Generation Interconnection Facility Study Report

For

PJM Generation Interconnection Request Queue Position AD2-074 & AF1-042

Garner DP-Lancaster 115 kV 49.78 MW Capacity / 131 MW Energy

Rev 0: Nov, 2021

General

This Facilities Study has been prepared in accordance with the PJM Open Access Transmission Tariff §207, as well as the Facilities Study Agreement between Waller Solar, LLC, the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is Virginia Electric and Power Company (VEPCO).

Point of Interconnection

AD2-074/AF1-074 will interconnect with the ITO transmission system at the new 115kV three breaker ring bus substation connecting to the Garner DP-Lancaster 115kV line.

Cost Summary

The AD2-074/AF1-074 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$545,875
Direct Connection Network Upgrades	$5,441,906
Non Direct Connection Network Upgrades	$1,287,460
Allocation for New System Upgrades	$0
Contribution for Previously Identified Upgrades	$0
Total Costs	**$7,275,241**

A. Transmission Owner Facilities Study Summary

1. Description of Project

Queue AD2-074 is a request to interconnect a new solar generating facility to be located in Lancaster County, Virginia. AF1-042 is a request to increase the MFO and capacity rating of the entire facility. After both projects are completed, the solar facility will have a MFO of 131 MW and a capacity rating of 49.78 MW. AD2-074/AF1-042 will interconnect with the ITO transmission system via a new three breaker ring bus switching station that connects on the existing Line 65 115kV Northern Neck to Rappahannock Substation. The interconnection facilities being constructed under the AD2-074 project are sufficient to support the AF1-042 project.

Attachment Facility and Network Upgrade construction is estimated to be 24-36 months.

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

None

3. Interconnection Customer's Milestone Schedule

- Plan to break ground October 15, 2023
- Permits – state level Permit By Rule and county level final site plan approval complete September 30, 2023
- Substantial site work completed September 15, 2024
- Delivery of major electrical equipment September 15, 2024
- Back Feed Power November 1, 2024
- Commercial Operation May 31, 2025

4. Scope of Customer's Work

Generator interconnection request AD2-074 is for an 86 MW Maximum Facility Output (MFO) solar generation facility. AF1-042 is an uprate to AD2-074 adding 45MW (MFO) for a total of 131 MW (MFO) at the facility.

5. Description of Facilities Included in the Facilities Study

The ITO will connect the proposed generator lead via Attachment Facilities to a new AD2-074/AF1-042 three-breaker ring bus switching station on the 65 line between the existing Northern Neck and Rappahannock substations. The site is located along Dominion Energy's existing 115kV line from Garner DP to Lancaster stations. The cut line will consume two of the positions in the ring bus. The third position will be for the 115kV feed from the Waller Solar I, LLC collector station for the new Solar farm.

The new 115kV three breaker ring substation will share a common footprint and fence line with Waller Solar I, LLC collector station. The demarcation point between the two stations will be the 115kV breaker disconnect switch 4-hole pad in the Waller Solar I, LLC collector station by the common fence. Dominion Energy will bring its bus to the demarcation point. The bus, structures, disconnect switch, metering accuracy CCVT's, metering accuracy CT's, protection and metering

equipment will be Attachment Facilities. The grounding systems for each station will be tied together. All substation permitting, site preparation and grading activity will be performed by Waller Solar I LLC.

The existing line segment between the new three breaker ring substation and Rappahannock Substation will be renumbered. The existing line segment between the new three breaker ring substation and Northern Neck Substation will remain line 65.

Additional work is required at Northern Neck, Rappahannock, and Harmony Village Substations.

Security and fence type – design level 4.

Note: Currently, the scope and estimate assume DVP standard spread footer foundations. Once the soil information is received and if it is decided to change that to "pile foundations" then DVP team should be informed at the earliest to adjust the project estimate.

6. Total Costs of Transmission Owner Facilities included in Facilities Study

Cost estimates for Dominion to perform construction:

Work Description	Direct		Indirect		Total Cost
	Labor	Material	Labor	Material	
Attachment Facilities	$317,096	$157,062	$54,535	$17,182	$545,875
Total Attachment Facilities Cost	$317,096	$157,062	$54,535	$17,182	$545,875
Generator Interconnect (n7973)	$2,552,037	$2,267,281	$387,553	$235,035	$5,441,906
Transmission Line (n7972)	$543,138	$308,954	$82,056	$35,136	$969,284
Total Remote Changes (n7974)	$156,231	$110,415	$34,289	$17,241	$318,176
Total Network Upgrades	$3,251,406	$2,686,650	$503,898	$287,412	$6,729,366
Total Project Costs	$3,568,502	$2,843,712	$558,433	$304,594	$7,275,241

7. Summary of Milestone Schedules for Completion of Work Included in Facilities Study:

Facilities are estimated to take 24-36 months from ISA execution and is based on the ability to obtain outages to construct and test the proposed facilities.

