Phase 2 Facilities Study Report

For

Physical Interconnection of

PJM Generation Interconnection Request

Project Identifier AG1-410

"Maddox Creek - RP Mone 345 kV"

Revision 0: December 2024

Introduction

This Facilities Study has been prepared in accordance with the PJM Open Access Transmission Tariff, as well as the Application and Studies Agreement between the Project Developer and PJM Interconnection, LLC (PJM or Transmission Provider (TP)). The Transmission Owner (TO) is to be Ohio Power Company abbreviated in the remainder of this report as OHPCo. Additional scope will be required by AEP Ohio Transmission Company Inc. to be abbreviated as OHTCo.

A. Transmission Owner Facilities Study Summary

1. PROJECT DESCRIPTION

The Project Developer has proposed a Solar Generating Facility located in Van Wert County, Ohio. The installed facilities for AG1-410 will have a total Maximum Facility Output (MFO) of 300 MW with 180 MW of this output being recognized by PJM as Capacity.

2. POINTS OF INTERCONNECTION AND CHANGE IN OWNERSHIP

The Generating Facility will interconnect with the American Electric Power (AEP) transmission system via a newly constructed, OHPCo owned, AG1-410 proposed, 345 kV station (name TBD) tapping the Maddox Creek - RP Mone 345 kV line, approximately 2.85 miles from the Maddox Creek 345 kV Station and 6.43 miles from the RP Mone 345 kV Station.

The Point of Interconnection (POI) is the point where the risers connect the generation lead circuit to the OHPCo 345 kV station line termination point. The Point of Change in Ownership (PCO) will be located at the first structure in the generation lead circuit outside of the proposed OHPCo 345 kV Station fence. OHPCo will own the span from the proposed OHPCo 345 kV Station to the AEP constructed and owned dead end PCO structure, including the jumpers. The Project Developer will own the other span connecting to the PCO structure, along with the remainder of the 345 kV generation lead transmission line and associated structures back to the AG1-410 generation collector substation.

The construction of the new interconnection substation will split the existing Maddox Creek - RP Mone 345 kV circuit into two lines on the transmission system.

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

3. SCOPE OF PROJECT DEVELOPER INTERCONNECTION FACILITIES

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

- Main Power Transformer(s) (MPT(s))
- Circuit breakers and associated equipment located between the high side of the MPT(s) and the Point of Change in Ownership
- Generation lead line conductors from the Generating Facility to the Point of Change in Ownership

- Relay and protective equipment and Telecommunications Equipment including Supervisory Control and Data Acquisition (SCADA) to comply with the TO's Applicable Technical Requirements and Standards
- **Installation of the submetering equipment listed in section B3 of this report.**
- **Instrument transformers required to provide revenue quality metering and settlement between the AG1-411 project and any previous/originating projects interconnecting behind the same Point of Change in Ownership.**
- **Additional fiber-optic cable connections required between the below-proposed ethernet switch (to be installed at the AG1-411 project collector station) and the primary router (either installed or to be installed at the originating project collector station) for metering data transport.**

B. Transmission Owner Facilities Study Results

The following is a description of the Transmission Owner facilities required for physical interconnection of the proposed AG1-410 project to the AEP transmission system. These facilities shall be designed according to AEP standards. Once built, AEP will own, operate, and maintain these Facilities.

1. INTERCONNECTION SUBSTATION (NEW) (Stand Alone Network Upgrade)

OHPCo will construct a new 345 kV ring bus station, initially populated with three (3) circuit breakers, expandable to four (4) circuit breakers. This typical arrangement is planned to be designed to accommodate 3000 A of continuous current. The station will be constructed to the south of the Maddox Creek - RP Mone 345 kV Circuit to interconnect the project with the AEP transmission system. **Major equipment is expected to include:**

- Three (3) 63 kA circuit breakers with associated control relaying.
- One (1) 16' x 48' Drop-In Control Module (DICM).
- Six (6) motorized breaker disconnect switches.
- Two (2) 3-phase coupling capacitor voltage transformers (CCVT), one (1) each on the line exits to the Maddox Creek and RP Mone 345 kV Stations.
- Two (2) single phase station service voltage transformers (SSVT).
- Two (2) A-Frame line exit structures, one (1) each for the line exits to the Maddox Creek and RP Mone 345 kV Stations.
- Two (2) single phase line traps for the line exit to the RP Mone 345 kV Station.
- Associated conductors (buswork, ground grid, jumpers), telecom terminal equipment, insulators, arresters, foundations, and structures.
- A fiber-based Integrated Communications Optical Network Multiplexor (ICON MUX) dual current differential line protective relay scheme for the line to the Maddox Creek 345 kV Station.
- A Directional Comparison Blocking (DCB) protective relay scheme for the line exit to the RP Mone 345 kV Station.

