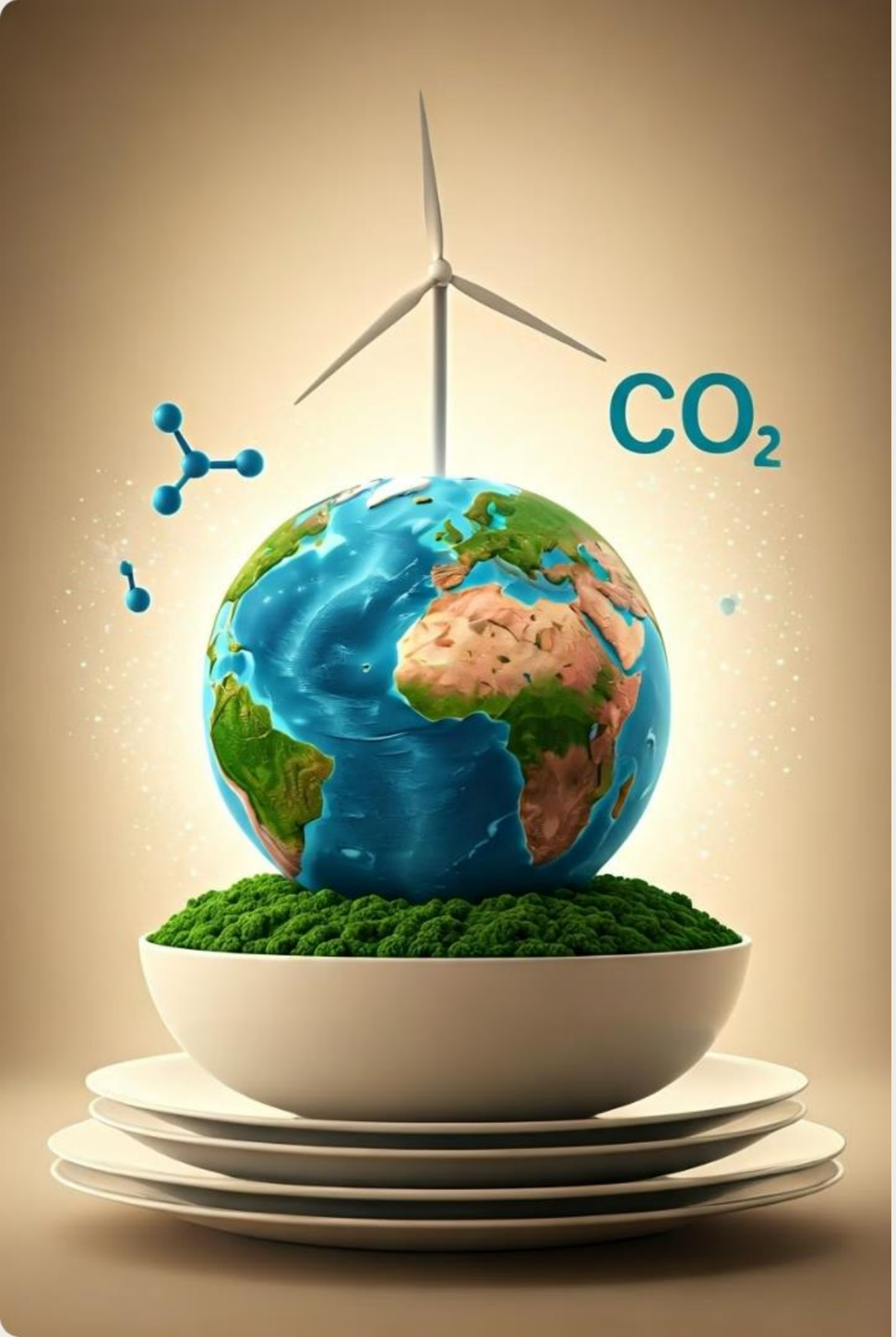

Assessing the relationship between Renewable Energy Consumption and CO2 Emissions

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Motivation

CO2 Emissions

Largest share of greenhouse gases, which are associated with global warming. Urgent need to mitigate climate change.

Renewable Energy

Clean alternative to fossil fuels e.g. solar, wind. Potential to reduce CO2 emissions significantly.

Research Question

Analyze the global consumption of renewable energy and assess its influence on the total CO2 emissions.

