Facilities Study Report

For

Physical Interconnection of

PJM Generation Interconnection Request Project ID AG2-176

Geneva 115 kV

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 (PD) and PJM Interconnection, LLC (PJM or Transmission Provider (TP)). The Transmission Owner (TO) is Mid-Atlantic Interstate Transmission, LLC (MAIT).

This Facility Study was performed to satisfy the Phase 2 Facility Study requirement of the PJM Tariff. The Facility Study is intended to provide scope, cost and schedule estimates for the project as currently defined and approved for Phase 2 study. In the event project changes are made during Decision Point 2 (DP2) that impact this report, updates will be provided as part of the Phase 3 report. Following execution of the project's final agreement, this report will not be updated to account for other changes made as part of the agreements modification clause and instead the scope change process will be followed.

A. Transmission Owner Facilities Study Summary

1. PROJECT DESCRIPTION

The Project Developer (PD) has proposed a solar Generating Facility located in Crawford County, Pennsylvania with a designated PJM Project ID of AG2-176. The installed facilities will have a total Maximum Facility Output (MFO) of 150 MW with 90 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 via a direct connection into the existing FirstEnergy (FE) Substation Geneva at Transformer #3 115 kV bus adjacent to breaker B6.

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

3. POINT OF CHANGE IN OWNERSHIP (PCO)

The Point in Change of Ownership will be located at the last Project Developer-owned structure near the Geneva Substation fence line.

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 PCO. This includes, but is not limited to:

- Circuit breakers and associated equipment located between the high side of the MPT(s) or Generator Step-Up (GSU(s)) and the PCO.
- Generator lead line from the Generating Facility to the PCO.
- 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 the physical interconnection of the proposed AG2-176 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 Geneva Substation

Interconnect AG2-176 Interconnection Generation Facility to existing FE Substation Geneva at Transformer #3 115 kV bus adjacent to breaker B6.

- Below Grade
    - Install (1) lot of conduit and control cables to equipment
    - Install (1) lot of foundations for all new equipment
- Above Grade
    - Install (1) 115kv dead-end/takeoff structure
    - Install (1) 115kv CB (40kA) and (2) Bus disconnects
    - Install (1) MOAB line switch
    - Install (1) 3-phase 115kv surge arrester
    - Install (1) single phase CCVTs for Morgan Street Line Terminal
    - Install (1) single phase CCVT for Wayne Line Terminal
    - Install (1) single phase CCVT for PD Line Terminal
    - Install (1) 3-phase phase CCVT for bus
    - Install (2) wave traps and line tuners for Morgan & Wayne lines
    - Install (1) set of three (3) slip-over current transformers on Transformer #3
- Relay & Control
    - Review/revise relay settings as needed.
    - Modify existing 115kV transmission breaker failure schemes to incorporate the new line terminal including CT connections, trips, and BFI.
    - The following is required for the Morgan Street 115kV Line terminal:
        - Wiring modifications to existing transmission protection schemes to implement pilot protection in the existing BU/MS SEL-411L backup line relay.
        - (1) 115kV CCVT, to be installed on a separate phase from existing on the line
        - New phase to match remote end, to be confirmed in design stage
        - (1) 115kV wave trap, to be installed on same phase as new CCVT
        - (1) 115kV line tuner, to be installed on same phase as new CCVT
        - (2) UPLC3 for backup carrier and anti-islanding receive from Morgan Street

- (2) PCM-5350, to monitor backup carrier and anti-islanding receive/Direct Transfer Trip (DTT) carrier communications

- The following is required for the Wayne 115kV Line terminal:
  - Wiring modifications to existing transmission protection schemes to implement pilot protection in the existing BU/W SEL-311B backup line relay.
  - (1) 115kV CCVT, to be installed on a separate phase from existing on the line
  - New phase to match remote end, to be confirmed in design stage
  - (1) 115kV wave trap, to be installed on same phase as new CCVT
  - (1) 115kV line tuner, to be installed on same phase as new CCVT
  - (3) UPLC3 for primary and backup carrier and anti-islanding receive from Wayne
  - One (1) UPLC to replace existing RFL-9785 transceiver used with primary carrier.
  - (3) PCM-5350, to monitor primary, backup carrier, and anti-islanding receive/DTT carrier communications
- The following is required for the 115kV No 1/No 3 bus tie breaker B6:
  - (1) SEL-451 relay for breaker failure with dedicated lockout, and control as needed
- The following is required for the 115kV No 3 Bus/No 3 Transformer Lead:
  - (1) set of three (3) single-phase 115kV CCVT for the bus
  - (2) SEL-487B relays
- The following is required for the 115/34.5kV No 3 Transformer:
  - (1) 115kV three phase, ganged, motor-operated air break (MOAB) switch to replace existing transformer 115kV high side switch, if existing ganged disconnect switch cannot be fitted with one (1) motor-operator
  - (1) set of three (3) slip-over current transformers, for the No 3 transformer 115kV bushings
  - Modifications to distribution transformer protection schemes to incorporate the new line terminal and transformer MOAB, including CT connections, trips, and BFI.
- The following is required for the 115kV PD Line terminal:
  - (1) single-phase 115kV CCVT for the new line
  - (2) SEL-411L relays, protection over fiber to PD substation
- The following is required for the 115kV PD Line breaker:
  - (1) 115kV circuit breaker, with two (2) sets of CTs per bushing
  - (1) SEL-451 for breaker failure with dedicated lockout, and control as needed
- For general relaying support:
  - (1) SEL-3555 or similar data concentrator (Real-Time Automation Controller) RTAC for use as PMU data concentration
  - (1) Ametek TR3XXX Digital Fault Recorder (DFR), exact model to be determined during the detailed design phase

