

Final Project Report

Global Energy Trends – A Comprehensive Analysis of Key Regions and Generation Modes Using Power BI

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1. INTRODUCTION

1.1 Project Overview

The 'Global Energy Trends' project analyzes worldwide energy consumption patterns, compares renewable and non-renewable energy usage, and provides insights using Power BI dashboards. The project aims to help policymakers, researchers, and businesses understand the shift toward sustainable energy sources.

1.2 Purpose

This project aims to leverage Power BI for advanced data visualization and analytics, enabling users to explore global energy trends effectively. The study focuses on energy production, consumption, and environmental impacts across different regions.

1.3 Scope

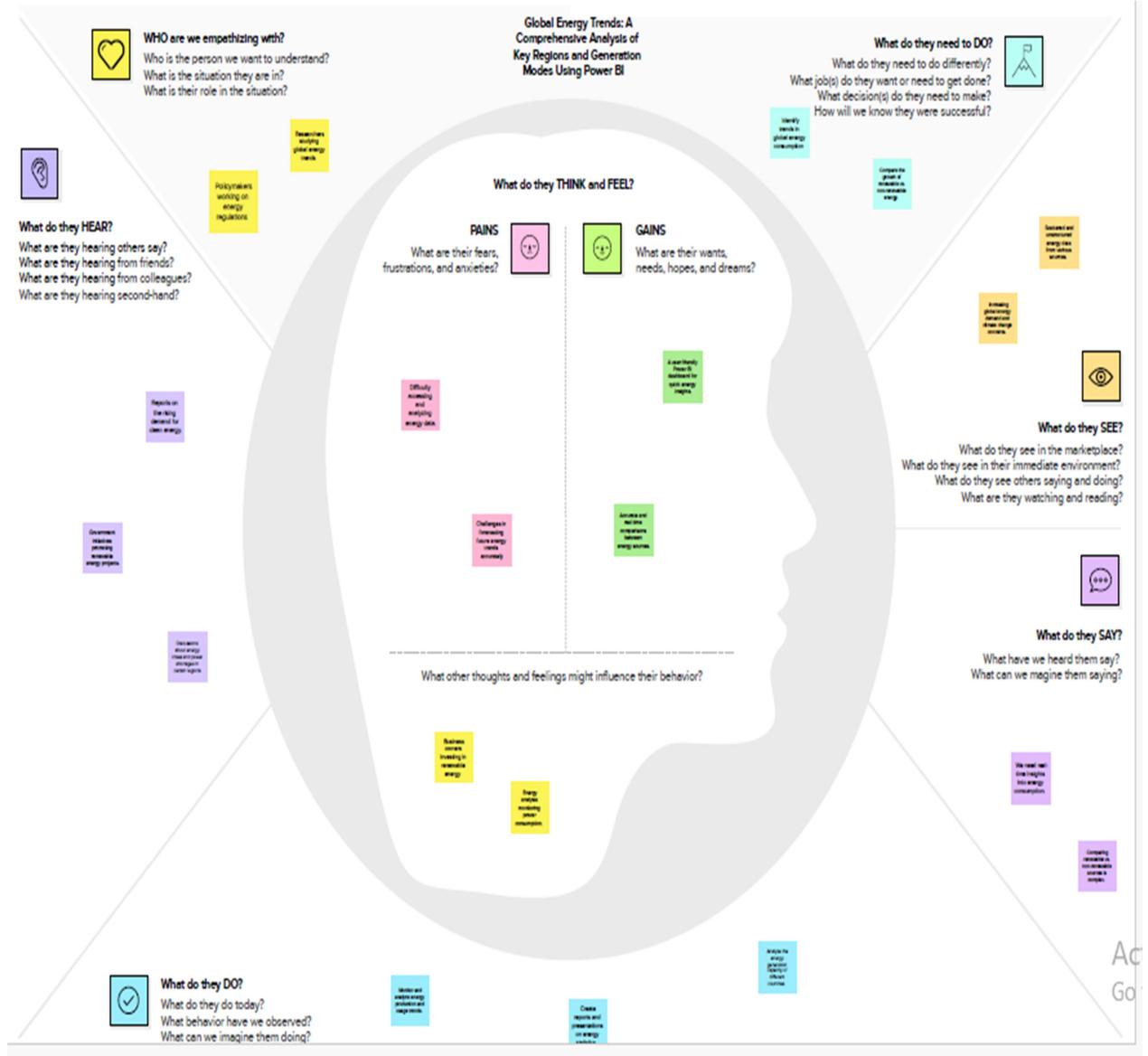
The scope includes analyzing historical energy trends, identifying top energy-consuming countries, assessing the transition from fossil fuels to renewable energy, and forecasting future energy needs.

