Individual Energy Choice and Climate Concerns

Abstract:
This visualization provides an in-depth exploration of individual energy choice and their thoughts in climate change. Glocal energy consumption patterns are also analyzed, focusing on renewable and non-renewable energy sources across various countries. Using a series of data visualizations, this project presents a comparative analysis of different energy choices made by individuals and the potential reasons behind. Besides, using survey data, the project explores how different demographic segments respond to combinations of energy and pricing scenarios, showing preferences for green energy options with varying costs and environmental benefits.

1. Introduction

This project aims to focusing on individual and global energy choice and individuals' climate concerns. The visualization has analyzed and visualized global energy usage, with a specific focus on renewable energy sources like bioenergy, solar energy, hydropower, and wind energy. The purpose is to understand how countries vary in their energy preferences and how these choices evolve over time. The motivation behind this analysis is to offer insights into global energy transitions, which are crucial for addressing climate change and meeting sustainability targets. In addition, this project also visualizes the relationship between individual energy consumption preferences, educational background, income levels, and climate-related concerns, which could reveal the factors hidden inside the energy choice.

2. Methodology

2.1 Data Collection
This data for this project comes from two sources. The first dataset contains energy usage information for multiple countries from 2000 to 2023. Data points include total energy consumption and the breakdown of sources such as fossil fuels, bioenergy, solar, wind, and hydropower. The second dataset is survey dataset, which captures information about individuals' preferences for green energy options, their educational background, income levels, and climate change concerns. The dataset includes several categories and variables that provide a comprehensive view of demographic characteristics and their relationship with environmental attitudes.

2.2 Visualization Techniques
Three main types of visualizations were created to represent the data:

1. **Geographical Map (Figure 1)**: This map displays the energy usage composition per country, using pie charts to show the percentage of each energy type (e.g., fossil fuels,

wind energy).

2. **Stacked Bar Charts (Figures 2 & 3)**: The stacked bar charts provide a timeline view of the energy mix in leading countries from 2003 to 2023. They highlight shifts in energy sources over time, with a clear distinction between renewable and non-renewable sources.

3. **Heatmap**: The heatmap categorizes preferences based on educational attainment, with levels ranging from compulsory schooling to doctorate degrees. The horizontal axis represents educational background, while the vertical axis depicts various combinations of green energy options and cost adjustments. The color intensity indicates the frequency of each preference combination within each educational group.

4. **Heatmap**: The second heatmap links income levels with preferences for green energy and pricing. Income ranges are shown on the horizontal axis, while green energy options are displayed on the vertical axis. The color scale reflects the frequency of each preference within income brackets.

5. **Diverging Bar Chart**: The diverging bar chart illustrates the survey respondents' self-reported concerns about climate change across several dimensions, including personal impact, sustainability behavior, and difficulties balancing sustainability with other needs. The responses range from "Not at all" to "Extremely," capturing the depth of concern for each climate aspect.

3. Visualization Analysis

3.1 Spatial Analysis
The geographical map (Figure 1) enables a spatial comparison of energy choices among countries. Each country is represented by a pie chart, sized according to total energy usage. For instance, China and the United States have the largest energy consumption, with fossil fuels still dominating their energy mix, shown by the large orange segments in their pie charts. In contrast, countries in Europe, such as Germany, display a more diversified mix, with a significant portion of renewable energy sources.

3.2 Temporal Analysis
Figures 2 and 3 showcase the evolution of energy sources over time. These stacked bar charts reveal a global trend towards renewable energy, although fossil fuels remain prevalent. From 2003 to 2023, countries such as Germany and Finland show an increase in the adoption of bioenergy and wind energy, indicated by the rising segments of green and light blue in the bars. China shows a slower transition, with fossil fuels still occupying the largest share but with slight increases in renewable energy.

3.3 Individual Energy Preferences Analysis
Figures 4 shows how educational attainment affects preferences for green energy and cost considerations, indicating that higher education levels may correlate with a greater emphasis on sustainability. Moreover, Figure 5 studies how income levels influence energy preferences,

suggesting that higher-income individuals may be more inclined to choose sustainable options despite higher costs, while lower-income groups prioritize affordability.

What's more, figure 6 assesses the extent of concern about climate change across various dimensions, showing how different populations perceive the impact of climate change and the challenges of integrating sustainability into daily life.

4. Discussion

4.1 Global Trends in Renewable Energy
The visualizations reveal an ongoing transition to renewable energy, especially in Europe and parts of North America. Countries like Finland and Germany have embraced bioenergy and wind power significantly, while China and the United States still rely heavily on fossil fuels but are beginning to diversify their energy sources.

4.2 Regional and Seasonal Challenges
Countries face unique challenges in their energy transitions due to geographical and climatic differences. For example, regions with limited sunlight have a lower dependence on solar energy. The seasonal variations captured in the circular timeline underscore these regional challenges, emphasizing the need for countries to adopt energy policies tailored to their environmental conditions.

4.3 Influencing of Education and Income in Energy Preferences
Individuals with higher educational backgrounds, such as those holding bachelor's or doctorate degrees, show a greater tendency to support green energy initiatives. This trend likely reflects varying levels of climate awareness and understanding, suggesting that education plays a crucial role in shaping pro-environmental attitudes. To foster broader public support for renewable energy, it may be beneficial to focus on educational campaigns that increase awareness of climate issues, especially targeted toward groups with lower educational backgrounds.

Higher-income respondents are more likely to choose renewable energy, even when it comes with higher costs, whereas those in lower-income brackets tend to prioritize affordability over sustainability. This highlights the financial constraints lower-income households face, which can hinder their adoption of green energy. Addressing these economic barriers through subsidies or pricing adjustments could make green energy options more accessible, promoting a more inclusive transition to sustainable energy.

4.4 Individual Climate Concerns

When individuals perceive the impacts of climate change as personally relevant, they are more likely to engage in pro-environmental behaviors. Localized messaging and community-based awareness programs that make climate impacts tangible could therefore be effective in increasing public support for sustainability initiatives.

5. Conclusion

The project's visualizations provide a comprehensive overview of global energy trends, showcasing both temporal and spatial patterns. Countries vary widely in their energy choices, influenced by both regional resources and policy. The shift towards renewable energy is evident but slow, and seasonal trends reveal additional complexities in the adoption of specific energy sources. This analysis offers valuable insights for energy policymakers and stakeholders in the push for global sustainability.

Also the findings of the survey suggest that demographic and socioeconomic factors play crucial roles in shaping attitudes toward green energy and climate change. Educational attainment influences awareness and support for sustainability, while income level affects the feasibility of choosing costlier renewable options. Personal connections to climate impacts further amplify concern levels, indicating that making climate change personally relevant can motivate individuals toward sustainable choices.

6. Future Work

Further improvements could include more detailed seasonal analyses and predictions using machine learning models to forecast energy trends based on historical data. Integrating socio-economic data could also add layers to the analysis, providing context on how economic factors influence energy transitions.

PS. I am currently working on putting all the figures in the dashboard, so no figures are shown here in the draft.