Generation Interconnection

Facilities Study Report

for

Queue Project AE2-319

Atlanta 69kV I

66.9 MW Capacity / 100 MW Energy

January 2022

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1 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.

2 General

The Interconnection Customer (IC), has proposed a Solar generating facility located in Pickaway County, Ohio. The installed facilities will have a total capability of 100 MW with 66.9 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is December 31, 2021. This study does not imply a TO commitment to this in-service date.

Queue Number	AE2-319
Project Name	ATLANTA 69KV I
State	Ohio
County	Pickaway
Transmission Owner	Dayton
MFO	100
MWE	100
MWC	66.9
Fuel	Solar
Basecase Study Year	2022

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.

3 Point of Interconnection

AE2-319 will interconnect with the Dayton Power and Light Company d/b/a AES Ohio transmission system via a direct connection into the Atlanta 69 kV substation.

Presently Atlanta Substation consists of two 345 kV line feeds, a 345/69 kV transformer, and a single 69 kV line. Proposed interconnection projects AC1-068, AC1-069, AC1-165, and AC1- 166 will expand the 69kV portion of the Atlanta Substation to a ring bus. The AE2-319 project will require the conversion of the 69kV ring bus to a breaker-and-a-half configuration. Two new 69kV bay positions and 69kV circuit breakers will need to be added in addition to three 345 kV breakers and a second 345/69 kV transformer to connect the AE2-319 project. The last takeoff structure leaving the Atlanta Substation will be designated as the Point of Interconnection (POI). Dayton will own the takeoff structure and all attachment hardware. The Interconnection Customer will own the generator lead line conductor terminating onto the structure.

Under the AE2-319 project, the IC will construct a single 69kV line up to the POI in the Atlanta 69 kV yard.

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

4 Cost Summary

The AE2-319 "Atlanta 69kV I" project is responsible for the following costs:

Description	Total Cost
Attachment Facilities	**$60,000**
Direct Connection Network Upgrades	**$0**
Non-Direct Connection Network Upgrades	**$15,624,714**
Total Costs	**$15,684,714**

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.

Note 2: For customers with System Reinforcements listed: If your present cost allocation to a System Reinforcement indicates $0, then please be aware that as changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, the cost responsibilities can change and a cost allocation may be assigned to your project. In addition, although your present cost allocation to a System Reinforcement is presently $0, your project may need this system reinforcement completed to be deliverable to the PJM system. If your project comes into service prior to completion of the system reinforcement, an interim deliverability study for your project will be required.

5 Transmission Owner Facilities Study Summary

5.1 Description of the Project

The Interconnection Customer (IC), has proposed a solar generating facility located in Pickaway County, Ohio. The installed facilities will have a total capability of 100 MW with 66.9 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is December 31, 2021. AE2-319 will interconnect with the Dayton Power and Light Company d/b/a AES Ohio transmission system via a direct connection into the Atlanta 69 kV substation.

5.2 Point of Interconnection

Presently Atlanta Substation consists of two 345 kV line feeds, a 345/69 kV transformer, and a single 69 kV line. Proposed interconnection projects AC1-068, AC1-069, AC1-165, and AC1- 166 will expand the 69kV portion of the Atlanta Substation to a ring bus. The AE2-319 project will require the conversion of the 69kV ring bus to a breaker-and-a-half configuration. Two new 69kV bay positions and 69kV circuit breakers will need to be added in addition to three 345 kV breakers and a second 345/69 kV transformer to connect the AE2-319 project. The last takeoff structure leaving the Atlanta Substation will be designated as the Point of Interconnection (POI). Dayton will own the takeoff structure and all attachment hardware. The Interconnection Customer will own the generator lead line conductor terminating onto the structure.

Under the AE2-319 project, the IC will construct a single 69kV line up to the POI in the Atlanta 69 kV yard.

5.3 Amendments to the Original System Impact Study Results

Below are the results of the network upgrades identified in the AE2-319 System Impact Study Report and their associated reinforcements. The results of the Impact Study are predicated on a 2022 transmission system based upon PJM's best assumptions at the present time for load growth and connection of proposed new generation additions.

1. **09ADKINS 345.0 kV - 05BEATTY 345.0 kV Ckt 1**

   PJM Retooled the analysis and determined that this facility is no longer overloaded as a result of the AE2-319 project. No upgrade required.

