



TRACKING THE ENERGY TRANSITION

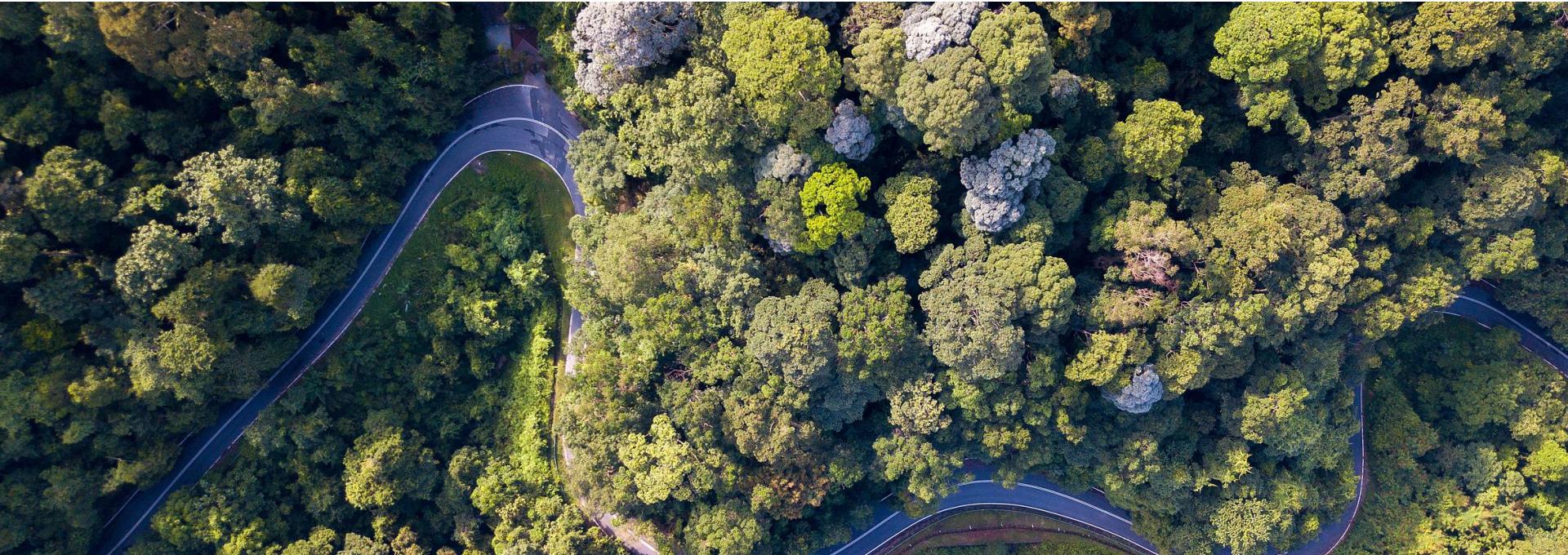
A GLOBAL DATA REVIEW

17 April, 2025



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ENERGY

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THANK YOU

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BACKGROUND

PROBLEM STATEMENT

- Many developing countries still face challenges in expanding electricity access, transitioning from fossil fuels, and scaling renewables.
- Inconsistent funding and misaligned policies highlight the urgent need for data-driven analysis to assess the effectiveness of global energy investments to guide future clean energy strategies.

THE GOAL

This report helps analyze global progress towards UN SDG 7.

Findings can be used to:

- Identify gaps in energy accessibility.
- Assess the adoption of renewable energy.
- Develop energy programs.
- Monitor sustainability goals.