The civil work required to develop a site that accommodates the installation of the above station includes grading of a 460' x 350' pad.

2. TRANSMISSION LINE TIE-IN

OHPCo will tie the proposed AG1-410 345 kV station into the existing Maddox Creek - RP Mone 345 kV Circuit by completing the following construction tasks:

- OHPCo will install two (2) steel, 150' single circuit, single pole dead end structures on concrete piers with anchor bolt cages in the existing Maddox Creek - RP Mone 345 kV Circuit Right of Way, two (2) additional steel, single circuit, single pole, dead end structures on concrete piers with anchor bolt cages along the perimeter of the proposed AG1-410 345 kV station, and four (4) spans of double bundle ACSR 954 (Cardinal) transmission line conductor with 96 Fiber OPGW shield wire, cutting in the proposed AG1-410 345 kV station in an in-and-out arrangement.

3. TRANSMISSION OWNER INTERCONNECTION FACILITIES:

The OHPCo Interconnection Facilities will include but are not limited to the following:

Please see Section 8.1, bullet #4 and Section 9 for submetering requirements.

- Installation of one (1) new steel, 150', single circuit, single pole dead end structure on a concrete pier foundation with an anchor bolt cage and one span of ACSR 336.4 (Oriole) transmission line conductor with 7#8 Alumoweld shield wire for the generation lead circuit extending from the proposed AG1-410 345 kV station.
- Extension of two (2) underground 96 count all dielectric loose tube (ADLT) fiber optic cables from the proposed AG1-410 345 kV station control house to fiber demarcation splice boxes to support direct fiber relaying between the proposed AG1-410 345 kV and Project Developer's collector stations. The Project Developer will be responsible for the fiber extension from the splice boxes to the collector station.
- Installation of a standard revenue metering package, including three (3) single phase current transformers (CT), three (3) single phase coupling capacitor voltage transformers (CCVT), associated structures and foundations, one (1) ethernet switch, and one (1) DICM-installed metering panel, for the generation lead circuit at the proposed AG1-410 345 kV station.
- Installation of one (1) A-Frame line exit structure for the line exits to the proposed AG1-410 345 kV Station.
- A dual, direct-fiber current differential relay protection scheme for the generation lead to the proposed AG1-410 collector station.
- OHPCo will review and revise (as necessary) the protective relay settings at the Proposed AG1-410 345 kV Station to account for the additional generation.

4. UPGRADE TO NEIGHBORING STATIONS

The Neighboring Station Upgrade Scopes will include the following:

4.1 Maddox Creek 345 kV

- OHTCo will remove two (2) single phase line traps on the line exit to the proposed AG1-410 345 kV Station.

- OHTCo will replace the protective relaying scheme at the Maddox Creek 345 kV Station with a dual, fiber-based ICON MUX current differential scheme.
- OHTCo will reconfigure the existing ICON at the Maddox Creek 345 kV Station, installing a new Small Form-Factor Pluggable (SFP) transceiver.
- OHPCo will procure one (1) metering panel with two (2) primary meters and one (1) ethernet switch for installation in the AG1-411 Project Developer's collector station.
- OHPCo will procure one (1) connected grid router (CGR) for installation in the Project Developer's originating project collector station.

4.2 RP Mone 345 kV

- OHPCo will review and revise (as necessary) the protective relay settings at the RP Mone 345 kV Station.

4.3 Van Wert Station

- OHPCo will reconfigure the existing ICON at the Van Wert Station, installing a new Small Form-Factor Pluggable (SFP) transceiver.

5. INSTALLATION OF FIBER CABLE CIRCUITS

The below fiber installations are required to accommodate supervisory control and data acquisition (SCADA) connectivity and ICON MUX relaying between the proposed AG1-410 and Maddox Creek 345 kV Stations.

- OHTCo will install one (1) station exit transition from the proposed AG1-410 345 kV Station, 0.7 miles of 96 ct All Dielectric Loose Tube (ADLT) fiber cable in new underground ROW, and 0.6 miles of 96 ct All Dielectric Self Supporting (ADSS) fiber optic cable along existing distribution structures to a splice an existing AEP fiber cable.
- OHPCo will install two (2) station exit transitions and 3.05 miles of Optical Ground Wire (OPGW) fiber cable along the existing Maddox Creek – RP Mone 345 kV circuit, terminating at the Maddox Creek 345 kV Station.