Proposed Schedule

- Detailed design: 6-12 months
- Permitting: 6-18 months (some overlap with design)
- Construction 8-12 months

ITO requires the site to be fully graded and permitted site so they can start construction by October 15 2023.

B. Transmission Owner Facilities Study Results

1. Attachment Facilities

The Attachment Facilities include the portion of the interconnecting switching station which is associated solely with the single feed to the generating facilities collector station. The equipment associated with the Attachment Facilities include the metering accuracy CCVT's, metering accuracy CT's, disconnect switch, conductors and connectors.

Purchase and install substation material:

1. One (1), 115kV, 2000A, 3-phase center break gang operated switch.
2. Three (3), 115kV, metering accuracy CCVT's.
3. Three (3), 115kV,500:5 metering accuracy CT's.
4. Conductor, connectors, conduits, control cables, foundations, steel structures and grounding material as per engineering standards.

Purchase and install relay material:

1. One (1), 1109 – 28" dual SEL-587Z transmission bus panel
2. One (1), 4200 – Bus differential C.T. make-up (M.U.) box
3. One (1), 1425 – 28" dual SEL-735 transmission & generator interconnect metering panel
4. One (1), 4524 – Revenue metering C.T. make-up (M.U.) box
5. One (1), 4506 – CCVT potential M.U. box
6. One (1), 1323 – 28" SEL-487E/735 PMU & PQ monitoring panel
7. Two (2), 4541 - Control cable make-up (M.U.) box

2. Transmission Line – Upgrades

PJM Network Upgrade #n7972 – Split Line #65 between Northern Neck Substation and Rappahannock Substation

The AD2-074/AF1-042 substation will be built in line with line 65 approximately halfway between existing structures 65/541 and 65/542. This location is approximately 5.4 miles to the southeast of Garner DP. The final location of the substation is subject to change but shall remain within the same vicinity. The portion of the 65 line between the Northern Neck substation and the AD2-074/AF1-042 substation will be assigned a new line number and the structures will be renumbered accordingly (This estimate will refer to this line as XXXX. Line number TBD).

The project work summary is described below:

TEMPORARY FACILITIES TO BE INSTALLED

1. None

EXISTING FACILITIES TO BE REMOVED

1. None

PERMANENT FACILITIES TO BE INSTALLED

1. Install (1) standard 70' 115 kV steel backbone structures (31'-6" pole spacing) within the limits of the proposed substation. (Str. 65/541A)
2. Install (2) galvanized static pole structures with foundations within the limits of the proposed substation. (Str. 65/541B and 65/541C)
3. Install approximately 575 feet total (3 spans) of one 7#7 alumoweld shield wire between the proposed static poles (Str. 65/541B & 65/541C) and proposed backbone (65/541A). This will include the installation of dampers
4. Renumber approximately 130 existing structures between Northern Neck and AD2-074 with new line number XXXX (Line Number TBD)

EXISTING FACILITIES TO BE TRANSFERRED:

1. Cut and transfer (2) spans of existing 3-phase 477 ACSR conductor to proposed backbone (Str. 65/541A).
2. Cut and transfer (4) spans of existing 3#6 static wire to proposed backbone (Str. 65/541A)

PROJECT ASSUMPTIONS:

1. The final location of the AD2-074/AF1-042 substation is subject to change. Final cost and structure locations may vary from the estimate as a result.
2. It is assumed that fiber is not required for this project.

3. New Substation/Switchyard Facilities

PJM Network Upgrade #n7973 - Build a three breaker AD2-074/AF1-042 115 kV switching station.

The objective of this project is to build a 115kV, 3-breaker ring bus to support the new solar farm built by Waller Solar I, LLC. The site is located along Dominion Energy's existing 115kV, 65 Line from Northern Neck Substation to Rappahannock Substation. The cut line will consume two of the positions in the ring bus. The third position will be for the 115kV feed from Waller Solar I, LLC collector station for the new solar farm.

