Generation Interconnection
Facility Study Report

For

PJM Generation Interconnection Request
Queue Position AC1-191

Elmont – Greenwood DP 115kV
53.4 MW Capacity / 80 MW Energy

December 2021 Rev 1

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 Springfield Farm Solar, LLC (Interconnection Customer (IC)) and PJM Interconnection, LLC (PJM or Transmission Provider (TP)). The Interconnected Transmission Owner (ITO) is Virginia Electric and Power Company (VEPCO).

The IC has proposed a solar generating facility located in Hanover County, VA. The installed facilities will have a total capability of 80 MW with 53.4 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is June 15, 2024. **This study does not imply an ITO commitment to this in-service date.**

Revision History

August 2021 revision of August 2020 report included updates to project milestones and project cost.

Point of Interconnection

AC1-191 will interconnect with the ITO transmission system via a single breaker tap switching station connecting to the Elmont – Greenwood DP 115kV line #59.

Cost Summary

The AC1-191 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities Oversight Costs	$ 795,376
Direct Connection Network Upgrades	$ 0
Non Direct Connection Network Upgrades	$ 2,459,175
Allocation for New System Upgrades	$ 0
Contribution for Previously Identified Upgrades	$ 0
Total Costs	**$ 3,254,551**

A. Transmission Owner Facilities Study Summary

1. Description of Project

Queue AC1-191 is a request to interconnect an 80 MW new solar generating facility to be located in Hanover County, Virginia. The proposed generating facility will interconnect with the ITO transmission system via a single breaker tap switching station connecting to the Elmont – Greenwood DP 115kV line #59. Attachment Facility Oversight and Network Upgrade construction is estimated to be 16 – 24 months for Dominion.

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

None

3. Interconnection Customer's Submitted Milestone Schedule

- Plan to break ground June 15, 2023
- Permits – state level Permit By Rule and county level Final Site Plan approval complete by October 15, 2022
- Substantial site work completed September 15, 2023
- Delivery of major electrical equipment January 1, 2024
- Back Feed Power October 15, 2023
- Commercial Operation March 31, 2024

4. Scope of Customer's Work

IC will build a solar generating facility in Hanover County, Virginia. The generating facility (Springfield Solar) will be comprised of solar arrays. AC1-191 consists of 40 x 2 MW SC 2200-US solar inverters. The 40 x 34.5/0.385 kV grounded wye delta 2 MVA generator step up (GSU) transformers will connect to the solar inverters to the 34.5 kV collector system. The generating facility will connect to the Point of Interconnection (POI) via a 115/34.5/13.8 kV wye grounded/wye grounded/delta main power transformer with a rating of 48/64/80 MVA. The AC1-191 POI will be at a tap of the Elmont – Greenwood DP 115kV line #59.

5. Description of Facilities Included in the Facilities Study

AC1-191 provides for the initial construction of a new 115 kV Single Breaker Tap Switching Station between Transmission Structures 59/36 and 59/37 in Hanover County, VA. The Interconnection Customer has selected 'Option to Build' as is their right to do so under the PJM Interconnection Service Agreement. By selecting this construction process method, the Interconnection Customer shall secure all required real estate, obtain all necessary permits, perform site work, furnish equipment, construction personnel and ancillary materials as found in the Facility Study for construction of the switching station in compliance with Dominion Energy Substation Engineering Standards. Oversight by Virginia Electric Power Company will include, but is not limited to, project management, engineering, permitting, survey, real estate, and construction methods when on site.

All equipment procured by Interconnection Customer will be reviewed and approved by Virginia Electric Power Company engineering teams.

Project Description

AC1-191 provides for the construction of a new interconnect station and necessary network upgrades to tie an 80MW capacity solar generating facility into the Virginia Electric Power Company transmission network. The work scope includes the construction of a 115 kV terminal station and the required 115 kV transmission line modifications.