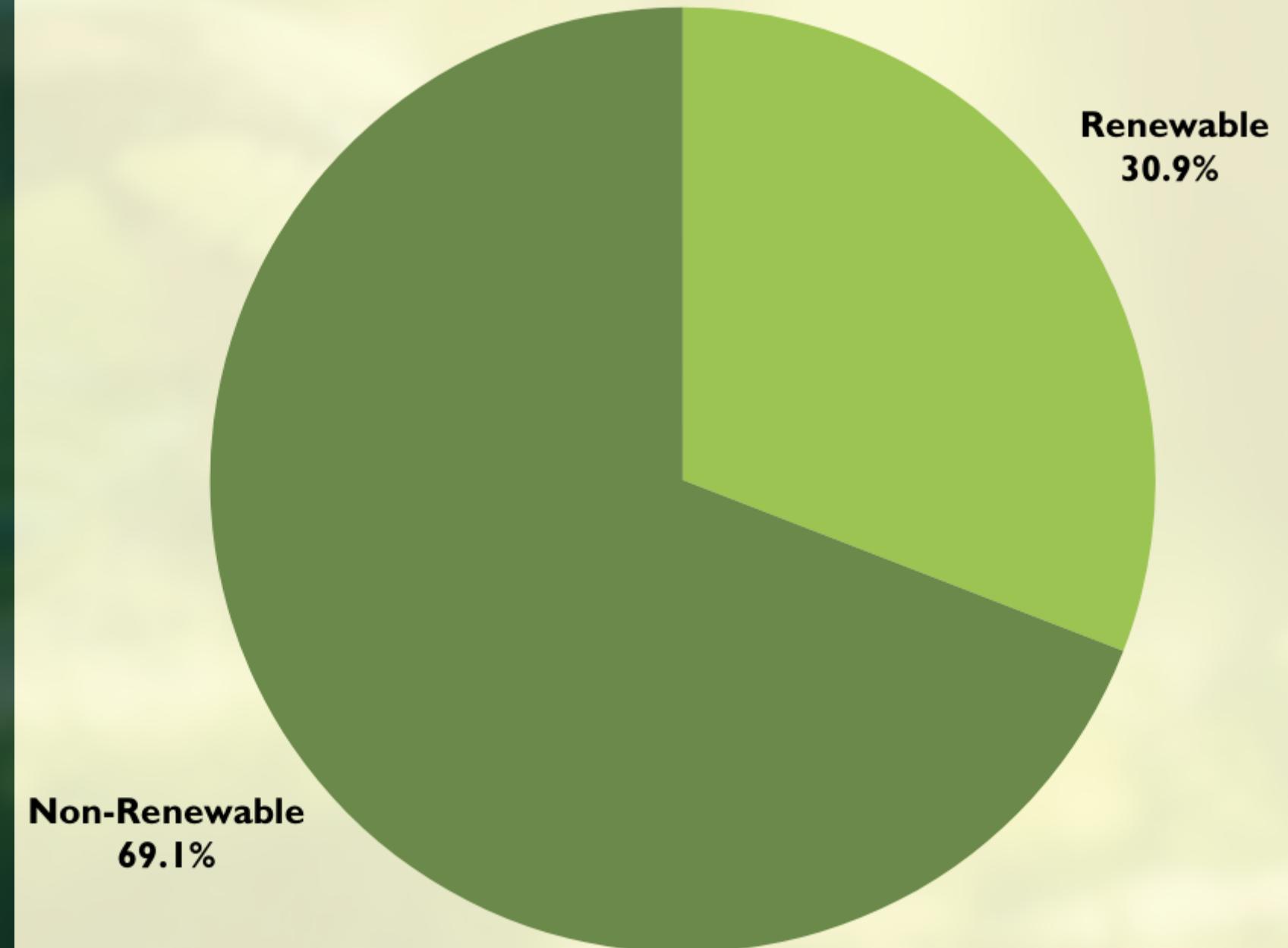
OBJECTIVES

- Examine the impact of renewable energy capacity on emissions and fossil fuel reliance.
- Compare renewable electricity adoption trends between developing and developed countries
- Investigate dominant energy sources in relation to national economic growth.
- Map regional trends in the balance of renewable and fossil fuel electricity generation.
- Determine key drivers of low-carbon electricity generation.
- Prioritise global investment strategies to optimise clean energy deployment in countries.
- Analyse the correlation between financial flows, renewable energy capacity, and emissions.
- Detect and interpret outlier behaviours in energy-related data.

