Community Energy Awareness Web Application

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ACEP Alaska Center for Energy and Power

Introduction

The Community Energy Awareness Web Application is a collaborative effort with Alaska Center for Energy and Power (ACEP) and the Kotzebue Electric Association (KEA) in Kotzebue, Alaska. The project aims to bring awareness to energy consumption in the Kotzebue community. With the goal of promoting renewable energy sources and reducing energy consumption, the web application will educate and engage the community on the generation and consumption of energy. By bridging the gap between KEA and the community, the Energy Awareness App will support KEA's goals to increase renewable energy integration, ultimately leading to sustainable living and reduced energy costs in the remote community.

Design & Architecture

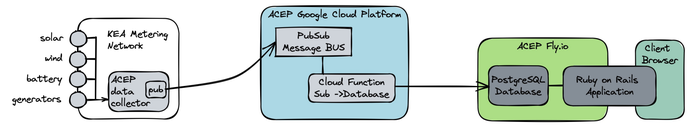

Figure 1: Architecture & Design Diagram

- ACEP collects the data from the KEA metering network.
- The cloud function subscribes to KEA message bus data and republishes directly to the database.
- PostgreSQL database and Ruby on Rails application are hosted at fly.io.

Feature 1: Generation Breakdown

- Shows past hour's energy source distribution.
- Hoverable pie chart display current breakdown of renewables and non-renewables (left).
- Additional hoverable pie chart representing all sources of energy: diesel, solar, wind (right).
- Table on the right the displays kWh and percentages for each energy source.

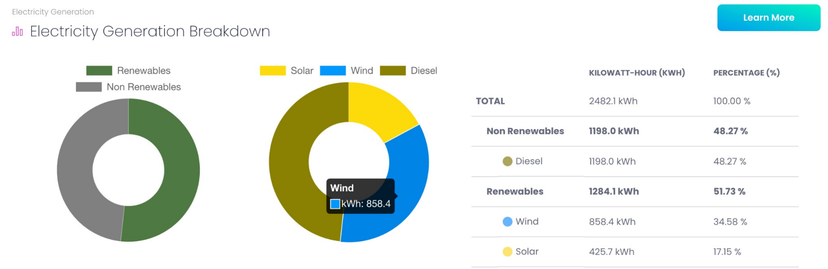

Figure 2: Generation Breakdown Feature

Data Collection

The data used is provided by Kotzebue Electric Association (KEA). KEA uses a combination of solar, wind, and diesel as energy sources. The energy data is stored in KEA's operational dashboard, distributed across roughly 9000 different tags. Currently, the data provided is from 2021 at a temporal resolution of one hour for the entire community of Kotzebue. The raw data has been cleaned and aggregated into the following meaningful data.

Total kWh → Kilowatt hours generated by all sources
Wind kWh → Kilowatt hours generated by wind turbines
Solar kWh → Kilowatt hours generated by solar panels
Diesel kWh → Kilowatt hours generated by diesel generators
Battery Charge → Charge of battery indicating charging, discharging or idle

Feature 2: Community Usage

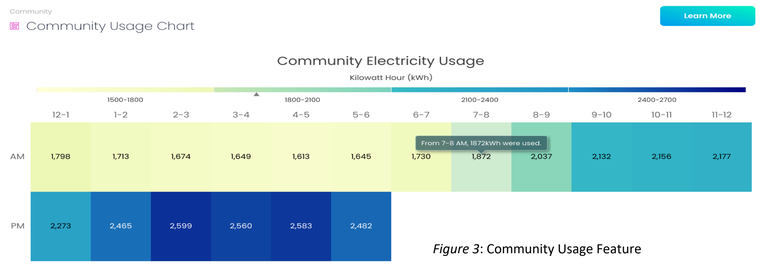

Figure 3: Community Usage Feature

- Community Usage feature provides a color-coded heat map of energy usage for every hour of the day.
- Darker colors indicate higher energy usage, while lighter colors correspond to lower usage
- Helps identify patterns and opportunities for energy conservation.
- Visual representation aids in understanding when the community uses the most energy.

Feature 3: Battery Status

- Displays the Kotzebue Electric Association's lithium-ion battery status.
- Shows the current charge level and state: charging, discharging, or idle.
- Stores excess energy generated by renewable sources for later use.
- Provides a visual representation of the battery status for easy monitoring and energy optimization.

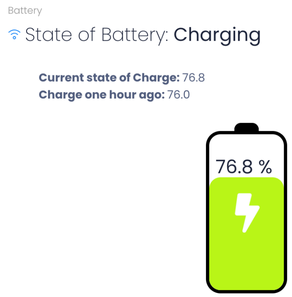

Figure 5: Battery Status Feature (Charging)

Feature 4: Diesel Savings

- Shows financial benefits of using renewable energy.
- Chart shows how much money the community saves by using renewables, compared to what they would have to pay for diesel.
- Table (right) calculates savings made this year, this month, and the current day (up to the past hour).
- City saves 200,000 to 250,000 gallons of diesel per year, resulting in cost savings of approximately $1 million - $1.25 million.

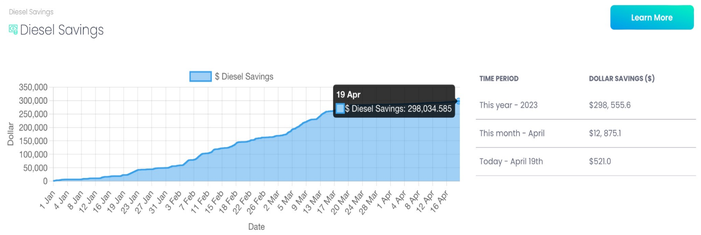

Figure 4: Diesel Savings Feature

Future Work

The Energy Awareness App's success in Kotzebue will model future expansion to remote communities in Alaska. We aim to evolve the app, including the use of a real-time data feed and community customization, for even greater user value. Through working with communities statewide, our goal is to create an informed and engaged network of energy consumers.

Acknowledgements

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