- Additional Equipment to be Removed
    - Remove (1) 115kV Transformer #3 high side switch which will be replaced.
- Assumptions
    - Assumed when replacing switch, it will re-use the existing foundations and have a new stand.
    - Assumed that the existing SCADA transport at Geneva Substation is sufficient for additional SCADA telemetry.
    - Control House:
        - New double fiber panel for 115 kV Project Developer Line Terminal: Add (2) SEL-411L relays, Add (1) SEL 451- Relay (room to add to E-8012-01).
        - Existing Panel Morgan Street Carrier Panel (PN-157-12-08): Assumes enough room to Add (2) UPLC3s for backup carrier and anti-islanding, & to add (2) PCM-5350's for monitoring backup carrier and anti-islanding (Used UPLC2s in Sage).
        - Existing Panel Wayne (PN-157-12-01): Not enough room. Add new panel with (3) UPLC3s for backup carrier and anti-islanding, & to add (3) PCM-5350's for monitoring backup carrier and anti-islanding (Used UPLC2s in Sage).
        - Existing Trans. #3 Panel (D-100209-01): Not enough room. Add (2) SEL-487Bs to new Wayne anti islanding panel.
        - Existing Panel 115 kV B2 Tie Breaker (PN-157-12-07): Assumes enough room to add (2) SEL-451 relays for breaker failure.
        - Existing Panel HMI (PN-157-12-05): Assumes enough room to add (1) SEL-3555 or similar data concentrator RTAC & 1 Ametek TR3XXX. (Used SEL-5330 & added DFR & removed panel).
- Ancillary Scope of Work
    - Project Management
        - Project management will be required for this asset
    - Environmental
        - Review drawings and verify if any permitting is required for below grade work.
    - Information Technology
        - SCADA work at Geneva Substation to support breaker, relays, meters, wave trap, MOABs, GOABs, data concentrator, DFR, PCMs, and disconnect switches installation, as well as the installation of a SASDxP-24 Switch with drawing updates.
        - In-sub fiber run from Geneva control house to developer-run fiber build at developer AG2-176 PCO (First PD dead-end structure outside of Geneva). Fiber only to the first dead-end structure outside of FE substation fence for communications and control to AG2-176 generation interconnection.
            - Update points list as required
            - Install and test approximately 0.07 miles of 48F/SM from the Geneva Control House to the AG2-176 PCO.
                - This build will be run utilizing the existing cable trench for the first

0.03 miles.

- Underground ADSS will be utilized for the remaining 0.04 miles from the substation cable trench to the PCO just south of the Geneva substation yard.
- It is assumed that two separate fiber cables are being run for this build, but no spatial diversity is required.

- Testing and Commissioning
  - Testing and commissioning as required for new equipment.

1.2 AG2-176 Transmission Line Interconnection

Installation of one span from FE Geneva Existing Substation to PD's dead-end structure at PCO.

- Installations:
  - 0.1 miles of 795 kcmil 26/7 ACSR conductor, shielded by (1) OPGW and (1) 7#8 Alumoweld
- Siting/Licensing Assumptions:
  - Full Application will be required.
- General Notes/Assumptions:
  - Assume minimal social and ecological impacts.
  - Assume no local opposition to the project.
  - Location of PCO assumed
  - Location of generator station assumed
  - A ground survey will be required for design and as-built.
- Ancillary Scope of Work
  - Project Management
    - Provide project management, coordination, administration, scheduling, material management and project development if required.

1.3 AG2-176 Generation Facilities

Energize and integrate generator interconnection facilities into the transmission system.

- Relay and Controls Scope of Work
  - Integrate interconnection facilities protection and controls to the transmission system.
- Ancillary Scope of Work
  - Project Management
    - Project management will be required for this asset.
  - Testing and Commissioning
    - Test and commission all power assets

2. STAND ALONE NETWORK UPGRADES

None

3. NETWORK UPGRADES

3.1 Vitro Glass Substation

Review and revise relay settings

- Below Grade Scope of Work:
    - Install (1) lot of conduit and control cables to equipment
- Above Grade Scope of Work:
    - Install (2) wave traps and line tuners for Morgan St & Geneva lines
- Relay & Control Scope of Work:
    - Review and revise relay settings
- Additional Scope to be Removed:
    - 1) and up to (2) 115kV wave traps, to block carrier frequencies on the Geneva-Morgan Street 115kV Line
    - If a wave trap exists and cannot be re-tuned for the addition of new power line carrier frequencies as needed, replace existing wave trap.
    - At least (1) wave trap to be installed on the same phase as the backup carrier at remote ends.
- Assumptions
    - Assumed that wave traps will be mounted on structure or CCVT.
- Ancillary Scope of Work
    - Project Management
        - Project management will be required for this asset
    - Testing and Commissioning
        - Testing and commissioning as required for new equipment.

3.2 Edinboro South Substation

Upgrade line terminal metering and relay equipment. the Review and update relay settings.

