

Exploring Global Trends: Clustering and Modeling Renewable Energy Consumption Across Countries

ABSTRACT

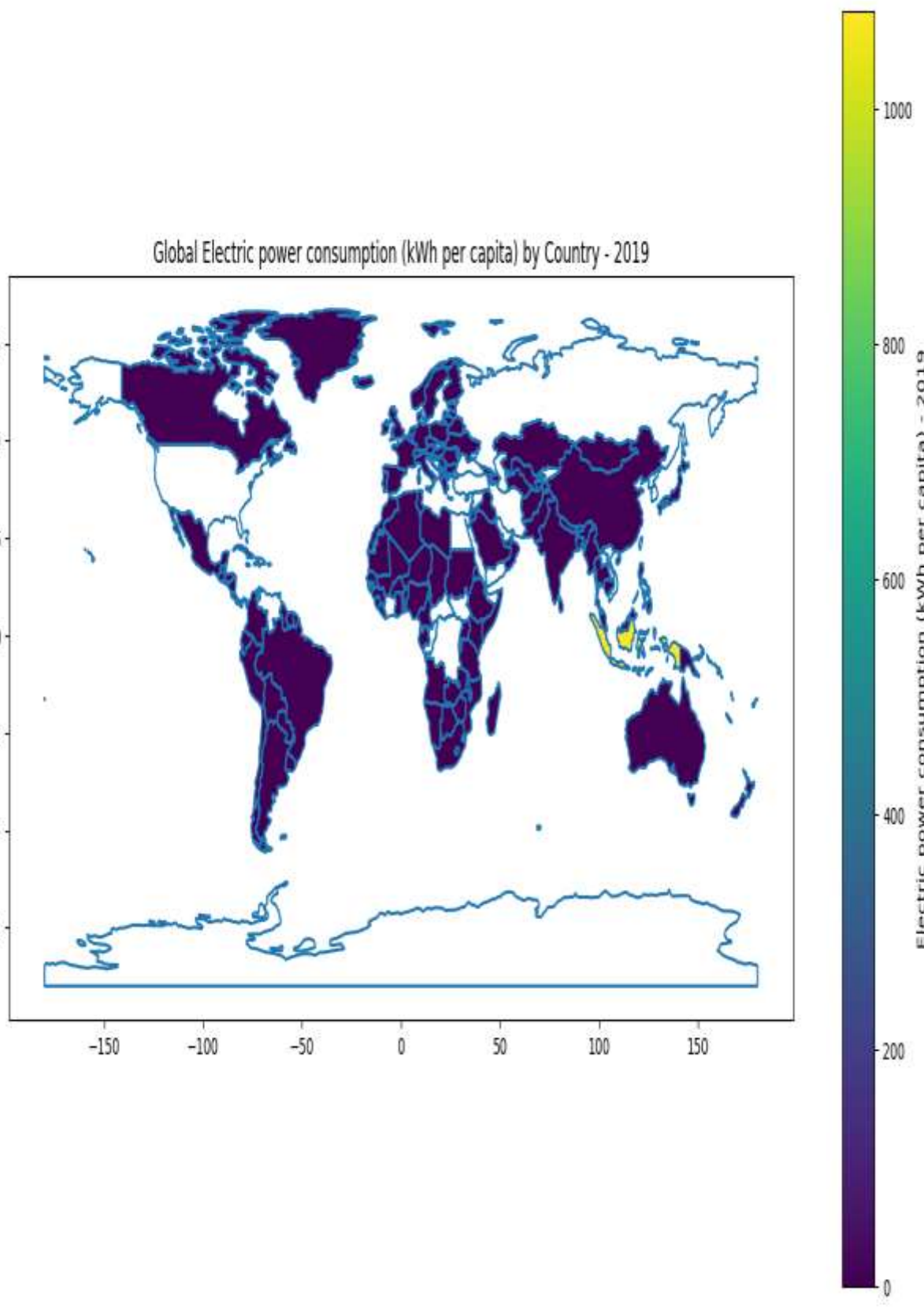
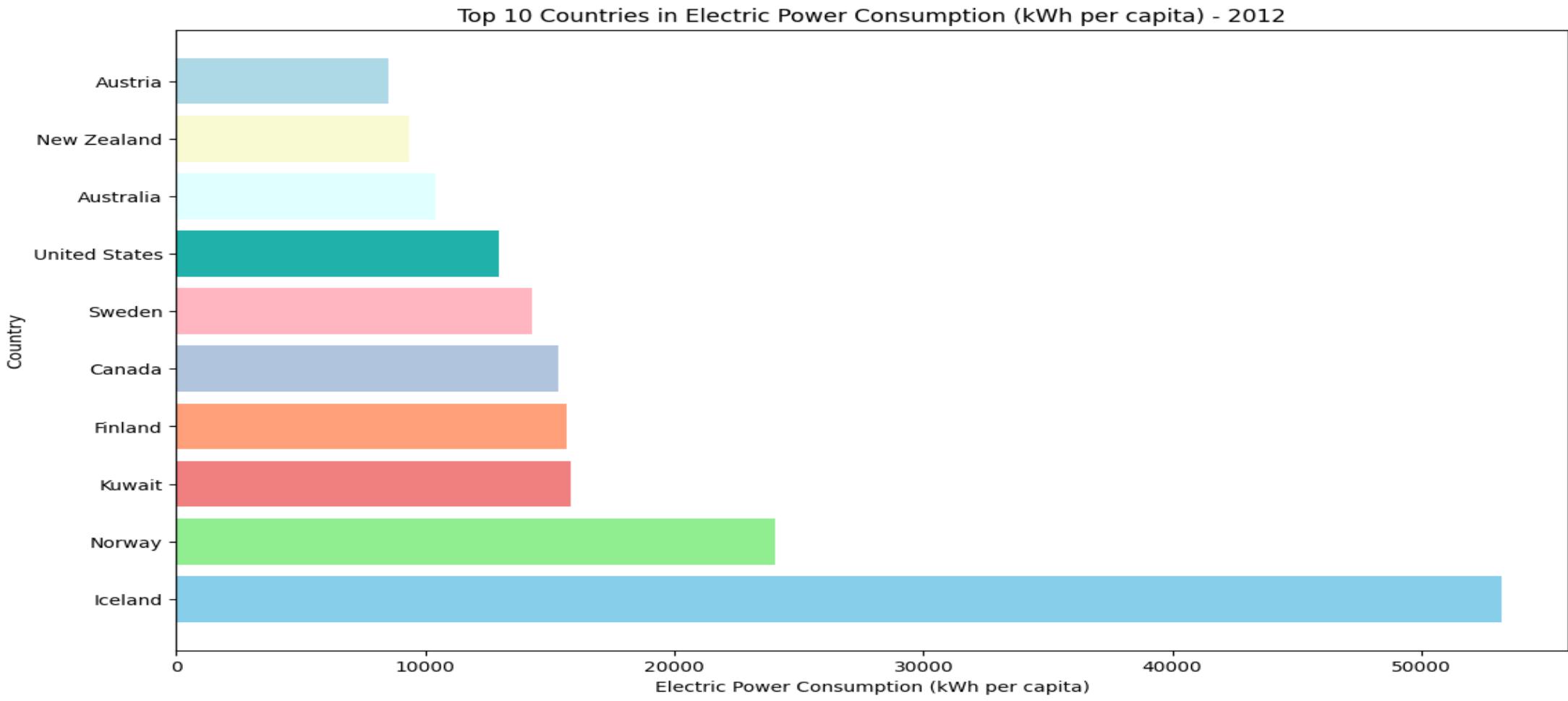
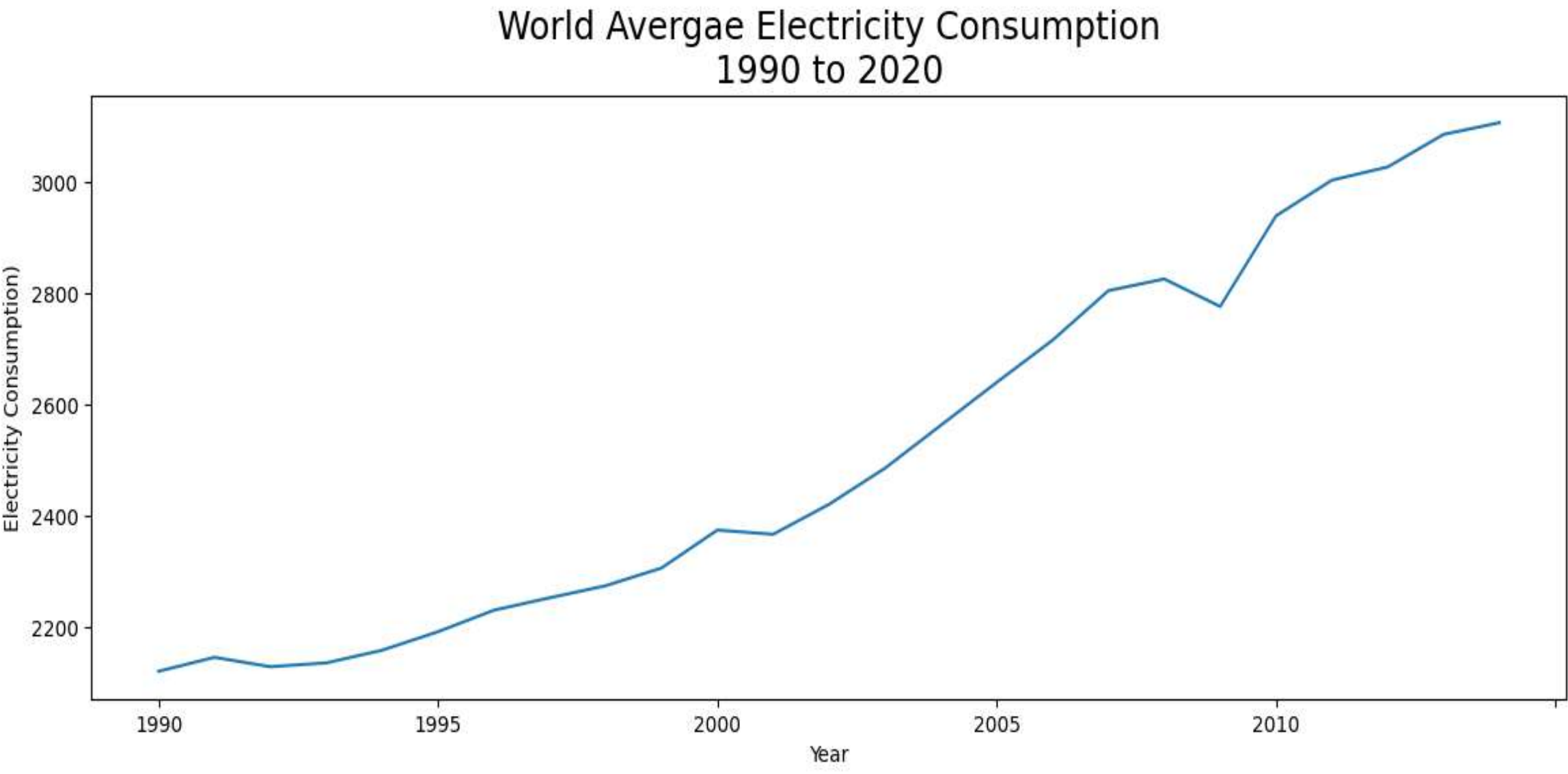
This study explores into the dynamics of global electricity consumption, critically assessing contributions from diverse resources. In the light of the environmental impact and unsustainability of non-renewable sources, the focus shifts to the escalating global trend of renewable energy adoption. The primary objective is to identify significant clusters among countries, unveiling distinctive patterns in renewable energy consumption. Analysis reveals five distinct clusters, each depicting a unique trajectory in the transition toward sustainable energy sources. This study provide valuable insights into the global shift towards renewable energy, emphasizing the importance for sustainable energy practices.

