Facilities Study Report
For
Physical Interconnection of
PJM Generation Interconnection Request
Project ID AF1-240

"Timblin 34.5 kV"

Revision 0: December 2024

Introduction

This Facilities Study has been prepared in accordance with the PJM Open Access Transmission Tariff. The Transmission Owner (TO) is the Mid-Atlantic Interstate Transmission, LLC (MAIT).

A. Transmission Owner Facilities Study Summary

1. PROJECT DESCRIPTION

The Project Developer (PD) has proposed a Solar generating facility located in Armstrong County, Pennsylvania with a designated PJM Project ID of AF1-240.

The total installed facilities will have a capability of 17.5 MW with 12 MW of this output being recognized by PJM as Capacity.

2. POINT OF INTERCONNECTION (POI)

The Generating Facility will interconnect with the MAIT transmission system by tapping the Brookville line out of Timblin 34.5 kV substation at pole P-78423 in the FirstEnergy Pennsylvania Electric Co (FE PA District).

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

3. POINT OF CHANGE IN OWNERSHIP

The Point in Change in Ownership will be located where TO-owned 34.5 kV attachment line conductor will terminate on the PD installed and owned pole located one span from the TO owned and maintained switch as shown in Attachment #1.

4. SCOPE OF PROJECT DEVELOPER INTERCONNECTION FACILITIES

Project 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:

- Generation step-up (GSU) transformer(s) or final transformation, as applicable.
- Circuit breakers and associated equipment located between the high side of the GSU 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, and Supervisory Control and Data Acquisition (SCADA) and telecommunications equipment to comply with the FirstEnergy "Technical Interconnection Requirements and Study Criteria for Distributed Energy Resources Interconnected to Distribution Systems" which can be found at

  https://www.firstenergycorp.com/content/dam/feconnect/files/wholesale/DG-Tech-Requirements.pdf

- The Project Developer shall provide and install the mounting structures (or enclosures) and conduits necessary for the TO metering installation and shall mount the TO instrument transformers unless otherwise agreed to by TO.

- The associated rights of way for the 34 kV line tap to the substation will be acquired by the Project Developer and transferred to the TO at no cost. The access road design must be approved by TO to ensure it provides adequate access to support installation and maintenance of the revenue metering.

B. Transmission Owner Facilities Study Results

The following is a description of the planned Transmission Owner facilities for the physical interconnection of the proposed AF1-240 project to MAIT transmission system. These facilities shall be designed according to FirstEnergy Applicable Technical Requirements and Standards. Once built, MAIT will own, operate, and maintain these Facilities.

1. TRANSMISSION OWNER INTERCONNECTION FACILITIES:

1.1 Line Estimate: Regional Distribution Estimate

- Region to install tap pole, SCADA switch, and SCADA radio. Costs captured under Distribution support estimate.
  - Existing Conditions
    - N/A
  - Structures Installed
    - N/A
  - Removals
    - N/A
  - Construction Considerations
    - N/A
  - General Notes/Assumptions
    - N/A
  - Project Developer / 3rd Party Impacted Sites
    - N/A

Support Estimates

- Project Management:
  - N/A
- Forestry:
  - N/A
- RE/ROW:
  - N/A
- Environmental:
  - N/A
- Information Technology:
  - N/A
- Access Road Construction:
  - N/A
- Distribution:
  - Distribution Scope:
    - Install tap pole, SCADA switch, and SCADA radio.
- Distribution Assumptions:
  - None

1.2 AF1-240 Generator Substation

- Energize and integrate Project Developer Interconnection Facilities to the transmission system.
  - Below Grade
    - None
  - Above Grade
    - Review oneline, nameplates, and relay settings.
    - Add to HV circuit diagram.
  - Relay & Control
    - Energize and integrate Interconnection Facilities to the transmission system.
  - Additional Equipment to be Removed
    - None
  - Assumptions
    - None
  - Project Developer / 3rd Party Impacted Sites:
    - None

  - **Support Estimates**
    - PROJECT MANAGEMENT (PM)
      - Project management will be required for this asset.
    - FORESTRY (FOR)
      - None
    - RE/ROW (RE-ROW)
      - None
    - ENVIRONMENTAL (ENV)
      - None
    - REVENUE METERING (METER)
      - None

- DISTRIBUTION
  - Revenue metering by FE PA.
- IT/NETWORK
  - Estimate:
    - No SCADA work required.
- TESTING & COMMISSIONING (TSCS)
  - Testing and Commissioning services as required.

