

## EE 491 Weekly Report 8

Start Date: March 27

End Date: April 2

Group number: 18

Project title: Utility Scale Lithium-Ion Energy Storage Project

Client: Burns and McDonnell

Faculty Advisor: Zhaoyu Wang

Team Members/Role:

- ❖ Oksana: Leader—responsible for keeping the team on track; cable sizing for the system.
- ❖ Sarah: Organizer—responsible for revising, editing, and helping keep track of all our reports; one-line diagram design
- ❖ James: Document Report—responsible for the submission of our reports; Inverter quantity; one-line diagram design
- ❖ Cole: Point of Contact/Communicator—responsible for meeting and contacting the clients, faculty advisor; AutoCAD site layout design.

### **Weekly Summary:**

This week, we all continued to work on the one-line diagram and the calculations for the cable sizing. We also continued to work on the technical document for our client. We met with the client as well as Professor Wang and discussed more in-depth the one-line diagram, as well as the cable sizing calculations.

### **Past Week Accomplishment:**

As a group:

- Cable sizing calculations
- One-line diagram work
- Worked on a technical document for our client

Individually

- James: Revised AutoCAD one-line
- Cole: Worked on the adding design parts to the final report
- Oksana: Worked on cable sizing research and the calculations
- Sarah: Continued editing the one-line diagram and worked on the documentation for it

### **Pending Issues:**

We need to make adjustments to the cable sizing calculations, make adjustments to the one-line diagram, and add legends to the finalized one-line diagram.

### Individual Contributions:

Name	Individual Contribution	Hours this reporting period break down	Total hours for the week	Total Hours
Oksana Grudanov	- I worked on the cable sizing calculations and continued to familiarize myself with the NEC code.	4.0 (Cable sizing calculations) 3.0 (Meetings) 1.0 (Weekly Report)	7.5	44.5
Sarah Ebert	- I worked on the final report by adding calculations and reasoning to justify the design choices we made.	3.0 (Meetings) 1.0 (Documentation and final report)	4.0	40.0
Cole Dustin	- Worked on the final report adding much of the design work - Found spec sheets for misc components	3.0 (Meetings) 3.0 (Final Report) 1.0 (Spec Sheets)	7.0	42.5
James Mendenhall	- I worked on the one-line and made updates and edits to it.	2.5 (AutoCAD drawing) 3.0 (Meetings)	5.5	41.0

### Plans for the upcoming week:

- Continue to make edits to the cable sizing calculations
- Work on adding a “legend” of some sort in the one-line diagram
  - Include a material section
  - Include symbols and descriptions for each component
- Continue to document and justify our design decisions in our final report

### Individual Assignments for the upcoming week:

Oksana: I will continue to work on the cable sizing calculations. We received some more feedback and clarification from the client, so I will make those adjustments to the calculations.

Sarah: I will work with James to add the final touches to our one-line diagram, which will include adding a materials section and adjusting the formatting/spacing to make it more legible.

Cole: Continue working on the final report, adding in more detailed explanations of the one-line and parts of the design process.

James: I will add notes from our client to our drawing, redo delta-wye labels, and clean up drawing.

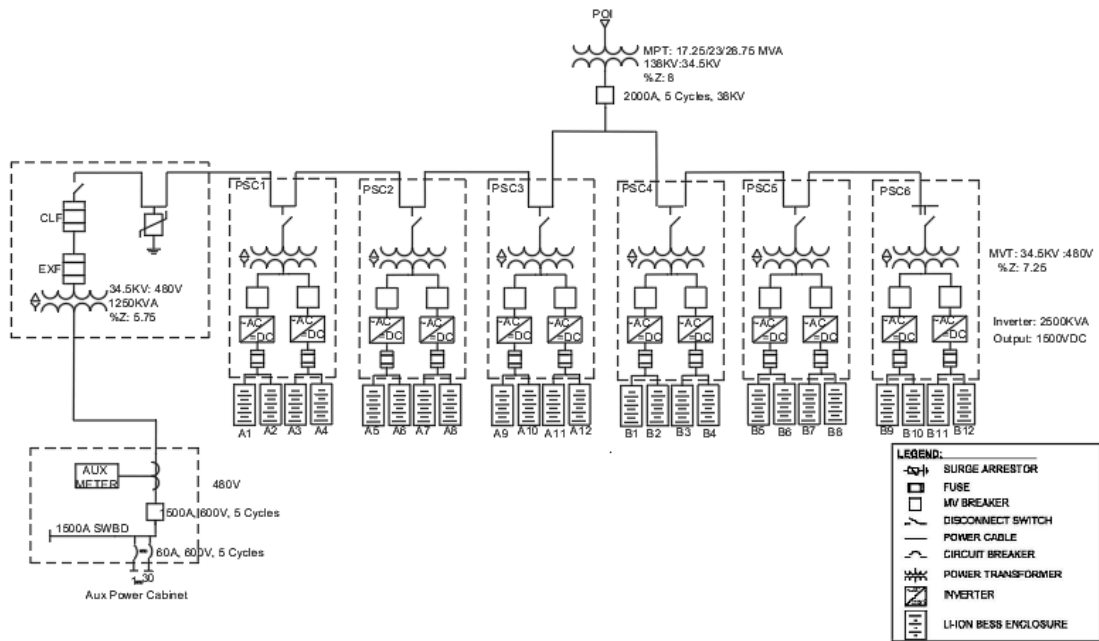
### Summary of weekly advisor meeting:

We met with Professor Wang to discuss what we have been working on so far. We discussed the one-line diagram, the site layout, as well as the cable sizing calculations. Professor Wang had a few questions regarding the way we drew our one-line diagram, how long the cables are supposed to be, and pointed out a few things to keep in mind if we were to create this project in a real-life scenario. Overall, he was impressed with our work. We discussed meeting with him another time before the end of the semester to discuss our finalized work for the semester and discuss more about the presentation we will need to give at the end of this semester. We also discussed what we will need to complete for next semester.

