2.1 Project Management/Tracking Procedures

- We are doing a waterfall management style. Our project is more effective with a waterfall approach because we are mainly developing informational documents. We don't really have hardware or software to test and iterate on.
- Our group will use Google Drive and Discord to record our progress. Discord will be used for communication and announcements, while Google Drive will be used to collaborate on assignments and deadlines.

2.2 Task Decomposition

Main Tasks

- Task 1
    - Find Iowa State University's yearly heat consumption
        - Power plant tour
    - Match it with the designs from PNE for optimal installation and usage
- Task 2
    - Understanding PNE design
        - How long it will take to charge a tank
        - The duration of the heat storage
        - Amount & price of renewable energy required to fully heat the storage
- Task 3
    - Determine the system specifications for our design
        - Storage volume. For daily/weekly/monthly storage
        - Required renewable energy for each size of storage
        - List of materials
- Task 4
    - System design and cost analysis for designed system
        - Fixed costs: Storage, sand, construction, permits, operation and maintenance
        - Variable costs: Renewable energy daily/weekly/yearly
- Task 5
    - Create Proposal for Iowa State University
        - Determine optimal design
        - Create final design documents to use for proposal/presentation purposes.

2.3 Project Proposed Milestones, Metrics, and Evaluation Criteria

What are some key milestones in your proposed project? It may be helpful to develop these milestones for each task and subtask from 2.2. How do you measure progress on a given task? These metrics, preferably quantifiable, should be developed for each task. The milestones should be stated in terms of these metrics: Machine learning algorithm XYZ will classify with 80% accuracy; the pattern recognition logic on FPGA will recognize a pattern every 1 ms (at 1K patterns/sec throughput). ML accuracy target might go up to 90% from 80%.

Our milestones revolve around when the parts of the proposal are completed. These milestones include completing the Heat Consumption Analysis, Deciding on optimal Polar Night Energy system size to match our consumption.

Milestone 1: Complete the power plant tour and University's heat consumption analysis.

- To be completed 10/10

Milestone 2: Understand PNE design

- To be completed 10/31

Milestone 3: Determine system specifications

- To be completed 11/30

Milestone 4: Complete design and cost analysis of satisfactory system

- To be completed 12/12

Milestone 5: Create a proposal to Iowa State University

- To be completed ⅝

2.4 Project Timeline/Schedule

	A	B	C	D	E	F	G	H	I	J
1	Polar Night Energy at Iowa State sdmay22 Group 16	Week of								
2		10/4/21	10/11/21	10/18/21	10/25/12	11/1/21	11/8	11/15	11/29	12/6/21
3	**Task**									
4										
5	Find ISU's heat consumption									
6										
7	Understanding PNE Design									
8										
9	Determine the system specifications for our design									
10										
11	System design and cost analysis for designed system									
12										
13	Create Proposal for Iowa State University									next semerster

2.5 Risks And Risk Management/Mitigation

Consider for each task what risks exist (certain performance target may not be met; certain tool may not work as expected) and assign an educated guess of probability for that risk. For any risk factor with a probability exceeding 0.5, develop a risk mitigation plan. Can you eliminate that task and add another task or set of tasks that might cost more? Can you buy something off-the-shelf from the market to achieve that functionality? Can you try an alternative tool, technology, algorithm, or board?

Task 1: Find Iowa State University's yearly heat consumption and tour of power plant

Risks:

- May not receive adequate information (found out later in the semester)

Risk Mitigation:

- Contact Utility Services for the required information

Task 2: Understanding PNE design

Risks:

- May not receive adequate information…

Risk Mitigation:

- Reach out to Polar Night Energy for help regarding specific design parameters.

Task 3: Determine the system specifications for our design

Risks:

- System size may be impractical to heat 100% of university demand.

Risk Mitigation:

- Design our system to meet a smaller demand (i.e. daily consumption)

Task 4: System design and cost analysis for designed system

Risks:

- System design requires more material than originally thought and increases design cost higher than anticipated.

Risk Mitigation:

- Decrease system size to meet cost constraints (16 Million).

Task 5: Create Proposal for Iowa State University

Risks:

- Proposal is rejected

Risk Mitigation:

- Determine future possibilities with PNE, and describe to the University the benefits to come from using more renewable energy on campus.

2.6 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 Needed	Description
1.1 - Heat Consumption Analysis	2 Hours	Compile heat energy data from ISU Energy Dashboard into one document broken into daily, weekly, and monthly energy requirements.
1.2 - ISU Power Plant Tour	2 hr/tour * 7 people = 14 Hours	Participate in a guided tour of the ISU power plant to gain a better understanding of the current heating system as well as how our proposed system will be implemented.
2.1 - Understanding PNE Design	2 Weeks * 2 hrs/weekly * 7 people = 28 Hours	Develop more questions for PNE in order to obtain a greater understanding of the finer details of their system. Ex. How long to charge? How long will it hold a charge?
2.2 - Research on Renewable Energy	1 Weeks * 2 hrs/weekly * 7 people = 14 Hours	Gather data for renewable energies needed to charge the storage such as cost and availability.
3 - Specs of Design	4 Weeks * 2 hrs/weekly * 7 people = 56 Hours	Determine specifications for a PNE system to meet different amounts of the university's heat energy requirements. Such as storing 25%, 50%, 75% of the university's heat energy needs.
4 - Design and Cost Analysis	2 Weeks * 2 hrs/weekly * 7 people = 28 Hours	For each system specification in Task 3 determine the cost to implement and maintain that system and compare those results to that of the current system.
5 - Proposal to University	16 Weeks * 2 hrs/weekly * 7 people = 224 Hours	Finalize and formalize our design documents and compile them into an implementation plan for the university that includes the cost and benefits of instituting the PNE system.

2.7 Other Resource Requirements

Identify the other resources aside from financial (such as parts and materials) required to complete the project.