Generation Interconnection
Facility Study Report

For

PJM Generation Interconnection Request
Queue Position AE1-007

"Camden-Crystal III 69 kV"
20.0 MW Energy, 7.6 MW Capacity

June 2021

Preface

The intent of the Facility 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 Facility Study estimates attempt to identify the estimated time required to obtain property rights and permits for construction of the required facilities. The project Interconnection Customer 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

Alamo Solar I, LLC, the Interconnection Customer (IC), has proposed a solar generating facility located at 1731 West Consolidated Road in Eaton, Preble County, Ohio. The installed facilities will have a capability of 20 MW with 7.6 MW of this output being recognized by PJM as capacity. Note that this project is an increase to the Interconnection Customer's AC2-067 "Camden-Crystal I 69kV" and AC2-068 "Camden-Crystal II 69kV" projects, which will share the same property and connection point. The AC2-067 and AC2-068 projects will have a capability of 69.9 MW with 26.5 MW being recognized as capacity. The total capability of the combined AC2-067, AC2-068, and AE1-007 projects will be 89.9 MW with 34.1MW being recognized by PJM as capacity.

The project capability is summarized below:

Queue	MFO	Energy	Capacity
AC2-067	49.9	49.9	18.9
AC2-068	20	20	7.6
AE1-007	20	20	7.6
Total	89.9	89.9	34.1

The proposed in-service date for the AE1-007 project is **December 1, 2022. This study does not imply a Dayton Power and Light Company commitment to this in-service date.**

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.

For the AC2-067 and AC2-068 projects, the interconnection with the Dayton Power & Light Company transmission system was planned to be a tap location on the Hutchings-Crystal 69 kV line between Crystal and Camden Substations. However, the increase in generation proposed by AE1-007 will require that a new three breaker ring bus be constructed to interconnect the projects to 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.

The POI for AC2-067, AC2-068, and AE1-007 will transition to the 69kV takeoff structure leaving the new three breaker ring bus switchyard that will be installed as part of the AE1-007 project. The Interconnection Customer will own the generator lead line conductor terminating onto the structure.

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

Cost Summary

The AC2-067 "Camden-Crystal I 69 kV", AC2-068 "Camden-Crystal II 69 kV", and AE1-007 "Camden-Crystal III 69 kV" will be connecting at the same POI. The scope of work to build a tap along the Hutchins-Crystal 69kV line (for AC2-067/AC2-068) will be amended and the new scope of work required to interconnect AC2-067, AC2-068, and AE1-007 will be a new three breaker ring bus switching station.

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

Description	Total Cost	
Attachment Facilities	$	15,000
Direct Connection Network Upgrades	$	2,600,000
Non-Direct Connection Network Upgrades	$	530,000
Allocation for New System Upgrades	$	0
Contribution for Previously Identified Upgrades	$	0
Total Costs	**$**	**3,145,000**

A. Transmission Owner Facilities Study Summary

1. Description of Project

Alamo Solar I, LLC, the Interconnection Customer (IC), has proposed solar generating facilities located at 39°42'7.77"N, 84°39'32.48"W, Eaton, Ohio. See Site Plan in **Attachment 1.** The installed facilities for this queue request, AE1-007, will have a total capability of **20.0 MW** with **7.6 MW** of this output being recognized by PJM as capacity.

The Interconnection Customer (IC), has also submitted solar queue request AC2-067 "Camden-Crystal I 69kV" and AC2-068 "Camden-Crystal II 69kV" with the total capability of 69.9 MW with 26.5 MW being recognized by PJM as capacity. The total capability of all three projects will be 89.9 MW with 34.1 MW being recognized by PJM as capacity.

Both the AC2-067 and AC2-068 projects will be behind the same Point of Interconnection (POI) as AE1-007. The IC expects to be in commercial operation by **December 2022.**

2. Point of Interconnection (POI)

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.

For the AC2-067 and AC2-068 projects, the interconnection with the Dayton Power & Light Company transmission system was planned to be a tap location on the Hutchings-Crystal 69 kV line between Crystal and Camden Substations. However, the increase in generation proposed by AE1-007 will require that a new three breaker ring bus be constructed to interconnect the projects to 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.

The POI will be the last 69kV takeoff structure leaving the new three breaker ring bus switchyard. The Interconnection Customer will own the generator lead line conductor terminating onto the structure.

