COM-480 Data Visualization

Global Energy Lens

Visualizing Today's Climate and Energy Dynamics

Introduction

We've developed a dynamic, data-rich platform to untangle the complex world energy landscape. Our site features four core sections - an interactive globe, temperature anomaly and global warming visuals, CO2 emission sources, and the interplay between income and clean energy access.Our objective is to make complex energy data accessible and engaging, promoting transparency and knowledge-sharing as tools for societal change. As we navigate urgent energy and environmental challenges, our platform aims to stimulate dialogues, inspire actions, and contribute towards a sustainable, equitable energy future.

Journey to Insights: The Process of the Visualization

Creating our webpage involved a complex, multi-step process, from layout design and color choice to content selection, data visualization, data processing, coding implementation, and final aesthetic touches.

We began with an interactive layout design, opting for a long, scrolling page reminiscent of an interactive science report. This choice allows for an engaging user experience, encouraging exploration and learning through interactive data visualization.

Color was a crucial consideration. We decided on a calming and engaging combination of blue, green, and black as our theme colors. These choices aimed to evoke feelings of nature and the environment, reinforcing the central theme of our site - energy usage and its global impact.

When it came to content selection, we approached from a global perspective, focusing on countries' energy usage and developmental changes. Our goal was to present a comprehensive overview of energy consumption trends worldwide.

We strived to find the perfect balance between information display, aesthetic appeal, and user engagement in our chart selection. To achieve this, we opted for various visualizations that could effectively communicate complex data in an engaging and visually appealing way.

Our data, originally downloaded in CSV format from various online resources, required meticulous processing. We converted the data into specific JSON formats suitable for our visualization tools, ensuring the accurate representation of our insights.

In terms of coding implementation, we utilized HTML, JSON, d3.js, and Echarts. The combination of these technologies allowed us to bring our data visualizations to life, creating an interactive and user-friendly platform.

Finally, we concentrated on layout polishing and aesthetic enhancement. We added a green wave element to the site design to imbue a sense of dynamism and fun. It's touches like these that we believe significantly enhance the user experience, making learning about energy usage and climate change enjoyable as well as enlightening.

Challenges and Decisions in Design

In our journey to craft a compelling website from a deluge of data, the most formidable challenge we faced was the efficient amalgamation of diverse information into a cohesive story that is not just engaging but also precise in delivering the intended message. It involved a relentless search for a balance between communicating effectively and retaining the richness of the original data.

We dove into countless examples, gaining inspiration from brilliant media websites, data communities, and the websites with similar topics, before making our decisions. Moreover, the task of choosing the optimal data visualization charts for each part of the website added another layer of complexity. This was a critical step as the right visual representation could significantly enhance comprehension and engagement, thus ensuring that our audience grasps the nuances of our message effectively. We combed through a plethora of visualization types, considering their strengths and limitations in relation to our data and

objectives, and selected the best-fit charts that would seamlessly merge into our data-driven narrative.

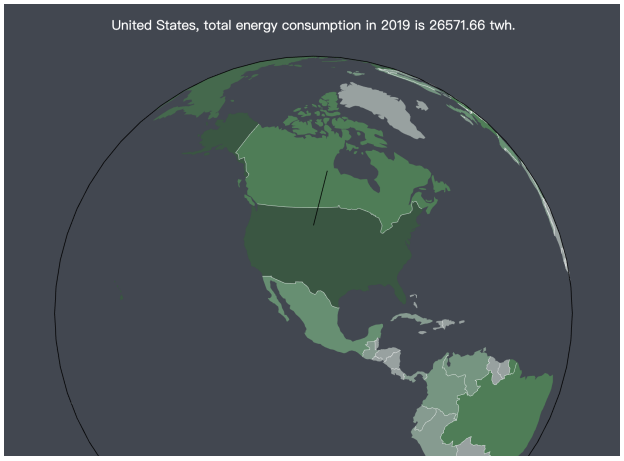
In the implementation phase, each of us is new to JavaScript and D3.js. Therefore, achieving our interactive and logical design becomes quite challenging. We invested significant additional time to learn these technical skills right from the beginning. Ultimately, we successfully met our requirements and completed our design.

