Functional Specification

Background

The Problem: Public utility groups implement demand response (DR) programs to encourage consumers to shift or reduce energy usage during periods of high demand. The primary goal of DR programs is to maintain resource adequacy and reduce costs. However, the impact of these programs on greenhouse gas emissions is not well understood. Knowledge of the emissions impacts of DR programs has the potential to inform state targets and motivate consumer participation.

Our Solution: Create a dashboard that shows how DR programs impact CO_2 emissions during different seasons and under different DR policy scenarios.

Data Sources

Description	Source	Type	Structure
Emissions Rates Avoided by DR Programs	John Ollis, Northwest Power and Conservation Council	Excel	Avoided emissions rates from 2021 to 2041 can be indexed by year, season, month, day, and hour. They are provided for the baseline scenario and five additional policy scenarios. The baseline scenario will be the main focus of this project.
DR Potential and Hours	Tina Jayaweera, Northwest Power and Conservation Council	Excel	DR potential and hours are each separated by binning strategy. DR hours can be indexed by year, season, month, day and hour. DR potential can be indexed by year.

User Profiles

User 1: Policymakers want to know how DR programs in the Northwest United States impact greenhouse gas emissions. Lacking formal training in data science, policymakers want a simple, easy-to-use interface to visualize the emissions impacts. They want a dashboard, including both figures and brief interpretations, that makes it clear how emissions rates may change under different DR scenarios. They want to use this information when considering DR targets for public utility groups.

User 2: Environmentally conscious members of the general public want to reduce their carbon footprints. They have heard that participating in DR programs might help reduce emissions. These consumers are not necessarily familiar with data science, so they want a simple, user-friendly dashboard that clearly shows how consumer participation in DR programs impacts emissions. They want to use this information to help them decide whether they want to participate in DR programs. For time-of-use programs, they want to know what times they could shift their electricity usage in order to maximize emissions reductions.

User 3: Journalists want to tell their audiences how DR programs impact greenhouse gas emissions. They are familiar with DR policies and the utilities groups that implement them. In addition to a simple dashboard, they want information on how the data is collected and analyzed. They want access to the data so that they can be sure the information they communicate to the public is accurate.

User 4: The researchers involved in gathering the data and designing the dashboard want to update the information as new data is collected. They want clear code and documentation that make it easy to update the data and make changes to the dashboard. They also want to easily output images for inclusion in a white-paper to policymakers.

Use Cases

Use Case 1: The user wants to view a dashboard that shows the emissions impacts of DR programs.

Expected Interactions:

- User: Loads the dashboard webpage (the emissions calculator has already processed the data and created files for the dashboard webpage in a GitHub repository)
- System: Shows the home page of the dashboard with default plots
- User: Looks at the default plots and uses the dropdown menus to compare different DR products during different seasons
- System: Displays new plots based on dropdown choices
- User: Chooses to view a different page with more information and uses the dropdown menus
- System: Displays new plots based on dropdown choices
- User: Downloads plots

Use Case 2: The user wants to run the emissions calculator using updated datasets.

Expected Interactions:

- User: Clones the GitHub repository
- System: Provides the code for analyzing data and deploying the dashboard
- User: Uploads new input data and runs the emissions calculator
- System: Outputs processed data
- User: Runs the dashboard generator and deploys it to the web using Heroku
- System: Displays updated dashboard