Facilities Study Report

For

Physical Interconnection of

PJM Generation Interconnection Request
Project ID AG2-057/AH1-060

"Cardington-Liberty 69 kV III"

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 American Transmission Systems, Inc. (ATSI), 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 agreements 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 an uprate to an existing Solar Generating Facility located in Morrow County, Ohio. The AG2-057/AH1-060 project is a 30 MW (18 MW Capacity) uprate to the previous project (AF1-122), for a total Maximum Facility Output (MFO) of 94 MW with 44.88 MW of this output recognized by PJM as Capacity.

2. POINT OF INTERCONNECTION (POI)

The Generating Facility will interconnect with the ATSI transmission system at the existing Cardington-Liberty Substation as an uprate to AF1-122.

3. POINT OF CHANGE IN OWNERSHIP (PCO)

The PCO will remain the same as AF1-122, located at the last Project Developer-owned structure outside the existing Cardington-Liberty 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 PCO. These facilities may have been constructed as part of AF1-122. This includes, but is not limited to:

- Circuit breaker and associated equipment located between the high side of the GSU and the PCO.
- Generator lead line from the Generating Facility to the PCO.
- 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.

B. Transmission Owner Facilities Study Results

The following is a description of Transmission Owner facilities for physical interconnection of the proposed AG2-057/AH1-060 project to ATSI transmission system. These facilities shall be designed according to FirstEnergy Applicable Technical Requirements and Standards. Once built, ATSI will own, operate, and maintain these Facilities.

1. TRANSMISSION OWNER INTERCONNECTION FACILITIES (TOIF)

1.1 AF1-122 Generator Substation

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 if required.
    - Revenue Metering
        - Support integration of AG2-057/AH1-060 with existing revenue metering owned by the Project Developer.
    - Testing and Commissioning
        - Testing and commissioning services as required.

2. STAND ALONE NETWORK UPGRADES

None.

3. NETWORK UPGRADES

3.1 AF1-122 Interconnection Substation

Install Power Line Carrier equipment at AF1-122 interconnection substation for communication between Tangy and the AF1-122 interconnection substation.

- Below Grade Scope of Work:
    - Installation of cables from line turners to control house
- Above Grade Scope of Work:

- Installation of (2) 69kv Wave Traps and (2) Line Tuners

- Relay & Control Scope of Work
  - (4) UPLCs
  - Review generator design drawings.
- Scope of Work Assumptions:
  - Foundations and stands are needed for wave traps.
  - Assume 1200A wave traps and 250 ft cable.
- Ancillary Scope of Work
  - Project Management
    - Provide project management, coordination, administration, scheduling, material management and project development if required.
  - Environmental
    - Review and provide support for the new foundations and determine if any permitting will be needed.
  - Information Technology
    - Estimate SCADA work at AF1-122 Substation to support relays, meters, wave trap, and PCM installation.
  - Testing and Commissioning
    - Testing and commissioning services as required.

3.2 Tangy Substation

Install Power Line Carrier equipment at Tangy substation for communication between Tangy and the AF1-122 interconnection substation.

- Below Grade Scope of Work:
  - Installation of cables from line turners to control house
- Above Grade Scope of Work:
  - Installation of (2) 69kv Wave Traps and (2) Line Tuners
- Relay & Control Scope of Work
  - (4) UPLCs
  - Review generator design drawings.
- Scope of Work Assumptions:
  - Assume there is sufficient room in existing control house for carrier panel install based on print O-607-30-04

- Assume foundations and stands needed for wave traps
- Assume 1200A wave traps and 250 ft cable

- Ancillary Scope of Work
  - Project Management
    - Provide project management, coordination, administration, scheduling, material management and project development if required.
  - Environmental
    - Review and provide support for the new foundations and determine if any permitting will be needed.
  - Information Technology
    - SCADA work at Tangy Substation to support relays, meters, wave trap, and PCM installation, as well as the installation of a SAS-DxP-24 Switch with drawing updates.
  - Testing and Commissioning
    - Testing and commissioning services as required.

4. Other Scope of Work

4.1 Provide support for updates to the existing Project Developer-Owned revenue metering

5. MILESTONE SCHEDULE FOR COMPLETION OF ATSI WORK

Facilities outlined in this report are estimated to take 21 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 Engineering	5	18
Siting, Permitting & Real Estate	-	-
Equipment Delivery	-	-
Construction	18	20
Testing and Commissioning	19	21

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.

6.2 Cost Estimate Assumptions:

- The cost estimates provided for this project were developed as of February 27, 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, ATSI 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.
- ATSI reserves the right to charge the Project Developer operation and maintenance expenses to maintain the Project Developer attachment facilities, including metering facilities, owned by ATSI. 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.
- ATSI'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 ATSI or the Transmission Provider.

7. REVENUE METERING REQUIREMENTS

Revenue metering equipment is owned, operated, and maintained by the Project Developer.

Transmission Owner's Revenue Metering Requirements may be found in the FirstEnergy Corporation Requirements for Transmission Connected Facilities document which can be found on the PJM website at:

https://pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy

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

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

8. LAND REQUIREMENTS FOR INTERCONNECTION SUBSTATION

Not Applicable

9. APPLICABLE TECHNICAL REQUIREMENTS AND STANDARDS

The Requirements for Transmission Connected Facilities, Revision 6, dated December 19, 2024, shall apply.

