

***Generation Interconnection  
Feasibility Study Report***

***For***

***PJM Generation Interconnection Request  
Queue Position AE1-007***

***“Camden-Crystal III 69 kV”***

***7.6 MW Capacity / 20 MW Energy***

**January 2019**

## 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 users, 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.

PJM utilizes manufacturer models to ensure the performance of turbines is properly captured during the simulations performed for stability verification and, where applicable, for compliance with low voltage ride through requirements. Turbine manufacturers provide such models to their customers. The list of manufacturer models PJM has already validated is contained in Attachment B of Manual 14G. Manufacturer models may be updated from time to time, for various reasons such as to reflect changes to the control systems or to more accurately represent the capabilities turbines and controls which are currently available in the field. Additionally, as new turbine models are developed, turbine manufacturers provide such new models which must be used in the conduct of these studies. PJM needs adequate time to evaluate the new models in order to reduce delays to the System Impact Study process timeline for the Interconnection Customer as well as other Interconnection Customers in the study group. Therefore, PJM will require that any Interconnection Customer with a new manufacturer model must supply that model to PJM, along with a \$10,000 fully refundable deposit, no later than three (3) months prior to the starting date of the System Impact Study (See Section 4.3 for starting dates) for the Interconnection Request which shall specify the use of the new model. The Interconnection Customer will be required to submit a completed dynamic model study request form (Attachment B-1 of Manual 14G) in order to document the request for the study.

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), has proposed a **20 MW MFO (7.6 MWC)** upgrade to their prior solar queue projects AC2-067 “Camden-Crystal I 69 kV” and AC2-068 “Camden-Crystal II 69 kV” also to be located at 1731 West Consolidated Road in Eaton, Ohio. The projects combined will have a total capability of **89.9 MW** with **34.1 MW** of this output being recognized by PJM as capacity. All of the projects will be behind the same Point of Interconnection (POI) and will share the same interconnection facilities.

The expected Commercial Operation Date for this uprate project is **December 2020**. **This study does not imply a Dayton Power & Light Company (DP&L) commitment to this in-service date.**

Queue Number	AE1-007
Project Name	CAMDEN-CRYSTAL III 69 KV
Interconnection Customer	
State	Ohio
County	Preble
Transmission Owner	Dayton
MFO	89.9
MWE	20
MWC	7.6
Fuel	Solar
Basecase Study Year	2022

### **Point of Interconnection**

The **AE1-007 “Camden-Crystal III 69 kV”** uprate project will interconnect behind the same Point of Interconnection (POI) as the AC2-067 “Camden-Crystal I 69 kV” and AC2-068 “Camden-Crystal II 69 kV” projects and will share the same interconnection facilities. This interconnection with the Dayton Power & Light Company transmission system is at a tap location on the Hutchings-Crystal 69 kV line between Crystal and Camden Substations. Presently, the Hutchings-Crystal 69kV line serves distribution loads at Camden, Gratis, and Germantown Substations.

Under the AC2-067 project, the IC will construct a single 69kV line up to the POI on the Crystal-Camden 69kV line section. The POI will be the pad of the switch towards the generator, with Dayton Power and Light owning the switch and associated hardware and the IC owning the conductor to the point where it connects to the switch at the pad.

See **Attachment 1** for a one line of the physical interconnection point.

### **Cost Summary: AE1-007 “Camden-Crystal III 69 kV”**

The AC2-067 “Camden-Crystal I 69 kV” project is responsible for the connection facilities to the Dayton Power and Light system. AC2-068 “Camden-Crystal II 69 kV” and AE1-007 “Camden-Crystal III 69 kV” will share the same interconnection facilities.

Should both the AC2-067 and AC2-068 projects elect not to move forward, the AE1-007 project would assume the responsibility of the interconnection facilities.