The new 115kV three breaker ring substation will share a common footprint and fence line with Waller Solar I, LLC collector station. The demarcation point between the two stations will be the 115kV breaker disconnect switch 4-hole pad in the Waller Solar I, LLC collector station by the common fence. Dominion Energy will bring its bus to the demarcation point. The bus, structures, disconnect switch, metering accuracy CCVT's, metering accuracy CT's, protection and metering equipment will be Attachment Facilities. The grounding systems for each station will be tied together. All substation permitting, site preparation and grading activity will be performed by Waller Solar I LLC.

The work required is as follows:

Purchase and install substation material – Direct Network Upgrade:

1. Approximately 291' x 186' site preparation and grading as required for installation of the switching station (by the developer).
2. Approximately 954 linear FT of 5/8" chain link, 12 ft tall, perimeter fence around the station along with the security cameras and integrators as per design 4 fence standards.
3. Three (3), 115 kV, 3000A, 40kAIC, SF-6 circuit breakers.
4. Six (6), 115 kV, 2000A, 3-phase center break gang operated switches.
5. Six (6), 115kV, relay accuracy CCVTs.
6. Two (2), 115 kV, 2000A wave traps.
7. Two (2), Line tuners.
8. Nine (9), 90 kV, 74 kV MCOV surge arresters.
9. Two (2), 115kV, 2000A, 2-phase center break gang operated switches (for PVT's).
10. Two (2), 115kV, 100KVA power PT's for station service.
11. One (1), 24' x 40' control enclosure.
12. One (1), 125 VDC, 300 Ah station battery and 50 amp charger (size to be verified during detail engineering).
13. Approximately 166 FT of cable trough, with a 20FT road crossing section.
14. Station stone as required.
15. Station lighting as required.
16. Steel structures as required including switch stands, bus supports, station service transformers, CCVT and wave trap supports.
17. Foundations as required including control house, equipment, and bus support stands.
18. Conductors, connectors, conduits, control cables, cable trough, and grounding materials as per engineering standards

Purchase and install relay material – Direct Network Upgrade:

1. Three (3), 1510 – 28" dual SEL-351-7 transmission breaker w/ reclosing panel
2. Three (3), 4510 - SEL-2411 breaker annunciator
3. Two (2), 1340 – 28" dual SEL 411L DCB line panel
4. Two (2), 4506 – 3-phase CCVT potential make-up (M.U.) box
5. One (1), 1603 – 28" SEL-451 islanding control scheme panel
6. Two (2), 4000 – Station service potential make-up (M.U.) box
7. Two (2), 4018 – 500A station service AC distribution panel
8. Two (2), 4007 – 225A outdoor transmission yard AC NQOD
9. Two (2), 4019 – 225A three phase throw over switch
10. Two (2), 4016 – 600A PVT disconnect switch
11. One (1), 4153 – Wall mount station battery monitor
12. One (1), 5618 - SEL-3555 communications panel
13. One (1), 1255 – Station annunciator panel
14. One (1), 5021 – SEL-2411 RTU panel
15. One (1), 5609 – Fiber optic management panel
16. Three (3), 4526_A – Circuit breaker fiber optic make-up (M.U.) box
17. One (1), 5202 – 26" APP 601 digital fault recorder
18. One (1), 5603 – Station network panel No. 1
19. One (1), 5603 – Station network panel No. 2

20. One (1), 4523 – Security camera interface box
21. One (1), 5616 – Station security panel
22. One (1), High voltage protection (HVP) box (Provided by IT)
23. One (1), Telephone interface box
24. One (1), 5616 - Security fence panel
25. Four (4), 4040 - Security fiber/power makeup (M.U.) box
26. One (1), 4044 – 225A 1Ø outdoor main security AC NQOD
27. Two (2), 4040 – 100A 1Ø outdoor security AC NQOD
28. Two (2), 4018 – 225A station service AC distribution panel branch breaker

4. Upgrades to Substation / Switchyard Facilities

PJM Network Upgrade #n7974 - Remote protection and communication work.

Additional work to be required at Harmony Village, Rappahannock, Northern Neck and Garner DP, Lancaster, Ocran & White Stone substations. These costs include the following:

Harmony Village 115 kV Substation

Project Summary
This project provides for the installation of islanding transfer trip to work with the AD2-074/AF1-042 project via Rappahannock substation. This project is the Non-Direct Connect for the AD2-074/AF1-042 generator interconnect project.