- Relay & Control
    - Review/revise relay settings as needed.
        - The following is required for the Morgan Street-Springboro 115 kV (Venango Junction) Line terminal:
            - Wiring modifications to existing transmission protection schemes to incorporate the anti-islanding communications
            - (1) UPLC3 for anti-islanding transmit to Morgan Street
            - (1) PCM-5350, to monitor the anti-islanding carrier communications
- Assumptions

    - Assumed new panel is not needed.
- Ancillary Scope of Work
    - Project Management
        - Project management will be required for this asset
    - Testing and Commissioning
        - Testing and commissioning as required for new equipment.

3.3 Wayne Substation

Upgrade line terminal metering and relay equipment. the Review and update relay settings.

- Below Grade
    - Install (1) lot of conduit and control cables to equipment
- Above Grade
    - Install (1) 115kV single phase CCVT
    - Install (1) wave trap and line tuner for Geneva line
- Relay & Control
    - Review/revise relay settings as needed.
    - The following is required for the Wayne 115kV Line terminal:
        - Wiring modifications to existing transmission protection schemes to implement pilot protection in the existing BU/G SEL-311B backup line relay
        - (1) 115kV CCVT, to be installed on a separate phase from existing on the line
        - New phase to match remote end, to be confirmed in design stage
        - (1) 115kV wave trap, to be installed on same phase as new CCVT
        - (1) 115kV line tuner, to be installed on same phase as new CCVT
        - (3) UPLC3 for primary, backup carrier, and anti-islanding transmit to Geneva
        - One (1) UPLC to replace existing RFL-9785 transceiver used with primary carrier.
        - See related RPAs. One transceiver of this scope used for anti-islanding receive may be implemented by another generation connection installing anti-islanding that may be re-used for anti-islanding toward Geneva.
        - (3) PCM-5350, to monitor primary, backup carrier, and anti-islanding transmit/DTT carrier communications
- Assumptions
    - Assumed no stand or foundation needed for wave trap/CCVT.
- Ancillary Scope of Work
    - Project Management
        - Project management will be required for this asset
    - Testing and Commissioning

        - Testing and commissioning as required for revised relay settings and new equipment.

3.4 Venango Junction

Replace (1) 115 kV Wave Trap on the Edinboro South-Morgan Street-Springboro 115 kV (Venango Junction) Line

- Below Grade
    - Install (1) lot of conduit and control cables to equipment
- Above Grade
    - Install (1) wave trap and line tuner on the Edinboro South-Morgan Street-Springboro 115 kV (Venango Junction) Line.
- Relay & Control
    - (1) 115 kV wave trap, to block carrier frequencies on the Edinboro South-Morgan Street-Springboro 115 kV (Venango Junction) Line
    - If new anti-islanding carrier communication on the line utilizes the existing channel, replace existing No 1 transformer wave trap, as the existing wave trap is single frequency and cannot be re-tuned to block multiple carrier frequencies.
    - If new anti-islanding carrier communications cannot be accommodated on the existing channel, install wave trap on the same phase as remote ends.
- Assumptions
    - Assumed that wave trap will be mounted on top of existing CCVT if there is clearance.
    - Assumed that new anti-islanding carrier communication on the line utilizes separate channel and existing wave trap does not need to be replaced.
- Ancillary Scope of Work
    - Project Management
        - Project management will be required for this asset
    - Testing and Commissioning
        - Testing and commissioning as required for new equipment.

3.5 Springboro Substation

Install new UPLC3 PLC and PCM-5350 to the Edinboro South – Morgan Street 115kV (Venango Junction) Line terminal.

- Relay & Control
    - Review/revise relay settings as needed.
    - The following is required for the Edinboro South-Morgan Street 115kV (Venango Junction) Line terminal:
        - See related RPAs. This scope may be implemented by another generation connection installing anti-islanding that may be re-used for anti-islanding toward Morgan Street.
        - Wiring modifications to existing transmission protection schemes to incorporate the anti-islanding communications
        - (1) UPLC3 for anti-islanding transmit to Morgan Street

        - (1) PCM-5350, to monitor the anti-islanding carrier communications
- Assumptions
    - Assumed enough space in existing control house.
- Ancillary Scope of Work
    - Project Management
        - Project management will be required for this asset
    - Testing and Commissioning
        - Testing and commissioning as required for revised relay settings and new equipment.

3.6 Morgan Street

Install new UPLC3 PLC and PCM-5350 to the Geneva Line terminal. Review and update relay settings.

- Below Grade
    - Install (1) lot of conduit and control cables to equipment
- Above Grade
    - Install (1) new single phase 115 kV CCVT.
    - Install (1) new wave trap and line tuner
- Relay & Control
    - Review/revise relay settings as needed.
    - The following is required for the Geneva 115 kV Line terminal:
        - Wiring modifications to existing transmission protection schemes to implement pilot protection in the existing BU/GN SEL-411L backup line relay.
        - (1) 115kV CCVT, to be installed on a separate phase from existing on the line
        - New phase to match remote end, to be confirmed in design stage
        - (1) 115kV wave trap, to be installed on same phase as new CCVT
        - (1) 115kV line tuner, to be installed on same phase as new CCVT
        - (2) UPLC3 for backup carrier and anti-islanding transmit to Geneva
        - (2) PCM-5350, to monitor backup carrier and anti-islanding transmit/DTT carrier communications
    - The following is required for the Edinboro South-Springboro 115 kV (Venango Junction) Line terminal:
        - Wiring modifications to existing transmission protection schemes to incorporate the anti-islanding communications
        - (2) UPLC3 for anti-islanding receive from each of the remote ends (one (1) per remote end)
        - (1) PCM-5350, to monitor the anti-islanding carrier communications
- Assumptions

- Assumed (1) new panel needed. Assumed CCVT & wave trap can be mounted on existing steel stand.

