**Report**

| Date | 1 August 2025 |
| --- | --- |
| Team ID | xxxxx |
| Project Name | Exploring Global Energy Generation |
| Maximum Marks | 5 Marks |

1. **Introduction**

**1.1 Project Overview**

This project is a data analytics initiative focused on visualizing global energy trends from 1990 to 2020. THe primary goal is to provide a clear and interactive dashboard that enables users to explore complex dataset related to energy production and consumption. The dashboard covers both renewable and non-renewable energy sources, highlighting key patterns, contributions by country and the evolution of different energy technologies over time.

**1.2 Objectives**

The main objectives of this project are to:

* Identify and visualize key global energy production and consumption trends.
* Analyze the contribution of various energy sources, distinguishing between renewable and non-renewable types.
* Compare and contrast energy consumption patterns across different countries and continents.
* Provide a foundation for informed decision-making related to energy policy, investment, and sustainability initiatives.
* Create an interactive, user-friendly dashboard that makes complex data accessible to a board audience.

1. **Project Initialization and Planning Phase**

**2.1 Define Problem Statement**

To analyze the vast and complex global energy landscape and present a clear, actionable overview that helps stakeholders understand key trends, production leaders, and consumption patterns. The challenge is to transform raw data into meaningful visualizations that tell a compelling story about the world's energy dynamics.

**2.2 Project Proposal**

The proposed solution is the development of a comprehensive, interactive dashboard using a business intelligence tool such as Power BI. This dashboard would feature a series of linked visualizations, including bar charts, pie charts, and Key Performance Indicators (KPI) cards, to present data on energy productions, consumption, and source contributions over a multi-decade period. The solution aims to be a single source of truth for energy data analysis within the specified scope.

**2.3 Initial Project Planning**

The project was planned in several key phases:

1. **Data Collection:** Identifying reliable, publicly available sources for global energy data.
2. **Data Preprocessing:** Cleaning, transforming, and structuring the raw data for analysis.
3. **Visualization Development:**  Designing and creating individual charts to address specific business questions.
4. **Dashboard Design:** Integrating the visualizations into a cohesive, intuitive, and aesthetically pleasing dashboard.
5. **Reporting:** Documenting the project’s methodology, design choices, and key findings.

**3. Data Collection and Preprocessing Phase**

**3.1 Data collection Plan and Raw Data Sources Identifies**

The data collection plan involved sourcing historical energy data from a reputable global database. THe identified raw data sources contained information on:

* Energy Production (in TWh) categorized by source (e.g., Coal, Oil, Natural Gas, Hydro, Solar, Wind).
* Energy Consumption (in TWh) per country and continent.
* Annual time series data spanning from 1990 2020.

**3.2 Data Quality Report**

A data quality check was performed to ensure the integrity and reliability of the data. Key findings from this process included:

* **Missing Values:** Gaps in data for specific years or countries were identified and either imputed or noted for exclusion in certain visualizations.
* **Inconsistent Formatting:** Country name and energy source labels were standardized to ensure consistency across the dataset.
* **Data Types:** All TWh and numerical fields were verified to be in the correct numerical format to support calculations and aggregations.

**3.3 Data Exploration and Preprocessing**

The preprocessing phase involved several steps:

* **Data Cleaning:** Removing any erroneous or duplicate entries.
* **Data Structuring:**  The data was structured into a clean, tabular format suitable for efficient loading and querying within the chosen Power BI tool.

**4. Data Visualization**

**4.1 Farming Business Questions**

Farming business questions was a critical step in guiding the visualization process. The following are examples of the key questions the dashboard was designed to answer:

* Which countries are the largest producers of renewable energy?
* How has the global consumption of energy changed over the past three decades?
* What is the relative contribution of different non-renewable sources like Coal, Natural Gas, and Oil?
* Is there a noticeable shift in power production towards renewable sources like Solar PV and Wind?
* Which continent has the highest energy consumption, and what are its trends?

**4.2 Developing Visualization**

Visualizations were developed based on the business questions.

