

***Generation Interconnection
Facilities Study Report***

For

***PJM Transmission Interconnection Request
Project Identifier AF1-302***

“Brookville-Squab Hollow 138 kV II”

September 2024

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Preface

The intent of the Facilities Study is to determine a plan, with approximate cost and construction time estimates, to connect the subject generation interconnection project to the PJM network at a location specified by the Project Developer. As a requirement for interconnection, the Project Developer may be responsible for the cost of constructing Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM Transmission System. All facilities required for interconnection of a generation interconnection project must be designed to meet the technical specifications (on PJM web site) for the appropriate transmission owner.

The Facilities Study estimates attempt to identify the estimated time required to obtain property rights and permits for construction of the required facilities. The Project Developer is responsible for the right-of-way, real estate, and construction permit issues. For properties currently owned by Transmission Owners, the costs may be included in the study.

A. Transmission Owner Facilities Study Summary

1. *Description of Project*

The Project Developer has proposed an uprate to a solar generating facility located in Jefferson County, Pennsylvania. AF1-302 is a 42 MW uprate (18 MW capacity uprate) to the previous project AE2-316 (90 MW with 41.22 MW capacity), together, hereinafter referred to as the “Generating Facility”. The combined output of the two projects will be 132 MW with 59.2 MW of this output being recognized by PJM as Capacity. The Generating Facility will interconnect with Mid-Atlantic Interstate Transmission, LLC (MAIT), hereinafter referred to as “Transmission Owner” (TO), at the newly constructed 138 kV Sulgar Substation by looping in the Brookville-Squab Hollow 138 kV transmission line, located 20.37 miles to Squab Hollow, 8.32 miles to Brookville constructed for AE2-316.

The Point of Interconnection (POI) is where the Squab Solar (AE2-316) line bay connects to the 138kV bus at Sulgar Substation.

2. *Amendments to the System Impact Study or System Impact Study Results*

The Maximum Facility Output posted on the System Impact Study posted on PJM’s website dated August 2020 has been reduced from 142 MW to 132 MW.

3. *Project Developer’s Milestone Schedule*

Project Developer’s requested Commercial Operation Date (COD) for AF1-302 is **December 31, 2026**.

Milestone Schedule:

February 28, 2026	Initial back-feed through Project Substation Date
December 31, 2026	Project Commercial Operation Date

4. *Project Developer's Scope of Work*

Project Developer is responsible for all design and construction related to activities on their side of the Point of Change in Ownership (PCO).

Point of Change in Ownership: The PCO will be located inside Sulgar Substation where Project Developer-owned 138 kV generator lead line conductor will terminate on the insulators on the dead-end takeoff structure.

Project Developer is required to own, install, and maintain a fully rated, fault-interrupting circuit breaker on the high-side of the GSU transformer, as well as the necessary revenue metering equipment. The revenue metering current and voltage transformers shall be installed on the high voltage side of the GSU, on the generation side of the fault-interrupting device, and within the local zone of fault protection for the facility. The protective relaying and metering design must comply with Transmission Owner's applicable standards as well as with PJM requirements.

5. *Description of Facilities Included in the Facilities Study*

Transmission Owner Interconnection Facilities

Squab Solar Substation:

Energize and integrate Interconnection Facilities protection and controls to the transmission system.

Stand Alone Network Upgrades

None

Network Upgrades

Sulgar Substation (AE2-316/AF1-302 interconnection substation) (PJM Network Upgrade Number n8701.0)

Relay settings will be modified.

Brookville Substation (PJM Network Upgrade Number n8700.0)

Relay settings will be modified.

Squab Hollow Substation (KATCo) (PJM Network Upgrade Number n87402.0)

Relay settings will be modified.

Other

Revenue metering

Revenue metering support will be provided.

6. Total Cost of Transmission Owner Facilities Included in the Facilities Study

Description	Total
Transmission Owner Interconnection Facilities:	\$79,816
Total Stand-Alone Network Upgrades Costs:	\$0
Total Network Upgrades Upgrade Costs:	\$206,935
Other Costs:	\$4,973
TOTAL Costs (ALL Categories)	\$291,724

7. Summary of the Schedule for Completion of Work for the Facilities Study

<i>Activity</i>	<i>Duration</i>
Engineering, Procurement, and Construction	10 months

B. Transmission Owner Facilities Study Results

This section describes facilities identified to be installed, replaced, and/or upgraded by the Transmission Owner to accommodate the project. During detailed design and analysis other components may be identified for installation or replacement due to this interconnection.

