



Comparative Regional Analysis of Energy Consumption Patterns (2020-2024)



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This research investigates how energy consumption patterns are projected to change in different regions from 2020 to 2024 and the implications for regional energy policy. Understanding these trends can help policymakers develop tailored energy strategies that address specific regional needs and promote sustainability.

Introduction

Problem Statement

How are energy consumption patterns projected to change in different regions by 2020 - 2024, and what implications does this have for regional energy policy?

Significance

This analysis allows for a comparative understanding of how different regions are expected to change their energy consumption patterns, providing valuable insights for policymakers to tailor energy strategies according to regional needs.

Hypothesis

01 Regions with higher industrial activity will show greater increases in energy consumption.

02 Regions investing in renewable energy will show a slower rate of increase in energy consumption.

03 Regions with higher economic growth will exhibit higher overall energy consumption.

Objectives

- Analyze and compare regional energy consumption trends.
- Identify dominant energy sources in each region.
- Provide policy recommendations based on energy consumption patterns.

Methodology

Data was sourced from the U.S. Energy Information Administration (EIA) using their API (APIv2). The process involved:

1. **Data Retrieval:** Using the EIA's API to obtain regional energy consumption datasets.

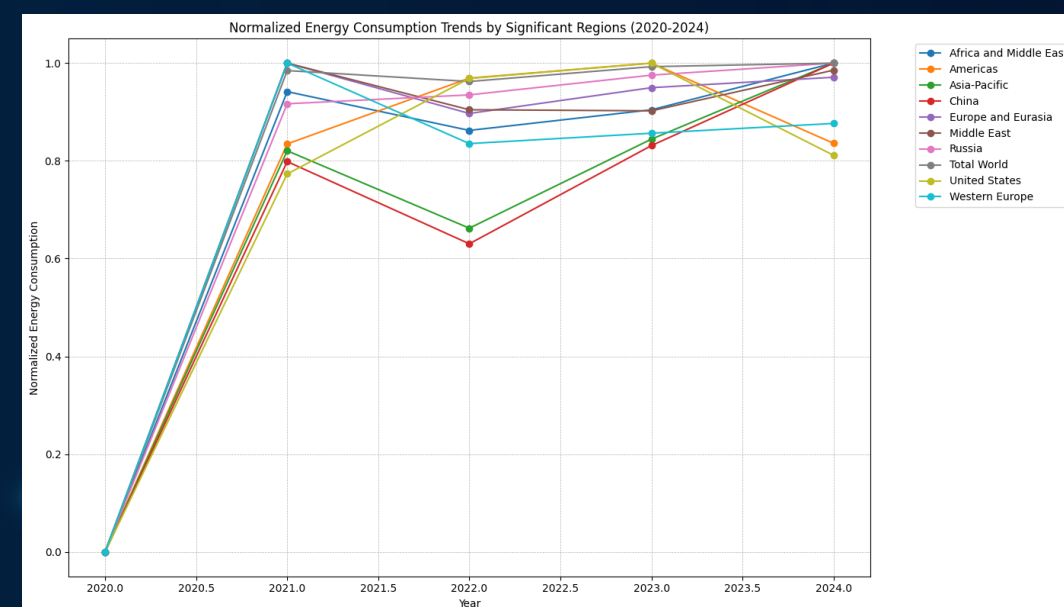
2. **Data Visualization:**

- Line Plot:** Displaying normalized energy consumption trends.
- Bar Chart:** Comparing total consumption across regions annually.
- Stacked Bar Chart:** Showing contributions of each energy source per region.
- Heatmap:** Visualizing consumption intensity and distribution.
- Diverging Bar Chart:** Comparing regional consumption to the average.

These visualizations were created using R, Python's Matplotlib and Pandas libraries.