Evolving Designs: From Sketches to Implementation

Part I - The rotating earth

The first element of our website is a rotating earth that fully engages the viewer's field of vision, presenting a global perspective on energy consumption. The shade of the background color changes based on this consumption: the higher it is, the darker the color becomes. This gradation in color offers users an intuitive understanding of global energy consumption, enabling our audience to better grasp the worldwide scope of our project.

Our initial idea was to let users freely rotate the globe while offering two versions of information, specifically energy consumption on a national scale and per individual. However, we eventually realized that implementing these different rendering modes was technically challenging and significantly slowed down the webpage's rendering speed. Consequently, we simplified our approach. Our globe now only reflects the most critical data - the annual energy consumption of each country - and presents what we most wanted our audience to understand through this globe: an awareness of the global scale of our project.



Part II - Climate change caused by human activities

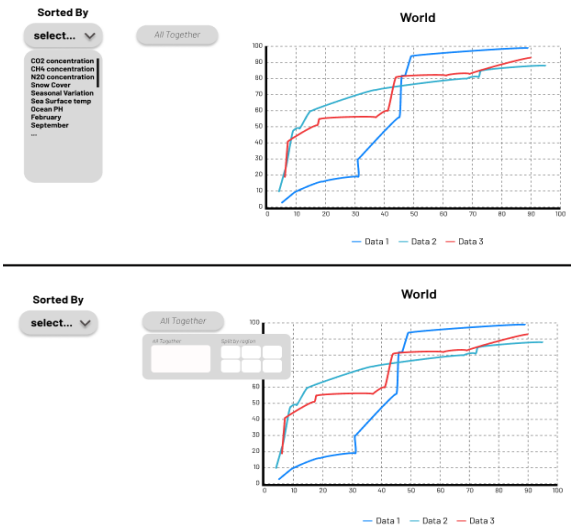
Initially, we planned an interactive section to explore climate change and greenhouse gas

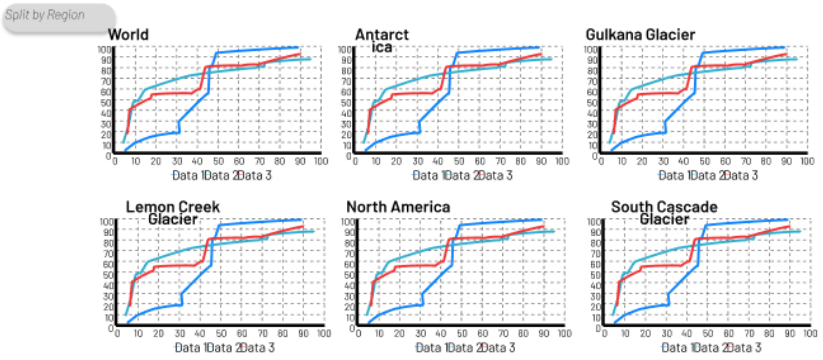
emissions trading. Yet, as our research highlighted CO2 as a key driver of climate change, we refocused on greenhouse gas emissions and climate change, sidelining other factors.

