PROGRAM ON THE ENVIRONMENT

INCREASING WATER DEMAND FORECAST ACCURACY THROUGH INCLUSION OF WEATHER DATA

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BACKGROUND

- Using recorded weather and usage values, create a short-term water usage model
- Short-term demand forecasts can allow utilities to better plan for spikes in water demand
- Forecasts can allow utilities to bring additional treatment facilities online prior to usage spikes

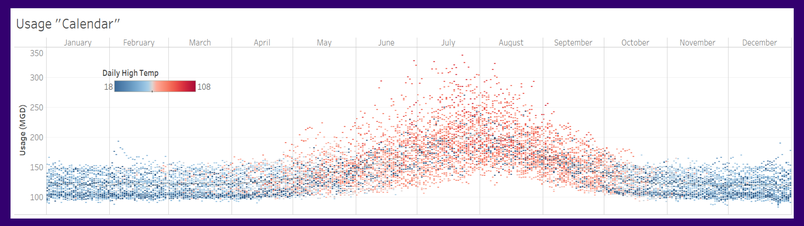
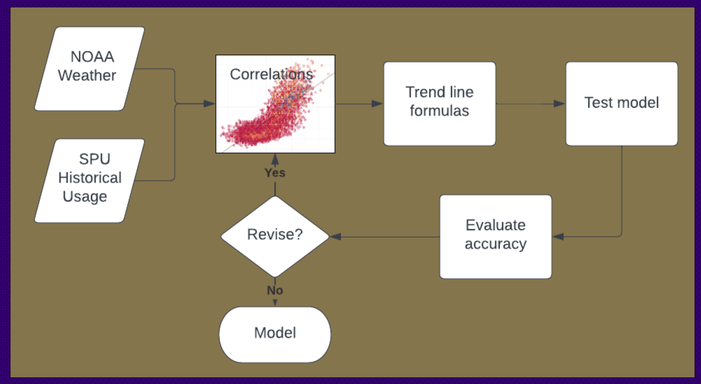


Figure 1: "Calendar" of water usage over the 25 years of data. Usage is most variable with warmer temperatures, particularly between mid-May and late September. The model attempts to forecast usage in this more variable usage timeframe.

PROCESS

- Retrieve daily water usage values from Seattle Public Utilities (SPU) and National Oceanic and Atmospheric Administration (NOAA)
- Merge NOAA and SPU data on date value
- Create scatterplot in Tableau comparing usage against weather data values
- Observe correlation or lack thereof between weather values and water usage
- Get point-slope formula for trendline of strongly correlated dimensions to use in forecast model
- Apply forecast model to each set of daily weather values
- Compare model results to actual water usage
- Evaluate model accuracy
- Adjust parameters for scatterplot or include additional dimensions
- Update model and re-evaluate accuracy



METHODS

I looked for strong correlations between water usage and different weather values by charting them on scatterplots in Tableau then calculated the point-slope equation for the trend line

These trend line equations were merged into the usage forecast model equation

Some dimensions showed strong correlations, including Daily High Temperature (Figure 2):

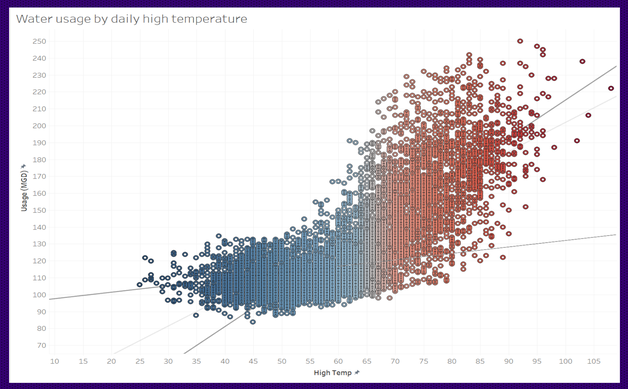


Figure 2: Scatterplot of Water use compared to Daily High Temperatures. Two trendlines are noted, for high temperatures of 60°F and greater, and for less than 60°F.

Consecutive days with precipitation showed more impact on water usage than consecutive days without precipitation:

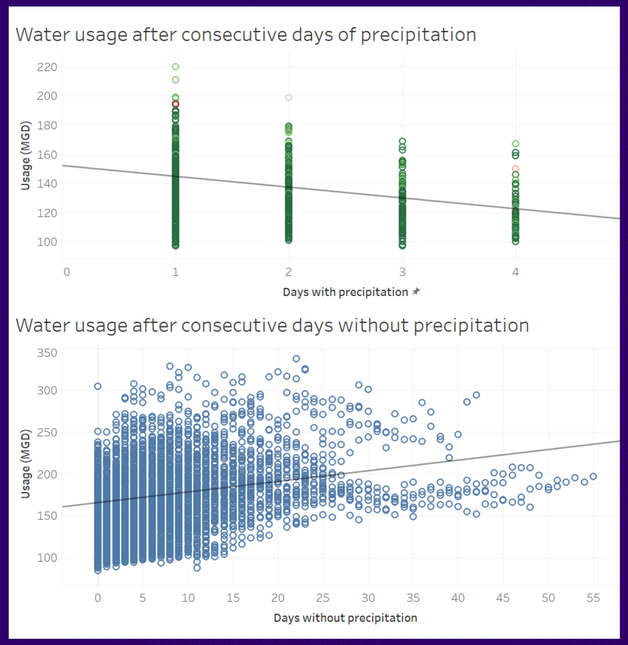


Figure 3: Usage changes after consecutive days with and without precipitation

RESULTS

I provided Seattle Public Utilities with a usage forecast model that will return an estimate of water demand based on the forecast high temperature, adjusted for consecutive days with precipitation. This model attempts to accurately predict summer usage spikes from weather patterns, and historic usage patterns.

IMPLICATIONS

- SPU can better plan for usage spikes
- Additional treatment facilities can be brought online
- In-town reservoirs can be "topped off" prior to forecast spikes
- Minimize non-renewable energy sources for pumping processes

ACKNOWLEDGEMENTS

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