“Drill, baby, drill”

The aim of this project is to explore the extent to which the United States is well positioned to phase down fossil fuels by analyzing global fossil fuel production, consumption, economic factors, and climate policy willingness.

I. Overview and Motivation

This visualization project was designed to assess the countries’ potential to reduce fossil fuel production – and particularly the potential of the United States. We focus on identifying the biggest producers and consumers of fossil fuels historically and currently, to understand global positioning and trends. Additionally, we evaluate economic factors including fossil fuel rent (USD per barrel of oil equivalent), GDP per capita, and emissions intensity of fossil fuel production to gauge which countries might face fewer obstacles economically or environmentally when reducing emissions. Lastly, the project incorporated an analysis of international climate policies to understand countries' willingness and commitments to phase down fossil fuels.

However, we note that the initial focus of our project included not only oil and gas, but coal as well. However, we decided to exclude coal as it would require a significant amount of additional cleaning even though coal has become increasingly less relevant, with countries already phasing down coal in the past few decades. Additionally, we had considered more broadly defining why countries should phase down fossil fuels, instead of focusing on the United States.

The motivation behind this approach is to provide a multidimensional perspective on the complex issue of fossil fuel reduction, revealing not only capability but also economic and political readiness.

II. Questions

Our objective is to provide a comprehensive, data-driven approach to answer the following questions

1. *Who are the biggest producers of fossil fuels today and historically?*

By analyzing consumption data, we identify leading countries such as China and the US and illustrate how energy consumption patterns have evolved.

2. *Who are the largest fossil fuel producers and consumers globally?*

We examine historical data and current levels of production to contextualize the United States’ role compared to other major producers like Russia, Saudi Arabia, and Canada.

3. *Which countries are economically best positioned to reduce fossil fuel use based on fossil fuel rents?*

Fossil fuel rent per barrel equivalent highlights countries that derive less economic benefit per unit of production, potentially signaling greater financial feasibility of transition.

4. *How do GDP per capita and emissions intensity inform a country's capacity for reducing emissions?*

We consider per capita economic wealth and emissions intensity of fossil fuel production; countries with lower GDP per capita or lower emissions intensity might face different challenges or opportunities in decarbonization.

5. *What are the climate policy commitments and the willingness of countries to reduce emissions?*

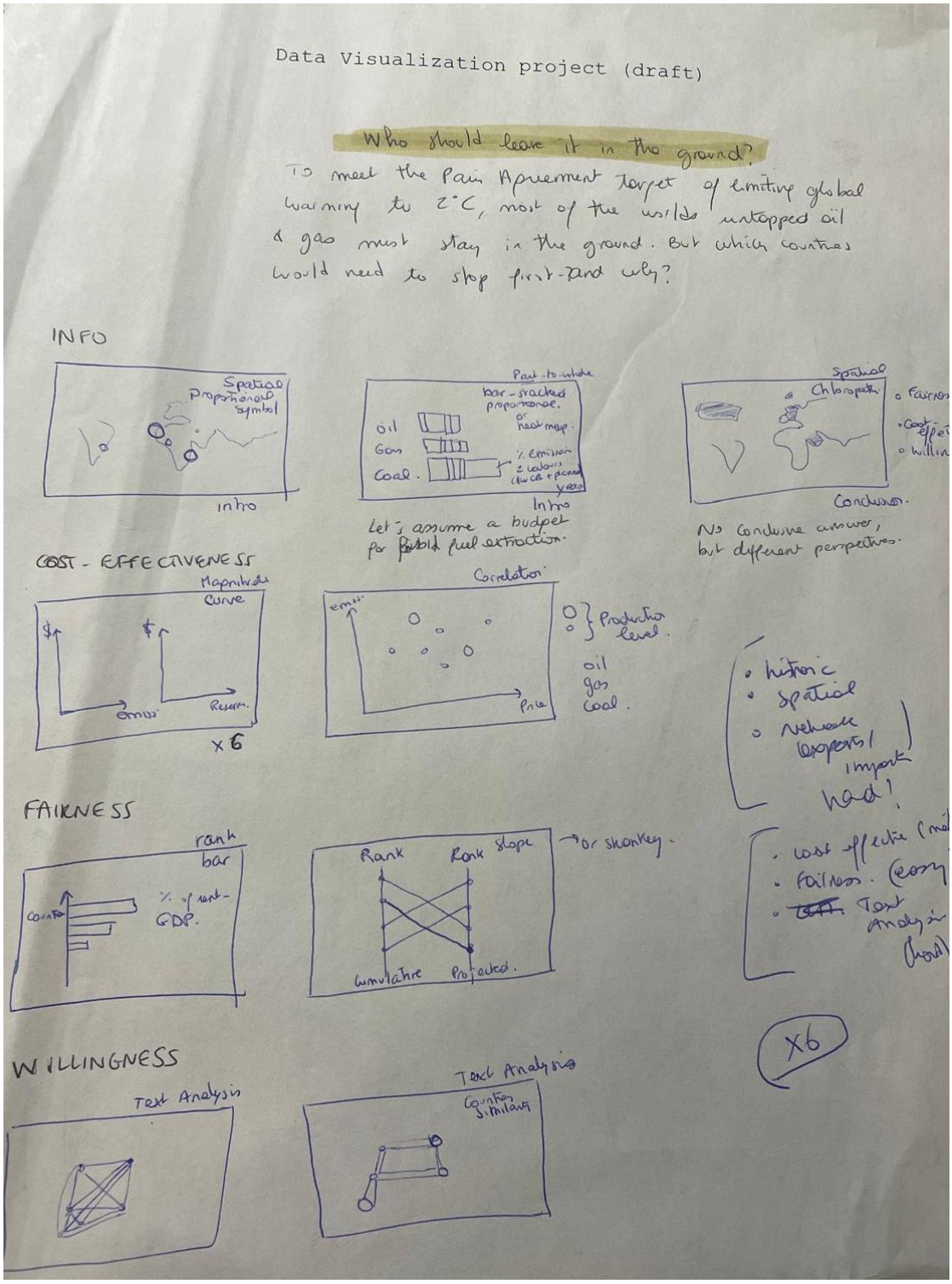
Analysis of global climate policies allows us to understand political will and readiness, providing a lens to view actual emission reduction potential beyond economics and production metrics.