The point of interconnection will be on the 115kV Line 59 between structures 59/36 & 59/37. The station will be positioned in such a way that the 115 kV Backbone (provided by Virginia Electric Power Company) will accept the new line tap and terminate into this structure. A 115kV Circuit Breaker will be installed at this terminal along with disconnect switches, arresters, and Potential Transformers. Additionally, metering equipment including metering accuracy CT's and metering accuracy CCVT's will be installed.

The collector station will be located adjacent to the interconnect station. The demarcation point between this station and the collector station will be the 4-hole pads on the interconnect station disconnect switch. The grounding systems for both the stations will be tied together. The Interconnection Customer will be responsible for all real estate, permitting, and site preparation and grading.

Additional Work to be required at Elmont Substation.

Security and Fence Type – Design Level 4.

The ITO requires transmission line protection and anti-islanding work required at the remote lineterminals in Elmont. Site plan (Attachment 2) was developed by the ITO during PJM's Generation Queue Process. The single line is shown in Attachment 1.

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

Work Description	Direct		Indirect		Total Cost
	Labor	Material	Labor	Material	
Dominion Oversight of 115kv breaker yard	$465,869	$217308	$100,412	$11,787	$795,376
Total Other Cost	$465,869	$217308	$100,412	$11,787	$795,376
Line #59 Transmission work (n6715)	$1,571,384	$440,750	$231,935	$45,544	$2,289,613
Remote relay (n6716)	$115,902	$28,075	$21,508	$4,077	$169,562
Total Network Upgrades	$1,687,286	$468,825	$253,443	$49,621	$2,459,175
Total Project Costs	$2,153,155	$686,133	$353,855	$61,408	$3,254,551

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

Facilities are estimated to take 16 - 24 months to construct and this is based on the ability to obtain outages to construct and test the proposed facilities.

Proposed Schedule

- Detailed design: 6 - 8 months
- Permitting: 8 - 12 months (Timeline runs with 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 June 2022.

B. Transmission Owner Facilities Study Results

1. Attachment Facilities

Build a one breaker AC1-191 115 kV terminal switching station. The ITO will connect the proposed generator lead via Attachment Facilities to a new AC1-191 115kV one breaker terminal switching station adjacent to the transmission right of way. The site is located along theITO's 115kV Line #59, 4.43 miles from the Elmont substation. This station will tap the 115kV Line 59 between structures 59/36 & 59/37. The station will be positioned in such a way that the 115 kV Backbone (provided by Transmission Engineering) will accept the new line tap and terminate into this structure. A 115kV Circuit Breaker will be installed at this terminal and rigidbus positioned towards the developer's collector station. The demarcation point between this station and the collector station will be the 4-hole pads on the Dominion disconnect switch. The customer will construct its bus to this demarcation point. Metering equipment, including a disconnect switch, metering accuracy CT's, and metering accuracy CCVT's, will be required between the Dominion bus and the collector station. The grounding systems for both the stations will be tied together. The developer will provide the property and access to the switching station.All substation permitting, site preparation and grading activity will be performed by the developer.

Option to Build, Attachment Facilities; Physical Facilities & Oversight – Virginia Electric Power Company

1. All Physical Engineering related oversight and approvals of activities related to equipment procurement, design, construction, and energization of switching station
2. All Real Estate related oversight and approval of activities related to construction of switching station
3. All Permitting related oversight and approval of activities related to construction of switching station
4. All Survey related oversight and approval of activities related to construction of switching station
5. All Construction and Methods oversight and approval of activities related to construction and energization of switching station
6. All Project Management oversight activities related to construction and energization of switching station
7. All riser conductor, connectors, spacers, and bolts related to connection of the switching station to the Bulk Electric Transmission System
8. All material related to the integration of the security fence software package back to the Corporate Security Fusion Center

Option to Build, Attachment Facilities; Physical Facilities – Interconnection Customer:

1. Approximate station fence line dimensions of 125' X 130'. At a minimum, site preparation and grading will be required to extend 10' beyond these dimensions for

station grounding. Additional property and site prep may be required for proper grading and stormwater management, etc.

