Generation Interconnection Facility Study Report

For

PJM Generation Interconnection Request Queue Position AC1-122/123

Smith Mountain-Candlers Mountain 138 kV

October 2019

General

Dragonfly Solar, LLC proposes to install PJM Project #AC1-122 and #AC1-123, a combined 80.0 MW (54.4 MW Capacity) solar generating facility in Altavista, VA (see Figure 2). The point of interconnection will be to the AEP's Smith Mountain – Candlers Mountain 138 kV section of the Smith Mountain – Opossum Creek 138 kV circuit (see Figure 1).

The requested in service date is June 1, 2019.

Point of Interconnection

Point of Interconnection (Smith Mountain - Candlers Mountain 138 kV)

To accommodate the interconnection on the Smith Mountain – Candlers Mountain 138 kV section of the Smith Mountain – Opossum Creek 138 kV circuit, a new three (3) circuit breaker 138 kV switching station physically configured in a breaker and half bus arrangement but operated as a ring-bus will be constructed (see Figure 1). Installation of associated protection and control equipment, 138 kV line risers, SCADA, and 138 kV revenue metering will also be required. AEP reserves the right to specify the final acceptable configuration considering design practices, future expansion, and compliance requirements.

Cost Summary

The AC1-122/123 project will be responsible for the following costs:

Description	Total Cost	
Attachment Facilities	$	26,400
Direct Connection Network Upgrades	$	74,800
Non Direct Connection Network Upgrades	$	299,000
Allocation for New System Upgrades	$	0
Contribution for Previously Identified Upgrades	$	0
Total Costs	**$**	**400,200**

A. Transmission Owner Facilities Study Summary

1. Project Description

Dragonfly Solar, LLC proposes to install PJM Project #AC1-122 and #AC1-123, a combined 80.0 MW (54.4 MW Capacity) solar generating facility in Altavista, VA (see Figure 2). The point of interconnection will be to the AEP's Smith Mountain – Candlers Mountain 138 kV line section of the Smith Mountain – Opossum Creek 138 kV circuit (see Figure 1). The Point of Interconnection is the first structure outside of the New IPP station with the Interconnected Transmission Owner (ITO) owning the first span of conductors, including fiber optic cable out of its station, and the Interconnection Customer (IC) owning the first structure and remaining structures back to its generation collector station. The IC has indicated their intent to exercise the Option to Build.

The requested backfeed date is August 30, 2020.

The requested (Generation) in-service date is December 30, 2020

2. Amendments/Changes to the Impact Study Report

No significant amendments/changes noted.

3. Interconnection Customer Schedule

PJM and AEP understand that the Customer has requested the following schedule dates:

Receive back feed power from AEP: August 30, 2020
Commercial Operation Date: December 30, 2020

4. AEP's Scope of Work to Facilitate Interconnection

(Option to Build Process)

- Review of Option to Build design documents and drawings
- Opossum Creek-Candlers Mountain 138 kV circuit cut-in to new station (Only installation of T taps and removal of jumper loops - assumes no modifications to existing structure 17-185 are needed, work can be accomplished without outages of the adjacent circuit sharing structure 17-185, and IC scope includes the portion of the Double-Circuit line extension that can be built in the clear.
- Review and revision of remote-end protection schemes and settings.
- P&C Checkout and end-to-end testing
- Construction oversight

5. Description of Transmission Owner Facilities Included in the Facilities Study

Direct Connection Work (Option to Build)

- Provide oversight for the design and construction of the new AEP 138 kV station and T-line extension in the clear
- Install 138 kV revenue metering at new switchyard
- Perform final connection of Opossum Creek-Candlers Mountain 138 kV circuit to the new station (Install T taps and remove jumper loops - assumes no modifications to existing structure are needed.)
- Perform P&C checkout including end-to-end testing

Network Upgrade Work

A. Due to system overloads found during the PJM Study, the following Network reinforcements are required:

No network upgrades were required.