1. Transmission Lines –New

None

2. Transmission Lines – Upgrade

None

3. New Substation/Switchyard Facilities

None

4. Substation/Switchyard Facility Upgrades

Squab Solar Substation

- Below Grade
 - None
- Above Grade
 - None
- Relay & Control
 - Energize and integrate Interconnection Facilities protection and controls to the transmission system.
- Additional Equipment to be Removed
 - None
- Assumptions
 - None
- Attachments
 - None
- **Ancillary Substation Estimates**
 - Project Management (PM)
 - Project Management will be required for this asset.
 - Forestry
 - None
 - RE/ROW
 - None
 - Environmental
 - None

- Revenue Metering
 - Support as needed for facility uprate.
- IT/Network
 - Fiber (Relaying And Communication)
 - None
 - SCADA
 - None
- Testing & Commissioning (TSCS)
 - Testing and commissioning services as required for revised relay settings.

Sulgar Substation (AE2-316/AF1-302 interconnection substation)

- Below Grade
 - None
- Above Grade
 - None
- Relay & Control
 - Revise relay settings.
- Additional Equipment to be Removed
 - None
- Assumptions
 - None
- Attachments
 - None
- **Ancillary Substation Estimates**
 - Project Management (PM)
 - Project management will be required for this asset.
 - Forestry
 - None
 - RE/ROW
 - None
 - Environmental
 - None
 - Revenue Metering
 - None
 - IT/NETWORK
 - Fiber (Relaying And Communication)
 - None
 - SCADA
 - None
 - Testing & Commissioning (TSCS)
 - Testing and commissioning services as required of revised relay settings.

Brookville

- Below Grade
 - None
- Above Grade
 - None
- Relay & Control

- Revise relay settings.
- Additional Equipment to be Removed
 - None
- Assumptions
 - None
- Attachments
 - None
- **Ancillary Substation Estimates**
 - PROJECT MANAGEMENT (PM)
 - Project management will be required for this asset.
 - FORESTRY
 - None
 - RE/ROW
 - None
 - ENVIRONMENTAL
 - None
 - REVENUE METERING
 - None
 - IT/NETWORK
 - FIBER (RELAYING AND COMMUNICATION)
 - None
 - SCADA
 - None
 - TESTING & COMMISSIONING (TSCS)
 - Testing and commissioning services as required of revised relay settings.

Squab Hollow

- Below Grade
 - None
- Above Grade
 - None
- Relay & Control
 - Revise relay settings.
- Additional Equipment to be Removed
 - None
- Assumptions
 - None
- **Ancillary Substation Estimates**
 - Project Management (PM)
 - Project management will be required for this asset.
 - Forestry
 - None
 - RE/ROW
 - None
 - Environmental
 - None
 - Revenue Metering

- None
- IT/Network
 - Fiber (Relaying And Communication)
 - None
 - SCADA
 - None
- Testing & Commissioning (TSCS)
 - Testing and commissioning services as required of revised relay settings.

5. Telecommunications Facilities – Upgrades

None

6. Metering & Communications

Revenue metering support will be provided.

7. Environmental, Real Estate and Permitting

None

8. Summary of Results of Study

The cost estimates provided in this report were developed as of April 2024. Hence, they are subject to significant changes in the event that project implementation is delayed for over one year.

Notwithstanding the cost estimates from this report being used in the AE2-316/AF1-302 Generation Interconnection Agreement (“AE2-316/AF1-302 GIA”), Transmission Owner reserves the right to re-evaluate and provide a more accurate cost estimate during the implementation phase of the project.

