EE 491 Weekly Report 3

Start Date: February 14
End Date: February 20
Group number: 18
Project title: Utility Scale Lithium-Ion Energy Storage Project
Client &/Advisor: Burns and McDonnell, Zhaoyu Wang
Team Members/Role:

- Oksana: Leader; responsible for keeping the team on track
- Sarah: Organizer; responsible for revising, editing, and helping keep track of all our reports.
- James: Document Report; responsible for the submission of our reports. Inverter quantity and cable sizing to batteries
- Cole: Point of Contact/Communicator; responsible for meeting and contacting the clients and faculty advisor.

Weekly Summary:

We met with our faculty advisor to get some guidance on calculations and help understand the datasheets we received. We also decided on a specific battery we will be using for our BESS design and the inverter. We will be using 24 BYD batteries and 6 Siemens Gamesa inverters. We also created a site layout and a map of our project using AutoCAD and a KMZ file(Google Earth).

Past Week Accomplishment:

As a group:

- Determined site location, Type of battery, Type of inverter
- Calculated the number of batteries and Inverters
- Used the design specifications to create an AutoCAD drawing of the site

Individually

- James: Helped with the report and determined which batteries and inverters to use. I decided to use Siemens Gamesa.
- Oksana: I started on calculations and reached out to the faculty advisor to review our project calculations. I also helped with the weekly report.
- Cole: I created the AutoCAD drawing to the proper distance specs.
- Sarah: I analyzed the spec sheets for the batteries and inverters, then compiled the data in an Excel spreadsheet for easy comparison. I also emailed my contact at Alliant Energy about the site location and utility constraints.

Pending Issues:
We need to reschedule the client meeting for this week.

Individual Contributions:

Name	Individual Contribution	Hours this reporting period	Previous Hours	Previous Cumulative Hours	Total Hours
Oksana Grudanov	Emailed the faculty advisor to schedule a weekly meeting and review calculations. I also spent some time doing some research for the spec sheets to begin calculations and working on the weekly report.	0.5 (emails to faculty advisor) 0.5 (calculation preparations) 2.0 (weekly report) 1.0 (faculty meeting) 1.0 (weekly meeting) 0.5 (calculations)	5.5	10.0	15.5
Sarah Ebert	Communicated with the utility company; Analyzed spec sheets and created an Excel doc to compare them	1.0(faculty meeting) 2.0 (weekly meeting) 3.0 (comparing spec sheets) 0.5 (emails with utility)	5.0	10.5	16.0
Cole Dustin	Worked on AutoCAD diagram	1.0(faculty meeting) 2.0 (weekly meeting) 3.0(Autocad Sketch)	5.5	10.0	16.0
James Mendenhall	Decided inverter to be Siemens Gamesa, reviewed the technical documents	1.0 (Weekly Meetings) 1.0 (faculty meeting) 1.0 (Weekly Meetings) 1.0 (Inverter Selection) 1.0 (weekly meeting)	5	10.0	15.0

Plans for the upcoming week:

We do not have any specific assignments this week since we did not meet with out client; however, we will continue to work with the AutoCAD, calculations, and work on our team website.

Individual Assignments for the upcoming week:

Oksana: Continue to work on the calculations for our project, as well as working with AutoCAD.
Sarah: I will familiarize myself with basic tools on AutoCad and start working on our team website.
Cole: Add transformers and comments to the AutoCAD drawing
James: Continuing working with AutoCad and refining calculations. I have several questions for the client that need to be addressed in the next meeting. Confirm inverter selection before the next client meeting. I also need to review the training modules uploaded by our client.

Summary of weekly advisor meeting:

This week, we discussed the calculations for our project and got some clarification about how the BESS system operates. We need to ask a few questions in our client meeting to understand our project's application better so we can determine some of the calculations. We were also able to determine how many inverters we wanted for our project and which specific inverter would best suit the design parameters.

Summary of weekly client meeting:

We did not meet with our client this week because they were unavailable. We will reschedule for Thursday.

Calculations:

$S = P + jQ$

$Q = S\sin(\theta)$

$S = \frac{P}{PF}$

$P = 25\ MW\ /\ 100\ MWh \rightarrow 10\%\ BOL$

$PF = 0.95$

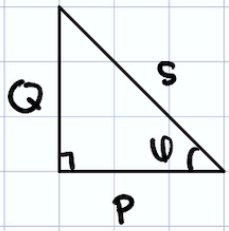
→ BYD : 1236 kW (battery)

→ Mgen : 4.2 MVA (inverter)

→ 4 battery containers / inverter

→ we need ~ 24 battery containers

→ we will need 6 inverters total



$\frac{25000\ kW}{1236\ kW} = 22.23 \times 1.1 = 22.25$ (1.1 → 10% BOL) ~ 24 battery containers

→ Calculating reactive power comes from the inverter; battery produces active power

$P = |V||I|\cos(\theta_v - \theta_i)$

$Q = |V||I|\sin(\theta_v - \theta_i)$

$S = P + jQ = \sqrt{P^2 + Q^2}$

$S = \frac{P}{PF} = \frac{25 \times 10^6}{0.95} = 26.34 \times 1.1 = 28.95\ MVA$ needed

inverter:

$PF = 0.95$

$S = 4.2\ MVA$

$4.2 \times 10^6 \times 6$ inverters ≈ 25.2 MVA ✓ (inverter)

6 inverters × 4 hrs = 24 batteries needed

$Q = S\sin(\theta)$ $\cos^{-1}(0.95) = 18.19°$

$Q = (25.2)\sin(18.19)$

$Q = 7.87\ MVAR$