Utility Scale Lithium-ion Battery Energy Storage System

Team: sddec24-18
Client: Burns & McDonnell
Faculty: Zhaoyu Wang

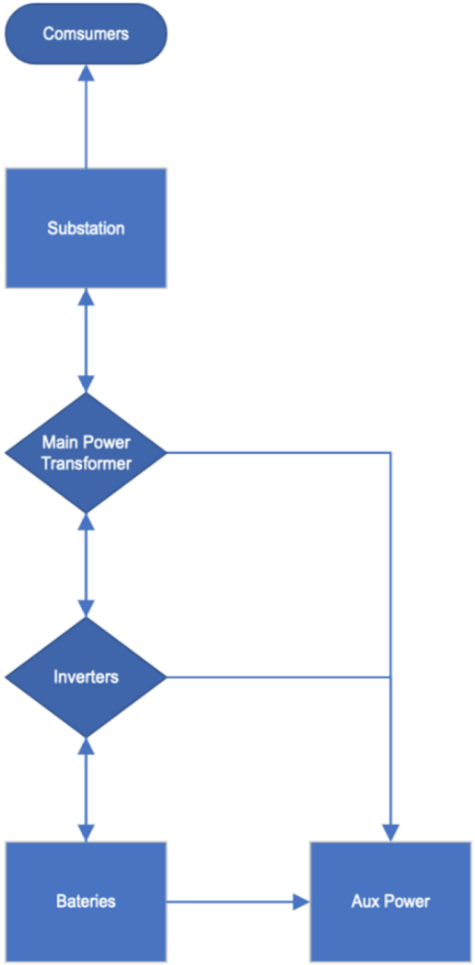
Project Overview

- A 25 MW/ 100 MWh battery energy storage system
- Build this system hypothetically design this on an “unoccupied” plot of land about 15 acres
- Determine which battery containers we want to use
- Determine which inverter technology and how many inverters we want to use
- Calculate various values for apparent power, reactive power, and current
- Calculate the cable sizings needed for the design
- Create a one-line diagram that will be used as a map showing where the equipment is interconnected

Design Details

One-line diagram:

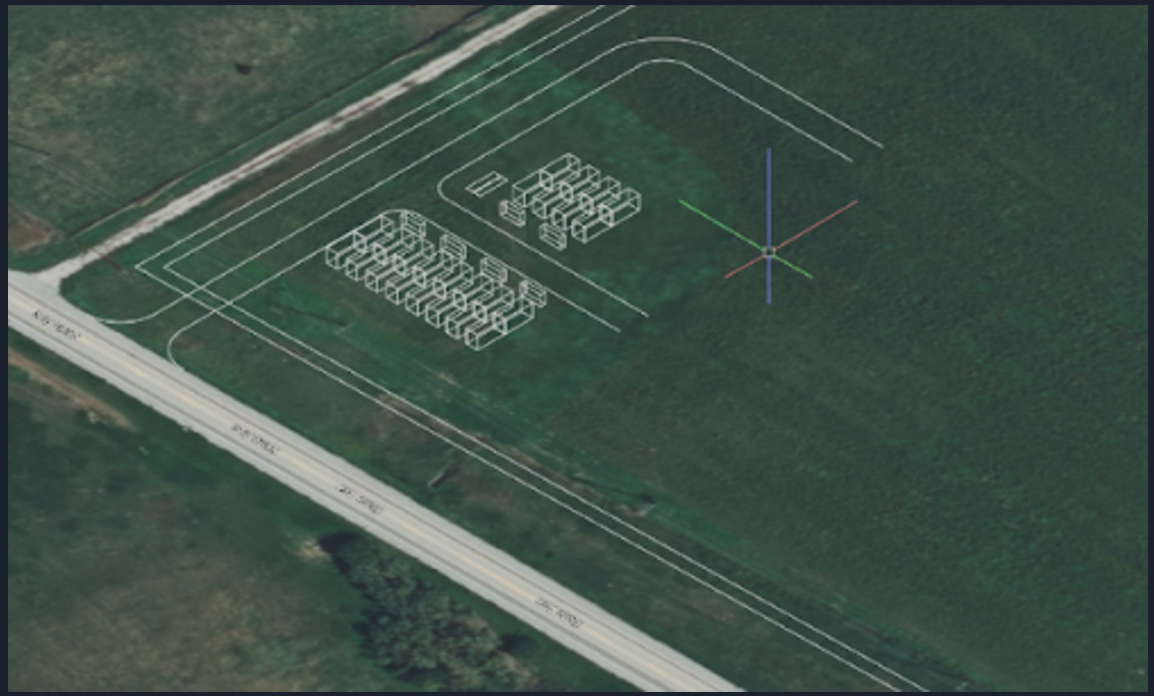
- The one-line diagram provides an outline of how the system is connected.
- We will have two main branches of PCS systems connected in series of “daisy-chained” together.
- We will have a total of 6 PCS systems connected to provide 25 MW of power for four hours.