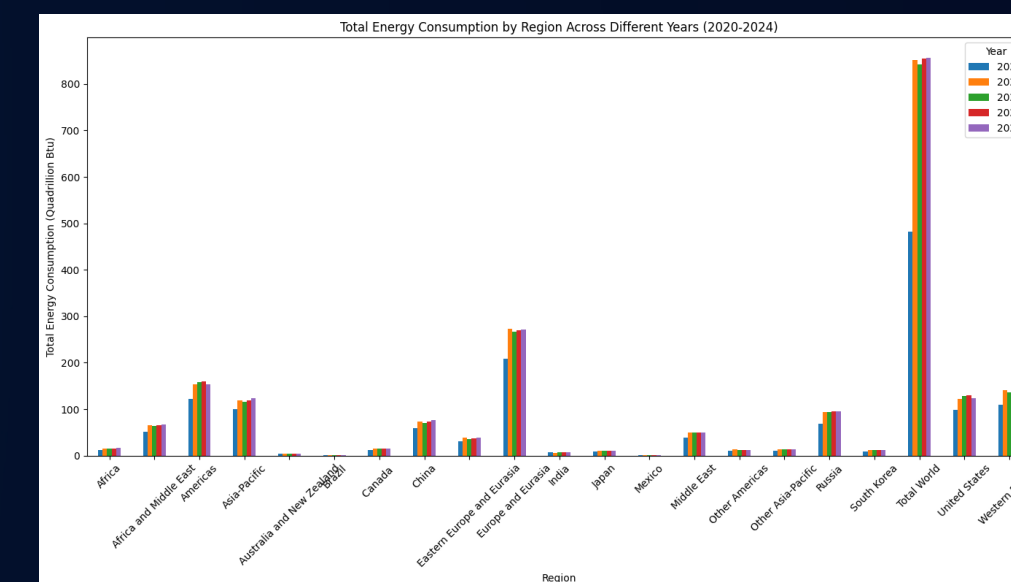
Research

Figure 1: Line Plot of Energy Consumption Trends (2020-2024)



Exhibits significant initial increases in energy use across most regions, especially noticeable in Europe and Eurasia for continuous growth, and the Middle East for an early spike then stabilization. The trends align closely with global consumption patterns observed in the United States.

Figure 2: Regional Comparison Bar Chart (2020-2024)



Highlights the "Total World" as having the highest energy consumption with major contributions from Asia-Pacific, Europe and Eurasia, and the Americas. Notably lower consumption is observed in Africa, South Korea, and the Middle East, indicating varying regional energy demands.

Showcases how different energy sources contribute to the total energy consumption, with "Industrial Electricity" as a predominant source across several regions. Notable high consumption from "Residential Natural Gas" is seen in Europe, Eurasia, and the Americas.