The **AE1-007** project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	\$ 15,000
Direct Connection Network Upgrades	\$ 0
Non Direct Connection Network Upgrades	\$ 30,000
<b>Total Costs</b>	<b>\$ 45,000</b>

In addition to the costs for the physical interconnection point above, the **AE1-007** project may be responsible for a contribution to the following costs:

Description	Total Cost
New System Upgrades	\$ 0
Previously Identified Upgrades	\$ 0
<b>Total Costs</b>	<b>\$ 0</b>

## **Camden-Crystal III 69kV Physical Interconnection**

### **Attachment Facilities<sup>1</sup>**

The total preliminary cost estimate for the AE1-007 Attachment work is given in the table below. This work is primarily for engineering drawing review. The main scope of work for Attachment Facilities is addressed by queue project AC2-067. These costs do not include CIAC Tax Gross-up.

<b>Description</b>	<b>Total Cost</b>
Engineering oversight and commissioning	\$ 15,000
<b>Total Attachment Facility Costs</b>	<b>\$ 15,000</b>

### **Direct Connection Cost Estimate**

There is no Direct Connection scope of work required for this project.

### **Non-Direct Connection Cost Estimate<sup>2</sup>**

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.

<b>Description</b>	<b>Total Cost</b>
Protection System changes at Crystal Substation	\$ 15,000
Protection System changes at Hutchings Substation	\$ 15,000
<b>Total Non-Direct Connection Facility Costs</b>	<b>\$ 30,000</b>

The substation non-direct connection cost estimate for the AE1-007 project is approximately **\$30,000**. Remote end relaying will need to be evaluated for settings changes at Crystal and Hutchings Substations to facilitate the interconnection of the new generation.

---

<sup>1</sup> Should both the AC2-067 and AC2-068 projects elect not to move forward, the AE1-007 project would assume the responsibility of the interconnection facilities.

<sup>2</sup> This scope of work assumes that the customer's main 34.5-69 kV step-up transformer is connected as a delta utility side/grounded-wye customer side.

## **Interconnection Customer Requirements**

### **Requirement from the PJM Open Access Transmission Tariff:**

1. An /Interconnection Customer entering the New Service 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.

### **Dayton Interconnection Requirements**

The Dayton Power and Light Company (DP&L) has prepared this Facilities Connection Requirements document to ensure compliance with North American Electric Reliability Council (NERC) Reliability Standards and applicable Regional Reliability Organization, sub regional, Power Pool, and individual Transmission Owner planning criteria and facility connection requirements in compliance to NERC Standard FAC-001-2. These connection requirements apply to all generation facilities, transmission facilities, and end-users connecting to the DP&L transmission system. Detailed information outlining DP&L interconnection requirements can be reviewed utilizing the following link:

<http://www.pjm.com/~media/planning/plan-standards/private-dayton/dayton-facilities-connection-requirements.ashx>

## **Schedule**

Based on the extent of the Dayton primary Non-Direct Connection and Attachment upgrades required to support the AE1-007 uprate project, it is expected to take a minimum of **12 months** from the date of a fully executed Interconnection Construction Service Agreement to complete the installation subject to market conditions and vendor lead times. This includes the requirement for the Interconnection Customer to make a preliminary payment to Dayton which funds the construction of the Non-Direct Connection facilities. It assumes that there will be no environmental or permitting issues to implement the Non-Direct Connection upgrades for this project and that all system outages will be allowed when requested.

## **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.

### **Dayton Metering Requirements**

The Interconnection Customer will be required to comply with all Dayton Revenue Metering Requirements for Generation Interconnection Customers as outlined in the link below. The Revenue Metering Requirements may be found within the Dayton Power & Light Co. "Requirements for the Connection of Facilities to the Dayton Power & Light Co. Transmission System" document located at the following link:

<http://www.pjm.com/~media/planning/plan-standards/private-dayton/dayton-facilities-connection-requirements.ashx>

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

## **Network Impacts**

The Queue Project AE1-007 was evaluated as a 20.0 MW (Capacity 7.6 MW) injection tapping the same Point of Interconnection as the AC2-067 and AC2-068 project off the Camden-Crystal 69 kV line in the Dayton area. Project AE1-007 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE1-007 was studied with a commercial probability of 53%. Potential network impacts were as follows:

## **Summer Peak Load Flow Analysis - 2022**

### **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

### **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. 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



## **Short Circuit Analysis**

### **Short Circuit**

*(Summary of impacted circuit breakers)*

None

**Attachment 1. AE1-007 ‘Camden-Crystal III 69 kV’  
One Line Diagram**