Facilities Study Report

For

Physical Interconnection of

PJM Generation Interconnection Request

Project ID AG1-323

Blue Jacket 138 kV

Revision 0: December 2024

Introduction

This Facilities Study has been prepared in accordance with the PJM Open Access Transmission. The Transmission Owner (TO) is Dayton Power & Light Company d/b/a AES Ohio ("AES Ohio").

The information, conclusions, analyses, studies and recommendations (hereinafter referred to as "Information") contained herein have been prepared by AES Ohio. The Information was developed, in part, based upon information which has not been independently verified or confirmed by AES Ohio. Although AES Ohio has made all commercially reasonable efforts to develop the Information in an accurate manner consistent with the exercise of Good Utility Practice, the user of such Information accepts all risk and liability for the use thereof and agrees to indemnify and hold AES Ohio harmless from any subsequent action related to such use. No guarantees or warranties of any kind, including express or implied warranties of merchantability of fitness are made with respect to the information by AES Ohio, its affiliates, its officers, directors, employees, or agents, who also assume no legal responsibility for the accuracy of the information contained herein. In addition, no liability is assumed, and all liability is expressly disclaimed for negligence or damages of any kind, any decisions, contracts, commitments, obligations or any other actions undertaken or made on the basis of the information contained herein.

A. Transmission Owner Facilities Study Summary

1. PROJECT DESCRIPTION

The Project Developer (PD) has proposed a Solar & Storage Generating Facility located in Bellefontaine, Logan County, Ohio with a designated PJM Project ID of AG1-323. See Attachment 2. The installed facilities will have a total Maximum Facility Output (MFO) of 40 MW with 40 MW of this output being recognized by PJM as Capacity.

This Facility Study assumes that the scope of the physical interconnection identified in the System Impact Study, dated August 2021, has not changed including the Network Upgrades required by PJM Project AE1-092. These Network Upgrades include the addition of a second 138/69 kV transformer and conversion of the 138 kV straight but into a ring. This Facility Study assumes that the DAYr190037 Network Upgrades will be constructed prior to construction of the AG1-323 upgrades.

2. POINT OF INTERCONNECTION (POI)

The Generating Facility will interconnect with the AES Ohio transmission system via a direct connection into the Blue Jacket substation 138 kV ring bus.

The proposed generation interconnection is shown on the single line diagram in Attachment #1.

3. POINT OF CHANGE IN OWNERSHIP

The Point of Change in Ownership will be located at the first dead-end structure outside the Blue Jacket interconnection substation fence line.

4. SCOPE OF PROJECT DEVELOPER INTERCONNECTION FACILITIES

Project Developer will design, build, own, operate and maintain the Project Developer Interconnection Facilities on Project Developer's side of the Point of Change in Ownership (PCO). This includes, but is not limited to:

- 40 MW solar and storage generating facility.
- Main Power Transformer(s) (MPT), Generation step-up (GSU) transformer(s) or final transformation, as applicable.
- Circuit breakers and associated equipment located between the high side of the MPT(s) or GSU(s) and the Point of Change in Ownership.
- Generator lead line from the Generating Facility to the Point of Change in Ownership.
- Protective relaying and telecommunication equipment and system(s) necessary to facilitate AES Ohio status monitoring and supervisory control of the circuit breaker(s) at the interconnection line terminal. Note: 48-count fiber will be installed between the AES Ohio interconnection substation and the Project Developer's collector substation for metering, relaying, monitoring, and remote tripping.
- See Attachment 3 for AES Ohio Generation Connection Requirements.
- See Attachment 4 for AES Ohio Protection Requirements.

AES Ohio requires the Project Developer to utilize all Schweitzer Engineering Laboratories (SEL) relays and related protective equipment for facilities that will be interconnecting or communicating with AES Ohio relaying. AES Ohio reserves the right to specify relays or other protective equipment utilized in the Project Developer's substation as required. All protection system designs shall be reviewed by AES Ohio during the design phase to ensure proper clearing times, coordination, and compliance with applicable NERC regulations and AES Ohio requirements.

