Facilities Study Report

For

Physical Interconnection of

PJM Generation Interconnection Request
Project ID AG2-423

"Cherry Run – Harmony 138KV"

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 and PJM Interconnection, LLC (PJM or Transmission Provider (TP)). The Transmission Owner (TO) is Potomac Electric Company (PE), a FirstEnergy company.

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 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 agreement's modification clause and instead the scope change process will be followed.

A. Transmission Owner Facilities Study Summary

1. PROJECT DESCRIPTION

The Project Developer has proposed a solar Generating Facility located in Barbour County, West Virginia. The installed facilities for AG2-423 will have a total Maximum Facility Output (MFO) of 80 MW with 48 MW of this output being recognized by PJM as Capacity.

2. POINT OF INTERCONNECTION (POI)

The Generating Facility will interconnect with the PE transmission system via a newly constructed 138 kV three (3) breaker ring bus substation, tapping the Beddington - Cherry Run – Marlow – (Harmony Jct.) 138 kV line, approximately 9.1 miles from Cherry Run substation.

The construction of the new interconnection substation will result in the splitting of the existing Beddington - Cherry Run – Marlow – (Harmony Jct.) 138 kV line, into two lines on the transmission system. New line designations are to be determined.

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

3. POINT OF CHANGE IN OWNERSHIP (PCO)

The Point of Change in Ownership (PCO) will be located at the first dead-end structure outside the new three (3) breaker ring bus interconnection substation fence line.

4. SCOPE OF PROJECT DEVELOPER 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:

- 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 TO's Applicable Technical Requirements and Standards.
- The easements and associated rights of way for the TO owned substation along with the 138 kV line taps to the substation will be acquired by the Project Developer and transferred to the TO at no cost. Site preparation for the TO owned substation, including clearing, grading and an access road, as necessary, is assumed to be by the Project Developer. The access road design must be approved by FirstEnergy to ensure it provides adequate access to the substation to support construction and maintenance activities. Route selection, line design, and right-of-way acquisition for the Project Developer's facilities are not included in this report and are the responsibility of the Project Developer.

B. Transmission Owner Facilities Study Results

The following is a description of Transmission Owner facilities for physical interconnection of the proposed AG2-423 project to PE transmission system. These facilities shall be designed according to FirstEnergy Applicable Technical Requirements and Standards. Once built, PE will own, operate, and maintain these Facilities.

1. TRANSMISSION OWNER INTERCONNECTION FACILITIES (TOIF)

1.1 New Interconnection Substation Line Terminal

Install line terminal equipment within the AG2-423 Interconnection substation. Install one span from AG2-423 Interconnection Substation to the Project Developer-owned dead-end structure outside of FE substation fence.

- Structures Installed

  0.1 miles of conductor 795 kcmil 26/7 ACSR shielded by (1) 7#8 Alumoweld

  Substation line exit facilities, including dead end structures and disconnect switches, described in the AG2-423 Interconnection substation scope.

- Siting and Permitting

  Informational Notice Letter will be required.

- Scope of work Assumptions
  - Location of PCO assumed
  - Location of generator substation assumed
  - A ground survey will be required for design and as-built.
  - Cost of mobilization/demobilization shared with line Loop scope of work.
  - Assume minimal social and ecological impacts.
  - Assume no local opposition to the project.

Ancillary Scope of Work

- Project Management
    - Provide project management, coordination, administration, scheduling, material management and project development if required.

1.2 Energize and integrate generator interconnection facilities to 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
    - Provide project management, coordination, administration, scheduling, material management and project development as required
- Testing and Commissioning
    - Test and commission all new relay settings.

2. STAND ALONE NETWORK UPGRADES

2.1 New Interconnection Substation

A new three (3) breaker ring bus substation will be constructed along the Cherry Run - Harmony 138 kV transmission line to interconnect AG2-423 with the PE transmission system.

The new substation will be located approximately 4.2 miles from Cherry Run Substation. The Project Developer will be responsible for acquiring all easements, properties, and permits that may be required to construct both the new interconnection switching station and the associated facilities. The Project Developer will also be responsible for the rough grade of the property and an access road to the proposed three-breaker ring bus site.

- Below Grade:
    - Install ground grid
    - Install cable trench, conduit, and control cables to equipment
    - Install foundations for all equipment, control house, fences posts, and structures

- Above Grade:
    - Install (3) 138kV, 40kAIC 3000A circuit breakers
    - Install (6) 138kV, 2000A motor operated disconnect switches
    - Install (3) 138kV, 2000A MOAB line disconnect switches
    - Install (1) 1380KV,100kVA SSVT

- Install (3) sets of 138kV 3-phase CVTs
- Install (9) 138 KV surge arresters
- Install (3) steel H-frame dead-ends
- Install (2) 138 kV dual frequency wave traps, line tuners, and coax for Cherry Run line
- Install (1) prefabricated control house building
- Install (1) lot battery, battery rack, and battery charger.
- Install (1) physical security camera system
- Install (1) high security fence with (2) sliding gates
- Install one lot of rigid buses, insulators, control cables, conductors, fittings, conduits, lightning mast and lighting as indicated in the attached proposed layout

- Relaying & Control:
  - Install (2) standard line relaying with (2) SEL-411L relays for primary and backup line protection over fiber for the generator lead line and Bedington-Marlowe line
  - Install (2) SEL-2411 controllers for anti-islanding scheme receive from Bedington and Marlowe
  - Install (1) standard line relaying panels, with (1) SEL-421 and (1) SEL-411L,
  - Install (1) carrier panel with (4) UPLCs and (3) PCM-5350s for Cherry run Line
  - Install (3) standard breaker control panels, each with (1) SEL-451 BFT, (1) SATEC Meter
  - Install (1) HMI Panel with (1) RTAC, (1) Arbiter GPS Clock
  - Install (1) SCADA RTU
  - Install (1) Qualitrol TWS systems for traveling wave monitoring, for networked lines >100kV

- Additional Equipment to be Removed:

  None

- General Notes/Assumptions:
  - Backup station service feed will be from local distribution
  - Rough graded site and access road provided by developer

Siting/Licensing Assumptions:

- Assumes Developer will provide final executed lease agreement noting the appropriate parcel ID.