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

3. Amendments to the Original System Impact Study Results

The AE1-007 System Impact Study report was revised to include the following requirement as a result of the Dynamic Simulation Analysis:

The AE1-007 queue project did not meet the 0.95 lagging power factor requirement. An additional 14.97 Mvar would be required for the plant to meet the 0.95 lagging power factor requirement. The plant did meet the 0.95 leading power factor requirement.

4. Interconnection Customer's Submitted Milestone Schedule

The IC's proposed Commercial Operation Date (COD) for the generation facility is **December 1, 2022.**

- Permits – state level CPCN and county level Final Site Plan approval complete by ---- January 1, 2022
- Substantial site work completed --- April 1, 2022
- Delivery of major electrical equipment --- March 1, 2022
- Back Feed Power early to --- November 1, 2022
- Commercial Operation --- December 1, 2022

A **24** month schedule has been developed for DP&L to complete all required engineering, construction, and associated activities from the date which is one month after the month in which the Interconnection Construction Service Agreement is effective.

5. Scope of Customer's Work

The IC will install a total of 89.9 MW of solar generation in Eaton, Ohio as part of the AC2-067, AC2-068, and AE1-007 projects. The IC will construct and own facilities including the solar generator facilities, inverters, a 34.5-69 kV generation step up (GSU) transformer, a 69 kV breaker with associated relay/protection/controls, and 69 kV line up to the Point of Interconnection (POI). The last 69kV takeoff structure leaving the new three breaker ring bus switchyard will serve as the POI. Dayton Power and Light will own the structure and associated hardware while the IC will own the conductor to the connection point as shown in **Attachment 2**.

The IC shall coordinate with Dayton on the establishment of dedicated communication circuits for SCADA monitoring to the Dayton Transmission System Control Center. Additionally, IC will be responsible for paying all expenses to meet the Dayton Protection Requirements due to direct connections and other upgrades required by this project. The DP&L Protection Requirements are outlined in **Attachment 4.**

The proposed attachment of the IC's project to the system is via the new three-breaker ring bus switchyard. The IC will need to construct a 69 kV line from their project substation up to the POI, which will be last 69kV takeoff structure leaving the new three breaker ring bus switchyard, as shown in **Attachment 2**. IC will be responsible for acquiring all rights-of-way, easements, properties, vegetation clearing, environmental, state siting approvals, and local permits that may be required to construct all attachment facilities, up to the POI shown in the one-line diagram in **Attachment 2**.

Reference the TO's Generation Connection Requirements in **Attachment 3.**

6. Description of Facilities Included in the Facilities Study

Attachment Facilities –
This report assumes that the Interconnection Customer will construct and own the attachment line from its generating facility into the proposed Point of Interconnection as depicted on the one line diagram in Attachment 1. The IC will also be responsible for the fiber/OPGW that Dayton requires on the generator line for the communication assisted trip scheme.

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. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Install 69kV revenue metering at the new AC2-067/AC2-068/AE1-007 69kV interconnection switching station.	$15,000
Total Attachment Cost Estimate	**$15,000**

Direct Connection Network/Local Upgrades –
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
Install a new 69 kV three breaker ring bus switchyard to interconnect the AE1-007 project. This will include the installation of all physical structures, P&C equipment, communications equipment, metering equipment, and associated facilities. PJM Network Upgrade Number 7244.2	$2,600,000
Total Direct Connection Facility Costs	**$2,600,000**

The direct connection cost estimate for the AE1-007 project is approximately **2,600,000.** The substation direct connection work for this project includes the construction of a new 69 kV three breaker ring bus switchyard which will be tapped off the Camden-Crystal 69 kV line. The three breaker ring bus is required to ensure proper protection. The protection issue is that the substantial infeed from the additional source on the line impacts the ability of the protection at Crystal Substation to see faults at Hutchings Substation. The additional generation from AE1-007 would require increasing the reach and delaying the phase distance protection. Dayton exhausted our protection limitations to accommodate the AC2-067 and AC2-068 projects prior to the implementation of our current standard and we will not compromise further for the AE1-007 project. It must be brought up to the current standard, regardless of the status of the W2-040 project. The 69 kV generator lead line will be constructed by the developer and will be terminated onto the 69 kV takeoff structure leaving the new three breaker ring bus switchyard. The new 69 kV breakers will be equipped with the necessary communication systems to facilitate remote supervisory control of the breaker and status monitoring. Dayton will install the line relaying, communications, and interconnection metering to accommodate the interconnection of the AE1-007 generator.

