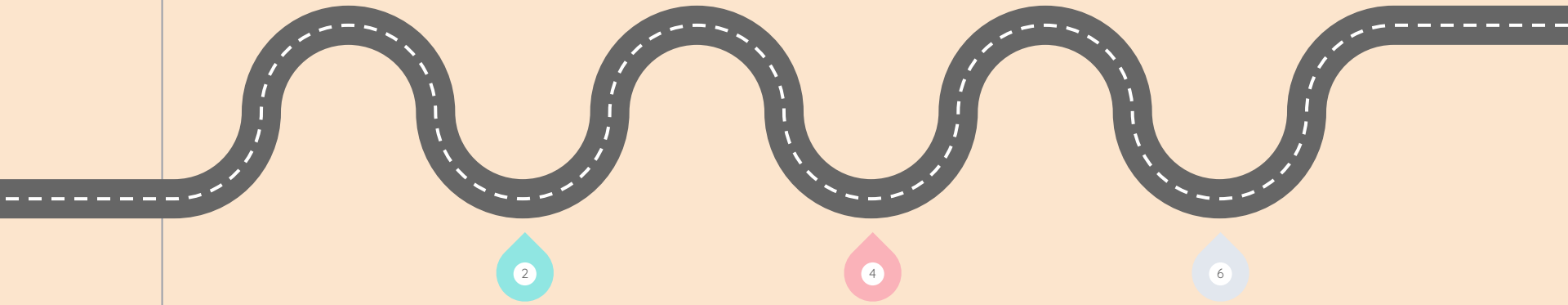

**Presented by Reach Consulting**

April 15th, 2021

# Agenda

1. **Project Team:** Introductions from each Reach member
2. **Project Procedure:** The steps we took in the project
3. **Methods:** How we did our analysis
4. **Findings:** The graphs and models that we worked on
5. **Recommendations:** Advice for ReNEWW residents based on the data
6. **Conclusion:** Wrapping things up



# Reach Team

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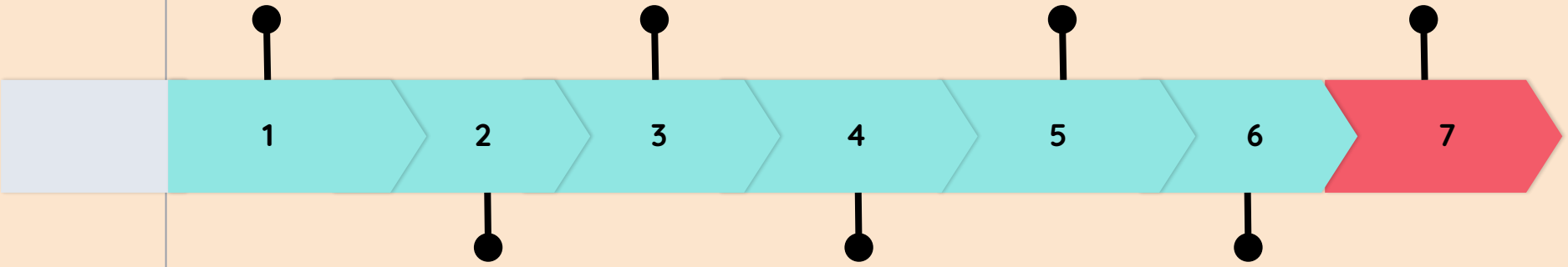
# Timeline