2. **Overload on the Atlanta 345/69 kV transformer and to mitigate the voltage collpase/instability for the loss of the Atlanta 345/69 kV transformer**

   This upgrade is required and is further explained in this Facilities Study Report - Install 2nd Atlanta 250 MVA 345/69kV transformer, a three breaker 345kV ring bus, and 69V circuit breaker for the connection of the transformer.

3. **Overload on the New Holland – Robinson 69 kV line**

   This upgrade is required and is further explained in this Facilities Study Report - Replace the 1200A wave trap at Robinson Substation with a new 2000A wave trap. The AE2-319 project will be initially responsible

for 100% of the identified network upgrade cost. This cost will be reimbursed to the AE2-319 project when prior Interconnection Customers decide to move forward with their projects.

Stability Analysis:

1. **PJM completed the stability analysis and determined the following that the AE2-319 project is responsible for the following:**

   It was found that AE2-319 might be tripped by frequency relays when the fault occurs at AE2-319 POI. These faults were retested with frequency relays disabled and the simulation results indicate that the system remains stable.

   It was also found that AE2-319 was tripped by its undervoltage relay for several P4 events due to the long fault clearing time. The undervoltage protection tripping time needs to be increased to 0.6 second from 0.3 second for the undervoltage relay 94319406, which resolves the issue.

   Please also note that the project AE2-319 does not meet the 0.95 leading and lagging reactive power requirement at the high side of the facility main transformer. It requires additional 4.14 MVar capacitive reactive power.

5.4 Interconnection Customer's Submitted Milestone Schedule

The IC's proposed Commercial Operation Date (COD) for the generation facility is December 31, 2021.

A **36-month** schedule has been developed for DP&L d/b/a AES Ohio 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.

After the completion of the Facilities Study Report, the Interconnection customer provided the following milestone dates which are reflected in the final Interconnection Service Agreement:

6.3 Substantial Site work completed. On or before **May 31, 2024** Interconnection Customer must demonstrate completion of at least 20% of project site construction. At this time, Interconnection Customer must submit to Interconnected Transmission Owner and Transmission Provider initial drawings, certified by a professional engineer, of the Customer Interconnection Facilities.

6.4 Delivery of major electrical equipment. On or before **April 30, 2024**, Interconnection Customer must demonstrate that all generating units have been delivered to Interconnection Customer's project site.

6.5 Commercial Operation. On or before **December 31, 2024**, Interconnection Customer must demonstrate commercial operation of all generating units. Demonstrating commercial operation includes achieving Initial Operation in accordance with Section 1.4 of Appendix 2 to this ISA and making commercial sales or use of energy, as well as, if applicable, obtaining capacity qualification in accordance with the requirements of the Reliability Assurance Agreement Among Load Serving Entities in the PJM Region.

5.5 Scope of Customer's Work

The IC will install a total of 100 MW of solar generation in Pickaway County, Ohio as part of the AE2-319 project. 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 a 69 kV line up to the Point of Interconnection (POI). The last 69kV takeoff structure leaving the Atlanta 69kV substation serve as the POI. Dayton Power and Light d/b/a AES Ohio will own the structure and associated hardware while the IC will own the conductor to the connection point as shown in Attachment 1.

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 will be made via the addition of two new 69 kV breaker and a half bay in the Atlanta 69kV substation along with three new 345kV breakers and a second 69/345kV transformer. The 69 kV generator lead line will be constructed by the developer as noted above and will be terminated onto the 69 kV takeoff structure leaving the Atlanta 69kV substation. Dayton will install the line relaying, communications, and interconnection metering to accommodate the interconnection of the AE2- 319 generator.

The 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 1.

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

5.6 Description of Facilities Included in the Facilities Study

5.6.1 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. This work is primarily for engineering drawing review. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
69kV Revenue Metering	**$60,000**
DP&L d/b/a AES Ohio requires the IC to build the lead line up to the POI which is the takeoff structure leaving the AES Ohio owned sub)	**$0**
Total Attachment Cost Estimate	**$60,000**

5.6.2 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
None	**$0**
Total Direct Connection Facility Costs	**$0**

5.6.3 Non-Direct Connection Network/Local Upgrades

The scope of work at Dayton's Atlanta Substation involves conversion of the 69kV ring bus installed to interconnect AC1-068, AC1-069, AC1-165, and AC1- 166, to a three-bay breaker and a half configuration and the installation of revenue class 69 kV metering, fiber line relaying, updated protection, and an RTU to interconnect the AE2-319 generator. In addition, three new 345 kV breakers and a second 69/345 kV transformer will also need to be added to connect the AE2-319 project. There will also be transmission line re-routing costs to accommodate the AE2-319 generator.