REPORT FINDINGS

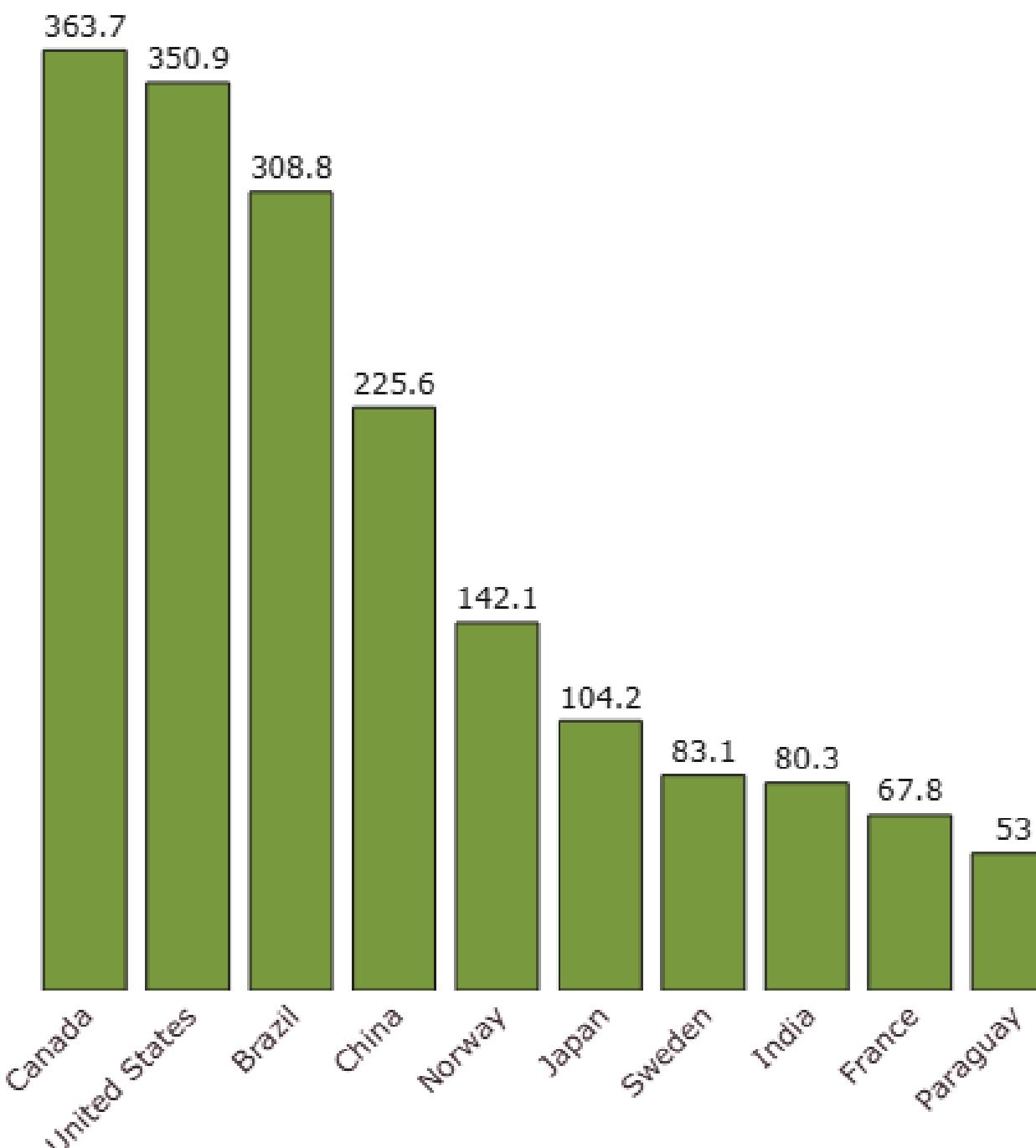
Despite strong growth in wind, solar and hydro energy sources, the world remains heavily reliant on coal, oil and gas.

Accelerating the shift to renewables is critical to cut CO₂ emissions and meet climate targets.