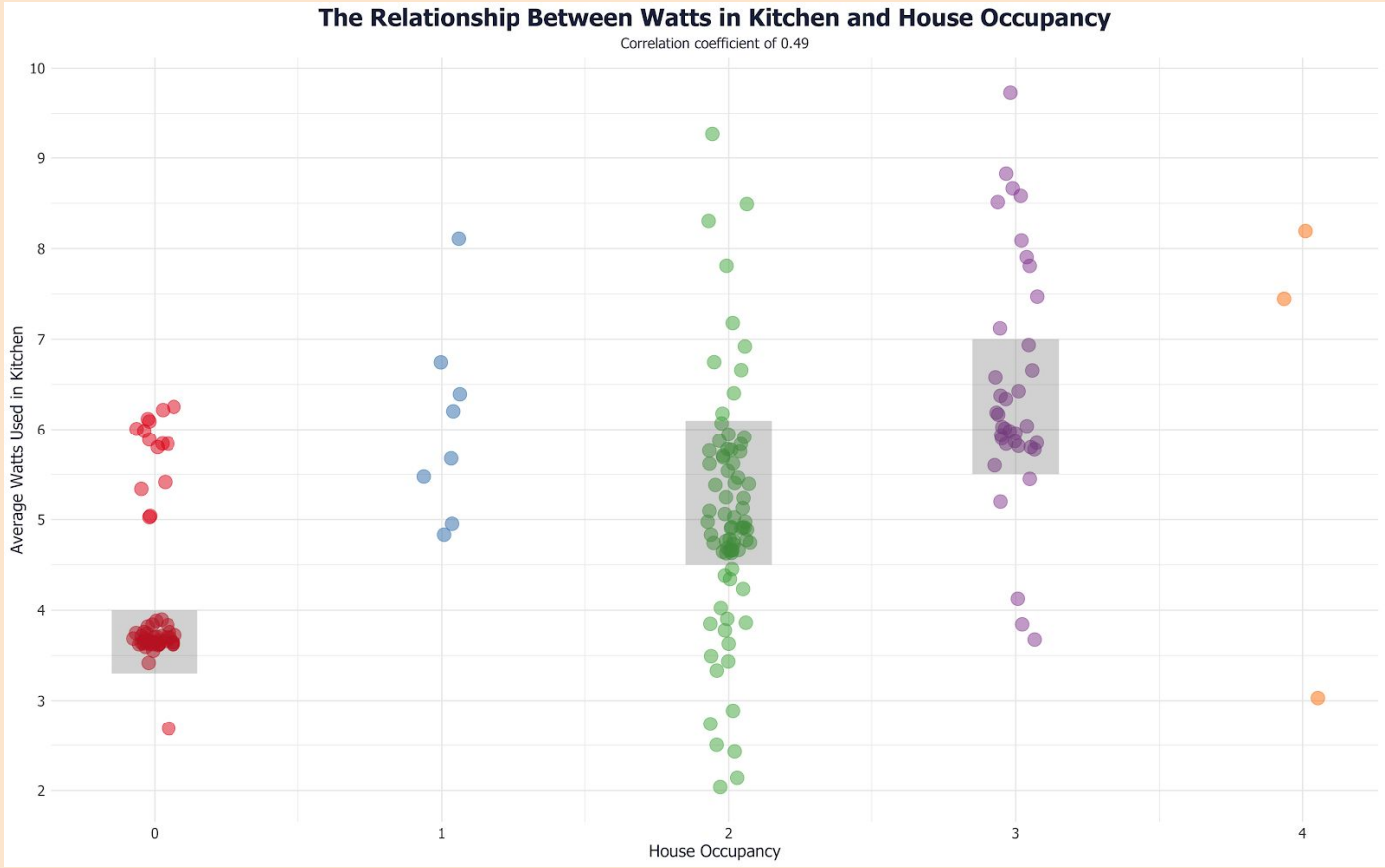

1. Had an initial meeting with Andrew Batek where he talked about the ReNEWW house.
2. Andrew provided the datasets to the group, including a spreadsheet with explanations of each dataset.
3. The group did some early data analysis, then split into three mini-groups.
4. Each mini-group started their analysis on their dataset. This mainly consisted of cleaning the data.
5. Had a mid-project check-in with Andrew where he explained some of the outliers.
6. Each mini-group went back to work and started working on their graphs, tables and overall analysis.
7. Compiled, visualized, and assessed the resulting analyses and put together a final report.

# Methods

- Data was uploaded to a shared Google Drive by Andrew
- CSV files were forked over to our team's Google Drive where members could download the data
- The CSV files were loaded into R Studio
- Packages used in R Studio included:
  - tidyverse
  - dplyr
  - gt
  - ggplot2