The total preliminary cost estimate for the Non-Direct Connection work is given in the table below. These costs do not include CIAC.

Description	Total Cost
Convert 69kV ring bus to 3 bay breaker and a half configuration along with a second 69/345kV transformer and three 345kV breakers. This will include the installation of all physical structures, P&C equipment, communications equipment, metering equipment, and associated facilities.	**$14,885,789**

Description	Total Cost
T-Line Re Routing Costs at the Atlanta 69kV Substation	**$723,925.00**
Review Protection and Control Settings at the Atlanta 69kV substation	**$15,000**
Robinson 69kV substation – Replace the 1200 amp wave trap with a 2000 amp wave trap. PJM Network Upgrade Number n5456.	**$40,000**
Total Non-Direct Connection Facility Costs	**$15,664,714**

5.7 Total Costs of Transmission Owner Facilities included in Facilities Study

Description	NUN	Total Cost without Tax
Attachment Facilities		
69kV Revenue Metering		**$60,000**
(DP&L d/b/a AES Ohio requires the IC to build the lead line up to the POI which is the takeoff structure leaving the AES Ohio owned sub)		**$0**
Direct Connection Network Upgrades		
None		**$0**
Non-Direct Connection Network Upgrades		
Convert 69kV ring bus to 3 bay breaker and a half configuration along with a second 69/345kV transformer and three 345kV breakers. This will include the installation of all physical structures, P&C equipment, communications equipment, metering equipment, and associated facilities.		**$14,885,789**
T-Line Re Routing Costs at the Atlanta 69kV Substation		**$723,925.00**
Review Protection and Control Settings at the Atlanta 69kV substation		**$15,000**
Robinson 69kV substation – Replace the 1200 amp wave trap with a 2000 amp wave trap. PJM Network Upgrade Number n5456.		**$40,000**
Total Costs		**$ 15,724,714**

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 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.

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

A proposed eighteen **(36)-month** schedule for Dayton's network upgrade 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. It should also be noted that existing units (AC1-068, AC1-069, AC1-165, and AC1- 166) will need to be offline for extended periods of times to accommodate the construction of this project.

Activity Schedule	Start Month	End Month
Preliminary Engineering	1	5
Detailed Engineering	5	11
Equipment Procurement – Delivery	11	20
Above Grade Construction	20	32
Testing & Commissioning	32	36

5.8.1 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 AE2-319 interconnection point when the units are out-of-service. This assumes the intent of the IC is to net the generation with the load.

5.8.2 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 require 6 to 12-month notice for greater than 5-day and 30-day outages respectively.
- IC provides location and orientation of their attachment facilities.
- No extreme weather.
- No force majeure.

5.8.3 Darby Plant Stability Restriction

Purpose: To provide Instructions to PJM Dispatch, AEP, Generation Owner, and Darby plant regarding operating restrictions of Darby unit's during a forced or planned outage of either the Atlanta-Stuart 345 kV line

or the Beatty-Adkins 345 kV line or the outage of one of the 345/69kV transformers at Atlanta. The intent is to ensure Darby Transient Stability while the Plant is operating more than two units until transmission network modifications are implemented to address transient stability violation. The Darby plant is limited to two units during a forced or planned outage of either the Atlanta-Stuart 345 kV line or the Beatty-Adkins 345 kV line, or the outage of one of the Atlanta 345/69kV transformer in order to ensure the Darby plant is transiently stable.

5.8.4 Procedure for the forced outage scenario.

More than two Darby CT's are on-line and either the Atlanta-Stuart or Beatty-Adkins 345 kV transmission line or at least one of the two 345/69kV transformer trips out-of-service.

1. PJM instructs Darby plant to remove unit(s), so that only two units remain on-line. Restriction is not unit specific, hence any two CTs can remain on-line.

2. Darby plant will determine which unit(s) to trip and will initiate a controlled shut-down of selected units to occur within 15 minutes.