III. Data

We used three datasets. Our first dataset comes from the U.S. Energy Information Administration (EIA). It includes data on Petroleum and Natural gas consumption and production. The second dataset is from the Climate Change Laws of the World which includes over 5000 climate policies, information about the countries that have adopted the policy, a description of the type of document (law, strategy, etc.), a summary of the document content. For our project we only used a subset of this larger dataset. The third dataset set is from the Global Registry of Fossil Fuels. It contains data from 139 fossil fuel producing countries, including Rent (USD), GDP per capita, and emissions intensity (gCO2/boe). For our project, we had to harmonize countries to be able to keep consistent across charts.

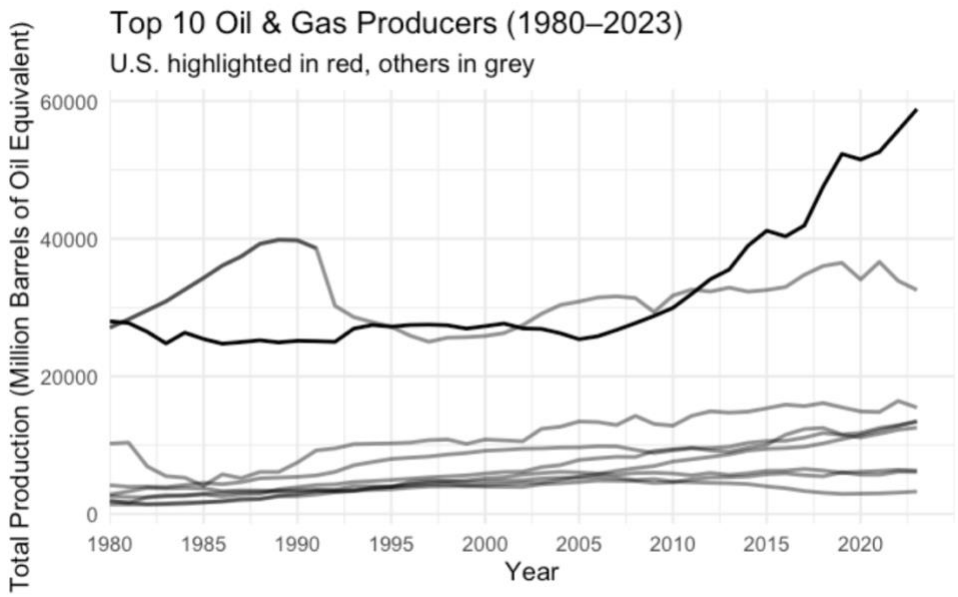
IV. Design evolution

This data visualization project evolved through several phases with the goal of creating clear, insightful, and consistent visuals focused on oil, gas, and coal. The initial phase aimed to produce nine charts encompassing diverse formats—two maps, two text analyses, and five static charts—each presenting a unique aspect of fossil fuel data. A key challenge throughout was maintaining visual and thematic consistency, while avoiding information overload that could confuse users.

