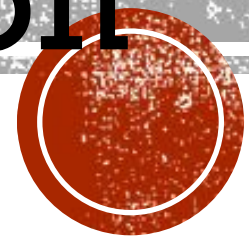




Temperature and Population Effects on Natural Gas Consumption



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March 2021

MOTIVATION & SUMMARY

1

-Analyze the relationship between gas consumption and temperature across the US.

Analyzed population numbers influence on amount of gas consumed

2

-Which region consumes the most natural gas?

-Has the energy gas consump. gone up over time?

-Which state has the most and least extreme weather? Is gas affected?

-How much does gas consump. fluctuate by season?

-Does temperature have an effect on state's average gas consumption?

-Do higher populated states consume more natural gas than others?

3

-Natural gas is used more in colder months than warmer, however, population effects these numbers.

-Population does not have a direct correlation with the use of gas consumption

-High population and colder weather doesn't have a direct correlation on natural gas consumption, but it does have an impact and reveal a trend



DATA CLEANUP & EXPLORATION

Natural Gas Data: <https://www.eia.gov>

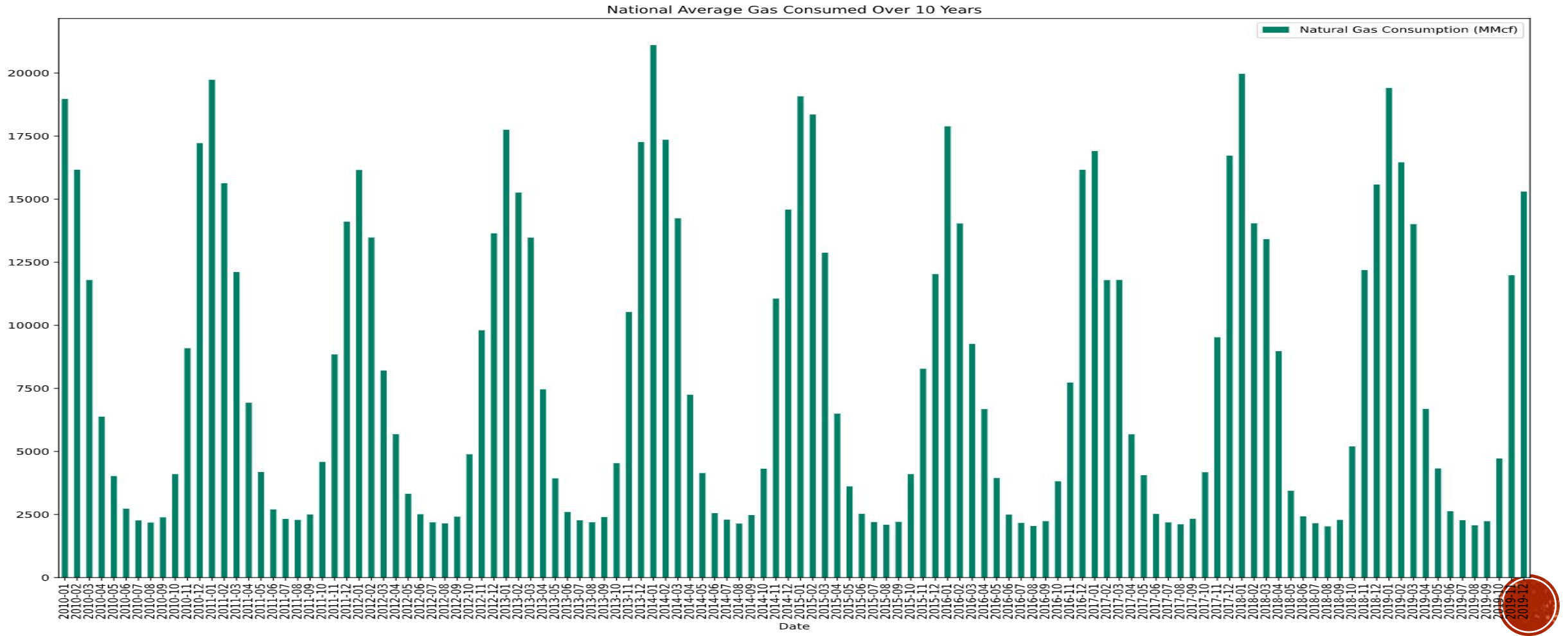
Average Temperature Data: <https://www.ncdc.noaa.gov>