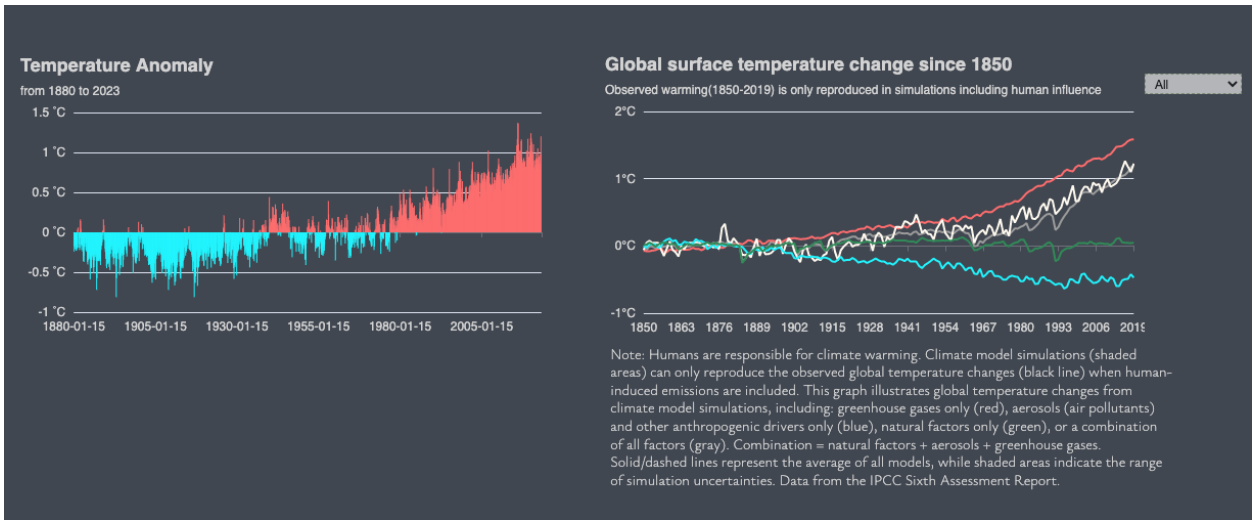
In visualizing temperature changes, we opted for a departure from the traditional line graph. Instead, we implemented a bar line chart to denote changes in temperature, utilizing contrasting colors of red and blue for maximum clarity. Accompanying this is a simulation graph of temperature changes, using data from the Sixth IPCC Assessment . This graph underscores the extent to which anthropogenic, or human-centered, warming diverges from the natural global warming cycle.

Realizing that world average temperature changes sufficiently represent global trends, we omitted localized variations to prevent information overload and maintain an engaging user experience.

These changes underscore the industrial nature of the current global climate change and debunk popular notions that contemporary global warming is merely a feature of Earth's natural warming cycle. Moreover, all these modifications and adjustments were strategically made to set the stage for the subsequent section of our narrative. By streamlining our focus and enhancing our visualization techniques, our design aims to contribute to a deeper understanding of the complex relationship between greenhouse gas emissions and global climate change.

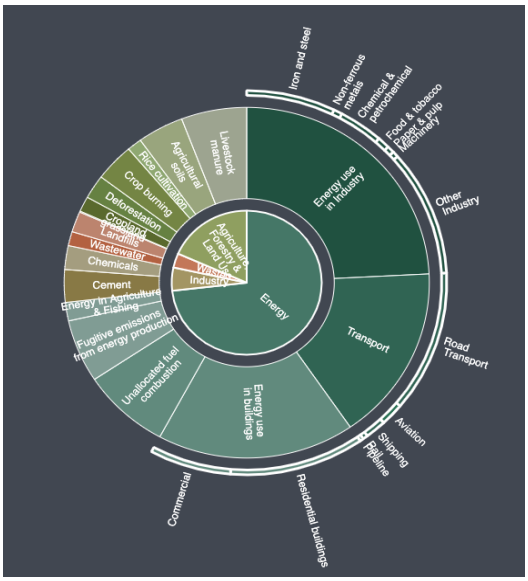






Part III - Global greenhouse gas emissions

In the course of our research, we found that the primary source of CO2 emissions - one of the key greenhouse gasses driving global warming - is energy usage. Consequently, we added a new section titled "Where do global greenhouse gas emissions come from?" to our platform.



