Generation Interconnection

Facilities Study Report

For

Queue Project AE1-100

Axton 138 kV

Henry County, Virginia

66 MW Energy / 41.9 MW Capacity

October 2021

1 Facilities Study Summary

1.1 Project Description

Caden Energix Axton, LLC proposes to install PJM project AE1-100, a 66 MW (41.9 MW Capacity) Solar generating facility in Henry County, Virginia (Figure 2). The point of interconnection for the generating facility will be a direct connection to the Axton 138 kV Station.

1.2 Amendments/Changes to the Impact Study Report

No significant amendments/changes noted.

1.3 Interconnection Customer Schedule

PJM and AEP understand that the Interconnection Customer (IC) has requested the following schedule dates:

Receive back feed power from AEP: 4/1/2022

Generation Commercial Operation Date: 6/1/2022

1.4 AEP's Scope of Work to Facilitate Interconnection

- AEP's Axton 138 kV Station will be expanded by extending the (south) 138 kV Bus #1 and installing two (2) new 138 kV circuit breakers.
- Associated protection and control equipment, line risers, switches, jumpers, SCADA, and 138 kV revenue metering will also be installed at the Axton 138 kV Station. AEP reserves the right to specify the final acceptable configuration considering design practices, future expansion, and compliance requirements.
- AEP will extend three consecutive spans of 138 kV transmission line for the generation lead going to the AE1-100 site, to a point after the generation lead crosses the Axton-Danville 138 kV circuit 2. AEP will build and own the first three transmission line structures outside of the Axton 138 kV Station fence to which the AEP conductor spans will attach. The AE1-100 transmission line conductors will attach to the last of the three AEP-owned structures, constituting the POI.
- Two fiber connections are required. AEP will extend the fiber-optic cables from the Axton 138 kV Station control house to the points of transition. The customer will be responsible for the fiber work on the IPP side of the points of transition
- AEP will review the protection and control settings at the Axton 138 kV Station and adjust as needed.

1.5 Description of Transmission Owner Facilities Included in the Facilities Study

1.5.1 Direct Connection Work

- AEP will extend the south 138 kV Bus #1 and install two (2) additional 138 kV circuit breakers and one line connection for the IPP at the Axton 138 kV Station.
- AEP will install associated line protection and control equipment, line risers, switches, jumpers, and SCADA at the Axton 138 kV Station.

1.5.2 Non-Direct Connection Work

- AEP will review the protection and control settings at the Axton 138 kV Station and adjust as needed.
- AEP will perform a protection and controls checkout including end-to-end testing.

1.5.3 Attachment Facilities Work

- Two fiber connections are required. AEP will extend the fiber-optic cables from the Axton 138 kV Station control house to the points of transition. The customer will be responsible for the fiber work on the IPP side of the points of transition.
- AEP will install 138 kV revenue metering at the Axton 138 kV Station.
- AEP will extend three consecutive spans of 138 kV transmission line for the generation lead going to the AE1-100 site, to a point after the generation lead crosses the Axton-Danville 138 kV circuit 2. AEP will build and own the first three transmission line structures outside of the Axton 138 kV Station fence to which the AEP conductor spans will attach. The AE1-100 transmission line conductors will attach to the last of the three AEP-owned structures, constituting the POI.

1.5.4 Network Upgrade Work

Due to system overloads found during the PJM studies, the following network reinforcements are required:

- None

1.6 Total Cost of Transmission Owner Facilities Included in the Facilities Study:

Attachment Facilities	$2,393,597.01
Direct Connection Facilities	$0
Non-Direct Connection Facilities	$1,412,180.99
Network Upgrade Facilities	$
Total Cost	$3,805,778.00

The estimates do not include the impact that delays in obtaining ROW, permits, or other approvals may have.