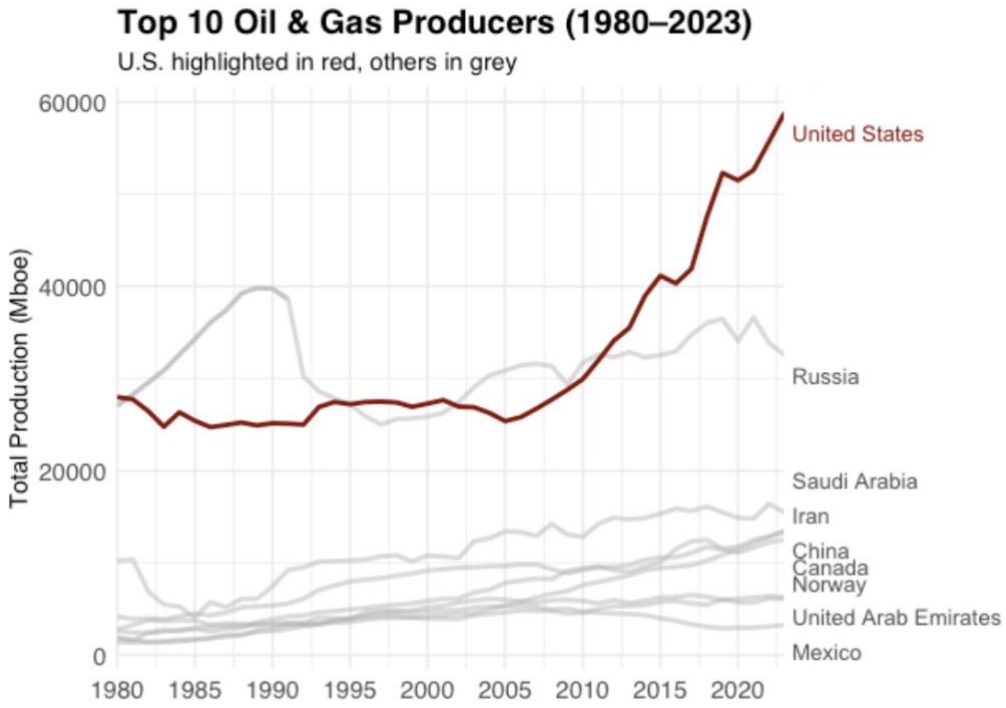


The first chart, *Historical Trends* of the top 10 oil and gas producers from 1980 to 2023, initially suffered from poor readability due to overlapping lines, which obscured the data's message. To resolve this, we added country labels on the right-hand side margin of the chart. We preferred this over interactivity because the overlapping lines would make it hard to see what line the user was selecting. In addition, the right-hand side legend ultimately gave the top 10 ranking for 2023. Emphasizing the United States as a distinct outlier helped direct audience attention effectively.

First version



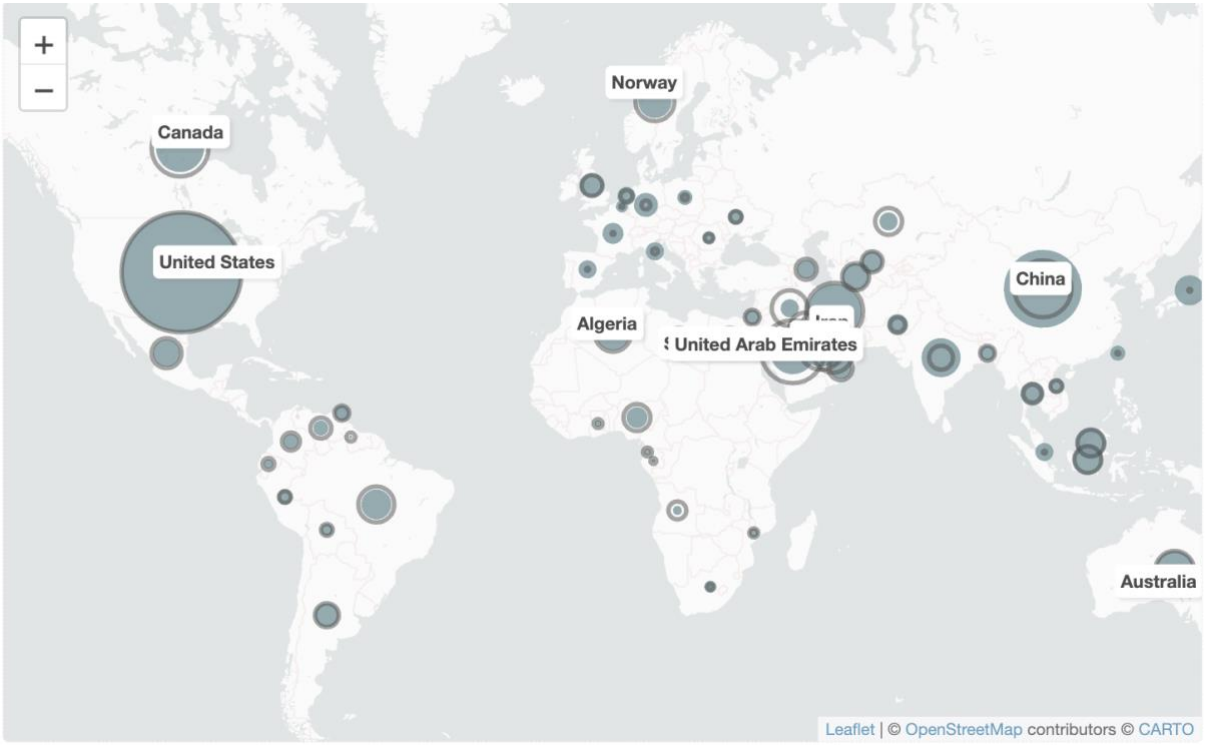
Last version



For the second chart, the *Top 50 oil and gas consumption around the world in 2023* map, the original idea combined nodes proportional to both production and reserves across three fossil fuel types on a map. However, this approach resulted in clutter and cognitive overload. The design was refined to focus on production and consumption for the top 50 countries, incorporating visible data labels only for the top five, with hover features for the rest. The use of filled circles for consumption and hollow circles for production subtly conveyed net export

insights. Further feedback from classmate suggested changing the colour palette as our selected muted tone could be hard to see, especially considering users with colour-blindness. We also readjusted the data label for further clarity and a legend.