Purchase and install relay material:
1. One (1), 1603 – 24" SEL-451 islanding control scheme panel w/ SEL-2506 fiber modem

Rappahannock 115 kV Substation

Project Summary
This project provides for the drawing work, relay resets, and field support necessary to change the Line 65 destination at Rappahannock Substation. The line number may or may not be changed. Install islanding transfer trip to work with the AD-074/AF1-042 project (Receive islanding from Harmony Village via fiber and transmit islanding to AD2-074/AF1-042 via PLC). This project is the Non-Direct Connect for the AD2-074/AF1-042 generator interconnect project.

Purchase and install relay material:
1. One (1), 1603 – 24" SEL-451 islanding control scheme panel w/ SEL-2506 & PLC transmitter.

Northern Neck 115 kV Substation

Project Summary:
This project provides for the drawing work, relay resets, and field support necessary to change the Line 65 destination at Northern Neck substation. The line number may or may not be changed. Install islanding transfer trip to work with the AD2-074/AF1-042 project. Remove breaker failure transfer trip receive from Lancaster substation's transmission capacitor bank. This function will be moved to the AD2-074/AF1-042 project. This project is the Non-Direct Connect for the AD2-074/AF1-042 generator interconnect project.

Purchase and install substation material:

1. One (1), 1603 – 24" SEL-451 islanding control scheme panel

Garner DP, Lancaster, Ocran, White Stone Substations – Change Line 65 Destinations

Project Summary:
This project provides for the drawing work, relay resets, and field support necessary to change the Line 65 destination(s) at Garner DP, Lancaster, Ocran & White Stone substation(s). The line number may or may not be changed. This project is the Non-Direct Connect for the AD2-074/AF1-042 generator interconnect project.

Modify Lancaster transmission capacitor bank carrier blocking & transfer trip schemes to work with AD2-074/AF1-042 instead of Northern Neck Substation.

Modify Ocran DG transfer trip to work with AD2-074/AF1-042 instead of Northern Neck.

Purchase and install substation material:

1. No relay material

Work Description	Direct		Indirect		Total Cost
	Labor	Material	Labor	Material	
Harmony Village Substation	$27,862	$36,805	$6,016	$5,747	$76,430
Rappahannock Substation	$36,527	$36,805	$7,618	$5,747	$86,697
Northern Neck Substation	$36,527	$36,805	$7,618	$5,747	$86,697
Change Line 65 Destinations	$55,315	$0	$13,037	$0	$68,352
Total Remote Relay Upgrades	$156,231	$110,415	$34,289	$17,241	$318,176

5. Metering & Communications

PJM Requirements

The IC will be required to install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for IC's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Section 8 of Attachment O Appendix 2.

ITO Requirements

Metering and SCADA/Communication equipment must meet the requirements outlined in section 3.1.6 Metering and Telecommunications of ITO's Facility Interconnection Connection Requirement NERC Standard FAC-001 which is publicly available at www.dom.com.

At the IC's expense, the ITO will supply and own at the Point of Interconnection bi-directional revenue metering equipment that will provide the following data:

a. Hourly compensated MWh received from the Customer Facility to the ITO;
b. Hourly compensated MVARh received from the Customer Facility to the ITO;

c. Hourly compensated MWh delivered from the ITO to the Customer Facility; and
d. Hourly compensated MVARh delivered from the ITO to the Customer Facility.

The IC will supply and own metering equipment that will provide Instantaneous net MW and MVar per unit values in accordance with PJM Manuals M-01 and M-14D, and Sections 8.1 through 8.5 of Appendix 2 to the ISA.

The IC will access revenue meter via wireless transceivers or fiber cabling to meter with RS-485 or Ethernet communication port for dial-up reads. IC must provide revenue and real time data to PJM from Interconnection Customer Market Operations Center per "PJM Telemetry Data Exchange Summary" document available at PJM.com.