- Ancillary Scope of Work
  - Project Management
    - Project management will be required for this asset
  - Testing and Commissioning
    - Testing and commissioning as required for revised relay settings and new equipment.

4. OTHER SCOPE OF WORK

4.1 AG2-176 Interconnection Substation Metering Requirements

Provide new revenue metering panel within existing Geneva Control House. Integrate revenue metering for the lead line going to AG2-176 Generation facility. Provide new 3-phase 115 kV Free-standing CT/VT Combo Units.

- Below Grade
  - (1) Lot of excavation, conduit, backfill, grounding, and wiring between Free Standing CT/VT Combo units to revenue metering.
  - (1) Lot of foundations for new Free-standing CT/VT 115 kV Combo Unit.
- Above Grade
  - (1) set of 3-phase Free Standing CT/VT Combo Unit 115 kV.
- Relay & Control
  - (1) New Revenue Metering Panel with test switches. The material for the Revenue Meter is to be included in revenue metering support estimate.
- Assumptions
  - It is assumed current and voltage signals will be pulled from new 3-phase free standing CT/VT Combo Units.
  - Assuming enough room in AG2-176 Control house to support a new revenue metering panel.
  - Assuming enough room in AG2-176 substation to add in free standing CT/VT Combo Units.
  - Location to be determined during detailed engineering.
  - Assuming the same crew that is constructing the substation expansion scope at Geneva will be adding the revenue metering panel and freestanding CT/VT combo units.
- Project Management
  - Provide project management, coordination, administration, scheduling, material management and project development if required.
- Revenue Metering
  - Provide high end revenue meter and engineering support for revenue metering at Interconnection Substation for AG2-176.
- Assumptions:
  - Assuming Metering panel and 3-phase free standing CT/VTs Combo Units are included in

Main Substation estimate.

- Testing and Commissioning
    - Testing and commissioning services as required.

5. MILESTONE SCHEDULE FOR COMPLETION OF MAIT WORK

Facilities outlined in this report are estimated to take 37 months to construct, from the time the Generation Interconnection Agreement is fully executed. This schedule may be impacted by the timeline for procurement and installation of long lead items, the ability to obtain outages to construct and test the proposed facilities.

Description	Start Month	Finish Month
Preliminary Engineering	1	2
Detailed Design	5	26
Siting, Permitting & Real Estate	3	26
Equipment Delivery	28	28
Construction	29	35
Testing and Commissioning	33	37

6. ASSUMPTIONS IN DEVELOPING SCOPE/COST/SCHEDULE

6.1 Scope Assumptions

- Project Developer is responsible for making all arrangements for electric distribution service (if required) for its generation station. No costs or schedule are included herein.
- Fiber shall be installed by the Project Developer between Geneva and Project Developer's substation for protection communication. At least (2) dedicated fiber pairs are required, for primary and backup line protection relaying. Primary and backup communications shall be routed in separate fiber cables, though physically independent paths are not required.

6.2 Cost Estimate Assumptions

- The cost estimates provided for this project were developed as of March 2026, 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.

6.3 Schedule Assumptions

- This schedule assumes that all issues covered by the "Environmental, and Permitting" section 10 of this document are resolved. Construction cannot begin until after all applicable permits and/or easements

have been obtained.

- 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 AG2-176 GIA, and in PJM Manuals M01 and M14D. The details of applicable revenue metering requirements are given in the "Requirements for Transmission Connected Facilities" posted on PJM website.

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

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.

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.

These requirements are in addition to any metering required by PJM.

8. LAND REQUIREMENTS FOR INTERCONNECTION SUBSTATION

Not applicable.

9. APPLICABLE TECHNICAL REQUIREMENTS AND STANDARDS

The Requirements for Transmission Connected Facilities, Revision 7, dated January 27, 2026, shall apply.

The TPP-REF-003 Transmission Planning Criteria, Revision 10, dated December 19, 2023, shall apply.

10. ENVIRONMENTAL AND PERMITING

The following are possible environmental, real estate and permitting issues:

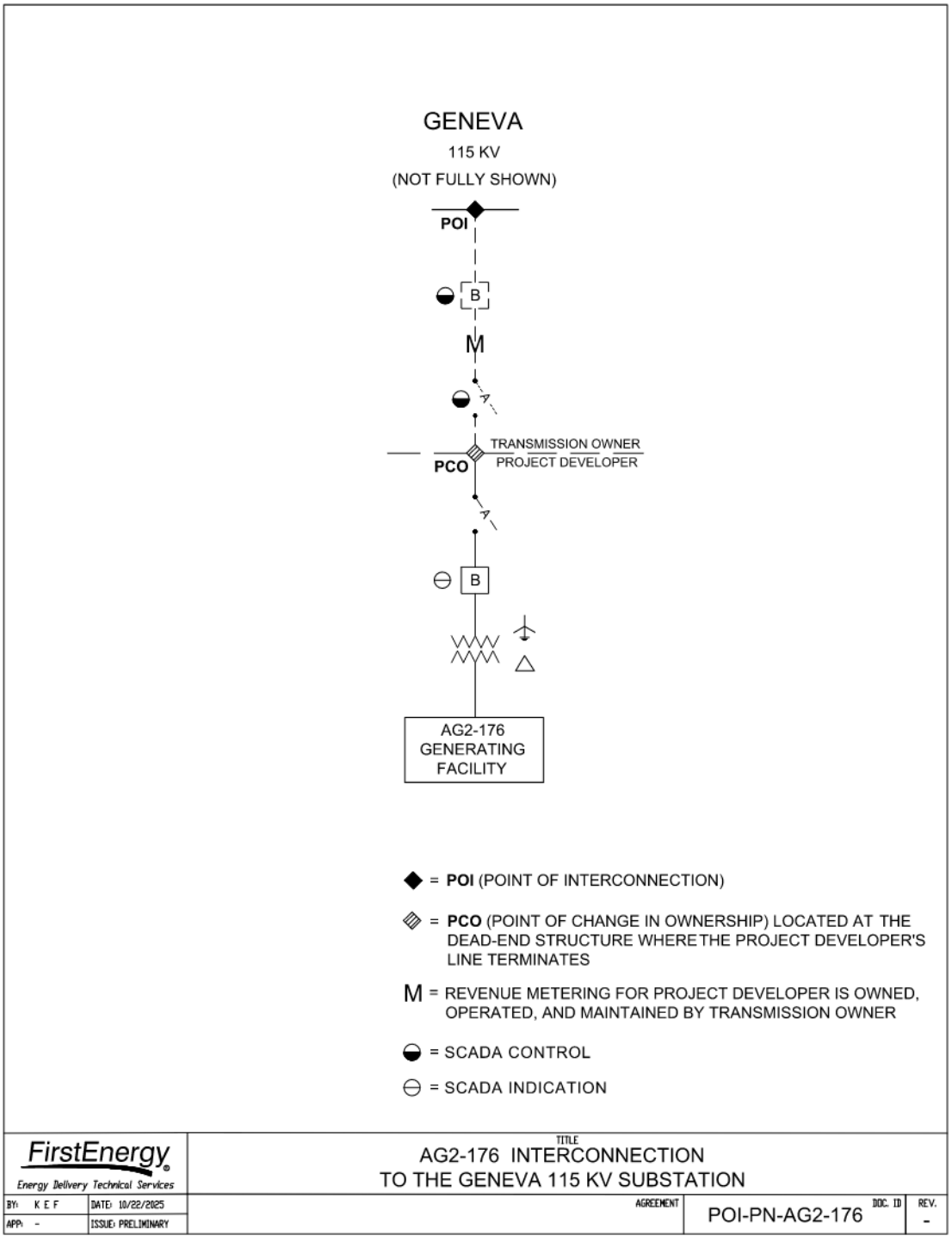
- Environmental permitting, Real Estate acquisition, and notifications to the state's Public Utilities Commission (PUC) vary, some up to twelve (12) months after preliminary engineering is completed to secure the required approvals.
- Prior to agreement by Project Developer to purchase the property, a Phase 1 Environmental Assessment should be conducted for the entire site to avoid assumption of environmental liabilities by Project Developer or Transmission Owner.
- The Transmission Owner interconnection substation may involve environmental surveys, permits, approvals and plans with federal, state, and/or local agencies.
- Assumed Project Developer is to provide all access rights, easements, rights-of-way (ROW) and permits necessary to complete the Project to the satisfaction of Transmission Owner. Environmental permitting shall encompass all federal, state, and local requirements, consultations, and agency coordination. Confirmation of meeting all permitting requirements shall be provided to Transmission Owner, prior to start of construction. Following construction and energization, confirmation of permit closeout shall be provided to the satisfaction of Transmission Owner, prior to transfer of ownership. If any of these elements are not included in the final agreement between Transmission Owner and Project Developer, twelve (12)-to-eighteen (18) months should be added to the Project Schedule to secure necessary permits, and additional costs would apply.
- Project Developer will provide copies of all the relative environmental permits and other necessary approvals to Transmission Owner before Transmission Owner accepts the interconnection facilities.
- Project Developer is required to install an access road from the new interconnection substation to the nearest public road (must be approved by Transmission Owner) and obtain access rights for Transmission Owner. Project Developer is responsible to maintain access road and ensure unimpeded access for Transmission Owner at all times.
- Project Developer is responsible for all property acquisition (including easements/ (ROW)) for transmission, distribution and communication facilities needed for the generator interconnection.
- If Project Developer owns the project property, in fee title, Transmission Owner will require a fee property transfer for the interconnection substation site which may require subdivision approval, together with permanent access rights to and from the substation, as well as a perpetual easement for any transmission lines to the substation. Project Developer is responsible for all costs, including but not limited to subdivision, associated with the property transfer.
- If Project Developer leases the project property, the Project Developer will be required to obtain fee property from the underlying fee property owner, on behalf of Transmission Owner, for the interconnection substation site, together with permanent access rights to and from the substation, as well as a perpetual easement for any transmission lines to the substation.
- All property rights must be surveyed and metes and bounds descriptions prepared for incorporation into Transmission Owner's document forms, for transfer of title.
- The Transmission Owner interconnection substation and transmission line loop will involve PUC notification/approval.
- All work occurs within an existing transmission line right-of-way or on Project Developer's property with access to all existing structures possible via that property and the right-of- way following established access routes that do not cross wetlands or streams.

