Global Energy Trends: A Comprehensive Analysis Of Key Regions And Generation Modes Using Power BI

Team ID : LTVIP2025TMID19867

Team Size : 4

Team Leader : Dhullipalla Gangadhar

Team member : Bugatha Sanjana

Team member : Kodali Sai Dhanushma

Team member : Buridi Revanth Naga Manikanta

Technologies used:

Excel/CSV – Used as the dataset source.

Power Query – For data cleaning and transformation.

DAX (Data Analysis Expressions) – For creating calculated measures and aggregations.

Power BI – For data visualization and dashboard creation.

1. Introduction

Energy is the backbone of modern civilization, playing an indispensable role in various sectors, including transportation, industries, and daily household activities. As the world experiences rapid industrialization and urbanization, the demand for electricity continues to surge. The growing reliance on electric vehicles, heat pumps, and smart technologies further accelerates the need for a sustainable and resilient energy infrastructure.

Despite the significant progress in energy production, global CO2 emissions remain a pressing concern. Conventional power generation methods, particularly those relying on fossil fuels, contribute heavily to environmental degradation. However, the energy sector is undergoing a monumental transformation, emphasizing sustainability and efficiency. The transition to

renewable energy sources such as solar, wind, hydro, and biofuels is crucial in mitigating climate change and ensuring a greener future.

In this project, we utilize **Power BI** to conduct an in-depth analysis of global energy trends. Through comprehensive data visualization, we explore electricity consumption patterns, energy generation modes, and the impact of renewable energy integration across different regions. This study aims to provide valuable insights that can inform policy-making, drive industrial advancements, and support sustainable energy development initiatives.

2. Project Scenarios

Scenario 1: Smart Grid Implementation in Urban Areas

A metropolitan city implements a smart grid system integrating renewable energy sources such as solar and wind power. Smart meters allow real-time monitoring of energy consumption, reducing reliance on fossil fuels and enhancing energy efficiency. Key benefits include:

- Minimized energy loss during transmission
- Reduced CO2 emissions
- Improved power grid resilience

Scenario 2: Industrial Energy Management in Manufacturing Plants

A manufacturing facility optimizes energy usage by leveraging **data analytics** and predictive models. The implementation of an advanced energy management system enables:

- Real-time monitoring of energy consumption
- Identification of inefficiencies and optimization strategies
- Integration of renewable sources (e.g., rooftop solar panels) to reduce dependence on the grid
- Significant cost savings and lower carbon footprint

Scenario 3: Rural Electrification Project in Developing Countries

A rural electrification initiative brings reliable electricity to remote communities through **solar microgrids**. The integration of data analytics ensures efficient power distribution, minimizing energy wastage. Key outcomes include:

- Enhanced educational and healthcare facilities
- Economic empowerment through electricity-driven enterprises
- A scalable model for sustainable rural development

3. Methodology and Workflow

The project follows a structured **data analysis pipeline** to derive insights from global energy trends.

Step 1: Data Collection

- Acquire datasets on electricity consumption and energy generation.
- Integrate data into **Power BI** for analysis.

Step 2: Data Preparation

- Clean and preprocess the data.
- Standardize metrics and units for accurate comparison.

Step 3: Data Visualization

- Develop multiple visual representations to highlight key insights.
- Compare trends across different countries and energy sources.

Step 4: Dashboard Design

- Build interactive dashboards with filters and drill-down capabilities.
- Provide a user-friendly interface for exploring energy consumption patterns.

Step 5: Report Generation

- Summarize findings into a structured report.
- Highlight major trends, patterns, and insights.

Step 6: Performance Testing

- Optimize dashboard performance using data filters and calculated measures.
- Validate the accuracy and responsiveness of visualizations.

Data Visualization

Data visualization is the process of creating graphical representations of data to help people understand information. The goal of data visualization is to make complex data sets more accessible, intuitive, and easier to interpret. By using visual elements such as charts, graphs, and maps, data visualization can help people identify patterns, trends, and outliers quickly in the data.

