3 Project Plan

3.1 Project Management/Tracking Procedures

For our project, we're adopting a hybrid project management style, combining both waterfall and agile methodologies. Initially, we are using a waterfall approach for the project's early phases, defining scope, establishing detailed requirements, and creating foundational one-line diagrams and system specifications. This structured approach ensures alignment with client expectations from the outset, which is critical given our focus on developing a resilient energy solution through battery integration, load-shedding protocols, and microgrid enhancements.

As we progress, we'll shift to agile principles in the implementation and refinement stages, allowing us to introduce flexibility in response to client feedback and adapt our design as new technical challenges arise, especially around battery system modeling and load prioritization. This hybrid approach, blending waterfall's organization with agile's adaptability, is ideal for managing the evolving needs of our project as we explore the most effective battery-based resilience strategies to maintain essential services during outages.

The project's outcome will be a conceptual design package, a comprehensive documentation set outlining the proposed battery storage, microgrid, and substation integration. This package will include one-line diagrams, battery sizing and specifications, load-shedding protocols, and other technical documentation necessary for guiding future detailed engineering work. Although not intended for immediate physical implementation, this conceptual package provides a strong foundation for subsequent development stages, focusing on the new battery and load-management components.

To effectively track progress and milestones over both semesters, we'll utilize several tools:

- **Snapchat**: For day-to-day communication, quick updates, and troubleshooting. Snapchat enables fast, informal exchanges, helping the team stay connected outside of formal meetings.
- **Project Website**: A required class project website will serve as a centralized platform for sharing updates and documentation on our conceptual design package. It will make our work accessible to stakeholders, promoting transparency and collaboration as we refine our battery and microgrid designs.
- **Shared Google Drive Folder**: This will contain all assignments, reports, and relevant documents for class, ensuring team members have access to the latest materials, which is crucial for efficient collaboration on complex design tasks.
- **Discord**: Discord will help organize our discussions into channels, segmenting conversations by topic (such as battery modeling, client communications, or load prioritization). Its real-time messaging, voice, and video call features will facilitate quick check-ins, brainstorming, and troubleshooting as we develop the new battery-focused design.
- **Microsoft Teams**: Used for weekly team and advisor meetings. Teams integrates with Outlook, helping us coordinate schedules, set reminders for key milestones, and maintain regular communication with our advisor.

3.2 Task Decomposition

Due to our project having two distinct teams, we have created separate task decompositions for each area of the project. Each team has created a decomposed list of tasks, as well as an approximate timeline for each task and a set of goals that is aimed to be achieved upon completion of the task.

3.2.1 Distribution Team Tasks

Week 1-3:

- Task: Define project scope
- Goal: Determine what are reasonable deliverables and what we are looking to accomplish.

Week 3-5:

- Task: Research software and tools to use for the project
- Goal: Work with advisors to determine what modeling tool we will use to model the campus microgrid and begin collecting load data to use in our distribution model

Week 5-7:

- Task: Request Load Data and Develop Campus Load Profile
- Goal: Obtain all data necessary to create a load profile for all campus buildings connected to the microgrid.

Week 7-10:

- Task: Develop model of Campus
- Goal: Learn how to use OpenDSS, and then transfer the data from Objective 3 to create a model of the Iowa State microgrid with the required loads and other system information.

Week 10-12:

- Task: Start working on area planning objectives (contingency and jumpering plans)
- Goals: Begin creating deliverables for the microgrid based on the load profile and IEEE standards

3.2.2 Substation Team Tasks

The Transmission Team is updating its project scope to focus on incorporating battery storage solutions and reducing emphasis on the Ames substation upgrades. Sean recently met with our client to discuss this shift in priorities, aligning the project more closely with resilience and load management objectives rather than traditional substation enhancements. We have a client meeting scheduled for November 1st to further discuss these updates and gather feedback on the proposed battery system integration. Below are the previously established team tasks created prior to this significant scope change, which will now require adjustments to reflect our new direction.

Week 1-2:

- Task: Introduction to the project, understand initial scope, and gather key requirements
- Goal: Define project goals, identify the needs of the users (ISU Utilities, campus landowners, power consumers)

Week 2-3:

- Task: Complete scope definition
- Goal: Submit finalized project scope to the client

Week 4-6:

- Task: Begin researching and selecting software/tools for modeling (PSCAD, AutoCAD)
- Goal: Understand software capabilities for the transmission side, prepare software for use, develop initial ideas for one-line diagram and substation concepts.