Population Data: <https://www2.census.gov>

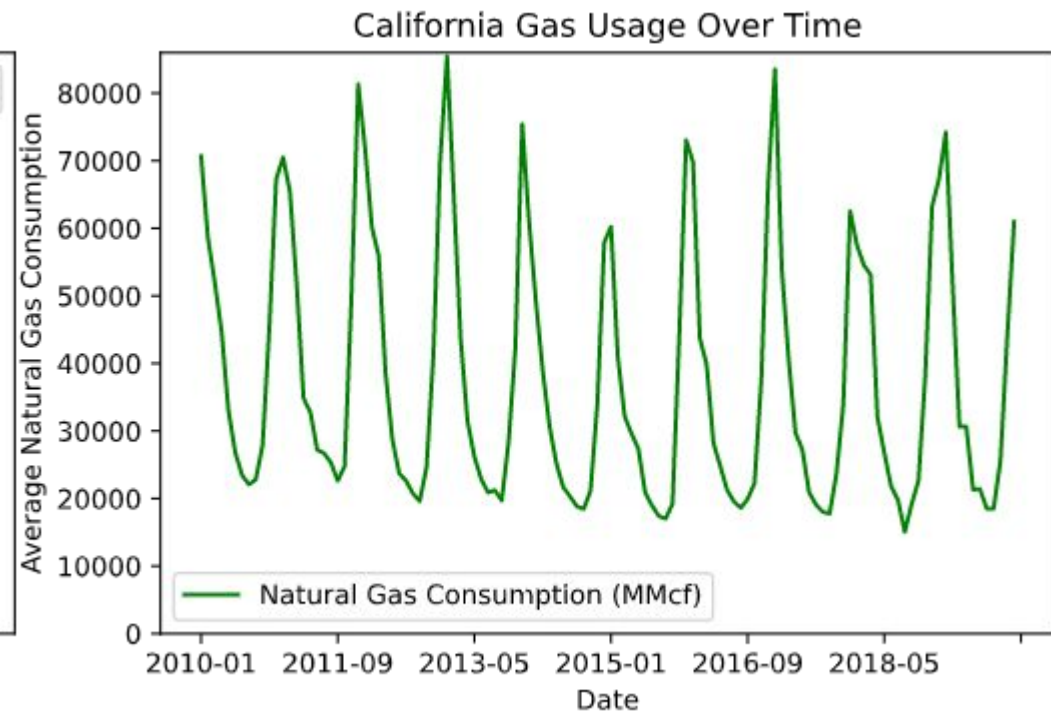
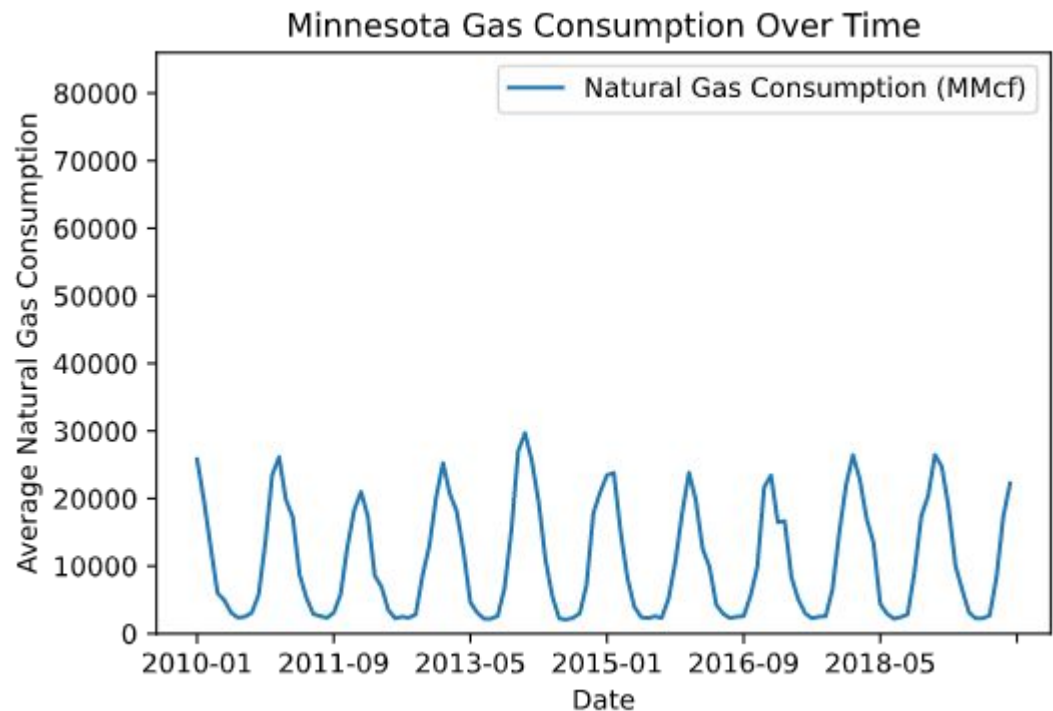
- Each dataset had dates associated with the information, but each one was formatted differently.
- Assured each dataset was reflecting the same time period, 2010-2019.
- Most of the cleanup process included reformatting each data frame to be uniform, in order to make merging easier.
- D.C. and Hawaii were dropped from the datasets as the weather information was not available from our source.
- A new, 'Usage Per Person' column was created using population and gas usage data.
- In an attempt to remove potential outliers, we dropped states that did not heavily rely on gas, removing states that used less than 5000 MMcf of natural gas in a 10 year period.
- Grouped by various factors to pull information. (State, Date)
- Separated states into federal regions for analysis