38.90K

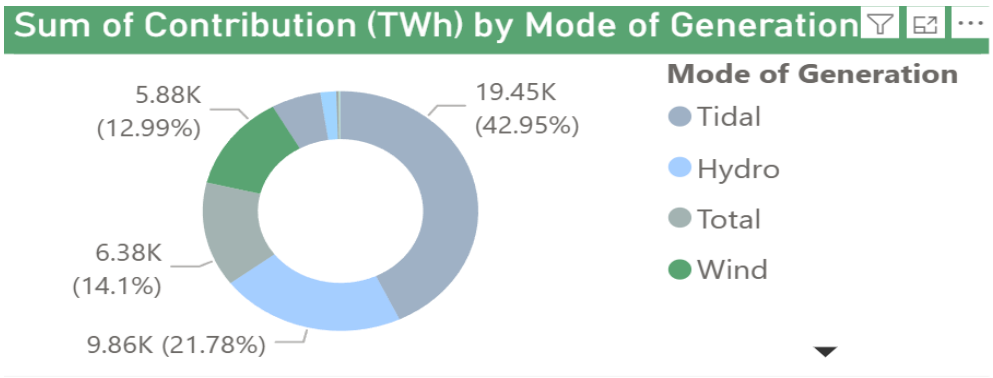
Sum_Contribution_Non...

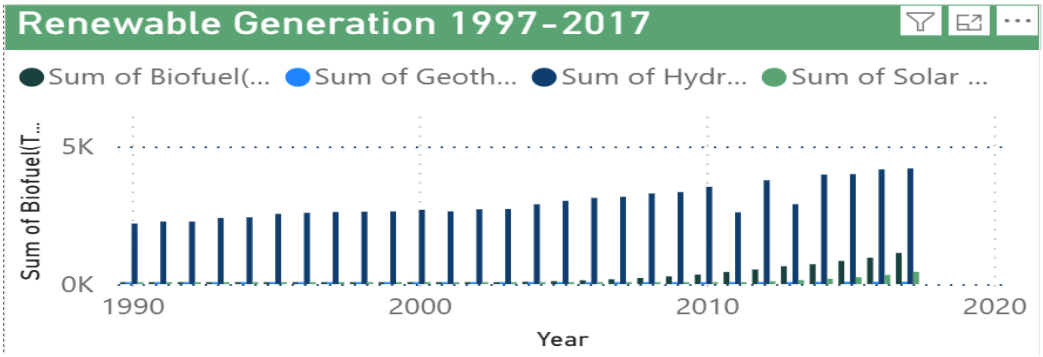
41.09M

Variance_Contribution_...

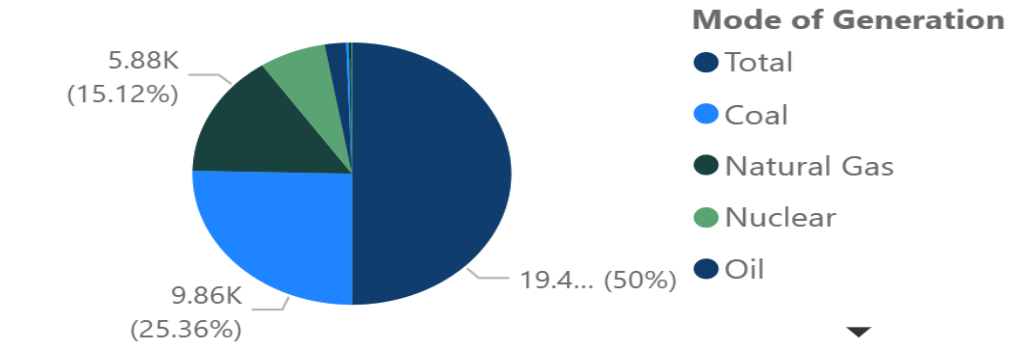
1.74K

Median_Contribution_...