B. Transmission Owner Facilities Study Results

The following is a description of the planned Transmission Owner facilities for the physical interconnection of the proposed AG1-323 project to the AES Ohio transmission system. These facilities shall be designed according to AES Ohio's Applicable Technical Requirements and Standards. Once built, AES Ohio will own, operate, and maintain these Facilities on the AES Ohio side of the Point of Change in Ownership.

1. TRANSMISSION OWNER INTERCONNECTION FACILITIES:

The TO Interconnection Facilities will include, but not be limited to, the following.

A 138 kV dead-end structure and foundation outside the fence of the Interconnection Substation to terminate the Project Developer's generator lead line.

A 138 kV take-off structure and foundations within the fence of the Interconnection Substation to support the line conductors from the dead-end structure outside the fence.

Line conductors from the dead-end structure to the take-off structure at the bus position in the switchyard of the interconnection substation.

A fiber optic enclosure and storage reel on the 138 kV dead-end structure outside the fence for termination and splicing of the Project Developer's OPGW.

Major material and equipment items:

Material / Equipment	*Quantity*
138 kV Transmission Line Conductor, 1351.5 kcmil 45/7 ACSR "Dipper"	700 FT
3/8 in 7-Strand EHS Steel Shield Wire	500 FT
138 kV Deadend Steel Take-Off Structure, 1 Bay	1
138 kV Dead-end Steel Monopole Structure	1
Drilled Pier Foundations, Deadend Take-Off Structure (group of piers)	1
Drilled Pier Foundation, Dead-end Structure	1
Fiber Splice Case	1
Fiber Splice Tray	2
Cable Storage, For OPGW Cable, 5ft Loop Diameter	1
Insulators, Connectors, Fittings, Grounding & Misc.	LOT

A geotechnical investigation will be required for the design of the transmission line and structure foundations. Additional studies may also be required.

2. STAND ALONE NETWORK UPGRADES

None.

3. NETWORK UPGRADES

The Network Upgrades will include, but not be limited to, the following.

Expanding existing TO substation:

Blue Jacket, Upgrade

The existing substation, Blue Jacket 138 kV, will be upgraded to interconnect the project with the AES Ohio transmission system.

A future/unused position in the 138 kV ring bus will be used for interconnection of the AG1-323 project. It requires installation of a new 138 kV, 2000A gas circuit breaker in the unused position in the ring. A new 138 kV, 2000A line disconnect switch and 138 kV potential transformers (PTs) will also be installed at the new line take-off structure for this bus position.

A new relay panel for protection and metering of the AG1-323 generation line containing SEL-411L (PRI) and SEL-411L (BU) relays and one (1) SEL-735 meter will be installed in the existing control house.

A 48 strand fiber optic ADSS cable from the splice enclosure on the PCO structure into the control house and a fiber distribution panel in the control house to terminate the ADSS cable will also be installed.

Major material and equipment items:

Material / Equipment	*Quantity*
138 kV Circuit Breaker 2000 A, 40 kA	1
138 kV Disconnect Switch, 2000 A	1
138 kV PT	3

Material / Equipment	*Quantity*
138 kV Surge Arresters	3
138 kV PT Stand, Single Phase	3
138 kV Breaker Foundation (slab)	1
138 kV PT Stand Foundation	3
138 kV Station Post Insulators, High Strength	3
5" SPS AL Bus (Sch 40) with 1351 ACSR Damper	100 FT
1351 AAC Bare Conductor	200 FT
4/0 AAC Bare Conductor	100 FT
Ground Conductor, 4/0 Bare Copper (Soft Drawn)	150 FT
Conduit	LOT
Power and Control Cable	LOT
Line Relay Panel with (2) SEL-411L, (1) SEL-451& (1) SEL-735 Meter	1
ADSS Fiber Optic Cable, 48 Strand	500 FT
Outdoor Junction Box	2
Yard Lights	1
Connectors, Fittings & Misc.	LOT

Upgrades to neighboring facilities:

Review and update as required relay protection settings at remote end of transmission line 13829, Hamilton Substation.

4. OTHER SCOPE OF WORK

None.