Work Description	Direct		Indirect		Total Cost
	Labor	Material	Labor	Material	
Squab Solar Substation: Energize and integrate Interconnection Facilities the transmission system.	\$63,046	\$0	\$16,770	\$0	\$79,816
Total Transmission Owner Interconnection Facilities Cost	\$63,046	\$0	\$16,770	\$0	\$79,816
None	\$0	\$0	\$0	\$0	\$0
Total Stand Alone Network Upgrades Cost	\$0	\$0	\$0	\$0	\$0
Brookville: Revise relay settings. (PJM Network Upgrade Number n8700.0)	\$53,377	\$0	\$14,398	\$0	\$67,775
Sulgar Substation (AE2- 316/AF1-302 interconnection substation): Revise relay settings. (PJM Network Upgrade Number n8701.0)	\$57,029	\$0	\$15,384	\$0	\$72,413
Squab Hollow (KatCo): Revise relay settings. (PJM Network Upgrade Number n87402.0)	\$52,567	\$0	\$14,180	\$0	\$66,747
Total Network Upgrades Cost	\$162,973	\$0	\$43,962	\$0	\$206,935
Revenue Metering	\$3,730	\$0	\$1,243	\$0	\$4,973
Other Costs	\$3,730	\$0	\$1,243	\$0	\$4,973
Total Project Costs	\$229,749	\$0	\$61,975	\$0	\$291,724

Generation projects meeting IRS "Safe Harbor" provisions generally do not incur tax on "CIAC" (Contribution in Aid to Construction), a tax collected by the utility for the state or federal government. Transmission Owner does not expect to collect tax on CIAC for this project. If for any reason, tax on "CIAC" would be required for this project, it would be the responsibility of the party owning the generator to pay this cost.

Transmission Owner reserves the right to charge the Project Developer operation and maintenance expenses to maintain the Interconnection Facilities, which may include metering facilities, owned by Transmission Owner.

9. Schedules and Assumptions

A proposed **ten (10) month Direct Connection** schedule is estimated to complete the engineering, construction and the associated activities, from the date of a fully executed AE2-316/AF1-302 GIA and construction kick-off meeting. This schedule assumes that all issues covered by the “Environmental, Real Estate and Permitting Issues” section of this document are resolved, and outages (typically not granted from June through September) will occur as planned. Construction cannot begin until after all applicable permits and/or easements have been obtained.

10 month Schedule

Activity	Start Month	End Month
Preliminary Engineering	1	4
Detailed Engineering	4	7
Testing & Commissioning	7	10

Attachment #1: Protection Study

Protection Requirements:

Sulgar Substation

- Revise relay settings as needed.

Brookville SS

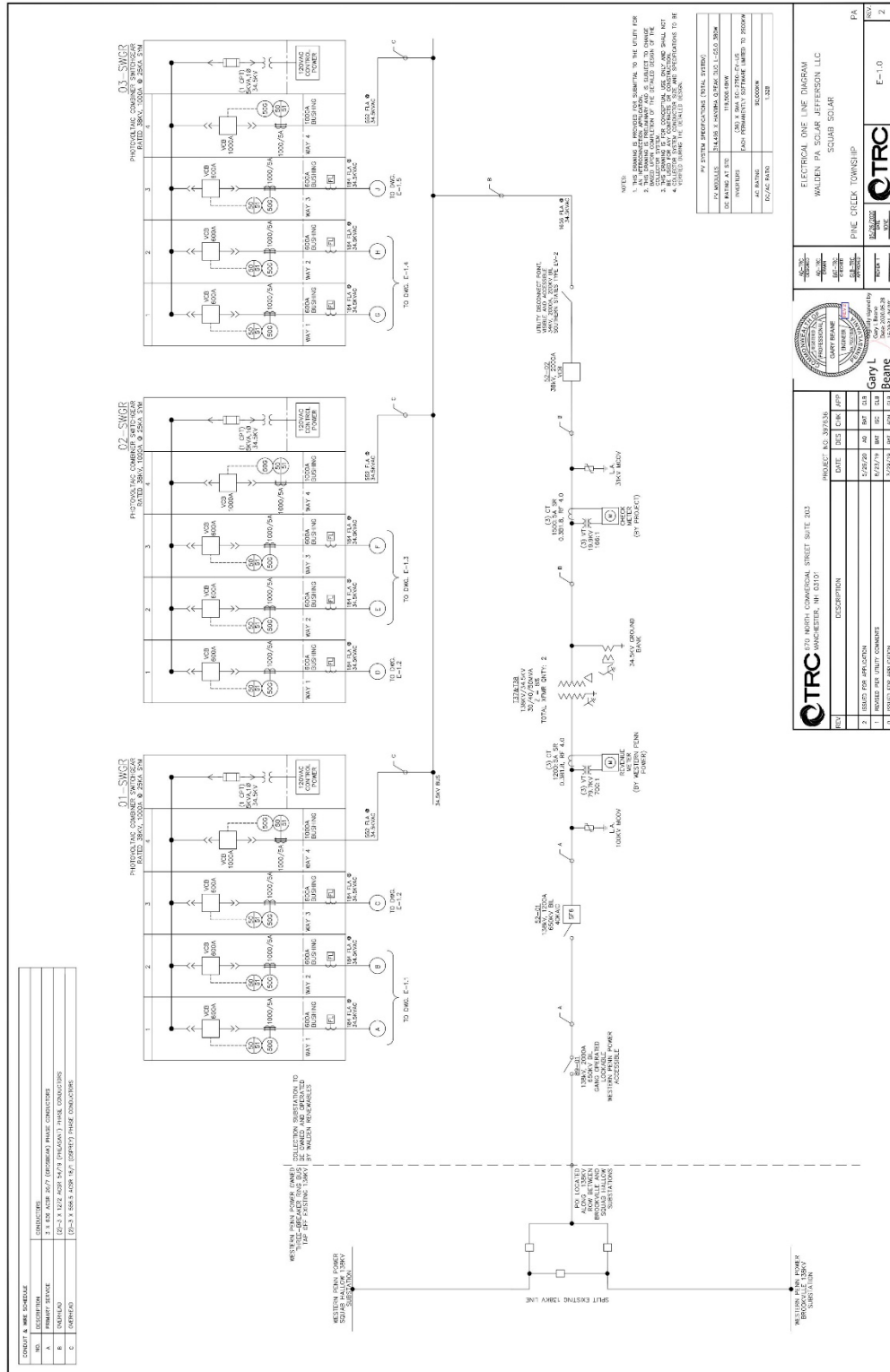
- Revise relay settings as needed.