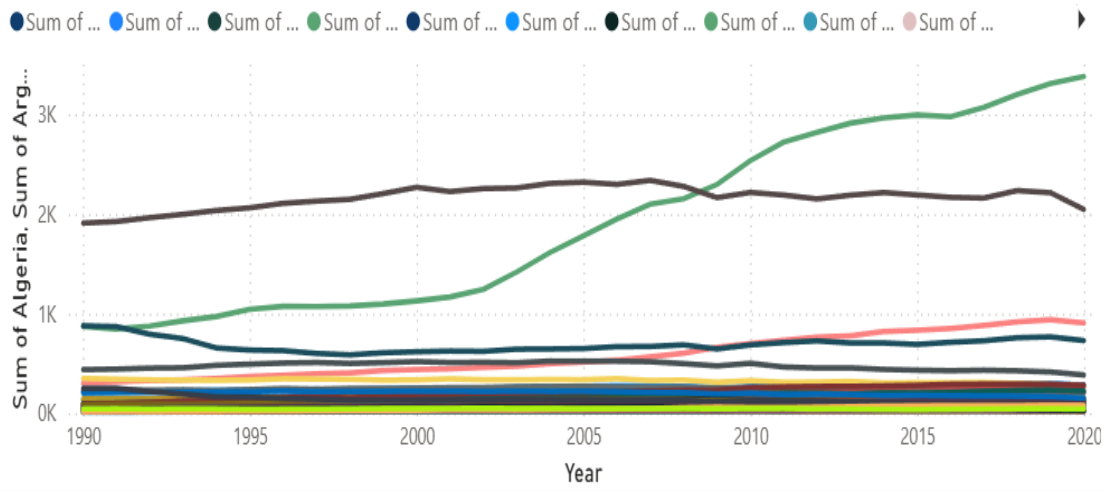




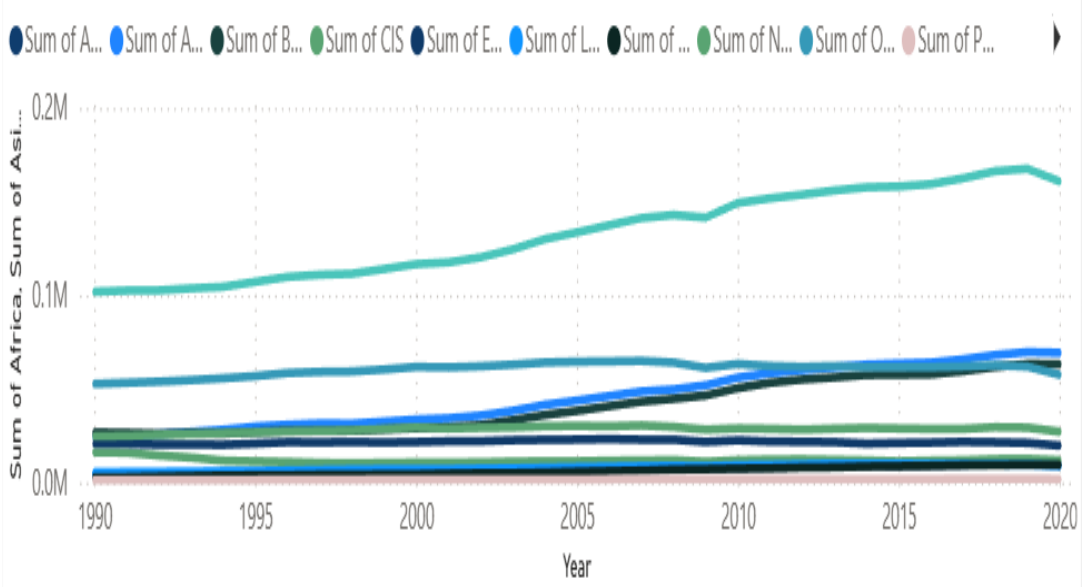
Sum of Contribution (TWh) by Mode of Generatio