Second version



Final version

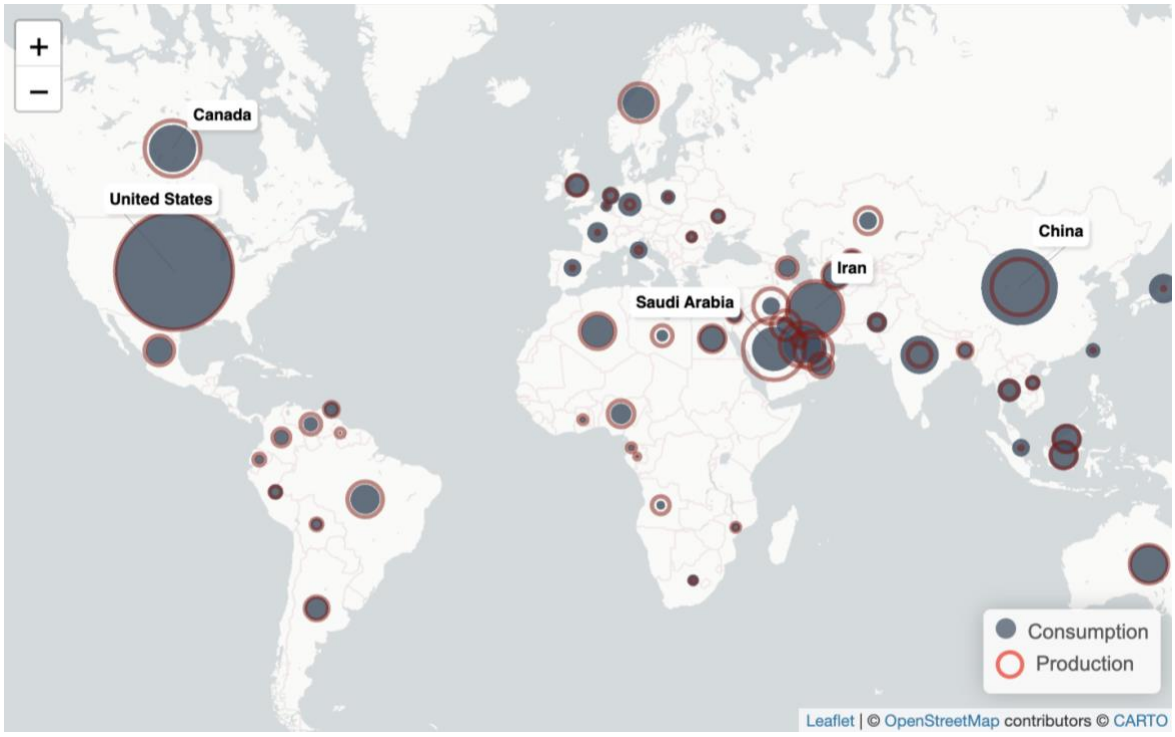
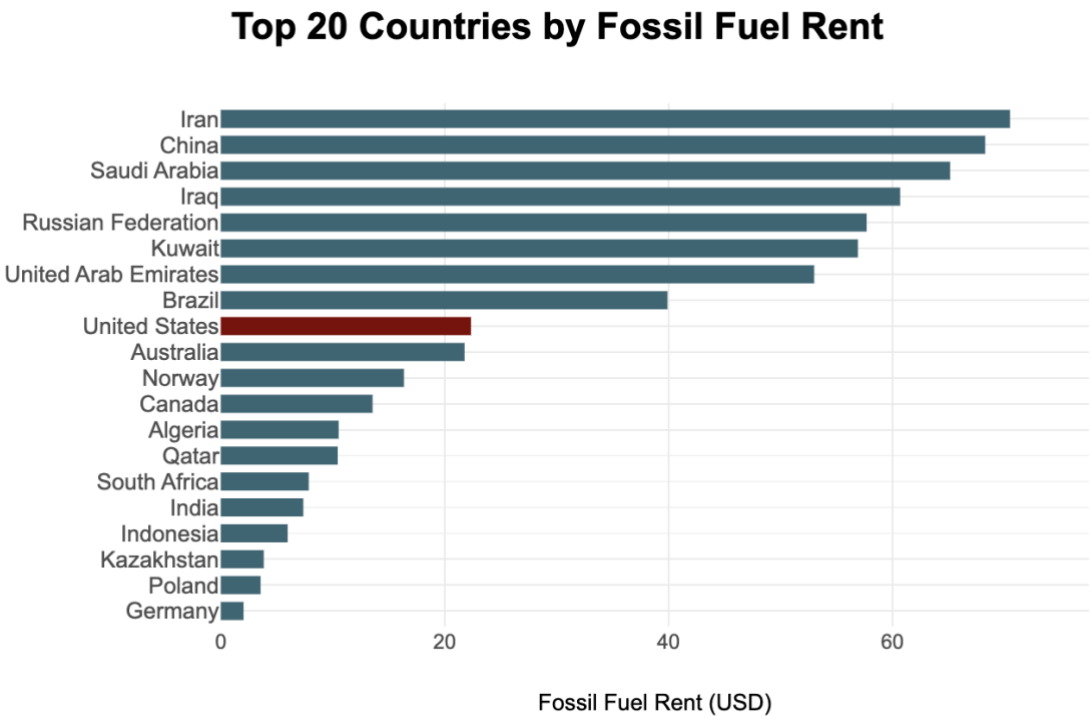


Chart 3 underwent few changes from the first version. It presented a horizontal ranking to aid reading of country names. Feedback from classmates further encouraged us to include a clear definition of “fossil fuel rent” to assist users unfamiliar with the term.