Design Details

Site Layout:

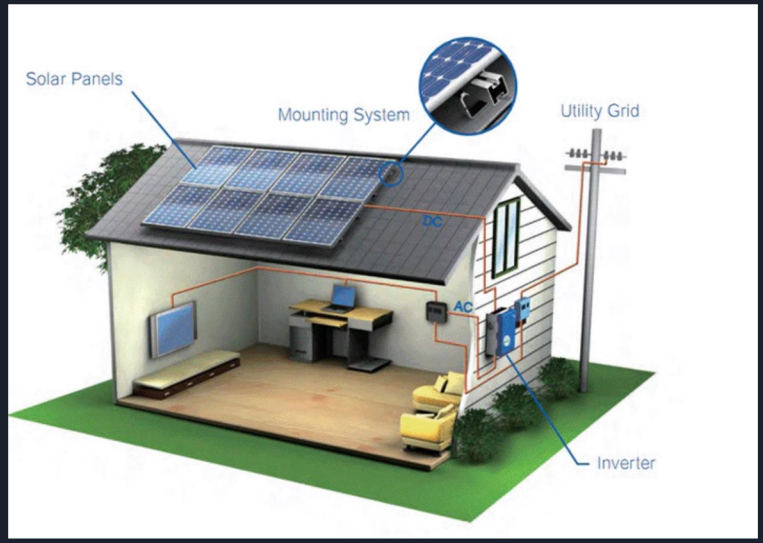
- Created using AutoCAD software.
- Displays the size of our design in the plot of land
- Displays the entrance roads
- Displays the technology and where we will organize the site we use.



Functionality

End users:

- This system would hook up to an existing solar farm/ solar panels from a residential home and hook up to a substation.
- The end user would be able to use energy freely without worrying about wasteful energy.
- The end users will not need to worry about repairs for this system



Functionality

interact directly with equipment– Construction Workers

- The construction team will have to understand the system design from the engineers in order to make necessary updates to the system
- They will need to proceed safely when designing this, following the layout design and following safety regulations

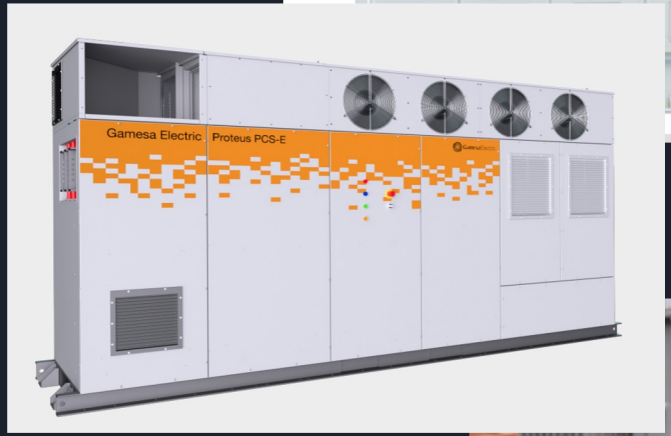
Functionality

Lead Engineers:

- The lead engineers need to design this system taking into consideration that the end user will not be able to make any adjustments in case of failure.
- The need to consider the end users needs and what benefits this system will provide

Technology Considerations

- BYD
  - Strengths: This offers the necessary discharge rate we needed
  - Weakness: There could be options that offer more power with less battery containers
- Siemens PCS
  - Strengths: It have two input ports so we do not need to maximize the number of inverters and can double up
  - Weakness: Two input ports could be a weakness as other options may offer more so we can minimize the number of inverters and minimize costs
- Oil-filled aux transformer
  - Strengths: Most commonly used in the industry, and so it is easier to find information on
  - Weakness: It still uses fossil fuels, so it is not 100% a viable options for designing a renewable energy system.



Solutions to the technology considerations

- BYD
  - 24 battery containers offer us the necessary power for the system along with a 10% BOL
- PCS
  - 6 Siemens Gamesa inverters with two input ports each so we can use 4 battery containers per inverter and minimize total costs
- Aux Transformer
  - This offers us the simplest design, using standard options offered in this industry.
  - The client thinks this will be the best choice for our design.
  - Easier to find information on this kind of auxiliary transformer

Development

- Users need a system that can help them save money, as well as make it easier to switch over to renewable energies.
- This system makes it easier for the end users use energy

Areas of Concern

- Building this system on only a quarter of the 15 acre plot we are using
- Taking the plot away from the equastrines that live there
- Initial costs of this system can be incredibly expensive regardless of the positive impact they will have in the future.

Conclusion

Any Questions?