- Construct the 69 kV yard at greenfield Substation to accommodate a three (3) breaker 69 kV ring bus configuration.
- Procure and install three (3) new 69 kV circuit breakers in the new 69 kV ring bus with associated switches, line relaying, and interconnection metering.
- The new Substation will require the addition of the following equipment:

- 69 kV Disconnect Switches
- 69 kV Fiber Line and Transfer Trip Relays
- (3) 69 kV Gas Circuit Breakers
- 69 kV Revenue Class Metering Equipment
- 69 kV Instrument Transformers
- 69 kV Bus Structures
- 69 kV Insulators
- 69 kV Lightning Arrestors
- SCADA Remote Terminal Unit (RTU)
- Physical Site Land Purchase
- Foundational Work for New Equipment
- Control building

Non-Direct Connection Network Upgrades[1] –
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
Camden - Crystal 69 kV – construct a new loop-in tap line from Dayton's existing Camden - Crystal 69 kV line to the new AC2-067/AC2-068/AE1-007 69kV interconnection switching station. PJM Network Upgrade Number n7244.3	$500,000
Protection System changes at Crystal Substation. PJM Network Upgrade Number n7244.4	$15,000
Protection System changes at Hutchings Substation. PJM Network Upgrade Number n7244.5	$15,000
Total Non-Direct Facilities Cost Estimate	**$530,000**

The substation non-direct connection cost estimate for the AE1-007 project is approximately **$530,000**. There will be 69 kV transmission line construction required to accommodate the new switchyard (Non Direct Connection). Remote end relaying will need to be evaluated for settings changes at Crystal and Hutchings Substations to facilitate the interconnection of the new generation.

- **Camden - Crystal 69 kV – (Dayton):** construct a new loop-in tap line.

- **Crystal Substation (Dayton):** Protection system changes.

- **Hutchings Substation (Dayton):** Protection system changes.

Contribution to Previously Identified System Upgrades[2] -
None.

7. Total Costs of Transmission Owner Facilities included in Facilities Study

The AC2-067 "Camden-Crystal I 69 kV" and, AC2-068 "Camden-Crystal II 69 kV", and AE1-007 "Camden-Crystal III 69 kV" will be connecting at the same POI. The scope of work to build a tap along the Hutchins-Crystal 69kV line (for AC2-067/AC2-068) will be amended and the new scope of work required to interconnect AC2-067, AC2-068, and AE1-007 will be a new three breaker ring bus switching station.

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

Description	NUN	Cost (without tax)
Attachment Facilities		
Install 69kV revenue metering at the new AC2-067/AC2-068/AE1-007 69kV interconnection switching station		$ 15,000
Direct Connection Network Upgrades		
Install a new 69 kV three breaker ring bus switchyard to interconnect the AE1-007 project. This will include the installation of all physical structures, P&C equipment, communications equipment, and associated facilities. (Dayton)	n7244.2	$ 2,600,000
Non-Direct Connection Network Upgrades		
Camden - Crystal 69 kV – construct a new loop-in tap line from Dayton's existing Camden - Crystal 69 kV line to the new AC2-067/AC2-068/AE1-007 69kV interconnection switching station.	n7244.3	$ 500,000

Description	NUN	Cost (without tax)
Protection System changes at Crystal Substation (Dayton)	n7244.4	$ 15,000
Protection System changes at Hutchings Substation (Dayton)	n7244.5	$ 15,000
Total Costs		**$3,145,000**

The costs given in this report show the estimates without state or federal tax. This tax may or may not be charged based on whether or not this project meets the eligibility requirements of IRS Notice 88-129. If applicable, the tax shown in the rightmost column above would be applied. The IC will be responsible for the actual cost of all implementing all work identified in the table above.

8. Summary of Milestone Schedules for Completion of Work Included in Facilities Study:

A proposed **twenty-four (24)-month** schedule for Dayton's network upgrade, attachment, direct, and non-direct transmission work is estimated to complete engineering, construction and the associated activities listed above starting one month from the date of a fully executed Interconnection Construction Service Agreement. This schedule assumes that all issues covered by the "Environmental, Real Estate and Permitting Issues" section of this document are resolved, and outages occur as planned.