5. MILESTONE SCHEDULE FOR COMPLETION OF [TO] WORK

Facilities outlined in this report are estimated to take 49 months to construct, from the time the Generation Interconnection Agreement is fully executed. This schedule may be impacted by the timeline for procurement and installation of long lead items, the ability to obtain outages to construct and test the proposed facilities.

Description	Start month	Finish month
Project Kickoff	1	1
Preliminary Engineering	1	5
Detailed Engineering	5	11

Description	Start month	Finish month
Procure Materials and Equipment	1	42
Permitting	35	41
Construction, non-Outage	42	46
Construction, Outage 1	48	49
Testing & Commissioning, Outage 1	49	49

6. ASSUMPTIONS IN DEVELOPING SCOPE/COST/SCHEDULE

This facility study assumes queue project AE1-092 direct connect upgrades and network upgrades will be constructed and in service prior to the AG1-323 upgrades. The direct connect upgrades required for queue project AE1-092 consist of a greenfield substation (Hamilton Substation) that taps into the Blue Jacket - Kirby 138 kV line, 13829. The network upgrades required for queue project AE1-092 consist of expansion of the Blue Jacket Substation 138kV into a ring bus.

Interconnection Construction Service Agreement or Generation Interconnection Agreement will be executed by the end of October 2025, and the project will start the following month.

Project Developer will be responsible for all expenses to meet the AES Ohio Protection Requirements required for developer to connect to the AES Ohio system.

Project Developer will be responsible for acquiring all new rights-of-way, easements and properties required for the project. The Project Developer will also be responsible for the costs incurred to obtain the necessary state siting approvals, environmental and other permits required to construct the facilities.

AES Ohio will grant overhead easement rights to the Project Developer along a route associated with the alignment of the generator lead line from the PCO structure to AES Ohio's property line.

Outages can be scheduled as planned. Outage starts are based on long lead material availability and are subject to change. Outage durations are based on 5x10s. Note: no outages have been planned or scheduled as of this study date.

Transmission outages are typically not granted from June to September and are discouraged during extreme winter conditions. PJM and AES Ohio require 6 to 12-month notice for greater than 5-day and 30-day outages, respectively.

Project developer will provide location and orientation of their attachment facilities.

No delays due to funding, equipment or material delivery, environmental, regulatory, permitting, real estate, extreme weather, or similar events. Lead times for long lead equipment and material are subject to change. Schedule assumes 168-week lead time for breakers.

No significant sub-surface rock will be encountered during construction, and soil conditions are suitable for standard foundation installations.

Neither foundation nor structural analyses have been performed. Study assumes that no significant foundation or structural issues are present.

Existing AC and DC power systems are adequate for proposed upgrades under normal and emergency conditions. Formal power studies will be conducted during detailed engineering to confirm.

Taxes are not required and have not been included.

7. REVENUE METERING REQUIREMENTS

All revenue metering needed for this interconnection project must meet the metering requirements stated in Appendix 2, section 8 of the AG1-323 GIA, and in PJM Manuals M01 and M14D. The details of applicable revenue metering requirements are given in the 'AES Ohio Interconnection Standards' posted on PJM website.

The revenue metering will be installed on the Project Developer side of the Point of Change in Ownership. It will be installed, owned and maintained by Project Developer and shall be electrically compensated to the Point of Interconnection (the take-off structure inside the Blue Jacket Substation fence). Revenue metering is to include KWH, KVARH and real time data (KW, KVAR) for the Project Developer's generating facility.

Check metering will be installed at the Point of Interconnection and will be owned and maintained by AES Ohio.

8. LAND REQUIREMENTS FOR INTERCONNECTION SUBSTATION

Expansion of the Blue Jacket Substation is not required or planned for this project.

9. ENVIRONMENTAL AND PERMITING

The facility study included an environmental desktop review of the proposed AG1-323 Interconnection Substation location:

40°22'58.13"N 83°45'29.50"W

The environmental desktop review included the following resource agency databases for potential environmental conflicts: U.S. Fish and Wildlife Service (USFWS), U.S. Geological Survey (USGS) National Hydrological Dataset (NHD) and topo maps, Federal Aviation Administration, Federal Emergency Management Agency, Ohio Environmental Protection Agency (Ohio EPA), Ohio Department of Natural Resources (ODNR), and Ohio Power Siting Board (OPSB).

