115/34.5KV SUBSTATION DESIGN AND SOLAR POWER PLANT
SDMAY24-18, FACULTY ADVISOR: DR. AJJARAPU
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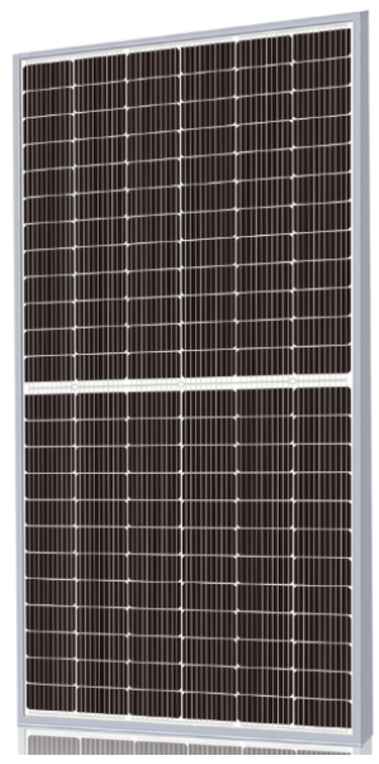
Project Vision:



Design:
- 115/34.5kV distribution substation
- 60MW solar plant

Deliverables:
- Full Sheets of Solar Design
- Full Sheets of Substation Design
- Testing of Substation and Solar together
- One Line
  - DC and AC for Solar
  - AC for Substation
- Three Line for Substation
- Equipment Sizing Calculations
- Grounding Calculations

Plan:
1.) Research
2.) Design/Plan
3.) Calculations
4.) Simulations

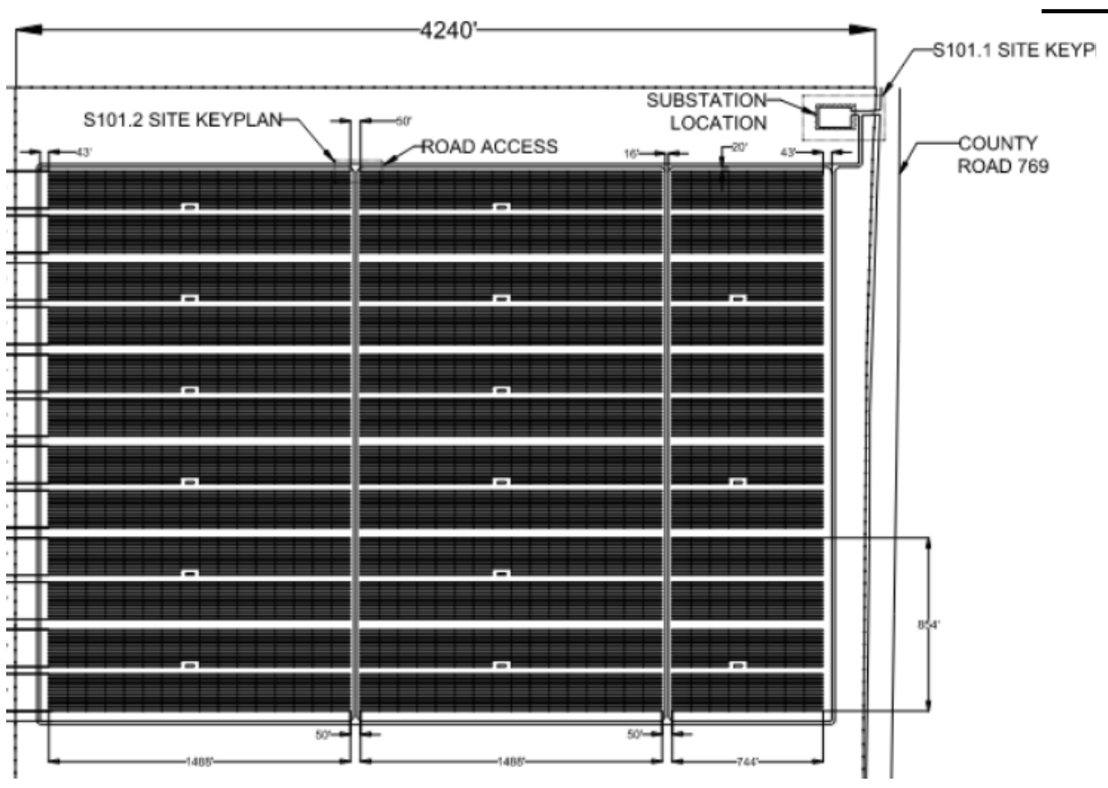
Design Requirements:

