Facilities Study Report

For

Physical Interconnection of

PJM Generation Interconnection Request

Project ID AE2-308

"Dale-Fawkes 138 kV Solar Project – 100 MW"

Revision 1: December 2024

Introduction

This Facilities Study has been prepared in accordance with the PJM Open Access Transmission Tariff. The Transmission Owner (TO) is East Kentucky Power Cooperative ("EKPC").

A. Transmission Owner Facilities Study Summary

1. PROJECT DESCRIPTION

The Project Developer (PD) has proposed a solar generating facility located near Madison County, Kentucky with a designated PJM Project ID of AE2-308. The installed facilities will have a total Maximum Facility Output (MFO) of 100 MW with 60 MW of this output being recognized by PJM as Capacity.

2. POINT OF INTERCONNECTION (POI)

The Generating Facility will interconnect with the East Kentucky Power Cooperative ("EKPC") transmission system via a newly constructed Three Forks 138 kV breaker and a half substation, tapping the Dale-Fawkes 138 kV line, approximately 4.6 miles from Dale and 3.6 miles from Fawkes.

The construction of the new interconnection substation will split the existing Dale Fawkes 138 kV line into two lines on the transmission system. The new line will connect Three Forks to the Dale and Fawkes substations.

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

3. POINT OF CHANGE IN OWNERSHIP

The Point of Change in Ownership (PCO) will be located at the Project Developer (PD) side of a 138 kV disconnect switch to be installed by EKPC at the interface between the PD-owned substation facilities and EKPC's substation facilities at the Three Forks Tap 138 kV Substation. The switch shall be installed on a steel transmission line monopole structure located outside the substation fence. The exact location will be determined during project detailed design and EKPC will install, own, operate, and maintain the switch.

4. SCOPE OF PROJECT DEVELOPER INTERCONNECTION FACILITIES

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

- Main Power Transformer (s) (MPT), Generation step-up (GSU) transformer(s) or final transformation, as applicable.
- Circuit breakers and associated equipment located between the high side of the MPT(s) or GSU(s) and the Point of Change in Ownership
- Generator lead line from the Generating Facility to the Point of Change in Ownership
- Relay and protective equipment, telecommunications equipment, and 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 planned Transmission Owner facilities for physical interconnection of the proposed AE2-308 project to EKPC transmission system. These facilities shall be designed according to EKPC Applicable Technical Requirements and Standards. Once built, EKPC will own, operate, and maintain these Facilities.

1. TRANSMISSION OWNER INTERCONNECTION FACILITIES:

A 138 kV transmission line monopole dead-end structure and foundation outside the fence of the Interconnection Substation, to terminate the Project Developer's generator lead line will be considered Transmission Owner Interconnection Facilities (TOIF). A 138 kV 3-pole disconnect switch will also be mounted to this monopole dead-end structure serving as the PCO.

The TOIF will also include the line conductor from the dead-end structure in the switchyard of the Thatcher's Mill Substation to the bus position in the switchyard of the interconnection substation.

Installation of fiber cable circuits

EKPC shall use telecommunications equipment that matches its current network and equipment requirements.

Two 48-strand fiber optic cables will be installed between the EKPC substation control house at Three Forks station and the PD facility for relaying, metering, and SCADA circuit requirements. The exact details and installation plans for this fiber will be developed during project scoping.

2. STAND ALONE NETWORK UPGRADES

Three Forks Tap Interconnection Substation

A new switching station substation, Three Forks Tap, 138kV, will be constructed along the Dale-Fawkes 138 kV transmission line to interconnect the project with the East Kentucky Power Cooperative ("EKPC") transmission system.

Scope of Work

The major equipment and material associated with the expanded station is listed below:

QTY	Unit	DESCRIPTION
1	Each	138 kV Low Profile structure
6	Each	138 kV, 2000A, Circuit Breaker
13	Each	138 kV GOAB Switches (Includes PCO Switch)
1	Lot	Electrical Material (insulators, terminals, etc.)
2	Each	Station Service Transformer, 138 kV, 1 PH
12	Each	Arresters, Lightning 138 kV Station 115 kV MCOV Polymer
3	Each	Metering CT's, 138 kV
12	Each	Line CCVT's, 138 kV
6	Each	Bus PT's, 138 kV

System Protection

The following system protection scope of work applies for this project. All system protection equipment described in this section will be owned, operated, and maintained by EKPC.

Control House: EKPC shall procure and install a drop-in style control building fully furnished and complete with the relay panels described below, along with auxiliary AC, and two 125V DC battery banks, and all required operating equipment.

Relay Panels: EKPC shall install the following protection and control panels.

North Bus Differential Panel – EKPC shall install a standard bus panel complete with P1 SEL-587Z and P2 SEL-487B relays tripping P1 & P2 bus lock-out relays.