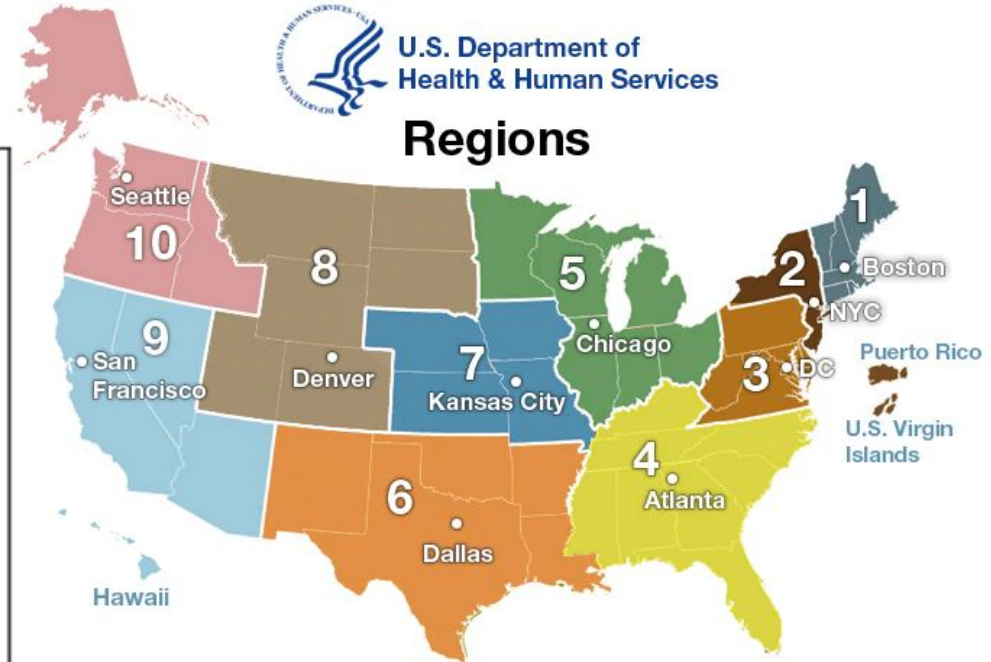
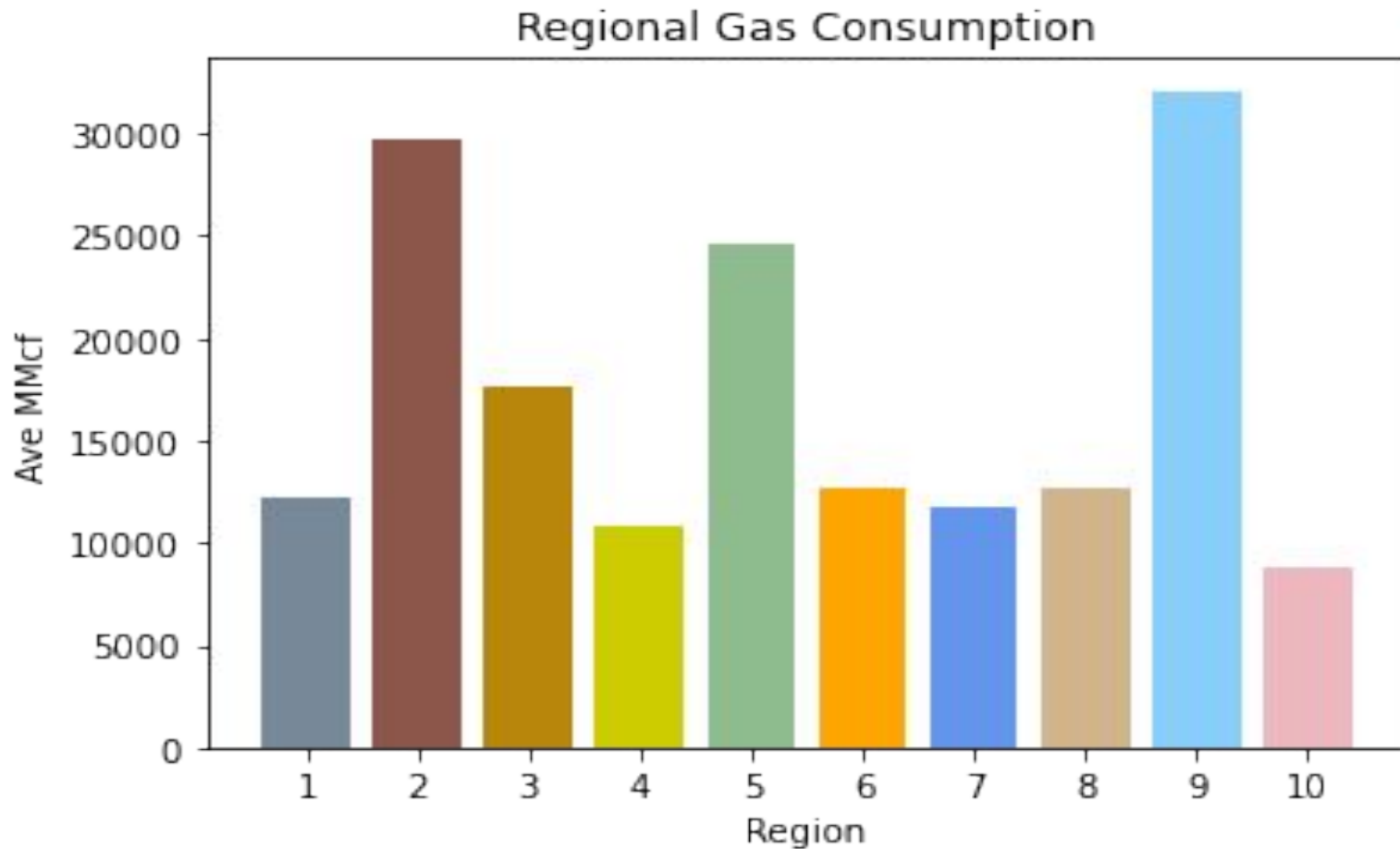
National Avg. Gas Consumed over 10 Years



