

Global Energy Trends: A Comprehensive Analysis of Key Regions and Generation Modes using Power BI

Documentation Report: Global Energy Trends

1. Introduction

Energy plays a crucial role in modern life and is increasingly important as electric vehicles and heat pumps become more prevalent. While power generation contributes significantly to global CO2 emissions, the transition to net-zero emissions is being accelerated through renewable energy sources such as solar and wind power.

2. Energy Landscape Transformation

The energy sector is undergoing significant changes with a focus on sustainability and efficiency. Key aspects include:

- Adoption of renewable energy sources
- Optimization of energy consumption
- Utilization of data analysis techniques for better energy management

3. Scenario Analyses

Scenario 1: Smart Grid Implementation in Urban Areas

- A city upgrades its energy infrastructure by integrating renewable sources into a smart grid.
- Real-time data from smart meters enables efficient electricity distribution.
- Outcomes: Reduced reliance on fossil fuels, lower CO2 emissions, and improved resilience.

Scenario 2: Industrial Energy Management in Manufacturing Plants

- A manufacturing plant adopts an energy management system with predictive analytics.
- Optimization strategies include off-peak production scheduling and energy-efficient equipment upgrades.

- Outcomes: Lower carbon footprint and cost savings.

Scenario 3: Rural Electrification in Developing Countries

- A non-profit organization deploys solar microgrids in a remote community.
- Data analytics optimize microgrid performance.
- Outcomes: Enhanced living standards, education, healthcare, and economic empowerment.

4. Technical Architecture

The dataset comprises six files containing energy consumption and power generation data.

Project Flow

To accomplish this, we have to complete all the activities listed below,

- Data Collection & Extraction from Database
 - o Collect the dataset,
 - o Storing Data in DB
 - o Perform SQL Operations
 - o Connect DB with Power Bi
- Data Preparation
 - o Prepare the Data for Visualization
- Data Visualizations
 - o No of Unique Visualizations
- Dashboard
 - o Responsive and Design of Dashboard
- Report
 - o Responsive and Design of Dashboard
- Performance Testing
 - o No of Visualizations/ Graphs
- Project Demonstration & Documentation

- o Record explanation Video for project end to end solution

Milestone 1: Data Collection & Extraction from Database

Data collection is the process of gathering and measuring information on variables of interest, in an established

systematic fashion that enables one to answer stated research questions, test hypotheses, and evaluate outcomes

and generate insights from the data.

Activity 1: Collect the dataset

Please use the link to download the

dataset:<https://www.kaggle.com/datasets/jamesvandenbergh/renewable-power-generation>

Understand the data

Data contains all the meta information regarding the columns described in the Excel files.

Dataset Description:

1. Continent Consumption TWH – Energy consumption across continents.
2. Country Consumption TWH – Energy consumption data for various countries.
3. Non-Renewable Power Generation – Data on power generation through non-renewable sources.
4. Renewable Power Generation – Data on power generation through renewable sources.
5. Renewable Power Generation (1997-2017) – Historical renewable energy data.
6. Top 20 Countries Power Generation – Ranking of power generation by country.

Activity 2: Connect Data with Power BI

With Power BI, users can seamlessly connect to a wide range of data sources, including databases, cloud services, spreadsheets, and streaming data. This capability allows organizations to consolidate disparate data sources into a single, unified platform, breaking down data silos and enabling holistic analysis.

Milestone 2: Data Preparation

Data preparation is a critical phase in the data lifecycle, encompassing activities that transform raw

data into a format suitable for analysis. This multifaceted process involves several steps including

data cleaning, integration, transformation, and enrichment. Data cleaning involves identifying and

rectifying errors, inconsistencies, and missing values within datasets to ensure accuracy and reliability.

Activity 1: Prepare the Data for Visualization

Preparing the data for visualization involves cleaning the data to remove irrelevant or missing data,

transforming the data into a format that can be easily visualized, exploring the data to identify patterns

and trends, filtering the data to focus on specific subsets of data, preparing the data for visualization

software, and ensuring the data is accurate and complete. This process helps to make the data easily

understandable and ready for creating visualizations to gain insights into the performance and

efficiency.

Milestone 3: Data Visualization

Data visualization is the process of creating graphical representations of data in order to help people understand

and explore the 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 visualizations

can help people quickly identify patterns, trends, and outliers in the data.

