 Cost Summary

The AF1-141 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	\$788,000
Direct Connection Network Upgrade	\$3,140,000
Non Direct Connection Network Upgrades	\$45,000
Allocation for New System Upgrades*	\$0
Contribution to Previously identified Upgrades*	\$0
Total Costs	\$3,973,000

*As your project progresses through the study process and other projects modify their request or withdraw, then your cost allocation could change.

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.

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.

Note 1: PJM Open Access Transmission Tariff (OATT) section 217.3A outline cost allocation rules. The rules are further clarified in PJM Manual 14A Attachment B. The allocation of costs for a network upgrade will start with the first Queue project to cause the need for the upgrade. Later queue projects will receive cost allocation contingent on their contribution to the violation and are allocated to the queues that have not closed less than 5 years following the execution of the first Interconnection Service Agreement which identifies the need for this upgrade.

6 Transmission Owner Scope of Work

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
138 kV Revenue Metering	\$388,000
Generator lead first span exiting the POI station, including the first structure outside the fence	\$400,000
Total Attachment Facility Costs	\$788,000

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
Five (5) new 138 kV circuit breakers will be installed (Figure 1). Installation of associated protection and control equipment, 138 kV line risers, and SCADA will also be required.	\$3,140,000
Total Direct Connection Facility Costs	\$3,140,000

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 line protection and control settings at the Varner 138 kV substation	\$45,000
Total Non-Direct Connection Facility Costs	\$45,000

7 Incremental Capacity Transfer Rights (ICTRs)

None

8 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 Agreement execution.

9 Interconnection Customer Requirements

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

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

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.

10 Revenue Metering and SCADA Requirements

10.1 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.

10.2 Meteorological Data Reporting Requirements

The solar generation facility 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)
- Wind direction (decimal degrees from true north) – (Accepted, not required)

10.3 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/>

11 Summer Peak Analysis

The Queue Project AF1-141 was evaluated as a 96.0 MW (Capacity 62.8 MW) injection at the Varner 138 kV substation in the AEP area. Project AF1-141 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-141 was studied with a commercial probability of 100.0 %. Potential network impacts were as follows:

11.1 Generation Deliverability

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

None

11.2 Multiple Facility Contingency

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

None

11.3 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

11.4 Steady-State Voltage Requirements

None

11.5 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.

None

11.6 System Reinforcements

ID	Idx	Facility	Upgrade Description	Cost	Cost Allocated to AF1-141	Upgrade Number
			TOTAL COST	\$0	\$0	

12 Light Load Analysis

Not Required.

13 Short Circuit Analysis

The following Breakers are overdutied:

None.

14 Stability and Reactive Power

To be determined in the Facilities Study Phase.

15 Affected Systems

15.1 TVA

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

15.2 Duke Energy Progress

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

15.3 MISO

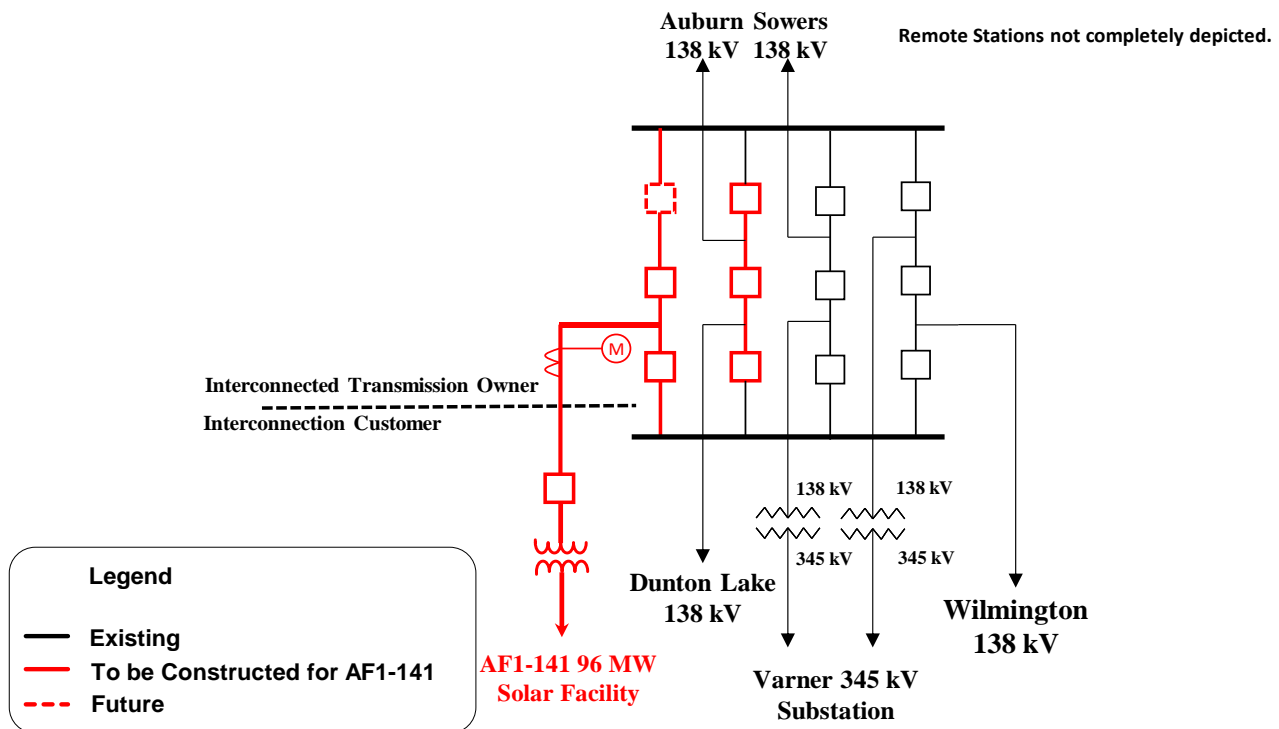
MISO Impacts to be determined during later study phases (as applicable).

15.4 LG&E

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

16 Attachment 1: One-Line Diagram

AF1-141 Point of Interconnection Varner 138 kV Substation



17 Attachment 2: Site Location