6. Environmental, Real Estate and Permitting Issues

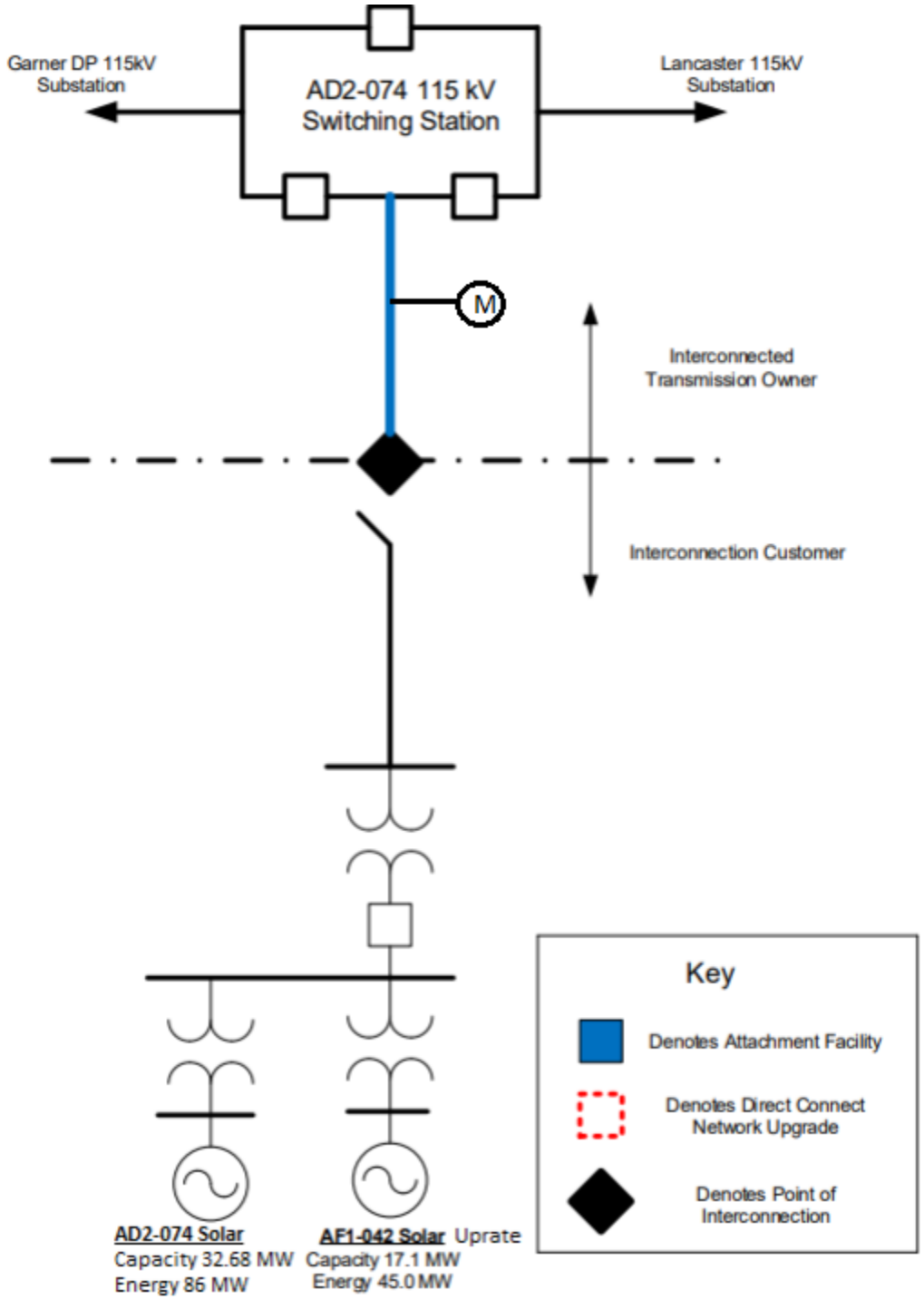
The IC would be responsible for the following expectations in the area of Environmental, Real Estate and Permitting:

- Suitable Access Road from Substation to a Virginia State Maintained Roadway.
- Any additional land needed for Storm Water Management, Landscaping, and Wetlands/Wetlands Mitigation.
- Conditional Use Permit for Substation.
- Any other Land/Permitting requirements required by the Substation.

ITO Real Estate Needs:

- The substation layout is complete and ITO requires a 291' x 186' piece of property (title in fee) to build the substation. The property includes the piece of property between the substation and collector station for the strain bus.
    - ITO requires ownership transfer of the substation site before they start construction. Target for the deed by October 15, 2023.
    - The size of the station assumes ITO will not need a separate storm water management system for the substation. If the county rules differently than the ITO will need to revisit the land requirements.
- ITO will need a letter similar to the zoning letter from the county stating that if the solar farm is retired and / or decommissioned the substation will remain.

Attachment 1.
Single Line Diagram



Attachment 2.
AE1-084 Switching Station General Arrangement