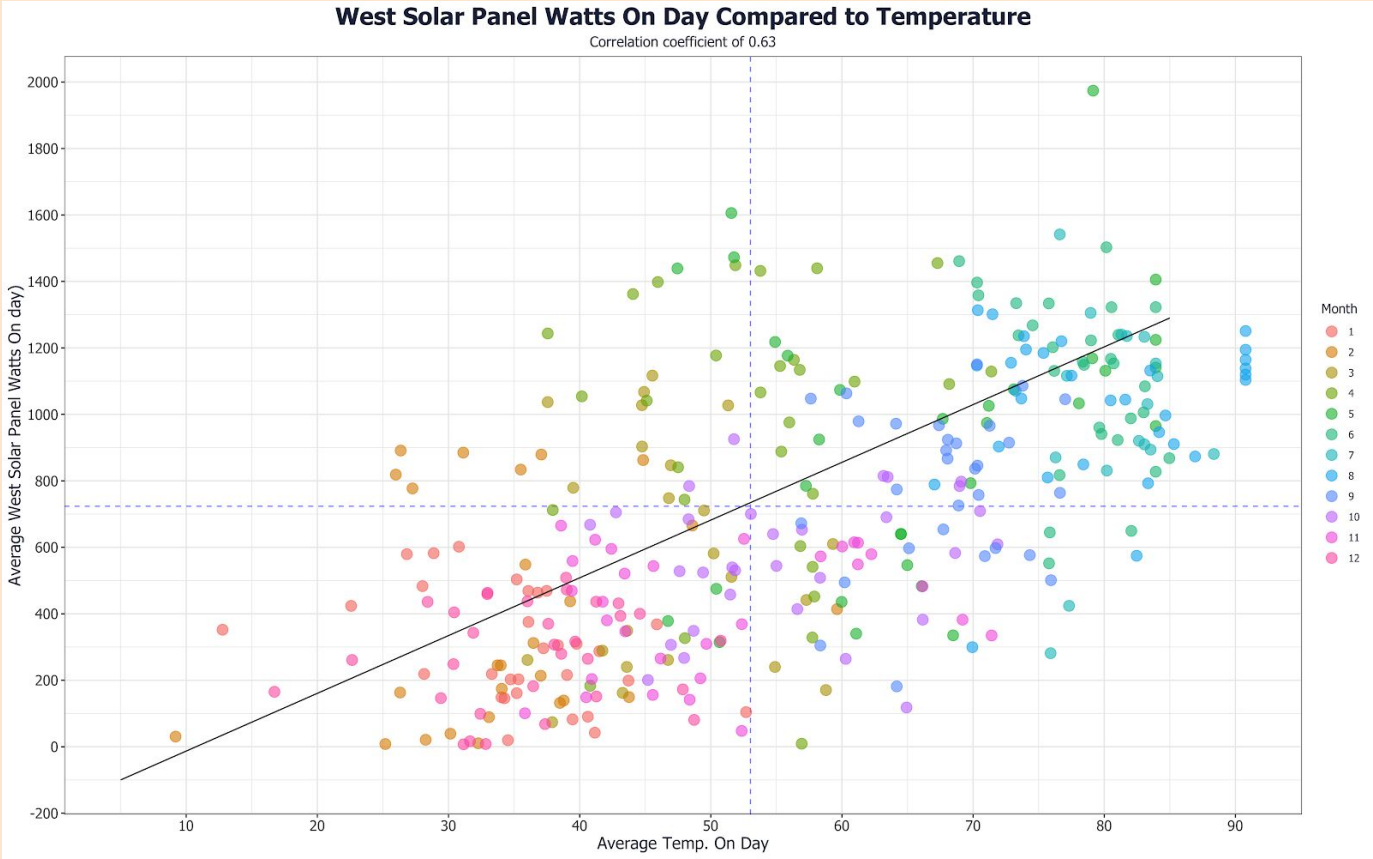
# Findings: Electrical #1

- Strong relationship between house occupancy and average watts used in the kitchen



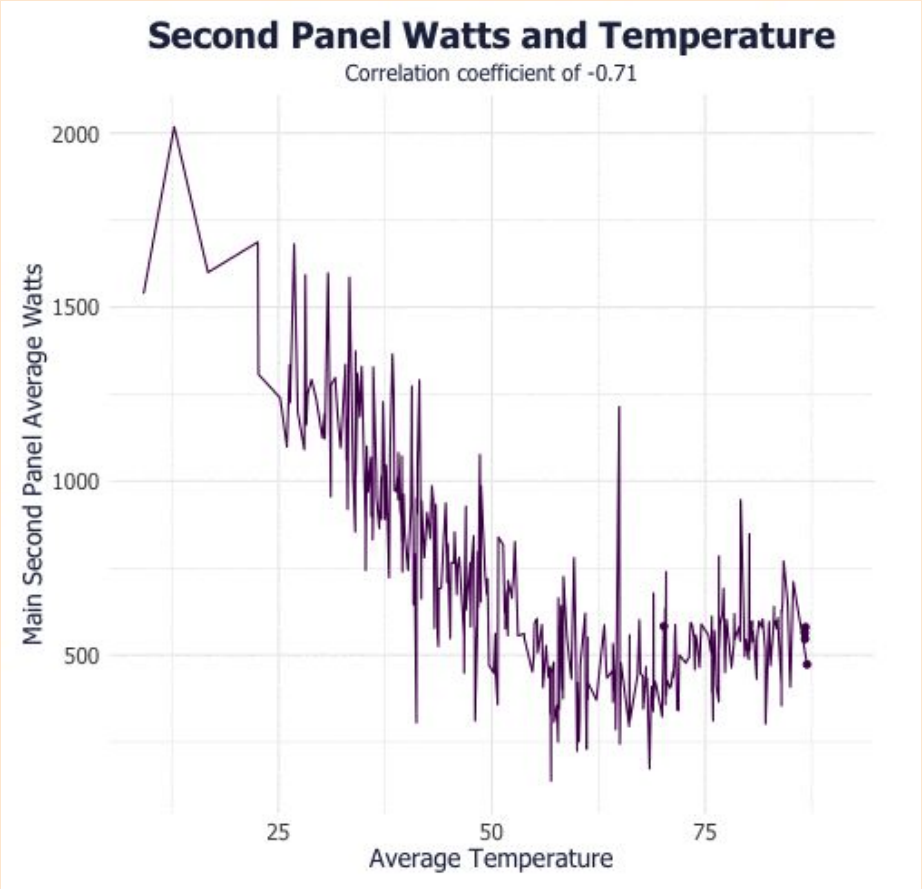
# Findings: Electrical #2

- Warmer months contributed to higher temperatures.