3. The Generation Owner (based on the plant determination) will notify PJM Generation Dispatch which units are coming offline.

5.8.5 Procedure for the planned outage scenario

1. Atlanta-Stuart 345 kV line or Beatty-Adkins 345 kV line or at least one of the two 69/345kV transformer is scheduled to be out-of-service.
2. AEP or Dayton Power & Light ("AES Ohio") submits a planned outage to PJM, for the Atlanta-Stuart 345 kV line or the Beatty-Adkins 345 kV line or at least one of the two 345/69kV transformers.
3. PJM eDART will send an automated notification, if subscribed to the Generation Owner (once when outage is received and a second time three days prior to the outage start date) informing them of an outage timeframe.
4. Darby plant will be limited to two CT's for duration of the outage.
5. PJM will document Darby limitation in eDART and provide the limitation to the Day Ahead Markets.
6. The Generation Owner to communicate the restriction to the Darby plant.

With the new AE2-319 generator, only two Darby units will be kept online and AC1-068, AC1-069, AC1-165, AC1-166 and AE2-319 will be curtailed in that order. Further, PJM will need to update Manual 03 to reflect the changes to the existing operating procedure.

6 Transmission Owner Facilities Study Results

6.1 Transmission Lines – New

None

6.2 Transmission Lines – Upgrades

None

6.3 New Substation / Substation Facilities

None

6.4 Upgrades to Substation / Substation Facilities

- A new 69 kV breaker at the Atlanta 69kV substation to interconnect the AE2-319 queue generator.
- Review Protection and Control Settings at the Atlanta 69kV substation.
- The following equipment will be required to add the AE2-319 queue project:
    - 69 kV Disconnect Switches
    - 69 kV Fiber Line and Transfer Trip Relays
    - (5) 69 kV Gas Circuit Breakers
    - (3) 345 kV Gas Circuit Breakers
    - (1) 345/69 kV Transformer
    - 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 Expansion including Grading
    - Foundational Work for New Equipment

Note: The interconnecting generator will be required to curtail for outages to the Atlanta-Stuart 345 kV line or Beatty-Adkins 345 kV line or the outage of at least one of the 345/69 kV Atlanta Transformers as noted above.

- Robinson 69kV substation – Replace the 1200 amp wave trap with a 2000 amp wave trap. PJM Network Upgrade Number n5456.

6.5 Metering and Communications

6.5.1 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 Sections 24.1 and 24.2.

IC will be responsible for designing, furnishing, and installing Supervisory Control and Data Acquisition (SCADA) RTU equipment in its generation substation, and for obtaining the telecommunication circuits and data transfer from the RTU to the Transmission Owner Data Center.

6.5.2 Transmission Owner (Dayton) Requirements

The Interconnection Customer will be required to comply with all Dayton d/b/a AES Ohio 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 AE2-319 generator as shown in **Attachment 1**.