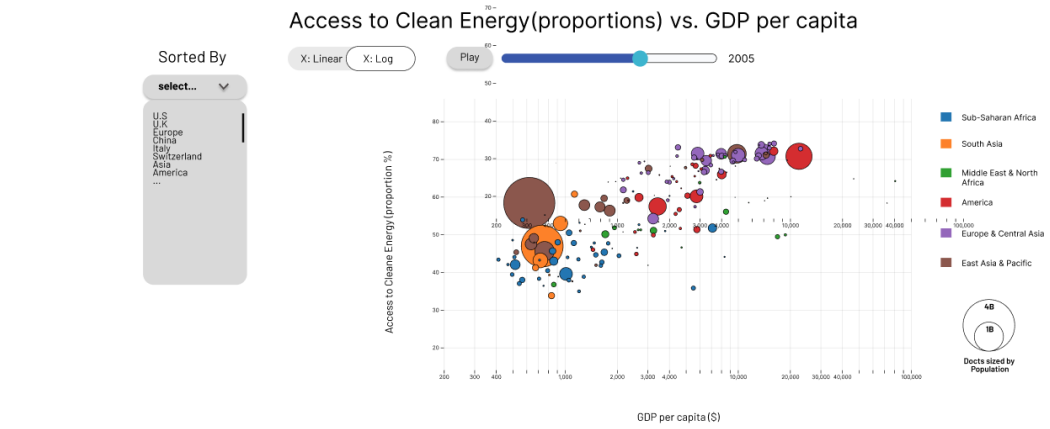
The main objective of this addition is to enhance users' understanding of the specific sources of CO2 in our daily lives and the connection to energy consumption. By shedding light on how our energy use translates into CO2 emissions, we aim to highlight the importance and potential impact of transitioning towards low-carbon and clean energy solutions. Through this enhanced understanding, we hope to inspire individual and collective actions that can contribute significantly to mitigating climate change.

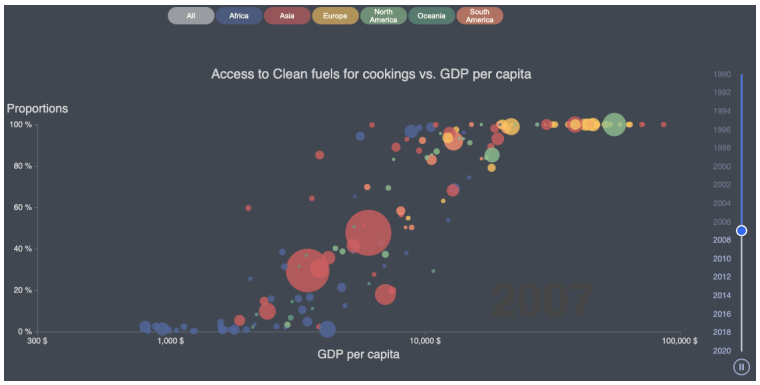
Part IV - Income & access for clean energy

In our newly enhanced section on 'Income and Access to Clean Energy,' we've incorporated a detailed introduction to various energy types using a ladder chart. This addition offers users an in-depth understanding of different energy sources, setting the stage for a clearer comprehension of clean energy in subsequent visuals.

One significant feature is a chart on 'Access to Clean Energy for Cooking,' revealing how different income households obtain their energy. To manage the vast number of countries, we've categorized them by continent, selecting specific countries within each for a more detailed analysis. Besides, we delete data processed by linearizing for reducing redundancy and showing data clearly. The scatters integrate information like continent, country, population, proportion and GDP. Users can see a comprehensive presentation.