### Summary of weekly client meeting:

In this week's meeting with our client, we mainly focused on the cable sizing calculations we completed. Our client also gave a few more clarifications needed to finalize our calculations for the cable sizing, and we discussed once we finished the calculations, we would create a cable schedule document with all the sizing and the lengths of each cable based on the site layout. Lastly, we discussed a little bit about the one-line diagram, and he pointed out a few suggestions for the layout of the diagram that would match more closely to what is expected of a one-line diagram. We talked about what we needed to complete this week, which will include making those adjustments to the cable sizing calculations and adding a few comments and legends to the one-line diagram to finish it up fully. We will also continue to work on the technical document for the client as well.

### One-line Diagram:



### Cable Sizing Calculations:

$$P = \sqrt{3} \times V \times I \times PF$$

$$\rightarrow I = \frac{P}{\sqrt{3} \times V \times PF}$$

References:

Medium voltage : Table 311.60(C)(86) - Pg. 180

- MV105
- two circuits
- Triplexed - directly buried in Earth

Assumptions:

- Aluminum lines
- PF = 1.0 (worst case scenario)
- Low V side - use min V to

Low voltage : Table 310.16 - Pg. 164

- Aluminum
- 90°C rated temp

Calc. max Amps in Line

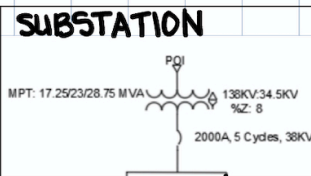
- Directly buried in Earth

$$\frac{1250 \times 10^3}{\sqrt{3} \times 34.5 \times 10^3 \times 1} = 20.92A$$

$$20.92 + 82.74 = 103.66A$$

$$103.66 + 82.74 = 186.39A$$

$$186.39 + 82.74 = 269.13A$$



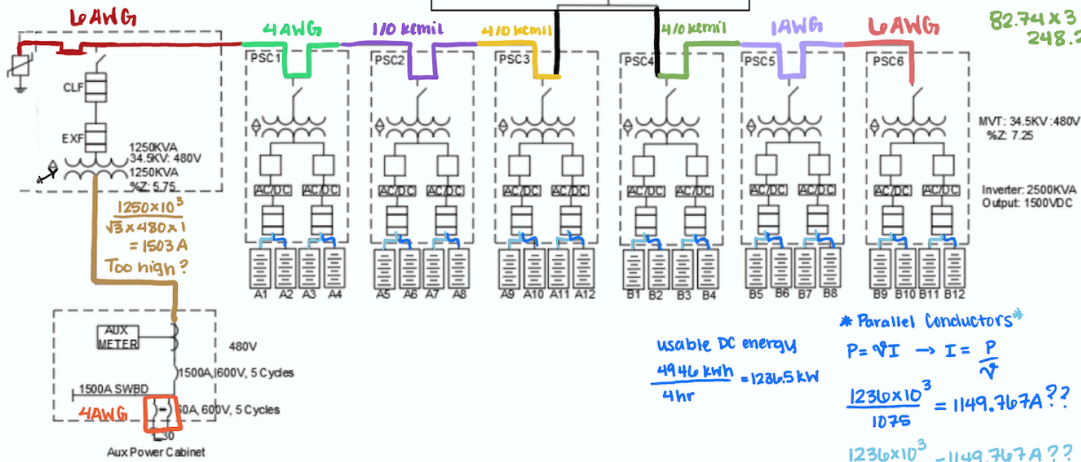
$$\therefore 248.21 + 269.13 = 517.34A$$

750 kcmil

$$\frac{4 \times 1236 \times 10^3}{\sqrt{3} \times 34.5 \times 10^3} = 82.74$$

$$82.74 \times 2 = 165.47A$$

$$82.74 \times 3 = 248.21A$$



$$\frac{38 \times 10^3}{\sqrt{3} \times 480 \times 0.8} = 57A$$

usable DC energy

$$\frac{4946 \text{ kWh}}{4 \text{ hr}} = 1236.5 \text{ kW}$$

\* Parallel Conductors\*

$$P = \sqrt{3} I \rightarrow I = \frac{P}{\sqrt{3}}$$

$$\frac{1236 \times 10^3}{1075} = 1149.767A ??$$

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Too high?

MVT: 34.5KV/480V  
%Z: 7.25

Inverter: 2500KVA  
Output: 1500VDC

1250KVA  
34.5KV/480V  
1250KVA  
%Z: 5.75

$$\frac{1250 \times 10^3}{\sqrt{3} \times 480 \times 1} = 1503A$$

Too high?

AUX METER  
480V  
1500A SWBD  
1500A, 600V, 5 Cycles

4AWG  
10A, 600V, 5 Cycles

Aux Power Cabinet