- Project Developer will develop, and secure regulatory approval for, all necessary Erosion and Sediment Control (E&SC) plans and National Pollutant Discharge Elimination System (NPDES) permits.
- Project Developer will obtain all necessary permits.
- Project Developer will conduct all necessary wetlands and waterways studies and permits.
- Project Developer will conduct all necessary historical and archaeological studies.
- If the Project Developer plans to cross the transmission line right of way with facilities or access roads, please refer to the Transmission Rights-of-Way Restrictions information located at:

  https://www.firstenergycorp.com/help/safety/real-estate-power-lines/transmission-right-of-way.html#ROWform

C. APPENDICES

ATTACHMENT #1: SINGLE LINE DIAGRAM FOR THE PHYSICAL INTERCONNECTION



ATTACHMENT #2: PROTECTION REQUIREMENTS

Project Developer Protection Requirements

- The generation delivery points must comply with the technical requirements detailed in the FirstEnergy "Requirements for Transmission Connected Facilities" document.
- The Generator Step-Up (GSU) transformer(s) connecting to the FE system shall have a grounded-wye winding configuration on the high side and a delta configuration on the low side. This establishes an effective ground on the transmission system and mitigates overvoltage conditions during ground faults. A delta connected winding on the low side provides isolation of zero-sequence currents such that the FE system will not be exposed to ground faults on the generator system.
- At least one and up to (2) fully rated circuit breaker(s) are required at the point of interconnection (POI). PD is to design their protective system to clear any faults within their zones of protection with one or more of their local breakers. A dedicated breaker failure to trip relay is required for each of the POI breaker(s) to initiate direct transfer trip to FE substation(s) to effect remote clearing.
- (2) SEL-411L's for primary and backup current differential protection are required for the transmission line connecting the FE interconnection substation to the PCO. Current inputs shall be taken directly from the POI breaker(s') current transformers (CTs) directly into each AC input on the tie line relays without additional transformation through auxiliary CTs or paralleling of CTs. These relays shall use direct fiber, installed and maintained by the PD, that is routed to the FE interconnection substation for primary and backup protection communication. Upon failure of the communications channel, these relays shall resort to a backup non-pilot based scheme and thus shall also be wired to voltage transformers (VTs) at the POI. See following bullet for redundancy requirements. Part number and firmware shall be sent to FE for approval to confirm communications compatibility. The 87L channel shall also be used for breaker failure DTT communications.
- Redundant high-speed protection schemes are required to protect the PD owned equipment at POI voltage. Each zone of protection covering the POI voltage portion of the PD's system, the GSU Transformer(s), and the POI voltage interconnection breaker, shall be protected by two independent relay schemes meeting the following redundancy requirements. Primary and backup relaying shall use independent CTs, and independent PTs or independent windings from the same PTs. Primary and backup relaying shall not have any common wiring, isolating switches, or auxiliary tripping relays. Redundancy of a protection system can be achieved by ensuring that there is no single point of failure between two locally independent primary and backup protection schemes for a given element. Relays from the same manufacturer are acceptable for both the primary and backup schemes.
- A protection scheme containing generator Intertie functions is required and must be able to provide tripping for the following functions: overfrequency, underfrequency, phase and zero-sequence overvoltage, phase undervoltage, directional overcurrent, and directional power. The current source and voltage source are to be at the Transmission POI voltage. The current source for the intertie relaying is preferred to be from CTs on the POI voltage interconnection breaker.
- C800 CTs must be used on the POI voltage portion of the PD's system, and the CTs should not saturate for the maximum expected through-fault current at the tap ratio in use.
- The relaying system and interrupting device control circuits shall have a reliable source of power independent from the AC system or immune to AC system disturbance or loss (for example - DC battery and charger) to assure proper operation of the protection scheme.
- If there are multiple existing utility feeds, they shall not be paralleled. Either a mechanical or electrical interlock shall be in place to prevent paralleling of service points.

The PD is solely responsible for protecting its own equipment in such a manner that electrical faults or other disturbances on the FirstEnergy transmission system do not damage its equipment.

FirstEnergy Protection Requirements

Regarding new power line carrier (PLC) equipment called out in these requirements

A detailed frequency study shall be performed in the design phases to identify new power line carrier frequencies where required. New wave trap, line tuner, and/or CCVT shall be installed to replace or in addition to existing if new frequencies cannot be supported.

On the 115kV Geneva-Morgan Street Line Tap to another load:

- (1) 115kV wave trap to be installed at the tap point to block new backup and anti-islanding carrier on the line.

To coordinate with proposed PD substation, the relay settings at the following stations will need adjusted (note that in some cases due to limitations of the existing relays, relays may need to be replaced):

- Edinboro South:
    - For the 115kV Morgan Street-Springboro Line Terminal – (1) UPLC3 and (1) PCM-5350 to send loss of network anti-islanding to Morgan Street. Additional auxiliary equipment to couple and support new scheme to line.
- Springboro:
    - For the 115kV Edinboro South-Morgan Street Line Terminal – (1) UPLC3 and (1) PCM-5350 to send loss of network anti-islanding to Morgan Street. Additional auxiliary equipment to couple and support new scheme to line.
- Venango Junction:
    - For the 115kV Edinboro South-Morgan Street-Springboro Line Terminal – (1) 115kV wave trap to be installed between the No 1 transformer and transmission line to block carrier on the line. This trap may be used to replace existing or be installed on a separate phase, dependent on which phase anti-islanding PLC is coupled at remote ends.
- Morgan Street:
    - For the 115kV Edinboro South-Morgan Street-Springboro Line Terminal – (2) UPLC3 and (2) PCM-5350 to receive loss of network anti-islanding from Edinboro South and Springboro. Additional auxiliary equipment to couple and support new scheme to line.
    - For the 115kV Geneva Line Terminal – (1) single phase 115kV CCVT, (1) 115kV wave trap, and (1) line tuner to create a new power line carrier channel on the line. (2) UPLC3 and (2) PCM-5350 to implement a backup carrier line protection scheme and send loss of network anti-islanding to Geneva. Additional auxiliary equipment to couple and support new schemes to line. Modifications to existing equipment to implement new pilot schemes in the backup relaying.