Most Extreme Weather State vs. Least Extreme Weather State



GAS CONSUMPTION BY REGION



Region IX: Arizona, California highest consumption

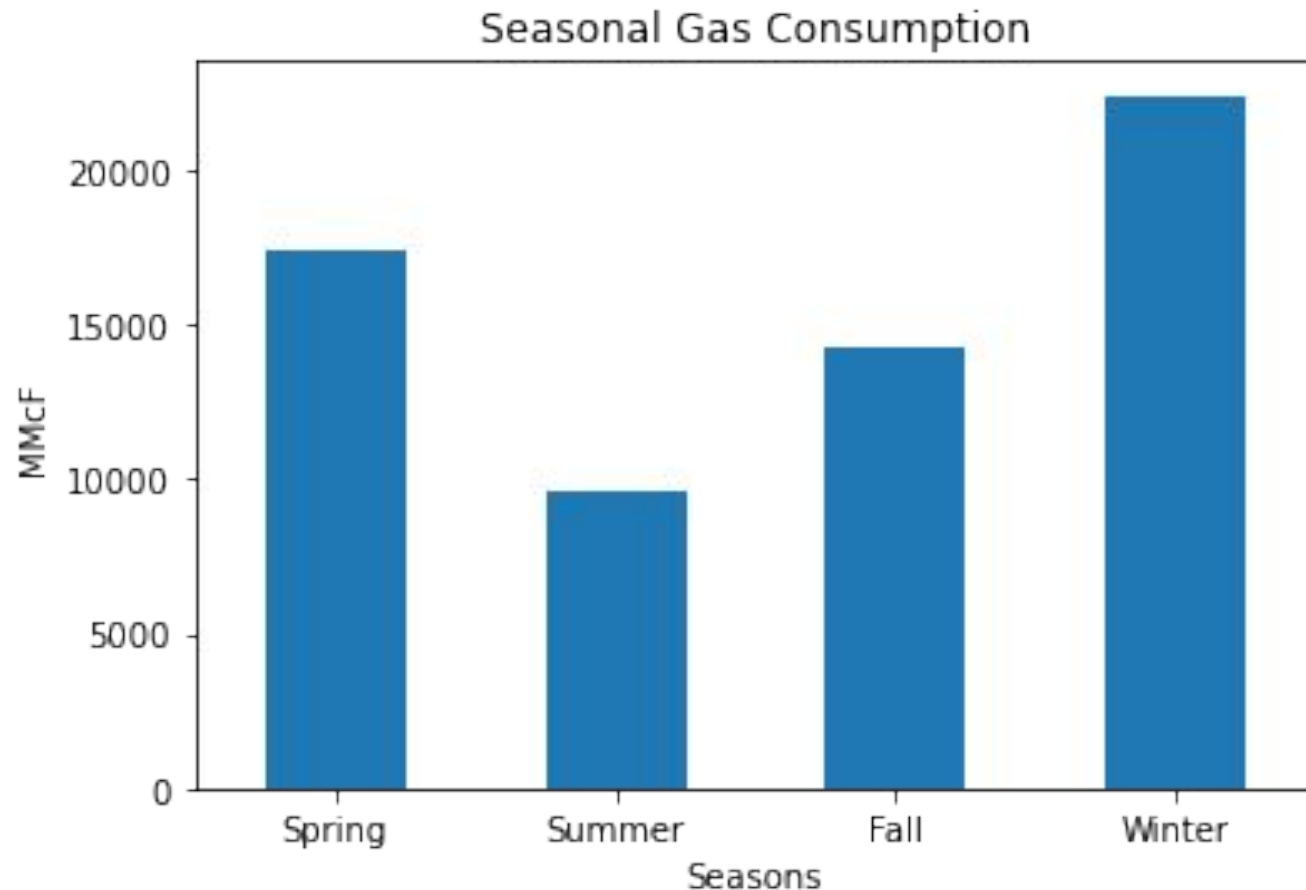
Region II: New York and New Jersey second highest