Activity 1: No of Unique Visualizations

The number of unique visualizations that can be created with a given dataset. Some common types of

visualizations that can be used to analyse the performance and efficiency of Social Pulse_ Illuminating

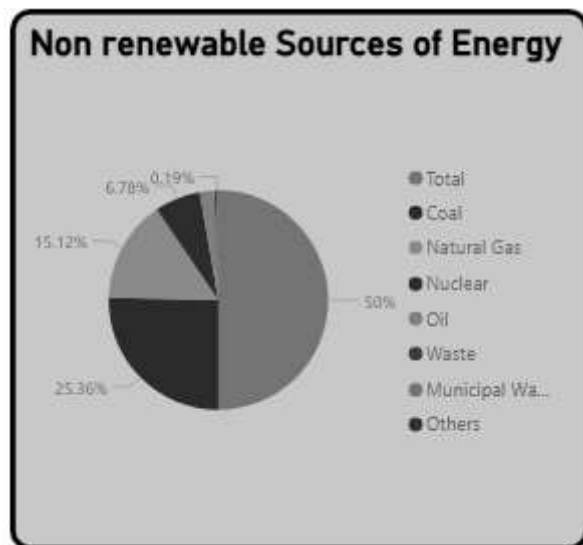
the Digital Footprint - Unveiling Social Media Engagement Dynamics include bar charts, line charts,

heat maps, scatter plots, pie charts, Maps etc. These visualizations can be used to compare performance,

track changes over time, show distribution, and relationships between variables, breakdown of revenue

and demographics, workload, resource allocation and location.

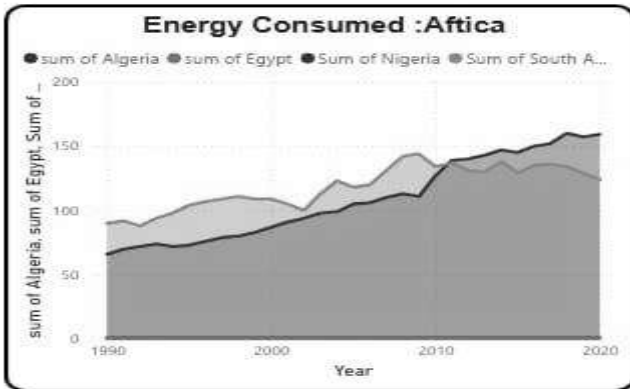
Activity 1.1: Non-renewable sources of Energy



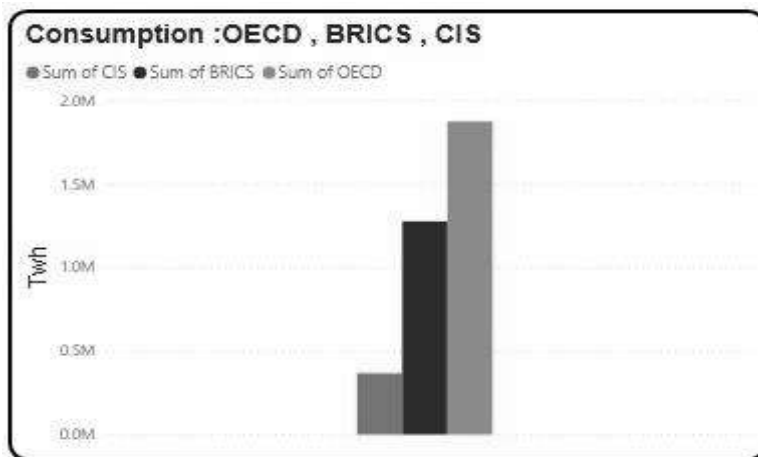
Activity 1.2: cards-Geothermal, Biofuel, Hydro and Solar PV



Activity1.3: Energy Consumed: Africa



Activity 1.4: Consumption: OECD, BRICS, CIS



Milestone 4: Dashboard

A dashboard is a graphical user interface (GUI) that displays information and data in an organized, easy-to-read

