



Facilities Study Report
For
Physical Interconnection of
PJM Generation Interconnection Request
Project ID AG1-237

"Dequine - Eugene 345 kV"

November 2024

Introduction

This Facilities Study has been prepared in accordance with the PJM Open Access Transmission Tariff VII, and, if applicable, Application and Studies Agreement between the Project Developer and PJM Interconnection, L.L.C. (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. IMTCo is an affiliate company of American Electric Power Service Corporation (AEP). All references to AEP include IMTCo unless otherwise specified. Additional scope will be required by Indiana Michigan Power Company to be abbreviated as IMPCo.

A. Transmission Owner Facilities Study Summary

1. PROJECT DESCRIPTION

The Project Developer has proposed a Wind Generating Facility located in Fountain County, Indiana. The installed facilities for AG1-237 will have a total Maximum Facility Output (MFO) of 200 MW with 26 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 IMTCo owned 345 kV station (referred to as a “New 345 kV Switching Station” or “the proposed 345 kV station”) tapping the Dequine - Eugene 345 kV line, approximately 8.94 miles from Dequine 345 kV Substation and 36.36 miles from Eugene 345 kV Substation.

The Point of Interconnection (POI) is the point where the risers connect the generation lead circuit to the IMTCo 345 kV Switching 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 IMTCo 345 kV Switching Station fence. IMTCo will own the span from the proposed IMTCo 345 kV Switching 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 circuit line and associated structures back to the AG1-237 generation collector substation.

The construction of the new interconnection substation will split the existing Dequine - Eugene 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. AMENDMENTS TO THE IMPACT STUDY DATA OR IMPACT STUDY RESULTS

No amendments to the impact study data or impact study results are required by AEP.

4. PROJECT DEVELOPER SCHEDULE

The Project Developer's requested in-service date for the generation facility is N/A.

This report does not imply a Transmission Owner commitment to this date.

5. 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:

- One (1) Main Power Transformer (MPT)
- One (1) circuit breaker and associated equipment located between the high side of the MPT 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

B. Transmission Owner Facilities Study Results

The following is a description of the Transmission Owner facilities required for physical interconnection of the proposed AG1-237 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 SUBSTATION (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 be designed to accommodate 5000A of continuous current. The station will be constructed to the west of the Dequine - Eugene circuit to interconnect the project with the AEP transmission system.

Major IMTCo 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 disconnect switches.
- Six (6) single phase coupling capacitor voltage transformers (CCVT), three (3) each on the lines to the Eugene and Dequine 345 kV Stations.
- Two (2) single phase station service voltage transformers (SSVT).
- Two (2) A-Frame line exit structures, one (1) each on the line exits to the Eugene and Dequine 345 kV Stations.
- 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 protection relay scheme for the line to the Dequine Station.
- A fiber-based Integrated Communications Optical Network Multiplexor (ICON MUX) dual current differential line protection relay scheme for the line to the Eugene Station.

The civil work required to develop a site that accommodates the installation of the above Switching Station includes grading of a 580' x 370' pad with an assumed fall across the pad of 18' and a minimum of 200' x 24' of access road.

2. TRANSMISSION LINE TIE-IN

IMPCo will tie the proposed AG1-237 345 kV Station into the Dequine – Eugene 345 kV Circuit by performing the following construction tasks:

- Removal of one (1) double circuit lattice tower along the existing Dequine – Eugene 345 kV Circuit.
- Installation of two (2) 120' new steel, single circuit, single pole dead end structures on concrete piers with anchor bolt cages along the existing Dequine - Eugene 345 kV Circuit.
- Installation of one (1) 120' steel, single circuit, single pole, running angle structure on a concrete pier with an anchor bolt cage to support the Dequine – Sullivan 345 kV Circuit, maintaining clearances to the Dequine – Eugene 345 kV Circuit.
 - Installation of two (2) spans of double bundle aluminum conductor steel reinforced (ACSR) 954 (Cardinal) transmission line conductor with ACSR GUINEA shield wire, cutting in the proposed 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:

- IMTCo will install one (1) new A-Frame take off structure for the generation lead circuit termination at the proposed AG1-237 345 kV station.
- IMTCo will install dual direct fiber-based current differential relays for the generation lead to the proposed AG1-237 collector station.
- IMTCo install 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 ACSR GUINEA shield wire for the generation lead circuit extending from the proposed 345 kV station.
- IMTCo will extend two (2) underground 48 count all dielectric loose tube (ADLT) fiber optic cables from the proposed 345 kV station control house to fiber demarcation splice boxes to support direct fiber relaying between the proposed 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.
- IMTCo will install 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 345 kV station.

4. UPGRADE TO NEIGHBORING STATIONS

4.1 Dequine 345 kV

- IMTCo will review and revise (as needed) the protective relay settings at the Dequine 345 kV Station.

- IMTCo will reconfigure the existing carrier ethernet switch (CES) and dual ICON MUX, installing three (3) new transceivers at the Dequine Station.
- IMTCo will upgrade the existing relays at the Dequine 345 kV Station by installing a new dual fiber-based ICON MUX current differential protection scheme.