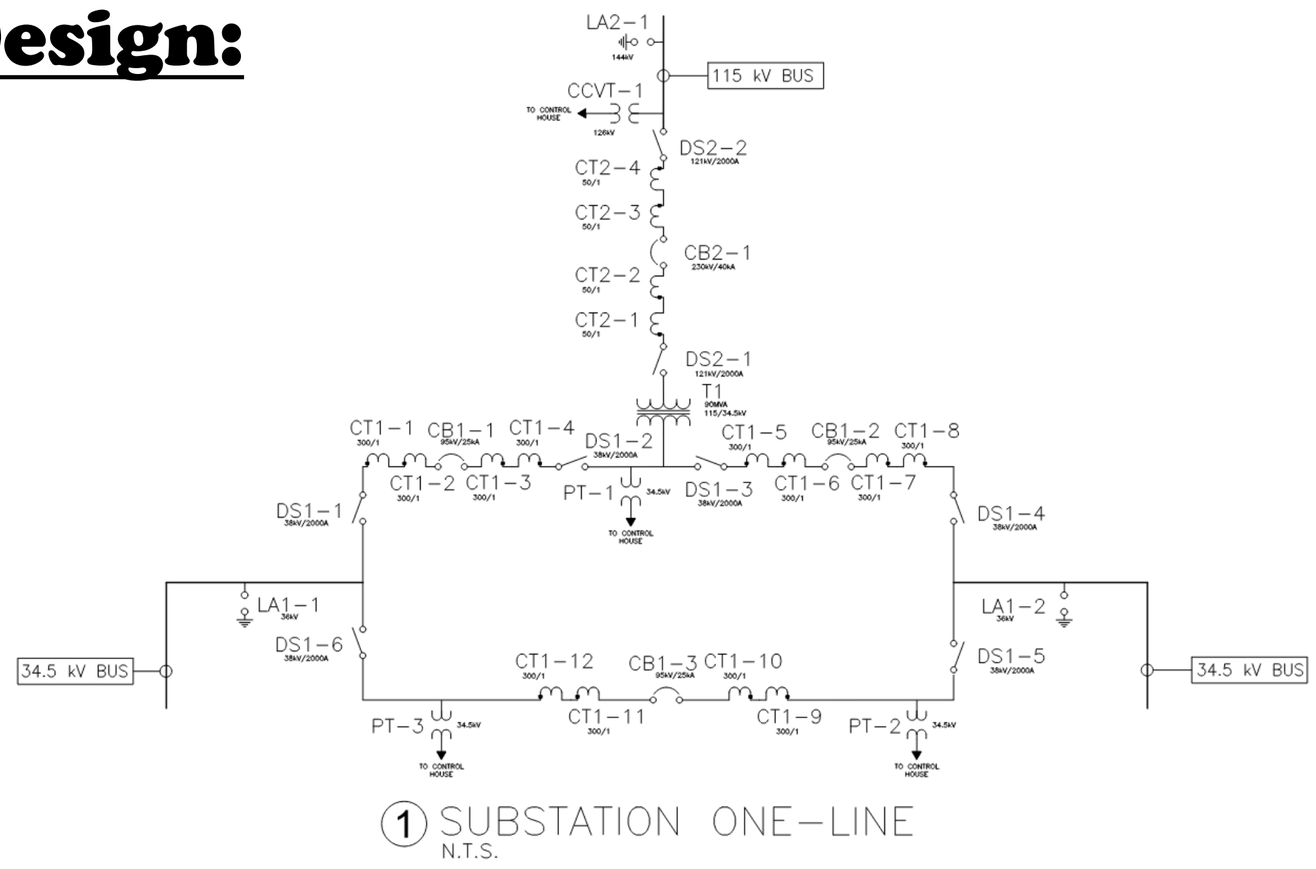
Functional
- Must be able to operate in environmental conditions
- Power rating at the solar farm of 60 MW
- Adhere to IEEE, NEC, ANSI standards
- Maintain reliability throughout the lifespan of the project
- Minimize voltage drop across solar plant
- Safely ground the entirety of the substation
- Establish over current protection system
- Calculate overall DC and AC loads