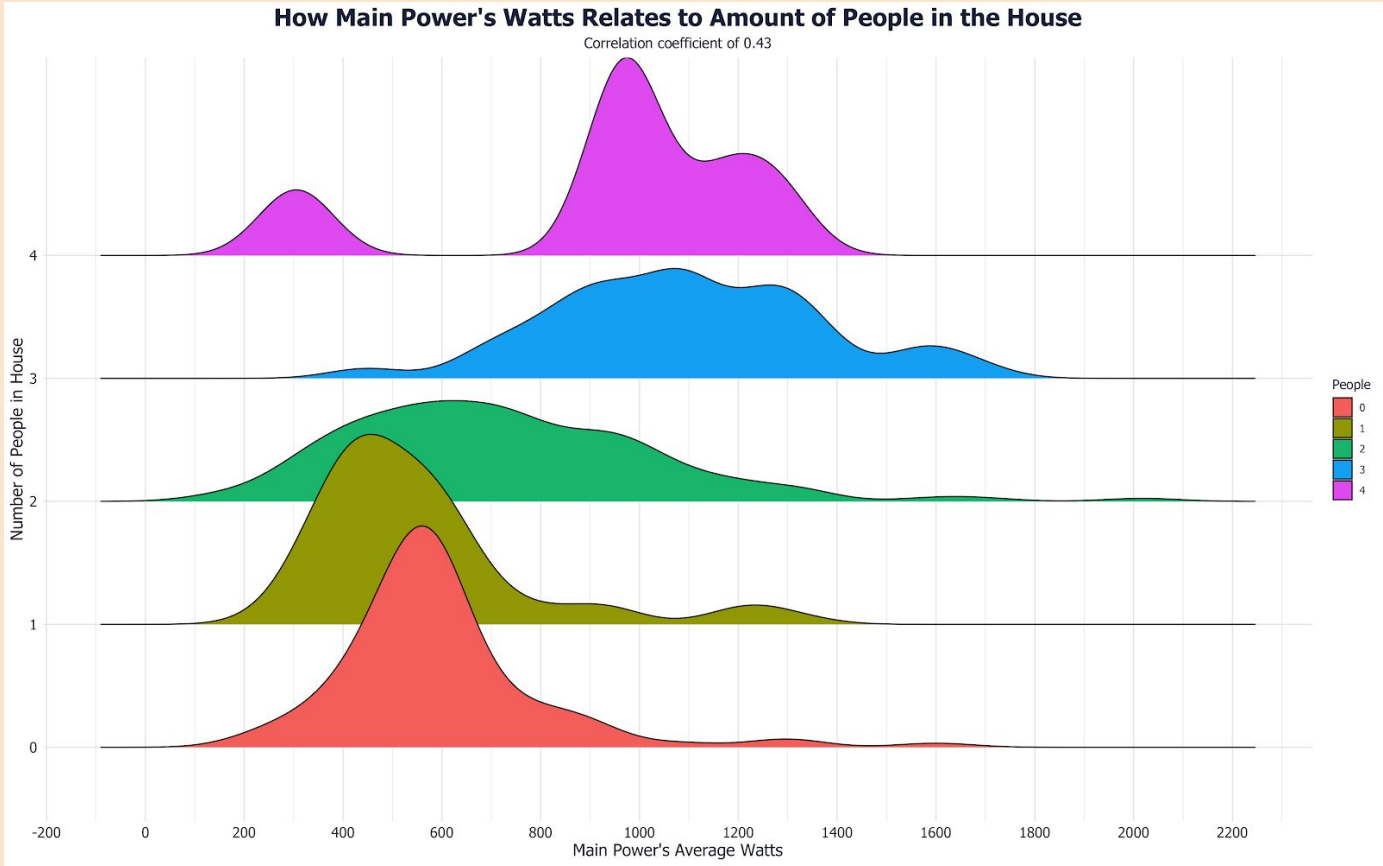
# Findings: Electrical #3

- Strong negative relationship: as the temperature increased, the average watts decreased.