2. Approximately 510 linear FT of 5/8" Chain Link, 12 FT tall, perimeter fence around the station (Design 4 Standard).
3. Full substation ground grid as per engineering standards
4. One (1) 115kV Light Duty, Single Circuit Backbones (by Virginia Electric Power Company)
5. One (1) shield wire pole and one span of shield wires (by Virginia Electric Power Company)
6. One (1), 115kV, 3000A, 40 kA, SF_6 circuit breaker
7. One (1), 115kV, 2000A center break switch
8. One (1), 115kV, 2000A vertical break switch
9. One (1), 115kV, 2000A single pole switch
10. Two (2), motor operators for switches
11. Three (3), 115kV, CCVT, relay accuracy
12. Six (6), 90kV MO, 74kV MCOV station class arresters
13. One (1), 115kV, 100 KVA power PT for station service
14. One (1), 34.5kV, 100KVA station service transformer
15. One (1), 34.5kV underground station service riser structure
16. One (1), SMU-20 fused disconnect switch
17. One (1), SMD-20 fuse
18. One (1), 23kV 12A-K fuse
19. One (1), 30kV MO, 24.4kV MCOV distribution class arrester
20. One (1), 24' x 30' control enclosure
21. One (1), 135VDC, 200Ah batteries and 50A charger
22. Three (3), 115kV, metering accuracy CCVT's
23. Three (3), 115kV, metering accuracy CT's
24. Cable Trough, concrete w/cover, 2' 6'' wide, approximately 60 FT, with a 28 FT road crossing section.
25. Steel structures as required including switch stands, bus supports, station service transformers, CCVT and wave trap supports
26. Foundations as required including control house, equipment, and bus support stands
27. Conductors, connectors, conduits, control cables and grounding materials as per Dominion Substation engineering standards

Option to Build, Attachment Facilities; Relay Protection Equipment – Virginia Electric Power Company:

1. All Protection & Controls Engineering oversight and approval of activities related to equipment procurement, design, construction, and energization of switching station
2. All relay panel installation methods oversight and approval of activities related to construction and energization of switching station
3. All relay, communications, security settings related to the connection of the switching station to the Bulk Electric Transmission System
4. One (1), 5616 – Station Security Panel
5. One (1), 5616 – Station Security Fence Panel
6. One (1) 5603h_2 – Network Panel No. 1

7. One (1), 5603h_0 – Network Panel No. 2
8. One (1), High Voltage Protection (HVP) Box (Provided by IT)
9. One (1), Telephone Interface Box

Option to Build, Attachment Facilities; Relay Protection Equipment – Interconnection Customer:

1. One (1), 1109 – Transmission bus panel (SEL587Z)
2. One (1), 1321L – Network transmission line / breaker panel (SEL421-421)
3. One (1),1425a – Dual metering panel (SEL735)
4. One (1), 1323b – PMU and PQ monitoring panel
5. One (1), 5613b – Combination comm / RTU / annunciator panel (SEL3355)
6. One (1), 1605a – Carrier blocking & transfer trip panel
7. One (1), 4510 - SEL-2411 breaker annunciator
8. Two (2), 4000 – Station service potential make-up (M.U.) box
9. Four (4), 4016 - 600A disconnect switch w/ 225A fuse
10. Two (2), 4006 - 60A transmission yard main breaker box
11. One (1), 4153c – Wall mount station battery monitor
12. One (1), 5610 – Wall mounted fiber optic management housing
13. One (1), 4526_A – Circuit breaker fiber optic make-up (M.U.) box
14. One (1), 5202 - APP 601 DFR (single cab., 36 ch., 26x26)
15. One (1), 4524 – Revenue metering C.T. make-up (M.U.) box
16. Two (2), 4541 - Control cable make-up (M.U.) box
17. Two (2), 4528_A – Generation fiber make-up (M.U.) box
18. Two (2), 4506 - Three phase CCVT potential make-up (M.U.) box
19. One (1), 1514 – Transmission transformer MOAB panel

2.Transmission Line – Upgrades

PJM Network Upgrade #n6715 – Rebuild the 115kV tap off Line #59 to accommodate theinterconnection of the new one breaker Queue AC1-191 substation. Originally constructedin 1979, Line 59 is an existing 115kV line that runs from Elmont substation to Greenwood DP.The project provides for the construction of a new substation set back approximately 100 feet from Line 59 between existing structures 59/36 and 59/37 in Hanover, VA. This project also includes the installation of fiber from Elmont Substation to the proposed AC1-191 substation.

