3: Project Plan

3.1 PROJECT MANAGEMENT/TRACKING PROCEDURES

For our battery energy storage system (BESS) design, we have adopted a waterfall management style. A waterfall management style involves detailed upfront planning and sequential phases. This is suitable for our project because there are a lot of regulations and requirements in this industry. In our first planning phase, we determined the system capacity and site location. We needed to know this before completing any of the following tasks.

We have been keeping track of our team's project on Microsoft teams. This is an easy way for us to share documents with our industry advisors, whom we have been working very closely with. It is also their preferred method for our weekly video calls.

3.2 TASK DECOMPOSITION

Our project follows very clearly defined sequential steps.

1. Determine the system capacity and site location.
    a. Our clients already knew the capacity they wanted and general location.
    b. Decide on a specific location near Ames and adjacent to a distribution substation for easy interconnection.
2. Spec out the required equipment.
    a. Looking through documentation on various lithium-ion battery containers and inverters.
    b. Do calculations to determine how many containers and inverters we will need based on the values in the spec sheets for our chosen equipment.
3. Draw our site layout on AutoCAD.
    a. Download and learn AutoCAD basics because no one on our team has used it before.
    b. Use the dimensions and quantities of the equipment and following NEC construction codes.
4. Create a one-line diagram of our system.
    a. Complete relevant calculations for the auxiliary power system and main power transformer.
    b. Follow industry standards and reference the training materials provided by our industry advisors.
5. Do string sizing calculations.
    a. Reference completed one-line diagram for voltage levels and current at different point in the system.
    b. Find appropriate cable sizes.
6. Learn how to use the software required to model our system
    a. ETAP (Electrical Transient Analyzer Program)

b. Enter the equipment ratings, line impedances, and load profiles to build our system in ETAP.

7. Complete load flow short circuit analysis using ETAP.
    a. Conduct load flow analysis to determine the steady-state voltage and power flow in the electrical system. This helps ensure that the system operates within acceptable voltage and power limits under normal operating conditions.
    b. Perform short circuit analysis to assess the system's response to fault conditions. This involves calculating fault currents and determining the magnitude and duration of short circuit events to ensure that protective devices can operate effectively and safely.
8. Compile all our work in one report.
    a. We will add to this as we complete each step.
    b. This completed report should give the reader a full understanding both of how our system works and our team's design process.

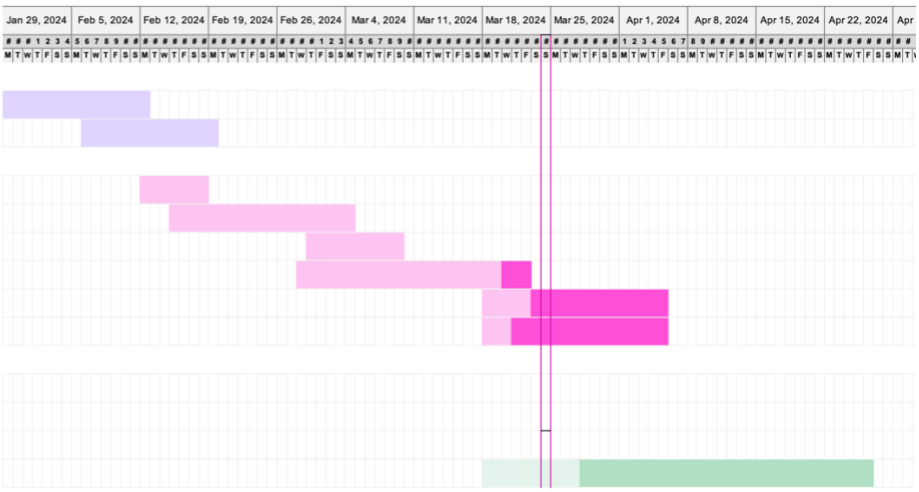
3.3 PROJECT PROPOSED MILESTONES, METRICS, AND EVALUATION CRITERIA

The key milestones for our project align closely with completion of the previously identified tasks. The evaluation criteria for all our steps are approval from our industry partners. They are familiar with the standards and regulations related to our project, and therefore can easily determine if our project is up to standards. When we believe we are done with a task, we present the results to our client in our weekly meeting. They will either approve of our work or give us specific feedback for improvement. We then make changes as directed and present at the next week's meeting.