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

Option to Build Process

Attachment Facilities	$26,400
Direct Connection Facilities	$74,800
Non-Direct Connection Facilities	$299,000
Total Cost	$400,200

The estimates do not include the impact that delays in obtaining ROW, permits or other approvals may have.

7. Summary of Schedule Milestones for Completion of Transmission Owner Work Included in Facilities Study:

Task (Option to Build Process)	Dates
Design Review (At 30%, 60%, 90% complete	30 Day notice to start, 2-3 week duration/review

Outage request submitted	Per PJM request scheduling guidelines*
Transmission Line Analysis	2-3 week duration
Construction Management	30 Day notice to start
Transmission Line Cut-over	30 Day notification prior to need date, approx. 4 weeks from Start to Return to Service
P&C, Meter Test & Check-out	30 Day notice to start, 2-3 week duration

*See Figure 3

Assumptions (Standard Process)

- ISA and ICSA executed without delay
- 138kV Projects have local approval option. Local approval includes A-1 Zoning, Special Use Permit (SUP) requirements for public utility structures. Solar energy projects in A-1 require a SUP. AEP direct connection facilities included in Customer SUP.
- The Customer to obtain, at its cost, all necessary permits and provisions for the AEP direct connection facilities.
- The Customer to provide station site (for transfer to AEP in Fee Simple) and any additional easements for 138kV station and line work to include access to all facilities and structures.
- Customer to perform site development and road construction in accordance with AEP specifications.
- System conditions allow scheduled outages to occur.
- The Customer will have their construction and required checkout completed prior to the start of the cut-in & testing outage.

Additional Assumptions (Option to Build Process)

- Customer uses Firms from the AEP Approved list that have experience with the AEP Roanoke Region
- Estimates and schedules provided assume that the transmission line analysis confirms present expectations that the loop-in can be accomplished without modifying the existing structure 17-185. Design and location of the new structure adjacent to the existing ROW will be critical to meet this assumption. If structure 17-185 requires modification, both cost and schedule will be affected.
- Customer follows "**AEP Siting, Permitting, Right of Way, and Real Estate Requirements for Independent Power Producers exercising the Option to Build"** available at: https://www.aep.com/assets/docs/requiredpostings/TransmissionStudies/docs/2019/MerchantGenerationGuidelinesPJMoptiontoBuild.pdf

B. Transmission Owner Facilities Study Results

1. Transmission Lines – New

A new 138 kV line extension consisting of approximately 0.11 miles will provide a loop feed by tapping the Opossum Creek-Smith Mountain 138 kV circuit, utilizing 1,033 kCM ACSR 54/7 Curlew overhead conductor and 7#10 alumoweld shield wire.

2. Transmission Lines – Upgrades

None.

3. Substation Facilities – New

A new 138 kV station will be established consisting of a 3-breaker ring bus looped fed by tapping AEP's Opossum Creek-Smith Mountain 138 kV circuit. Installation of a Drop In Control Module (DICM) and associated protection and control equipment will also be required.

4. Substation Facilities – Upgrades

None.

5. Metering & Communications

Standard 138 kV metering will be installed at AEP's new 138 kV station. A standard station communication scheme will be used. All metering equipment shall meet the requirements as specified by AEP in the "AEP Metering and Telemetering Requirements for AEP Transmission Customers" document (SS-490011). Communication requirements are published in the "AEP SCADA RTU Requirements at Transmission Interconnection Facilities" (document SS-500000).
The Generation Interconnection Agreement does not in or by itself establish a requirement for American Electric Power to provide power for consumption at the developer's facilities. A separate agreement may be reached with the local utility that provides service in the area to ensure that infrastructure is in place to meet this demand and proper metering equipment is installed. The metering work above and cost indicated below does not include any potential work or cost to address metering requirements of the local service provider. It is the responsibility of the developer to contact the local service provider to determine if a local service agreement is required.