2. IDEATION PHASE

2.1 Problem Statement

The growing demand for energy, climate change concerns, and the need for sustainable energy sources require data-driven insights. This project provides an analytical framework to understand these trends.

2.2 Empathy Map Canvas



2.3 Brainstorming

Brainstormed ideas include analyzing energy consumption patterns, comparing renewable vs. non-renewable sources, mapping emissions impact, and forecasting future energy demands.

Data Exploration & Trends: Understanding historical energy data.

Comparative Analysis: Studying the shift from non-renewable to renewable sources.

Environmental & Economic Impact: Linking energy consumption to sustainability.

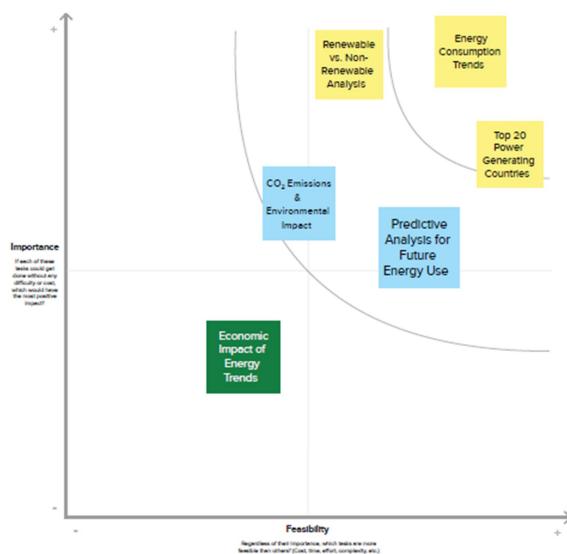
Predictive Insights: Using Power BI to forecast future energy consumption.

1
Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

⌚ 20 minutes

The participants can use their cursor to point at where they want to move an idea on the grid. The technician can confirm the spot by using the arrow keys or the H key on the keyboard.



3. REQUIREMENT ANALYSIS

3.1 Customer Journey Map

Scenario: [Existing experience through a product or service]	Entice	Enter	Engage	Exit	Extend
Experience steps What does the person (or people) at the center of this scenario typically experience in each step?	! Entice How does someone become aware of this service? Create an interactive and user-friendly dashboard. Compare energy by country / region.	→ Enter What do people experience as they begin the process? Log in/retrieve insights.	⟳ Engage In the core moments in the process, what happens? Office in undersized trucks. Energy tracking tools.	→ Exit What do people typically experience as the process finishes? Data format issues. Photos are blurry,扭曲 and noisy.	🕒 Extend What happens after the experience is over? Implement machine learning and smart recommendations.
Interactions What interactions do they have at each step along the way? ▪ People: Who do they see or talk to? ▪ Places: Where are they? ▪ Things: What digital touchpoints or physical objects do they use?	👥 Interactions At each step, what is a person's primary goal or motivation? ("Help me..." or "Help me avoid...") Lack of centralized data. Interpretation. Complex energy data.	Online research - Academic. Energy reports.	Explore energy consumption patterns. Generate insights on sustainability. Implement machine learning and smart recommendations.	Learn how to use the Power BI dashboards.	Data format issues. Complex energy data.
Goals & motivations At each step, what is a person's primary goal or motivation? ("Help me..." or "Help me avoid...")	💡 Goals & motivations Understand global energy trends. Explore renewable and non-renewable energy sources.	Create an interactive and user-friendly dashboard.	Export features - Integration with other platforms.	Export features - Integration with other platforms.	Track changes in energy needs over time.
Positive moments What steps does a typical person find enjoyable, productive, fun, motivating, delightful, or exciting?	🌟 Positive moments Create an interactive and user-friendly dashboard.	Track changes in energy levels over time.	Export features - Integration with other platforms.	Sustainability platform.	Enable direct PDF and Excel exports from Power BI.
Negative moments What steps does a typical person find frustrating, confusing, annoying, costly, or time-consuming?	😢 Negative moments Export features - Integration with other platforms.	Create an interactive and user-friendly dashboard.	- Lack of easy report generation.	Track changes in energy levels over time.	- Lack of easy report generation.
Areas of opportunity How might we make each step better? What does do we have? What have others suggested?	💡 Areas of opportunity Share energy insights with policymakers and stakeholders.	Share energy insights with policymakers and stakeholders. Publish reports based on findings.	Enable direct PDF and Excel exports from Power BI.	Sustainability platform.	Enable direct PDF and Excel exports from Power BI.