The conceptual design and estimate include costs for the following:

ESTIMATE – PERMANENT FACILITIES TO BE INSTALLED:

1. Install one (1) 55’ SC steel backbone structure with foundations.
2. Install one (1) steel static pole with foundation inside proposed substation.
3. Install one (1) SC guyed DOM 3-pole DE terminal structure.
4. Install one (1) single pole DOM-type suspension structure in order to bring fiber to theproposed backbone structure in the AC1-191 substation.

5. Install approximately 0.03 miles of 3-phase 636 ACSR (24/7) from proposed 3-pole DE structure to the proposed backbone structure. This includes the installation of risers fromthe main line to the tap span.
6. Install approximately 95 feet of 1-7#7 alumoweld shield wire between the proposedbackbone structure and static pole inside the proposed substation.
7. Install approximately 4 miles of DNO-14110 OPGW from Elmont Substation to the proposed AC1-191 Substation, excluding spans from str. 59/2 - str .59/4, and str. 59/25 -str.59/26. This includes the installation of dampers and splice points at structures 59/1C,59/2, 59/4, 59/25, 59/26, 59/33, and the proposed backbone structure at the AC1-191 Substation.
8. Install approximately 350 feet of underground fiber optic cable from structures 59/2 to59/4.
9. Install approximately 620 feet of ADSS fiber under-build spanning from structure 59/25to 59/26.

ESTIMATE – FACILITIES TO BE REMOVED:

1. Remove approximately 4 miles of 1-3#6 AW shield wire from Elmont Substation to existing structure 59/36.

ESTIMATE – FACILITIES TO BE MODIFIED:

1. 1. Thirty-six (36) existing structures from Elmont Substation to the proposed AC1-191 Substation will need to be modified to include fiber hardware assemblies on one side of each structure.

ESTIMATE ASSUMPTIONS:

1. Structures were spotted inside the substation using a preliminary general arrangement.Estimate assumes that detailed substation drawings with exact locations of structures, equipment, and fence will be provided during detailed design.
2. Access/Forestry costs have been submitted envisioning the worst case scenario.

3. Upgrades to Substation / Switchyard Facilities

PJM Network Upgrade #n6716 - Remote protection and communication work. ITO protection requirements to reliably interconnect the proposed generating facility with the transmission system determined that work is required at Elmont 115kV substation by Dominion. These costs include the following:

Elmont 115 kV Substation

Project Summary

The project provides for the Necessary Drawing updates, Transfer trip and Fiber Installation to support the new AC1-191 Substation on Line 59. Fiber will be required to be installed between

Elmont and the new tap Station. Line Transfer Trip and Islanding transfer trip will be sent via Fiber using SEL-2506 Mirror bits scheme.

Purchase and install Substation material:

1. Two (2), 2" conduits from the substation backbone to the cable trough
2. Conduit Tracer Wire, 1/C #10, Green

Purchase and install relay material:

1. One (1), 1603 – 28" SEL-451 Islanding Control Scheme Panel
2. Three (3), SEL-2506 Transfer Trip Transmitters
3. Three (3), SEL-2829 Fiber Modem
4. One (1), Transmission Fiber Patch Panel (To be installed by IT)

Work Description	Direct		Indirect		Total Cost
	Labor	Material	Labor	Material	
Elmont	$115,902	$28,075	$21,508	$4,077	$169,562
Total Remote Relay Upgrades	$115,902	$28,075	$21,508	$4,077	$169,562

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 Sections 24.1 and 24.2.