Squab Hollow SS

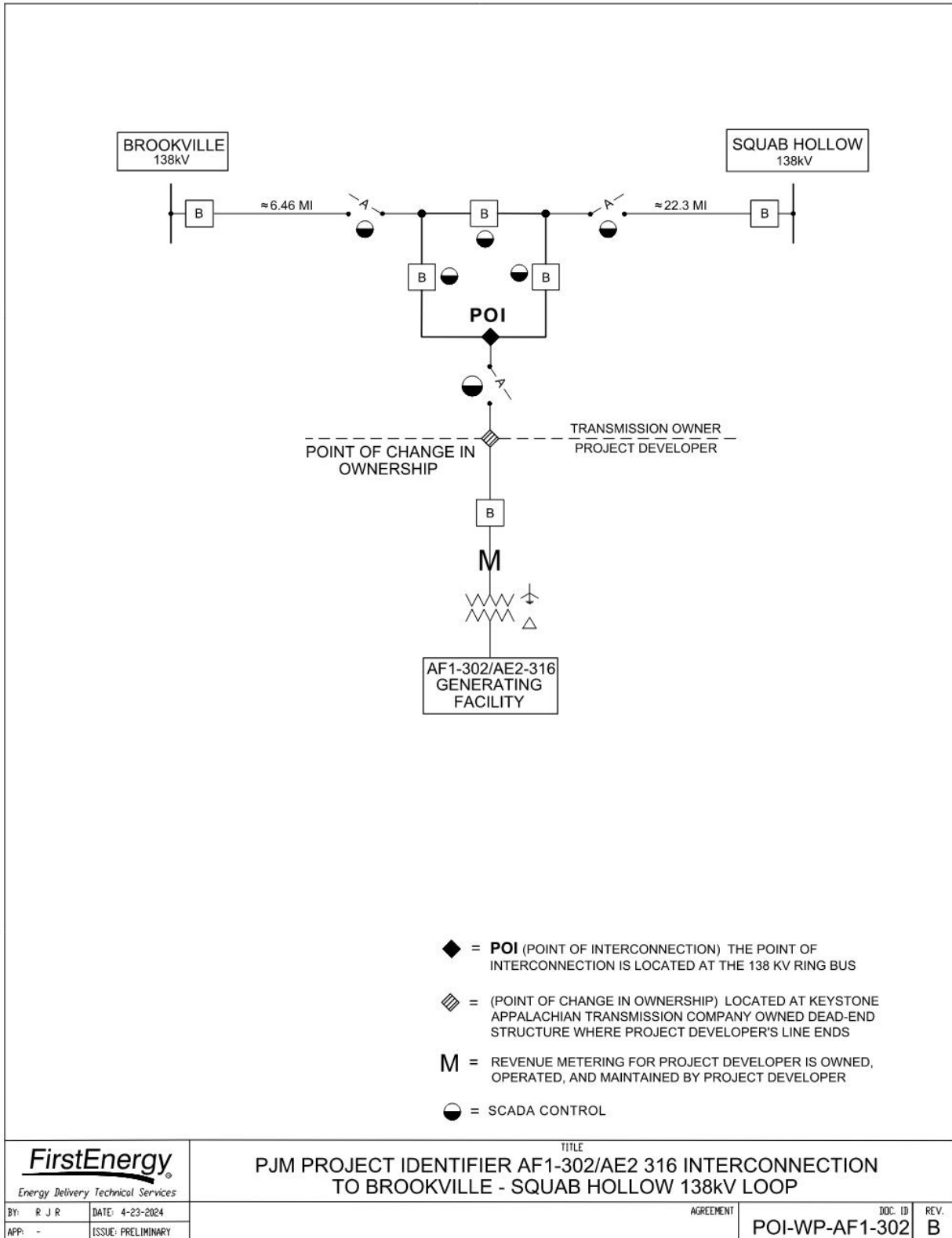
- Revise relay settings as needed.

