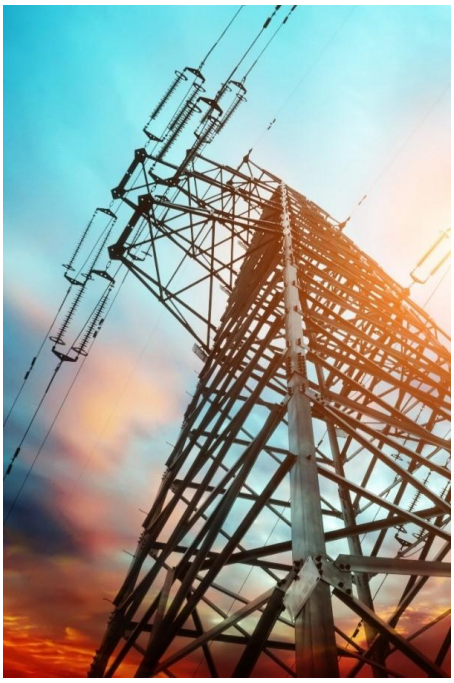
Appendix 21-2

Brookside Solar Energy Facility 115 kV Transmission & 34.5 kV Collection Design Criteria



BROOKSIDE SOLAR ENERGY FACILITY 115 kV Transmission & 34.5 kV Collection

Design Criteria Document

Prepared For:

Prepared By:

PN # 422299

REVISION INDEX

REVISION NUMBER	DESCRIPTION	DATE	BY
A	IFR - Issued for 30% Client Review	4/2/2021	TRC
B	IFR - Issued for 60% Client Review	5/25/2021	TRC
C	IFP	12/2/2021	TRC

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1.0 SUMMARY

Brookside Solar is a proposed 100 MW solar facility in the towns of Burke and Chateaugay, NY. This document summarizes the design criteria for the 115 kV Transmission Interconnection, as well as the 34.5 kV collector cable system from the solar inverters to the collector substation.

This document defines criteria for:

- 115 kV Structures
- 115 kV Wire and Insulators
- 115 kV Operating parameters
- 34.5 kV Trench layout
- 34.5 kV Cable operating parameters
- 34.5 kV Cable

2.0 DESIGN CODES, STANDARDS, GUIDELINES AND REFERENCES

A summary of codes, industry standards, and guides to be referenced, as needed, are listed below. Application of these codes, standards, guidelines, and references have been considered at the discretion of the responsible engineer based upon Federal and State requirements, and as per the specific needs and objectives of the project.

2.1 Industry Standards

- ANSI C2, National Electric Safety Code (NESC), 2017
- ANSI Z535.2011 Product Safety Signs and Labels
- ACI 318: Building Code Requirements for Structural Concrete
- ASCE 48: Design of Steel Transmission Pole Structures
- ASCE 72: Design of Steel Transmission Pole Structures
- ASCE 74: Guidelines for Electrical Transmission Line Structural Loading
- ASCE 91: Design of Guyed Electrical Transmission Structures
- ICEA S-93-639 5-46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy
- IEC 60287, Electric cables – Calculation of the current rating – Part 2-1: Thermal resistance – Calculation of thermal resistance.
- IEC 60383-2: Ceramic or Glass Insulators Units for AC Systems - Part 1
- IEEE 524: Guide to Installation of Overhead Transmission Line Conductors
- IEEE 738: Standard for Calculating the Current-Temperature of Bare Overhead Conductors
- IEEE 48, IEEE Standard for Test Procedures and Requirements for Alternating-Current Cable Terminations Used on Shielded Cables Having Laminated Insulation Rated 2.5 kV through 765 kV or Extruded Insulation Rated 2.5 kV through 500 k, 2009.
- IEEE 404, IEEE Standard for Extruded and Laminated Dielectric Shielded Cable Joints Rated 2.5 kV to 500 kV, 2012.
- RUS BULLETIN 1724E-200 Design Manual for High Voltage Transmission Lines
- RUS BULLETIN 1728F-806 Specifications and Drawings for Underground Electric Distribution

- UL 1072 Standard for Medium-Voltage Power Cables

Other recognized standards have been be used where appropriate to serve as guidelines for the design, when not in conflict with the above listed standards.

It is assumed that 115 kV transmission interconnection will be designed to NYSEG standards.

3.0 GEOGRAPHICAL CONSTRAINTS

3.1 Coordinate System

NAD83 NY east, US foot coordinate system

4.0 115 kV STRUCTURES

Type	Vertical Pole Steel Deadend (TM2.23.TE-S1CP)
Foundation	Concrete Caisson

5.0 115 kV WIRE AND INSULATORS

Power Conductor	336.4 kcmil 30/7 ACSR “Oriole”
Shield Wire / OPGW	¼” High Strength (HS) Steel
Insulators	Porcelain Disc - Grey

6.0 115 kV OPERATING PARAMETERS

Frequency	60 Hz
Nominal Phase to Phase Operating Voltage Max Phase to Phase Operating Voltage	115 kV 121 kV
Maximum Steady State Ampacity	Based on NYSEG Standards for Oriole Conductor
Emergency Ampacity	Based on NYSEG Standards for Oriole Conductor

7.0 34.5 kV TRENCH CONFIGURATION

The trench design criteria will be applicable for the 34.5 kV Collector system. The collection system is planned to be installed as a direct buried installation with the exception for any trenchless crossing locations.

7.1 Clearances

Utility Crossing Vertical	18”
Utility Spacing Horizontal	36”
Circuit Spacing	To be determined by ampacity calculations

7.2 Installation

Minimum Cover	36 in. inside Solar Field Fence Area 48 in. outside the fence area (Roadways, Cropland, Hayland and Improved Pasture)
Installation Method	Open Trenched Via Excavator Crossings - Horizontal Directional Drill (HDD)

7.3 Conduit (Trenchless Installations)

Material (Trench)	Electrical Grade Schedule 40 High Density Polyethylene (HDPE)
Material (Aboveground Transitions)	Electrical Grade Schedule 80 High Density Polyethylene (HDPE)
Connections	Bell and Spigot

8.0 34.5 kV OPERATING PERAMETERS

Frequency	60 Hz
Nominal Phase to Phase Operating Voltage	34.5 kV
Max Phase to Phase Operating Voltage	36.3 kV
Maximum Feeder Ampacity	543 Amps
Sheath Bonding Configuration	Solid Bonded

9.0 34.5 kV CABLE SYSTEM DESIGN CRITERIA

Voltage Class	34.5 kV MV-105
Conductor Size	1/0 AWG AL, 4/0 AWG AL, 500 MCM AL, 1000 MCM AL
Insulation	Ethylene-Propylene Rubber (EPR) or Tree Resistant Cross-Linked Polyethylene (TR-XLPE)
Insulation Level	100%

10.0 COMMUNICATIONS FIBER

Type	12 Strand - Multimode Cable
Qty.	Single Cable per Circuit
Conduit	1.25” HDPE