Data Sources

Dataset	CO2 Emissions	Renewable Energy Consumption
Coverage	266 countries/associations	266 countries/associations
Time Period	1990 - 2020	1990 - 2021
Unit	kt	% of total final energy consumption
License	CC BY-NC 4.0	CC BY-4.0
Source	Climate Watch – Historical GHG Emissions	IEA, IRENA, UNSD, World Bank, and WHO
Provider	The World Bank	The World Bank

ETL Pipeline

Adaptation and Changes

The time period for the Renewable Energy Consumption Dataset is set to 1990 – 2020.

Countries/Associations without records have been excluded.

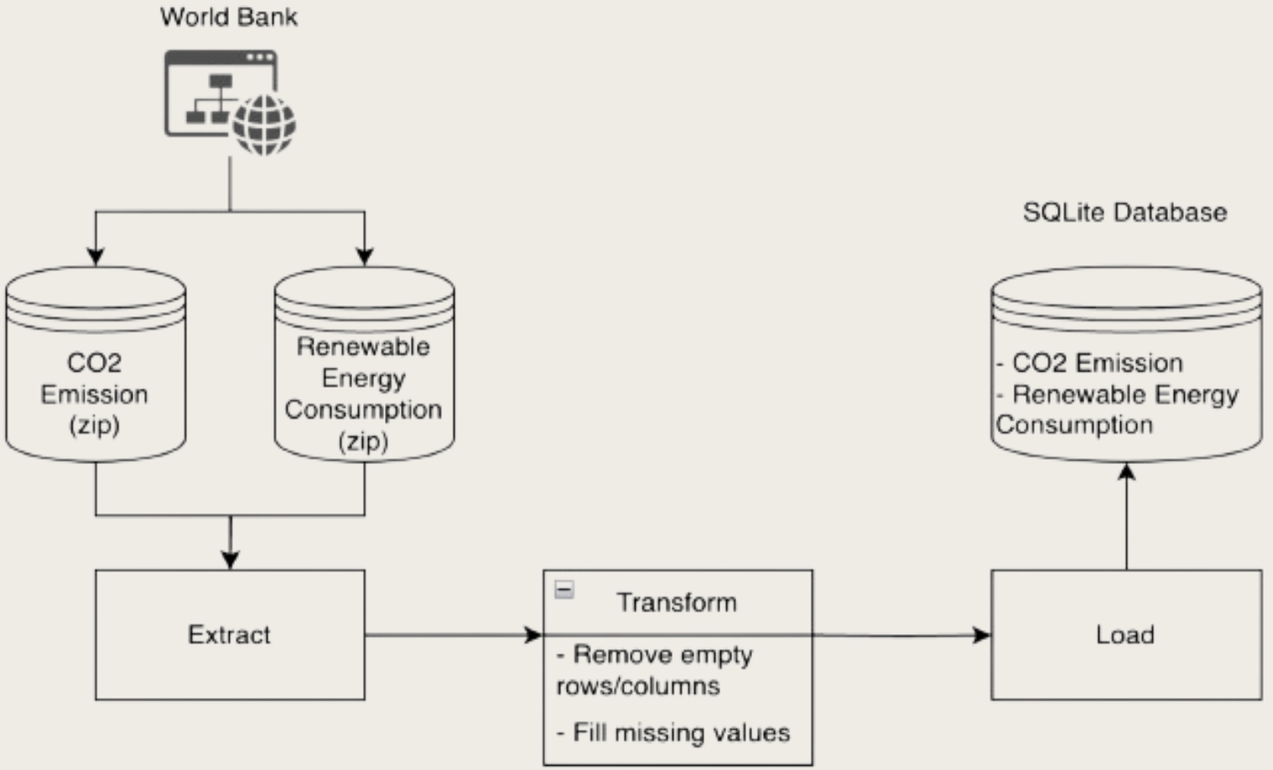
Only countries/associations present in both datasets are selected.

Missing values are filled using the first available value for each country/association.

