

***Generation Interconnection  
Impact Study Report***

***For***

***PJM Generation Interconnection Request  
Queue Position AC2-111***

***College Corner 138 kV***

**March 2019**

## 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 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

Angelina Solar I, LLC proposes to install PJM Project #AC2-111, an 80.0 MW (30.4 MW Capacity) solar generating facility in Preble County, Ohio (see Figure 2). The point of interconnection will be a direct connection to AEP's College Corner 138 kV substation in Union County, Indiana (see Figure 1).

The requested in service date is July 1, 2019.

## Attachment Facilities

### Point of Interconnection (College Corner 138 kV Substation)

To accommodate the interconnection at the College Corner 138 kV substation, the College Corner substation will have to be expanded requiring the installation of two (2) additional 138 kV circuit breakers (see 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.

#### College Corner Station Work:

- Expand the College Corner substation: Install two (2) additional 138 kV circuit breakers (see Figure 1). Installation of associated protection and control equipment, 138 kV line risers and SCADA 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 table below:

For AEP building Non-Direct Connection cost estimates:

Description	Estimated Cost
138 kV Revenue Metering	\$250,000
<b>Total</b>	<b>\$250,000</b>

**Table 1**

## Interconnection Customer Requirements

It is understood that Angelina Solar I is responsible for all costs associated with this interconnection. The cost of Angelina Solar'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 Angelina Solar'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.

#### **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 AC2-111 was evaluated as a 80.0 MW (Capacity 30.4 MW) injection into the College Corner 138 kV substation in the AEP area. Project AC2-111 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC2-111 was studied with a commercial probability of 100%. Potential network impacts were as follows:

### **Base Case Used**

Summer Peak Analysis – 2020 Case

### **Contingency Descriptions**

The following contingencies resulted in overloads:

None

### **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

### **Steady-State Voltage Requirements**

None

### **Stability Analysis**

No stability criteria violations were identified, however, the project as presently specified requires addition of 15.05 MVAR to meet the 0.95 lagging power factor requirement.

### **Short Circuit**

*(Summary of impacted circuit breakers)*

New circuit breakers found to be over-duty:

None

## **Affected System Analysis & Mitigation**

### **LGEE Impacts:**

None

### **MISO Impacts:**

None

### **Duke, Progress & TVA Impacts:**

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.

None

### **New System Reinforcements**

*(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)*

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 provided between anticipated normal completion of Facilities Studies, subsequent execution of ISA and ICSA documents, and the requested in service date is shorter than usual and will be difficult to achieve.

## **Conclusion**

Based upon the results of this Impact Study, the construction of the 80.0 MW (30.4 MW Capacity) solar generating facility of Angelina Solar I (PJM Project #AC2-111) 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 Angelina Solar I generating facility.

<b>Cost Breakdown for Point of Interconnection (College Corner 138 kV Substation)</b>			
<b>Network Upgrade Type</b>	<b>Network Upgrade Number</b>	<b>Description</b>	<b>Estimated Cost</b>
<b>Attachment Cost</b>	<b>n6034</b>	Expansion of College Corner 138 kV substation and installation of associated protection and control equipment	<b>\$3,000,000</b>
<b>Non-Direct Connection Network Upgrade</b>	<b>n6035</b>	138 kV Revenue Metering	<b>\$250,000</b>
<b>Total</b>			<b>\$3,250,000</b>

**Table 2**

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.

### Single-Line Diagram

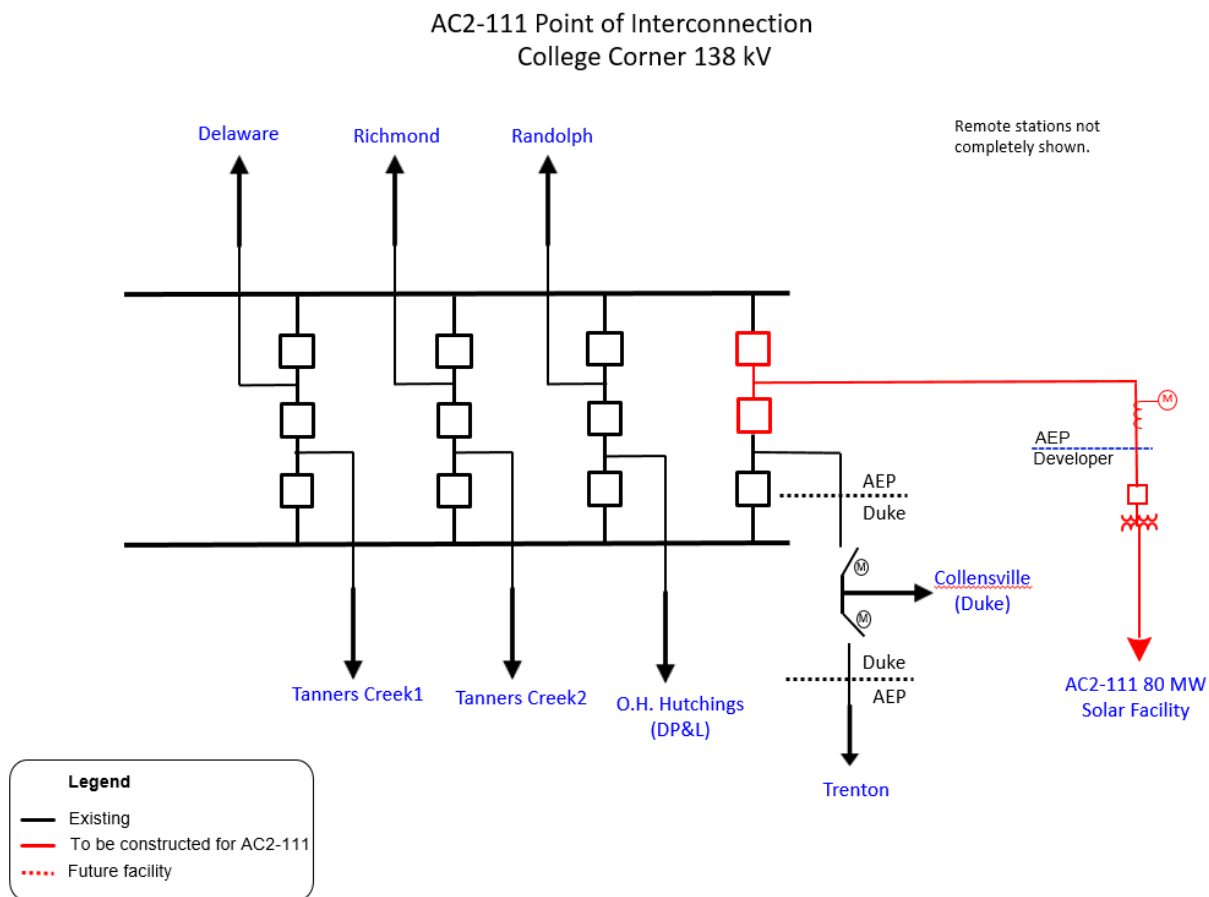


Figure 2: Point of Interconnection (College Corner 138 kV Substation)