Attachment #2: One-Line Diagrams

**Project Developer One-Line
Not Approved for Construction**



MAIT One-Line



Attachment #4: Generation Connection Requirements

Generation Connection Requirements

The proposed interconnection facilities must be designed in accordance with the Transmission Owner's Transmission Planning and Protection Requirements for Transmission Connected Facilities, Rev. 5, January 18, 2023, located at either of the following links:

www.firstenergycorp.com/feconnect

www.pjm.com/planning/design-engineering/to-tech-standards.aspx

Any different reactive power requirements that MAIT and/or PJM determines to be appropriate for wind-powered or other non-synchronous generation facilities will be stated in the AE2-316/AF1-302 GIA.

Design Requirements

Project Developer is responsible for specifying appropriate equipment and facilities such that the parallel generation is compatible with Transmission Owner's transmission system. Project Developer is also responsible for meeting any applicable federal, state, and local codes.

Transmission Design Requirements

Design Criteria

Facilities owned and operated by Transmission Owner shall comply with the Transmission Owner's Applicable Technical Requirements and Standards as identified in Schedule D of the AE2-316/AF1-302 GIA, and the following criteria. Where there are different requirements for the same criterion, the more restrictive shall apply. Project Developer must abide by any PJM, RFC or NERC criteria imposed that is more restrictive than those of Transmission Owner.

General Design Requirements

- | | |
|--|---|
| • System phasing (counter clockwise) | X-Y-Z |
| • System frequency: | 60 hertz |
| • Elevation, AMSL: | Less than 1000 meters |
| • Isokeraunic level: | 40 |
| • Maximum ambient temperature: | 40 degrees C |
| • Minimum ambient temperature: | -40 degrees C |
| • Maximum conductor operating temperature: | Contact Transmission Owner |
| • Wind Loading (round shapes): | Per ASCE 7-98, per Fig. 6-1 depending on location |
| • Ice loading – Substations (no wind): | 25 mm |
| • Seismic zone: | Per ASCE 7-98, per Fig. 9.4.1.1(a) and (b). Equipment qualification per IEEE 693-97 |

Voltage and Current Ratings

• Nominal phase-to-phase:	138 kV
• Maximum phase-to-phase:	145 kV
• Basic impulse level (BIL):	650 kV
• Maximum continuous current carrying capacity:	2000 A
• Design fault current:	40 kA
• Single Contingency (breaker failure) clearing time:	60 cycles

Clearances and Spacing

• Recommended rigid bus center-to-center phase spacing:	96"
• Minimum phase-to-phase, metal-to-metal distance:	63"
• Recommended phase-to-ground:	52.5"
• Minimum phase-to-ground:	50"
• Low bus height above top of foundations (match existing):	16'-0"
• High bus height above top of foundations (match existing):	24'-0"
• Minimum vertical clearance from live parts to grade:	12'-2"
• Minimum horizontal clearance from live parts:	6'-8"
• Minimum conductor clearance above roads in switchyard:	25'-0"
• Minimum bottom of insulator to top of foundation:	8'-6"