South Bus Differential Panel – EKPC shall install a standard bus panel complete with P1 SEL-587Z and P2 SEL-487B relays tripping P1 & P2 bus lock-out relays.

Bay #1 Control Panel – EKPC shall install a bay control panel with three SEL-451 relays, one for both line breakers and the tie breaker in the bay. The SEL-451 relays will be used for breaker control breaker failure, and reclosing.

Bay #2 Control Panel – EKPC shall install a bay control panel with three SEL-451 relays, one for the PD generator line breaker, the Three Forks Tap line breaker and a tie breaker in the bay. The SEL-451 relays will be used for breaker control breaker failure, and reclosing.

Panel for protection of the Project Developer (PD) facility connection– EKPC shall install a standard line panel with P1 & P2 SEL-411L relays. Line relays shall utilize a line current differential protection scheme.

Line Panel for the Dale 138kV Line Exit (4.6 miles) – EKPC shall install standard line panel with P1 & P2 SEL-411L relays for each line exit. The P1 & P2 relays shall utilize comm-assisted tripping schemes over fiber.

Line Panel for Fawkes 138kV Line Exit (3.6 miles) – EKPC shall install standard line panels with P1 & P2 SEL-411L relays for each line exit. The P1 & P2 relays shall utilize comm-assisted tripping schemes over fiber.

Transformer Panel for Three Forks Distribution Substation Line – EKPC shall install a Distribution Transformer Relay Panel with a P1 SEL-787 relay and P2 SEL-451 relay for protection of the distribution transformer. A SEL-451 relay shall be utilized for breaker control and breaker failure.

SCADA Panel – EKPC shall install a standard SCADA panel with an Orion LX+ and dual metering for the PD. P1 Meter shall be an ION8650A, and P2 Meter shall be a SEL-735.

DFR Panel – EKPC shall install a fault recording panel with two SEL Axion 2240 I/O modules and a SEL-3555 RTAC unit.

EKPC requires the PD to utilize all Schweitzer Engineering Laboratories (SEL) relays and related protective equipment for facilities interconnecting or communicating with EKPC relaying. EKPC reserves the right to specify relays or other protective equipment utilized in the PD substation as required based on the protection schemes utilized. All protection system designs shall be reviewed by EKPC System Protection or its designer during the design phase to ensure proper clearing times, coordination, and compliance with applicable NERC regulations.

Control cables shall be pulled from new breakers and other required equipment to the control house.

Commissioning: Each relay panel shall be fully commissioned prior to being placed in service. Commissioning shall include AC current and potential circuits, DC functional, relay testing, SCADA alarms, and end-to-end testing where required.

3. NETWORK UPGRADES

Transmission Line Tie-in for new interconnection substation:

The Dale-Fawkes 138 kV line will be cut and looped into the new interconnection substation.

The new transmission line loop-in facilities will be owned, operated, and maintained by EKPC. Eight (8) new transmission poles will be installed to facilitate the connection to the existing line sections and looping the lines into the new switching station, including (6) deadends and (2) tangent structures. Both the circuit from Dale and Fawkes substations will span directly into the new substation and dead-end on A-frame structures. The new transmission structures are assumed to be direct embedded structures. The tap will allow for the connection of the existing transmission line to the new substation. Each of the two loops from the Dale to Fawkes 138kV line to the new substation is expected to extend approximately 300 feet. The Three Forks Tap 138kV line's rerouted section is expected to be approximately 950 feet.

Upgrade to Neighboring Substations:

Dale Substation:

Relay settings shall be reviewed for the Dale-Fawkes 138 kV line to accommodate the new Three Forks Tap substation, and relay files will be updated accordingly. If acceptable relay setting adjustments are not possible due to older model relays, and new modern SEL line relays are required, the cost will be higher. This is to be determined during detailed design.

Fawkes Substation:

Relay settings shall be reviewed for the Dale-Fawkes 138 kV line to accommodate the new Three Forks Tap substation, and relay files will be updated accordingly. If acceptable relay setting

adjustments are not possible due to older model relays, and new modern SEL line relays are required, the cost will be higher. This is to be determined during detailed design.

Installation of fiber cable circuits

For the new Three Forks Tap 138 kV switch station, the existing Overhead Optical Ground Wire (OPGW) infrastructure on the Dale-Fawkes line section will be split and terminated on a splice box on the north transmission structure installed for the line loop-in facilities. This will complete the fiber communication path on the Three Forks Tap-Dale line section. In addition, a new OPGW will be run from the south loop-in facility transmission structure to the Fawkes substation (3.6 miles). A new splice box will be placed on the transmission structure to terminate the OPGW.