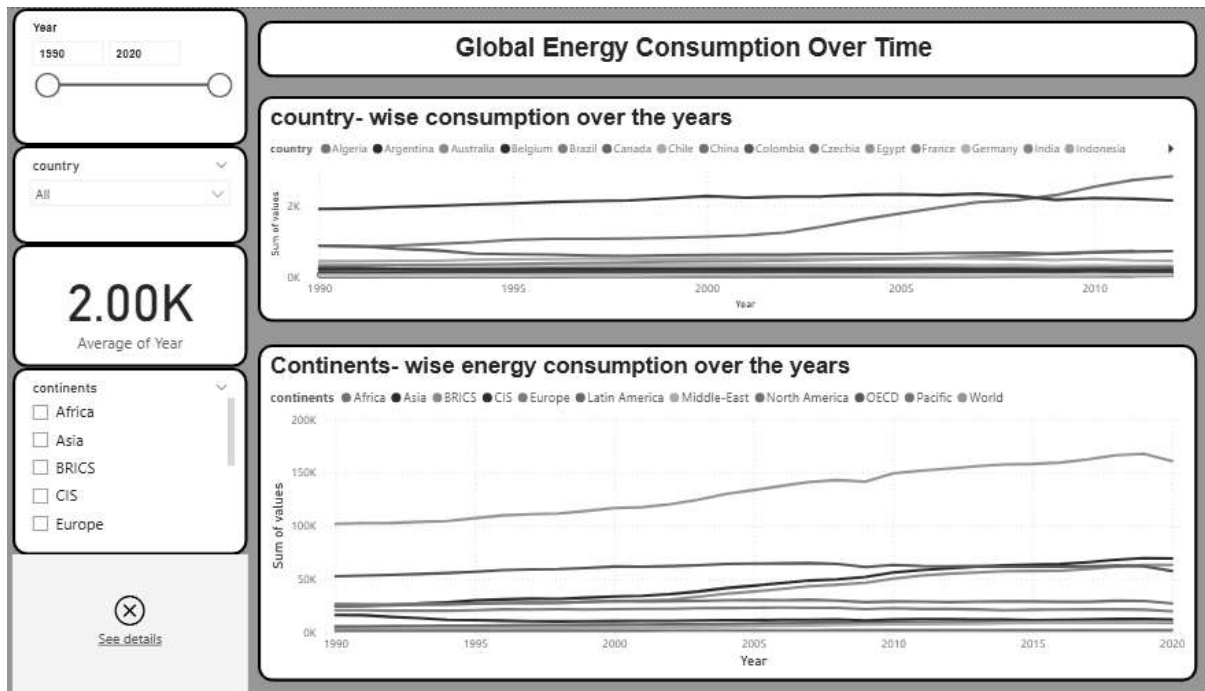
format. Dashboards are often used to provide real-time monitoring and analysis of data, and are typically

designed for a specific purpose or use case. Dashboards can be used in a variety of settings, such as business,

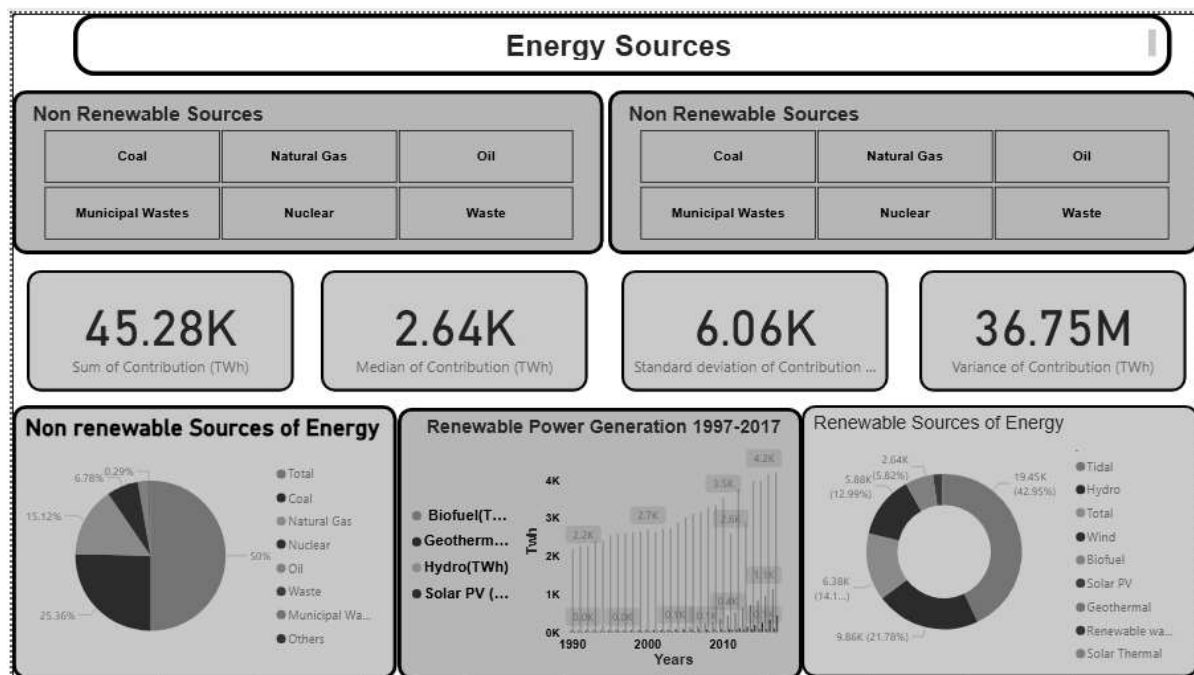
finance, manufacturing, healthcare, and many other industries. They can be used to track key performance

indicators (KPIs), monitor performance metrics, and display data in the form of charts, graphs, and tables.