1.7 Summary of Schedule Milestones for Completion of Transmission Owner Work Included in Facilities Study:

Standard Process

Task	Dates
Engineering Start	Q4 2021
Material Ordered	Q4 2022
Construction Start (Grading & Below Grade)	Q2 2023
Construction Start (Above Grade)	Q3 2023
Outage Requests Made By	Q2 2022
Outage (Structure Foundations)	Q3 2023
Outage (Interconnection & Testing)	Q4 2023
Ready For Back Feed (TO In-Service Date)	11/09/2023
In-Service Date	12/07/2023

Assumptions

- **ISA and ICSA executed by 10/15/2021**
- **Estimates provided are based on a table top process without the benefit of the results of site specific engineering studies (e.g., soil borings, environmental survey, ground grid, etc.), unless otherwise provided by the interconnection customer.**
- **The customer will comply with requirements as documented in** https://www.pjm.com/-/media/planning/plan-standards/private-aep/aep-interconnection-requirements.ashx
- **System conditions must allow scheduled outages to occur. All transmission outages are subject to PJM and AEP Operations BES outage scheduling requirements.**
- **The customer will perform site development and road construction in accordance with AEP specifications as required for this interconnection.**
- **The customer will provide any required additional easements for the 138 kV station and line work to enable access to all facilities and structures.**
- **The customer will have their construction and required checkout complete prior to the start of the interconnection to the Axton 138 kV Station and any required testing outages.**

2 Transmission Owner Facilities Study Results

2.1 Transmission Lines - New

- AEP will extend three consecutive spans of 138 kV transmission line for the generation lead going to the AE1-100 site, to a point after the generation lead crosses the Axton-Danville 138 kV circuit 2. AEP will build and own the first three transmission line structures outside of the Axton 138 kV Station fence to which the AEP conductor spans will attach. The AE1-100 transmission line conductors will attach to the last of the three AEP-owned structures, constituting the POI.

2.2 Transmission Line - Upgrades

- No transmission line upgrades will be required for this project.

2.3 Station Facilities - New

- No new station facilities will be required for this project.

2.4 Station Facilities - Upgrades

- AEP will expand the existing Axton 138 kV Station by extending the south 138 kV Bus #1 and installing two (2) additional circuit breakers to create a new connection point for the generation lead going to the PJM project AE1-100.
- Associated protection and control equipment, line risers, switches, jumpers, SCADA, and 138 kV revenue metering will also be installed at the Axton 138 kV Station. AEP reserves the right to specify the final acceptable configuration considering design practices, future expansion, and compliance requirements.
- Nearby protective relay settings for the remainder of the Axton 138 kV Station will be reviewed and updated (as needed) to account for the addition of the AE1-100 generation source.

2.5 Metering & Communications

Standard 138 kV metering will be installed at the Axton 138 kV Station. A standard station communication scheme will be used. All metering equipment shall meet the requirements as specified by AEP in the 'AEP Metering and Telemetering Requirements for AEP Transmission Customers' document (SS-490011). Communication requirements are published in the 'AEP SCADA RTU Requirements at Transmission Interconnection Facilities' (SS-500000).

Two fiber connections are required. AEP will extend the fiber-optic cables from the Axton 138 kV Station control house to the points of transition. The customer will be responsible for the fiber work on the IPP side of the points of transition.

The Generation Interconnection Agreement does not in or by itself establish a requirement for American Electric Power to provide power for consumption at the developer's facilities. A separate agreement must be reached with the local utility that provides service in the area to ensure that infrastructure is in place to meet this demand and proper metering equipment is installed. The metering work described above and the associated cost estimates indicated below do not include any potential work or cost to address metering requirements of the local service provider. It is the responsibility of the developer to contact the local service provider to obtain a local service agreement. This is required prior to energization.

2.6 Environmental, Real Estate, and Permitting Issues

The Interconnection customer is expected to obtain, at its cost, all necessary permits and provisions for the IPP station connecting to the Axton 138 kV Station.