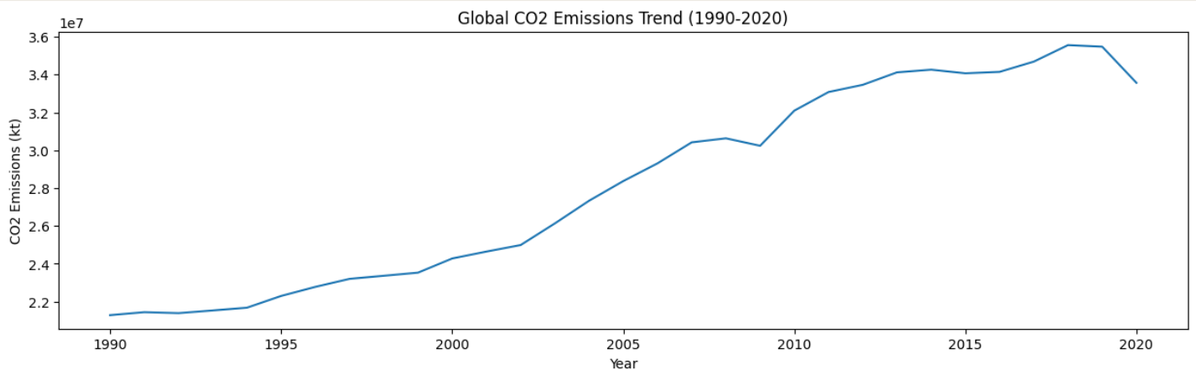
Result

The final datasets encompass 236 countries and associations from 1990 – 2020.

