115/34.5kV Solar Plant & Substation

Team: SDMAY25-41
Client: Black & Veatch: Adam Schroeder, Elymus Schaffer, Utsavee Desai
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PROJECT OVERVIEW

- Fully design a 60 MW solar plant and its corresponding 115/34.5 kV substation through site and component selection, modeling, and calculations to ensure our design meets all requirements for our client
- Provide reliable, renewable energy transmission and distribution to the users of our plant

REQUIREMENTS

Functional

- Solar farm needs to provide power 24/7 without unplanned interruptions
- Solar panel needs to work to properly produce clean energy
- Solar farm needs to be cost effective and help to save money

Aesthetic

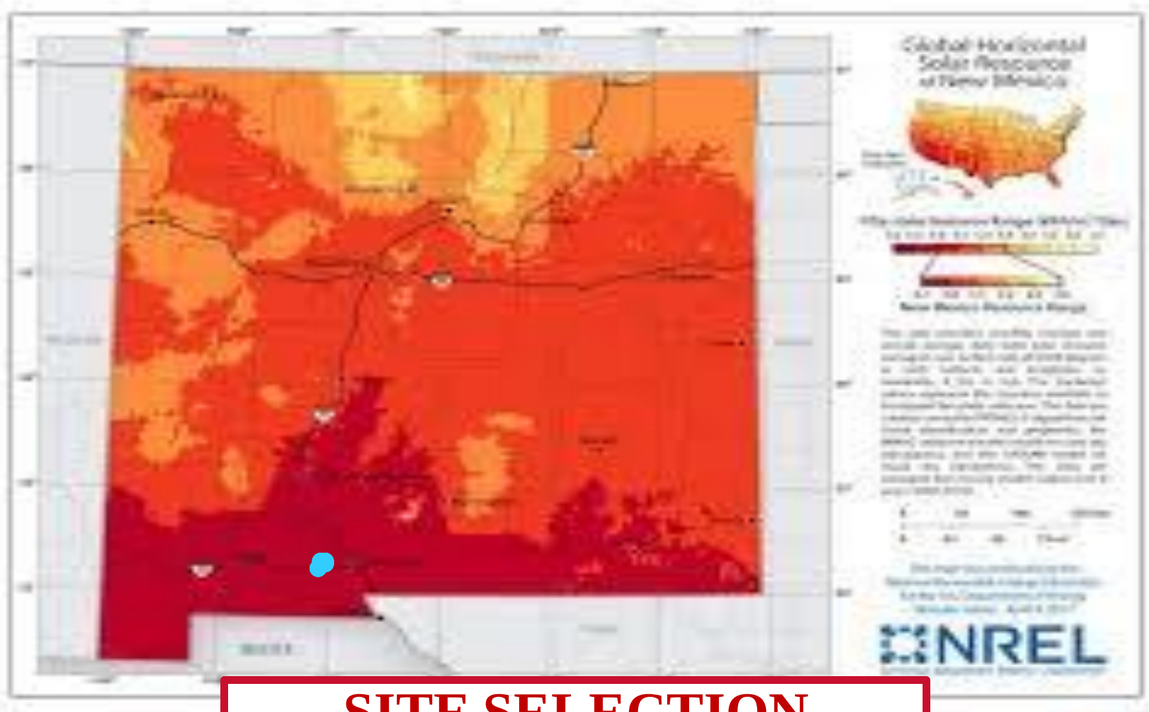
- Farm needs to be in calculated rows to maximize the panel efficiency and space. Panel efficiency corresponds to power output.