Ancillary Scope of Works

- Project Management
    - PM Scope:

      Provide project management, coordination, administration, scheduling, material management and project development as required

- Environmental
    - Environmental Scope:

      Environmental will be needed for new substation

    - Environmental Assumptions:

      Road Bonds are required

      Environmental Filming (Documentation of Existing roads are required)

      Environmental Access and Road Crossing Permit Fees are required

      Environmental Development of Permit Binder is required

      Environmental Cultural Resource Consultation is required

      Environmental Construction walk down is required

      RTE consultation letters are required

      Wetland Delineations and WDR are required

      Stormwater permits and local approvals are assumed

      Internal environmental engineering and external project management costs are included

      A phase 1-A site assessment is included

- Forestry

  Forestry by developer.

- Information Technology:
    - Network equipment and scopes described in sections 2.2, 2.3 and 2.4.
- RE/ROW

  RE/ROW Scope:

    - RE/ROW will be needed for new substation. Developer to provide leased land to FE to build new substation
    - Real estate estimate has been included for:
        - Internal support including document review, project planning meetings, subcontractor oversight and assistance with transfer of assets if required.
        - External support for general project support, and minimal construction support and damage settlements/releases.
        - Direct damage payments not included in estimate

- Kept GIS / R&R for installation of structures.

- Distribution
  - Existing:
    - PE - Nipetown - Circuit # 312680076 - Circui Name River Bend Park - (2) #4 - 7.2/12.47 kV - Two Conductor
    - Existing: Tap Pole installed 2018 45' height
  - Installation
    - Tap near M57873-PE-17 (Lat/Long 39.5838, -77.9180)
    - 1 Dead End Included
    - 1 Tap Structure
    - 2 Tangent Structures
    - 0.15 Mile NEW Tap line
    - 0.15 Mile REPLACE Existing Line from S4132-PE17 to M57873-PE17 (Existing line installed in 1963 and is currently de-energized).
    - Approximately 200' Span Lengths
  - Distribution Assumptions:
    - New Poles are wood direct embed
    - No guying needed
    - Assumed Conductor for new line to match existing
    - Assumed no forestrty needed, on farmland owned/leased by developer.
    - Assumed roughly 0.3 miles of Access Roads/matting.
    - Assumed ROW coordination needed to cross 12.47 kV Circuit underneath existing 138 kV and 34.5 kV circuits.
    - Assumed no enivornmental permitting needed since it's located on developer land.
    - Assumed no wetlands.
- Testing & Commissioning

  T&C Scope:
  - Testing and commissioning of all new substation equipment
- Revenue Metering
  - Revenue Metering by PE.
- Standard Design References:
  - FirstEnergy's Requirements for Transmission Connected Facilities:
  - www.pjm.com/planning/design-engineering/to-tech-standards.aspx.

- PJM Protection Standard (PJM Manual 7):
- https://pjm.com/-/media/documents/manuals/m07.ashx

- PE Protection Specification:
  - Refer to Attachment 4 of this document.
- Material List and Equipment Ratings:
  - Refer to Attachment 3.

2.2 ADSS Fiber Installation

Install/Test approximately 4.83 miles of new 96F/SM ADSS cable from the AG2-423 substation control house to Marlowe substation control house. Underground ADSS will be utilized for approximately 0.07 miles from the substation control building to the riser pole M85963-PE17.

- Aerial ADSS Fiber will be utilized for approximately 4.71 miles from riser pole M85963-PE17 to the distribution structure X1A-PE17.
- Underground ADSS will be utilized for approximately 0.05 miles from the structure X1A-PE17 to the Marlowe Substation Control House.
- Install/Test approximately 3.85 miles of new 96F/SM ADSS cable from the AG2-423 substation control house to Nipetown substation control house.
- Underground ADSS will be utilized for approximately 0.04 miles from the substation control building to the riser pole M85967-PE17.
- Aerial ADSS Fiber will be utilized for approximately 2.04 miles from riser pole M85967-PE17 to the distribution structure M85946-PE17.
- Underground ADSS will be utilized for approximately 0.54 miles from the structure M85946-PE17 to the distribution structure WV4579-PE31.
- Aerial ADSS Fiber will be utilized for approximately 1.17 miles from riser pole WV4579-PE31 to the distribution structure WV4548-PE31.
- Underground ADSS will be utilized for approximately 0.06 miles from the structure WV4548-PE31 to the Nipetown Substation Control House.

IT Assumptions:

- The new substation build will include conduit builds for necessary Project Developer connections.
- Two fiber cables are required to the PCO, but they will not need to be independently routed.

2.3 MPLS Equipment

- Estimated design, installation, and testing/commissioning for MPLS equipment for SCADA transport at AG2-423 Substation.
- Estimated cost associated with Crossbow engineering and materials at AG2-423 Substation.

2.4 In – Sub Fibers Run

- Estimated (2) in-sub fibers to connect to the PCO demarcation point.

2.5 New Interconnection Substation – FE Option to Build Scope

FirstEnergy work at new Interconnection Substation

- Above Grade
  - Install (1) security system and camera system.
  - Install (1) indoor security AC cabinet.
- Relay and Control Scope of Work
  - Install (1) network fiber termination rack.
  - Programming of SCADA RTU.
- Scope of Work Assumptions
  - Assumed Project Developer will install camera foundations and conduits to FirstEnergy standards.
  - Assumed 2 weeks of testing and commissioning for testing to Transmission Control Centers.
  - Assumed Project Developer will install fiber from generator station to OTB station and bring fiber into control house.
  - FirstEnergy will be responsible for network fiber.

Ancillary Scope of Work

- Project Management
  - Provide project management, coordination, administration, scheduling, material management and project development as required.
- Testing and Commissioning
  - Testing of new site to Transmission Control Center; perform functional testing as required

3. NETWORK UPGRADES

3.1 Beddington - Cherry Run – Marlow – (HarmonyJct.) 138 kV Line

Loop Bedington - Cherry Run - Marlowe 138 Kv (Harmony Jct) Line into the proposed AG2-423 interconnection substation, approximately 9.1 miles from the Cherry Run 138 KV Substation and 1.9 miles from the Harmony Junction Tap/ The new interconnection substation will be located south of the BEDINGTON - CHERRY RUN - MARLOWE 138 KV (HARMONY JCT) LINE with the loop occurring around structure WC-32 and crossing over existing MARLOWE - TWO LOCKS 34.5 KV LINE.

Existing Conditions:

Per TAMI the existing line is constructed on single circuit, multi-pole wood and H-frame structures, or

steel monopole structures. Existing conductor is 556.5 kcmil 26/7 ACSR shielded by (2) 1/2" 7-strand EHS Steel or (2) 7#9 Alumoweld.

Per GIS View, there does not appear to be distribution under-build along the length of the project area on the Bedington - Cherry Run - Marlowe 138kV (Harmony Jct) Line.

