

Phase 2 Facilities Study Report
For
Physical Interconnection of
PJM Generation Interconnection Request
Project Identifier AG1-226
"Eugene - Dequine 345 kV"

Introduction

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

A. Transmission Owner Facilities Study Summary

1. PROJECT DESCRIPTION

The Project Developer has proposed a Solar Generating Facility located in Fountain County, IN with the PJM project ID of AG1-226. The installed facilities for AG1-226 will have a total Maximum Facility Output (MFO) of 450 MW with 142 MW of this output being recognized by PJM as Capacity.

2. POINTS OF INTERCONNECTION AND CHANGE IN OWNERSHIP

The Generating Facility is proposed to interconnect with the American Electric Power (AEP) transmission system via a newly constructed, IMTCo owned, 345 kV station (name TBD), tapping the existing Eugene - Dequine 345 kV line, approximately 28.3 miles from the Eugene 345 kV Station and 17.2 miles from the Dequine 345 kV Station.

Fast lane project AG1-237 has proposed a new station along the Eugene - Dequine 345 kV line approximately 8.9 miles from the Dequine 345 kV station and 8.9 miles from the proposed AG1-226 station. The remainder of this report assumes the proposed AG1-237 station will be constructed prior to the construction of the proposed AG1-226 station, therefore the AG1-226 station will be tapping the Eugene – Proposed AG1-237 345 kV Station line.

The Point of Interconnection (POI) is the point where the risers connect the generation lead circuit to the IMTCo owned, proposed AG1-226 345 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 AG1-226 345 kV Station fence. IMTCo will own the span from the proposed AG1-226 345 kV Station to the IMTCo 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 circuit transmission line and associated structures back to the AG1-226 generation collector station.

The construction of the new interconnection station will split the existing Eugene - Dequine 345 kV, future Eugene – Proposed AG1-237 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 circuit 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.
- The fiber extension from the splice boxes to the collector station.

B. Transmission Owner Facilities Study Results

The following is a description of the Transmission Owner facilities required for physical interconnection of the proposed AG1-226 project to the AEP transmission system. These facilities shall be designed according to AEP Applicable Technical Requirements and Standards. Once built, AEP will own, operate, and maintain these Facilities.

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

IMTCo will construct a new 345 kV breaker and a half station, to be operated as a three (3) circuit breaker ring bus, initially expandable to six (6) circuit breakers. This typical arrangement is planned to accommodate 5000A of continuous current. The station will be constructed to the southeast of the Eugene – Proposed AG1-237 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).
- Nine (9) motorized breaker disconnect switches.
- Six (6) single phase coupling capacitor voltage transformers (CCVT), three (3) each on the line exits to the Eugene and Proposed AG1-237 345 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 Eugene and the proposed AG1-237 345 kV Stations.
- Associated conductors (buswork, ground grid, jumpers), telecom terminal equipment, insulators, arresters, foundations, and structures.
- A dual, fiber-based, Integrated Communications Optical Network Multiplexor (ICON MUX) current differential line protection relay scheme for the line to the Eugene 345 kV Station.
- A dual, fiber-based, ICON MUX current differential line protection relay scheme for the line to the proposed AG1-237 345 kV Station.

The civil work required to develop a site that accommodates the installation of the above station includes grading of a 350' x 300' pad with an assumed fall across the pad of 5' and a minimum of 2000' x 20' of access road.