4.2 Eugene 345 kV

- IMTCo will review and revise (as needed) the protective relay settings at the Eugene 345 kV Station.
- IMTCo will upgrade the existing relays at the Eugene 345 kV Station by installing a new dual fiber-based ICON MUX current differential protection scheme.
- IMTCo will reconfigure the existing carrier ethernet switch (CES) and dual ICON MUX, installing three (3) new transceivers at the Eugene Station.

5. INSTALLATION OF FIBER CABLE CIRCUITS

IMTCo will install two (2) new fiber-optic cable station exit transitions to new splices on the existing Eugene – Dequine 345 kV optical ground wire (OPGW). This installation is required to accommodate ICON MUX relaying between the proposed AG1-237, Eugene, and Dequine 345 kV Stations, supervisory control and data acquisition (SCADA) connectivity, and carrier ethernet switch (CES) connectivity.

6. COST ESTIMATE OF AEP FACILITIES FOR PHYSICAL INTERCONNECTION

The following tables summarize the total estimated costs according to FERC criteria. The estimated costs are in 2024 dollars. **This cost excludes Federal Income Tax Gross Up charges on Contributions in Aid of Construction (CIAC).** This tax may or may not be charged based on whether this project meets the eligibility requirements of IRS Notice 88-129. If at a future date it is determined that the Federal Income Tax Gross Up charges are required, the Transmission Owner shall be reimbursed by the Project Developer for such taxes. The estimated reimbursement amount is noted in the table below.

6.1 COST ESTIMATE FOR TRANSMISSION OWNER-BUILD OPTION

Work Description	Type of Upgrade	Direct		Indirect		Total	Tax
		Labor	Material	Labor	Material		
Transmission Owner Interconnection Facilities	TOIF	\$1,602,066	\$869,267	\$326,891	\$158,794	\$2,957,018	\$0
New Interconnection Substation	Stand Alone Network Upgrade IMTCo n8905.0	\$8,365,193	\$6,727,162	\$746,930	\$625,072	\$16,464,357	\$0
Expansion of existing substation	Network Upgrade	\$0	\$0	\$0	\$0	\$0	\$0
Interconnection Substation tie-in	Network Upgrade IMPCo n8906.0	\$914,167	\$766,159	\$100,775	\$84,459	\$1,865,560	\$0
Remote Upgrades at Dequine 345 kV Station	Network Upgrade IMTCo n8907.0	\$263,278	\$109,657	\$89,794	\$30,415	\$493,144	\$0
Remote Upgrades at Eugene 345 kV Station	Network Upgrade IMTCo n8908.0	\$263,278	\$109,657	\$89,794	\$30,415	\$493,144	\$0
Fiber Installation in Existing ROW	Network Upgrade	\$0	\$0	\$0	\$0	\$0	\$0
Fiber Installation in New ROW	Stand Alone Network Upgrade	\$0	\$0	\$0	\$0	\$0	\$0
Final Tie in for Fiber installation in New ROW	Network Upgrade IMTCo n8909.0	\$220,768	\$54,241	\$21,249	\$5,221	\$301,479	\$0
Total Project Costs		\$11,628,750	\$8,636,143	\$1,375,433	\$934,376	\$22,574,702	\$0

6.2 COST ESTIMATE FOR DEVELOPER-BUILD OPTION

Work Description	Type of Upgrade	Direct		Indirect		Total	Tax
		Labor	Material	Labor	Material		
Transmission Owner Interconnection Facilities (Oversight)	TOIF	\$0	\$0	\$0	\$0	\$0	\$0
New Interconnection Substation (Oversight)	Stand Alone Network Upgrade	\$224,288	\$55,462	\$108,244	\$26,767	\$414,761	\$0
Expansion of existing substation	Network Upgrade	\$0	\$0	\$0	\$0	\$0	\$0
Interconnection Substation tie-in	Network Upgrade	\$914,167	\$766,159	\$100,775	\$84,459	\$1,865,560	\$0
Remote Upgrades at Dequine 345 kV Station	Network Upgrade	\$263,278	\$109,657	\$89,794	\$30,415	\$493,144	\$0
Remote Upgrades at Eugene 345 kV Station	Network Upgrade	\$263,278	\$109,657	\$89,794	\$30,415	\$493,144	\$0
Fiber Installation in Existing ROW	Network Upgrade	\$0	\$0	\$0	\$0	\$0	\$0
Fiber Installation in New ROW (Oversight)	Stand Alone Network Upgrade	\$0	\$0	\$0	\$0	\$0	\$0
Final Tie in for Fiber installation in New ROW	Network Upgrade	\$220,768	\$54,241	\$21,249	\$5,221	\$301,479	\$0
Total Project Costs		\$1,885,779	\$1,095,176	\$409,856	\$177,277	\$3,568,088	\$0