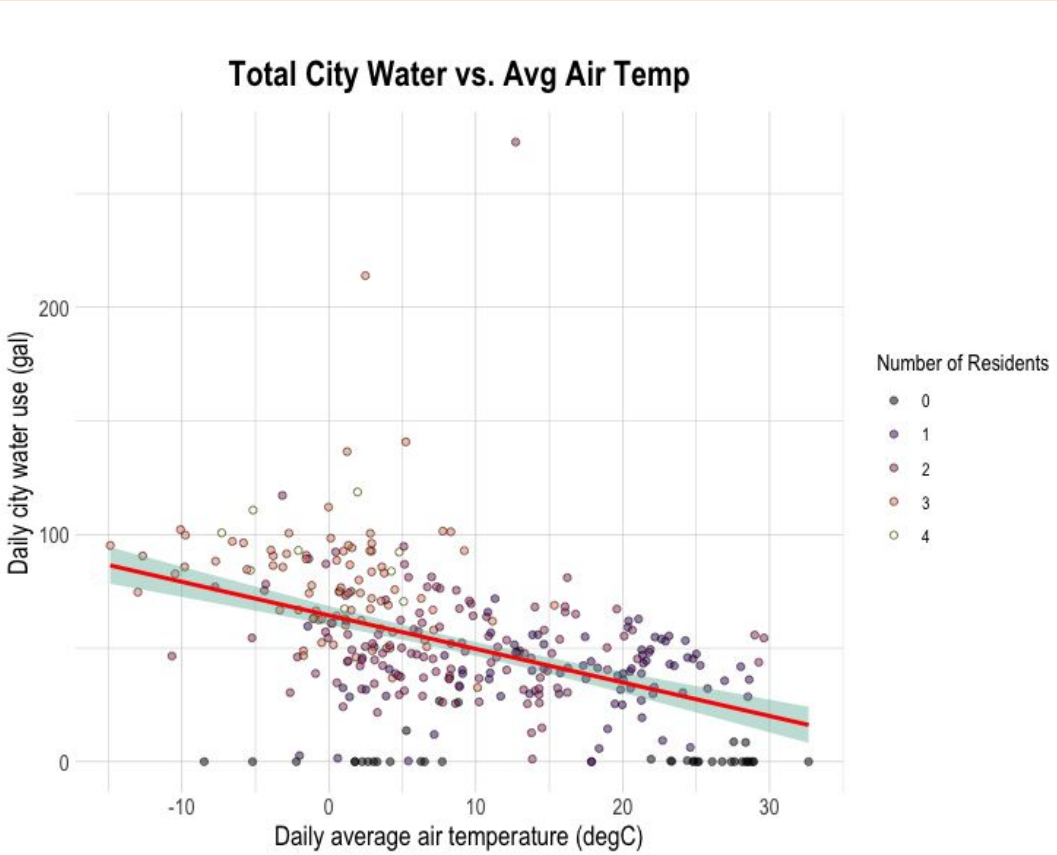
# Findings: Electrical #4

- House occupancy has the greatest effect over main power wattage count.



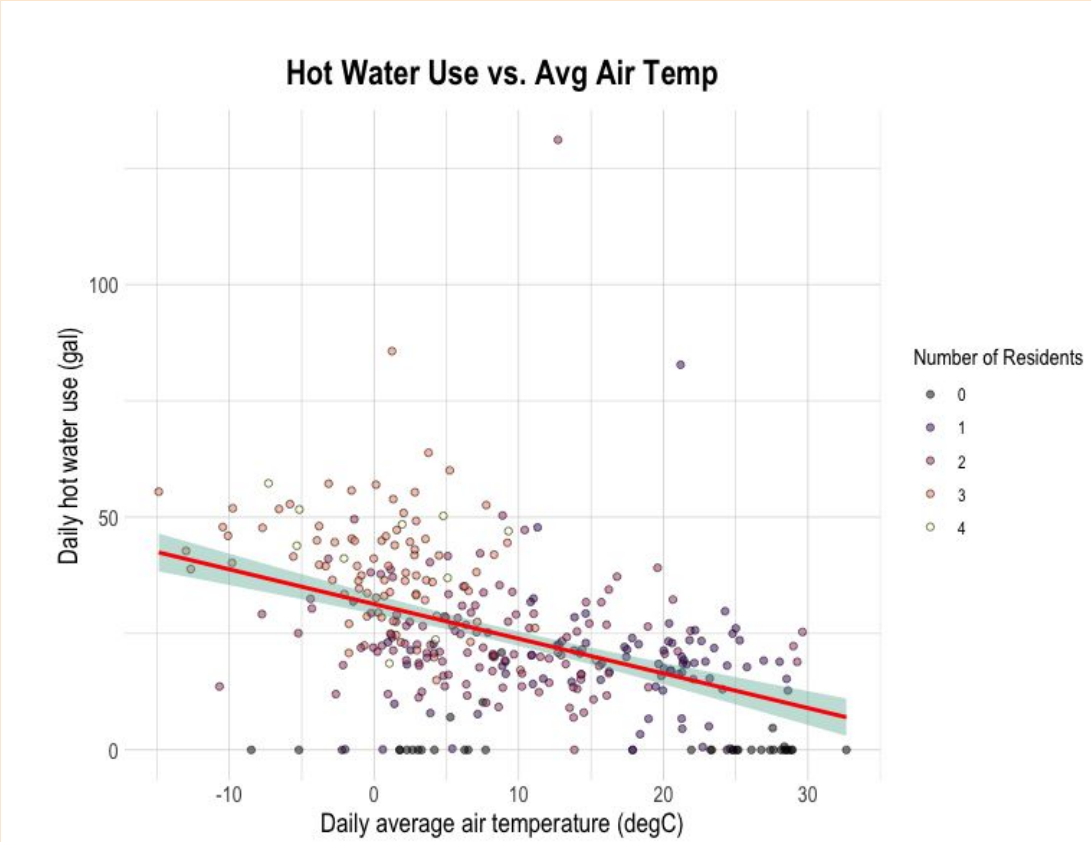
# Findings: Water Flow #1

- Strong negative relationship
- Colder days have higher house occupancy
- Air temperature non-significant