- Install:
    - (2) single circuit steel monopole dead-end structures on concrete foundations
    - 0.2 miles of conductor 795 kcmil 26/7 ACSR shielded by (1) 7#8 alumoweld and (1) OPGW
- Transfer:
    - Existing conductor and shield wire to new dead-end structures
- Removal:
    - Approximately 0.01 miles of 556.5 kcmil 26/7 ACSR conductor and (2) 1/2" 7-strand EHS Steel shield wire
- Siting/Licensing Assumptions:
    - Informational Notice Letter will be required.
    - Assume minimal social and ecological impacts.
    - Assume no local opposition to the project.
- General Notes/Assumptions:
    - Outage can be obtained to perform line construction.
    - A ground survey will be required for design and as-built.
    - It is assumed the existing conductor and shield wire are in adequate condition and can be transferred. An engineering analysis during project development will be required.
    - It is assumed the adjacent structures are in adequate condition and can handle the new loading. An engineering analysis during project development will be required.
    - The loop cut-in and substation location were not provided in detail. A general area was provided. Specific substation location and layout will be required during project development and execution. Scope of project may change.

Ancillary Scope of Works

- Project Management
    - Scope:

      Provide project management, coordination, administration, scheduling, material management and project development if required.
    - Assumptions:

      Project management will be required for this asset.
- Access Roads
    - Scope:

Access roads will be required, terrain is flat, approximately 0.1 miles.

- Forestry
    - Scope:

      Approximately 1.0 acre of forestry clearing required.

      Land appears to be a tree farm

- Environmental
    - Scope:
        - Environmental will be needed for new substation
    - Environmental Assumptions:
        - Road Bonds are required
        - Environmental Filming (Documentation of Existing roads are required
        - Environmental Access and Road Crossing Permit Fees are required
        - Environmental Development of Permit Binder is required
        - Environmental Cultural Resource Consultation is required
        - Environmental Construction walk down is required
        - RTE consultation letters are required
        - Wetland delineations and WDR are required
        - Stormwater permits and local approvals are assumed
        - Internal environmental engineering and external project management costs are included
        - A phase 1-A site assessment is included
- RE/ROW
    - Scope:
        - Rights & restrictions review on existing line
        - New ROW will be required
    - Assumptions:
        - Project Developer is providing the land for the line loop from our existing lines to the new substation.
        - Only internal consultive support is needed with 1 access road and 1 laydown yard.
        - Real estate estimates included:
            - Internal support including document review, project planning meetings, subcontractor oversight and assistance with transfer of assets if required.
            - External support for general project support, and minimal construction

support and damage settlements/releases.

- Direct damage payments not included in estimate
- Kept GIS / R&R for installation of structures.

3.2 Bedington Substation

Install new relays and revise relay settings at Bedington Substation.

- Below Grade

  None.

- Above Grade
  - Install relay and controls as noted below
- Relay & Control
  - Install (1) standard line relaying with(2) SEL-411L relays for primary and backup line protection over fiber
  - Install (1) SEL-2411 controller with appropriate fiber transceiver for anti-islanding scheme transmit
  - Review/revise relay settings, as needed
- Install:
  - Install one (1) 138kV CCVT
  - Install one (1) wideband wave trap to be used with the backup protection.
  - Install one (1) wideband line tuner to be used with the backup protection.
- Additional Equipment to be Removed
  - Wavetrap and line tuner
  - Carrier equipment, line relays, and associated accessories
- Assumptions
  - Assumed the existing SEL 411L is required to be replaced
  - There is enough space in the existing Control house for the new panel
  - The DC B/U Battery system can support the added relays
  - New panel required for relaying. Assume there is room in the conrol house.

Ancillary Scope of Works

- Project Management

  Scope:

  - Provide project management, coordination, administration, scheduling, material management and project development if required.

  Assumptions:

- Project management will be required for this asset.

- Information Technology

  Assumptions:

  - Existing SCADA transport at Bedington Substation is sufficient for additional SCADA telemetry.

- Testing and Commissioning

  Scope:

  - Testing and Commissioning to support new relays and revision of relay settings.

3.3 Cherry Run Substation

Install new relays, CCVT, Slip-over CTs, Wave Traps, Line Tuners, Hybrids, and revise relay settings at Cherry Run Substation per protection scope. Remove existing breaker failure and associated accessories at Cherry Run.

- Below Grade
  - Install cable conduit, and control cables for new equipment
  - Install foundations for new equipment.
- Above Grade
  - Install (1) set of (3) 138kV slip over CTs for the transformer high side bushings
  - Install (1) 138kV CCVT on the new line
  - Install (1) wideband wave trap and line tuner on the new line
- Relay & Control
  - Install (1) carrier panel with (2) UPLCs and (1) PCM-5350
  - Install (1) SEL-451 relay for breaker failure
  - Install (1) lot of hybrids for phase-to-phase coupling
  - Review/revise relay settings, as needed
- Additional Equipment to be Removed
  - Remove breaker failure relay and associated accessories
- Assumptions
  - There is enough space in the existing Control house for the new panel.
  - The DC B/U Battery system can support the added relays
  - There is enough space inside the station for the added equipment

Ancillary Scope of Works

- Project Management

  Scope:

- Provide project management, coordination, administration, scheduling, material management and project development if required.

Assumptions:

- Project management will be required for this asset.

- Environmental

Scope:

- Review drawings and support work related to new equipment and new foundations. Provide any necessary support for permitting, if required.

- Information Technology

Assumptions:

- Existing SCADA transport at Cherry Run Substation is sufficient for additional SCADA telemetry.

- Testing and Commissioning

Scope:

- Testing and Commissioning to support new relays and revision of relay settings.

3.4 Marlowe Substation

Install new relays and revise relay settings at Marlowe Substation per protection scope. Remove existing wave trap, line tuner, carrier equipment, relays, and associated accessories at Marlowe

- Below Grade
  - None
- Above Grade
  - Install relay and control as noted below
- Relay & Control
  - Install (1) standard line relaying with(2) SEL-411L relays for primary and backup line protection over fiber
  - Install (1) SEL-2411 controller with appropriate fiber transceiver for anti-islanding scheme transmit
  - Review/revise relay settings, as needed
- Additional Equipment to be Removed
  - Wavetrap and line tuner
  - Carrier equipment, line relays, and associated accessoriess
- Assumptions
  - There is enough space in the existing Control house for the new panel.
  - The DC B/U Battery system can support the added relays
  - There is enough space inside the station for the added equipment

Ancillary Scope of Works

- Project Management

  Scope:

  - Provide project management, coordination, administration, scheduling, material management and project development if required.