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 and a typical period for agreement processing, AEP can support a backfeed date of May 6, 2027, 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 and a typical period for agreement processing, AEP can support a backfeed date of November 5, 2026, 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 345 kV station and associated line work to enable access to all facilities and structures.
- The proposed 345 kV station interconnecting AG1-237 will be located in close proximity to the existing Dequine - Eugene 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 345 kV station and any required testing outages.
- The existing structures intended to support the installation of new fiber optic ADSS 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 AG1-237 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" (Rev. 4, dated December 11, 2023), 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 AG1-237 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" (Rev. 5, dated December 31, 2023) 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 set forth in "Standards and Expectations for Siting, Real Estate, Right-of-Way, and Environmental Permitting for Transmission Interconnection Projects," Version 3 dated

October 31, 2022 at <https://www.aep.com/requiredpostings/AEPTransmissionStudies> posted on AEP website.

The land footprint required for a typical 345 kV interconnection station is 580' x 370', 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.

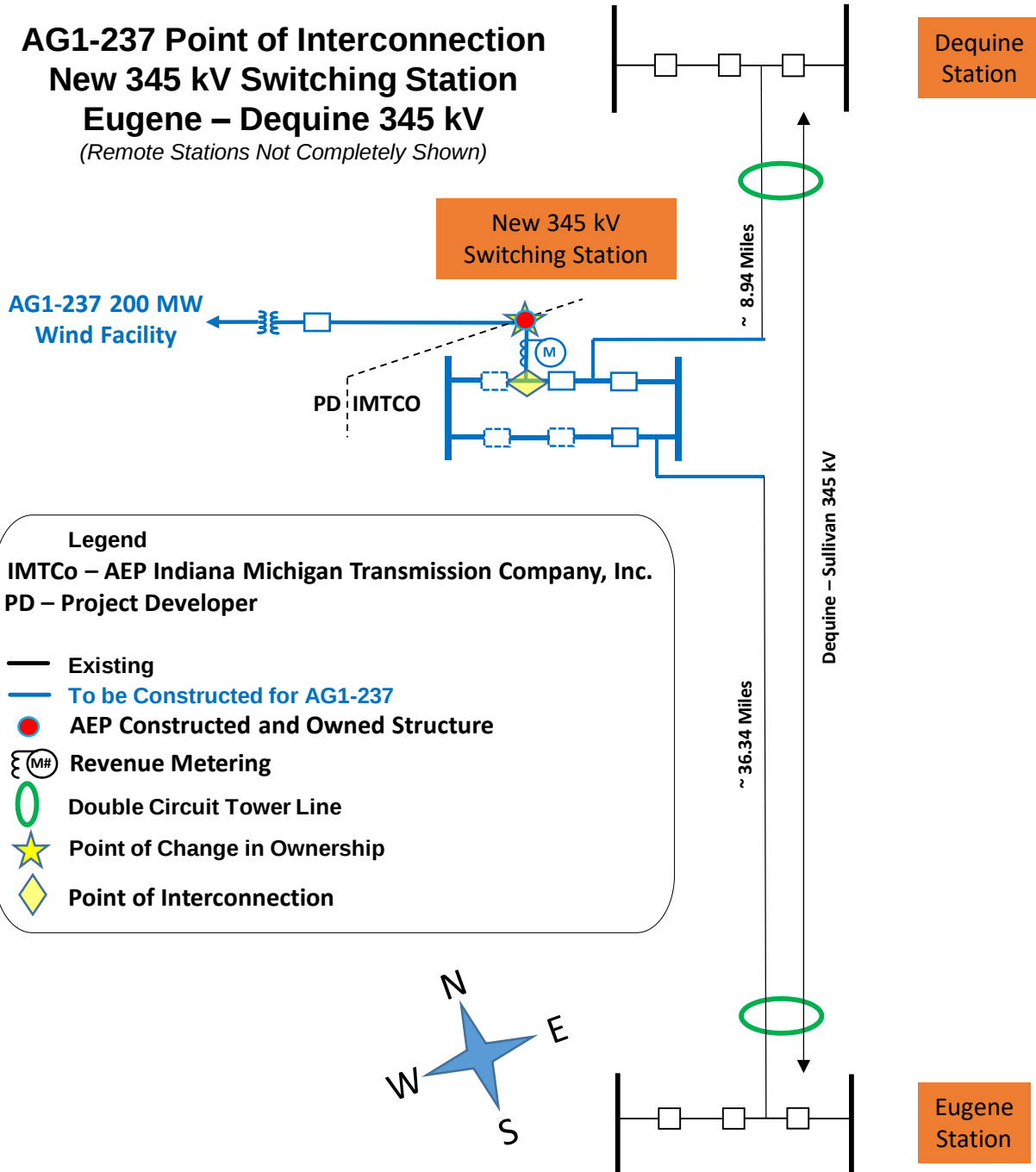
11. ENVIRONMENTAL AND PERMITTING

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", Version 3 dated October 31, 2022 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

AG1-237 Point of Interconnection New 345 kV Switching Station Eugene – Dequine 345 kV (Remote Stations Not Completely Shown)



Attachment #2: POI Map