2.7 System Modeling and Operating Requirements

In addition to the IPP modeling requirements imposed by PJM as part of the Generation Interconnection process, the following system modeling parameters are required to be supplied by the Interconnection Customer to AEP:

- None

2.8 Summary of Results of Study

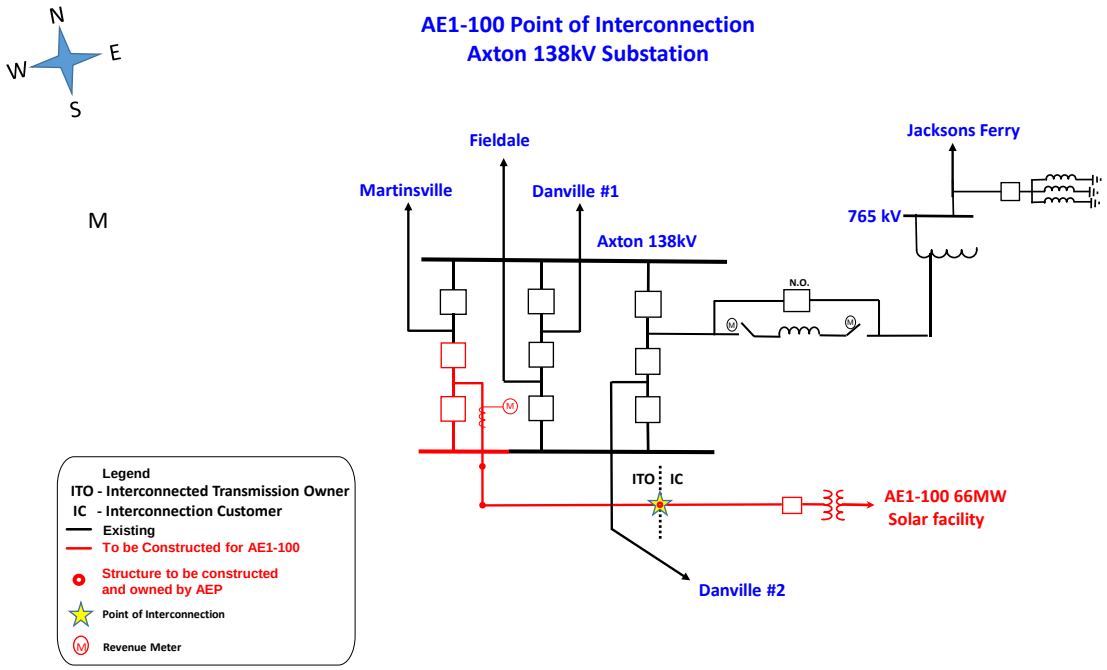
Cost Estimates for AEP

Task	Network Upgrade Number	Engineering	Material	Construction	Other	TOTAL
Axton Station Work	N7671.2	$103,058.33	$663,040.33	$446,828.33	$199,254.00	**$1,412,180.99**
Axton – Caden Energix TLine	N7671.2	$286,604.00	$272,991.00	$1,116,829.00	$238,544.00	**$1,914,968.00**
Axton – Caden Energix Fiber	N7671.1	$15,526.67	$24,280.67	$96,810.67	$24,212.00	**$160,830.01**
138 kV Revenue Metering	N7671.1	$35,163.00	$101,870.00	$124,003.00	$56,763.00	**$317,799.00**
TOTAL		**$440,352.00e**	**$1,062,182.00**	**$1,784,471.00**	**$518,773.00**	**$3,805,778.00**

2.9 Information Required for Interconnection Service Agreement

Description	DCF Facility	NUF Facility	ATF Facility	TOTAL
Direct Material	$663,040.33	$0.00	$399,141.67	$1,062,182.00
Direct Labor	$549,886.66	$0.00	$1,674,936.34	$2,224,823.01
Indirect Material	$108,921.18	$0.00	$124,612.41	$233,533.59
Indirect Labor	$90,332.82	$0.00	$194,906.59	$285,239.41
TOTAL	**$1,412,180.99**	**$0.00 e**	**$2,393,597.01**	**$3,805,778.00**

Figure 1: Point of Interconnection One-Line Diagram



The Point of Interconnection ("POI") is at the third 138 kV structure outside the AEP Axton station, which will be the first structure east of the Axton-Danville 138 kV circuit 2. AEP will build and own the first three transmission line structures outside of the Axton 138 kV Station fence, to which the AEP conductor spans will attach. The AE1-100 transmission line conductors will also attach to the last of the three AEP-owned structures, constituting the POI. Caden Energix Axton, LLC owns the span connecting to the POI from the east, and the 138kV generator lead line and remaining structures back to the AE1-100 generation collector station.

Figure 2: Point of Interconnection Map