The desktop review indicated no wetlands and no streams are present, limited potential habitat for threatened/endangered species, and no floodplains within the project's Limits of Disturbance (LOD). A field visit and agency consultation are required to confirm no potential Waters of the US, sensitive species habitat, and to complete informal consultation with the USFWS related to the Migratory Bird Treaty Act (MBTA) and Bald And Golden Eagle Protection Act (BGEPA). This documentation will be required for OPSB submission.

USFWS Information for Planning and Consultation (IPaC) determined that "There are likely bald eagles in your project area." An on-site habitat evaluation is recommended to complete informal consultation with the USFWS related to the MBTA and BGEPA. Due to the apparent lack of potential habitat from a desktop review, it is anticipated there will be no effect to bald or golden eagle. Costs have been included for informal consultation with USFWS to confirm no impacts to threatened or endangered species, and no effects to bald or golden eagles.

There appear to be no trees on site, and the site appears to be dominated by shrubs. However, if trees are to be cleared, a survey should be conducted to identify the presence of potentially suitable habitat for listed threatened and endangered bat species. It is recommended that any necessary tree clearing be conducted between October 1st and March 31st to avoid direct impacts to listed bat species.

The proposed project space is anticipated to be less than 1 acre of disturbance (0.4 acres) and will not require an National Pollutant Discharge Elimination System (NPDES) permit. Additionally, the project meets the OPSB criteria for a "Major utility facility" due to design capacity being greater than the 100kV threshold (Section 4906.01 of the Ohio Revised Code). Due to the need for OPSB filing, Cultural and Historic Resource Consultation with State Historic Preservation Office (SHPO) will be required, and consultation with the USFWS and ODNR for threatened and endangered species will be required. Due to the location of this project within the footprint of an existing asset, the proposed project is assumed to not require any additional ROW or driveway

C. APPENDICES

Attachment #1: Single Line Diagram for the Physical Interconnection

Attachment #2: Substation Location Plan

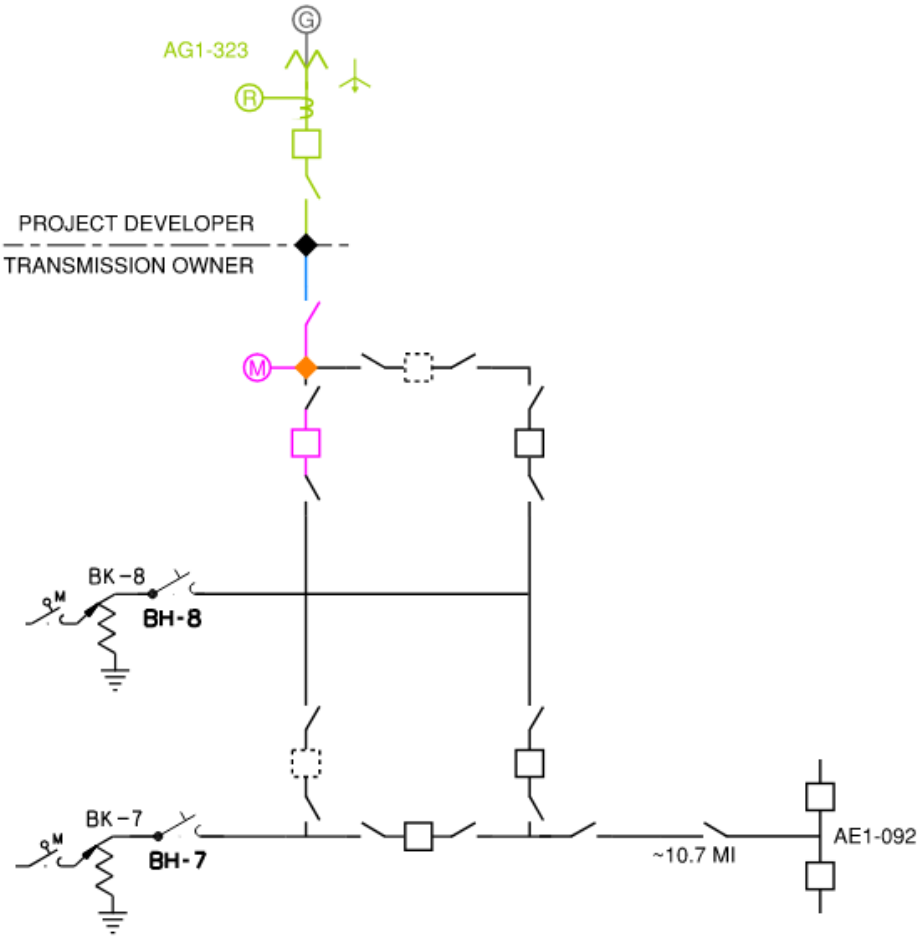
Attachment #3: Generator Connection Requirements

