

Cluster Analysis of Energy Use and Renewable Energy Transition in Countries Between 2000-2022

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Abstract

This study utilizes the “Renewable Energy Share by Country 2000–2025” dataset, compiled by Our World in Data (OWID) and accessible via the Kaggle platform. The dataset provides a detailed overview of countries' energy production based on various sources such as solar, wind, hydroelectric, nuclear, coal, natural gas, and oil. The main objective of the study is to reveal the energy transition patterns of countries and to identify countries with similar energy transition profiles, applying cluster analysis to their common structural characteristics. The findings demonstrate that the renewable energy transition cannot be explained solely by an increase in the share of renewable electricity production. While some countries have a low-carbon energy structure supported by nuclear energy infrastructure, others still rely heavily on natural gas and fossil fuels for electricity production. Countries with a mixed industrial profile exhibit a multi-source energy transition model that utilizes coal, natural gas, nuclear, and renewable resources together. China, the United States, France, Denmark, Brazil, and India were identified as countries that deviate from the general data structure and were evaluated separately from the overall clustering analysis.

Keywords

Energy Use, Cluster Analysis, Renewable Energy.