Construction cannot begin and is predicated upon (a.) all applicable environmental, power siting, and local permits obtained, and (b.) all line and equipment outages secured through Dayton Transmission System Operations and PJM.

Activity Schedule	Start Month	End Month
Preliminary Engineering	1	4
Detailed Engineering	4	12
Equipment Procurement – Delivery	12	15
Above Grade Construction	15	22
Testing & Commissioning	22	24

Month #1 corresponds to the first month after this CSA is effective.

Back-up Service Agreement

The execution of a back-up retail service agreement with the TO will be necessary to serve the customer load supplied from the AC2-067, AC2-068, and AE1-007 interconnection point when the units are out-of-service. This assumes the intent of the IC is to net the generation with the load.

General Assumptions/Qualifiers

The accomplishment of the work on the TO system to support the estimated costs and proposed schedule is dependent on the following:

- Obtaining the necessary transmission line/equipment outages. Transmission outages are typically not granted from June to September and are discouraged during extreme winter conditions. PJM and Dayton TSO requires 6 to 12-month notice for greater than 5-day and 30-day outages respectively.
- The scope of the project may need revised if there are scope changes or project status changes associated with either the AC2-067, AC2-068, or AE1-007 projects.
- IC provides location and orientation of their attachment facilities.
- No extreme weather.
- No force majeure.

B. Transmission Owner Facilities Study Results

1. Transmission Lines – New

Camden - Crystal 69 kV – (Dayton): construct a new loop-in tap line.

PJM Network Upgrade Number n7244.3

2. Transmission Line – Upgrades

None.

3. New Substation/Substation Facilities

New 69kV Substation

- Construct a 69kV greenfield Substation to accommodate a three (3) breaker 69 kV ring bus configuration.
- Procure and install three (3) new 69 kV circuit breakers in the new 69 kV ring bus with associated switches, line relaying, and interconnection metering.
- The new Substation will require the addition of the following equipment:

    - 69 kV Disconnect Switches
    - 69 kV Fiber Line and Transfer Trip Relays
    - (3) 69 kV Gas Circuit Breakers
    - 69 kV Revenue Class Metering Equipment
    - 69 kV Instrument Transformers
    - 69 kV Bus Structures
    - 69 kV Insulators
    - 69 kV Lightning Arrestors
    - SCADA Remote Terminal Unit (RTU)
    - Physical Site Land Purchase
    - Foundational Work for New Equipment
    - Control building

PJM Network Upgrade Number n7244.2

4. Upgrades to Substation / Substation Facilities

Crystal Substation

Protection system changes.
PJM Network Upgrade Number n7244.4

Hutchings Substation

Protection system changes.
PJM Network Upgrade Number n7244.5

5. Metering & Communications

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

The meter will be located on the 69 kV line connected to the AC2-067 generator as shown in **Attachment 2**.

6. Environmental, Real Estate and Permitting Issues

IC will be responsible for acquiring all rights-of-way, easements, properties, vegetation clearing, environmental, state siting approvals, and municipal permits that may be required to construct all attachment facilities, up to the POI shown in the one-line diagram in Attachment 1. The IC will be responsible for the costs incurred to obtain the necessary environmental and other permits necessary to construct the non-direct and direct connect facilities.

7. Information Required for Interconnection Service Agreement

The following table summarizes the total estimated costs according to FERC criteria. The estimated costs are in **2020 dollars.** The taxes are a CIAC (Contribution in Aid of Construction)

Federal Income Tax Gross Up charge. This tax may or may not be charged based on whether or not this project meets eligibility requirements of IRS Notice 88-129. This tax is not included in the table below.