2. STAND ALONE NETWORK UPGRADES

None

3. NETWORK UPGRADES

3.1 Substation Estimate: Timblin

- Replace Brookville line relaying.
  - Below Grade
    - Foundation, conduits, and grouding for new equipment.
  - Above Grade
    - Install (3) 34.5kV line PTs.
  - Relay & Control
    - Replace 34.5kV Brookville line relaying and metering with (1) SEL-351 and (1) SATEC meter.
  - Additional Equipment to be Removed
    - None
  - Assumptions
    - AC & DC station service and SCADA RTU are adequate.
    - There is adequate space in existing panel for new relaying.
  - Project Developer / 3rd Party Impacted Sites:
    - None

  - **<u>Support Estimates</u>**
    - PROJECT MANAGEMENT (PM)
      - Project management will be required for this asset.
    - FORESTRY (FOR)
      - None
    - RE/ROW (RE-ROW)
      - None
    - ENVIRONMENTAL (ENV)
      - None
    - REVENUE METERING (METER)

        - None
    - DISTRIBUTION
        - Revenue metering by FE PA.
    - IT/NETWORK
        - Assumptions:
            - Scoping documentation provided to BMcD as estimate input included in SAGE Estimating Software.
            - Assumed ISD of 11/25/2029 based on documentation included in SAGE Estimating Software.
            - Assumed that the existing SCADA transport at Timblin Substation is sufficient for additional SCADA telemetry.
            - Estimate:
                - Update points list as required
    - DISTRIBUTION
        - Distribution Scope:
            - None.
    - TESTING & COMMISSIONING (TSCS)
        - Testing and Commissioning Scope:
            - To test and commission all power assets.
        - Testing and Commissioning Assumptions:
            - SCADA, Fiber and Security Testing and Commissioning

4. OTHER SCOPE OF WORK

4.1 Revenue Metering

- The TO shall install, own, and maintain the revenue metering.

- The Project Developer shall provide and install the mounting structures (or enclosures) and conduits necessary for the TO metering installation and shall mount the TO instrument transformers unless otherwise agreed to by TO.

5. MILESTONE SCHEDULE FOR COMPLETION OF TRANSMISSION OWNER WORK

Facilities outlined in this report are estimated to take 25 months to construct, from the time the Generation Interconnection Agreement is fully executed. This schedule is may be impacted by the ability to obtain outages to test the proposed facilities.

Description	Start Month	Finish Month
Preliminary Engineering	1	2
Detailed Engineering	3	19
Siting, Permitting & Real Estate	5	19
Equipment Delivery	21	21
Construction	22	24
Testing and Commissioning	24	25

6. ASSUMPTIONS IN DEVELOPING SCOPE/COST/SCHEDULE

6.1 Cost Estimate Assumptions:

- The cost estimates provided in this report were developed as of September 2024, based upon current market conditions. Hence, they are subject to significant changes in the event that project implementation is delayed. Notwithstanding the cost estimates from this report being used in the Generator Interconnection Agreement for the related project, MAIT reserves the right to re-evaluate and provide a more accurate cost estimate during the implementation phase of the project. In accordance with section 217 of the Open Access Transmission Tariff, the Project Developer will be responsible for 100 percent of the actual costs of the facilities required to accommodate its Interconnection Request.
- MAIT reserves the right to charge the Project Developer operation and maintenance expenses to maintain the Project Developer attachment facilities, including metering facilities, owned by MAIT. These costs will be specified in the Generator Interconnection Agreement.
- Replacement of Timblin Transformer #2 and the reconductoring of the 34kV line identified in the Impact Study are not included in this reports and will be re-evaluated in Phase 3 of the Interconnection Study Process

6.2 Schedule Assumptions:

- MAIT's ability to support this schedule also depends on the feasibility of taking the required outages to support construction. Outages that are determined to negatively impact system reliability or cause congestion may be delayed or denied, at any time, even if they are submitted on time based on the Outage Submittal Rules in section 4.2.1 of PJM Manual 03. This includes, but is not limited to, outages requested between the months of June and September, as well as January and March, which typically get denied due to summer and winter peak conditions. Therefore, the construction schedule will be adjusted as needed to accommodate any outage restrictions that have been

identified by MAIT or the Transmission Provider.