6.6 Environmental, Real Estate and Permitting Issues

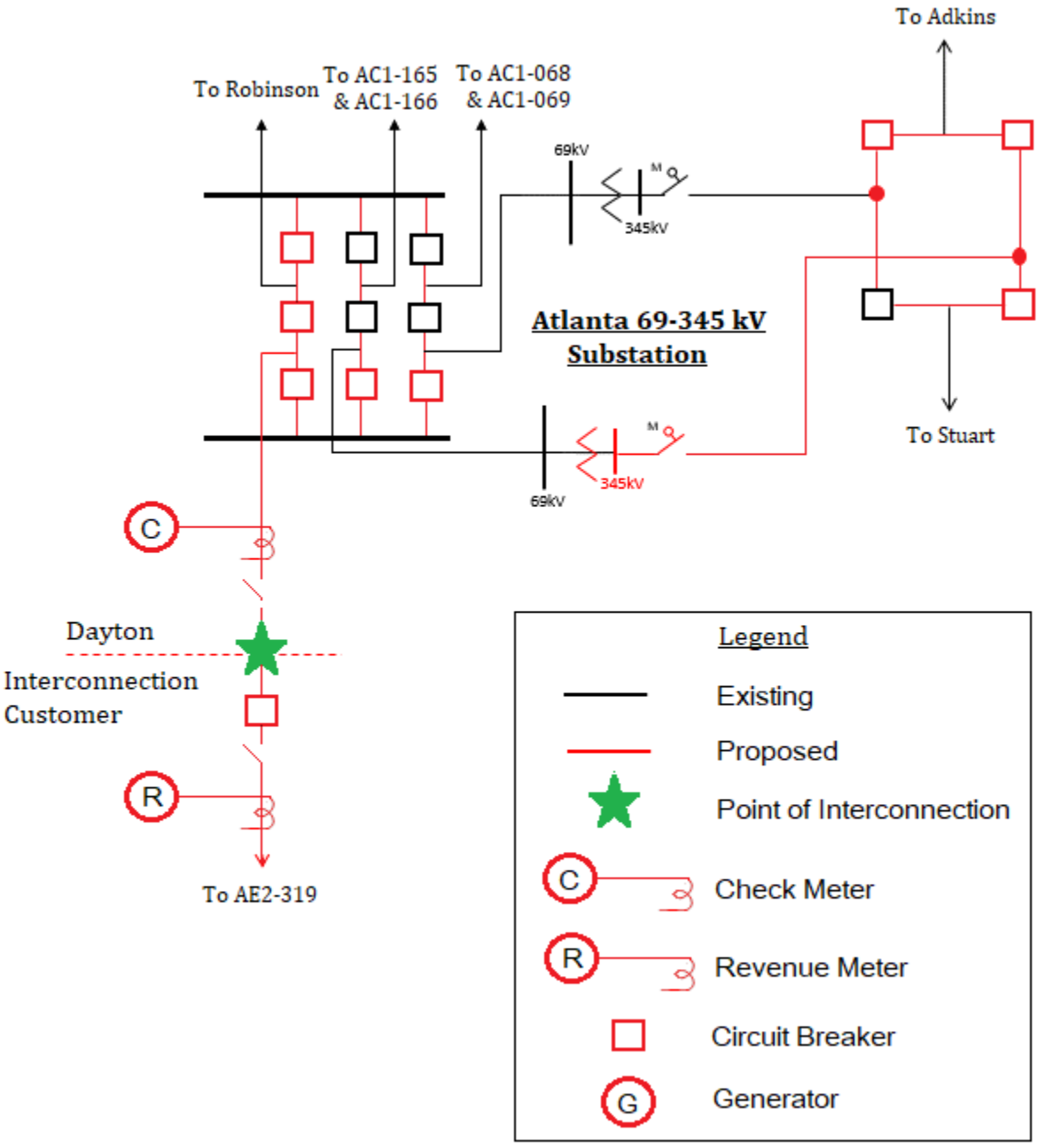
The IC will be responsible for acquiring all rights-of-way, easements, properties, vegetation clearing, environmental, state siting approvals, and municipal permits that may be required to construct all attachment facilities, up to the POI shown in the one-line diagram in Attachment 1. The IC will be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