- Wayne:

    - For the 115kV Geneva Line Terminal – (1) single phase 115kV CCVT, (1) 115kV wave trap, and (1) line tuner to create a new power line carrier channel on the line. (3) UPLC3 and (3) PCM-5350 to implement a backup carrier line protection scheme and send loss of network anti-islanding to Geneva, as well as replace existing primary relaying carrier transceiver. Additional auxiliary equipment to couple and support new schemes to line. Modifications to existing equipment to implement new pilot schemes in the backup relaying.

- Geneva:

    - For existing transmission protection schemes - Modify existing 115kV transmission protection schemes to incorporate the new line terminal including CT connections, trips, and BFI.

    - For the 115kV Morgan Street Line Terminal – (1) single phase 115kV CCVT, (1) 115kV wave trap, and (1) line tuner to create a new power line carrier channel on the line. (2) UPLC3 and (2) PCM-5350 to implement a backup carrier line protection scheme and receive loss of network anti-islanding from Morgan Street. Additional auxiliary equipment to couple and support new schemes to line. Modifications to existing equipment to implement new pilot schemes in the backup relaying.

    - For the 115kV Wayne Line Terminal – (1) single phase 115kV CCVT, (1) 115kV wave trap, and (1) line tuner to create a new power line carrier channel on the line. (3) UPLC3 and (3) PCM-5350 to implement a backup carrier line protection scheme and receive loss of network anti-islanding from Wayne, as well as replace existing primary relaying carrier transceiver. Additional auxiliary equipment to couple and support new schemes to line. Modifications to existing equipment to implement new pilot schemes in the backup relaying.

    - For the 115kV Bus Tie Breaker B6 – (1) SEL-451 relay to replace existing SEL-501 breaker failure relay for breaker failure. Additional lockouts and auxiliaries as needed to support the new relay. Existing SEL-501 relay shall be used with the existing No 3 Distribution Transformer as backup overcurrent protection.

    - For the 115kV No 3 Bus – (1) set of (3) single phase 115kV CCVTs for the bus to provide three phase potentials for PD Line terminal relaying. (2) SEL-487B relays for differential protection of the bus, and to isolate bus and transformer protective zones.

    - For the 115/34.5kV No 3 Distribution Transformer – (1) motor operator for the existing transformer 115kV disconnect switch, if feasible. Otherwise, replace existing disconnect switch with (1) 115kV, three phase, ganged, motor-operated air break (MOAB) switch. (1) set of (3) 115kV slip-over current transformers for the No 3 transformer high side bushings. Modifications to existing transformer protection schemes to operate the MOAB and isolate the transformer from 115kV bus on transformer faults. Modifications also include the implementation of existing B6 breaker failure SEL-501 relay as a new transformer backup overcurrent relay, the relocation of current transformer inputs to isolate transformer and bus protective zones, and the installation of additional lockouts and auxiliaries as needed.

- For the new 115kV PD Line Terminal – (1) 115kV circuit breaker, with (2) sets of CTs per bushing. (2) SEL-411L relays for primary and backup line current differential protection. (1) SEL-451 relay for breaker failure and controls. (1) single-phase line CCVT to support breaker/line controls. Associated auxiliary equipment and lockouts as needed. Additional auxiliary equipment to be installed to confirm islanding from communications on Morgan Street and Wayne, and send DTT to PD.

- For general protection support - Install an SEL-3555 RTAC for synchro phasors data concentration. Install an Ametek DFR for disturbance monitoring.

Short Circuit Data

The short circuit levels at the Geneva 115 kV bus are the following:

Short Circuit values at 115 kV

Three phase faults = 6.1723 kA

Single line to ground fault = 4.0253 kA

Transmission System Impedances at 115 kV, 100 MVA base

Positive sequence: Z1 = (0.0130 + j0.0803) (per unit)

Zero sequence: Z0 = (0.0736 + j0.1999) (per unit)

The fault currents provided are bolted, symmetrical values for present, normal transmission system conditions with no proposed generation facilities in-service. Future increases in fault currents are possible and it is the PD's responsibility to upgrade their equipment and/or protective equipment coordination when necessary. No generation assets were modeled.

ATTACHMENT #3: PRELIMINARY GEOTCHNICAL SUMMARY

Observation and Concern Table

Category	Source	Risk	Comment
Surficial Soil Survey	USDA Soil Survey	Moderate	Frenchtown silt loam. Fine grained soils. Shallow groundwater table
Geologic Formation/Group	PA/USGS Geologic Survey	Low	No geologic concerns based on bedrock mapping
Karst	USGS/ TAMI 2	Low	Not mapped to contain any karst related bedrock
Landslide Susceptibility	GIS/Google Earth/FEMA Risk Map	Low	Level site, low risk of landslides
Coal Mining and Oil and Gas Wells	PA Geologic Survey/TAMI 2	Low to Moderate	No mining. Nearby gas well
Environmental Hazard	US Wetland Maps/FEMA	Moderate	Adjacent wetlands
Past Development	TAMI/GIS MAP/Historic Aerials	Moderate to High	Existing facility and manmade lake