Safety

- The solar farm construction and operation must adhere to all applicable safety codes

Environmental

- Solar panels need to be sustainable and help reduce carbon emissions



SITE SELECTION

Deming, New Mexico

CLIENT DELIVERABLES

Solar Plant Design (Fall)

- Array parameter tool
- String, rack, and array layouts
- Plant characteristics
- Voltage drop calculations
- Datasheets
- Site selection

Substation Design (Spring)

- One-Line
- Equipment layout
- Grounding study and calculations
- Lightning protection calculations
- AC and DC calculations
- ETAP simulations

USERS

- Utility companies
- Citizens who use electricity

Needs

- Clean energy
- Uninterrupted supply of power
- Optimal use of land and budget
- Adhere to all safety codes and regulations

DESIGN STANDARDS

- **IEEE –** Grounding, protection, and design calculations
- **NEC (National Electric Code) -** Conductor sizing, safety margins
- **Black & Veatch Design Guidelines –** Client specific expectations and deliverables

TESTING

ETAP

- For load flow and short-circuit simulations

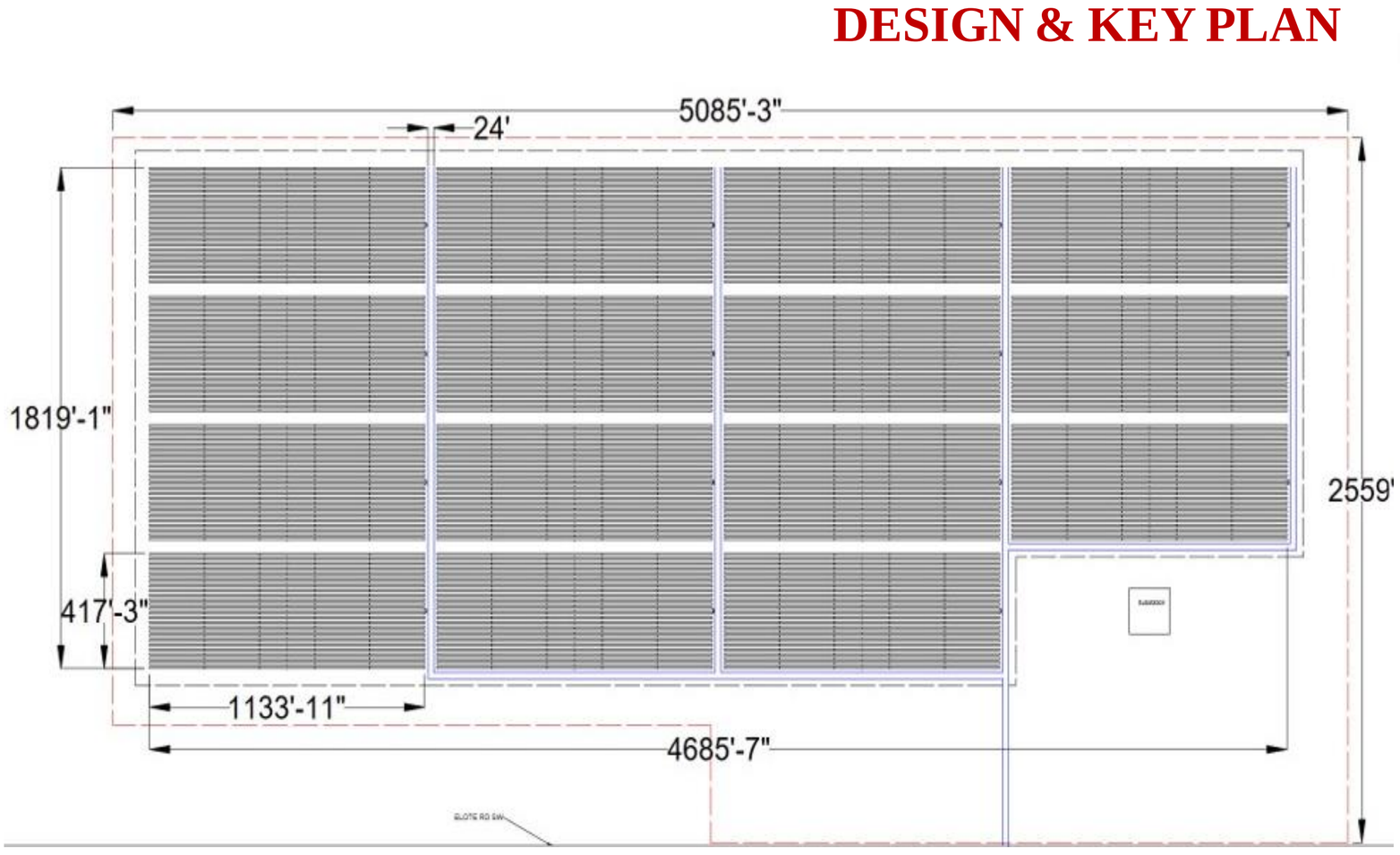
AutoCAD

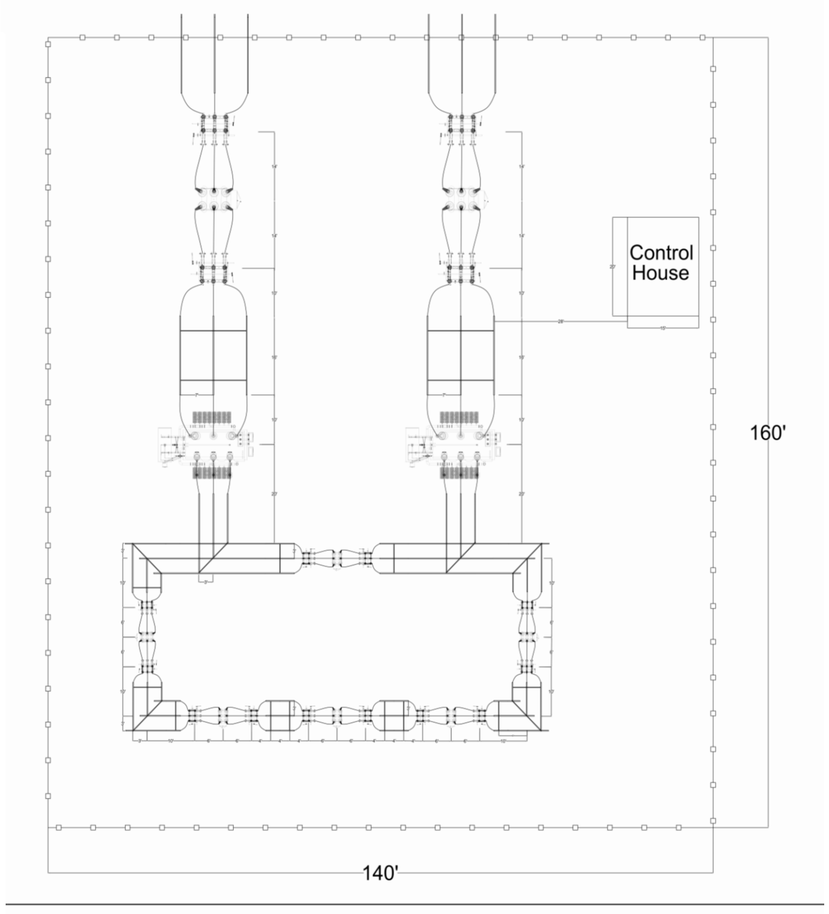
- To draw one-line, three-line, and layout diagrams

Microsoft Excel

- To perform hand calculations (voltage drop, AC & DC, array sizing)

DESIGN & KEY PLAN





OVERVIEW OF 60MW SOLAR PLANT

- Within a string, solar panels are connected in series to combine their voltages to achieve our desired string voltage
- Strings are connected in parallel within racks, which are then fed to a combiner box
- The combiner box combines the strings and directs it to an inverter.
- The inverter converts the electricity from DC to AC and includes skids to step up the voltage to 34.5kV
- The electricity is transmitted to the feeder and carried to the substation

OVERVIEW OF SUBSTATION

- Step-up transformer increases voltage from 34.5kV to 115kV
- The higher voltage allows integration into the local electrical grid
- Electricity is distributed to end users, including homes and businesses
- Substation is located near high voltage transmission lines for grid connection

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