6. Environmental, Real Estate and Permitting Issues

The Customer is expected to obtain, at its cost, all necessary permits and provisions for the IPP station site adjacent AEP's new station.

7. Summary of Results of Study

Cost Estimates for AEP (Option to Build Process)

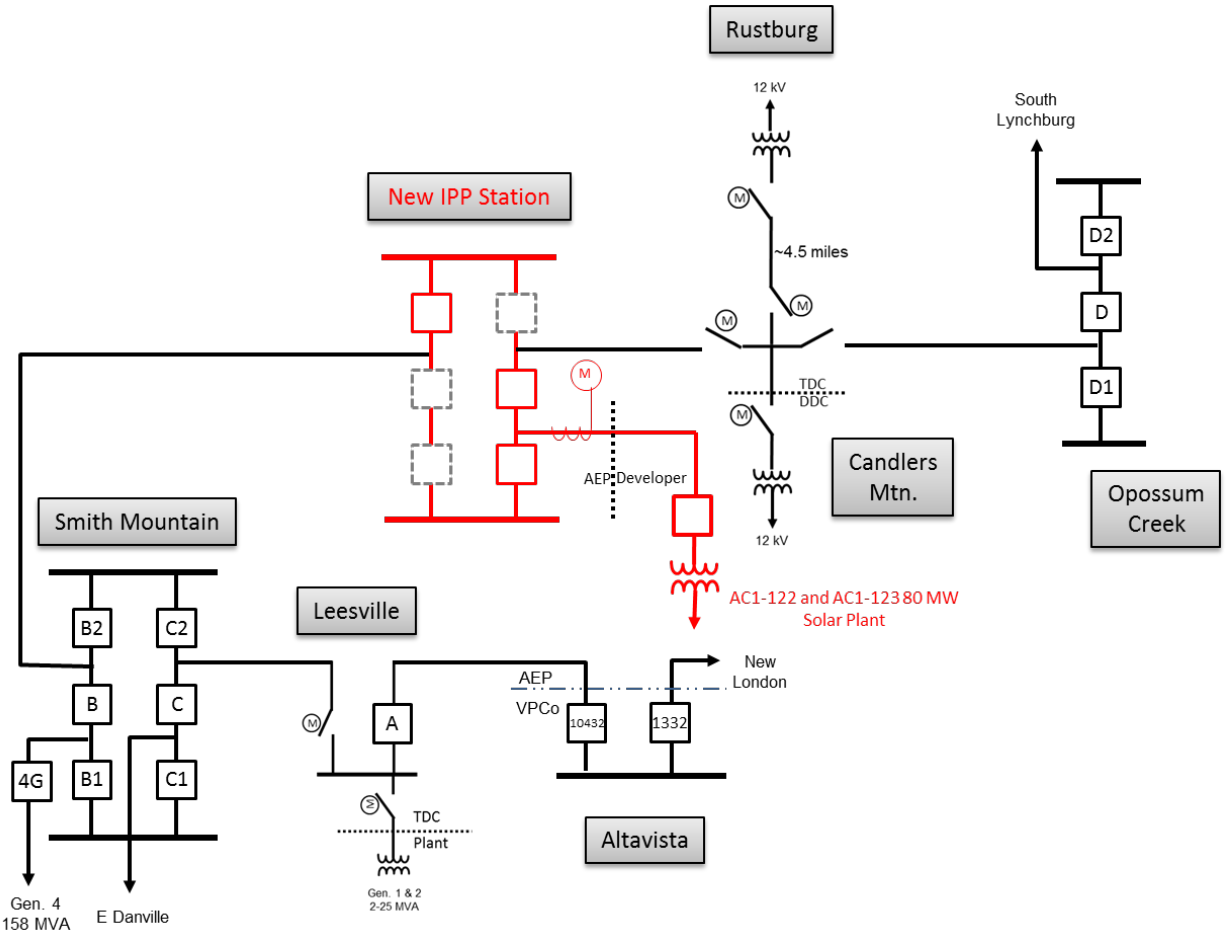
Task	Engineering	Material	Construction	Other	Total
Oversight of New 138 kV Switching Station, line extension and updates to remote end relay settings (Direct Connection Upgrade #n5626)	$35,114	$0	$27,220	$12,466	$74,800
Update remote end relay settings at Smith Mountain 138kV Substation (Non-Direct Connection Upgrade #n5630)	$46,943	$0	$36,390	$16,667	$100,000
Update remote end relay settings at Candlers Mountain 138kV Substation (Non-Direct Connection Upgrade #n5631)	$46,943	$0	$36,390	$16,667	$100,000
Smith Mountain-Candlers Mountain 138 kV Tline Extension (OTB Portion Upgrade #n5627)	$0	$0	$0	$0	$0
138 kV Revenue Metering (Attachment Facility Upgrade #n5626)	$14,000	$0	$8,000	$4,400	$26,400
Smith Mountain-Candlers Mountain 138 kV cut in (Non-Direct Connection Upgrade #n5627)	$16,000	$5,000	$45,000	$33,000	$99,000
Remote End Relay Upgrade at Opossum Creek					Not Required
TOTAL	$130,000	$5,000	$182,000	$83,200	$400,200