Description	Direct Labor	Direct Material	Indirect Labor	Indirect Materials
Attachment Facilities				
Install 69kV revenue metering at the new AC2-067/AC2-068/AE1-007 69kV interconnection switching	$ 7,500	$ 0	$ 7,500	$0
Direct Connection Network Upgrades				
Install a new 69 kV three breaker ring bus switchyard to interconnect the AE1-007 project. This will include the installation of all physical structures, P&C equipment, communications equipment, and associated facilities. (Dayton) *(PJM Network Upgrade n7244.2)*	$ 1,250,000	$ 1,160,000	$ 150,000	$ 40,000
Non-Direct Connection Network Upgrades				
Camden - Crystal 69 kV – construct a new loop-in tap line from Dayton's existing Camden - Crystal 69 kV line to the new AC2-067/AC2-068/AE1-007 69kV interconnection switching station. (PJM Network Upgrade *n7244.3)*	$ 250,000	$ 210,000	$ 30,000	$ 10,000
Protection System changes at Crystal Substation (Dayton) *(PJM Network Upgrade n7244.4)*	$ 7,500	$ 0	$ 7,500	$0
Protection System changes at Hutchings Substation (Dayton) *(PJM Network Upgrade n7244.5)*	$ 7,500	$0	$ 7,500	$0
Total	**$1,522,500**	**$1,370,000**	**$202,500**	**$50,000**

Schedule:

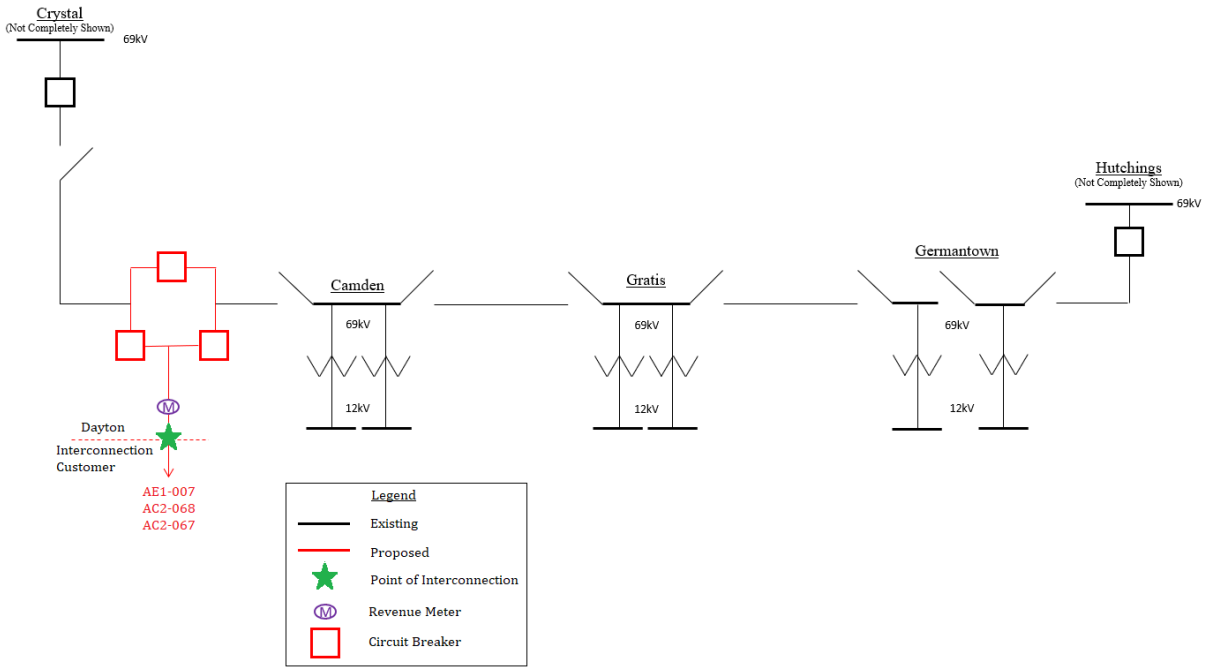
A proposed **twenty-four (24)-month** schedule for Dayton's network upgrade, direct, and non-direct transmission work is estimated to complete engineering, construction and the associated activities listed above starting one month from the date of a fully executed Interconnection Construction Service Agreement. This schedule assumes that all issues covered by the "Environmental, Real Estate and Permitting Issues" section of this document are resolved, and outages occur as planned.

Construction cannot begin and is predicated upon (a.) all applicable environmental, power siting, and local permits obtained, and (b.) all line and equipment outages secured through Dayton Transmission System Operations and PJM.