  Assumptions:

  - Project management will be required for this asset.

- Information Technology

  Assumptions:

  - Existing SCADA transport at Marlowe Substation is sufficient for additional SCADA telemetry.
  - Assumed developer is responsible for building fiber communications from generator site to AG2-423 interconnection substation

- Testing and Commissioning

  Scope:

  - Testing and Commissioning to support new relays and revision of relay settings.

4. Other Scope of Work

2.6 Revenue metering.

Provide revenue metering panel within new AG2-423 Control House. Integrate revenue metering to Interconnection Substation. Provide new 3-phase 138kV Free-standing CT/VT Combo Units.

- Below Grade Scope of Work:
  - (1) Lot of excavation, conduit, backfill, grounding, and wiring between Free Standing CT/VT Combo units to revenue metering.
  - (1) Lot of foundations for Free-standing CT/VT 138 kV Combo Unit.
- Above Grade Scope of Work:
  - (1) set of 3-phase Free Standing CT/VT Combo Unit 138 kV.
- Relay & Control Scope of Work
  - (1) New Revenue Metering Panel with test switches. The material for the Revenue Meter to be included in revenue metering Ancillary Scope of Work.
- Scope of Work Assumptions:
  - It is assumed current and voltage signals will be pulled from new 3-phase free standing CT/VT Combo Units. Costs for these combo units are included in the AG2-423 Interconnection substation scope.
  - Assumes enough room in AG2-423 Control house to support a new revenue metering panel.

- Assumes enough room in AG2-423 substation to add in free standing CT/VT Combo Units.
- Assumes the same crew that is constructing the OTB FE Work scope will be adding the revenue metering panel and freestanding CT/VT combo units.
- Temp const facilities and construction general conditions (Scope Capture) are included in AG2-423 Interconnection substation scope.

Ancillary Scope of Work

- 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 new Interconnection Substation AG2-423.
- Testing and Commissioning
  - Testing and commissioning services as required.

Option to Build Oversight

FirstEnergy oversight of developer design and construction of new interconnection substation

- Below Grade
  - Must meet FirstEnergy standards - Option to Build.
- Above Grade
  - Must meet FirstEnergy standards - Option to Build.
- Relay and Controls Scope of Work
  - Must meet FirstEnergy standards - Option to Build.
- Scope of Work Assumptions
  - Engineering oversight for review/comment of OTB site design for meeting FirstEnergy Standards.
  - Geotechnical/site/civil oversight for review/comment of OTB site grading design for meeting FirstEnergy standards.
  - Construction Oversight assumed for 6 months (note: potential for additional oversight for Geotech/site/civil site construction for challenging projects).
  - Developer responsible for apparatus testing of devices and supplying results to FirstEnergy
  - FirstEnergy commissioning oversight is assumed for duration of construction
  - Developer responsible for providing final 3D As-builts per FE direction, oversight, and approval
- Ancillary Scope of Work

- Project Management
    - Coordinate with developer and provide project management, coordination, administration, scheduling, material management and project development for FirstEnergy scope of work.
    - Provide construction oversight for project construction duration.
- Forestry
    - Completed by Developer.
- Real Estate and Right-of-Way
    - Support as required for transfer of property to FirstEnergy upon construction completion
    - Internal support including document review, project planning meetings, assistance with transfer of assets as required.
- Environmental
    - Environmental review of proposed site.
- Testing and Commissioning
    - Commissioning review of developer supplied information and witness of critical testing

5. MILESTONE SCHEDULE FOR COMPLETION OF PE WORK

Facilities outlined in this report are estimated to take 41 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.

Activity	Start Month	End Month
Preliminary Engineering	1	2
Siting, Permits & Real Estate	5	30
Detailed Engineering	3	30
Equipment Delivery	32	32
Construction	33	39
Testing & Commissioning	37	41

6. ASSUMPTIONS IN DEVELOPING SCOPE/COST/SCHEDULE

6.1 Scope Assumptions:

- Project Developer will coordinate design and alignment of proposed 138 kV generator lead line with the Transmission Owner for review of any clearance, right-of-way or right-of-way encroachment issues with TO owned facilities.

- Project Developer will coordinate design and construction of proposed 138 kV lead line. For these areas, the Project Developer shall provide TO with proposed drawings prior to construction and as-built drawings, confirmed by as-built survey data post-construction.
- Transmission Owner's preference would be to limit interference and avoid transmission line crossings with new 138 kV terminal positions. As a minimum, Project Developer facilities should not encroach within 100 feet of TO centerline at blowout conditions. If Project Developer's line design does not comply with this requirement TO would need to review this area as a special exception.
- Additional costs will be incurred by the Project Developer, if final alignment of the 138 kV generator lead line causes encroachments, changes, or modifications to any existing or relocated TO facilities.
- 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.
- All new generator only and new generator plus load facilities must be isolated from the PE Transmission System by a Power Transformer with a winding configuration meeting the requirements in FirstEnergy's "Requirements for Transmission Connected Facilities" document.

6.2 Cost Estimate Assumptions:

- The cost estimates provided in this report were developed as of February 13, 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, PE 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.
- PE reserves the right to charge the Project Developer operation and maintenance expenses to maintain the Project Developer attachment facilities, including metering facilities, owned by PE. These costs will be specified in the Generator Interconnection Agreement.

6.3 Schedule Assumptions:

- This schedule assumes that all issues covered by the "Environmental, Real Estate and Permitting Issues" section of this document are resolved. Construction cannot begin until after all applicable permits and/or easements have been obtained.
- PE'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 PE 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 AG2-423 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

Land requirements for the Interconnection Substation needed for this interconnection project must meet the requirements in the following documents posted on PJM website.

- Requirements for Transmission Connected Facilities
- Geotechnical Design Requirements

The appropriate land requirements for a new Interconnection Substation are dependent on several electrical and physical factors/attributes. FirstEnergy will ultimately have to evaluate every property individually to assess the feasibility of construction, as well as any additional requirements that may be needed to support geotechnical and environmental concerns.

As a preliminary guide for site selection, FirstEnergy has provided a list of specifications for the substation size, Siting and Geotechnical standards, and Environmental requirements. It is important to note that these specifications are general, and as such, no construction activities should be performed on a selected site without prior approval from FirstEnergy.

8.1 Site Dimensions and Layout:

The typical new interconnection substation is a three-breaker-ring bus tapping an existing transmission line. The standard layout and dimensions of the substation are based on the voltage level of the interconnection system.