8. Information Required for Interconnection Service Agreement

(Option to Build Process)

Description	DCF Facility	NUF Facility	Total
Direct Material	$0	$5,000	$5,000
Direct Labor	$251,000	$61,000	$312,000
Indirect Material	$0	$12,000	$12,000
Indirect Labor	$50,200	$21,000	$71,200
TOTAL	**$301,200**	**$99,000**	**$400,200**

Figure 1: Point of Interconnection (New AEP IPP Station) One-Line Diagram



The Point of Interconnection is the first structure outside of the New IPP station with the Interconnected Transmission Owner (ITO) owning the first span of conductors, including fiber optic cable out of its station, and the Interconnection Customer (IC) owning the first structure and remaining structures back to its generation collector station.

Figure 2: Point of Interconnection (New AEP IPP Station)

Coordinates of proposed station site: Latitude: 37.133, Longitude: -79.353

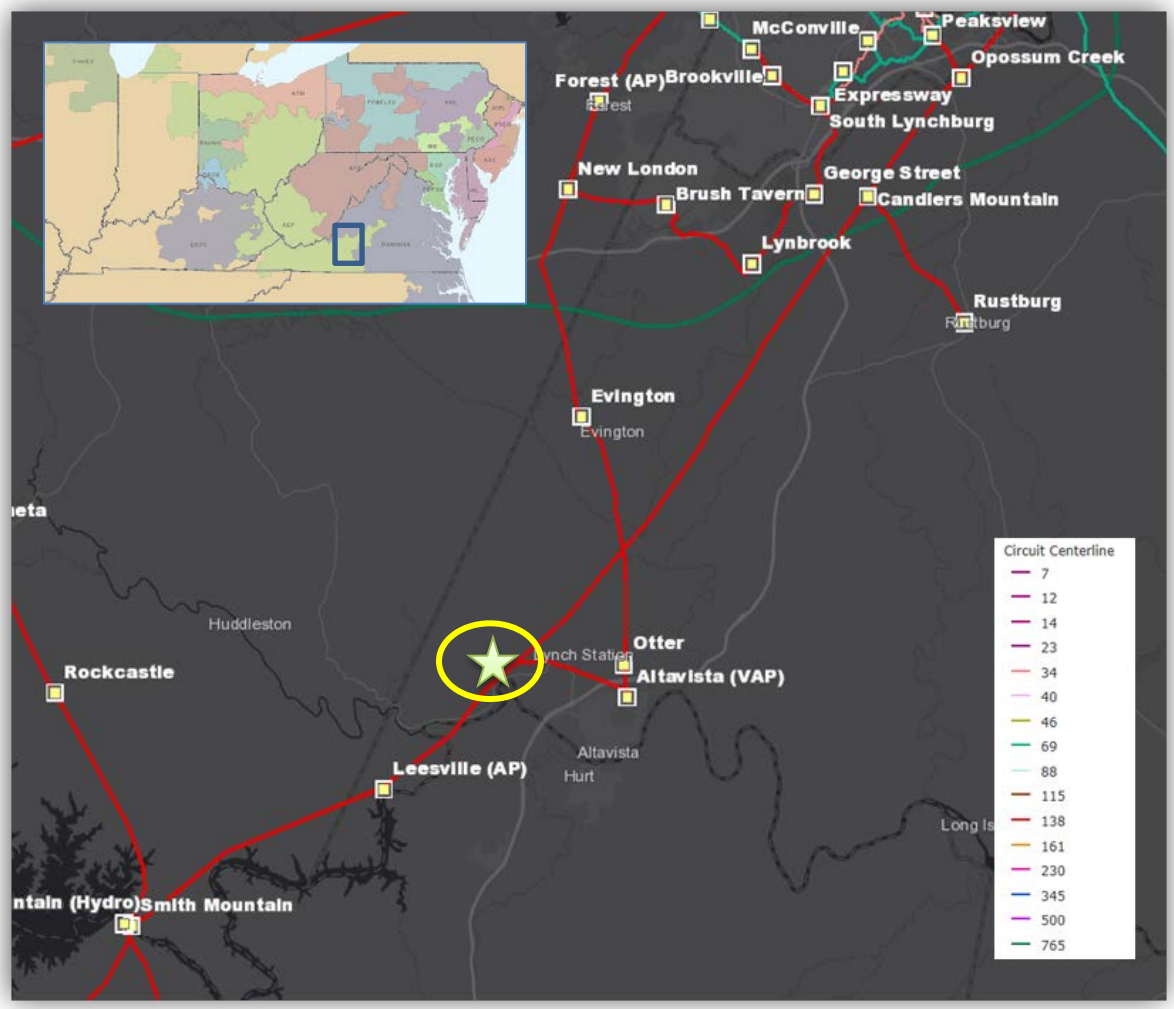


Figure 3: PJM Outage Scheduling Requirements

Minimum Requirements

Jobs 31 Days or More	
To Be Started In	Requested By
January	Jan. 15th, Year Prior