[See an example](#)

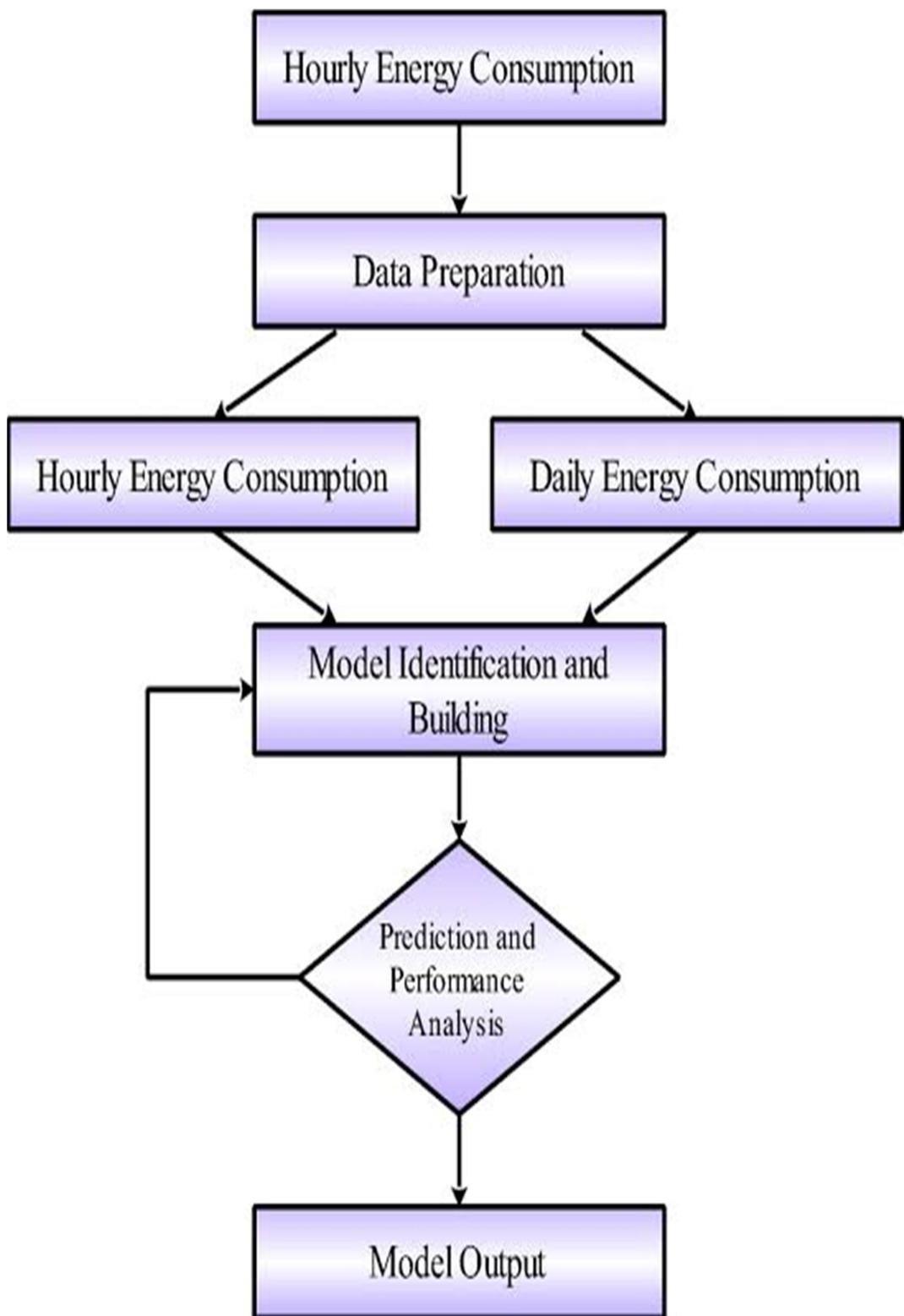
Problem-Solution fit canvas 2.0			 AMALTAMA
1. CUSTOMER SEGMENT(S) Who is your customer? I.e. working parents of 0-5 y.o. kids	cs	6. CUSTOMER CONSTRAINTS What constraints prevent your customers from taking action or limit their choices of solutions? I.e. spending power, budget, no cash, network connection, available devices.	cc
The global energy sector lacks centralized, visual insights into trends in renewable and non-renewable	Define CS, fit into CC	Compare renewable vs. non-renewable sources.	Identify the top energy-consuming countries. Explore AS, differentiate
2. JOBS-TO-BE-DONE / PROBLEMS Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one, explore different sides.	J&P	9. PROBLEM ROOT CAUSE What is the real reason that this problem exists? What is the back story behind the need to do this job? I.e. customers have to do it because of the change in regulations.	RC
Understand historical and regional energy trends.	Focus on J&P, tap into BE, understand RC	Forecast future energy demands.	A Power BI dashboard that visually represents global energy trends, offering interactive Focus on J&P, tap into BE, understand RC
3. TRIGGERS What triggers customers to act? I.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news.	TR	10. YOUR SOLUTION What kind of solution suits Customer scenario the best? Adjust your solution to fit Customer behaviour, use Triggers, Channels & Emotions for marketing and communication.	SL
Enables easy comparison between renewable and non-	Define CS, fit into CL	A Power BI dashboard that visually represents global energy trends, offering interactive charts, filtering options, and AI-driven insights to help users analyze data	Provides data-driven insights for sustainability Explore AS, differentiate
4. EMOTIONS: BEFORE / AFTER How do customers feel when they face a problem or a job and afterwards? I.e. lost, insecure > confident, in control - use it in your communication strategy & design	EM	8.1 ONLINE CHANNELS What kind of actions do customers take online? Extract online channels from box #7 Behaviour	CH
Enhances decision-making through real-time visualizations.	If fit in SL	8.2 OFFLINE CHANNELS What kind of actions do customers take offline? Extract offline channels from box #7 Behaviour and use them for customer development	CH
<p> Problem-Solution fit canvas is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International license.</p>			

