Global Energy Consumption and Sustainability Analysis

Overview of the Project and its Purpose

This project aims to analyze global energy consumption trends using the World Bank Open Data and the Global Energy Consumption Dataset from Kaggle. The focus will be on identifying changes in energy consumption over time and comparing fossil fuels with renewable energy adoption across different regions.
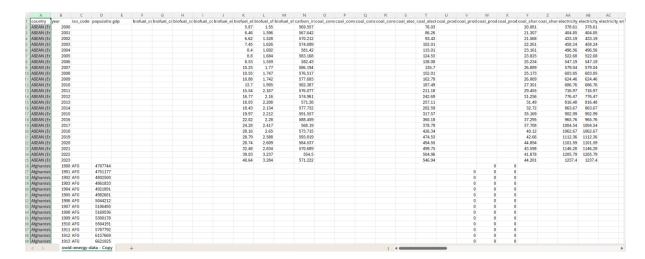
Link to GitHub:

https://github.com/singhashishpal/project3_world_energy_consumption/tree/main

Dataset Sources

Kaggle Global Energy Consumption Dataset: Energy consumption data categorized by coal, renewables, and oil.

https://www.kaggle.com/code/olgashevtsova/3-energy-the-world-and-the-city

Database Choice

We will use MongoDB to store and manage the data, as it provides flexibility in handling semi-structured datasets. MongoDB's document-based model is well-suited for managing energy data, which can vary across countries and sources. The dataset will be loaded, cleaned, and transformed before being stored for analysis.
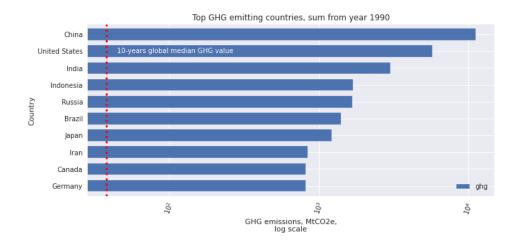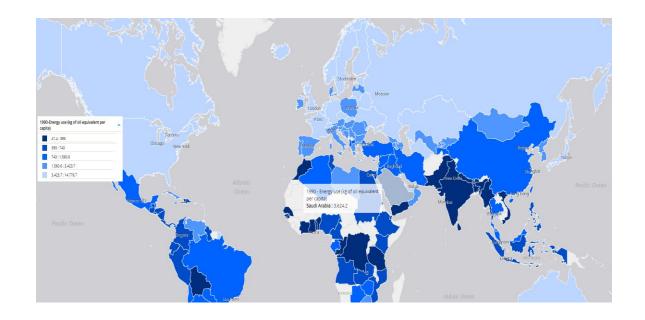
ETL Workflow

The raw data will be extracted from the World Bank and Kaggle datasets, cleaned to remove missing values, and transformed to ensure consistency in energy units. The cleaned data will be loaded into MongoDB for efficient storage and querying.
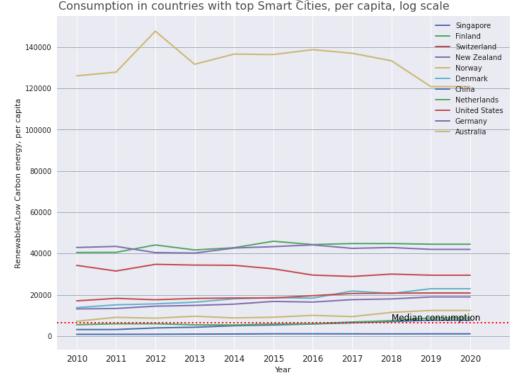
Visualizations

The project will provide multiple visualizations to showcase the global trends in energy consumption. These will offer insights into the comparison between fossil fuel usage and renewable energy adoption across different regions, as well as consumption trends over time. Additionally, visualizations will enable users to explore the per capita energy consumption by country.

Renewables/Low Carbon energy and Smart Cities
Consumption in countries with top Smart Cities, per capita, log scale

User Interaction

A web-based application will be built to allow users to select specific regions and energy sources for customized visualizations. The application will dynamically update the analysis and visualizations based on user input, such as region and year, providing a tailored and interactive experience for exploring energy data.

Key Questions to Address

- How has global energy consumption changed over time, and what are the major regional differences in energy usage?
- What is the relationship between fossil fuel consumption and the adoption of renewable energy sources in different regions?
- Which countries or regions are leading in renewable energy adoption, and how has this impacted their fossil fuel consumption?
- How does per capita energy consumption vary between developed and developing countries, and what factors might explain these differences?
- What impact does energy consumption have on climate change, and how does the shift toward renewable energy affect greenhouse gas emissions?
- How have recent geopolitical events, such as wars or political conflicts, impacted global energy consumption and the shift toward renewable energy?

Flow of project

- Use MongoDB to sort and organize the data, then convert it into a DataFrame.
- Import the DataFrame into a Jupyter Notebook to generate visualizations.
- Transfer the visualizations to an HTML page (you might need to use JavaScript for this).
- Share the HTML page link on Slack on the day of the presentation.
- Verify if there are APIs available that provide similar data for comparison.

Step Forward: Impact of Energy Usage on Climate Change and Pollution

One critical aspect of energy consumption is its effect on climate change and environmental pollution. Fossil fuels, such as coal and oil, are major contributors to greenhouse gas emissions, driving global warming. According to data from Our World in Data and the Intergovernmental Panel on Climate Change (IPCC), approximately 73% of global greenhouse gas emissions originate from the energy sector, with a significant portion tied to fossil fuels.

In contrast, renewable energy sources such as wind, solar, and hydroelectric power have the potential to significantly reduce harmful emissions. Analyzing trends may reveal how

countries with higher adoption rates of renewable energy are more successful in reducing carbon emissions and improving air quality.

Relevant data sources for this analysis include:

1. Our World in Data - Comprehensive reports and datasets on greenhouse gas emissions and climate change: [Our World in Data] (https://ourworldindata.org)

2. IPCC Reports - Intergovernmental Panel on Climate Change reports on the effects and predictions of climate change: [IPCC Reports] (https://www.ipcc.ch/reports/)

Conclusion

This project will offer a concise analysis of global energy consumption trends, highlighting shifts toward renewable energy sources. MongoDB will be used for its flexibility in handling diverse data formats, and Flask will enable efficient data interaction for users, ensuring smooth data processing and insightful visualizations.