

EE 491 Weekly Report 9

Start Date: April 3

End Date: April 9

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

Weekly Summary:

This week, we worked closely on the cable sizing calculations and determined various cable parameters and assumptions. We will need to make some adjustments to the low-voltage cables based on the ambient temperature ratings we decided to move forward with. Finally, we worked on adding a legend to the one-line diagram with various symbols identified, voltages used, and equipment descriptions and quantities.

Past Week Accomplishment:

As a group:

- Worked on one-line diagram
- Continued calculating cable sizing
- Technical documentation for the client
- Add legend and notes to one-line

Individually:

- James: one-line diagram in AutoCAD,
- Cole: Technical document for the client
- Oksana: Cable sizing calculations
- Sarah: Technical documentation for the client and updating the team website

Pending Issues:

We need to set up a final meeting with our faculty advisor.

Individual Contributions:

Name	Individual Contribution	Hours this reporting period break down	Total hours for the week	Total Hours
Oksana Grudanov	- Calculate cable sizing	2.0 (Cable sizing math and reviewing spec sheets) 2.5 (Weekly meetings) 1.0 (Weekly report)	5.5	50.0
Sarah Ebert	- Worked on updating our team's website.	2.5 (Weekly meetings) 1.0 (team website)	3.5	43.5
Cole Dustin	- Adding a section in the final report	2.5 (Weekly meetings) 0.5 (Final Report)	3.0	45.5
James Mendenhall	-Finalize one-line diagram	2.5 (Weekly meetings) 1.5 (Autocad)	4	45.0

Plans for the upcoming week:

- Finish cable calculations
- Size the site layout to determine cable lengths.
- Start on reports for the client:
 - Cable schedule– include calculations of cable sizes, cable sizing numbers, number each cable for easy reporting, get cable lengths from site layout, to and from cables, and how many conductors per phase.
 - Site layout and technology selection justifications– technology selection: battery, inverter, auxiliary equipment, calculations for numbers of inverters and batteries
 - One-line diagram report– calculations, equipment, voltages used.

Individual Assignments for the upcoming week:

Oksana: Finalize cable sizing calculations. Start on the cable schedule report for the client.

Sarah: Continue to work on our technical documentation for our client including a document describing our decision and design process regarding the equipment selection and one-line diagram.

Cole: Add the cable layout into the autoCAD file.

James: Make final revisions to the one-line diagram.

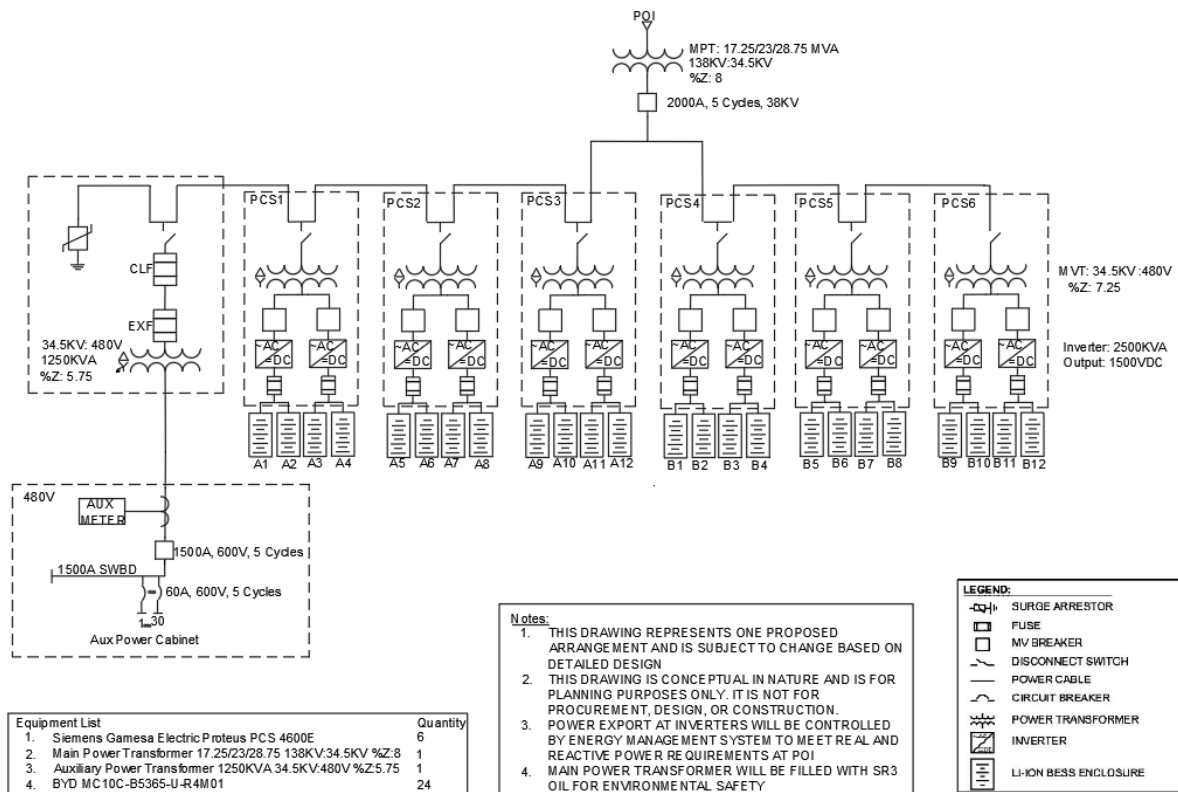
Summary of weekly advisor meeting:

We will not be meeting with our faculty advisor this week. Since we have been moving along with the project, we have no questions for him this semester. We will continue to keep him posted on our progress via email and plan to have a final meeting with him to showcase our finished work and plans for next semester.