These datasets are stored in 2 tables within an SQLite database, saved locally

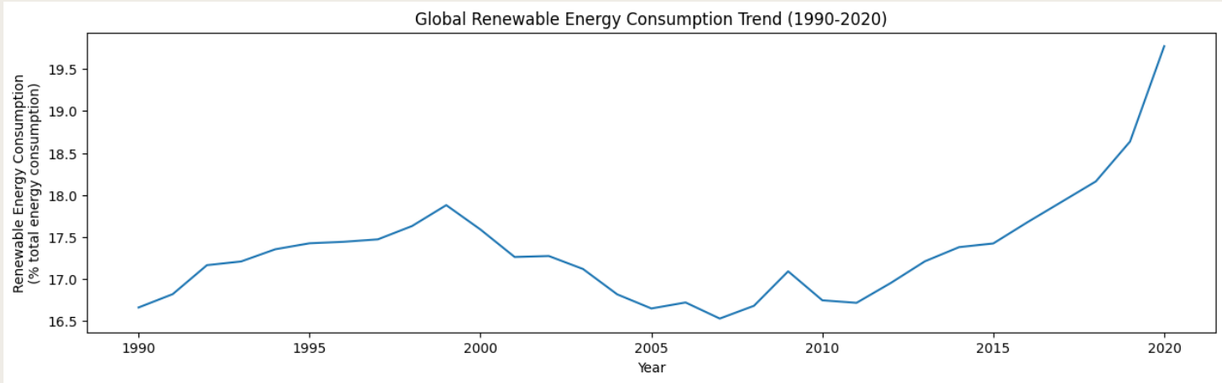


Global Trend



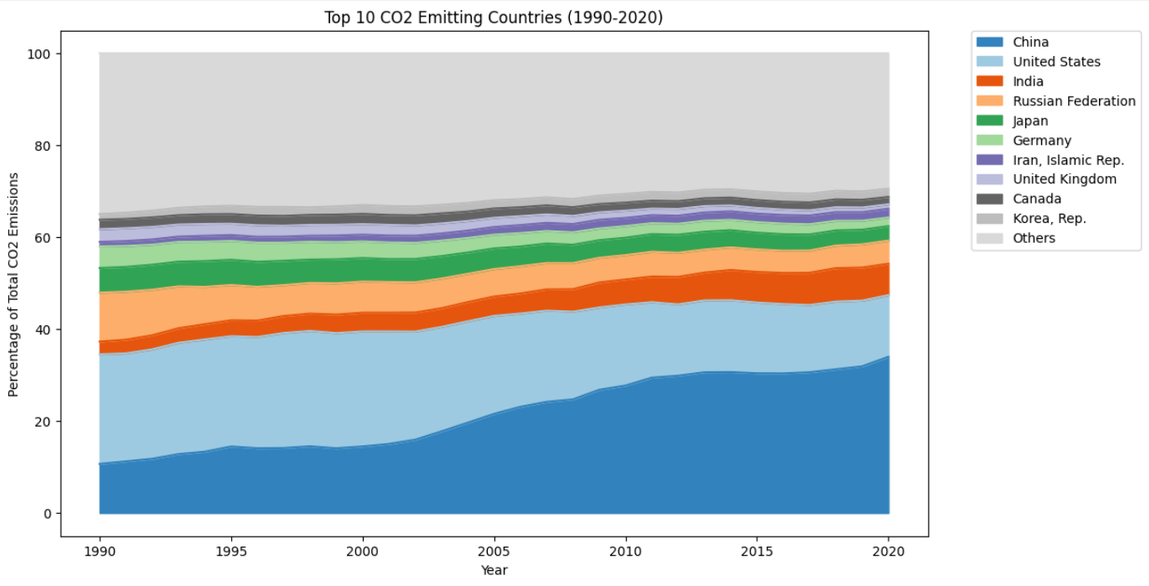
CO2 Emissions

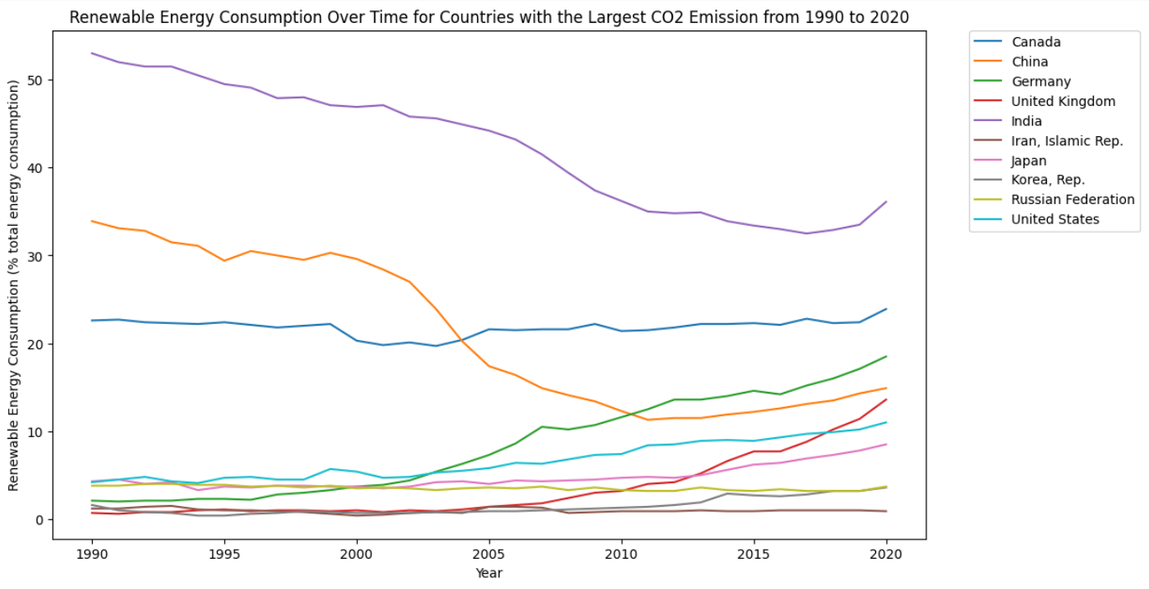
Steady increase from 1990 to 2020, with a significant rise of 57.7% and a modest decline of about 5% towards the end of the period



Renewable Energy Consumption

Steady increase in renewable energy consumption, with noticeable fluctuations and a sharp rise towards 2020





Top CO2 Emitters

Concentration of Emissions

60% of global CO2 emissions come from just 10 countries, with China (growing by four times) and the USA being the largest emitters.

Renewable Energy Correlation

Among the top 10 emitters, China has seen a dramatic decline in renewable energy consumption as has India.

In contrast, other countries have shown a steady increase in renewable energy consumption.