10. ENVIRONMENTAL AND PERMITING

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

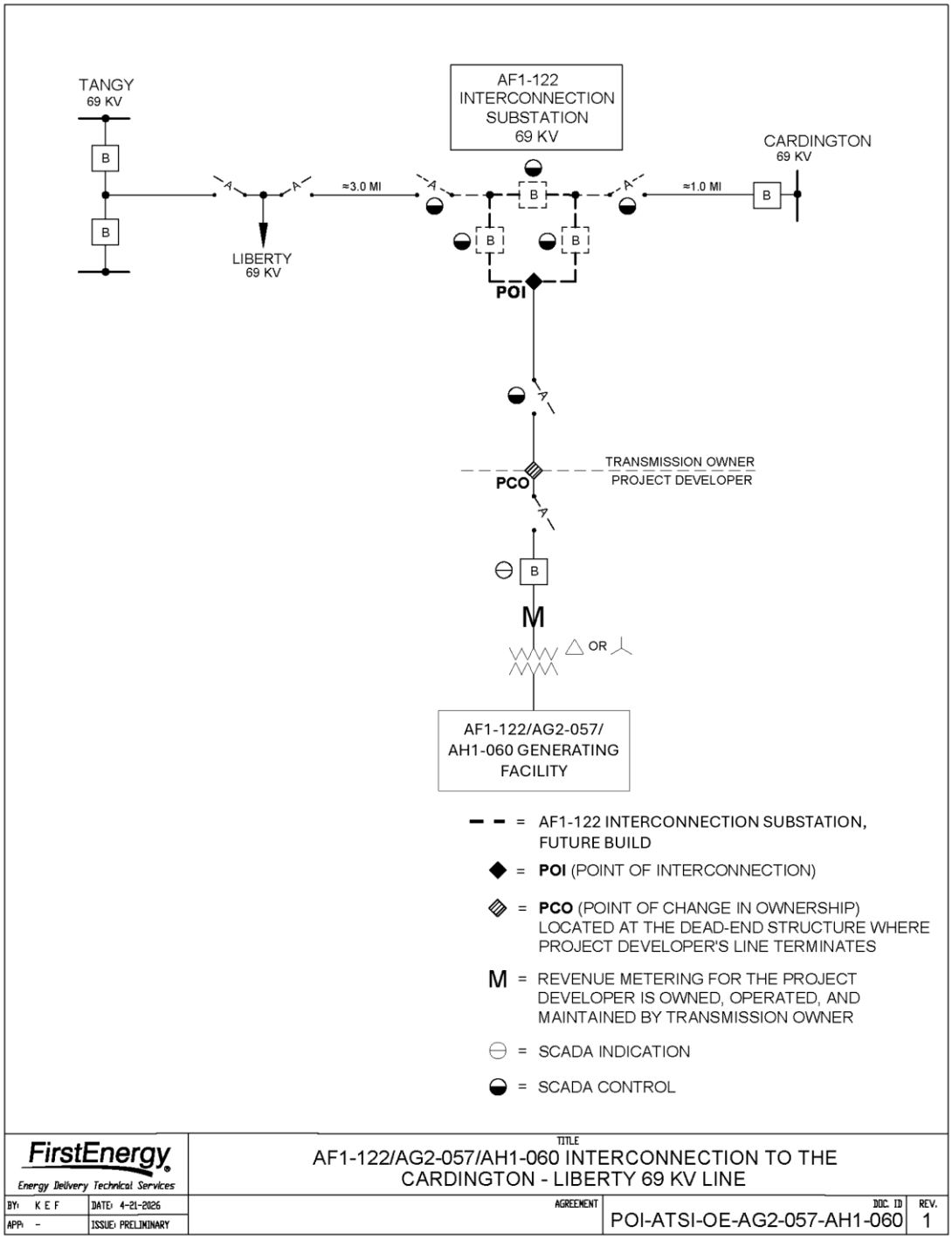
- Environmental permitting, Real Estate acquisition, and notifications to the state's Public Utilities Commission (PUC) vary, some up to twelve (12) months after preliminary engineering is completed to secure the required approvals.
- Prior to agreement by Project Developer to purchase the property,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

Assumption:

- AF1-122 is in-service prior to AG2-057/AH1-060
- Protection Requirements:
- The AF1-122 facility shall consist of 64MW solar interconnection to the Cardington- Tangy 69kV line. Construct a 69 kV 3-breaker ring bus by looping in Cardington-Tangy 69 kV Line into new generation interconnection substation using 336 ACSR 26/7 The developer will need to provide information on the inverters and show that they meet the requirements of UL 1741 certification for anti-islanding protection. Any necessary intertie functions will be incorporated into the line relaying at the generator terminal of the interconnecting line. The Project Developer will not supply fault current to the FE system. Scope and cost estimates supplied assume that the AF1-122 facility will meet the requirements as stated in the AF1-122 facility study document, but documentation must be supplied to FirstEnergy to verify inverters meet these standards. AG2-057/AH1-060 works under the assumption that these standards shall be met with AF1-122 and that AF1-122 is in-service prior to AG2-057/AH1-060.

Power Line Carrier Communication Channels

Transmission Owner power line carrier requirements:

Tangy -New 69 kV Ring Bus:

1. FSK Carrier frequency for primary DCUB scheme
2. FSK Carrier frequency for backup DCUB scheme
3. FSK frequencies, one for DTT send/, one for DTT receive, one for anti-islanding send (52b contacts)

Tangy Substation:
For power line carrier communication channels, the following new equipment is required:
four UPLC carrier sets, two wave traps and two (2) line tuners

New 69 kV Ring Bus Substation

For power line carrier communication channels, the following new equipment is required:
four UPLC carrier sets, two wave traps and two (2) line tuners
Short Circuit Values

The preliminary 69kV fault values at the AF1-122 interconnection location are:

Three Phase = 7.2kA
Single line to ground = 6.8kA
Z1= (2.958+ j 10.837) %
Z0= (2.871 + j 13.076) %

These values are provided for bolted, symmetrical faults under anticipated normal system conditions and are provided on a 71.07kV, 100MVA base. 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.

Possible Settings changes at Tangy and remote end.