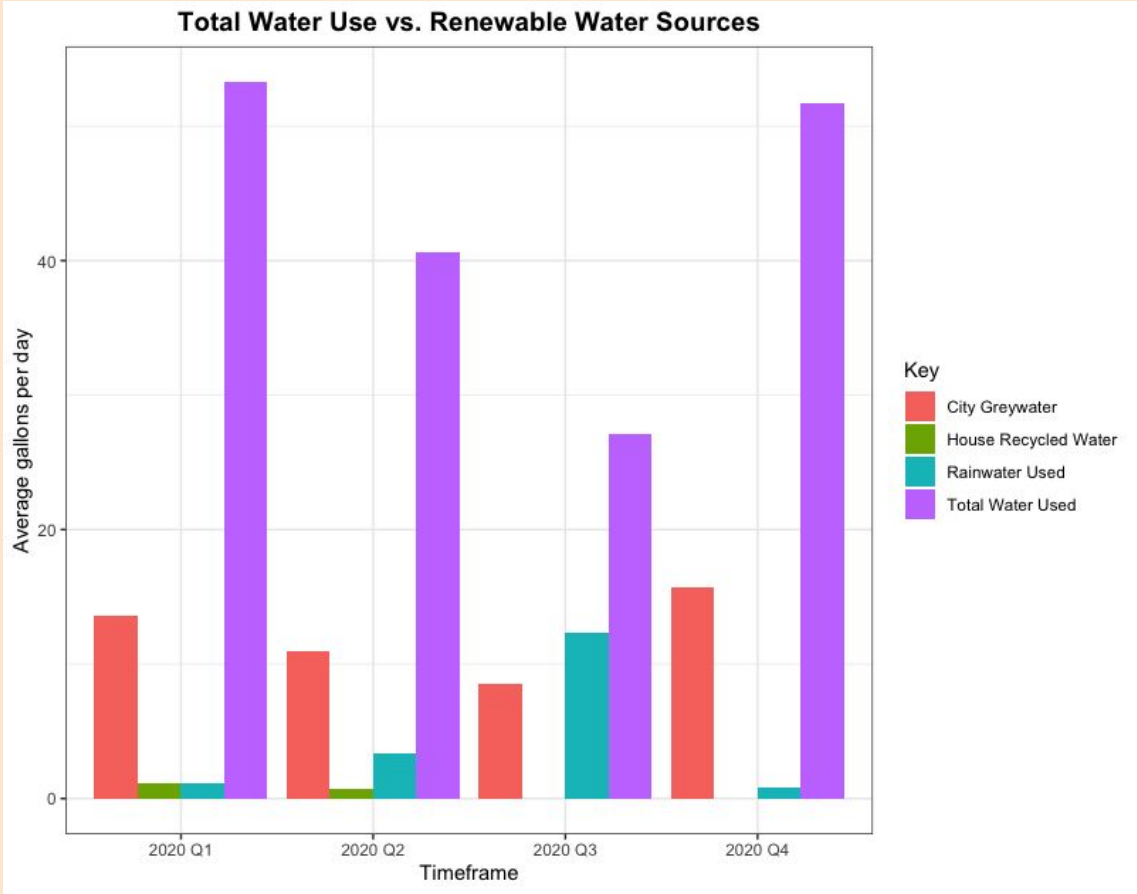
# Findings: Water Flow #1 pt. 2

- Response variable now hot water use
- House occupancy still impactful
- Air temperature is now significant



