

EE/CprE/SE 492 WEEKLY REPORT 2

Start Date – End Date: 2/18-3/4

Group number: 27

Project title: 60 MW Solar Field and 34.5/115 kV Substation Design

Client &/Advisor: Black & Veatch advised by Ajarapu

Team Members/Role: Omer Karar, Madison Lakomek, Madissen Lawrence, Jacob Miller, Brooke Nelson, Ashton Randolph, Jenna Runge, Zachary Zimmerman

Weekly Summary

These past two weeks were focusing on finalizing the one line based on the updated comments that Black & Veatch gave us along with completing various calculations to go along with the design of the substation. With this, bus, trench, and battery calculations were done and the pieces within the substation were finalized.

Past week accomplishments

- One line Diagram - Jacob and Omer
 - Simplified One-line diagram to include only one transformer and transitioned the existing CT's & relays to accommodate that.
 - Researched and found national standards for required protection on buses, transformers, feeders and verified choice of relays needed to accomplish those standards with B&V
- Bus Calculations - Madison and Zachary
 - Went through the IEEE guide for bus design to determine the equations that needed to be used as well as how each variable connects to the specific bus that was chosen (Maddy and Zach)
 - Calculated the ampacity for both a rigid bus and flexible bus and realized that we need to up the diameter of our chosen bus based on our current running through it (Maddy and Zach)
 - Calculated the weight, wind force, ice force, and short circuit force of the rigid bus based on the allowable current found (Maddy)
 - Calculated the total allowable span of the rigid bus based on the forces and allowable current of the conductors that are being used on the bus (Maddy)
- Battery Calculations - Madissen and Jenna
 - We began looking at the battery calculations, and got a spreadsheet for the load profile set up, but we got stuck trying to find cut sheet values and had to put the calculations on pause until we were given guidance on where to find them.
 - We made Enersys and SEL accounts to use while doing the battery calculations
- Pricing Estimates - Madissen and Jenna
 - We used the PEGuru website to get rough estimates and lead times for various pieces of equipment in the substation. These estimates are the best we can get without going to the companies for a quote.
- Trench Fill Calculations

- Calculated Gause area and determined AWG cable standards for:
 - Transformer
 - AC Power
 - AC Test
 - DC Power
 - Control
 - Fiber Optic
 - CT
 - Sump Pump
 - Breakers
 - Control
 - AC power
 - PT
 - CT
 - Yard Lighting
 - Disconnect Switches
 - Capacitor Banks
 - Circuit Switchers
 - CCVT
 - Station Service Transformer

Pending issues

As a group, we still need to create a key plan. This plan shows each component in the substation, where they are going to physically be located with respect to each other, and how each component is connected to each other. We need this information to finish up the bus and battery calculations. The trench fill calculation also needs to be finalized given the suggestions that Black & Veatch gave in our last client meeting. We will also need to start playing around with the ETAP software as it was just installed in the senior design lab. We need to finalize the DC battery calculations as well.

Individual contributions

*this should be short and concise based on past week accomplishments. Instructions say do not include group meetings

Name	Individual Contribution	Hours in the Past 2 Weeks	Hours Cumulative
Omer Karar	I worked on the one-line diagram configurations, found a place to put PT in the schematic, and started working on CT and the relay.	7	13

Madison Lakomek	Bus calculations, lead client meeting on 2/22	7	13
Madissen Lawrence	Worked on Battery Calculations, determined component cost estimates.	8	14
Brooke Nelson	Trench calculations, looked into ETAP	8	14
Jacob Miller	Reworked one-line configuration, CT and PT placement. Researched specific components needed.	10	18
Ashton Randolph	Trench calculations, and watched ETAP getting started videos on their website.	8	14
Jenna Runge	Outlined approximate cost for substation parts, researched ETAP application to the project, DC battery calculations, attended all meetings.	7	14
Zachary Zimmerman	Worked on bus calculations, continued looking into ETAP.	7	13

Plans for the upcoming week

(Please describe duties for the upcoming week for each member. What is(are) the task(s), Who will contribute to it? Be as concise as possible.)

Omer Karar- I looked for the new ETAP software by watching videos about the software. I worked on the one-line diagram configurations, found a place to put PT in the schematic, and started working on CT and the relay.

Madison Lakomek- Start working on the key plan, spend time in the senior design lab looking through the new ETAP software, update the bus calculations based on the key plan

Madissen Lawrence- Continue working on the battery calculations, look into the newly installed ETAP software, update the senior design website.

Brooke Nelson- Continue working on the trench calculations, work on the key plan, get more familiar with the ETAP software.

Jacob Miller- Verify specific feeder part/model that will be used, its connection method to the 34.5kV bus. Verify connection method of PT. Size all parts, find New Mexico's clearance regulations when it comes to bus/line spacing, spacing between all components in our one-line. From our chosen one-line components, find accurate physical measurements of each part. Using the prior mentioned information, create a three-line diagram that closely resembles the final "real placement" of our substation design. Once this is complete, the bus lengths will be useful in calculating a more accurate estimate regarding our DC battery, and bussing calculations.

Ashton Randolph- Continue working on trench calculations, help with beginning our Key plan, and watch tutorials to prepare for beginning our ETAP Simulation.

Jenna Runge- Continue working on the DC battery calculations, start getting familiar with ETAP now that it is installed, research standards.

Zachary Zimmerman - I plan to continue working on bus calculations. I also plan to start working on our solar plant and substation simulation using the ETAP software that was just installed.

Summary of weekly advisor meeting

The meeting on 2/23 was canceled due to weather, so we sent an email to our advisor letting him know we would be working on bus, battery, and trench calculations for the next week and what we had learned about ETAP.

During the 3/02 meeting, we discussed our progress from the last week, our last meeting with Black and Veatch (3/01) and the final presentation at the end of the semester. The presentation discussion included talking about our design decisions and he would like us to get together a list of standards that influenced our design decisions. For our next meeting, Professor Ajarapu would like us to check out the ETAP software that has just been installed, and present on the general progress of our substation design.