2. TRANSMISSION LINE TIE-IN

The Eugene – Dequine 345 kV circuit is a double circuit tower line where the line on the western side of the structures is the Eugene – Dequine circuit and the line of the eastern side of the structure is the Sullivan – Dequine circuit. To interconnect with the Eugene – Dequine circuit, IMPCo will lower the Sullivan – Dequine circuit into a horizontal configuration allowing the Eugene – Dequine circuit to pass above. IMPCo will tie the proposed AG1-226 345 kV station into the existing Eugene - Dequine Circuit by completing the following construction tasks:

- Remove two (2) steel lattice structures, #354 and #355, with associated conductor and shield wire along the existing Eugene – Dequine circuit.
- Install two (2) single pole, double circuit, steel dead end structures along the existing Eugene – Dequine circuit.
- Install two (2) three pole, single circuit, horizontally configured steel dead end structures for the Dequine – Sullivan circuit.
- Install two (2) new steel, 120' single circuit, single pole dead-end structures and two (2) spans of double bundle aluminum conductor steel-reinforced (ACSR) 1272 (Pheasant) transmission line conductor steel-reinforced (ACSR) 159 (Guinea) shield wire routing the Eugene – Proposed AG1-237 circuit above the Dequine – Sullivan circuit, cutting in the proposed AG1-226 345 kV Station in an in-and-out arrangement.

3. TRANSMISSION OWNER INTERCONNECTION FACILITIES:

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

- Installation of one (1) A-frame dead-end take off structure for the generation lead circuit line exit.
- Installation of one (1) new steel, 120', single circuit, single pole dead end structure on a concrete pier foundation with an anchor bolt cage and one span of double bundle ACSR 954 (Cardinal) transmission line conductor with 7#8 Alumoweld shield wire for the generation lead circuit extending from the proposed AG1-226 345 kV Station.
- Extension of two (2) underground 48 count all dielectric loose tube (ADLT) fiber optic cables from the proposed AG1-226 345 kV Station control house to fiber demarcation splice boxes to support direct fiber relaying between the proposed AG1-226 345 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 AG1-226 345 kV Station.
- Installation of a dual, direct-fiber, current differential protection scheme for the generation lead circuit.

4. UPGRADE TO NEIGHBORING STATIONS

4.1 Eugene 345 kV

- IMPCo will review and revise (as needed) the protective relay settings at the Eugene 345 kV Station.
- IMPCo will reconfigure the ICONs, installing Small Form-Factor Pluggable (SFP) transceivers.

4.2 Proposed AG1-237 345 kV (Kickapoo)

- IMTCo will review and revise (as needed) the protective relay settings at the proposed AG1-237 345 kV Station.
- IMTCo will reconfigure the ICONs, installing SFP transceivers.

4.1 Dequine 345 kV

- IMTCo will reconfigure the ICONs, installing SFP transceivers.

5. INSTALLATION OF FIBER CABLE CIRCUITS

IMTCo will perform the following tasks to accommodate fiber-based relaying between the proposed AG1-226, proposed AG1-237, Eugene, and Dequine Stations.

- Install exit transitions at the proposed AG1-226, proposed AG1-237, and Eugene Stations.
- Install a new fiber optic cable path consisting of 25.1 miles of 144 count ADLT cable in new underground right-of-way.

The additional fiber may not be required. The scope above and estimates below are provided to convey the total potential cost. AEP will provide a revised facilities study report during the phase 3 study period with a final determination.

7. MILESTONE SCHEDULES FOR COMPLETION OF AEP WORK

7.1 STANDARD OPTION:

<u>Activity</u>	<u>Number of Days (See Notes)</u>
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, 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, timeline for the phase 3 study, and a typical period for agreement processing, AEP can support a backfeed date of March 14, 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:

<u>Activity</u>	<u>Dates (See Notes)</u>
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 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, timeline for the phase 3 study, 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 AG1-226 345 kV station and associated line work to enable access to all facilities and structures.
- The proposed AG1-226 345 kV station interconnecting AG1-226 will be located in close proximity to the existing Eugene - Dequine 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 AG1-226 345 kV station and any required testing outages.
- The proposed AG1-237 station will be constructed prior to the in servicing of AG1-226. Should AG1-226 come in service prior to AG1-237 additional scope may be required.

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 AG1-226 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 AG1-226 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 350' x 300', 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

AG1-226 Point of Interconnection Proposed AG1-226 345 kV Station Eugene – Dequine 345 kV (Remote Stations Not Completely Shown)