Second version



Final version.

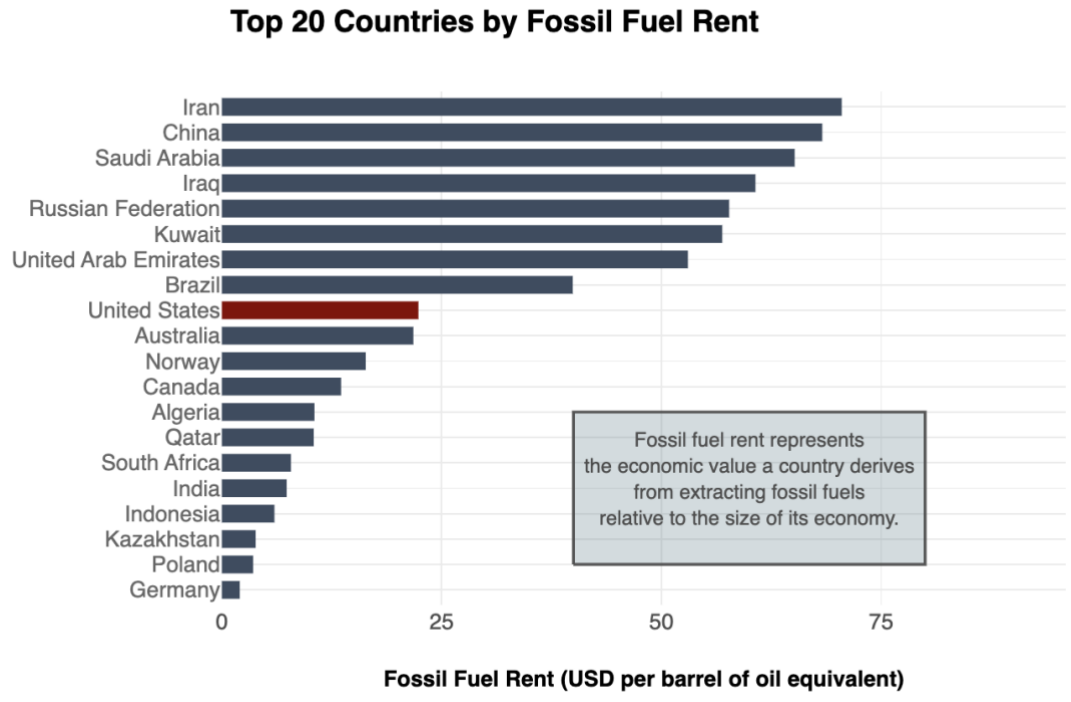
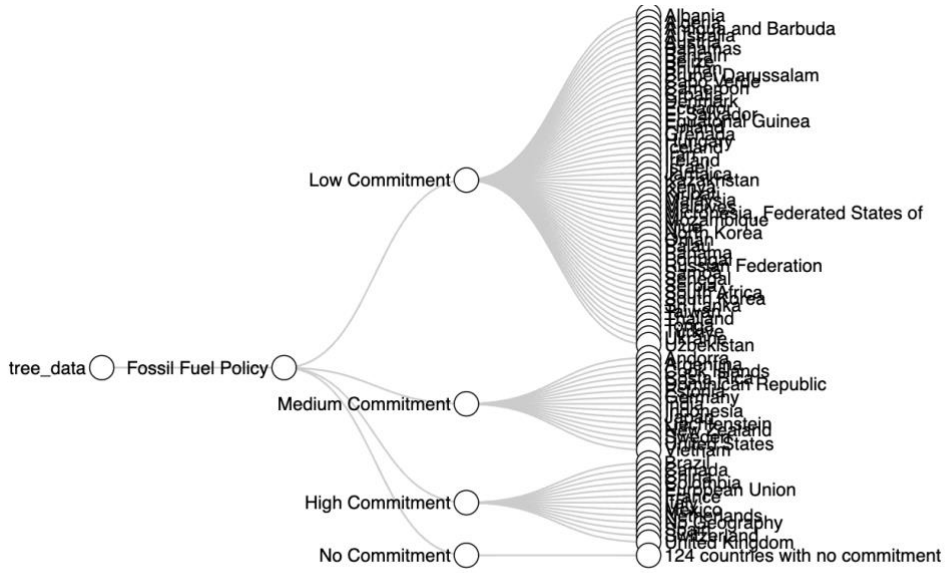
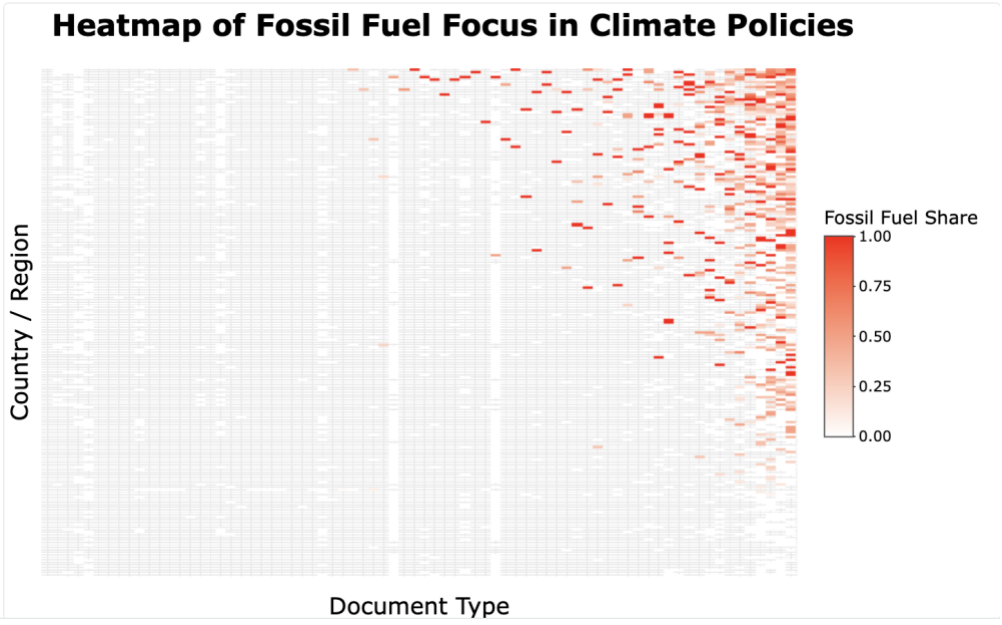