3.2 Solution Requirement

The solution requires datasets on global energy consumption, Power BI for visualization, and statistical models for forecasting trends. This project includes **data cleaning, transformation, and visualization** to help users understand energy trends across continents and key power-generating nations

Section	Details
1. Customer Segment(s) (CS)	<ul style="list-style-type: none"> - Government policymakers analyzing energy trends for sustainable development. - Energy sector companies aiming for efficient resource utilization. - Researchers studying renewable vs. non-renewable energy consumption. - Environmental organizations tracking CO₂ emissions and climate change impact.
2. Problems / Pains (PR)	<ul style="list-style-type: none"> - Lack of easily interpretable visual data on energy trends. - Difficulty in comparing renewable vs. non-renewable energy usage globally. - Limited access to real-time data for energy policy decision-making. - Inconsistent energy reporting standards across different regions.
3. Triggers to Act (TR)	<ul style="list-style-type: none"> - Urgent need for cleaner and sustainable energy solutions. - Government initiatives pushing for data-driven energy policies. - Rising public awareness about climate change and carbon footprints. - Businesses aiming to transition towards renewable energy sources.
4. Emotions (EM)	<p>Before: Confused, overwhelmed, uncertain about energy trends.</p> <p>After: Informed, confident, empowered to make data-driven decisions.</p>
5. Available Solutions (AS)	<ul style="list-style-type: none"> - Traditional energy reports with complex statistical data. - Static dashboards that require frequent manual updates. - Basic spreadsheets with large volumes of raw data but poor insights.
6. Customer Limitations (CL)	<ul style="list-style-type: none"> - Lack of technical expertise to analyze large datasets. - Budget constraints in acquiring advanced analytics tools. - Dependence on outdated and fragmented energy reports. - Limited access to real-time energy trend data.