INTRODUCTION

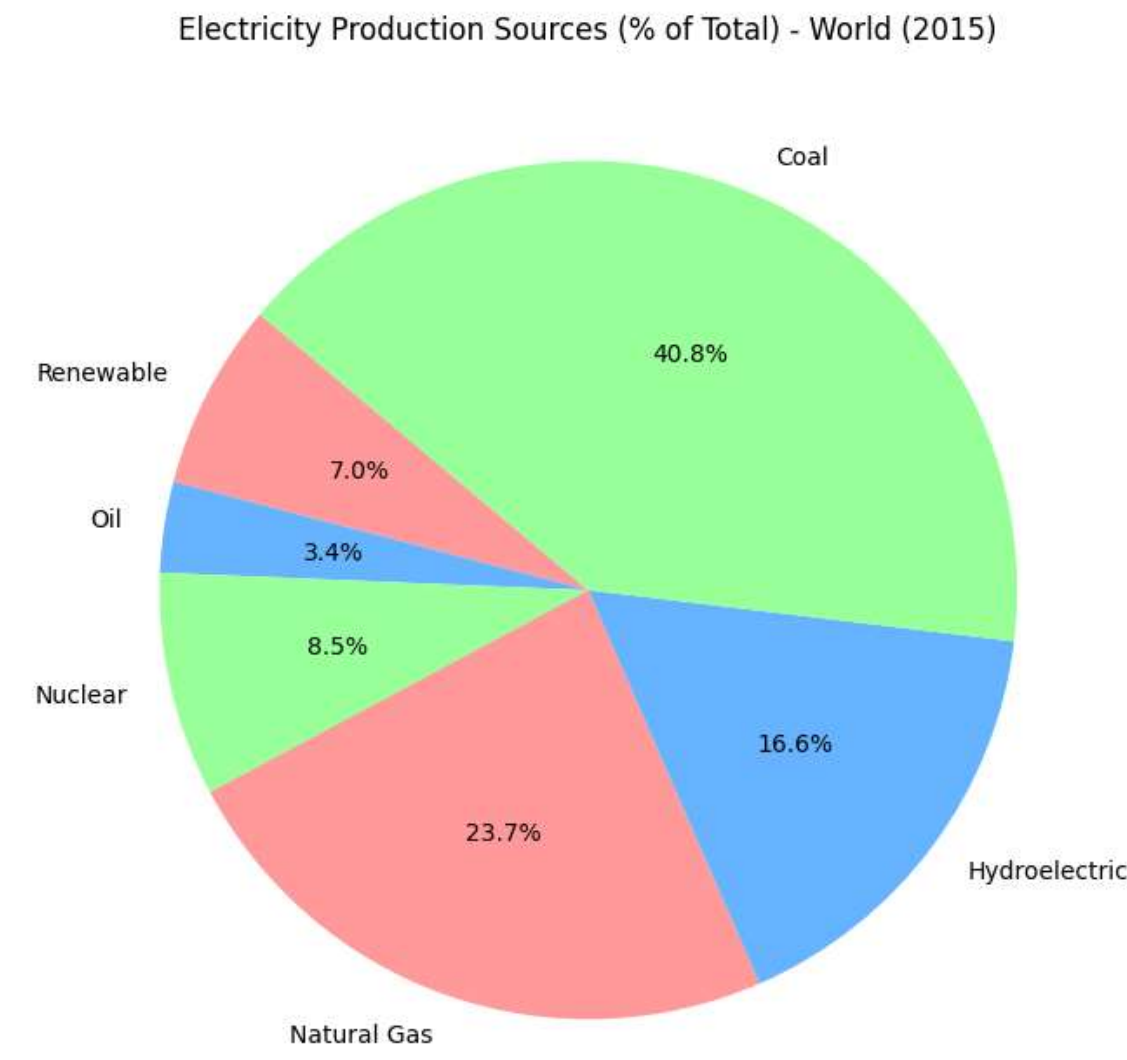
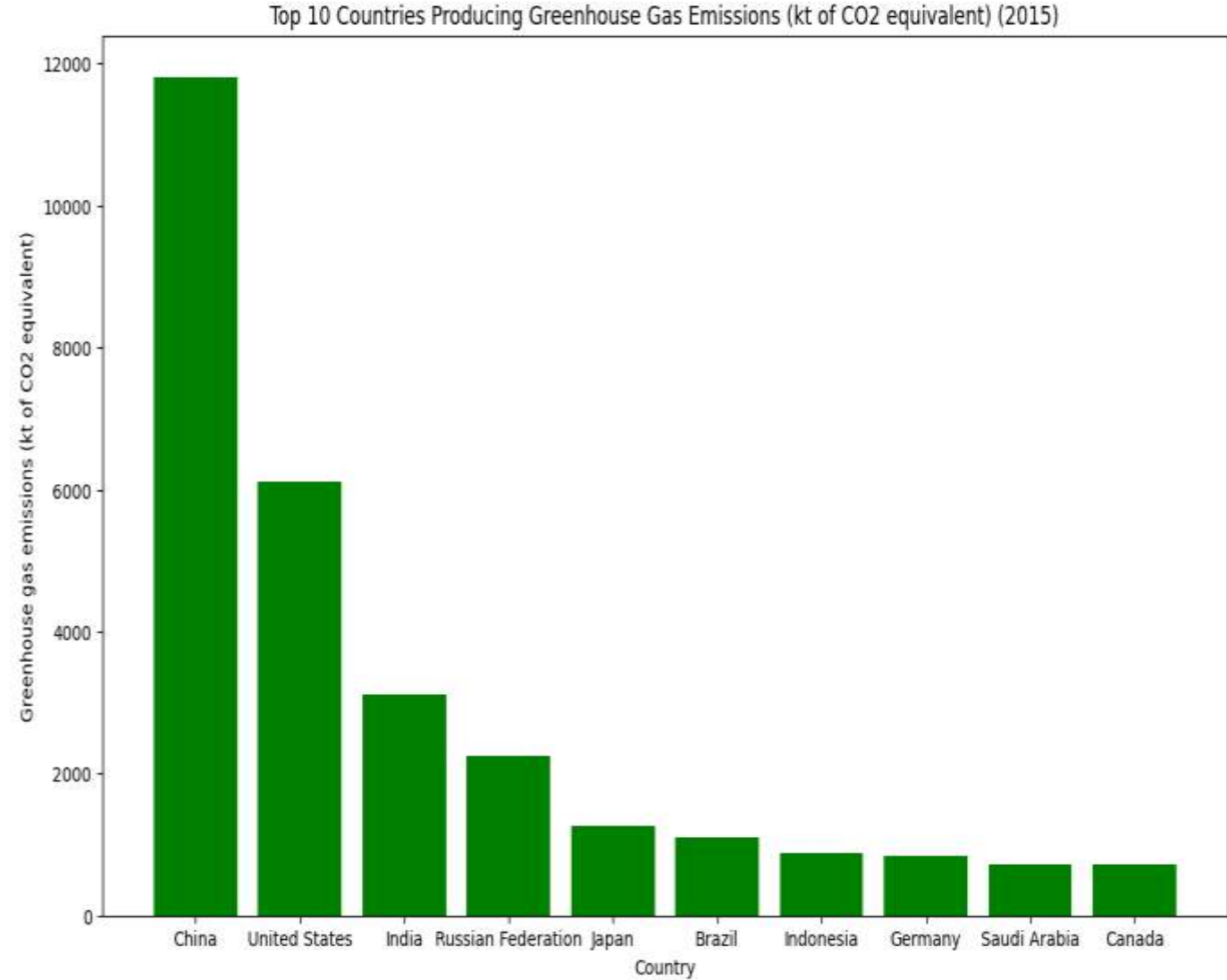
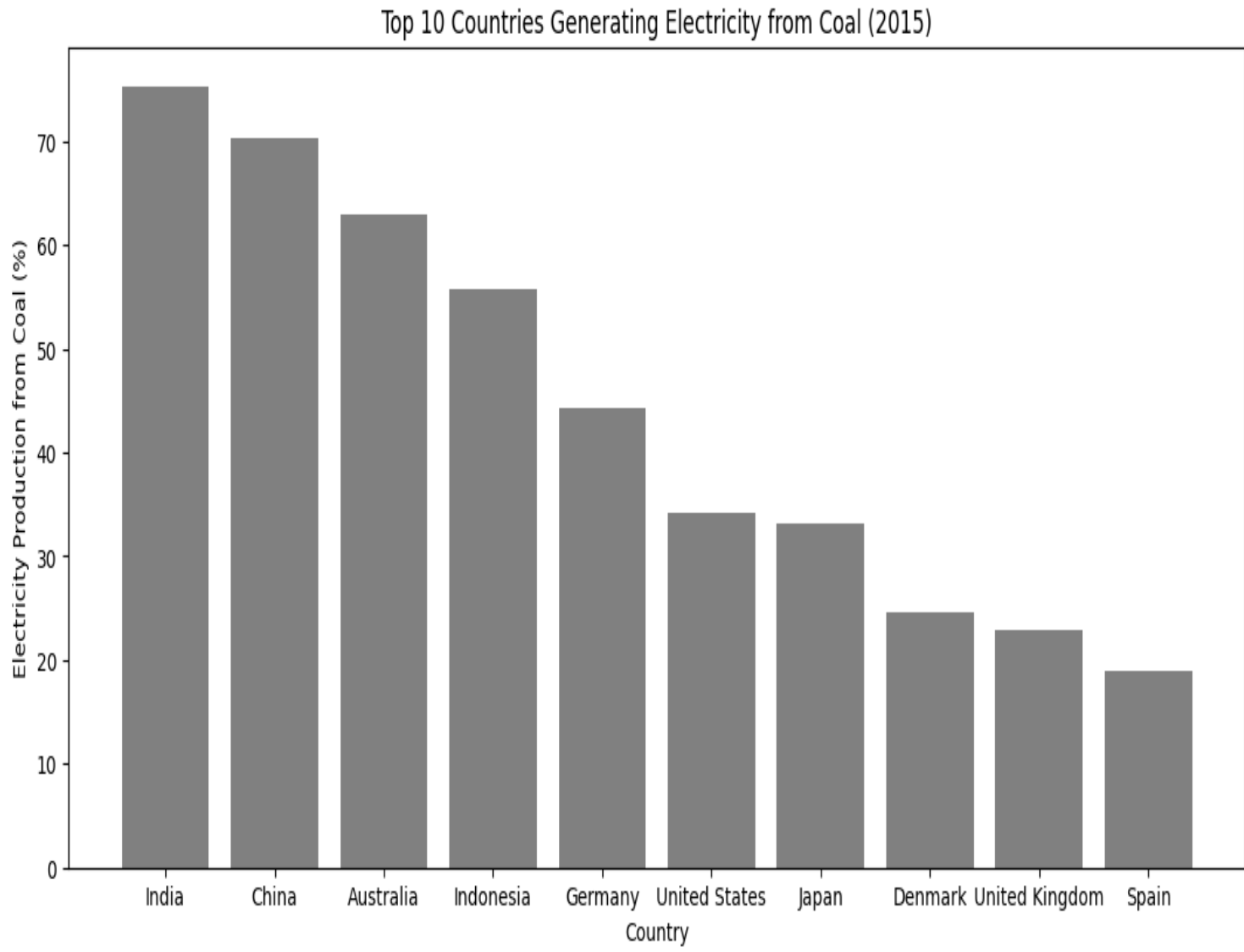
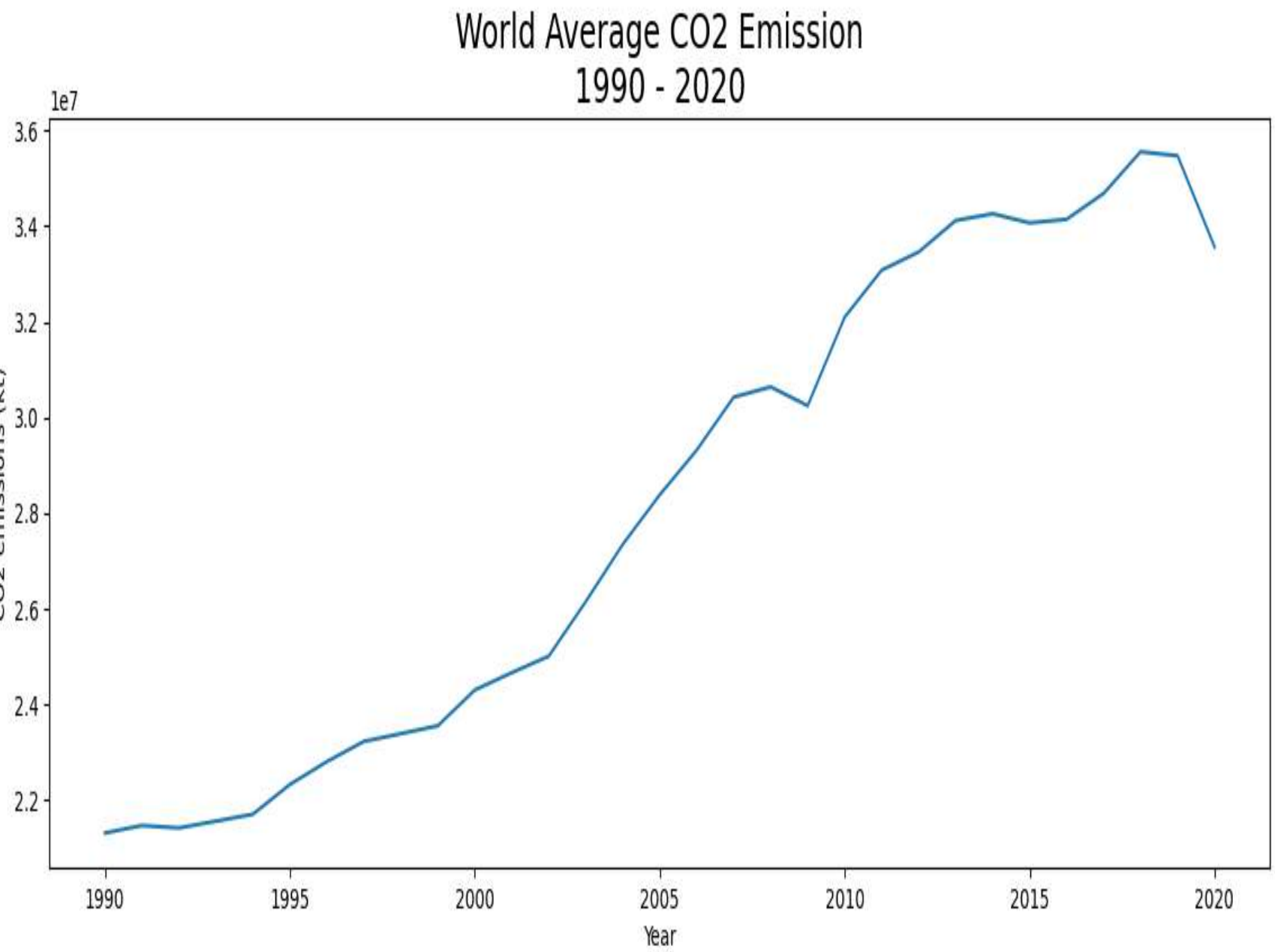
Our planet faces the twin challenges of environmental degradation and resource scarcity, the urgency for adopting sustainable energy practices has been gaining significance. Over the past few decades, electricity consumption and CO2 emissions by countries worldwide have experienced a rapid rise. The shift from traditional energy sources, such as coal, oil, and natural gas, to renewable sources has become increasingly necessary. This study examines the global trends in electricity consumption and CO2 emissions, with a focus on renewable energy consumption and its potential to shape the future of our planet. The primary objective is to identify distinct clusters of countries based on their patterns of renewable energy consumption, to unravel diverse trajectories.