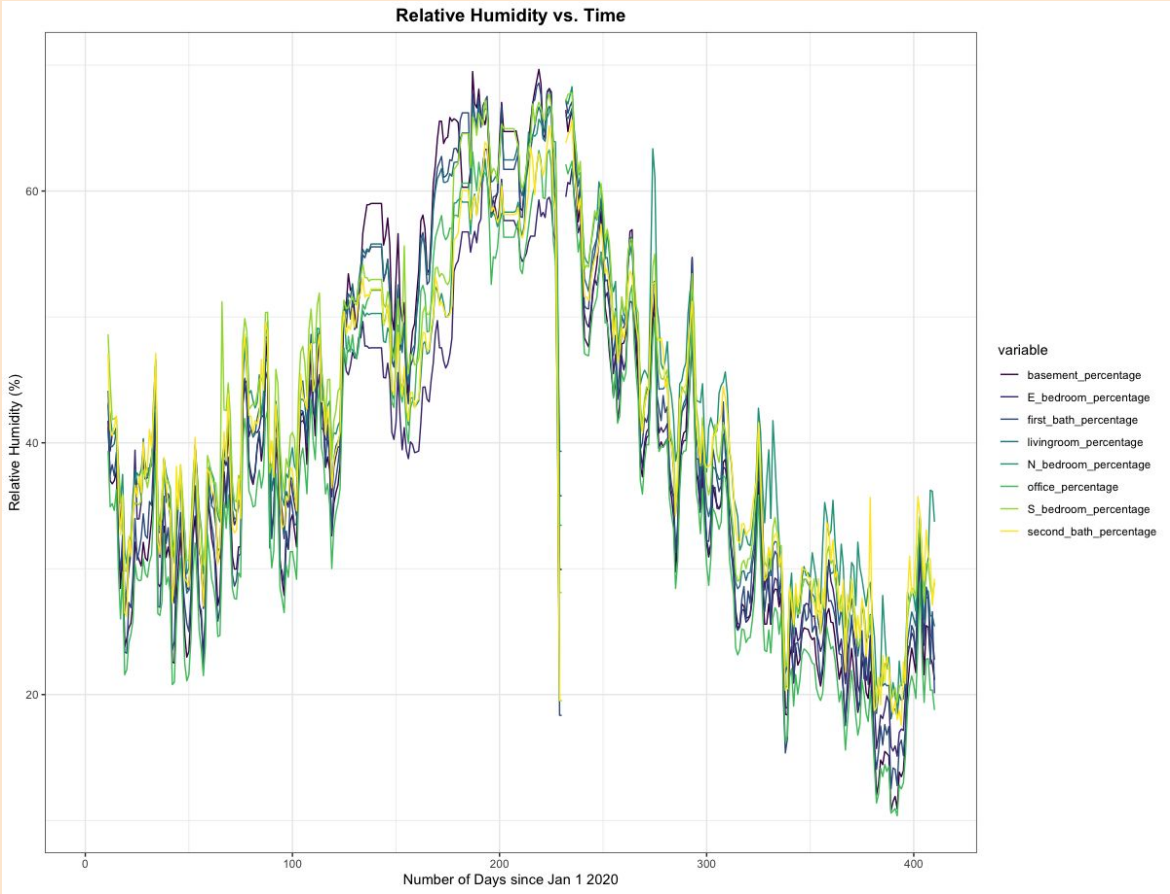
# Findings: Water Flow #2

- Displays the total water use per day vs. the recycled water sources
- House Recycled Water is the most underutilized
- Changes in total water use are mostly due to house occupancy



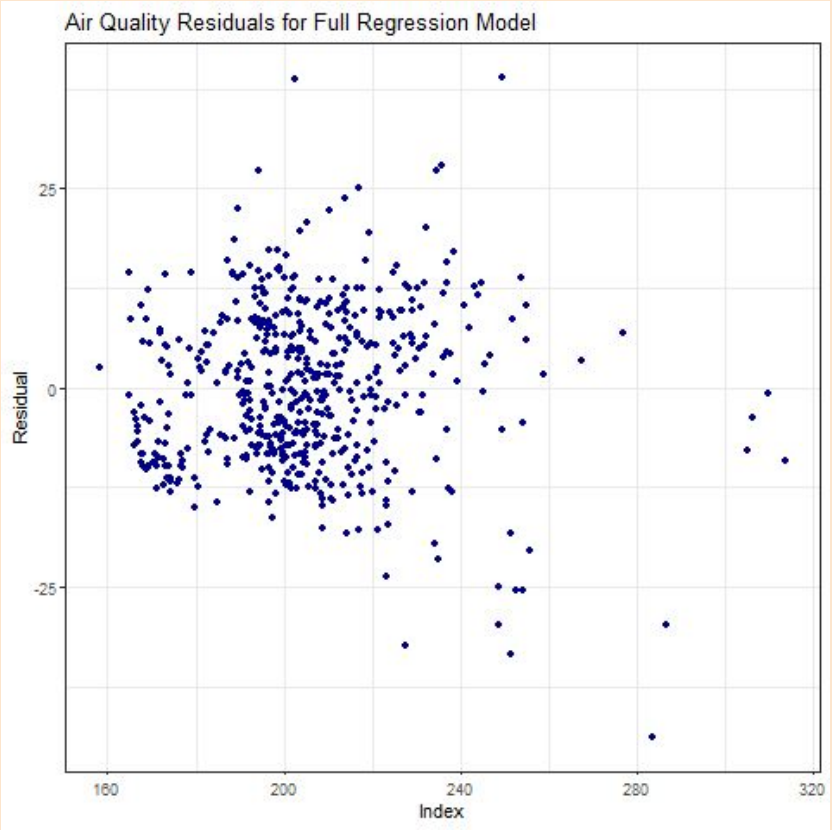
# Findings: Water Flow #3

- Shows the relative humidity over the course of one year
- Clear increase in humidity during the summer months



# Findings: Air Pressure #1

- Variables such as averages on indoor temperature, air pressure, $CO_2$ levels, relative humidity, TVOC, and PM2.5.
- Clear relationship between these variables and air quality



# Findings: Air Pressure #2

- Most relevant predictors: Average Temperature, Air Pressure, Relative Humidity, and PM2.5) using LASSO
- LASSO Regression used to both simplify the model and make it more applicable