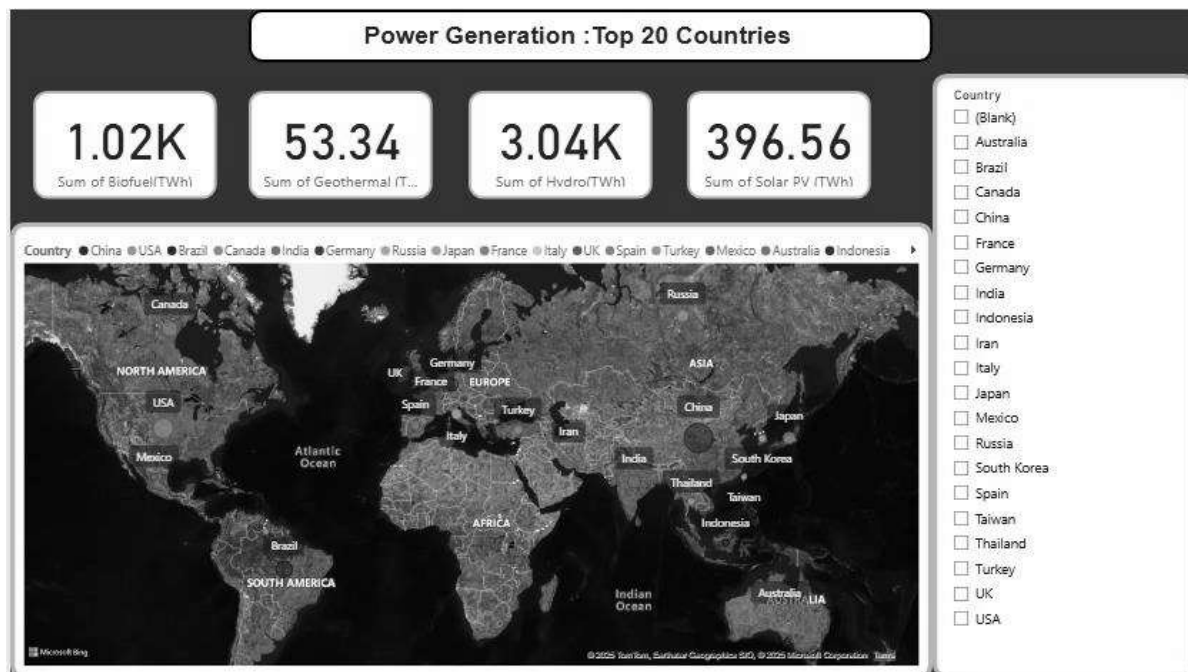
Activity 1: Global Energy Consumption Over Time