BACKGROUND

Electricity consumption worldwide has been growing steadily over the years. The number of people without access to electricity has fallen substantially.

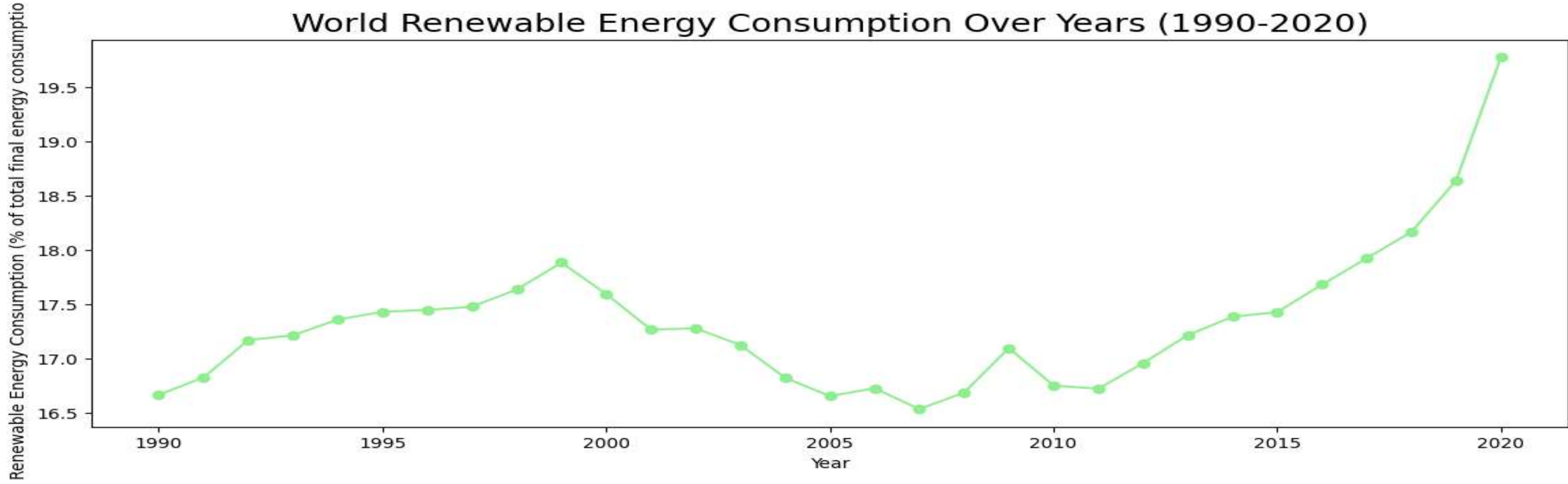


Electricity is produced through various resources. But fossil fuels, especially coal, still dominate electricity production. Coal has several drawbacks, including high carbon emissions, air pollution, and negative health impacts. Global energy-related carbon dioxide (CO2) emissions set the highest on record. Meeting rapidly growing energy demand while reducing harmful emissions of greenhouse gases is a considerable challenge. Countries contributing the most to CO2 emissions, such as the China, United States, and India, are facing growing pressure to reduce their reliance on fossil fuels and transition to cleaner energy sources.