Geologic Hazards

This review was conducted to determine potential geologic hazards and risk at the existing Geneva 115 kV substation generator developer location (AG2-176). The existing substation is located south of the Virto Meadville Flat Glass manufacturing facility in Conneaut Lake, Crawford County, Pennsylvania. This project includes improvements to the existing Geneva substation which is located at the southwest terminus of the Geneva-Morgan Street 115 kV GMO transmission line. The existing substation and transmission line are operated by FirstEnergy and was installed in 1965. The proposed improvements to the substation would consist of the installation of one breaker with SCADA control. The site location was reviewed for surficial soils survey, geologic formation/group, karst, landslide susceptibility, coal mining and oil and gas well resource mapping, environmental hazards, and past development. No geotechnical data was available from the existing substation. The review was performed to identify any geologic risks that could affect the project's budget, constructability, and/or schedule.

Surficial Soil Survey

The United States Department of Agriculture Web Soil Survey indicates that the site is currently mapped as Frenchtown silt loam (FhA). This soil series is generally highly variable and consist of clays and silts, and sandy clays. The soil series is poorly drained and currently mapped with a Hydrologic Soil Group (HSG) D classification, indicating the soils have a very slow infiltration rate. The depth to the water table is listed as less than one-foot below the ground surface. The fine-grained soils and shallow groundwater table present a moderate risk for the new improvements.

Geologic Formation/Group

The site is located in the Northwestern Glaciated Plateau Section of the Appalachian Plateaus Physiographic province. The Appalachian Plateaus Physiographic province features relatively flat-lying sedimentary rocks deeply cut by rivers, creating rugged, dissected landscapes with high ridges and deep. The site is located in the Northwestern Glaciated Plateau Section of the Appalachian Plateaus Physiographic province. The Appalachian Plateaus Physiographic province features relatively flat-lying sedimentary rocks deeply cut by rivers, creating rugged, dissected landscapes with high ridges and deep

Karst
The site is mapped to be within the Shenango Formation, which is primarily sandstone or shale/siltstone bedrock which are not prone to karst related concerns. The Transmission Asset Mapping Interface (TAMI 2) was reviewed and the site is not mapped within an area prone to karst features. Based on the bedrock geology and karst mapping, there appears to be a low risk of karst related concerns for the site. A determination of karst risk should be discussed in the sites geotechnical report to better understand the risk.

Landslide Susceptibility
The northwest Glaciated Plateau Section is listed as a generally low risk, but includes local areas of high to moderate risk of landslide susceptibility by the Pennsylvania Geological Survey titled "Landslides in Pennsylvania". FEMA national risk index for the area in which the site is located as a relatively low risk to landslides. Transmission Asset Mapping Interface (TAMI) was utilized to generate elevation profiles for the site area and are provided in Appendix D. The ground surface is generally level in a north to south direction as well as an east to west direction, with a slightly dip beyond the western edge of the station.

The TAMI profiles should be considered an approximation. Given the mapped risks by FEMA and the Pennsylvania Geological Survey, there appears to be a low risk of landslide susceptibility.

Resource Mapping
The site is not underlain by a geologic formation that contains coal. Based on the Pennsylvania Department of Environmental Protection Mining map tool, the maps indicate that no mining has occurred at the site or in the surrounding area. TAMI 2 was also reviewed and also does not show any mining in the area. Several unconventional and conventional natural gas wells are located within Crawford County. Available mapping indicates that an active gas well is located approximately 600 feet west of the substation site, however no infrastructure is present from current aerial photographs, except for a clearing within the wooded area where the well is said to be located. Given the lack of any coal mining the risk of encountering any geologic concerns related to coal or natural gas is low to moderate.

Environmental Hazards
Based on U.S. Fish and Wildlife Service maps there is a small lake present immediately to the south of the substation site. TAMI II also shows an area adjacent to the east of the site as apparent wetlands, however these are not shown on the U.S. Fish and Wildlife Service maps. Aerial photographs also show standing water in the area to the east of the station. The FEMA maps indicate that the floodplain of the lake do not encroach upon the substation site. An environmental study should still be conducted to confirm this prior to construction. Due to the surrounding wetlands, there appears to be a moderate risk to flooding and environmental hazards. FE region should be consulted to review any prior issues with flooding at the site prior to the installation of the improvements.

Past Development
The past development assessment of the site was based on aerial photography. Based on aerial photography dating back to 1958, this site was developed to the north which later becomes the current glass manufacturing facility. In addition, the lake located to the south of the station is not showing on topographic maps predating 1950, indicating the lake is manmade. The substation was constructed between 1964 and 1970. Due to the facility predating the construction of the substation, and lake construction the risk of past development at the site is moderate to high.

Recommendations, Geotechnical Opinion, and Estimating

List of Observations/ Geneva 115 kV

1. The site is mapped to be with Frenchtown silt loam, which are poorly drained, fine grained soils, with a high water table
2. This site is part of the Shenango Formation and does not generally have any inherent risks associated with the geology
3. Low potential for karst
4. Low risk for landslide occurrence
5. Moderate environmental impact risk
6. No mining activity present in the immediate area, but gas well located west of the site
7. Potential concerns from past construction of facility and construction of lake to the south

The geotechnical conditions of this site seem to conclude that it is relatively moderate risk due to the high groundwater table and flooding risk and unknown potential of prior construction at the site. To the extent possible, any background from the substation construction should be reviewed further.