Below is a table summary of the typical substation dimensions for AG2-423. The standard requirement for a parking area has been included. However, Environmental, Geotechnical, and other factors may significantly increase the area required. For example, sites that require stormwater detention facilities will require area in addition to the typical dimensions provided in the table.

3 breaker Ring Bus Voltage	Dimension Size (ft)	Dimension Acres	Dimension size w/ 100ft buffer (ft)	Acre size w/ 100ft buffer	Parking (15 cars) 230ftx60ft	Total Acres (Buffer + Parking)
138kV	228x228	1.35	328x328	2.7	0.5	3.2

8.2 Real Estate Transfer

The preferred method for conveying a property to the TO is by "fee simple" transfer. If there are subdivisions or other conditions that hinder the ability for the Project Developer to convey the property by "fee simple" transfer, the TO may allow the use of an exclusive easement. These conditions should be discussed with the TO, and the accepted method of transfer should be confirmed early in the Interconnection process.

The Project Developer is required to obtain the following documents in the sequence listed below:

- Acquire the Interconnection Facilities property in fee from the property owner.
- Acquire an easement from the property owner for the Interconnection Facilities to the TO's T-Line (using the TO's template), if the size of property acquired doesn't sufficiently bi-sect the TO's existing right of way. If the property acquired by the Project Developer sufficiently overlaps the TO's existing right of way, this Interconnection Facilities easement is not needed.
- Provide access agreements to the TO from the property owners and Project Developer (this may be required if an exclusive easement is being used instead of conveying property to the TO in "fee simple".
- Provide an assignment of appropriate easement rights to the TO upon project completion. (Note: assignment must include all of TO's language in order to safely, operate and maintain facilities. It's critical that TO's easement templates are used when Project Developer is acquiring easements intended to be assigned to the TO.
- Provide deed conveyance of "fee simple" property for the Interconnection Facilities to the TO upon project completion and prior to transfer of title to personal property.

Document Exhibits:

Project Developer shall provide a survey and legal description detailing the location of the substation (preferably located adjacent to an existing transmission line right of way), ingress-egress to the substation from a dedicated public roadway, and easement for distribution and communication facilities and/or transmission facilities if necessary. This drawing shall be prepared by a licensed and registered surveyor and include at a minimum (ingress-egress, distribution and communication facilities locations may not need to be shown on the survey if property being conveyed is by "fee simple"):

- Legal description and survey of fee property being conveyed, including all lot split requirements
    - When property is conveyed to the TO by fee simple, the Project Developer is required to submit a completed Phase I Environmental Site Assessment (ESA) to the TO in accordance with all the requirements outlined in ASTM E 1527-05 prior to the start of construction of a substation property that will be transferred to the TO. Furthermore, if the Phase I ESA completed for the property documents the presence of any recognized environmental conditions (RECs), the Project Developer shall bear the cost and responsibility to complete a Phase II ESA in

accordance with ASTM Standard E 1903-97 (Guide for Environmental Site Assessments: Phase II Environmental Site Assessment Process), however, final approval and property conveyance shall be at the sole discretion of the TO.

- Legal description for new transmission right of way (if "fee simple" conveyance is not used)
- Legal description for new distribution right of way (if "fee simple" conveyance is not used)
- Legal description for any other energy-related facilities that may be required (if "fee simple" conveyance is not used)
- Legal description for ingress-egress to a dedicated public roadway (if fee simple conveyance is not used)
- Survey drawing that shows:
    - New right of way along with the location of existing easements
    - Other existing facilities on the property
    - Names of adjoining property owners
    - Basic drawing features: title block, north arrow, legend, graphic scale

8.3 Geotechnical and Siting Requirements:

Project Developer shall refer to Geotechnical Design Requirements provided on PJM's website. In addition, below are a list of standard siting guidelines to account for when selecting a property for the interconnection substation:

- Slopes steeper than 2:1 and/or taller than 10' shall have slope stability performed.
- Factor of Safety (FS) shall be 1.5 for permanent condition.
- Minimum road width shall be 16'. AutoTurn Analysis shall be performed to accommodate the design vehicle needed inside the substation curve widening to be provided as necessary.
- Longitudinal slope for main access road to substation shall be 0.5%-10%. This is a mandatory design specification.
- Slope across the substation pad shall be 0.5%-2%.
- Every 20' vertical slope shall require a bench.

Site Grading and Preparation Responsibility:

It is the responsibility of the Project Developer to properly vet a proposed substation location. The proposed location should be reviewed by a Civil Engineer to determine the site's suitability for construction and operation as a substation (refer to Attachment 5 to FE's preliminary Geotechnical summary report). This should include a review of available information regarding the specific site location that should be considered when estimating constructability, risk, cost, and schedule. The substation is considered the substation and all associated FirstEnergy Facilities needed to operate and maintain the site such as, access roads, stormwater management facilities, walls/structures, and utilities. This review should include, but is not limited to:

- Geologic Hazards
    - Karst
    - Geologic formation/group

        - Hard bedrock (shallow bedrock difficult to excavate)
        - Weak bedrock
    - Landslide susceptibility and topography
    - Surficial soils survey
    - Coal resource mapping
- Environmental Hazards
    - Flood mapping
    - Wetland Mapping
    - Any pollution information that could affect construction.
    - Corrosivity
- Past development
    - Mining activity
    - Previously reclaimed site

9. APPLICABLE TECHNICAL REQUIREMENTS AND STANDARDS

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

The GeoTechnical Design Requirements, dated July 20, 2022, shall apply.

The FirstEnergy Approved Vendor List, dated February 6, 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:

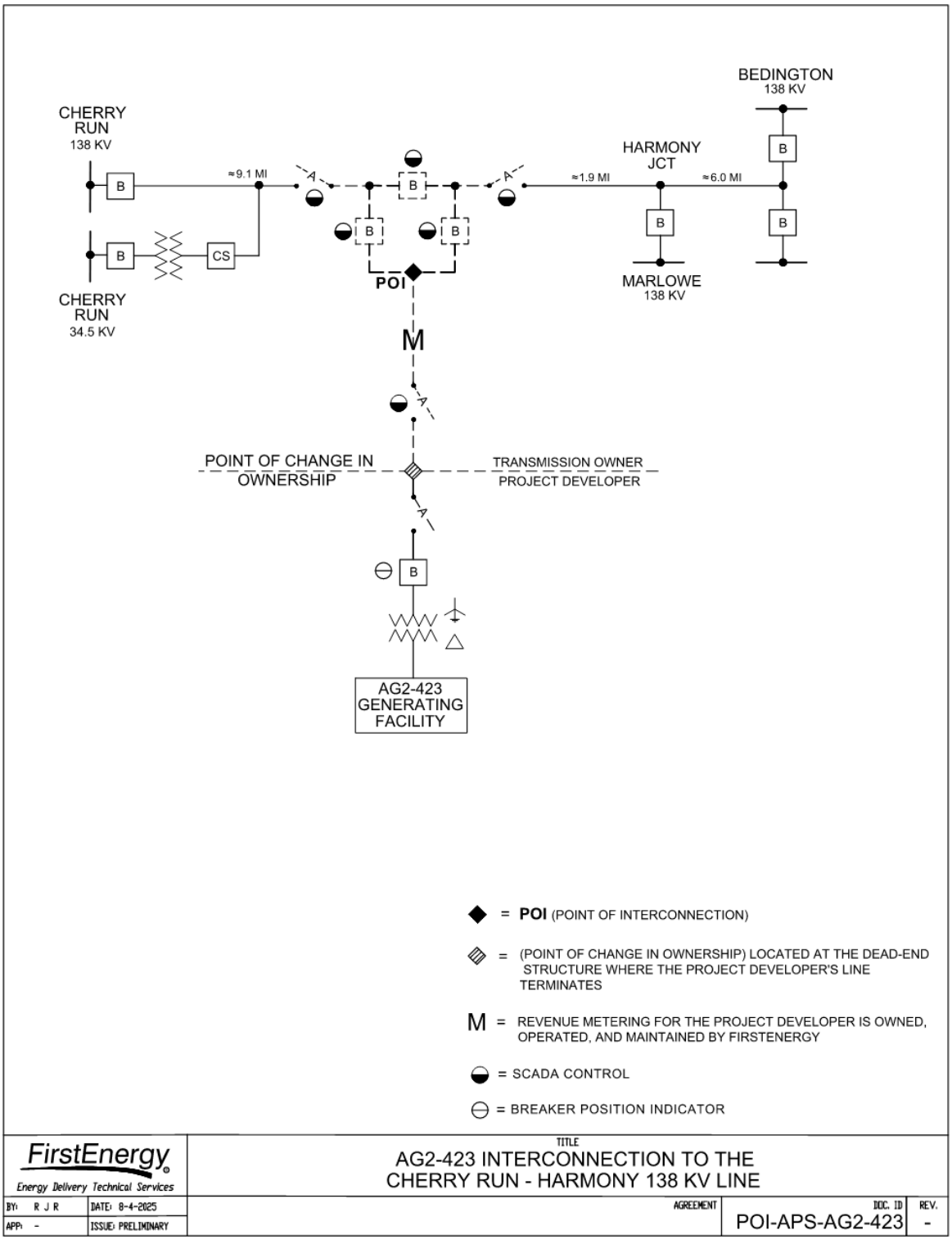
- Environmental permitting, Real Estate acquisition, and notifications to the state's Public Utilities Commission (PUC) vary, some up to twelve (12) months after preliminary engineering is completed to secure the required approvals.
- Prior to agreement by Project Developer to purchase the property, 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, 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/rights-of-way (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:

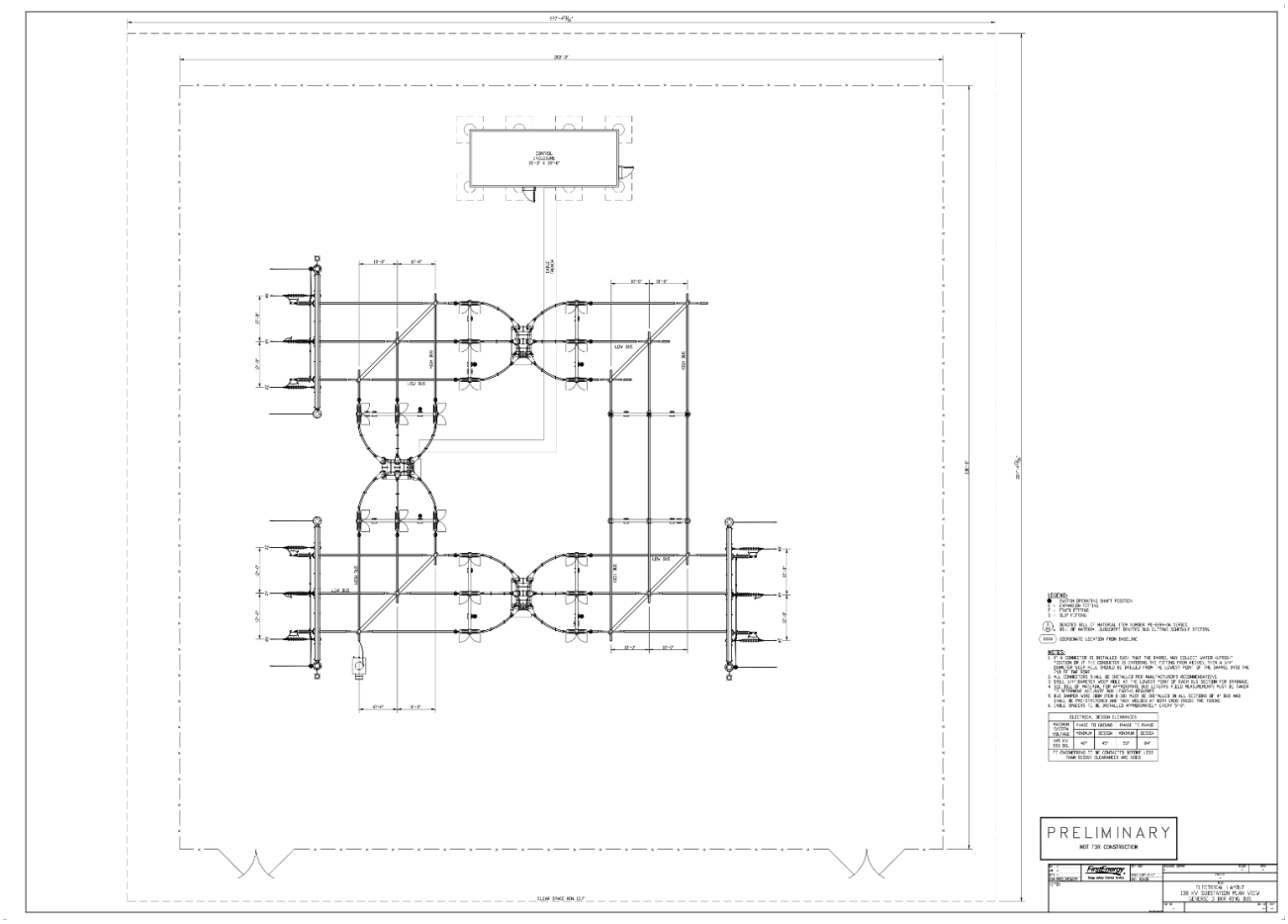
https://www.firstenergycorp.com/help/safety/real-estate-power-lines/transmission-right-of-way.html#ROWform