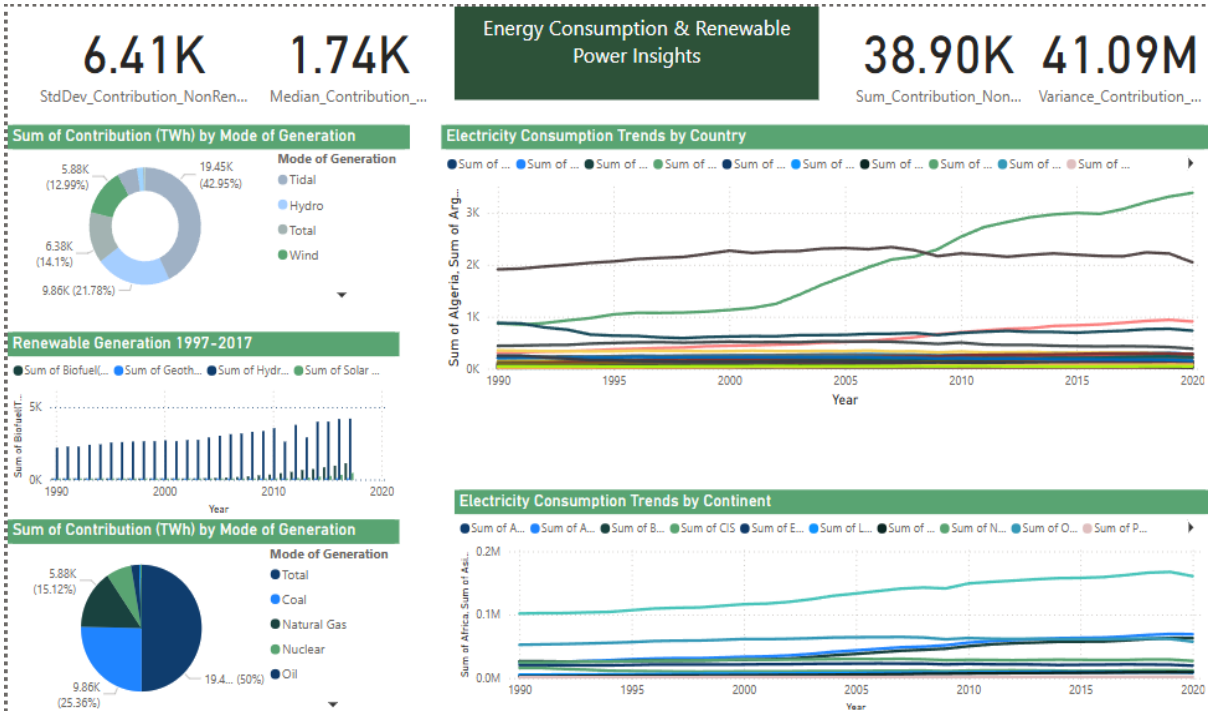
Electricity Consumption Trends by Country



Electricity Consumption Trends by Continent



Dashboard:



1.60K
Sum of Geothermal (TWh)

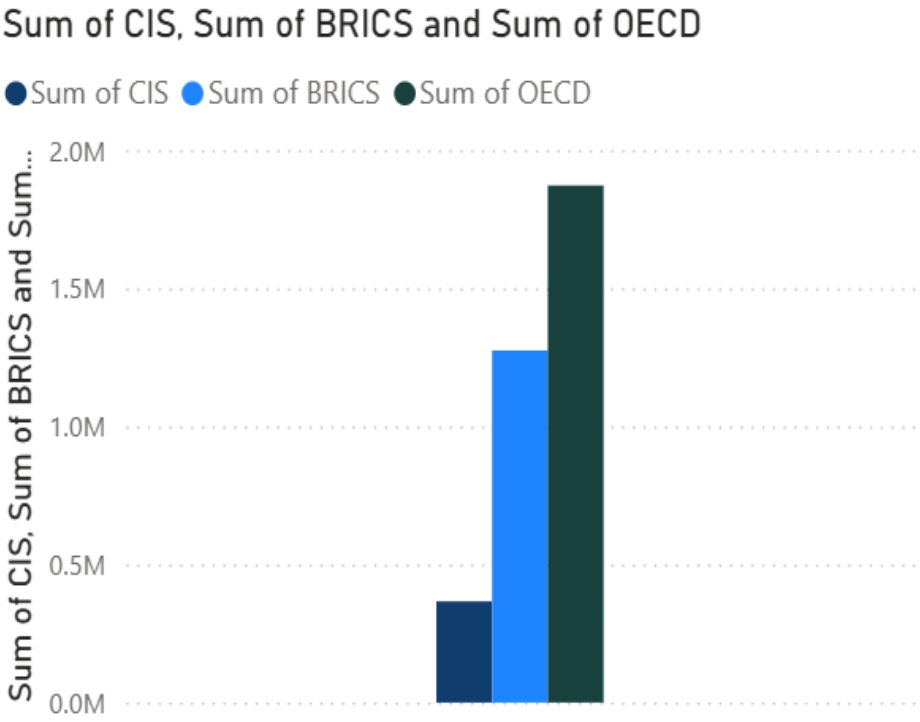
83.28K
Sum of Hydro(TWh)