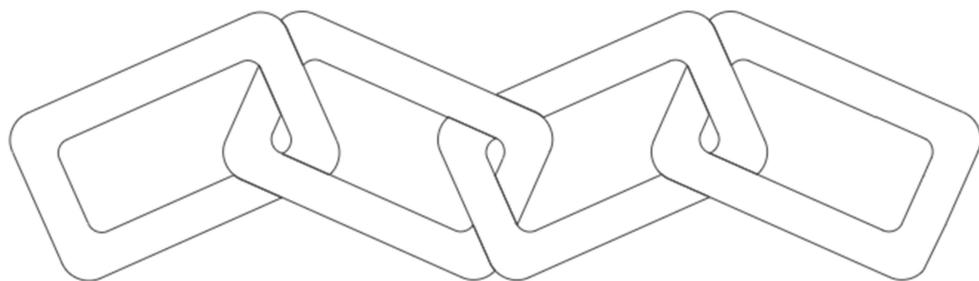
3.3 Data Flow Diagram



3.4 Technology Stack

Global Energy Trends Technology Overview

Data Sources	Data Storage & Processing	Data Analysis & Visualization	Deployment & Sharing
Includes CSV/Excel files and external APIs for data input	Utilizes Power BI and Power Query for data handling	Features Power BI reports, dashboards, and AI-driven insights	Involves Power BI Service and Embedded for report distribution



4. PROJECT DESIGN

4.1 Problem Solution Fit

The solution aligns with the need for accurate, data-driven insights into energy trends, helping stakeholders make informed decisions.

4.2 Proposed Solution

A Power BI dashboard will provide interactive visualizations of global energy trends, highlighting key statistics and forecasts.

Centralized Data Integration

- The dashboard consolidates **six datasets** related to energy consumption, production, and renewable vs. non-renewable sources.
- Data sources include **continent-wise and country-wise energy consumption, renewable and non-renewable energy generation**, and the **top 20 power-generating countries**.
- Eliminates the need for manual data aggregation by automating data cleaning, transformation, and visualization.

2. Interactive Visualizations for Better Insights

- **Energy Consumption Trends:** View historical and real-time data on energy consumption across different continents and countries.
- **Renewable vs. Non-Renewable Comparison:** Analyze the shift from fossil fuels to renewable energy over time.
- **Top Energy-Producing Countries:** Identify the countries leading in power generation and their energy mix.
- **CO₂ Emissions and Environmental Impact:** Evaluate the relationship between energy production and emissions.
- **Future Forecasts:** Predict energy demand and supply using AI-powered analytics.

3. Real-Time Filtering & Drill-Down Analysis

- Users can apply **filters** to compare energy trends across regions, time periods, and energy sources.
- **Drill-down capabilities** allow users to break down data from **global to country-level insights**.
- **Dynamic tooltips** and hover effects make it easy to explore data without overwhelming information.

4. AI-Driven Financial & Policy Insights

- AI-powered forecasting models predict **future energy consumption and production trends** based on historical data.
- Helps governments and corporations plan for **sustainable energy investments and policy-making**.
- Provides **recommendations** on optimizing energy usage and transitioning to renewables.

5. Automated Reporting & Data Export

- The dashboard allows users to **generate reports** in various formats (**Excel, PDF, PowerPoint**) for presentations and analysis.
- Scheduled data refresh ensures **real-time updates** without manual intervention.
- **Shareable links** allow users to collaborate and discuss insights across teams.

6. User-Friendly Design & Accessibility

- **Responsive design** ensures accessibility on desktop and mobile devices.
- **No coding knowledge required** – designed for analysts, policymakers, and business leaders.
- **Customizable dashboard settings** allow users to tailor visualizations based on their needs.