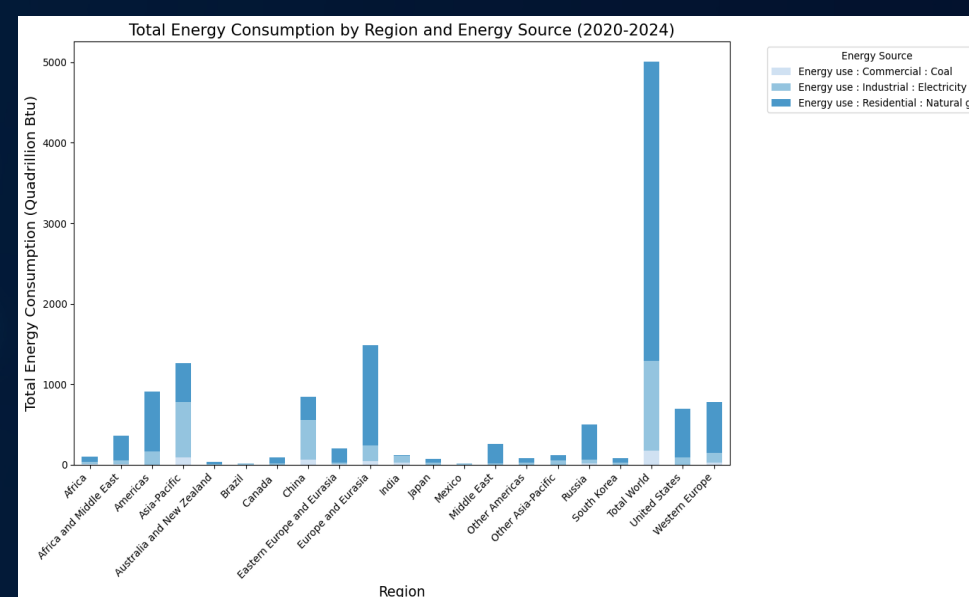


Figure 3: Stacked Bar Chart by Energy Source

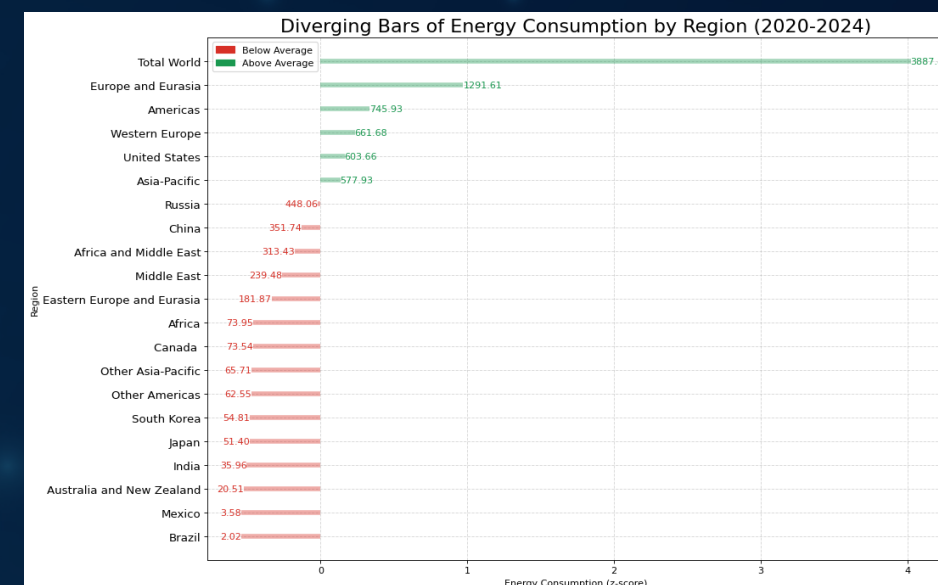
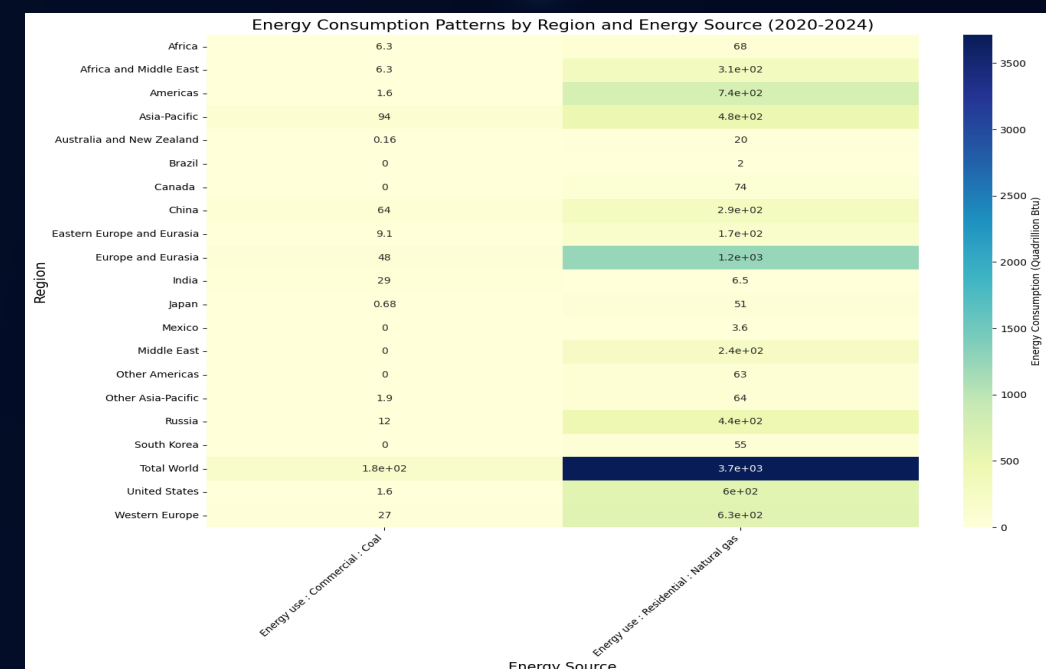


Figure 5: Diverging Bars of Energy Consumption

Compares regions based on whether their energy consumption is above or below the average. The Total World, along with Europe and Eurasia and the Americas, exhibits higher than average consumption, while regions like Russia, China, and Africa show potential for growth or efficiency improvements.

Provides detailed insights into the distribution and intensity of energy use. Europe and Eurasia dominate in residential natural gas usage, whereas Brazil, Canada, and Mexico show minimal energy consumption, suggesting areas for targeted energy policy interventions.

Figure 4: Heatmap of Energy Consumption Patterns



Conclusion

The analysis of energy consumption patterns from 2020 to 2024 reveals key insights:

- Steady Increase:** Europe and Eurasia show consistent energy demand growth.
 - High Consumption Regions:** Total World, Asia-Pacific, and Americas are major consumers, needing sustainable energy policies.
 - Low Consumption Regions:** Africa, South Korea, and Middle East require infrastructure development and energy access.
 - Recommendations:**
 - Invest in Renewables:** Prioritize renewable energy in high consumption regions.
 - Improve Efficiency:** Implement energy efficiency programs in stabilizing regions.
 - Develop Infrastructure:** Enhance energy infrastructure in low consumption regions.
 - Regional Collaboration:** Foster international collaboration on energy policies.
 - Target Key Sources:** Focus on dominant energy sources in each region for tailored policies.
- Understanding these trends allows policymakers to address regional energy needs efficiently and sustainably.

References

Gahlot, R., Garg, M. (2024). The Effect of Energy Consumption on Economic Growth: a Scientometric Analysis. Journal of Knowledge Economy. <https://doi.org/10.1007/s13132-024-02048-y>

U.S. Energy Information Administration (EIA). API Documentation. Retrieved from <https://www.eia.gov/opendata/browser/ieo>