3.4 PROJECT TIMELINE/SCHEDULE

SIMPLE GANTT CHART by Vertex42.com
https://www.vertex42.com/ExcelTemplates/simple-gantt-chart.html

TASK	PROGRESS	START	END
Initiation and Planning			
Capacity and Site Location	100%	1/29/24	2/12/24
Spec epuiptment	100%	2/6/24	2/19/24
Design Docs and Calcutations			
Learn AutoCAD	100%	2/12/24	2/18/24
Create site layout	100%	2/15/24	3/4/24
Documentation for site layout	100%	2/29/24	3/9/24
Draw one-line Diagram	90%	2/28/24	3/22/24
Documentation for one-line	30%	3/18/24	4/5/24
String Sizing	20%	3/18/24	4/5/24
Testing and Final Report			
Learn ETAP software	0%	8/19/24	8/24/24
Load flow analysis	0%	8/26/24	8/30/24
Short circuit analysis	0%	9/9/24	9/14/24
Final Report	25%	3/18/24	4/26/24



*This only shows the first semester, but some tasks are to be completed next semester.

3.5 RISKS AND RISK MANAGEMENT/MITIGATION

Task #	Risk	Risk Factor	Mitigation Strategy
1	The local utility company may not cooperate with us fully, making it difficult to find information about interconnecting to the grid and the nearby substation.	0	
2	The manufacturers might not have the best documentation available.	0.75	Work with our client to get access to multiple spec sheets.
3	The drawing might not fully meet NEC standards.	0.2	
4	The documentation for our one-line could be incomplete.	0.5	Have our clients review our work and many steps throughout the process.
5	The calculations may be inaccurate because we make incorrect assumptions about our system.	0.7	Discuss standard cables in this type of system with our client.
6	We may have trouble gaining access to the software and using it on campus.	0.3	
7	The analyses may reveal weaknesses in our system.	0.3	
8	The report could be disjointed because many people are working on it separately at different times.	0.6	We can assign one group member to be the document proofreader. They will make sure the writing flows in all reports before submitting.

3.6 PERSONNEL EFFORT REQUIREMENTS

Include a detailed estimate in the form of a table accompanied by a textual reference and explanation. This estimate shall be done on a task-by-task basis and should be the projected effort in total number of person-hours required to perform the task.

Task #	Man-Hours Required	Explanation
1	5 hours	The system capacity and site location were discussed during the first two of our weekly client meetings. We also emailed with an engineer at the local utility company.
2	20 hours	We spent several meetings discussing this as a group before deciding on our equipment. Individually, two group members spent about 3 hours comparing spec sheets.
3	12 hours	This time involves time familiarizing ourselves with AutoCAD, a tool we have never used before. It also involved reading NEC construction standards and building the layout in AutoCAD.
4	30 hours	For this task, we completed training from our client on how to draw one-line diagrams and do relevant calculations. We drew several rough drafts and received feedback from our clients in our weekly meeting after each iteration. Then, we made a final draft in AutoCAD. Finally, we will add notes and a key to the AutoCAD draft and write up more formal documentation to justify the values and drawing.
5	10 hours	To complete the cable sizing, we will review industry standards. Then we will do calculations based on our one-line to determine the load

		on each part of the system. After deciding on the cable size for each part of the BESS, we will write a detailed report explaining and justifying our decisions.
6	8 hours	Each member of our group will need to be familiar with this software, so we will work with our clients to get adequate training to run the required simulations.
7	30 hours	We will need to build our BESS in the software and run the required analyses. Based on those results, we will complete a report highlighting our system's limitations and fault conditions.
8	30 hours	We will work on our final report as we complete each task.