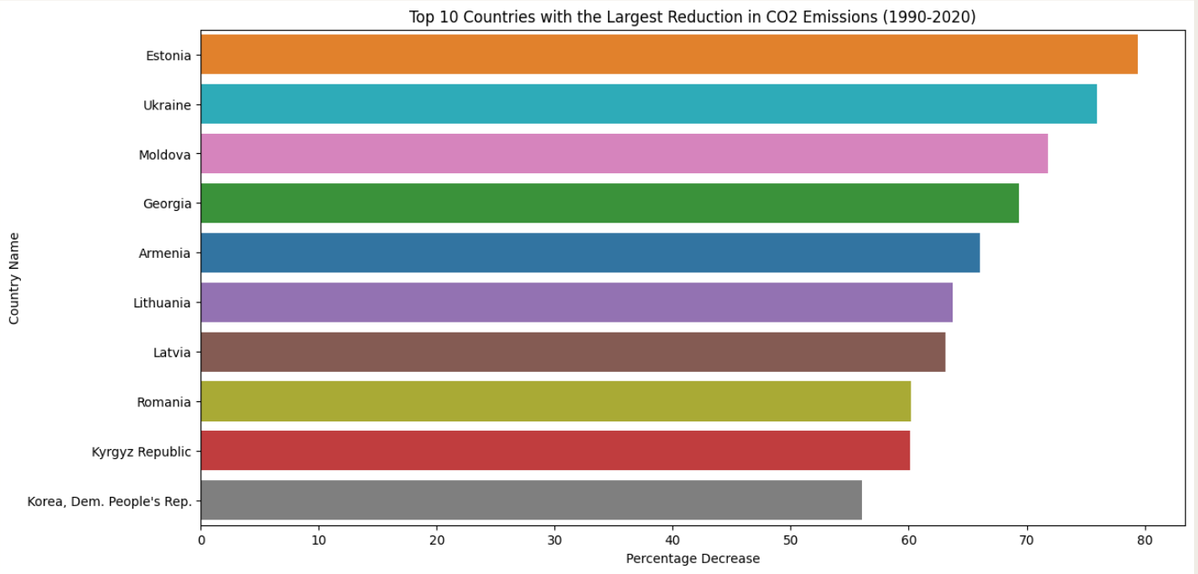
Top CO2 Reducers

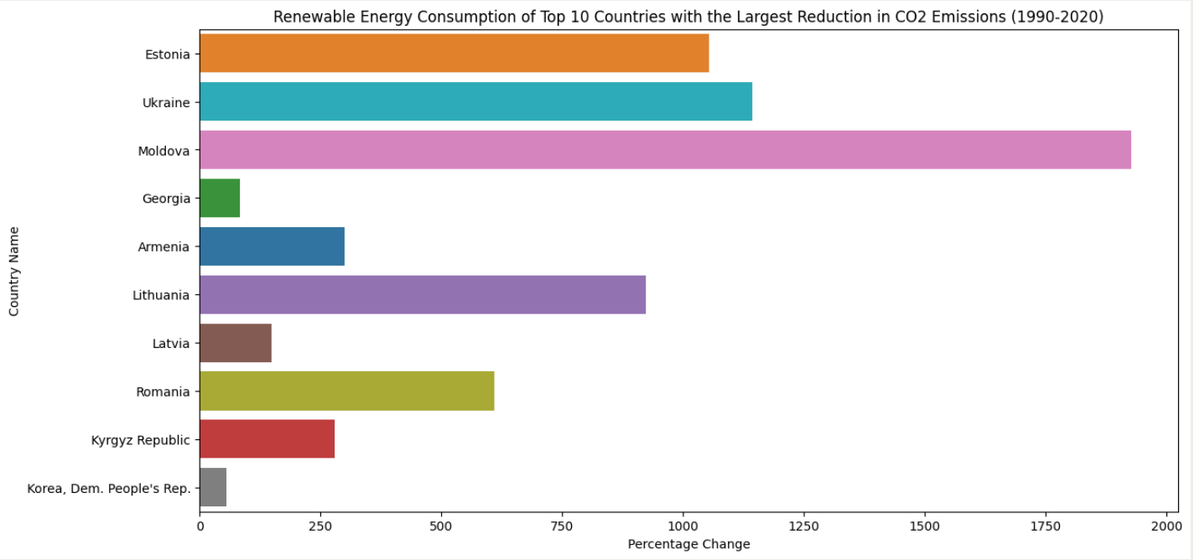
CO2 Reduction

Countries like Estonia, Ukraine, Moldova, Georgia have significant decrease in emissions > 50%

Increased Consumption

Significant decrease in emissions correlating with increased renewable energy usage