To accommodate the OPGW installation and replacement of the existing shield-wire, one (1) h-frame structure will be modified to add a shield-wire bayonet pole top extension to both poles of the structure to maintain adequate clearances on the line. In addition, a 700-foot section of underground fiber is required at the location where the Dale-Fawkes 138kV line joins the J.K. Smith-Fawkes line near the Fawkes Substation.

Two new 48-strand fiber optic cables will be run from the Three Forks Tap switch station control house to each transmission structure splice box to establish communications to the new substation from the remote ends.

4. OTHER SCOPE OF WORK

No other scope has been identified for the construction of the Three Forks substation.

5. MILESTONE SCHEDULE FOR COMPLETION OF EKPC WORK

Facilities outlined in this report are estimated to take 36 months to construct, from the time the Generation Interconnection Agreement is fully executed. This schedule is based on the ability to obtain outages to construct and test the proposed facilities.

Description	Start month	Finish month
Detailed Design	1	6
Procurement	3	27
Construction	25	36

6. ASSUMPTIONS IN DEVELOPING SCOPE/COST/SCHEDULE

Transmission Line Assumptions:

The following general assumptions have been included for the transmission line information. provided:

1. Required transmission line outages can be scheduled as planned. Transmission line outages are:
    a. typically, not taken in the summer (June-August) or winter (December-February),
    b. cancelled during extreme weather conditions, and

c. in some cases, required to be scheduled twelve (12) or more months in advance.

2. No delays due to equipment or material delivery, environmental, regulatory, permitting, real estate, extreme weather, or similar events.
3. No significant sub-surface rock was encountered during construction, and soil conditions are suitable for standard foundation installations.

The following engineering assumptions have been included for the transmission line information provided:

1. Neither foundation nor transmission pole structural analyses have been performed. Information provided assumes that no significant foundation or structural issues are present.
2. Construction will be scheduled to avoid winter peak load periods (December - February).
3. The preliminary schedule assumes that transmission line outages can be obtained as necessary.
4. Material and equipment costs are based on current (December 2022) pricing.
5. Easements, if necessary, shall be acquired by EKPC.
6. Environmental permits and reviews shall be completed by EKPC and can be completed in a timely manner.

Substation & System Protection Assumptions:

The following general assumptions have been included for the substation information provided:

1. No delays due to equipment or material delivery, environmental, regulatory, permitting, property/easement acquisitions, extreme weather, or similar events.
2. No significant sub-surface rock encountered during construction, and soil conditions suitable for standard ground-grid and foundation installations.
3. PD shall acquire an adequate and suitable site and grant ownership to EKPC to accommodate EKPC's interconnection substation, as mentioned above.
4. The PD will provide all necessary easements for a permanent road to provide substation access. This substation access shall be from an existing county or state road. The PD will convey these rights to EKPC if they own the property on which the substation access road will be located. Otherwise, EKPC will need to acquire the access rights from the owner of the property.

Metering Assumptions:

The following assumptions have been included for the metering information provided:

1. No delays due to equipment or material delivery, environmental, regulatory, permitting, real estate, extreme weather, or similar events.
2. Fiber-optic cable and associated equipment installation is completed as scheduled.
3. Material and equipment-related costs are based on current pricing at the time of this study.
4. Once fiber-optic cable installation is complete, the fiber will not be damaged.

Communications Assumptions:

The following assumptions have been included for the telecommunications information provided:

1. No delays due to equipment or material delivery, environmental, regulatory, permitting, real estate, extreme weather, or similar events.
2. Material and equipment-related costs are based on current pricing at the time of this study.

3. Once fiber-optic cable installation is complete, the fiber will not be damaged.

Environmental Assumptions:

The following general assumptions have been included for environmental permitting requirements:

1. For the PD's project, there are no "federal actions" (i.e., federal financial assistance or grants; or federal permit, license, or approval) present that would trigger NEPA compliance obligations for the EKPC facilities as a connected action.
2. Substation location will remain in the currently identified location. Relocation of the substation site may require a re-evaluation of the permitting obligations.

7. REVENUE METERING REQUIREMENTS

All metering needed for this interconnection project must meet the metering requirements stated in Appendix 2, section 8 of the AE2-308 GIA, and in PJM Manuals M01 and M14D. The details of applicable metering requirements are given in the EKPC's Facility Connection Requirements Document posted on PJM website.

The metering will be installed on the EKPC side of the Point of Change in Ownership will be owned and maintained by EKPC.

The cost for installation of the metering facilities contained in the new EKPC substation are included in the substation costs provided in Section 6 above.

8. LAND REQUIREMENTS FOR INTERCONNECTION SUBSTATION

Land requirements for the Interconnection Substation needed for this interconnection project must meet the requirements in the EKPC's Facility Connection Requirements Document posted on PJM website.