Summary of weekly client meeting:

This week's meeting consisted mostly of talking over the cable sizing calculations. We worked on identifying weak points in the calculations and clarifying where changes can be made. We discussed how we can go about sizing conductors when the ampacity is too high, past what the NEC code lists for one conductor per phase. Lastly, on this topic, we clarified the calculations on the low-voltage cables, multiplying a T rating by the ampacities since we will be sizing based on a 40°C ambient temperature, and the NEC code chart is for 30°C. Once we understood that, we talked about the reports the clients want from us before the end of the semester to help us keep track of all our decisions made for the project and to make it easier when we need to make changes for next semester. We will each be working on a report based on our respective tasks to provide to the client for our next meeting.

One-line Diagram:



** Equipment legend not visible for MacBook users

Cable sizing calculations:

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

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

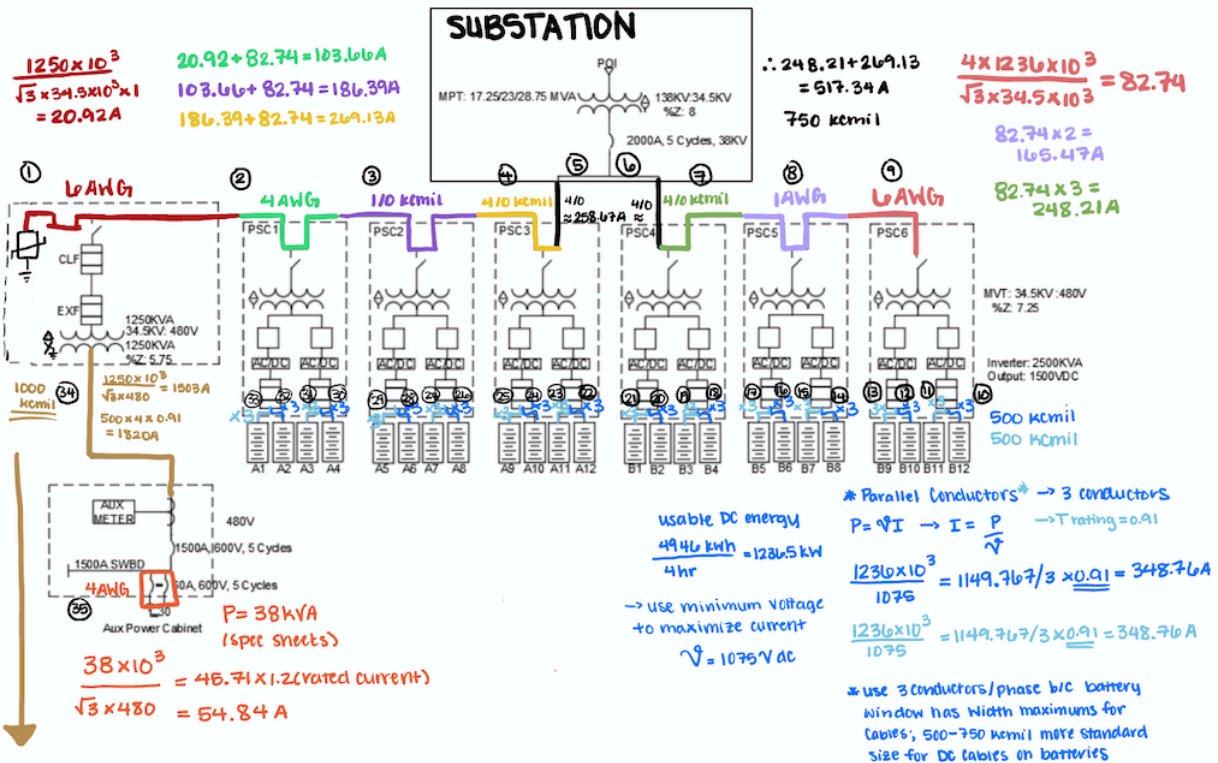
References from NEC code 2020 version
Medium voltage : Table 311.60(C)(86)-Pg.180

Assumptions:

- Aluminum lines
- PF = 1.0 (worst case scenario)
- Low V side - use min V to Calc. max Amps in line
- Directly buried in Earth
- using ambient temp of 40°C for low-voltage lines
- MV105
- two Circuits
- Triplexed - directly buried in Earth
- Low voltage: Table 310.16 - Pg.1164
- Aluminum
- 90°C rated temp

Ampacity correction factors

- Table 310.15(B)(1) - Pg.1162
- Correction factor = 0.91



- * 1503A → Table 310.16 doesn't go up that high; need more conductors/phase
- 1. Choose conductor size - 1000 kcmil ~ 500A
- 2. multiply ampacity by # of conductors - 4/phase
- 3. multiply by T rating - 0.91
- 4. Size up; NOT too much - 1820A ✓