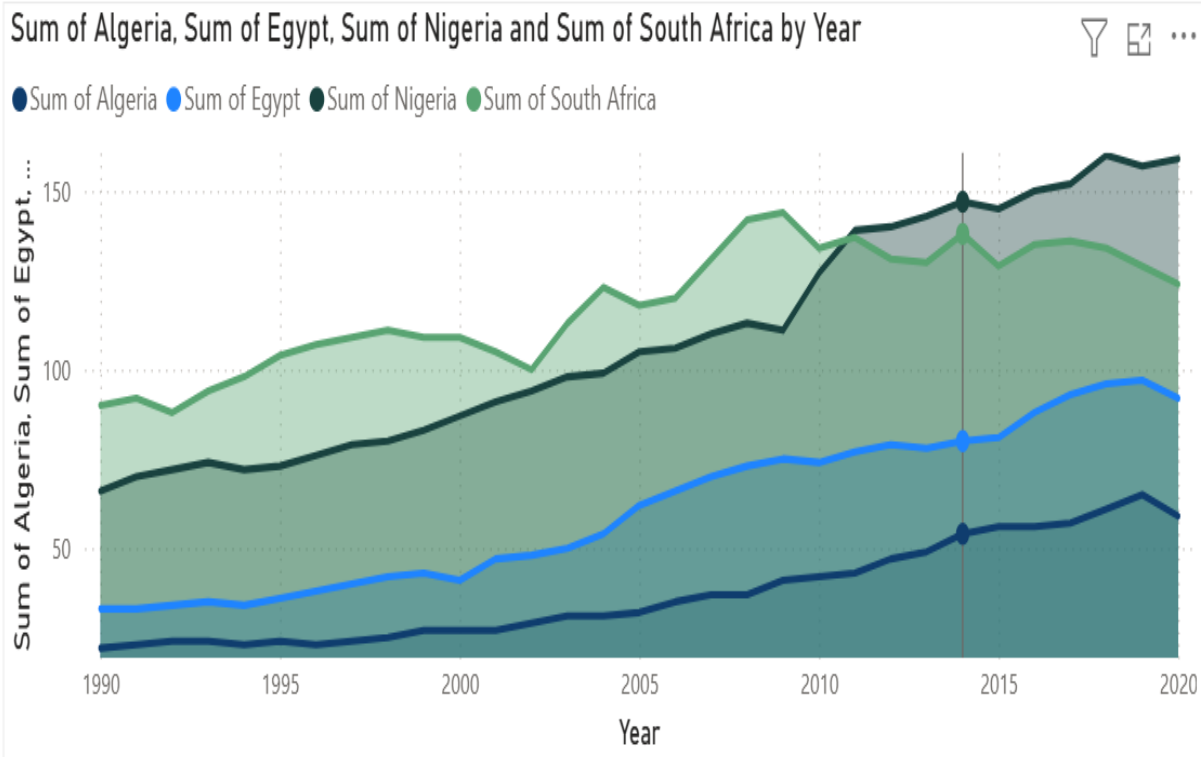
6.86K
Sum of Biofuel(TWh)

1.61K
Sum of Solar PV (TWh)