February	Jan. 15th, Year Prior
March	Jan. 15th, Year Prior
April	Jan. 15th, Year Prior
May	Jan. 15th, Year Prior
June	Nov. 15th, Year Prior
July	Dec. 15th, Year Prior
August	Jan. 15th, Same Prior
September	Jan. 15th, Same Year
October	Jan. 15th, Same Year
November	Jan. 15th, Same Year
December	Jan. 15th, Same Year

Jobs 6 Days to 30 Days	
To Be Started In	Requested By
January	June 15th, Year Prior
February	July 15th, Year Prior
March	Aug. 15th, Year Prior
April	Sept. 15th, Year Prior
May	Oct. 15th, Year Prior
June	Nov. 15th, Year Prior
July	Dec. 15th, Year Prior
August	Jan. 15th, Same Year
September	Feb. 15th, Same Year
October	March 15th, Same Year
November	April 15th, Same Year
December	May 15th, Same Year

Jobs 5 Days or Less	
To Be Started In	Requested By
January	Nov. 15th, Year Prior
February	Dec. 15th, Year Prior
March	Jan. 15th, Same Year
April	Feb. 15th, Same Year
May	March 15th, Same Year
June	April 15th, Same Year
July	May 15th, Same Year
August	June 15th, Same Year
September	July 15th, Same Year
October	Aug. 15th, Same Year
November	Sept. 15th, Same Year
December	Oct. 15th, Same Year