6.7 Information Required for Interconnection Service Agreement

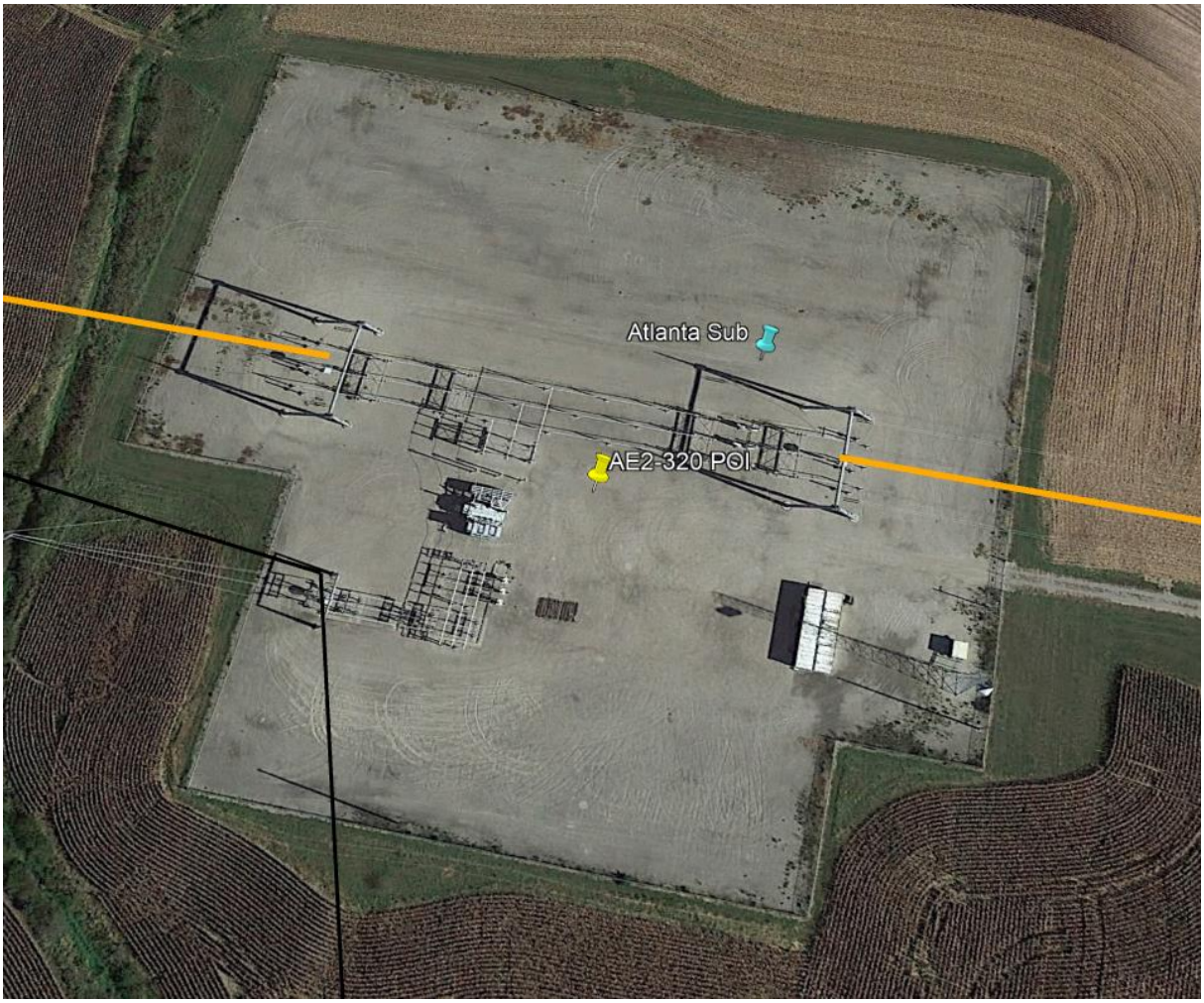
The following table summarizes the total estimated costs according to FERC criteria. The estimated costs are in **2020 dollars.** The taxes are a CIAC (Contribution in Aid of Construction) Federal Income Tax Gross Up charge. This tax may or may not be charged based on whether this project meets eligibility requirements of IRS Notice 88-129. This tax is not included in the table below.

Description	Direct Labor	Direct Material	Indirect Labor	Indirect Material
Attachment Facilities				
69kV Revenue Metering	**$25,452**	**$28,191**	**$3,915**	**$2,442**
(DP&L d/b/a AES Ohio requires the IC to build the lead line up to the POI which is the takeoff structure leaving the AES Ohio owned sub)				
Direct Connection Network Upgrades				
None	**$0**	**$0**	**$0**	**$0**
Non-Direct Connection Network Upgrades				
Convert 69kV ring bus to 3 bay breaker and a half configuration. This will include the installation of all physical structures, P&C equipment, communications equipment, metering equipment, and associated facilities.	**$5,805,457.71**	**$6,698,605.05**	**$893,147.34**	**$1,488,578.90**
T-Line Re Routing Costs at the Atlanta 69kV Substation	**$542,943.62**	**$2,533.74**	**$173,741.96**	**$4,705.68**
Review Protection and Control Settings at the Atlanta 69kV substation	**$10,000**		**$5,000**	
Robinson 69kV substation – Replace the 1200 amp wave trap with a 2000 amp wave trap. PJM Network Upgrade Number n5456.	**$10,000**	**$10,000**	**$10,000**	**$10,000**
Total Costs	**$6,393,853**	**$6,739,330**	**$1,085,804**	**$1,505,727**

7 Attachment 1: One Line Diagram



8 Attachment 2 – Project Location



9 Attachment 3

9.1 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

10 Attachment 4

10.1 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