Region X: Idaho, Oregon, Washington least consumption

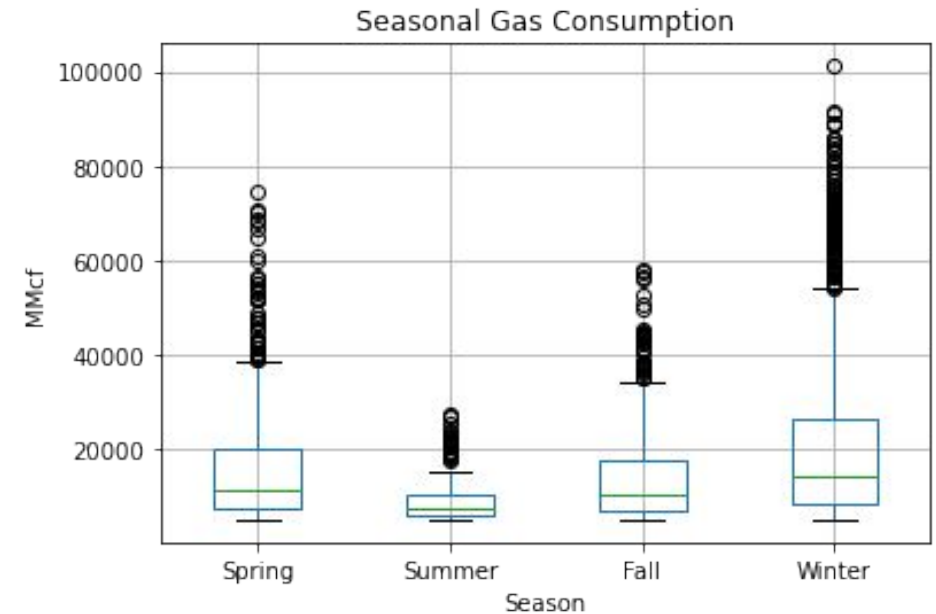
AVG temp Arizona: 61, California: 59

AVG temp Idaho: 44, Oregon: 48,
Washington: 47

Seasonal Gas Consumption Across United States

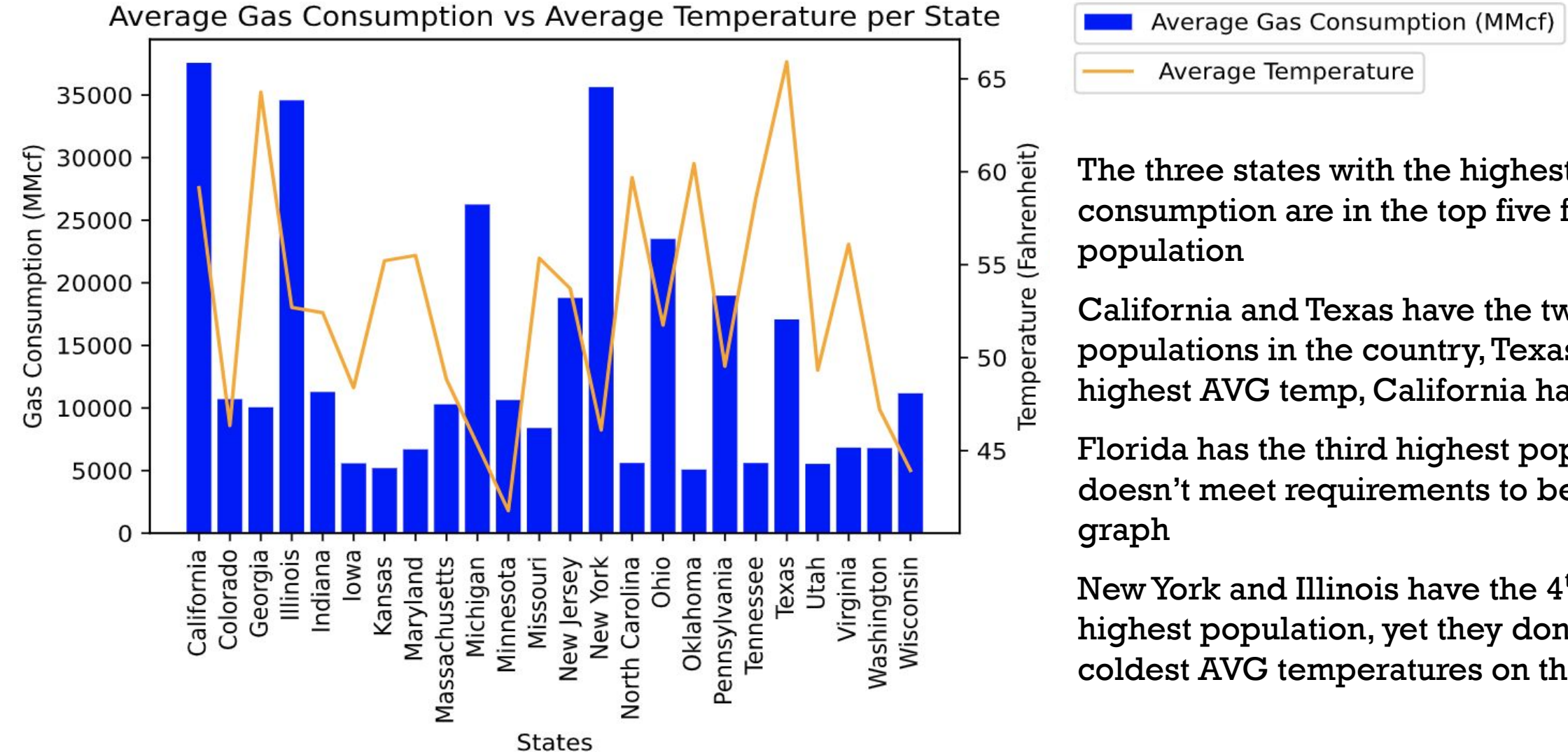


Confirming our hypothesis, the US uses the most natural gas in the colder seasons, and less natural gas in the warmer ones.



Temperature's Effect on Gas Consumption

Average Gas Consumption vs Average Temperature per State



The three states with the highest consumption are in the top five for highest population

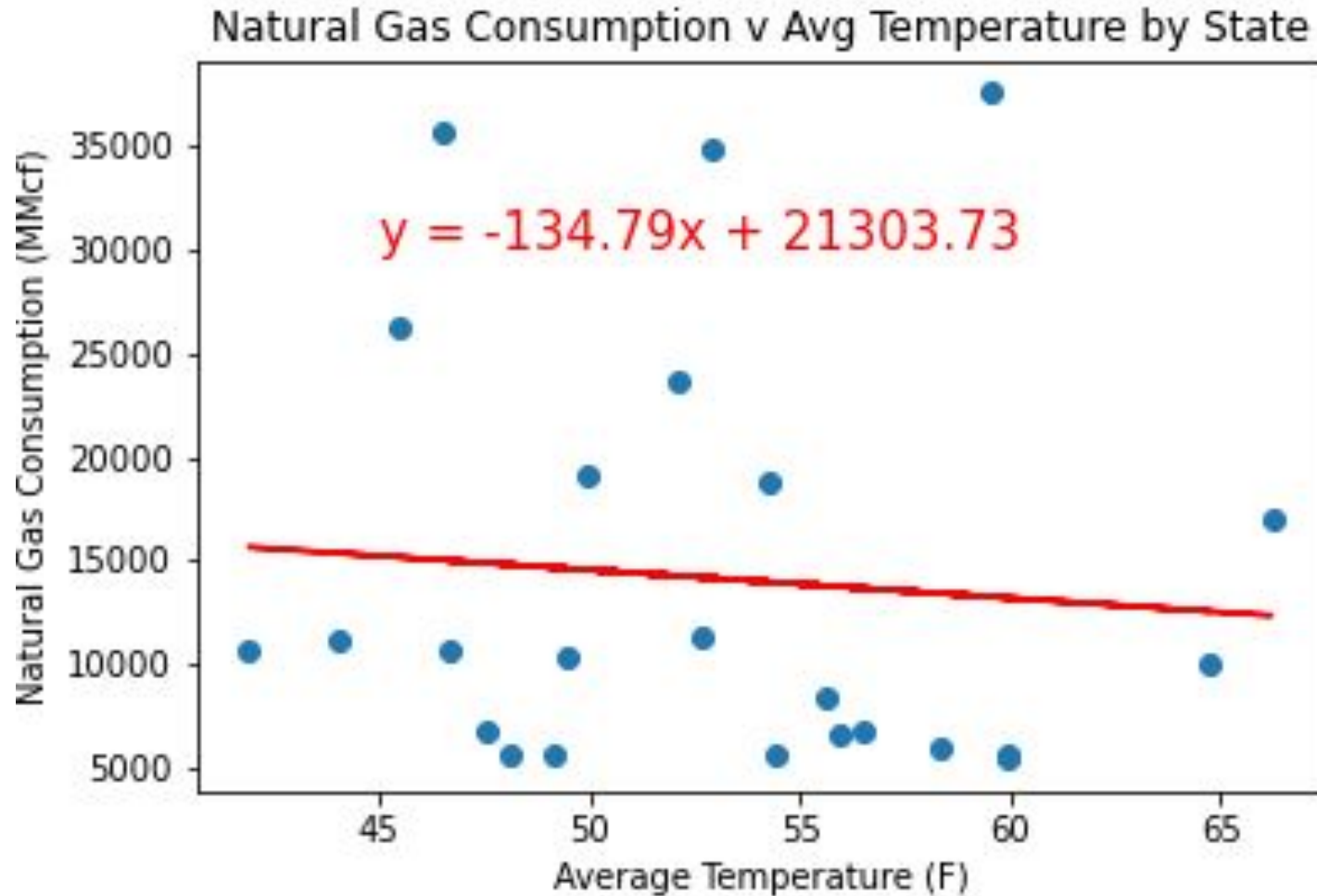
California and Texas have the two highest populations in the country, Texas has the highest AVG temp, California has the fourth