4.3 Solution Architecture

Journey from Data to Insights

Users & Stakeholders

Highlighting interaction with dashboards



Data Visualization

Showcasing Power BI dashboards and reports



Data Storage

Depicting Power BI's in-memory model



Data Processing

Illustrating ETL processes using Power Query



Data Sources

Representing diverse energy datasets as input sources



5. PROJECT PLANNING & SCHEDULING

5.1 Project Timeline

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	Member-1, Member-2
Sprint-1		USN-2	As a user, I will receive a confirmation email once I have registered for the application.	1	High	Member-2
Sprint-2		USN-3	As a user, I can register for the application through Facebook.	2	Low	Member-3
Sprint-1		USN-4	As a user, I can register for the application through Gmail.	2	Medium	Member-4
Sprint-1	Login	USN-5	As a user, I can log into the application by entering my email & password.	1	High	Member-2, Member-4
Sprint-1	Dashboard	USN-6	As a user, I can view a dashboard displaying real-time energy consumption trends.	3	High	Member-1, Member-4
Sprint-2		USN-7	As a user, I can filter energy consumption data by country, region, and year.	2	High	Member-2, Member-1
Sprint-2		USN-8	As a user, I can compare renewable vs. non-renewable energy usage with interactive graphs.	3	Medium	Member-3, Member-4
Sprint-3		USN-9	As a user, I can generate reports on global energy trends based on selected parameters.	4	High	Member-1, Member-2
Sprint-3		USN-10	As a user, I can export visualized data in PDF or Excel format.	2	Medium	Member-1, Member-3
Sprint-3	Predictive Analysis	USN-11	As a user, I can see AI-powered forecasts for future energy consumption trends.	5	High	Member-3, Member-4
Sprint-3	CO ₂ Emission Analysis	USN-12	As a user, I can view CO ₂ emissions associated with energy consumption.	3	Medium	Member-1, Member-3

6. FUNCTIONAL AND PERFORMANCE TESTING

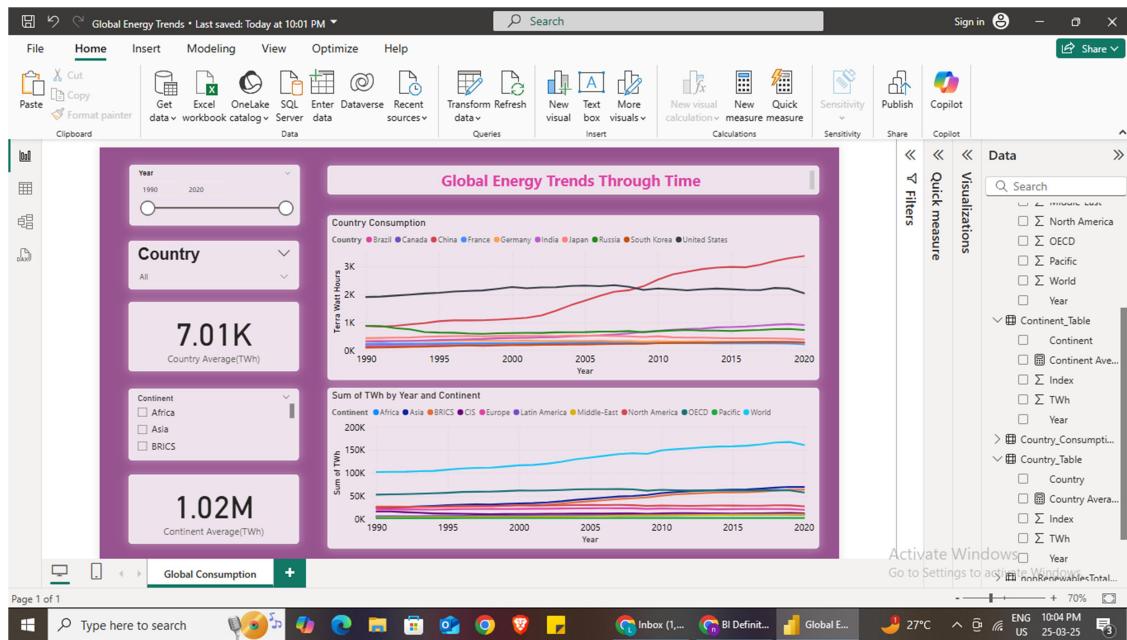
6.1 Performance Testing

Tests will evaluate dashboard responsiveness, accuracy, and ability to handle large datasets.