7. REVENUE METERING REQUIREMENTS

All revenue metering needed for this interconnection project must meet the metering requirements stated in Appendix 2, section 8 of the AF1-240 GIA, and in PJM Manuals M01 and M14D. The details of applicable revenue metering requirements are given in the FirstEnergy 'Technical Interconnection Requirements and Study Criteria for Distributed Energy Resources Interconnected to Distribution Systems' posted on the PJM website.

The revenue metering will be owned and maintained by the TO.

The revenue metering system (particularly the revenue metering current transformers) shall be designed to accurately meter the light loads that will occur when the facility is not generating power and only back-feeding station service from the Transmission Owner. This may require the use of high accuracy extended range current transformers.

The revenue metering CTs and VTs shall be located on the transmission voltage side of the Project Developer's step-up transformer, on the generation side of the fault-interrupting device, and within the local zone of fault protection for the facility.

Transmission Owner will obtain real-time, site-specific, generation data from PJM, via the required communication link from Project Developer to PJM. Transmission Owner will work with PJM and Project Developer to ensure the generation data provided to PJM meets Transmission Owner's requirements.

8. LAND REQUIREMENTS FOR INTERCONNECTION SUBSTATION

None

9. ENVIRONMENTAL AND PERMITING

None

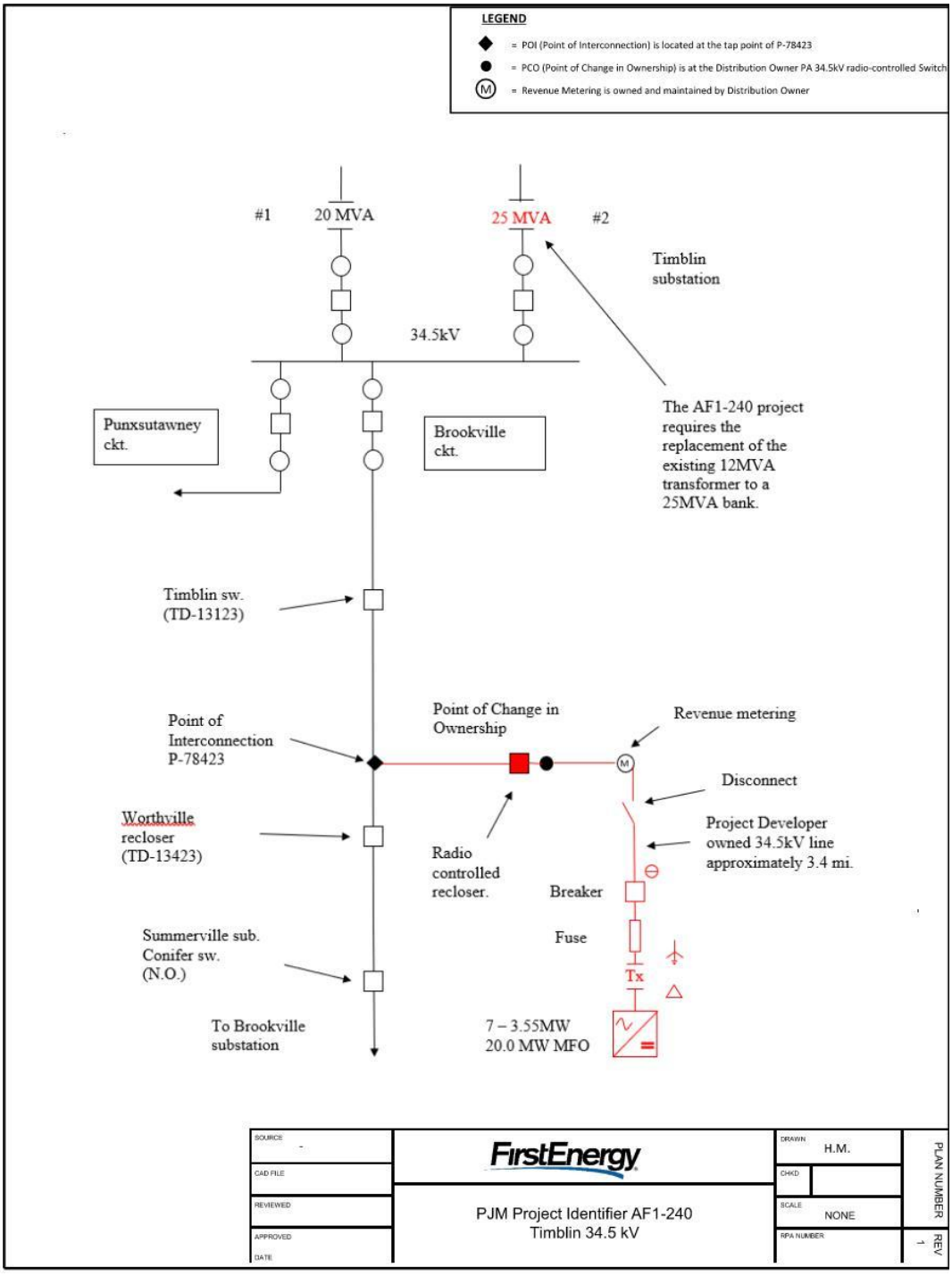
C. APPENDICES

Attachment #1: Single line Diagram for the Physical Interconnection

Attachment #2: Substation General Arrangement

Attachment #3: Protection Study

Attachment #1: Single line Diagram for the Physical Interconnection



Attachment #2: Substation General Arrangement

Not Applicable

Attachment #3: Protection Study

Preliminary Transmission Protection Scope

AF1-240 Timblin 34.5kV

Following is the protection requirements information (Facility Study Stage only) for the AF1-240 solar generation project.

The following facilities study transmission protection requirements are for the AF1-240 solar generation project, located on the Timblin – Brookville 34.5kV line. This document only provides the transmission protection requirements for changes at Timblin SS. Please refer below for details on the distribution protection requirements.

Timblin Substation