7. MILESTONE SCHEDULES FOR COMPLETION OF AEP WORK

7.1 STANDARD OPTION:

Activity	Number of Days (See Notes)
Project Engagement*	1
Engineering Start	70
Material Ordering	112
Construction (Grading & Below Grade)	457
Construction (Above Grade)	547
Outage Requests Made By	400
Outage (Structure Foundations)**	832
Outage (Cut-in & Testing)**	882
Ready For Back Feed (ITO In-Service Date)	912

***Day 1 will be determined at the PJM construction project kick off meeting.**
****Scheduled Outages are contingent upon outage availability. Longer duration outages are not available during peak load periods.**

The above schedule is based on typical AEP construction timelines, long lead material availability, PJM phase 3 studies and common outage constraints. The facilities outlined in this report, as constructed by AEP, are estimated to take 30 months to complete. Given this construction timeline and a typical period for agreement processing, AEP can support a backfeed date of February 10, 2028, subject to change during the tariff defined Final Agreement Negotiation Phase. The Project Developer is expected to have the interconnection facilities constructed and ready to accept backfeed by the business day prior to the final negotiated backfeed date.

7.2 OPTION TO BUILD:

Activity	Dates (See Notes)
Project Engagement*	1
Engineering Start	70
Material Ordering	140
Construction (Grading & Below Grade)	600
Construction (Above Grade)	630
Outage Requests Made By	335
Outage (Structure Foundations)**	650
Outage (Cut-in & Testing)**	700
Ready For Back Feed (ITO In-Service Date)	730

***Day 1 will be determined at the PJM construction project kick off meeting. Scheduled Outages are contingent upon outage availability. Longer duration outages are not available during peak load periods.**
****Coordination with the Project Developer will be required 90 days prior to the start of this task.**

The above schedule is based on typical AEP construction timelines, long lead material availability, and PJM phase 3 studies and common outage constraints. The facilities related to the cut-in and remote end stations outlined in this report, as constructed by AEP, are estimated to take 24 months to complete. Given this construction timeline and a typical period for agreement processing, AEP can support a backfeed date of October 15, 2027, subject to change during the tariff defined Final Agreement Negotiation Phase. The Project Developer is expected to have the interconnection facilities, including the interconnection station, ready to accept backfeed by the business day prior.

8. ASSUMPTIONS IN DEVELOPING SCOPE/COST/SCHEDULE

Note - Any materials purchased, or design decisions made by the Project Developer (relative to any facilities to be owned by AEP) prior to coordination with and approval by the executing AEP team (pursuant to an Engineering and Procurement or Generation Interconnection Agreement) are at the developer's risk and may not meet the specifications required for interconnection with the AEP transmission system.

8.1 SCOPE ASSUMPTIONS:

- Equipment specifications (Breaker ratings, conductor size, etc.) are a result of the desktop functional scoping process observed while conducting this facilities study. These specifications are subject to change based on the results of the detailed scoping efforts that will take place post-interconnection or engineering and procurement agreements.
- Protection and Control (P&C) coordination with the Project Developer will be needed throughout the project. The Project Developer will be required to install an AEP-compatible line relaying protection panel at the collector substation using AEP standards to ensure relay coordination and adequate line protection. The AEP design team will ensure that the firmware at the collector station terminal matches the approved firmware at the AEP terminal. Failure to accept the cost of a matching line relay protection panel may change scoping.
- Scopes 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 Project Developer.
- The Project Developer will obtain, at its cost, all necessary provisions for the AEP direct connection facilities.
- The Project Developer will provide a site acceptable to AEP (for transfer in Fee Simple) and any required easements for the proposed AG1-410 345 kV station and associated line work to enable access to all facilities and structures.
- The proposed AG1-410 345 kV station interconnecting AG1-410 will be located in close proximity to the existing Maddox Creek - RP Mone Transmission Line Right of Way.
- The Project Developer will have their construction and required checkout completed prior to the start of the interconnection to the proposed AG1-410 345 kV station and any required testing outages.
- The existing structures intended to support the installation of new fiber optic OPGW cable are assumed to be capable of the additional burden. As such, this scope is subject to change as result of the detailed engineering processes that take place after execution of a Generation Interconnection Agreement.

8.2 SCHEDULE ASSUMPTIONS:

- All transmission outages are subject to PJM and AEP Operations outage scheduling requirements.
- Significant scope of work changes will impact the schedule.
- The above schedule reflects only the work required to interconnect the AG1-410 project. The schedules regarding network upgrades associated with this project, if any, are detailed in the documentation related to the specific network upgrade.

- Slippage by the Project Developer in executing the Generation Interconnection Agreement (GIA) does not equate to a "day for day" slippage in the scheduled back feed and in service dates. Depending on the time of year, planned outages, neighboring projects and maintenance of the grid, outage availability has the potential to shift by weeks or months depending on conditions at the time of the fully executed agreement.

8.3 ESTIMATE ASSUMPTIONS:

- 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 Project Developer.