Activity Schedule	Start Month	End Month
Preliminary Engineering	1	4
Detailed Engineering	4	12
Equipment Procurement – Delivery	12	15
Above Grade Construction	15	22
Testing & Commissioning	22	24

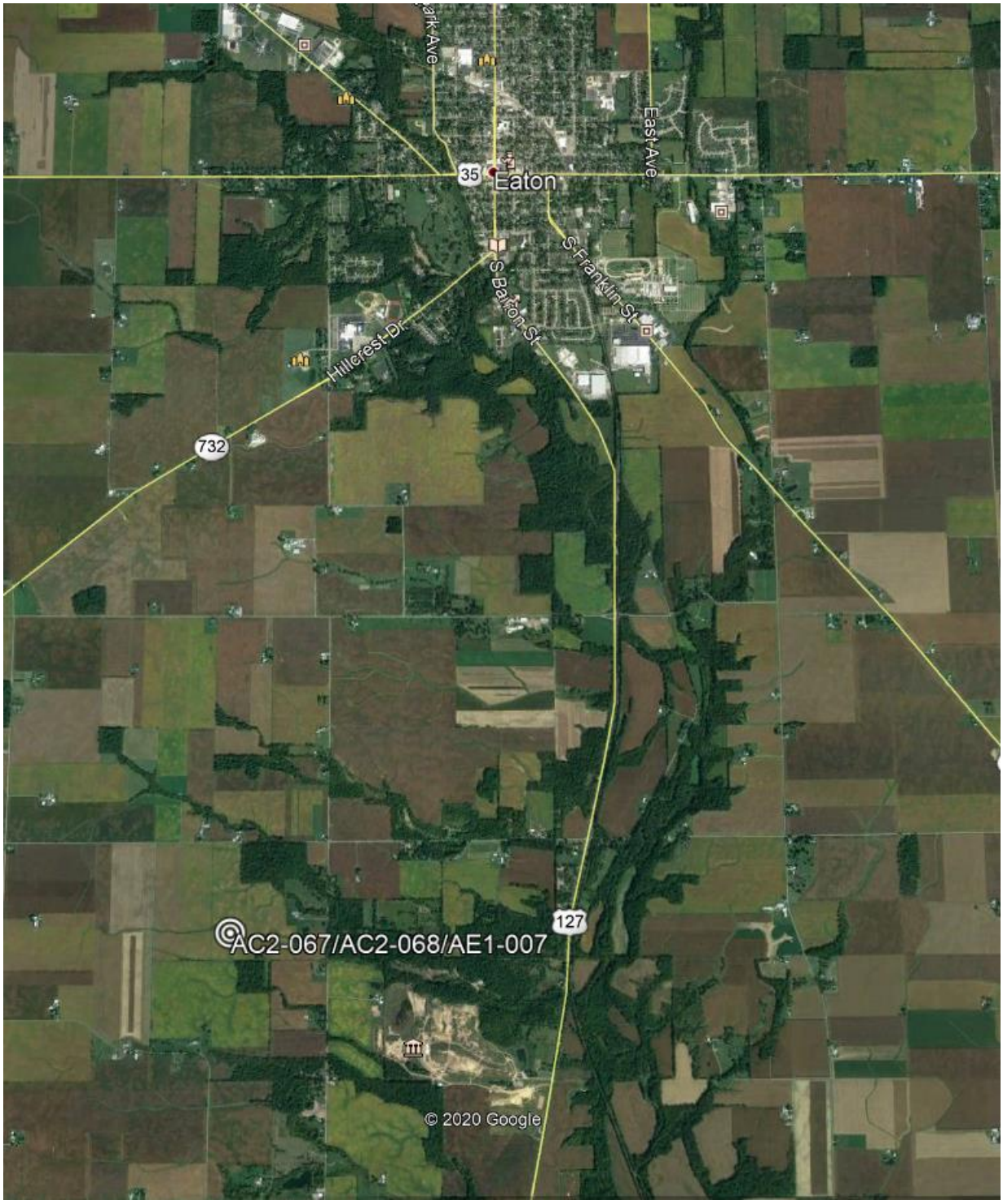
Attachment 1. PJM Queue #AE1-007

One Line Diagram



Attachment 2. PJM Queue #AE1-007

Site Location



Attachment 3. PJM Queue #AE1-007

Dayton Generation Connection 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:

https://www.pjm.com/-/media/planning/plan-standards/private-dayton/dayton-facilities-connection-requirements.ashx?la=en

Attachment 4. PJM Queue #AE1-007

System Relay and Protection Requirements

The Interconnection Customer will be required to comply with all Dayton System Relay and Protection Requirements. The System Relay and Protection 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:

Specifically reference the "System Protection and Coordination" section which can be found on pages 8-10.

https://www.pjm.com/-/media/planning/plan-standards/private-dayton/dayton-facilities-connection-requirements.ashx?la=en

System Protection and Coordination.