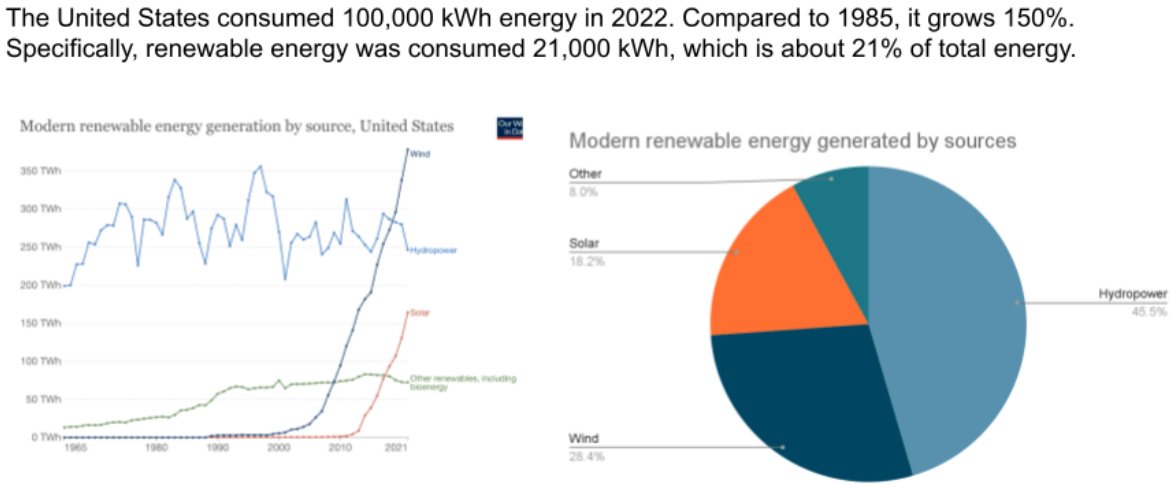
To engage users and track overall trends, we've connected the points representing changes over time, creating a clear trajectory. This novel approach enables users to trace changes in a country's per capita GDP and access to clean energy, and effectively compare these two variables. We believe these enhancements will enrich our users' understanding of the interplay between income and access to clean energy.



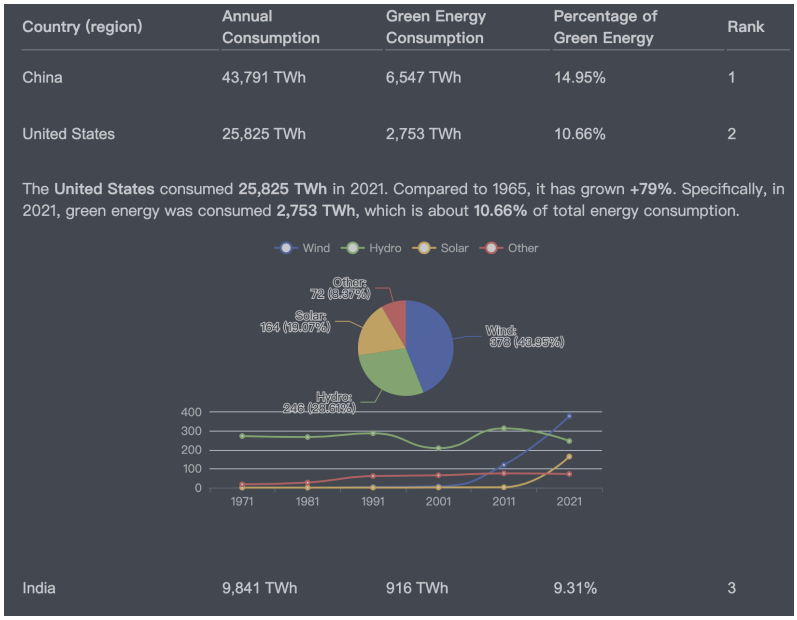


Part V - Green Energy Future

This part aims to dominate the low-level of development in green energy of top energy consumption countries and to show their green energy generation details by source. Initially we decided to design a table which contains the summary of the top 5 countries' energy consumption information. When you click each row, a detailed information plus one line chart which contains the time series data of each green energy sub-category and a pie chart which contains the portion of each green energy in 2021. The original design is shown below.



When we searched Enchart, we found a more interactive design which combines the time series data and pie chart, where the pie chart could show a portion of each green energy of any time you select on the line. We decided just to use years [1971, 1981, 1991, 2001, 2011, 2021] in order to give the audience the trend but not too much information. The final table is shown below.



Peer Assessment

Weier Liu: Web design, data visualization and its description for Part I. Screencast video.

Xinyi Ding: web design, data visualization and its description for Part II, Part III and Part IV.

Sijia Du: Web design, data visualization and its description for Part V. GitHub wrap up.