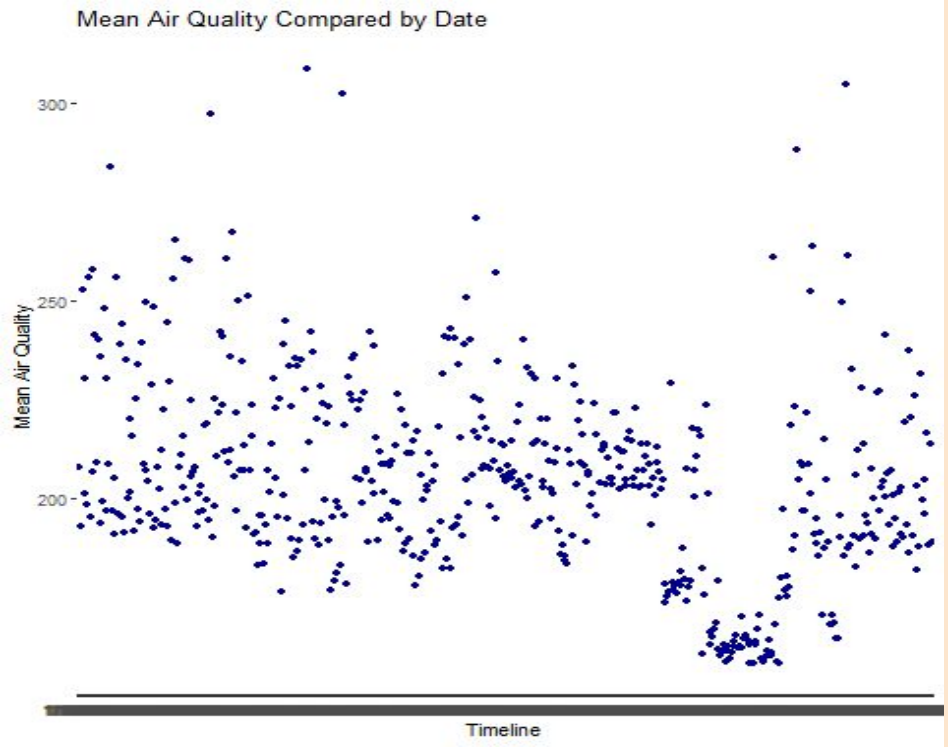
Air Quality Statistics

At Whirlpool RENEWW House

| Date | Mean Temperature | Mean Air Pressure | Mean CO2 | Mean Air Quality Value | Mean RH | Mean TVOC | Mean PM2.5 | Weekend? | Winter? |
|---|---|---|---|---|---|---|---|---|---|
| | 72.74 | 996.00 | 699.67 | NA | 37.31 | 57.18 | 4.07 | NA | NA |
| 1/1/2020 | 62.46 | 986.89 | 646.80 | 207.97 | 35.15 | 26.05 | 7.36 | 0 | 1 |
| 1/1/2021 | 70.00 | 990.27 | 712.00 | 193.12 | 30.16 | 19.50 | 1.00 | 0 | 1 |
| 1/10/2020 | 67.89 | 995.47 | 929.20 | 252.56 | 39.68 | 129.24 | 8.17 | 0 | 1 |
| 1/10/2021 | 65.77 | 1,004.43 | 791.00 | 201.28 | 26.57 | 84.50 | 1.00 | 1 | 0 |
| 1/11/2020 | 68.67 | 984.84 | 846.88 | 230.47 | 41.56 | 66.32 | 8.95 | 1 | 1 |
| 1/11/2021 | 72.60 | 1,003.67 | 766.50 | 198.52 | 26.60 | 33.50 | 1.25 | 0 | 0 |
| 1/12/2020 | 68.72 | 1,003.05 | 883.36 | 255.80 | 36.01 | 234.67 | 7.44 | 1 | 1 |
| 1/12/2021 | 68.80 | 998.50 | 768.50 | 195.46 | 25.80 | 60.00 | 1.17 | 0 | 0 |

# Findings: Air Pressure #3

- Time of the year has a clear effect on air quality, as certain variables are affected by seasonal weather
- These dates are great starting points for further analysis into air quality.



# Recommendations

- Residents should understand the solar panels will pick up more energy on days where it's warmer and that when there's more people in the house, they should be more aware of their energy usage.
- Whirlpool should look to install more house greywater recycling so that they can improve on their renewable water usage.
- Residents should also be cognizant of using hot water in colder months.
- Indoor temperature, CO2 levels, relative humidity, and PM2.5 levels are the most important factors in air quality.  If air quality is an area that the Whirlpool team would like to focus on improving, these areas will be the most effective in doing so.

# Conclusion

- After weeks of analyzing data sets and comparing findings with each other as a group, we were able to arrive at a plethora of suggestions for the residents of the ReNEWW house. We hope that our recommendations will be helpful as Whirlpool looks to develop more of these houses across the United States.

- Reach Consulting Group has been grateful for the opportunity to provide Whirlpool with our findings and recommendations. Thank you to Andrew and the rest of the team!