Environmental
- Parcel of land must be flat and continuous
- High amount of average sunshine per year
- High irradiance on the land
- Substation should be able to safely provide power to nearby communities
- Efficient use of land

Economic
- Our solar plant must be able to produce enough power per year to recover initial investment and operational costs over 10 years

Design:





① SUBSTATION ONE-LINE
N.T.S.

Problem Context:

- The electricity generated from the solar power plant will benefit the people of New Mexico, as well as Texas, as the substation will be connected to the nearest main power grid (SSP Interconnection)
- Residential consumers: Homes and apartments for lighting, heating and power appliances.
- Commercial and Industrial Consumers: Business, factories, offices and other commercial entities to operate their equipment, machinery and other facilities.
- Government facilities: Public buildings,schools, hospitals, and other government institutions, reducing reliance on fossil fuels and promoting sustainability.

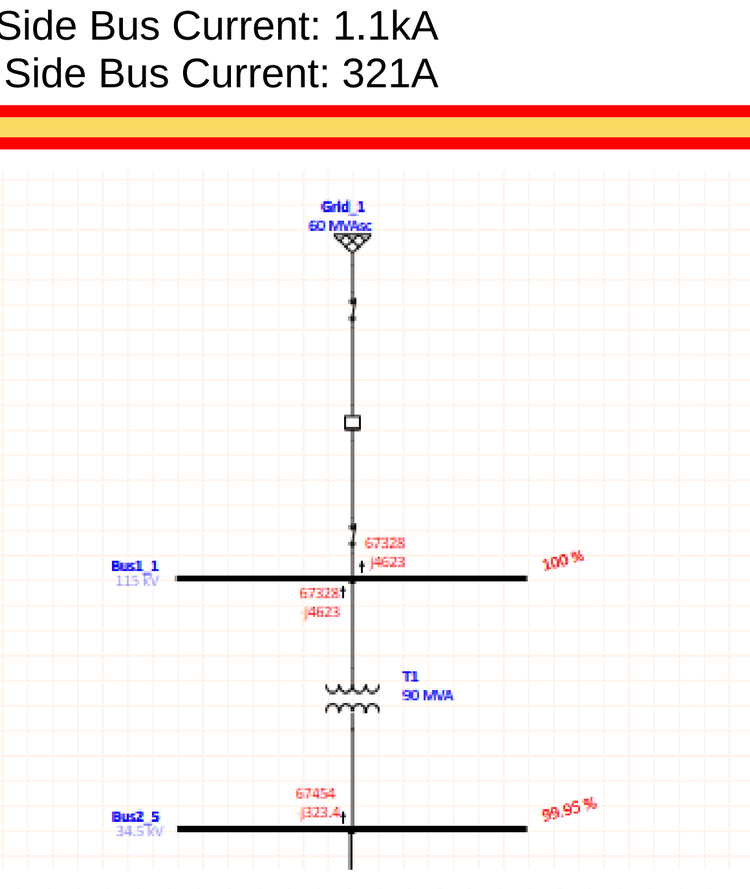
Electrical Characteristics:

Low Side Voltage: 34.5kV
High Side Voltage: 115kV
PV Farm Production: 64MW
Low Side Bus Current: 1.1kA
High Side Bus Current: 321A

Testing:

While testing our project, we used a program called ETAP. This program is used in other industry companies, which shows the validation of the program. We used ETAP to conduct our power flow analysis and short circuit analysis.

We found that our solar farm actually produced 64MW instead of the intended 60MW. This increased the line currents slightly.



Issues:

- Compatible components
- Scheduling
- File access and organization
- Component pricing and specifications
- Engineering drawing details and information

Pricing:

- Solar Farm
  - $43 million
- Substation
  - $3 million
- Total Cost
  - $46 million
- Repayment/Production
  - Farm pays for itself after 5 years

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