

# 115 kV/34.5 kV Solar Power Plant and Substation

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**Client:** Black & Veatch **Client Contacts:** Patrick Kester **Advisor:** Venkataramana Ajjarapu

## Problem Statement

**Problem:** Due to traditional energy sources proving to be harmful to the environment, there is a movement to provide clean energy and shift towards a renewable set up to the grid.

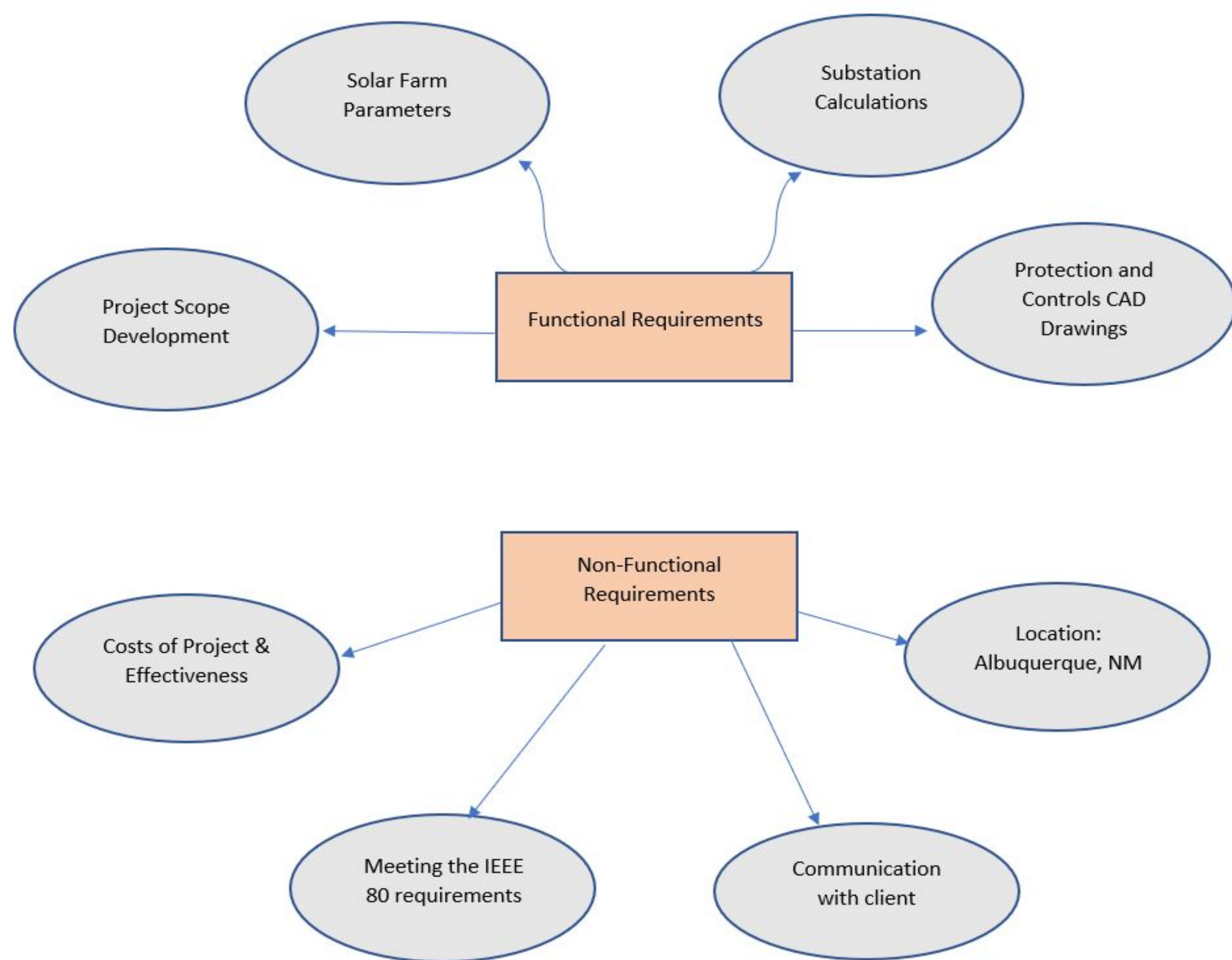
**Solution:** Design a 60 MW solar power plant and 115 kV/34.5 kV substation and tie it to the general grid.