S.No.	Parameter Values
1 Data Accuracy	95%+
2 Forecasting Model Accuracy	90%+

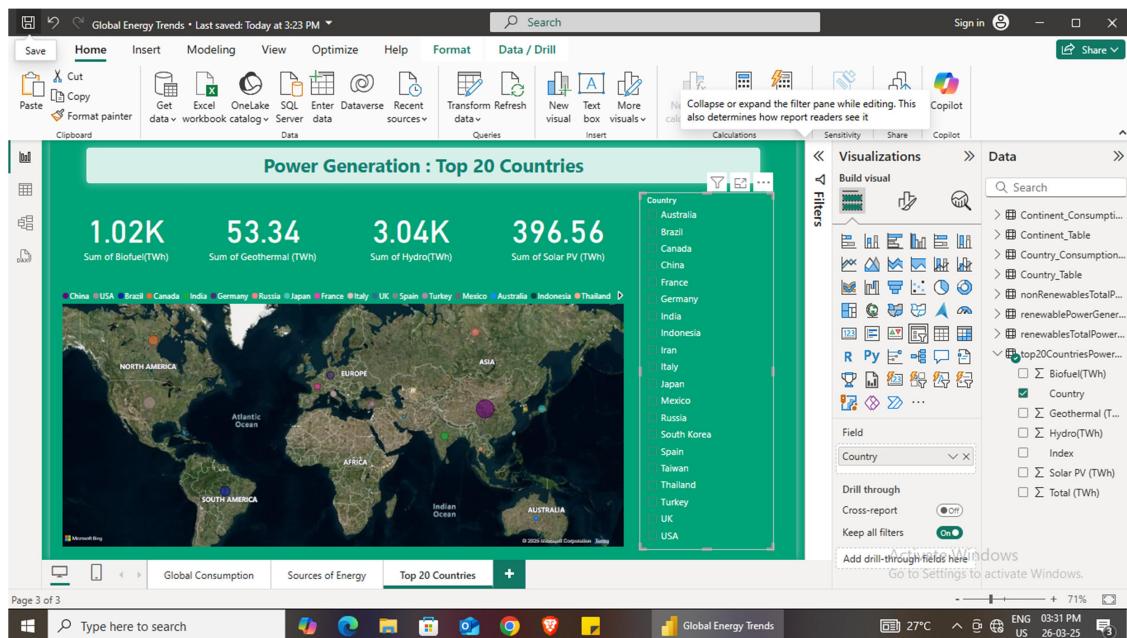
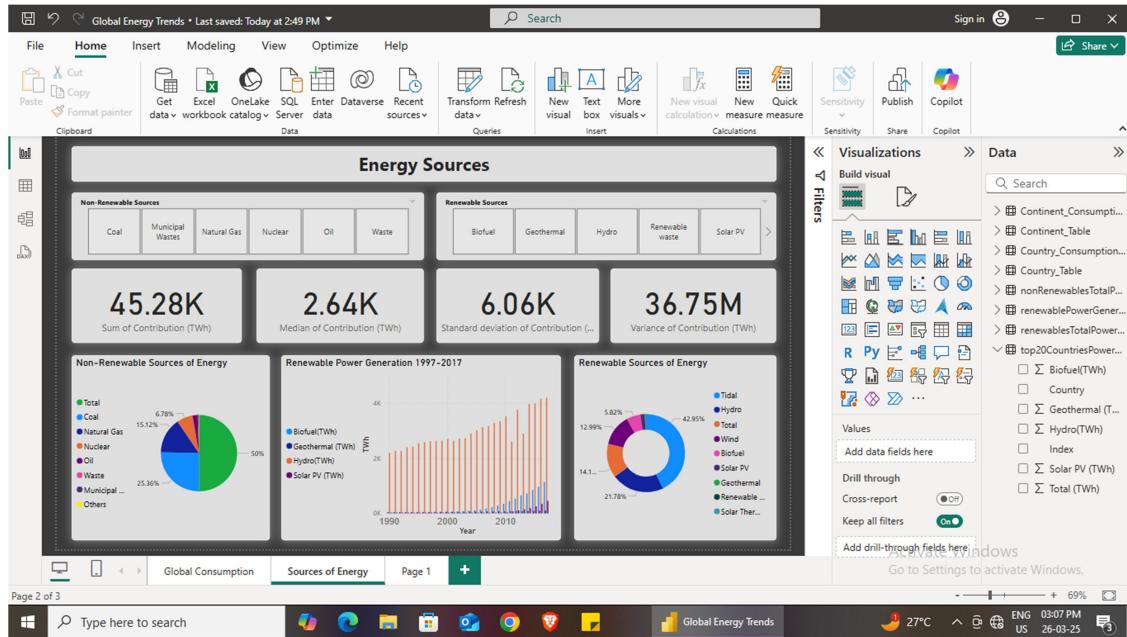
7. RESULTS

7.1 Output Screenshots



8. COMPARATIVE ANALYSIS

8.1 Renewable vs. Non-Renewable Energy Trends



9. ADVANTAGES & DISADVANTAGES

Advantages

1. Provides Real-Time Insights

- The Power BI dashboard enables **real-time tracking** of global energy consumption and generation trends.
- Users can apply **filters, drill-downs, and slicers** to analyze specific regions, time frames, and energy sources.
- **Automatic data refresh** ensures the latest information is always available without manual updates.