8.4 OPTION TO BUILD ASSUMPTIONS:

- The Project Developer will use firms from the AEP approved list that have experience in the transmission region where the POI is located.
- The Project Developer follows the requirements specified in "Independent Power Producers Option to Build Guidelines", available at:

https://www.aep.com/requiredpostings/AEPTransmissionStudies

9. METERING REQUIREMENTS

All metering needed for this interconnection project must meet the metering requirements stated in Appendix 2, section 8 of the AG1-410 GIA, and in PJM Manuals M01 and M14D. The details of applicable metering requirements are provided in the "Connection Requirements for the AEP Transmission System" document, found at:
https://www.aep.com/requiredpostings/AEPTransmissionStudies

The primary and backup metering will be installed on the Transmission Owner side of the Point of Change in Ownership and will be owned and maintained by the Transmission Owner.

Any additional generation proposed behind an originating project's PCO that differs in either fuel type or corporate entity from the originating project will require the installation of additional submetering for both the originating project and the uprate for the purpose of settlement. Submetering will require additional space within the originating project's facilities. The meters, routers, Ethernet to fiber converters, and telecom switch will be procured and owned by AEP. The revenue quality instrument transformers, fiber-optic cable connecting the submeters, and any other additional hardware for the required submetering will be procured, installed, owned, and maintained by the Project Developer.

10. LAND REQUIREMENTS FOR INTERCONNECTION SUBSTATION

Land requirements for the Interconnection Substation needed for this interconnection project must meet the requirements in the https://www.aep.com/requiredpostings/AEPTransmissionStudies posted on AEP website.

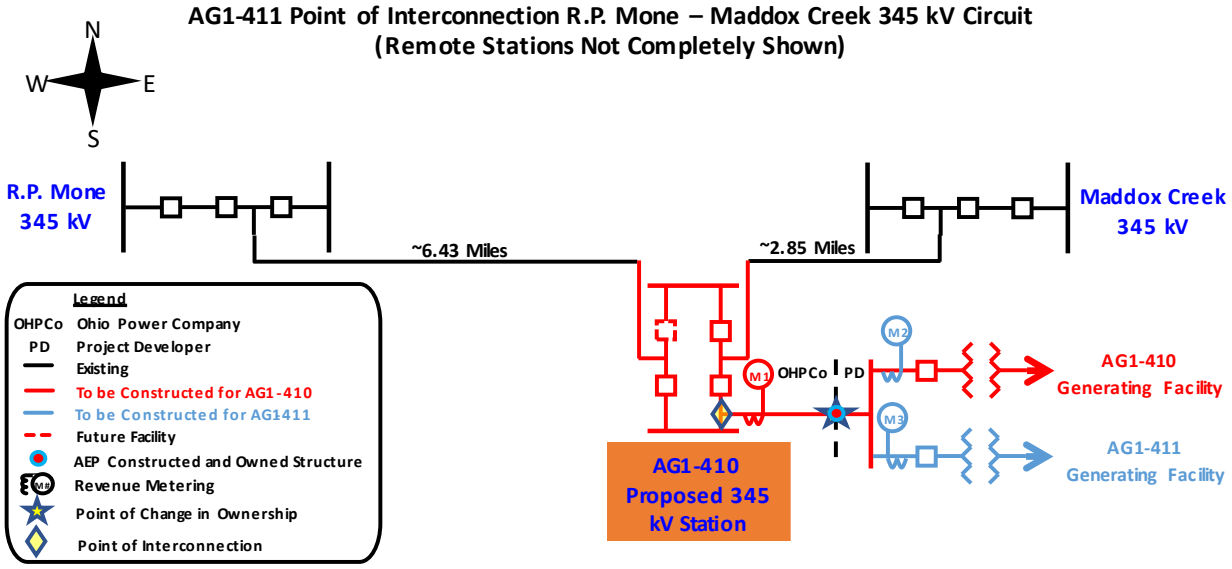
The land footprint required for a typical 345 kV interconnection station is 460' x 350', not accounting for additional retention/detention ponds that may be required. This area is subject to change as result of the detailed engineering processes that take place after interconnection agreement execution.

11. ENVIRONMENTAL AND PERMITTING

The Project Developer is expected to obtain, at its cost, all necessary permits and provisions for the facilities to be constructed for this interconnection. AEP requires that the standards provided in the "Standards and Expectations for Siting, Real Estate, Right-Of-Way, and Environmental Permitting for Transmission Interconnection Projects", found at: https://www.aep.com/requiredpostings/AEPTransmissionStudies be adhered to for all facilities interconnecting with the AEP transmission system.

C APPENDICES

Attachment #1: Single line Diagram for the Physical Interconnection



Attachment #2: POI Map