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 publically 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

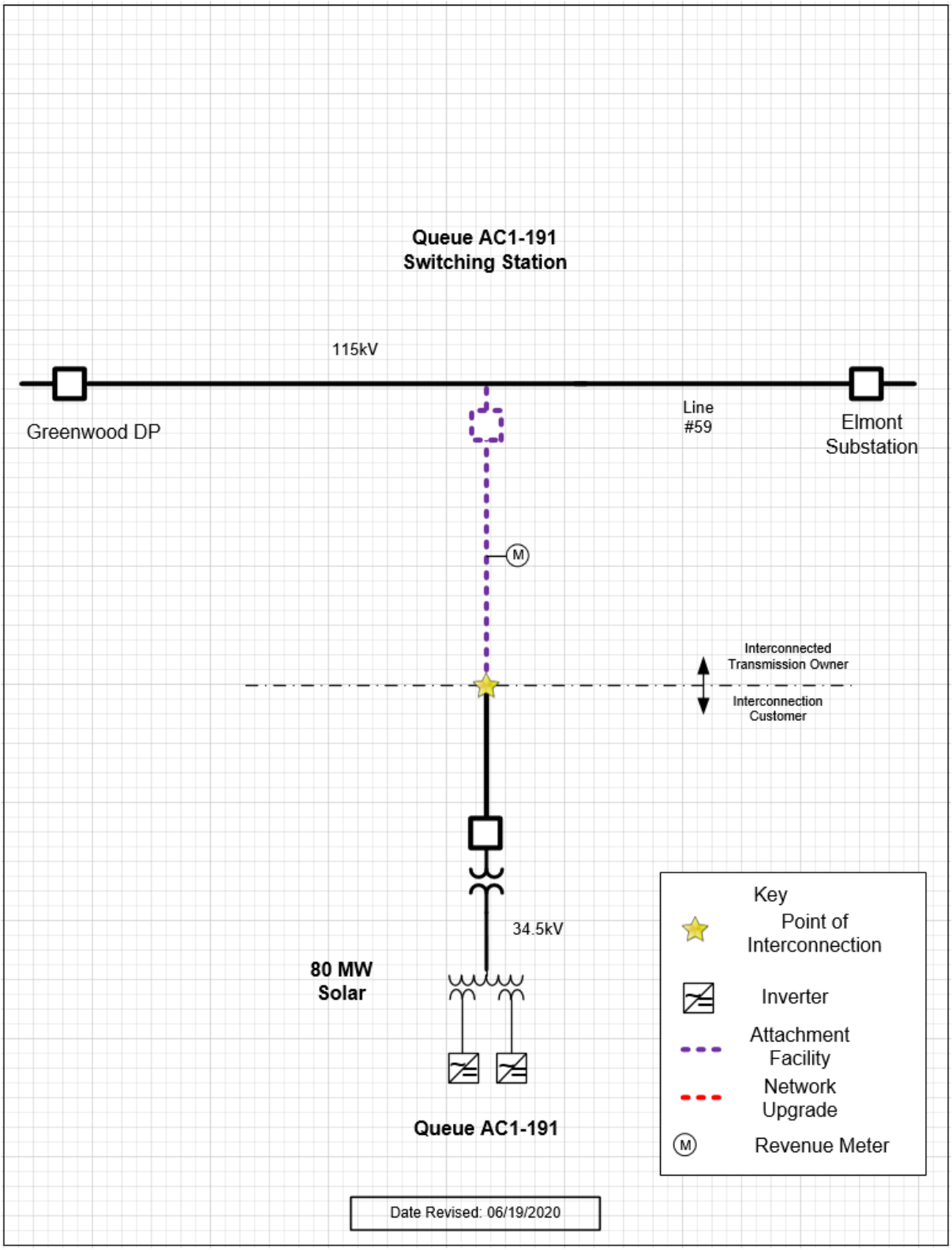
The IC would be responsible for the following expectations in the area of Environmental, Real Estate and Permitting:

- 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 130'x 125' 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 June 2022.
    - 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



Attachment 2.
AC1-191 Switching Station General Arrangement