Activity 2: Energy Sources

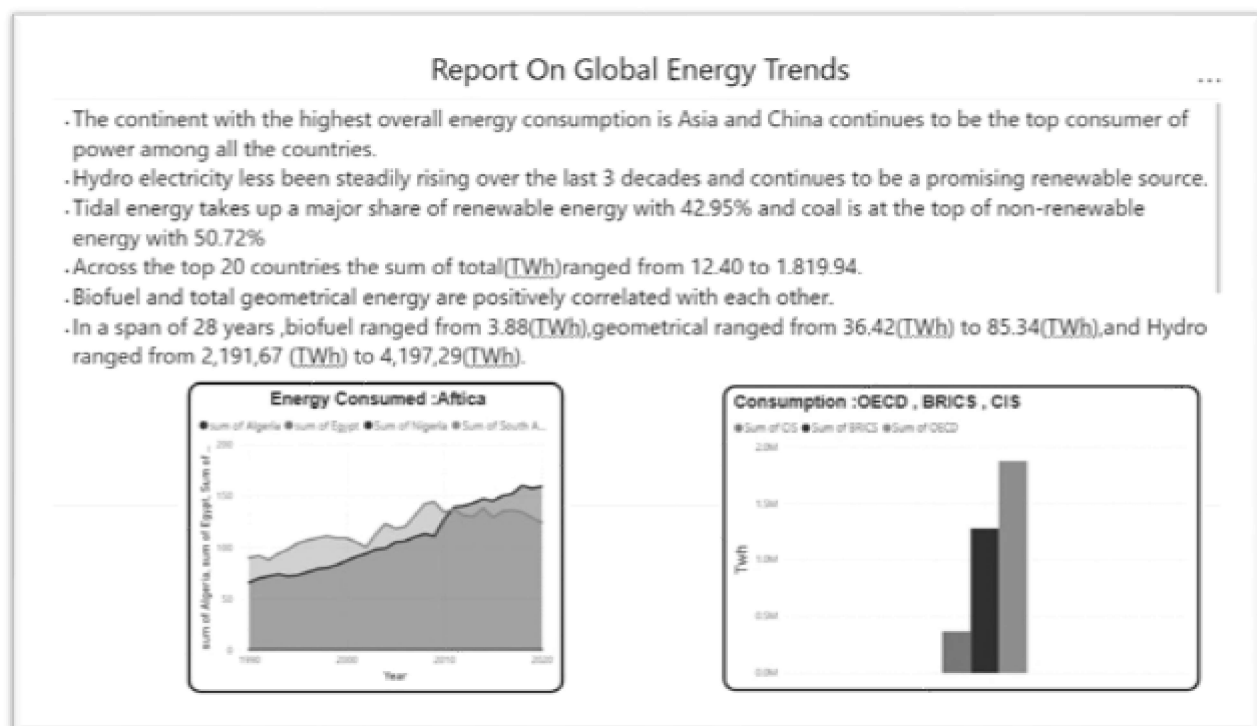


Activity 3: Power Generation: Top 20 Countries



Milestone 5: Report

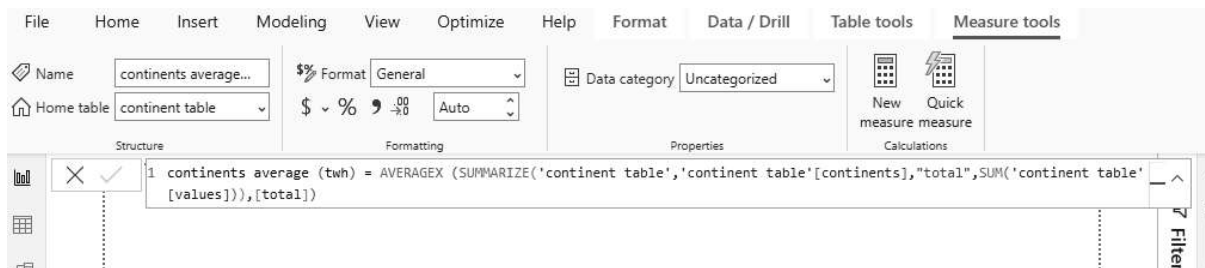
A data report is a way of presenting data and analysis in a narrative format, with the goal of making the information more engaging and easier to understand. A data story typically includes a clear introduction that sets the stage and explains the context for the data, a body that presents the data and analysis in a logical and systematic way, and a conclusion that summarizes the key findings and highlights their implications. Data Report can be told using a variety of mediums, presentations, and interactive visualizations



Milestone 6: Performance Testing

Performance testing is a crucial aspect of software development aimed at evaluating the speed, responsiveness, stability, and scalability of an application under various workload conditions. It involves simulating real-world usage scenarios to assess how the system behaves and performs under stress, peak loads, or normal conditions.

Activity 1: Utilization of Measures



Activity 2: No of Visualizations/ Graphs

1. Country-wise energy consumption
2. Continent Energy Consumption
3. Continent Average (TWh)
4. Country Average (TWh)
5. Non-renewable sources of Energy
6. Renewable Generation 1997-2017 (TWh)
7. Cards - Sum, Median, Standard Deviation and Variance of Contribution (TWh)
8. Renewable Sources of Energy
9. Cards - Geothermal, Biofuel, Hydro and Solar PV
10. BRICS, OECD, and CIS Comparison
11. Report Narrative
12. Energy Consumption in African countries

Milestone 7: Project Demonstration & Documentation

Below mentioned deliverables to be submitted along with other deliverables

Activity 1: - Record explanation Video for project end to end solution

Creating a record explanation video for a project's end-to-end solution is crucial for ensuring clarity and transparency in its implementation. This video serves as

a comprehensive guide, detailing every aspect of the project from inception to completion.

➤ **Video Link:**

<https://drive.google.com/file/d/1xTByE7hZkTUA008SVK1q81QEHXyjVN8b/view?usp=sharing>

➤ **Activity 2: Project Documentation-Step by step project development procedure**

5. Conclusion

The study highlights the importance of data-driven solutions in energy management. Smart grids, industrial energy efficiency measures, and rural electrification projects showcase the potential of renewable energy to drive sustainability and economic growth.