Trend by Income Group

1 Low-income

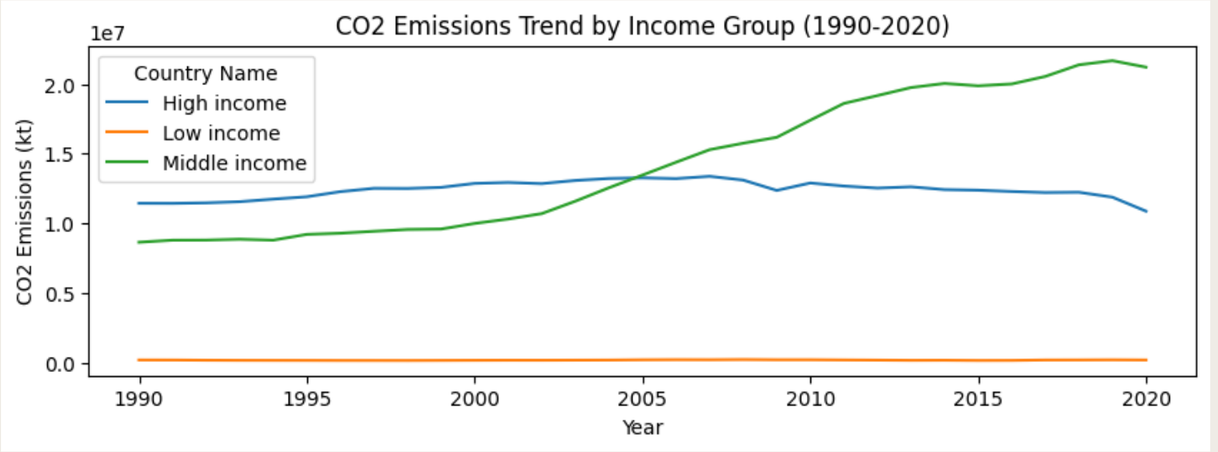
Low-income countries lead in renewable energy consumption while consistently maintained very low CO2 emissions throughout the entire period, showing minimal change.

2 Middle-income

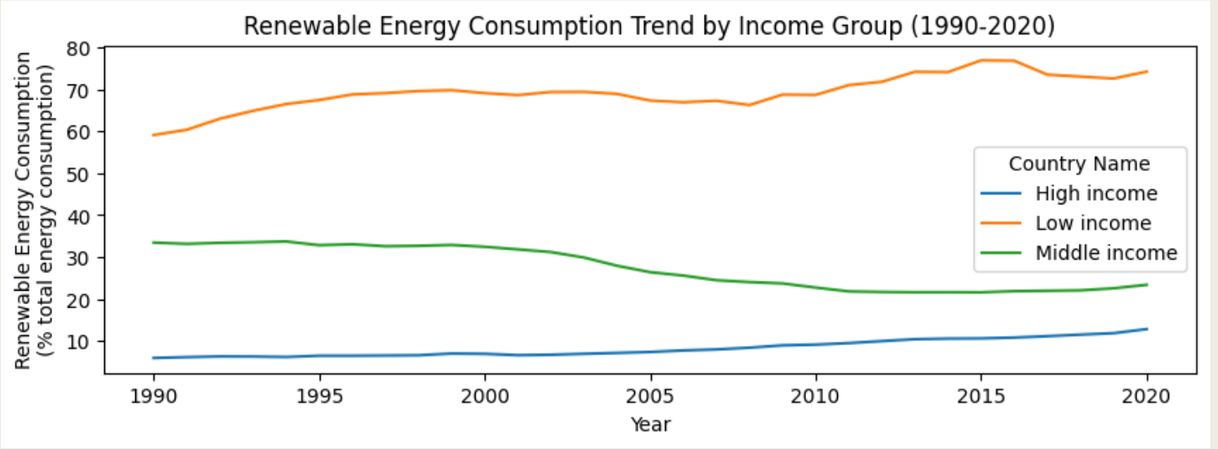
Middle-income countries face the dual challenge of rising emissions and decreasing renewable energy shares.

3 High-income

High-income countries, despite having lower renewable energy consumption, are beginning to show a decline in emissions as they transition to cleaner energy.



CO2 Emission



Renewable Energy Consumption

Challenges and Limitations

1

Regulations

Different policies across countries affect renewable energy adoption and CO2 reduction.

2

Technology

Varying access to renewable technologies impacts emission reduction capabilities.

3

Measurement

Accuracy and consistency of data collection methods affect analysis reliability.

Conclusion and Future Work

Complex Correlation

Relationship between renewable energy and CO2 emissions varies by country and economic group. The question remain **OPEN**!

Further Research

Investigate specific renewable technologies and country regulations for more targeted solutions.

Global Cooperation

Renewable energy adoption alone isn't enough. Need comprehensive strategies for emission reduction. International collaboration crucial for effective CO2 reduction and renewable energy implementation.

Thank you!