Generation facilities, transmission facilities, and end-user facilities connecting to the DP&L transmission system are responsible for determining that the proper protective equipment meet all applicable standards, is properly installed and coordinates with DP&L relaying. Protective relaying systems and associated communications systems for all facility interconnections shall be planned, designed, constructed, and maintained in accordance with applicable NERC, RF, and PJM standards. Utility grade protective relays and fault clearing systems are to be utilized on the interconnected power system. Utility grade relays are defined as follows:

- Meet ANSI/IEEE Standard C37.90, *Relays and Relay Systems Associated with Electric Power Apparatus*.
- Have relay test facilities to allow testing without unwiring or disassembling the relay.
- Have appropriate test plugs/switches for testing the operation of the relay.
- Have targets to indicate relay operation.

The Applicant must take responsibility for providing adequate system protection to its facilities and to DP&L facilities under any transmission operating condition, whether or not their facilities are in operation. Conditions may include but are not limited to:

Single phasing of supply

System faults.

Equipment failures.

Abnormal voltage or frequency.

Lightning and switching surges.

Excessive harmonic voltages and/or currents.

Excessive negative sequence voltages

Separation from DP&L.

Synchronizing of generation to the DP&L system.

DP&L reserves the right to specify functional specifications and relay settings deemed necessary to avoid safety hazards or to prevent any disturbance, impairment or interference with DP&L's ability to serve other customers. The criteria for these functional specifications and settings will be based on existing DP&L protection practices. DP&L reserves the right to specify the type and manufacturer for these protective relays to ensure compatibility with existing relays. DP&L will make the specific recommendations and requirements for protection based on the individual substation location, voltage and configuration.

For generation facilities, the relay protection system may be part of a self-contained generation control package. Additional relay protection may be required if testing or operational problems are encountered with this self-contained generation control package. DP&L shall review the interface protection and/or the self-contained protection schemes included with the generation before the unit will be permitted to connect to the DP&L system. The following relay functions are required by the Applicant for protection of the DP&L system. Use of the transfer trip receiver is conditional as set forth below.

Relay	**Purpose**
Frequency	To detect under and over frequency operation and separate the customer's parallel generation.
Under/over voltage	To detect under and over voltage operation and cause separation of the customer's parallel generation.
Transfer Trip Receiver	To receive a trip signal from a DP&L transfer trip transmitter and separate the customer's parallel generation.
Ground Detector	To detect a ground fault on the DP&L or customer system and separate the customer's parallel generation.
Directional Power	To detect a reverse power flow condition and separate the customer's parallel generation.

The purpose of these relays is to detect the Generation Owner's energizing of a DP&L circuit that has been isolated from the DP&L system, by circuit breaker or other disconnect device operations or detect the generation operating at an abnormal voltage or frequency, or to detect a fault or abnormal condition on the DP&L system requiring the Generation Owner to separate their generation from the DP&L system.

Output contacts of these relays shall directly energize the trip coil(s) of the generation breaker or an intermediate auxiliary tripping relay that directly energizes the breaker trip coil(s). The relaying system shall have a power source independent from the ac system or immune to ac system loss or disturbances (e.g., dc battery and charger) to assure proper operation of the protection scheme. Loss of this source shall cause removal of the generation from the DP&L system.

DP&L will specify settings for the generation's DP&L-required relays to ensure coordination between the generation protective equipment and the DP&L system relays. It is the Generation Owner's responsibility to determine that their internal protective equipment coordinates with the required DP&L protective equipment and is adequate to meet all applicable standards. DP&L reserves the right to modify relay settings when deemed necessary.

A transfer trip relaying system (or other not specified above) must be installed at the Generation Owner's expense if DP&L determines it is necessary to protect the Transmission System. The transfer trip relaying system shall consist of all transfer trip transmitters located at DP&L facilities, transfer trip receivers at the Generation Facility and the communication channels between the DP&L location(s) and the Generation Facility.

Also, the Interconnection Customer should be familiar with the PJM Protection System Standards which can be found at the link below.

(http://www.pjm.com/-/media/documents/manuals/m07.ashx