Attachment #4: Protection Requirements

Attachment #1:

Single Line Diagram for the Physical Interconnection

AG1-323 BLUE JACKET 138 KV

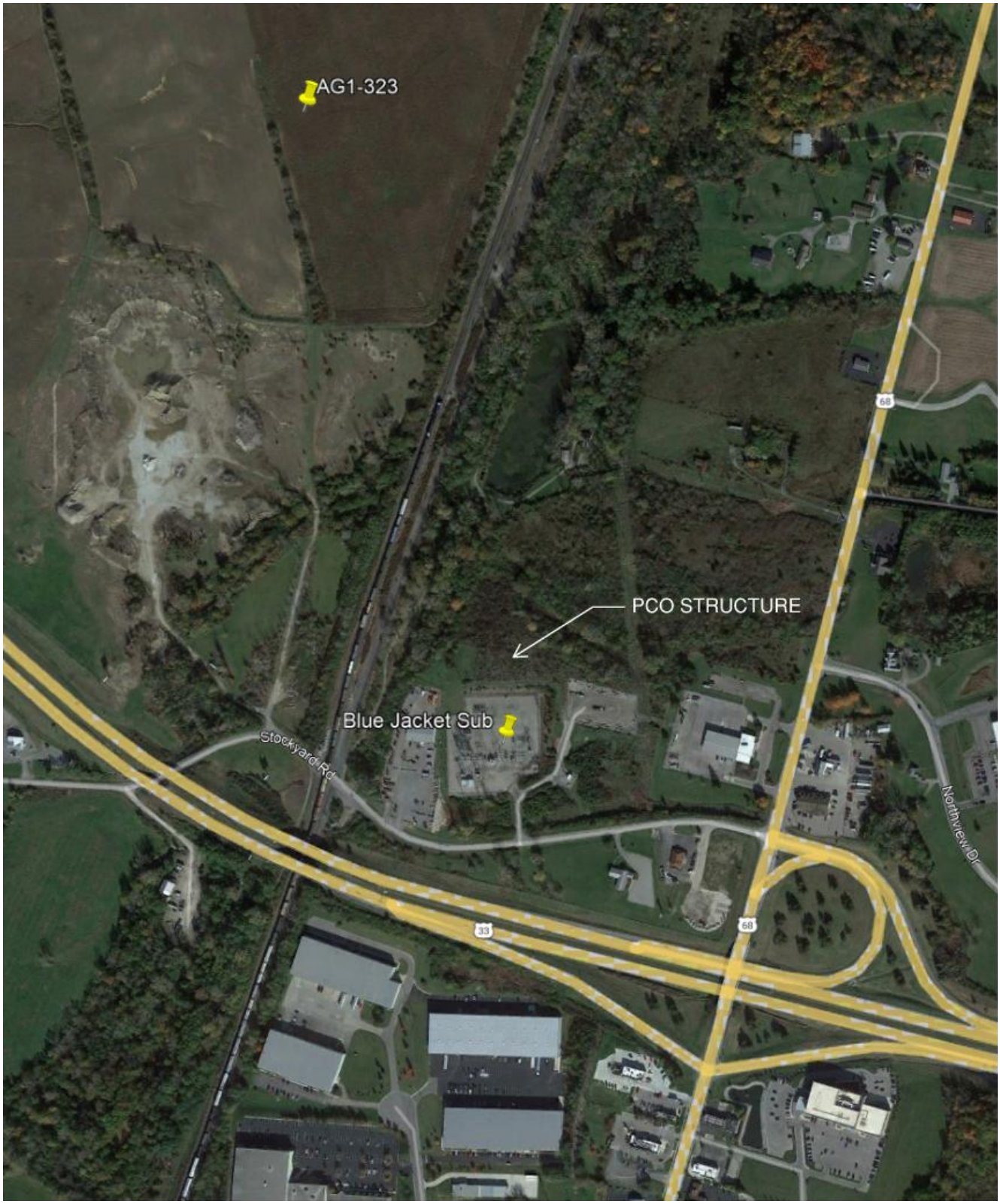


LEGEND

PROJECT DEVELOPER INTERCONNECTION FACILITY	
TRANSMISSION OWNER INTERCONNECTION FACILITY	
STAND-ALONE NETWORK UPGRADE	
NETWORK UPGRADE	
FUTURE UPGRADE	
POINT OF INTERCONNECTION (POI)	
POINT OF CHANGE IN OWNERSHIP (PCO)	
REVENUE METER	Ⓡ

Attachment #2:

Substation Location Plan



Attachment #3:

Generator Connection Requirements

AES Ohio has prepared this “AES Ohio Interconnection Standards” document to ensure compliance with North American Electric Reliability Council (NERC) Reliability Standards and applicable Regional Reliability Organization, sub regional, Power Pool, individual Transmission Owner planning criteria and Facility Interconnection requirements in compliance to NERC Standard FAC-001-3. These connection requirements apply to all generation facilities, transmission facilities, and end-users connecting to the AES Ohio transmission system. The “AES Ohio Interconnection Standards” document can be reviewed utilizing the following link:

https://www.pjm.com/planning/design-engineering/to-tech-standards/private-dayton.aspx

Attachment #4:

Protection Requirements

The Project Developer will be required to comply with all AES Ohio System Relay and Protection Requirements. The System Relay and Protection Requirements may be found within the "AES Ohio Interconnection Standards" which can be reviewed at the following link:

https://www.pjm.com/planning/design-engineering/to-tech-standards/private-dayton.aspx

System Protection and Coordination

Generation facilities, transmission facilities, and end-user facilities connecting to the AES Ohio transmission system are responsible for determining that the proper protective equipment meet all applicable standards, it is properly installed, and it coordinates with AES Ohio 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 Developer must take responsibility for providing adequate system protection to its facilities and to AES Ohio's facilities under any transmission operating condition, whether or not their facilities are in operation. Conditions may include but are not limited to:

1. Single phasing of supply