* **Pie Charts:** Used to show the proportion of energy generation from different sources and the top contributing countries, as they are ideal for representing pats of a whole.
* **Bar Charts:**  Utilized to display trends per ime, such as annual energy consumption by continent, and to compare the contribution of various sources side-by-side.
* **KPI Cards:** Created to provide immediate, high-impact summaries of key metrics like “Total Renewable Energy Contribution”.

**5. Dashboard**

**5.1 Dashboard Design File**

The Global Energy Dashboard is designed with a clear and intuitive layout to facilitate easy data exploration. The dashboard’s content and elements are organized as follows:

* **Key Performance Indicators(KPIs):** A series of clear, title cards are displayed at the top of the dashboard. These cards provide at-a-glance summaries of key metrics such as “Total Energy Produced” and “Renewable Energy Contribution" for the selected time period.
* **Top 20 Countries by Renewable Energy:** A pie chart is used to visually represent the proportion of renewable energy production for the top 20 countries. The visualization allies users to quick;y identify the global leaders in the sector.
* **Contribution by Mode of Generation:** A second pie chart details the percentage contribution of both renewable and non-renewable energy sources to the total energy mix. It uses distinct colors to differentiate between sources like Coal, Oil, Natural Gas, Hydro, Solar, and Wind.
* **Energy Consumption by Country Over Years:** A bar chart is utilized to track the production trends of specific renewable sources over time, highlighting the growth of solar, wind, and hydro power.
* **Power Production By Renewable Sources:** A bar chart is utilized to track the production trends of specific renewable sources over time, highlighting the growth of solar, wind, and hydro power.
* **Interactive Filters and Slicers:** The dashboard includes interactive filters and slicers for **Year, Country and Energy Source.** These features allow users to dynamically adjust the data presented in the visualizations, enabling a personalized and in-depth analysis.

**6. Report**

**6.1 Story Design File**

The report’s story is designed to guide the reader through a logical narrative. It begins with a high-lever overview of global energy contributions, then delves into the energy-specific trends of both renewable and non-renewable sources. The narrative concludes by analyzing consumption patterns by country and continent, providing a holistic view of the global energy landscape. This structure ensures that the key takeaways are presented in a clear, sequential, and easy-to-follow manner.

**7. Performance Testing**

**7.1 Utilization of Data Filters**

The dashboard utilizes data filters and slicers for **Year, Country, and Energy Source** to allow users to refine their analysis and focus on specific data points.

**7.2 No**  **of Calculation Field**

A total of approximately 5-7 calculated fields were created during the preprocessing phase to support the dashboard’s visualizations and KPIs. These include fields for total renewable energy, non-renewable energy, and various percentage contributions.

**7.3 No of Visualization**

The dashboard contains approximately 10 distinct visualizations, including bar charts, pie charts and KPI card, to provide a comprehensive view of the data.

**8. Conclusion/Observation**

The analysis of the dashboard reveals several key observations:

* China, the USA, and Brazil are leading the world in renewable energy production.
* Coal continues to be the dominant non-renewable energy source, contributing over 50% of the total.
* There is a clear and growing trend in the production of solar and wind energy, though Hydro remains a major contributor.
* Global energy consumption has seen a significant increase over the last three decades, with China and the United Sates being two largest consumers.
* The dashboard successfully highlights that the total renewable energy contribution is significantly higher than that of non-renewable sources within the datasets’s scope.

**9. Future Scope**

The project has several potential avenues for future development:

* **Real-time data Integration:** Connecting the dashboard to live data feeds to provide up-to-date insights.
* **Predictive Analytics:** Incorporating machine learning models to forecast future energy production and consumption trends.
* **Additional Metrics:** Expanding the dataset to include economic factors. CO2 emissions, or energy efficiency data for a more holistic analysis.
* **User-Defined Alerts:** Adding features that allow users to set alerts for significant changes in key metrics.

**10. Appendix**

**10.1 Source Code**

As this project develops using a business intelligence too (like Power BI), the primary asset in the project file itself, which contains the data model and visualizations. There is no traditional source code to be in this report.

**10.2 GitHub & Project Demo Link**