Florida has the third highest population and doesn't meet requirements to be on the graph

New York and Illinois have the 4th and 5th highest population, yet they don't have the coldest AVG temperatures on the graph



Temperature's Effect on Gas Consumption



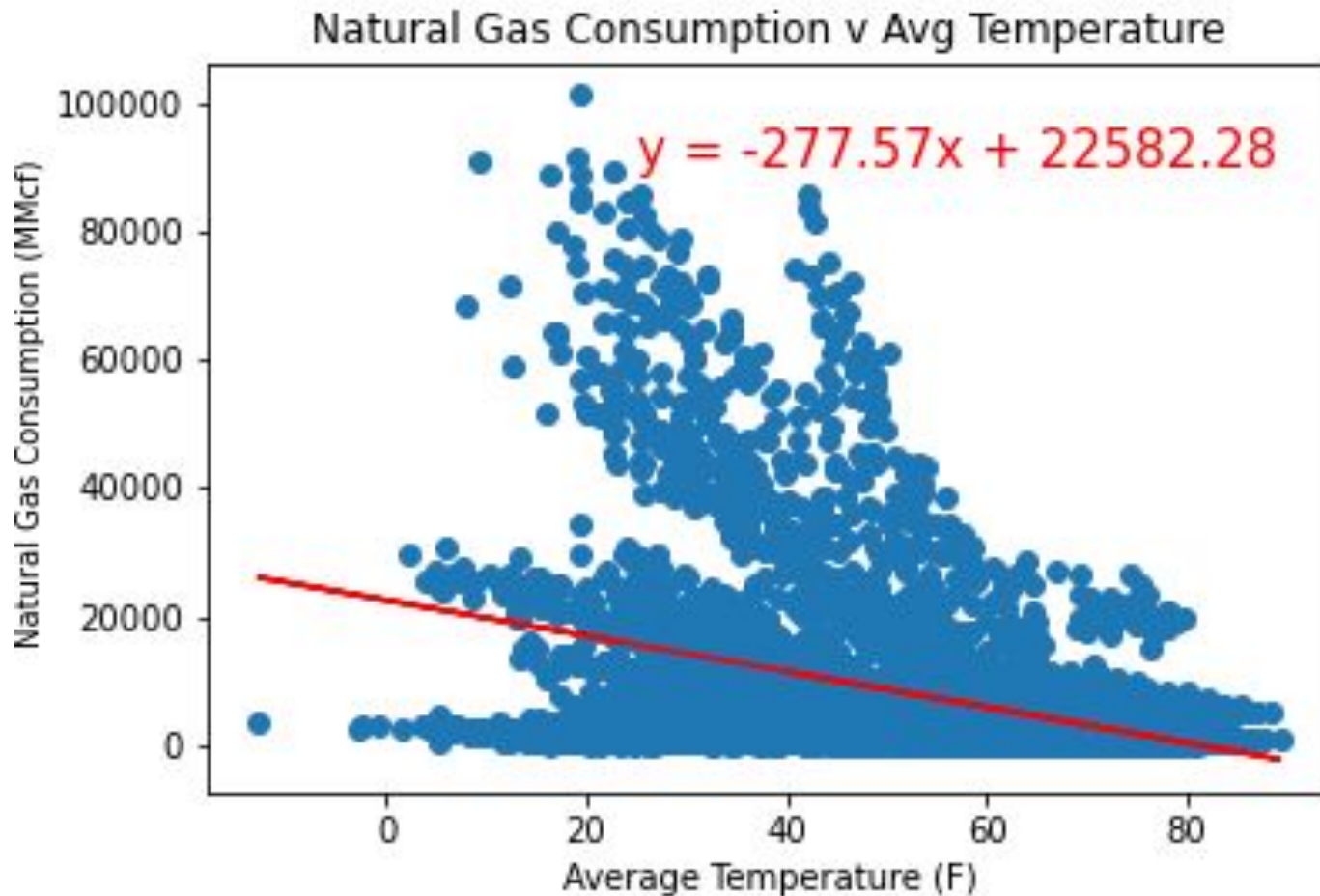
R-squared: (0.01) 1%

This shows **average** gas usage versus **average** temperature over a **10 year period**.

Although the linear regression curve shows a slight trend downwards as the temperature gets higher, it is too sporadic to be considered statistically significant.