C. APPENDICES

ATTACHMENT #1: SINGLE LINE DIAGRAM FOR THE PHYSICAL INTERCONNECTION



ATTACHMENT #2: SUBSTATION GENERAL ARRANGEMENT



ATTACHMENT #3: MATERIAL LIST AND EQUIPMENT RATINGS

Item name (unit)	Quantity
Wire - Shield - OHGW (lf)	3,104.00
Wire - Fiber - ADSS (ft)	124,753.96
Wire - Fiber - Underground (ft)	7,913.50
Conduit - Rigid (lf)	2,005.00
Conductor - AAC (ft)	1,290.00
Conductor - ACSR (ft)	5,227.20
Cable - Control/Communication (lf)	41,775.00
Switch - Motor Operator - Substation (ea)	9.00
Disconnect Switch - Substation - 138 kV (ea)	9.00
AC/DC Panelboard (ea)	4.00
Battery - 125V (ea)	1.00
Security - Camera (ea)	26.00
Security - Physical Access Control (Badge Reader) (ea)	4.00
Capacitor Coupled Voltage Transformer (CCVT) - 138 kV (ea)	10.00
Current Transformer - Freestanding (CT) - 138 kV (ea)	3.00
Current Transformer - Slip Over (CT) - 138 kV (ea)	3.00
Potential Transformer (PT) - 138 kV (ea)	3.00
Station Service Voltage Transformer (SSVT) - 138 kV (ea)	1.00
Anchor Bolt - Substation (ea)	236.00
Insulator - Substation - 138 kV (ea)	18.00
Line Trap - 138 kV (ea)	2.00
Surge Arrester - 138 kV (ea)	9.00
Circuit Breaker - 145 kV 40 kA (ea)	3.00
Battery Monitor (ea)	1.00
Package Control Enclosure - Prefabricated (ea)	1.00
Relay - Individual (ea)	25.00
Relay Panel (ea)	15.00
Hard Bus - 1.5 inch (ft)	240.00
Hard Bus - 4 inch (ft)	820.00
Steel Support Structure (ea)	40.00
Engineered Steel Poles (ea)	3.00
Insulator - Line - Polymer (ea)	6.00
Insulator - Line - Porcelain/Glass (ea)	252.00
Battery Charger (ea)	1.00
Remote Terminal Unit (RTU) (ea)	3.00

ATTACHMENT #4: PROTECTION SCOPE

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 (1) and up to (2) fully rated circuit breaker(s) are required at the point of interconnection (POI) voltage.

(2) SEL-411L's for primary and backup current differential protection are required for the transmission line connecting the FE interconnection substation to the generating facility substation. Project Developer shall install and maintain direct fiber that is routed to the FE interconnection substation for use by primary and backup relays for protection communication. 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 Project Developer owned equipment at POI voltage. Each zone of protection covering the POI voltage portion of the generator 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 Project Developer'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 Project Developer's protection system shall be designed and constructed in accordance with all mandatory Protection and Control (PRC) standards established by the North American Electric Reliability Corporation (NERC). The Project Developer shall coordinate with FirstEnergy and Regional Reliability Coordinator to determine all applicable PRC requirements and ensure the facility's design and operation achieve full compliance.

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

FE Protection Requirements

Fiber Requirements:

Fiber shall be installed between the new ring bus substation, Bedington, and Marlowe for protection communication. At least (8) dedicated fiber pairs are required, for primary and backup line protection relaying and anti-islanding communications.

Fiber pairs used for primary and backup line protection communications shall be routed in separate fiber cables, though physically independent paths are not required.

The interconnection of the new load to the Bulk Electric System (BES) transmission network will initiate a review of existing protection schemes and may introduce new requirements to ensure compliance with the Protection and Control (PRC) standards established by the North American Electric Reliability Corporation (NERC). Additional protection system upgrades at the interconnecting station, and potentially at other affected Stations, will be determined by FirstEnergy and the Regional Reliability Coordinator during subsequent stages of the project, prior to design.

To coordinate with proposed Project Developer 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):

Cherry Run:

AG2-423 Ring Bus 138kV line – Modify the primary DCB scheme to convert to a phase-to-phase coupled pilot scheme. Install (1) UPLC and (1) PCM-5350 for a backup PLC scheme.. Install (1) wideband wave trap. Install (1) wideband line tuner. Install (1) 138kV CCVT on the line. Install (1) UPLC for anti-islanding scheme transmit. Install (1 lot) hybrids for phase-to-phase coupling. Upgrade the firmware of (1) SEL-421 and (1) SEL-411L relays.

Install (1) SEL-451 relay for 138kV breaker failure to trip protection.

No 1 138kV/34.5kV Transformer – Install (1) set of (3) slip over current transformers for use with existing line protection.

Bedington:

AG2-423 Ring Bus 138kV line –Install a standard line protection relay panel with Primary and Backup SEL-411L. The primary and backup line protection schemes will provide current differential protection over dedicated fiber. Install (1) SEL-2411 controller with appropriate fiber transceiver for anti-islanding scheme transmit.

Remove wavetrap, line tuner, carrier equipment, line relays, and associated accessories.

Marlowe:

AG2-423 Ring Bus 138kV line – Install a standard line protection relay panel with Primary and Backup SEL-411L. The primary and backup line protection schemes will provide current differential protection over dedicated fiber. Install (1) SEL-2411 controller with appropriate fiber transceiver for anti-islanding scheme transmit.

Remove wavetrap, line tuner, carrier equipment, line relays, and associated accessories.

New AG2-423 Ring Bus Substation:

Generator 138kV line – Install a standard line protection relay panel with Primary and Backup SEL-411L. The primary and backup line protection schemes will provide current differential protection over dedicated fiber.

Cherry Run 138kV line – Install a standard line protection relay panel with Primary SEL-421, Backup SEL-411L, (4) UPLCs, (3) PCM-5350s, (1 lot) hybrids, and (1 lot) of auxiliary relays. The primary relay will provide primary line protection via a PLC scheme. The backup relay will provide backup line protection via a PLC scheme. (1) UPLC will receive anti-islanding communications.