Chart 4 posed the greatest design challenge, originally conceived as a complex tree illustrating fossil fuel mentions by country and document type; the visual was too dense and unreadable. Our second option was to create a heatmap of fossil fuel mentions in climate policies. This gave us the advantage of more clearly seeing the distribution of fossil fuel mentions across all 5000 climate policies. However, two issues made the graph difficult to read. First, using white in the scale for Fossil Fuel Share hid a number of documents that briefly mentioned fossil fuels. We therefore had to change the palette to accommodate this. Secondly, the heatmap made it difficult to read which countries and document types had mentioned fossil fuels. The design therefore changed to an interactive heatmap with scrolling, accommodating over 5,000 data points.

First version (abandoned)



Intermediary chart



Final version

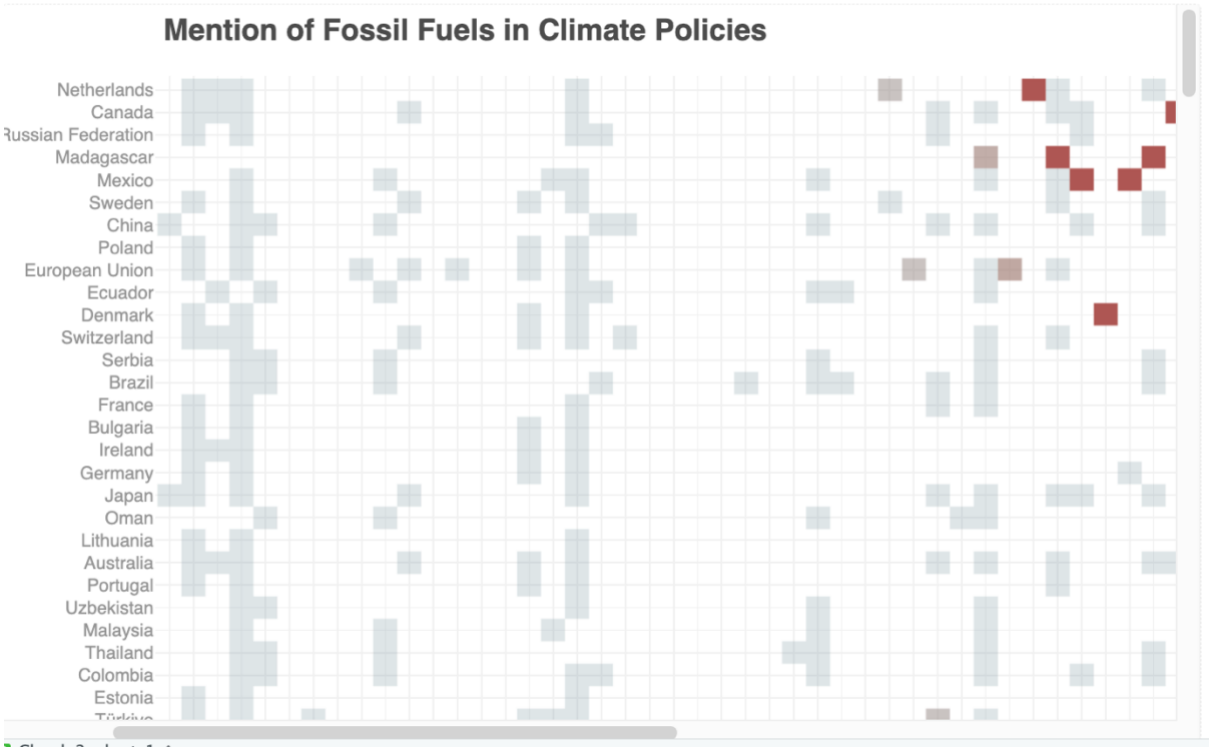
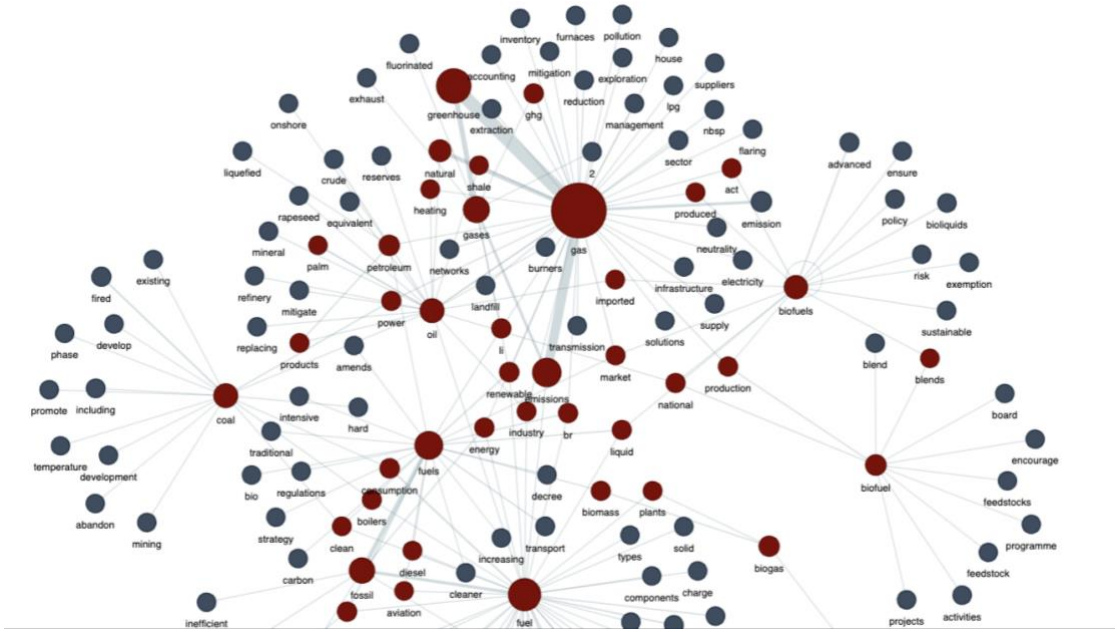


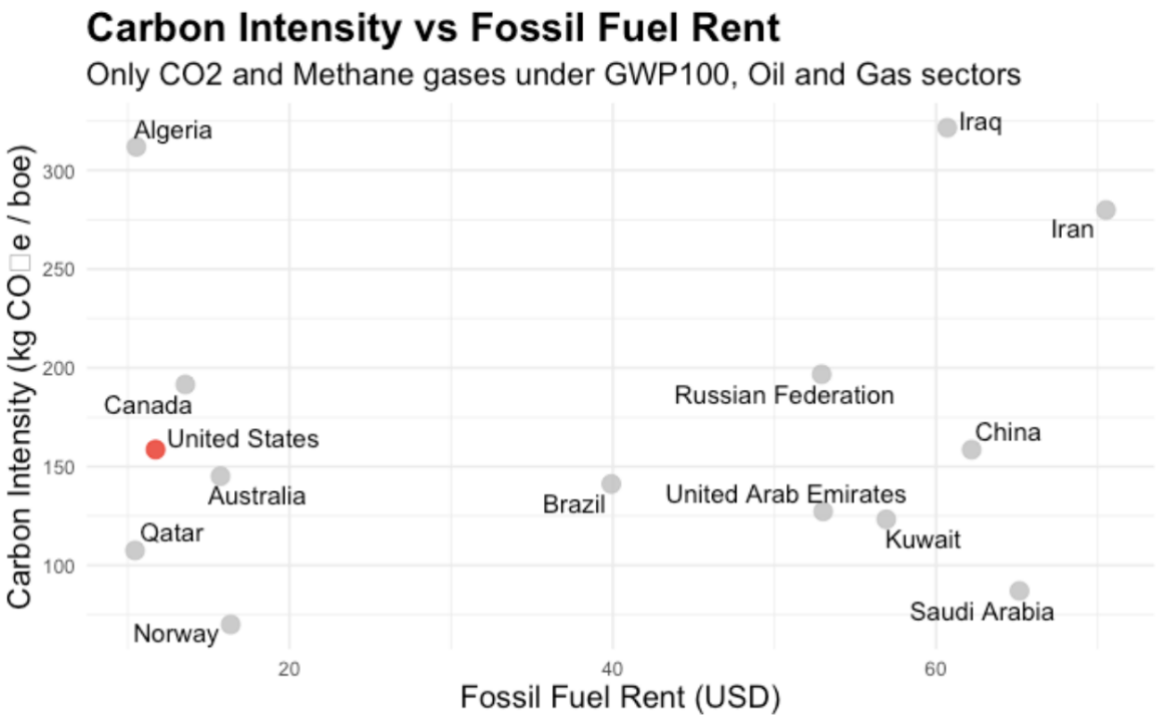
Chart 5 complemented Chart 4 by displaying a word network linking gas and oil to related terms, reflecting climate policy content. The main edit with this chart was a change from a static chart to an interactive one that would help the user identify how fossil fuel was mentioned.