9. ENVIRONMENTAL AND PERMITING

EKPC or its representative will perform all necessary environmental assessments and obtain all necessary permits/approvals associated with construction of all EKPC facilities required to facilitate the interconnection of the new generating facility. This includes the Storm-water Pollution Prevention Plan ("SWPPP"), obtaining KYR 10 storm-water permit, and conducting the necessary SWPPP inspections prior to all construction activities.

C. APPENDICES

Attachment #1: Single line Diagram for the Physical Interconnection

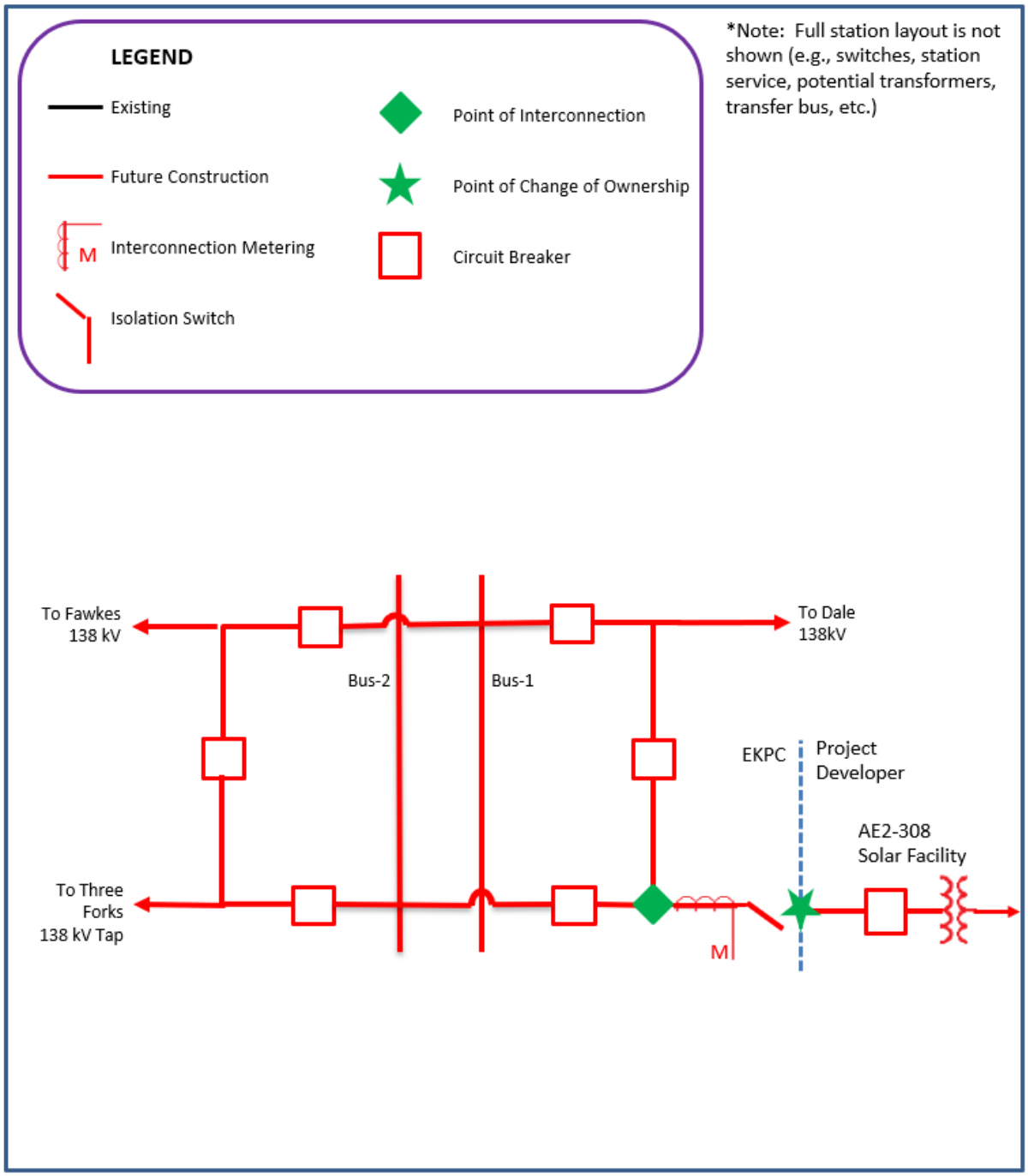
Attachment #2: EKPC Station General Location/Layout

Attachment 1:

Single Line Diagram for the Physical Interconnection

AE2-308 Conceptual One-Line Diagram of Interconnection Facilities

Three Forks Tap 138kV Substation



Attachment 2:

EKPC Station General Location/Layout