Temperature's Effect on Gas Consumption



R-squared: (0.15) 15%

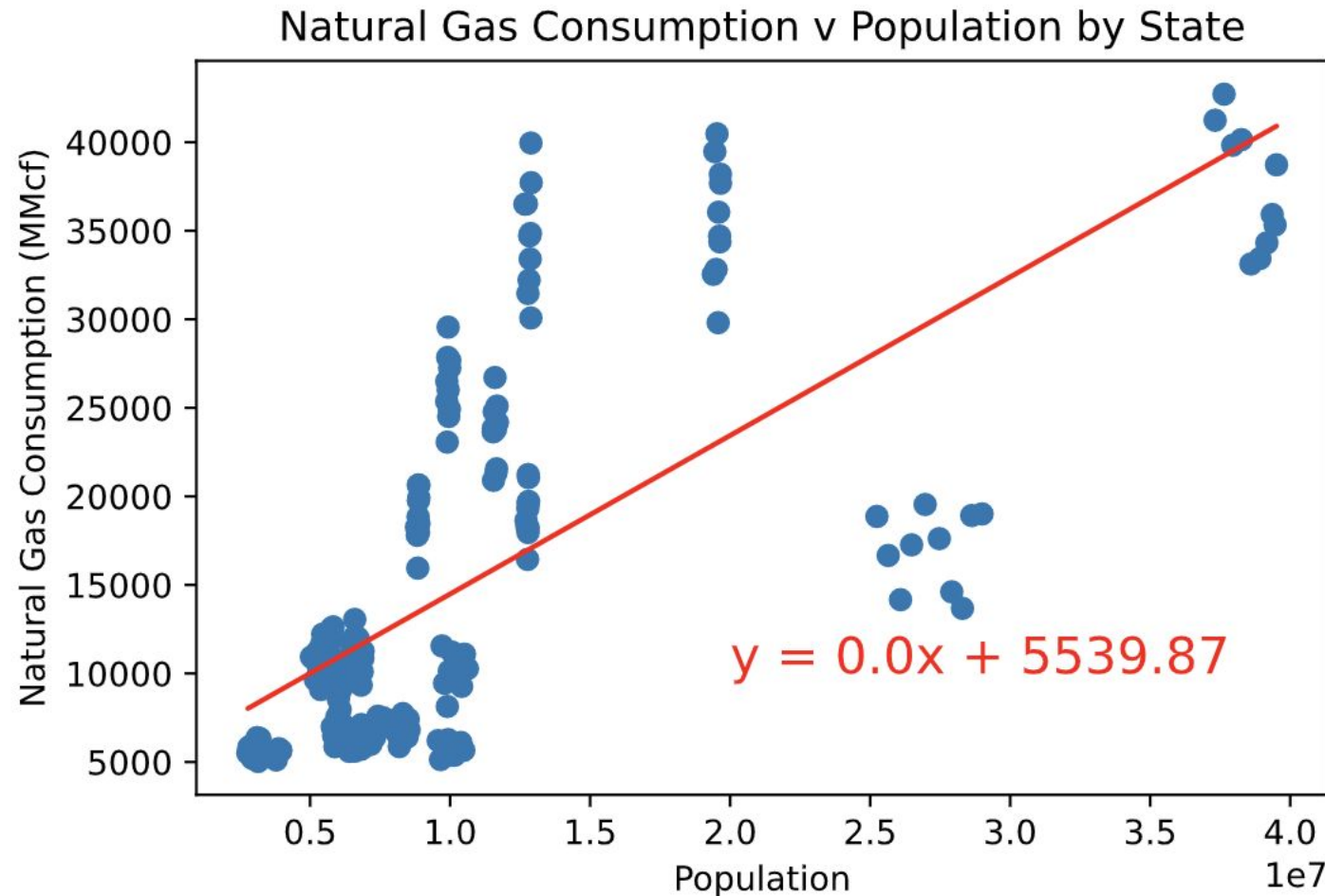
This plot is showing the relationship between gas consumption and average temperature over a 10 year period, instead of using the averages for each year.

There is a much clearer trend downwards, and it is statistically more significant than the previous plot.

This falls in line with our prediction, that higher temps result in less gas usage.



Population's effect on Gas Consumption



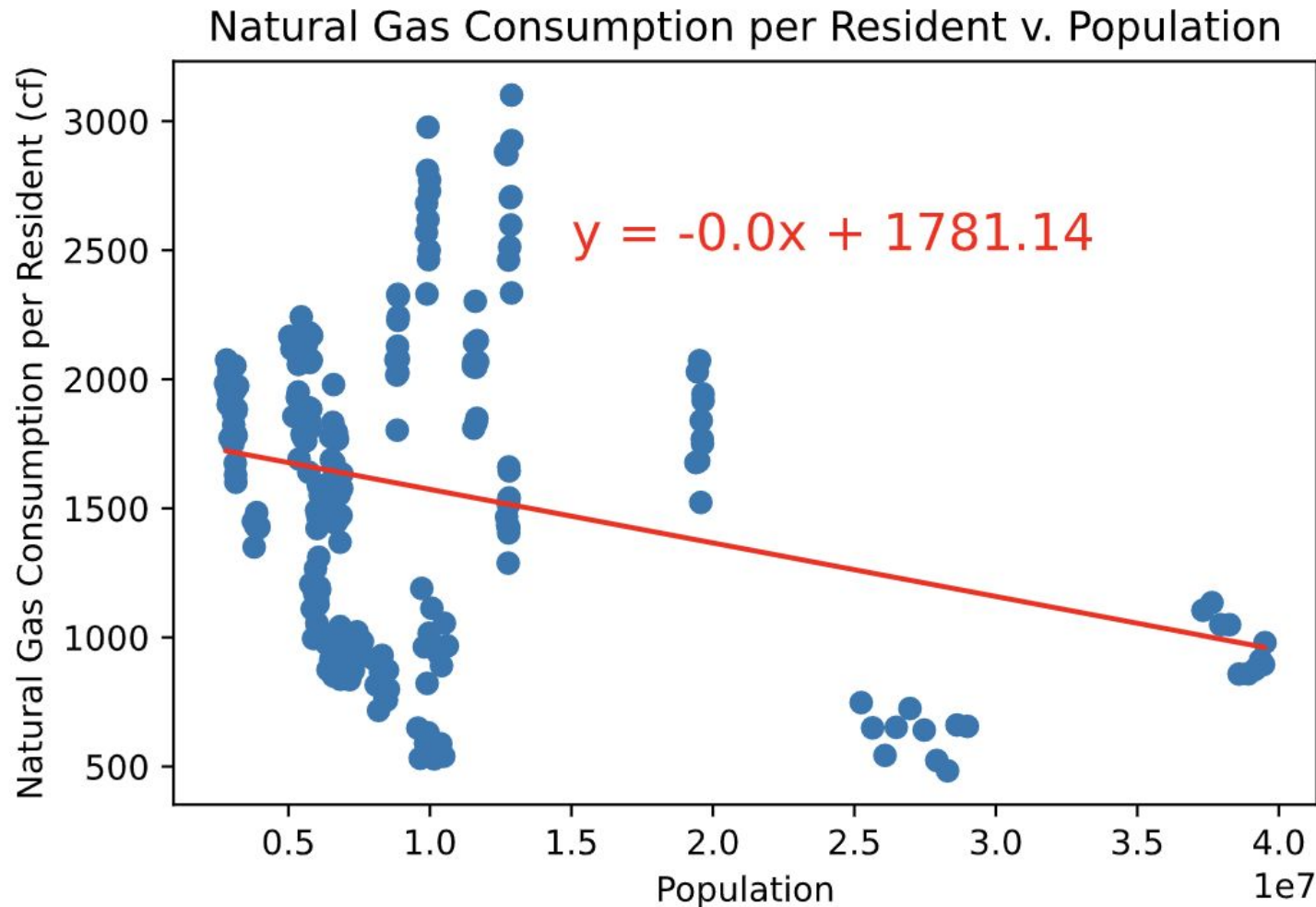
R-squared:(0.51) 51%

The plot includes all 10 years, with each point representing one year.