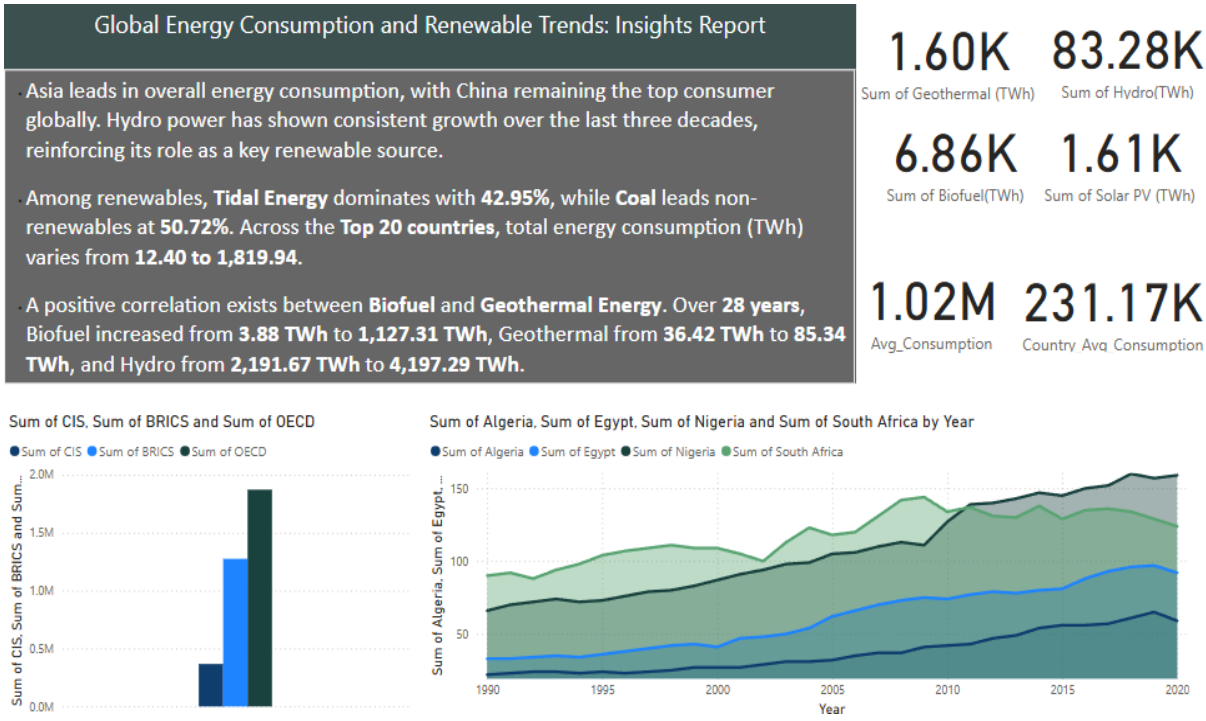
1.02M
Avg_Consumption

231.17K
Country Avg Consumption


Sum of CIS, Sum of BRICS and Sum of OECD
Sum of CIS
Sum of BRICS
Sum of OECD
Sum of CIS, Sum of BRICS and Sum...
2.0M
1.5M
1.0M
0.5M
0.0M


Sum of Algeria, Sum of Egypt, Sum of Nigeria and Sum of South Africa by Year
Sum of Algeria
Sum of Egypt
Sum of Nigeria
Sum of South Africa
Sum of Algeria, Sum of Egypt, ...
150
100
50
1990
1995
2000
2005
2010
2015
2020
Year

Report:



4. Key Insights and Findings

Electricity Consumption Trends by Country and Continent

- **Asia** leads global energy consumption, with **China** being the largest consumer.
- Electricity usage trends vary significantly between **developed and developing nations**.

Contribution of Different Energy Sources

- **Coal (50.72%)** dominates non-renewable energy sources.
- Among renewables, **Tidal Energy (42.95%)** has the highest contribution.
- **Biofuel and Geothermal Energy** exhibit a positive correlation.

Renewable Energy Growth (1997-2017)

- **Biofuel** consumption rose from **3.88 TWh to 1,127.31 TWh**.
- **Geothermal Energy** increased from **36.42 TWh to 85.34 TWh**.
- **Hydropower** expanded from **2,191.67 TWh to 4,197.29 TWh**.

5. Conclusion

The global energy landscape is at a pivotal juncture, where the shift toward renewable energy sources is not just a choice but a necessity. The adoption of renewable energy has the potential to significantly reduce carbon emissions, enhance energy security, and drive economic growth. However, achieving this transition requires collective efforts from governments, industries, and individuals.

Through the use of **Power BI**, this project highlights key energy trends, offering data-driven insights into electricity consumption and generation patterns. The findings underscore the importance of integrating renewable sources into existing energy grids, optimizing industrial energy usage, and ensuring rural electrification for sustainable development.

This analysis serves as a critical resource for policymakers, researchers, and stakeholders in the energy sector. By leveraging data analytics, we can make informed decisions that align with long-term sustainability goals. As technology continues to evolve, future advancements in artificial intelligence, machine learning, and IoT can further enhance energy efficiency, making the vision of a cleaner and more sustainable energy future a reality.

6. Future Scope

- Expanding the dataset to include **real-time energy consumption trends**.
- Incorporating **machine learning models** for predictive analytics.
- Enhancing dashboard functionalities with **AI-powered insights**.

This documentation serves as a structured guide to the project's objectives, methodology, and key findings, offering valuable insights into global energy trends using Power BI.