## Design Approach

Here is a detailed approach of what we did for the solar power plant and substation design

1. Find best location for solar plant that meets all our requirements.
2. Determine solar array parameters by performing various calculations
3. Create solar plant layout based on previously found parameters and design layout.
4. Create substation one-line diagrams and schematics
5. Calculate grounding and bus calculations based on layout and sizing of substation.

## Design Requirements

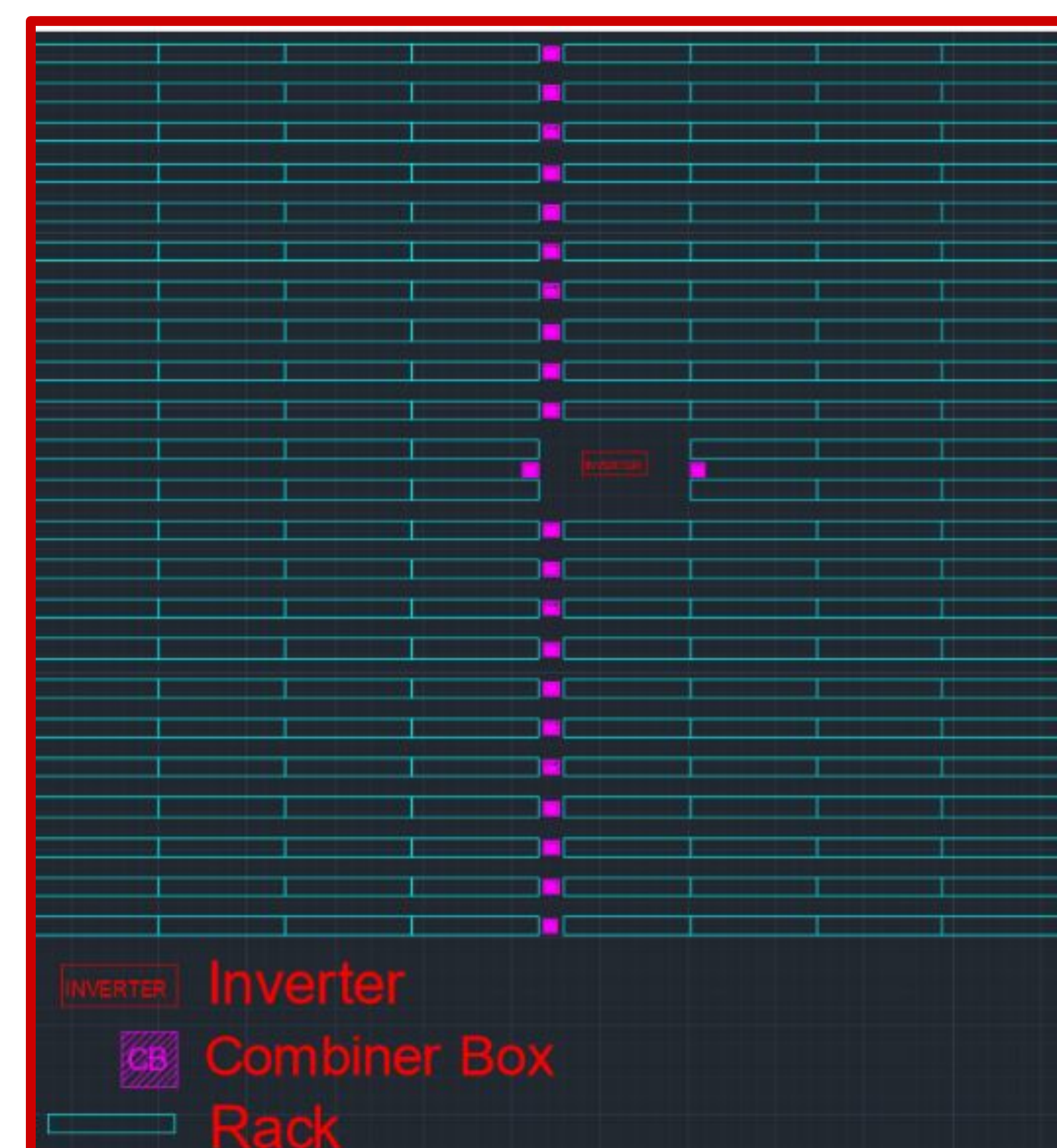


## Engineering Standards and Design Practices

In the scope of this project we adhere to NEC guidelines and practices, specifically with regards to conductor sizing requirements and loading factors. Throughout the design process we followed Black & Veatch standards in regards to safety tolerances, company-specific design tools, and project design flow.