Final version

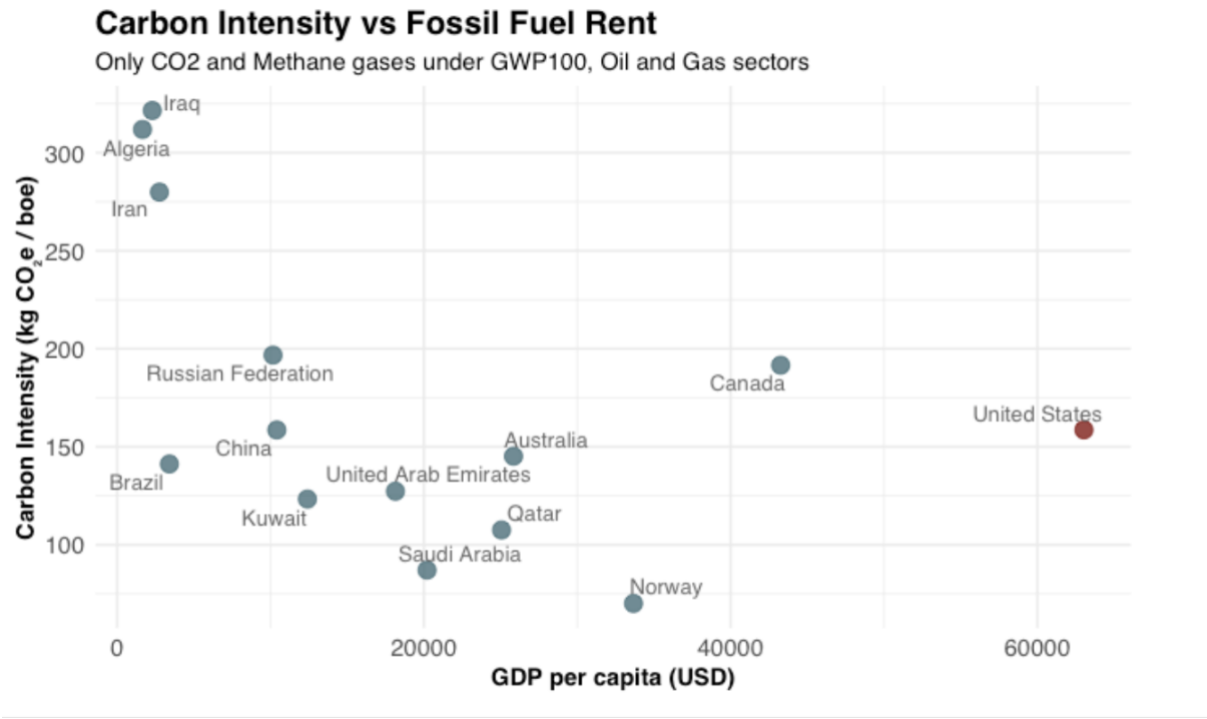


Finally, Chart 6 provided a fairness perspective by depicting countries' emission levels relative to GDP per capita, revealing disparities in environmental impact and economic status. The intermediate chart focused on fossil fuel rent (USD), however we found that this was redundant given previous charts, we therefore decided to move on to a chart with a focus on GDP per capita. In addition, the feedback we received encouraged us to (1) sense-check our GDP per capita figures who were indeed being double-counted, (2) align formatting with previous charts in terms of font.

Intermediate chart



Final chart



Overall, the project demonstrated a design evolution focused on balancing detailed data presentation with user-friendly interfaces, ensuring that each chart effectively communicated its story while fitting cohesively within the broader visualization narrative.

V. Conclusion

The suite of charts collectively underscores the complexity and urgency of addressing fossil fuel production and consumption in the pursuit of Paris Agreement goals. They reveal how countries vary widely in their production volumes, economic dependence on fossil fuels, and engagement with climate policies. Notably, the United States emerges as a dominant producer and consumer with substantial economic capacity to lead transitions, yet also faces unique challenges due to its high internal demand and political narratives supporting continued extraction.

By systematically examining production trends, consumption patterns, fossil fuel economic reliance, policy discourse, and fairness in emissions intensity, these visualizations invite a nuanced understanding of global fossil fuel dynamics. They highlight the importance of prioritizing countries' climate responsibilities according to both their contribution to supply and the socio-economic context shaping their energy systems. The inclusion of interactive elements and clear, targeted designs enhanced accessibility and helped users explore data complexity without overwhelm.

Ultimately, these charts form a coherent narrative illustrating that effective climate action requires coordinated, equitable efforts to cut fossil fuel production, especially among top producers like the United States. The data-driven insights here provide a foundation for informed dialogue and decision-making, necessary to break the cycle of fossil fuel dependency and mobilize global commitment to a sustainable, low-carbon future.