

Exercise 3 Report: Uncovering Environmental Disparities in Fossil Fuel Usage in the United States

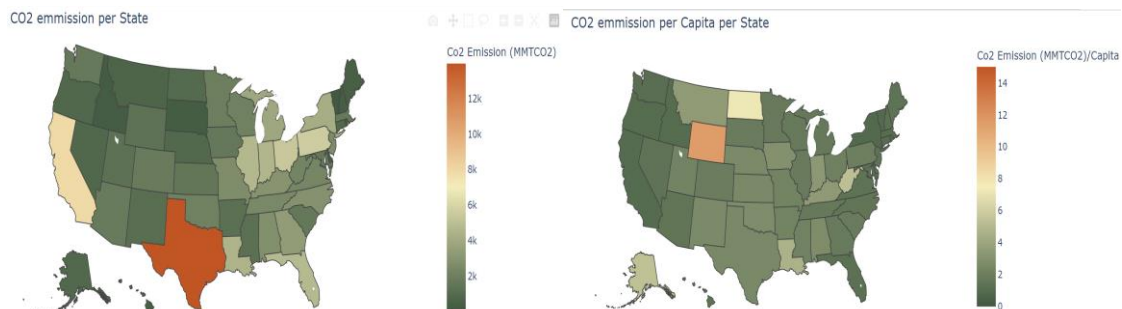
Motivation: This data analysis project focuses on investigating the patterns and trends in CO₂ emission resulting from the combustion of fossil fuel in the United States. The primary goal is to identify which state has the highest total combustion value and determine if this ranking changes when considering per capita combustion and then investigate the sector that has the highest contribution to the combustion. By comparing both total combustion values and per capita combustion values, we can pinpoint which states might require more attention in terms of environmental policies and sustainability efforts. ([Reference](#))

Data augmentation: The researcher initiated the process by integrating data from two distinct CSV files - co2-population.csv and FIPS code for US states, creating a consolidated dataset that offered a better way to connect to the provided JSON file. To ensure equitable state-to-state comparisons, a new field, "value/population," was introduced, normalizing combustion values by considering the population of each state. To calculate precise per capita combustion values, population data were extracted from the Value column under the Sector "Population".

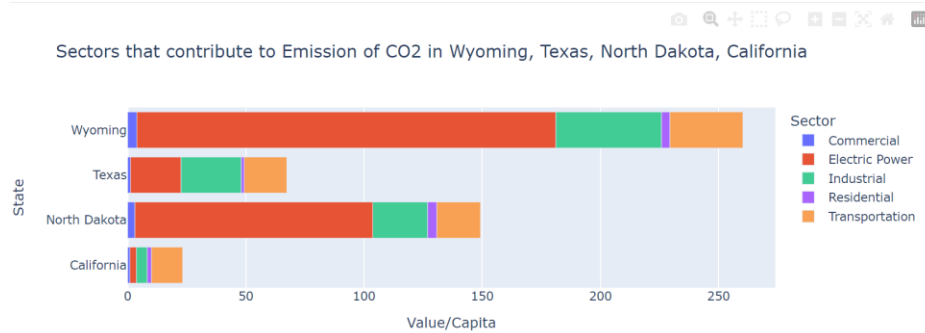
Task: The objective is to identify which state has the highest total combustion value and determine if this ranking changes when considering per capita combustion.

Expressiveness of design: The design choices made in this data analysis project were carefully considered to effectively convey the information regarding CO₂ emissions and environmental disparities in fossil fuel usage in the United States. The following visual elements were used to enhance expressiveness.

Choropleth Maps (CO₂ Emission per State and CO₂ Emission per Capita per State): The choropleth maps provide a geographical perspective of CO₂ emissions across states. The color coding helps viewers easily identify regions with higher or lower emissions. Hover-over data adds interactivity and enables users to access specific information about each state's emissions.



Bar Chart: The bar chart is a straightforward way to compare sector-specific CO₂ emissions for four selected states: Wyoming, Texas, North Dakota, and California. This chart highlights how emissions are distributed across sectors in these states.



Effectiveness of the Solution: This data analysis project effectively addresses the objective of identifying states with the highest total combustion value and whether this ranking changes when considering per capita combustion and effectively visualizes the sector that has the highest contribution to the combustion in selected 4 states.

The choropleth map indicating CO2 emission per state indicates that Texas and California are the states with higher emissions. The choropleth map indicating CO2 emission per capita per state indicates that Wyoming and North Dakota are the states with the highest emissions whereas Texas and California are not even close to the higher emissions states.

The bar graph shows which of the sectors was more responsible for CO2 emissions in selected 4 states. This helps in concluding immediately why Electricity plays a major part in CO2 emissions in Wyoming and North Dakota

Interaction: Interactivity is a valuable aspect of this data analysis project as it enables users to explore the data further. The following interactive elements enhance user engagement:

1. On choropleth maps, users can hover over each state to view specific CO2 emission data, helping them gain insights into regional variations.
2. The bar chart allows users to compare CO2 emissions by sector since they are color-coded, facilitating a deeper understanding of sector-specific contributions.

Conclusions: Based on the analysis conducted in this project, the following conclusions can be drawn:

1. The state with the highest total combustion value is Texas, indicating a significant contribution to CO2 emission.
2. States with high total CO2 emission values per capita (Wyoming, North Dakota) experience extremely cold winters, which creates an increased demand for heating and energy which is why the contribution of the Electricity sector is high in these two states. These states may require more focused interventions to reduce their carbon footprint and mitigate the impact of fossil fuel usage on climate change.
3. When considering per capita combustion values, the ranking of states with the highest emissions changes. This highlights the importance of accounting for population size when evaluating environmental disparities.