## Solar Plant Layout and Cost

Solar Plant is composed of 16 identical arrays containing the modules, combiner boxes, and inverters. These are then fed to the substation through 4 transmission lines.

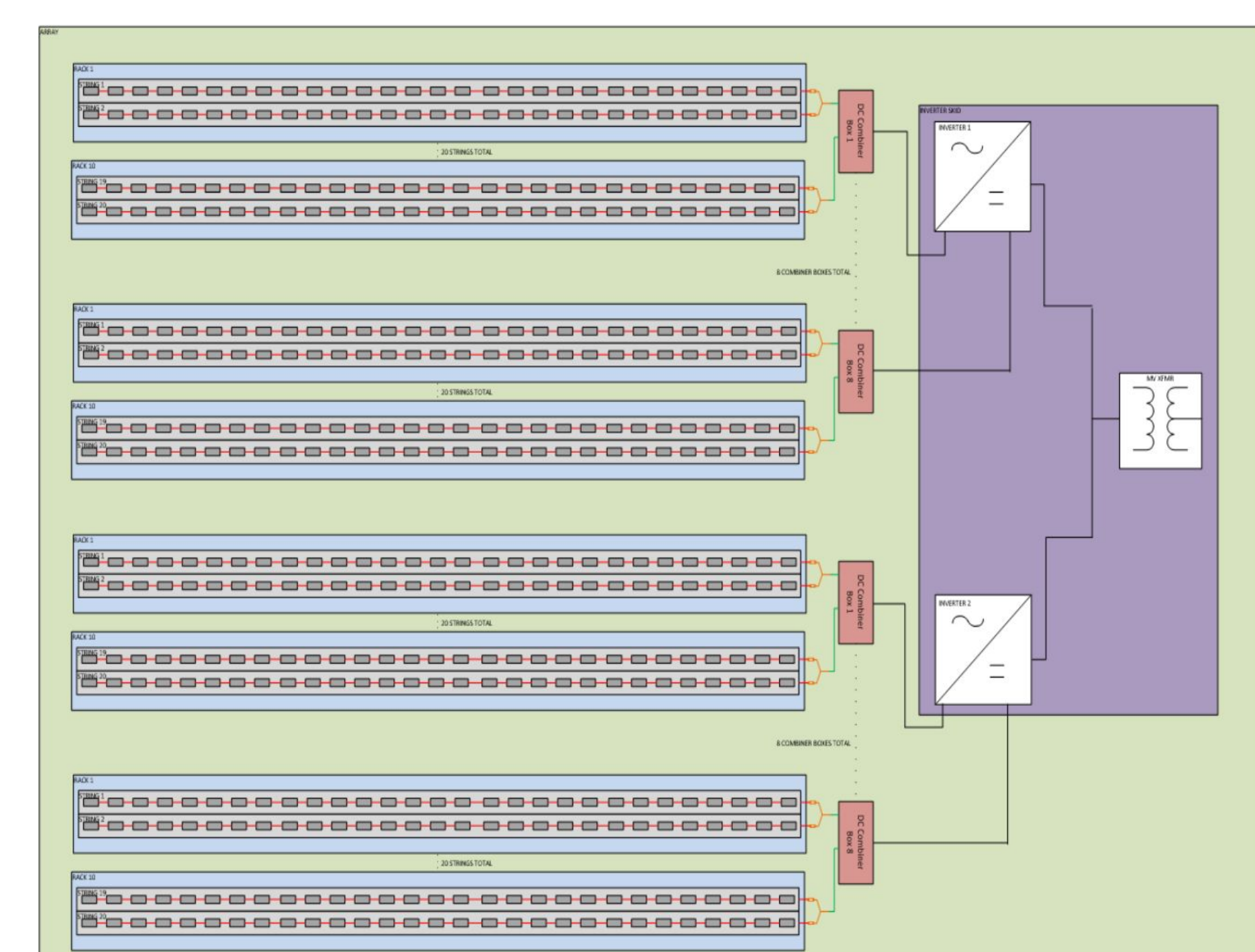
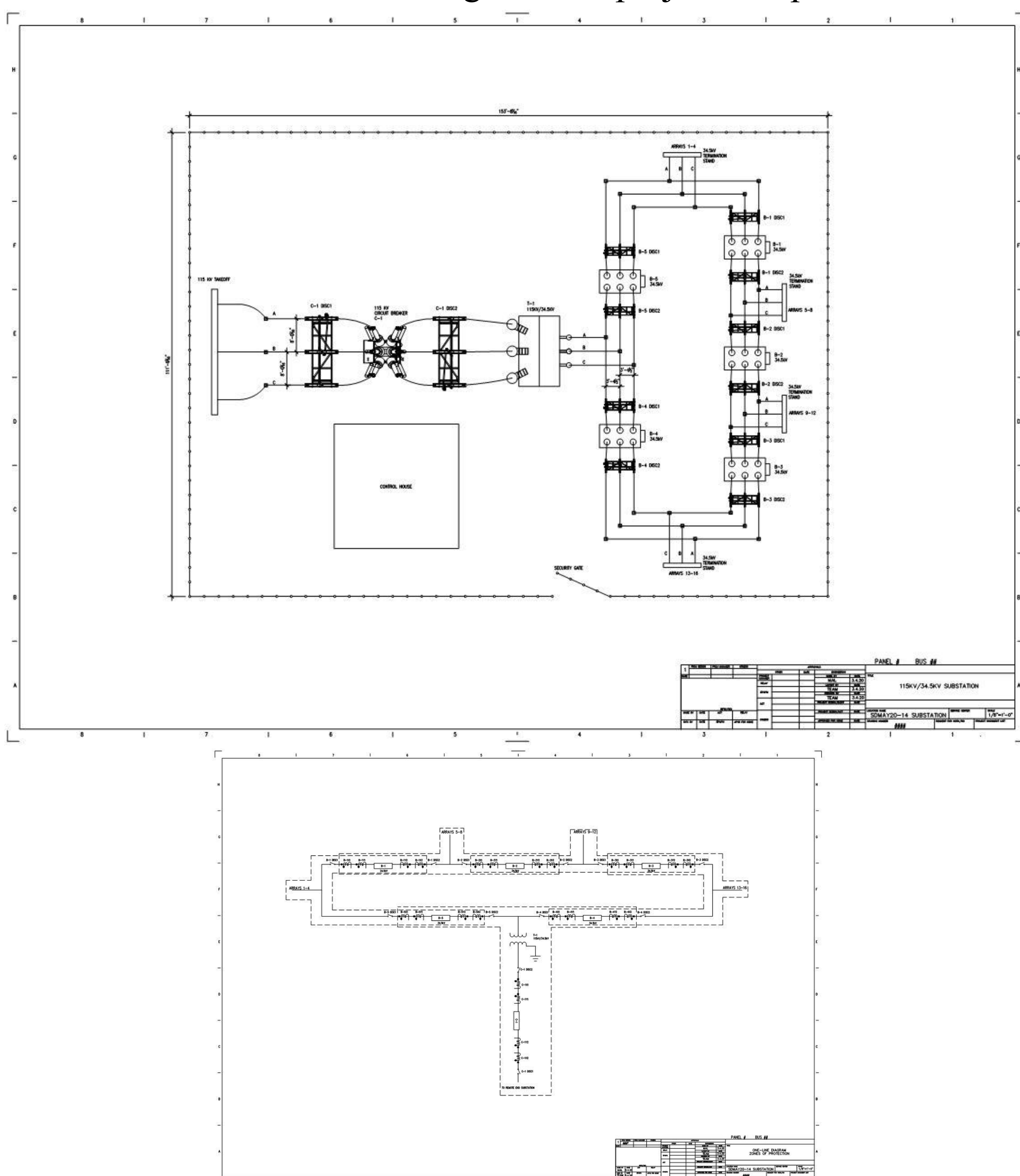


Solar Plant Cost	Quantity	Cost/Unit	Total Cost
Solar Panels	163,072	\$198.68	\$32,399,927.71
Combiner Boxes	368	\$900.00	\$331,200.00
Inverters	16	\$155,000.00	\$2,480,000.00
		<b>Total Cost</b>	<b>\$35,211,127.71</b>

Land Cost: \$109,000  
 Implementation Cost: \$60 million  
 Final Cost: \$95.3 million

## Protection and Controls Drawings for Substation

Final AutoCad drawings for our projects scope:



## Project Resources

1. IEEE std 800-2000 Document
2. Microsoft Excel
3. AutoCAD
4. National Electrical Code (NEC) Document