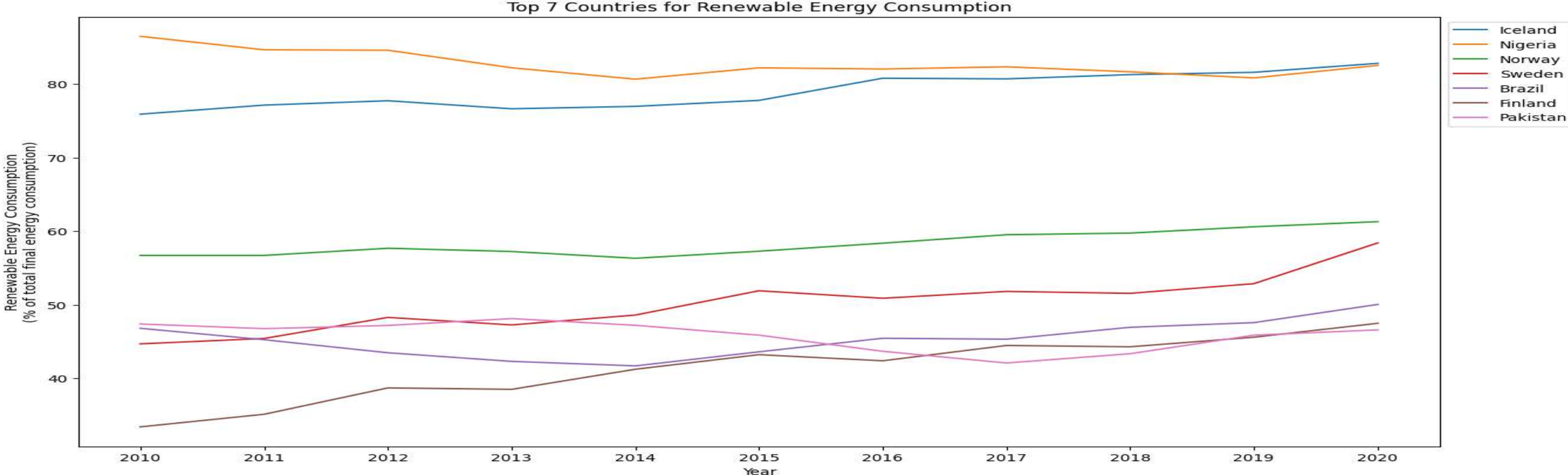


RENEWABLE ELECTRICITY CONSUMPTION

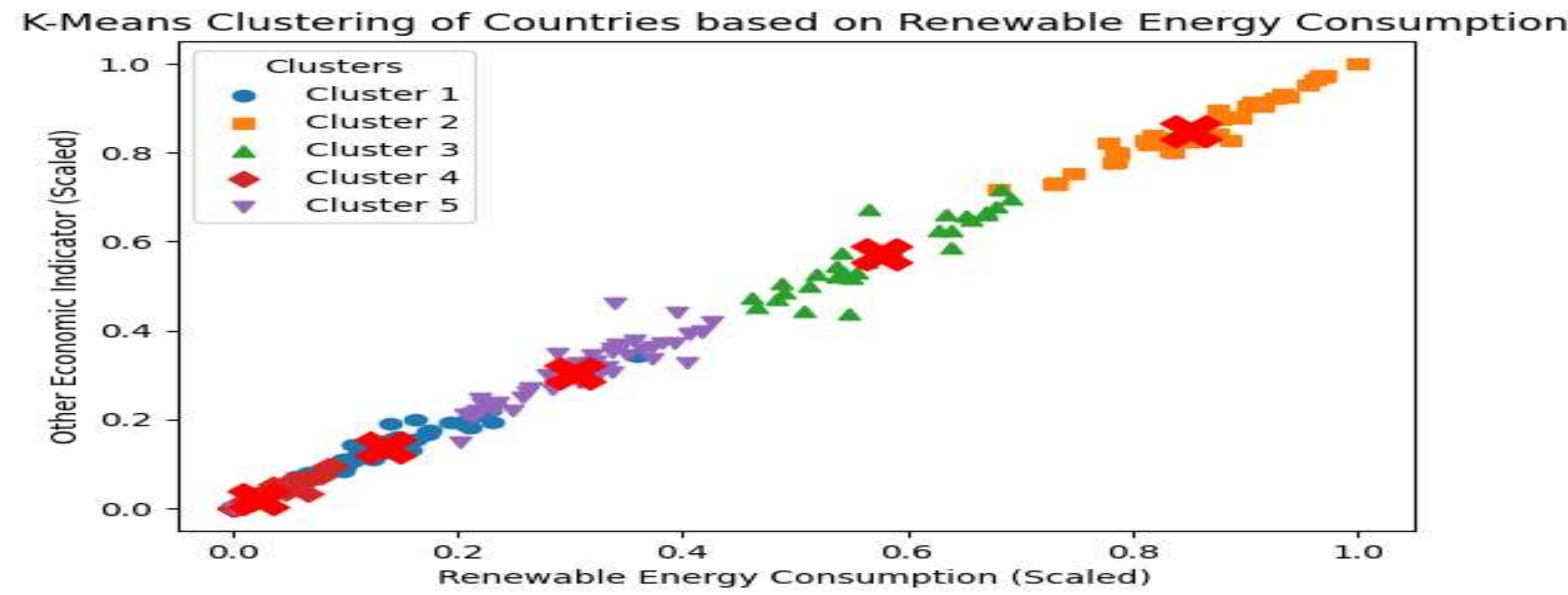
There is a need to shift towards renewable energy sources. Countries are increasingly adopting renewable energy sources.



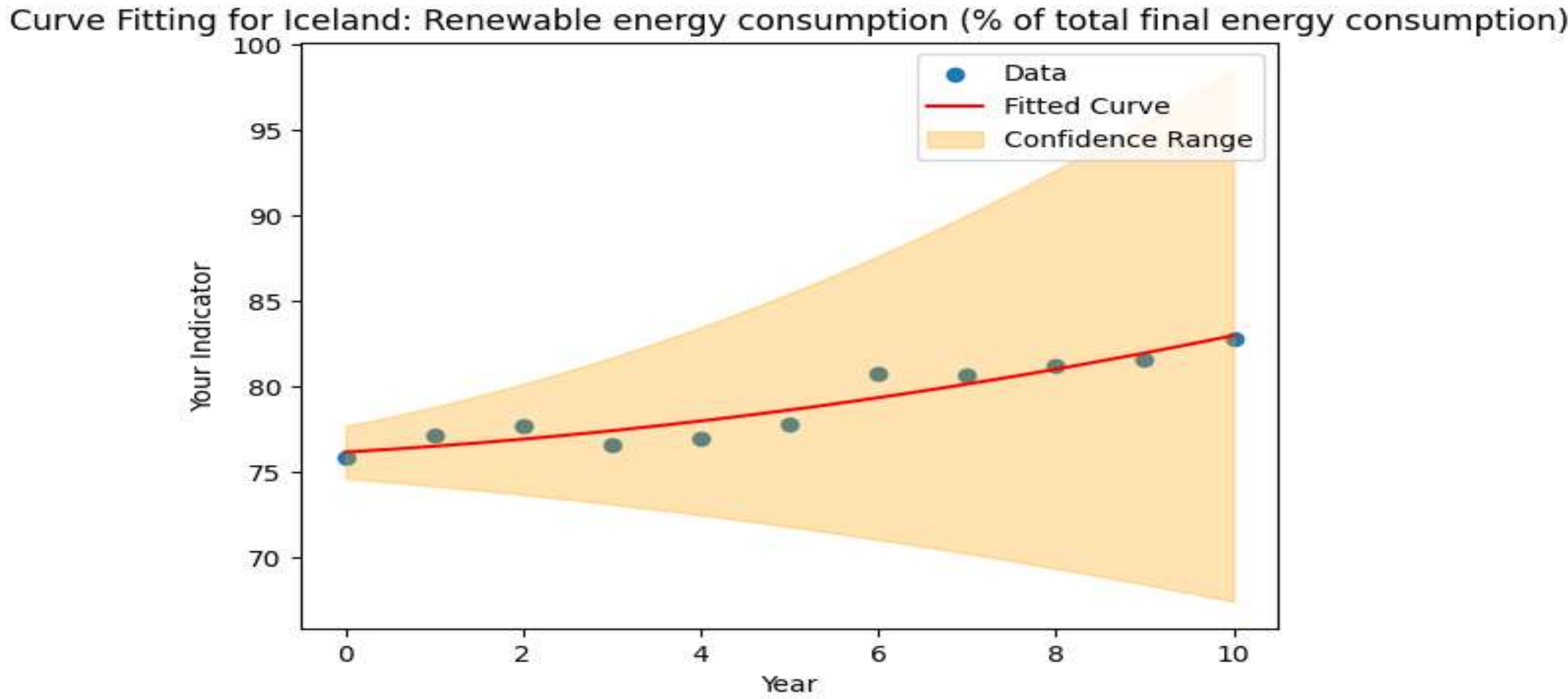
In fact, several countries, such as Germany, and Sweden, have made commitments to transition their energy systems towards 100% renewable sources. The increasing trend towards renewable energy consumption has clearly seen for countries like Sweden, Finland, Nigeria. Countries with high renewable energy consumption have several benefits over those generating electricity from coal, including lower operating costs, stable and predictable electricity prices, lower carbon emissions, and reduced air pollution. They are reducing negative health impacts and contributing to climate change mitigation.