There is a very clear trend, matching our hypothesis, showing states with higher populations use more natural gas.



GAS CONSUMPTION PER RESIDENT



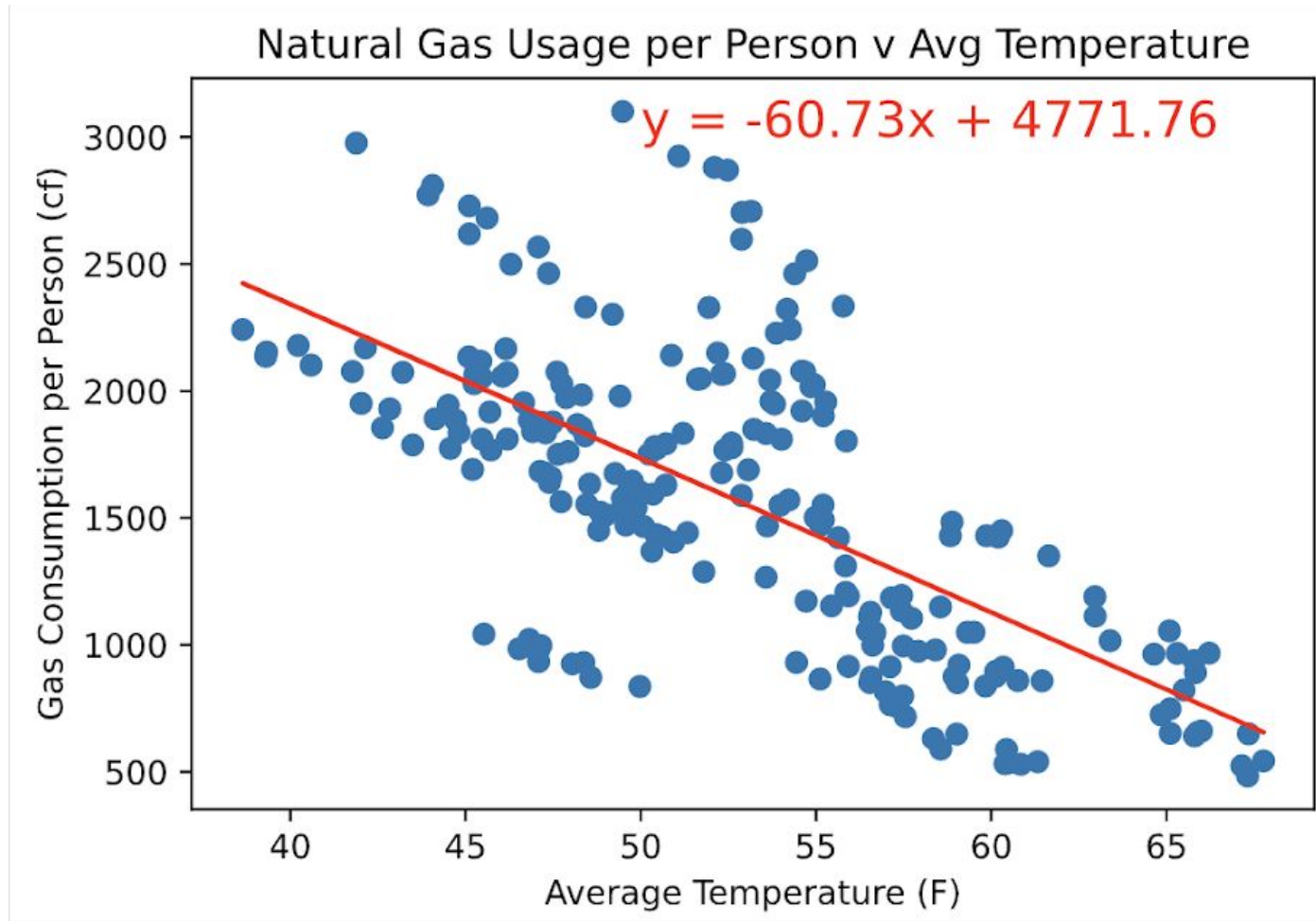
R-squared: (0.08) 8%

Each dot represents one year.

Although not as statistically significant, the plot seems to indicate that the larger a state's population is, the less gas is used per capita.



Temperature Effect on Individual Gas Usage



R-squared: (0.44) 44%

There is a clear trend showing less usage as the temperature gets higher.

One point represents one year.

Using this plot you could reasonably predict the gas usage per person in a state when given its average temperature.



Analysis

- In general, natural gas is consumed at a higher rate per person in colder weather
- The coldest weathered states do not necessarily consume the highest amounts of natural gas
- The most extreme(varied) temperature state uses less natural gas than the least extreme (varied) temperature state.
- Population plays a significant role in the amount of gas consumption
 - California, New York, and Illinois have the three highest gas consumption rates and are in the top five states for highest population
 - Because of this population does not have a direct correlation with gas consumption either

However, typically, colder states with a high population such as New York will average much higher gas consumption



POST MORTEM

- Finding good data to use, unable to find useful APIs, CSVs were better
- Originally going to focus on multiple types of energy consumption, however, access to data was not equal across all different types of energy
- Deciding what parameters to filter the data with
- Data was very complex, there were many factors that contribute to gas consumption that we didn't have access too



QUESTIONS

- Open-floor Q&A with the audience

