Vision Statement

Team Pina Colada | AgMonitor
Kaiwen Li (Team Lead), Alex Mei, Jasun Chen, Jayden Yu, Yuyuan Wang

---

Project Summary

Our project will build a pipeline to clean and aggregate energy data streams to create an application that will store and visualize energy data. We also hope to implement a real-time algorithmic system that can effectively manage energy assets and optimize energy costs.

Problem Description

Microgrids are decentralized and self-sufficient energy systems, oftentimes with a complex array of electricity sources, forms of storage, and energy demands. Instances of microgrids are becoming increasingly more common as private individuals and businesses, such as farms, hospitals, homes, or even the UC Santa Barbara campus, make the switch to solar power.

Our project attempts to tackle the need for user-friendly tooling to effectively manage and visualize complex microgrid systems, specifically dealing with time-series data.

Furthermore, with intelligent control of energy systems and modification of human behavior, microgrids can optimize their energy usage to minimize their dependence on the microgrid and thus reduce costs. Our projects will explore the potential implementation and application of artificially intelligent systems to automatically optimize usage in real time.

Why is this Important?

There are a few major trends that make this issue particularly relevant. The growing popularity of electric vehicles has also increased the popularity of solar power as people look to offset expensive utility bills. The push for sustainability has also led to solar power and other sources of renewable energy becoming increasingly prevalent. Production fluctuates as solar panels peak around midday, which is why it can oftentimes be more expensive to use energy through the night.

The optimal utilization of renewable energy allows us to minimize greenhouse gas emissions on a societal level and minimize utility costs on the individual level.

Current Existing Solutions

AgMonitor is running a Permanent Load Shifting program by sign-up farms to turn pumps off between 5-8 pm when the sun sets in order to avoid power shutoffs when the California grid peaks in the summer, which is not an optimized way to minimize the cost of energy but nevertheless decreases the energy costs.

Project Goals

- Develop a full-stack application which inputs, stores, and visualizes historical energy data.
- Develop an algorithm to optimize the usage of solar energy.
- Validate our optimization algorithm on real-world use cases such as estates and farms.

Technologies

- Full Stack Architecture: React, Javascript, Python, Django, PostgreSQL
- Data Visualization: QGis, GoogleAPI, **We need a data visualization renderer**
- Energy Optimization: Python, NumPy, Pandas, Tensorflow, Pytorch, SKLearn

---

Milestones

I. Intake, clean, and store energy asset data from test sites in an internal database.
   - Existing data exists via Tesla's Powerwall or AgMonitor.com test sites in which we can just process and store in an internal database.
   - A stretch goal could be to process the data from a CSV input on our full-stack experience.

II. Create a visualization tool to display internal energy data.
   - Discuss with stakeholders to determine which visualization features would be useful.
   - Integrate with a visualization tool to allow for interactive visualization and ad hoc exploration.

III. Design an energy optimization algorithm to improve energy usage.
   - Perform ad hoc statistical analysis to determine preliminary optimizations.
   - Work with the Smart Infrastructure Lab to design an optimization algorithm given historical energy consumption data.
   - A stretch goal could be to allow real-time inputs and optimizations.

IV. Apply real-world user acceptance testing by verifying optimization progress with test sites.
   - Work with stakeholders to determine the effectiveness of our optimization algorithm.
   - A stretch goal could be to generalize the energy optimization to other sectors.

Resources

Trello: https://trello.com/agmonitor
Github: https://github.com/alexmeigz/AGMonitor
Burndown:
https://docs.google.com/spreadsheets/d/1r1MEQJlPxqP8-NKlYjpadKKkqnlcl72nG3SarLfXixA/edit?usp=sharing
Workspace: https://drive.google.com/drive/folders/14K7YsXlp41kp6TjzDRM-jxdnCQJA2m7K?usp=sharing