Week 5-10:

- Task: Finalize substation design updates, complete any necessary adjustments to the one-line diagram
- Goal: Iterate through the design process for the one-line and three-line diagram with feedback, produce a final design for review by the client

Week 7:

- Task: Integrate additional renewable energy sources into the one-line diagram, such as wind/solar farms
- Goal: Create a preliminary design for the renewable integration

Week 8-9:

- Task: Begin initial fault current and grounding studies
- Goal: Conduct preliminary analysis for safety and compliance

Week 10-11:

- Task: Develop a mock budget/Bill of Materials (BOM) for substation upgrades
- Goal: Estimate the cost of materials for the project

Week 12:

- Task: Prepare for final presentation and submit all project deliverables
- Goal: Ensure all designs, models, and documentation are ready for submission

3.3 Project Proposed Milestones, Metrics, and Evaluation Criteria

3.3.1 Distribution Team Tasks

Week 1-3: We will have a written out scope and key requirements approved by our client and faculty advisor. We will measure the progress of this task by getting the approval.

Week 3-5: We will have decided on what software will use to build the model. We will measure this goal by getting our software approved by our client and advisor.

Week 5-7: We will create a load profile data spreadsheet including all buildings on campus. We will measure this goal by getting our software approved by our client.

Week 7-10: We will build a model of the campus and it's power structure. We will measure this goal by getting our software approved by our client and advisor.

Week 10-12: We will determine our schedule of area planning objectives for the spring semester. We will measure this goal by getting our software approved by our client.

3.3.2 Substation Team Tasks

Week 1-3: We will have a written out scope and key requirements approved by our client and faculty advisor. We will measure the progress of this task by getting the approval.

Week 4-6: We will have decided on what software will use to build the model. We will measure this goal by getting our software approved by our client and advisor.

Week 5-10: We will create a one-line and three-line diagram with feedback produce a final design. We will measure this goal by getting our software approved by our client and advisor.

Week 7: We will create a design for renewable integration. We will measure this goal by getting our software approved by our client and advisor.

Week 8-9: We will conduct preliminary analysis for safety and compliance. We will measure this goal by getting our software approved by our client and advisor.

- Task: Begin initial fault current and grounding studies
- Goal: Conduct preliminary analysis for safety and compliance

Week 10-11: We will estimate the cost of materials for the project. We will measure this goal by getting our software approved by our client and advisor.

Week 12: We will ensure everything is ready to submit. We will measure this goal by getting our software approved by our client and advisor.

3.4 Project Timeline/Schedule

Based on the task decompositions outlined in section 3.2, Gantt charts have been designed showing the proposed timeline of completing these tasks. Since we are primarily using a waterfall approach for project scheduling, these deadlines should be fairly rigid in nature and used to keep the project on track. Below are the Gantt charts for the first semester deliverables:

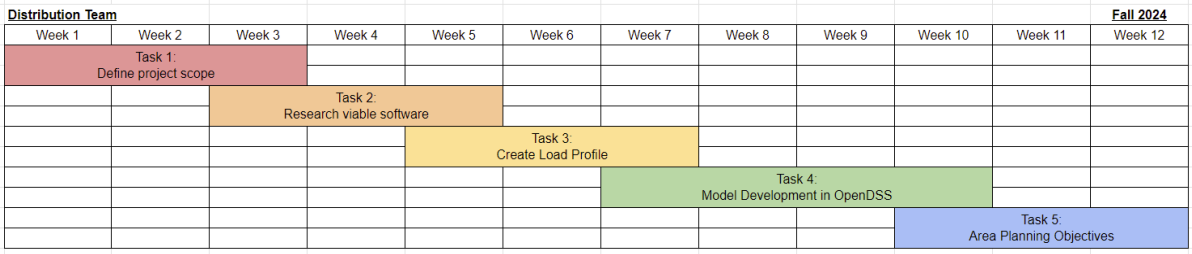

Figure 1: Gantt Chart for the Distribution Team

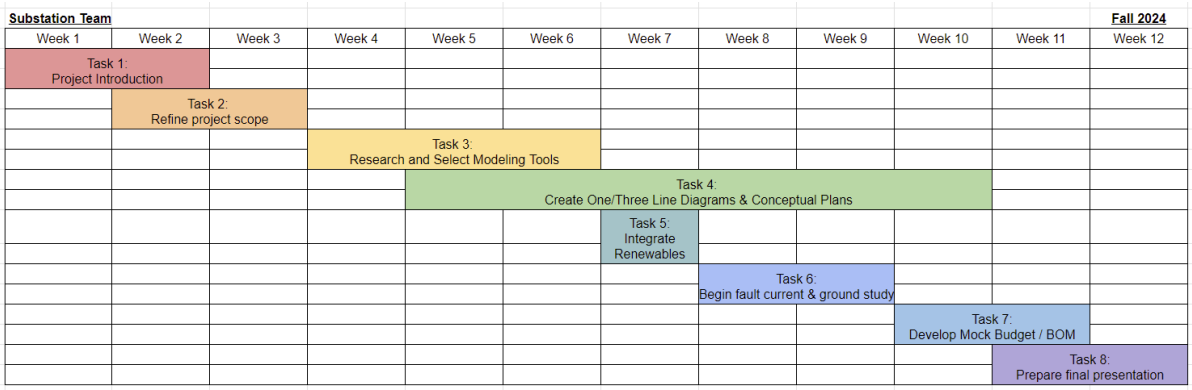

Figure 2: Gantt Chart for the Transmission/Substation Team

Above in Figure 2 is the previously established Gantt Chart for the Substation/Transmission team that was created prior to our significant scope change, which will now require adjustments to reflect our new direction.