Bedington-Marlowe 138kV (Harmony Jct) line – Install a standard line protection relay panel with Primary and Backup SEL-411L. The primary and backup line protection schemes will provide current differential protection over dedicated fiber. Install (2) SEL-2411 controllers with appropriate fiber transceivers for anti-islanding receive from Bedington and Marlowe.

Install (3) appropriately rated circuit breakers for 138kV application, (2) CTs per bushing

Install (3) SEL-451 relays for 138kV breaker failure to trip protection.

Install (1) set of (3) 138kV CCVTs for each line position of the ring bus (9 total).

Install (1) SEL-3350 RTAC for relay remote access, (1) SEL-3555 RTAC for PMU data concentration, (1) Arbiter 1094B or similar GPS Clock, (1) Qualitrol TWS system for traveling wave monitoring, and (1) DFR for fault recording.

Short Circuit Data

The short circuit levels at the line tap to the AG2-423 Ring Bus 138 kV bus are the following:

Short Circuit values at 138 kV

Three phase faults = 15.9 kA

Single line to ground fault = 10.9 kA

Transmission System Impedances at 138 kV, 100 MVA base

Positive sequence Z1 = (0.00380 + j0.2605) (per unit)

Zero sequence Z0 = (0.01680 + j0.06084) (per unit)

The fault current and system impedance values are for the proposed tap location on the existing 138 kV line, for the normal system configuration connecting to Bedington, Cherry Run, and Marlowe substations. The fault currents provided are bolted, symmetrical values for present, normal transmission system conditions. Future increases in fault currents are possible and it is the Project Developer's responsibility to upgrade their equipment and/or protective equipment coordination when necessary.

ATTACHMENT #5: PRELIMINARY GEOTECHNICAL SUMMARY

Observation & Concern Table:

Category	Source	Risk	Comment
Surficial Soil Survey	USDA Soil Survey	Low to Moderate	Fine grained soil and potentially shallow bedrock
Geologic Formation/Group	WV/USGS Geologic Survey	Moderate	Anticipated shallow limestone and dolomite bedrock
Karst	USGS	Moderate to High	Bedrock mapped with minor known karst area
Landslide Susceptibility	GIS/Google Earth/FEMA Risk Map	Low	Site is not prone to landslides
Coal Mining and Oil and Gas Wells	MD/WV Geologic Survey/TAMI 2	Low	No coal mining, no oil or natural gas wells
Environmental Hazard	US Wetland Maps/FEMA	Low	Low risk of flooding
Past Development	TAMI/GIS MAP/Historic Aerials	Low	Undeveloped except for existing T-Line

Site Background / Geologic Hazards

This review was conducted to determine potential geologic hazards and risks at the proposed generator developer location (AG2-423). The reviewed location is in Falling Waters, Berkley County, West Virginia. This includes a proposed substation located along the Bedington - Cherry Run - Marlowe (Harmony Junction) 138 kV transmission line. The Marlowe-Two Locks 34.5 kV transmission line also runs parallel to the Harmony Junction line at the location of the prospective station. The substation would be located between existing tower structures WC-33 and WC-32. The existing transmission line operated by Potomac Edison was installed in 1976. The proposed substation would consist of (3) breaker 138kV ring bus with SCADA control. This 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. 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 Hagerstown silt loam (HbB) or Hagerstown silty clay loam (HcC). The Hagerstown silt loam and silty clay loam soil series are both moderately well-drained soils consisting of clays and silts (CL, ML, CH) with varying amounts of sand and gravel in the soil matrix. The depth to bedrock is listed at relatively shallow depths at the site (estimated 59 to 69 and 73 to 83 inches). Both formations are mapped as Hydrologic Soil Group (HSG) B classification, indicating the soils have a moderate infiltration rate. The depth to the water table is listed as greater than 80 inches below the ground surface. The fine-grained soils and potentially shallow bedrock would present low to moderate difficulties in creating the new substation.

Geologic Formation/Group

The site is located at the western edge of the Great Valley section of the Valley and Ridge physiographic province, which is characterized by folded and faulted rocks ranging in age from late Ordovician to early Mississippian. The valleys are primarily composed of less-resistant shale and siltstone, while the mountain ridges are mainly resistant sandstone and limestone. The Geologic Map of West Virginia maps the site to be underlain by the Conococheague Formation. The Conococheague consists of primarily limestone and dolomite.

Karst

The site is underlain by the Conococheague Formation consisting of limestone and dolomite both of which can be prone to karst conditions. The West Virginia Geological Survey identifies that the site is located in a karst area. The Developing a Karst Map for West Virgina indicates several rock outcroppings as well as published cave locations with Berkeley County. In addition, Transmission Asset Mapping Interface was reviewed and also maps the site to be within a known karst area.

A determination of karst risk should be discussed in the site geotechnical report to better understand the risk. Based on available mapping there is a moderate to high risk of karst.

Landslide Susceptibility

The FEMA national risk index for Berkeley County rates the area as a low risk to landslides. The West Virginia Landslide Project LiDAR mapped landslide density has the Appalachian Ridges and Valleys amongst the lowest rating in the state with 0.5 landslides per square mile. Transmission Asset Mapping Interface (TAMI) was utilized to generate elevation profiles for the potential site area. The ground surface is located on a gently sloping area at the proposed substation area, approximately El. +500 feet. Grades slope downward in a relatively uniform gradient from north to south and are generally undulating in an east to west direction. The risk of a landslide occurrence is low.

Resource mapping

There is no historical coal mining activity in this region.

Environmental Hazards

Based on FEMA and U.S. Fish and Wildlife Service maps there are no wetlands or features that would cause an increased risk of flooding. An environmental study should still be performed to confirm this prior to construction.

Past Development

The past development assessment of the site was based on aerial photography. The site is currently an apple orchard. Based on aerial photography dating back to 1955 this site has only been developed for the transmission line, otherwise the site has only been used for farming.

Recommendations & Geotechnical Opinion

List of Observations/ Cherry Run – Harmony 138kV

1. This site is part of the Conococheague Formation (Limestone and Dolomite)
2. Moderate to high potential for karst
3. Low risk for landslide
4. Low environmental impact risk
5. No coal mining, oil, or natural gas wells activity present in the area
6. No prior development other than transmission line. Site used for farming.

This opinion is based on the assumption this is a generator developer, option to build project. The geotechnical conditions of this site seem to conclude that it is relatively moderate risk to develop a substation due to the karst related construction concerns. The budget should anticipate the additional need for borings and/or rock probes, and potentially geophysical studies to determine the overall karst related concerns for construction. There are no anticipated budget, constructability, or schedule issues for the prospective station. All findings should be confirmed by the developer prior to construction.