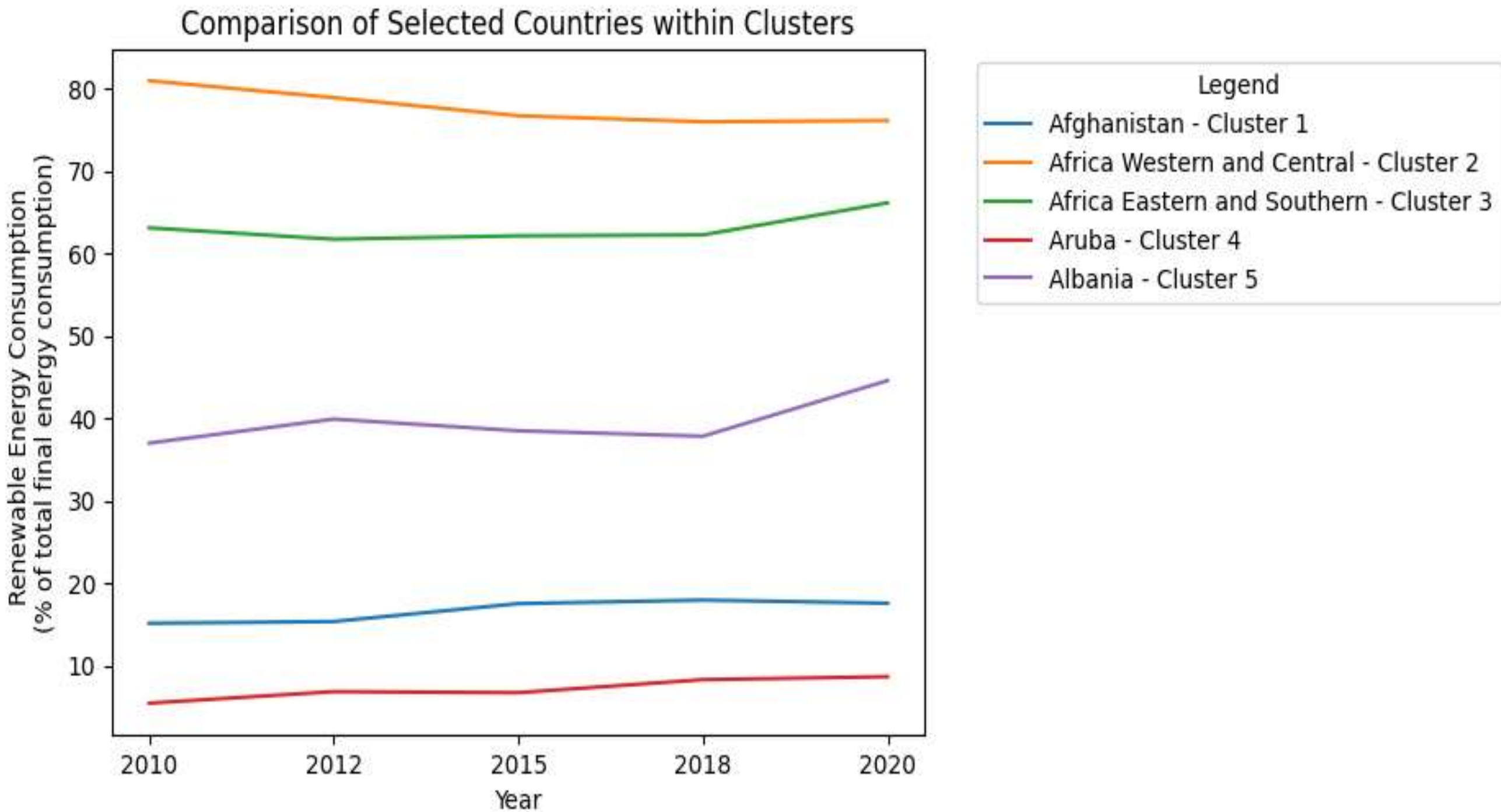
Countries are categorized into clusters based on renewable energy consumption patterns using K-Means clustering. Five distinct clusters are identified, showcasing different trajectories in renewable energy consumption. Cluster 2 include countries with highest renewable energy consumption from 2010 and onwards.



Curve fitting allows us to predict Iceland's future trend in renewable energy consumption by identifying patterns in its historical data. It indicates a positive trend in increasing renewable energy consumption.



Comparison of countries from each cluster offers a dynamic insight into how countries in each cluster have evolved in terms of renewable energy consumption. This provides a snapshot of the diverse paths these countries have taken in transitioning towards sustainable energy sources. Afghanistan and Aruba has similar trends while Africa Eastern and Southern and Africa Western and Central show progression from 2018.



CONCLUSION

In conclusion, our exploration into the dynamics of global electricity consumption and the clustering of countries based on renewable energy patterns has significant insights. It emphasizes the critical role of renewable energy in sustainable development. The identification of distinct clusters with varying trajectories in renewable energy consumption emphasizes the global diversity in adopting sustainable practices