At the end of each period, each tasks' goals are expected to be completed and any deliverables will be sent to the client in order to progress through the design. The completion of these tasks will help set the project up for success for the action phase of the project.

3.5 Risks And Risk Management/Mitigation

3.5.1 Transmission Team

Software/Tool Limitations

- Risk: The programs (e.g., OpenDSS, AutoCAD) may not fully meet the needs for accurate transmission modeling or may be difficult to integrate with renewable energy sources. As there are better programs that could offer a better transmission modeling but they are not free.
- Mitigation: As we research and consult with experts on which program we should use before final software selection. Backup tools (e.g., PSCAD for simulations) should be identified early in case the chosen software fails to perform as expected.

Battery Integration Complexity

- Risk: Difficulty in integrating the battery storage system with the transmission network, especially in terms of load management and ensuring compliance with safety standards.
- Mitigation: Collaborate with the Distribution Team to align load-shedding strategies. Schedule regular consultations with experts in battery storage systems and power resilience. Conduct smaller, iterative tests of battery performance in the model to catch integration issues early, adjusting load-shedding protocols accordingly.

3.5.2 Distribution Team Tasks

Week 1-3: We will have a written out scope and key requirements approved by our client and faculty advisor. We will measure the progress of this task by getting the approval.

Week 3-5:

- Task: Research software and tools to use for the project
- Goal: Work with advisors to determine what modeling tool we will use to model the campus microgrid and begin collecting load data to use in our distribution model
- We will have decided on what software will be using to build the

Week 5-7:

- Task: Request Load Data and Develop Campus Load Profile
- Goal: Obtain all data necessary to create a load profile for all campus buildings connected to the microgrid.

Week 7-10:

- Task: Develop model of Campus
- Goal: Learn how to use OpenDSS, and then transfer the data from Objective 3 to create a model of the Iowa State microgrid with the required loads and other system information.

Week 10-12:

- Task: Start working on area planning objectives (contingency and jumpering plans)
- Goals: Begin creating deliverables for the microgrid based on the load profile and IEEE standards

3.6 Personnel Effort Requirements

Task	Hours
Research Software: Find the best modeling software for our purposes. Also find software for substation studies.	6
Data Collection of Current Microgrid: Coordinate meetings with utilities contacts. Email University contacts to learn all of the relevant characteristics of the microgrid.	30
Develop Model of Microgrid: Use the characteristics of the current microgrid to develop a model of the grid and the substation. This includes a one-line, three-line, and 3D model.	100
Area Planning: Create detailed contingency and jumpering plans for the microgrid.	60
Substation Studies:	60

Perform studies on the new substation to determine fault current, grounding, and other important metrics which impact efficiency and safety.	
Battery Research: Research how to best implement batteries into our design. Come up with some potential configurations.	30
Bill of Materials: Create a list of all equipment and material. Use this and projected labor hours to come up with a reasonable cost estimate for completing the project.	50

3.7 Other Resource Requirements

In addition to financial support, our project will require several essential resources to complete our work effectively, especially given the Transmission Team's new focus on integrating battery storage rather than substation upgrades. These resources include:

1. **Software Tools:**
    a. **AutoCAD:** Essential for creating detailed one-line diagrams and schematics of the microgrid and battery storage system, allowing precision in design and visualization of electrical component layouts.
    b. **OpenDSS:** This distribution system simulator will be used to model and analyze the performance of the proposed microgrid and battery system, enabling evaluation of system interactions under varying load conditions and operational scenarios.
2. **Hardware:**
    a. **Computers:** Reliable computing resources are required to run design software, perform simulations, and analyze data effectively.
3. **Technical Documentation:**
    a. **Standards and Specifications:** Access to industry standards, codes, and best practices documentation will be crucial to ensure our designs adhere to safety and operational guidelines, including resources from IEEE (Institute of Electrical and Electronics Engineers) and IEC (International Electrotechnical Commission)
4. **Consultation with Experts:**
    a. **Advisor and Industry Contacts:** Engaging with our faculty advisor and industry experts will provide key insights and guidance. These consultations will be invaluable in refining our battery system integration approach, maintaining industry standards, and addressing technical challenges.
5. **Team Collaboration Tools:**
    a. **Project Management Software:** Tools such as Snapchat, Google Drive, Discord, Microsoft Teams, and our Project Website will be vital for effective collaboration, ensuring coordination, communication, and progress tracking across the team.
6. **Time Commitment:**

a. Each team member’s time and consistent dedication to the project will be critical. Coordinating schedules for meetings, design sessions, and collaborative efforts will be essential to ensure all members can contribute effectively.

By securing these resources, we will strengthen our capacity to produce a comprehensive conceptual design package that aligns with the project's updated scope and objectives.