2. System faults.
3. Equipment failures.
4. Abnormal voltage or frequency.
5. Lightning and switching surges.
6. Excessive harmonic voltages and/or currents.
7. Excessive negative sequence voltages
8. Separation from AES Ohio.
9. Synchronizing of generation to the AES Ohio system

AES Ohio 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 AES Ohio's ability to serve other customers. The criteria for these functional specifications and settings will be based on existing AES Ohio protection practices. AES Ohio reserves the right to specify the type and manufacturer for these protective relays to ensure compatibility with existing relays. AES Ohio will make 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. AES Ohio 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 AES Ohio system. The following relay functions are required from the Project Developer for protection of the AES Ohio 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 AES Ohio transfer trip transmitter and separate the customer's parallel generation.
Ground Detector	To detect a ground fault on the AES Ohio 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 AES Ohio circuit that has been isolated from the AES Ohio 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 AES Ohio system thereby requiring the generation owner to separate their generation from the AES Ohio 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 AES Ohio system.

AES Ohio will specify settings for the generation's AES Ohio -required relays to ensure coordination between the generation protective equipment and the AES Ohio system relays. It is the generation owner's responsibility to determine that their internal protective equipment coordinates with the required AES Ohio protective equipment and is adequate to meet all applicable standards. AES Ohio 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 AES Ohio determines it is necessary to protect the transmission system. The transfer trip relaying system shall consist of all transfer trip transmitters located at AES Ohio facilities, transfer trip receivers at the generation facility and the communication channels between the AES Ohio location(s) and the generation facility.

Project Developer should also 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