2. Supports Sustainability Efforts

- The dashboard highlights **renewable vs. non-renewable energy trends**, helping organizations and governments make informed decisions toward **clean energy adoption**.
- Helps **track CO₂ emissions** and measure the impact of energy policies.
- Identifies **countries leading in renewable energy adoption**, inspiring others to follow.

3. Aids Decision-Making for Policymakers & Businesses

- Provides **data-driven insights** to assist governments in **formulating energy policies and regulations**.
- Businesses can use the dashboard to optimize **energy consumption, cost efficiency, and investment strategies** in renewable energy sectors.
- Forecasting models predict **future energy demand and supply**, helping stakeholders prepare for sustainable energy needs.

4. Easy-to-Use Interactive Visuals

- Power BI's **drag-and-drop interface** allows even non-technical users to explore insights.
- **Drill-through reports, heatmaps, and trend analysis** make data more accessible.

Disadvantages:

1. Requires Updated Datasets

- The dashboard's accuracy depends on **frequent data updates** from **reliable energy sources**.
- If data sources are outdated, insights and forecasts may become **irrelevant or misleading**.
- **Solution:** Automate data refresh schedules in **Power BI Service** and integrate with real-time APIs.

2. Dependency on Accurate Data Sources

- If **incorrect or incomplete data** is imported, the **analysis may lead to false conclusions**.
- Data inconsistencies (e.g., different formats for energy units, country names, or missing values) can impact visualization accuracy.
- **Solution:** Implement **data validation steps** and use **Power Query transformations** to clean and standardize data before analysis.

3. Performance Issues with Large Datasets

- Handling **huge energy datasets** with millions of records can slow down Power BI performance.
- **Complex queries, multiple relationships, and detailed granularity** can lead to **slow loading times**.
- **Solution:** Use **data aggregations, indexing, and DirectQuery mode** to optimize performance.

10. CONCLUSION

This project successfully visualizes **global energy trends** and provides **critical insights for stakeholders** such as policymakers, energy analysts, businesses, and environmental organizations. By leveraging **Power BI's data visualization capabilities**, the dashboard transforms **complex energy data** into **meaningful insights** that drive informed decision-making.

Comprehensive Data Analysis:

- The project effectively analyzes **energy consumption patterns**, distinguishing between **renewable and non-renewable energy sources**.
- Users can explore **regional energy distribution, CO₂ emissions, and power generation trends**.

Interactive & Dynamic Dashboards:

- The Power BI interface allows users to **filter data, compare energy trends across regions, and forecast future scenarios**.
- **Custom visuals, heatmaps, and trend lines** help users quickly grasp **important insights**.

Data-Driven Decision Making:

- The dashboard provides **critical insights to governments, businesses, and energy researchers** for strategic planning.
- Policymakers can use the tool to **assess sustainability efforts, track energy policies, and promote clean energy initiatives**.

- Businesses can optimize **energy investments, cost efficiency, and risk management** based on **historical and predictive analytics**.

Future-Ready Scalability:

- The solution can be **expanded with additional datasets, real-time API integrations, and AI-based forecasting models**.
- It supports **global energy transition efforts** by identifying trends and promoting **renewable energy adoption**.

11. FUTURE SCOPE

Future enhancements may include AI-based forecasting, integration with IoT devices, and additional datasets.

Real-Time Energy Monitoring: Integrating live energy data feeds from global agencies.

Machine Learning Integration: Enhancing predictive analytics for more accurate energy forecasts.

User-Friendly Customization: Allowing users to adjust metrics, timeframes, and custom reports.

Expanded Data Coverage: Incorporating economic and policy-based energy indicators for a holistic analysis.

12. APPENDIX

Source Code:

[GitHub Repository Link]

https://github.com/YadamLavanya/Global_Energy_Trends

Project Demo Link:

[Demo Video]

<https://drive.google.com/file/d/1XlI7T1pH3fTxgotwzGlQYCSma7C470v0/view?usp=sharing>