No. 1 and 2 115/34.5kV Transformers – Install a new No. 2 115/34.5kV 25MVA Transformer. Install a new 115kV breaker on the high-side of the No. 1 and 2 Transformers. Install one SEL-451 relay, for failure to trip protection of the new breaker. Install two SEL-487E relays for primary and overall differentials of both transformers. For the No. 1 Transformer, install one SEL-421 for low side system backup protection. For the No. 2 Transformer, install one SEL-421 for low side system backup protection. Install two SATEC meters.

115kV Bus: Install two SEL-487B relays for primary and backup bus differentials.

Distribution Protection Scope

Short Circuit Data (Symmetrical Values Only) - NORMAL CONFIGURATION

	SLG	3 Phase
34.5 kV Z1 = 0.30571 + j5.09553 ohms	4925A	3902A
Z0 = 0.19947 + j1.91495 ohms		

Project Scope

The AF1-240 20 MW generation will interconnect with the Penelec distribution system via a tap on the Timblin 34.5 kV Brookville circuit #00115-23 at pole # P-78423. Penelec performed an analysis of its distribution system. The AF1-240 project contributed to an overloaded transformer on the distribution system. Replace overloaded transformer #2 with a 25MVA. Replace Brookville breaker relay equipment for synch check.

EQUIPMENT AT Timblin:

Existing 34.5 kV #1 Transformer circuit breaker rated 34.5kV 1200A 38kA
Existing 34.5 kV #1 Transformer circuit breaker rated 34.5kV 600A 8kA
Existing 34.5 kV Brookville circuit breaker rated 34.5kV 1200A 16kA

Existing Brookville CO-9 (3ea) 60/1 Directional Phase Overcurrent Relay
Existing Brookville Reclosing relay

RELAY SPECIFICATIONS:
Replace existing Timblin 34.5kV Brookville phase, and RC relays with a FirstEnergy corporate standard Schweitzer SEL-0351 Line protection relay, 48/125 DC power supply, 67 VAC phase-neutral, 5 A phase current, 125 DC control with DNP protocol. Install 34.5kV Line potential Transformer, 200kV BIL 300/1 PT Ratio to monitor the 34.5kV voltage parameters.

DIRECT TRANSFER TRIP NOTES
The interconnection proposal will require Developer to meet applicable "Technical Requirements" as outlined in FirstEnergy's document titled “Technical Requirements for the Interconnection of Project developer-Owned Generation to the FirstEnergy Distribution System". Anti-islanding system shall meet IEEE 1547 and UL 1741 Therefore no Direct Transfer Trip (DTT) will be required.

METERING
SATEC PM174-60HZ-5-ACDC-00-00 three element, digital volt, amp and power indicating meter with DNP3.0 protocol. Meter used for panel indication and to supply analog data to the substation RTU. Meter to be powered by 48/125VDC.