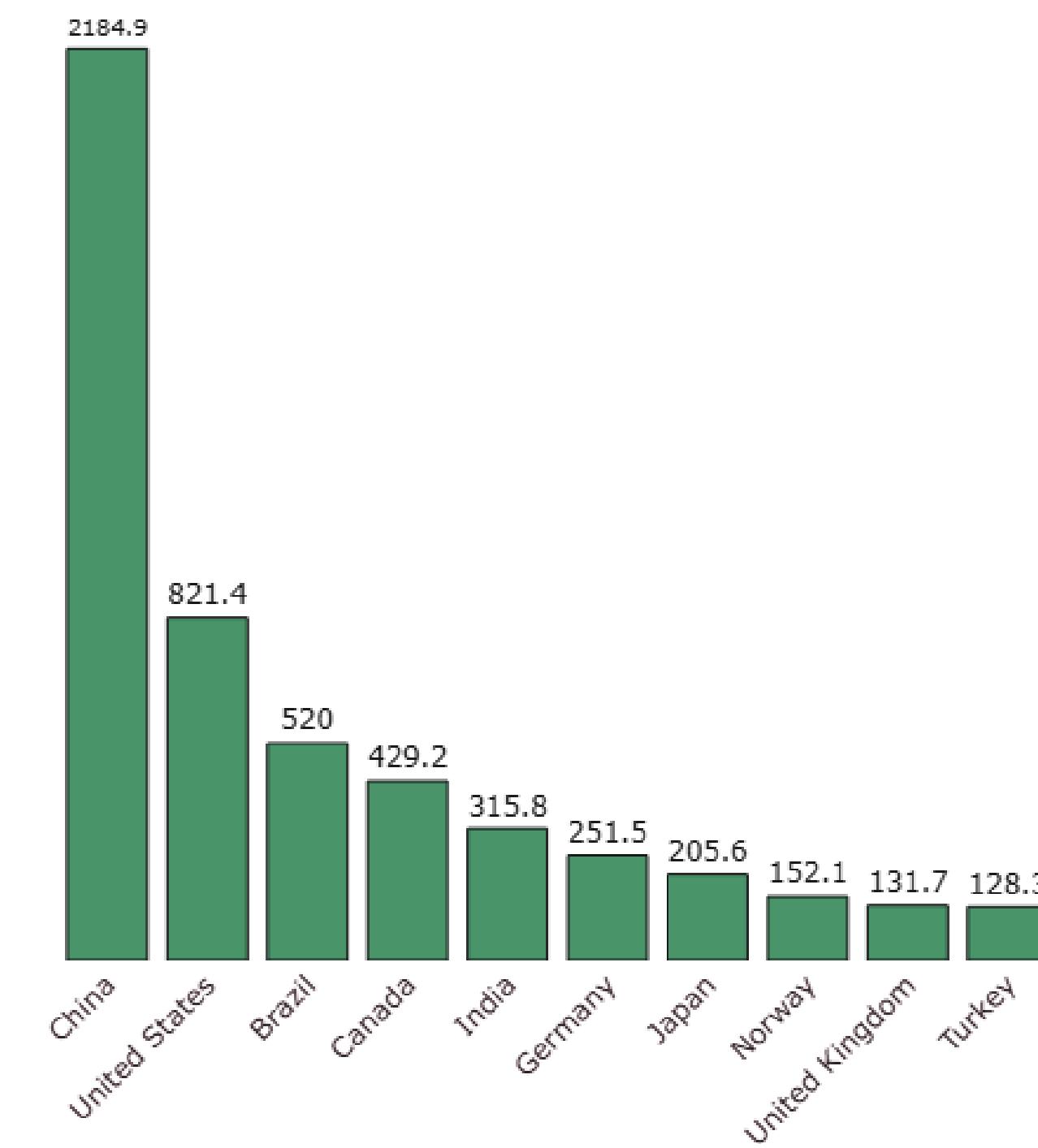




Renewable Electricity in 2000 (TWH)



Renewable Electricity in 2020 (TWH)



FINDINGS:

- In 2000, the top 10 countries were generating relatively lower amounts of renewable electricity.
- By 2020, there's a noticeable increase in the scale of renewable energy generation, and new countries emerged in the top 10 list.
- The countries leading in 2020 show a significant shift towards clean energy investment over the 20-year period.



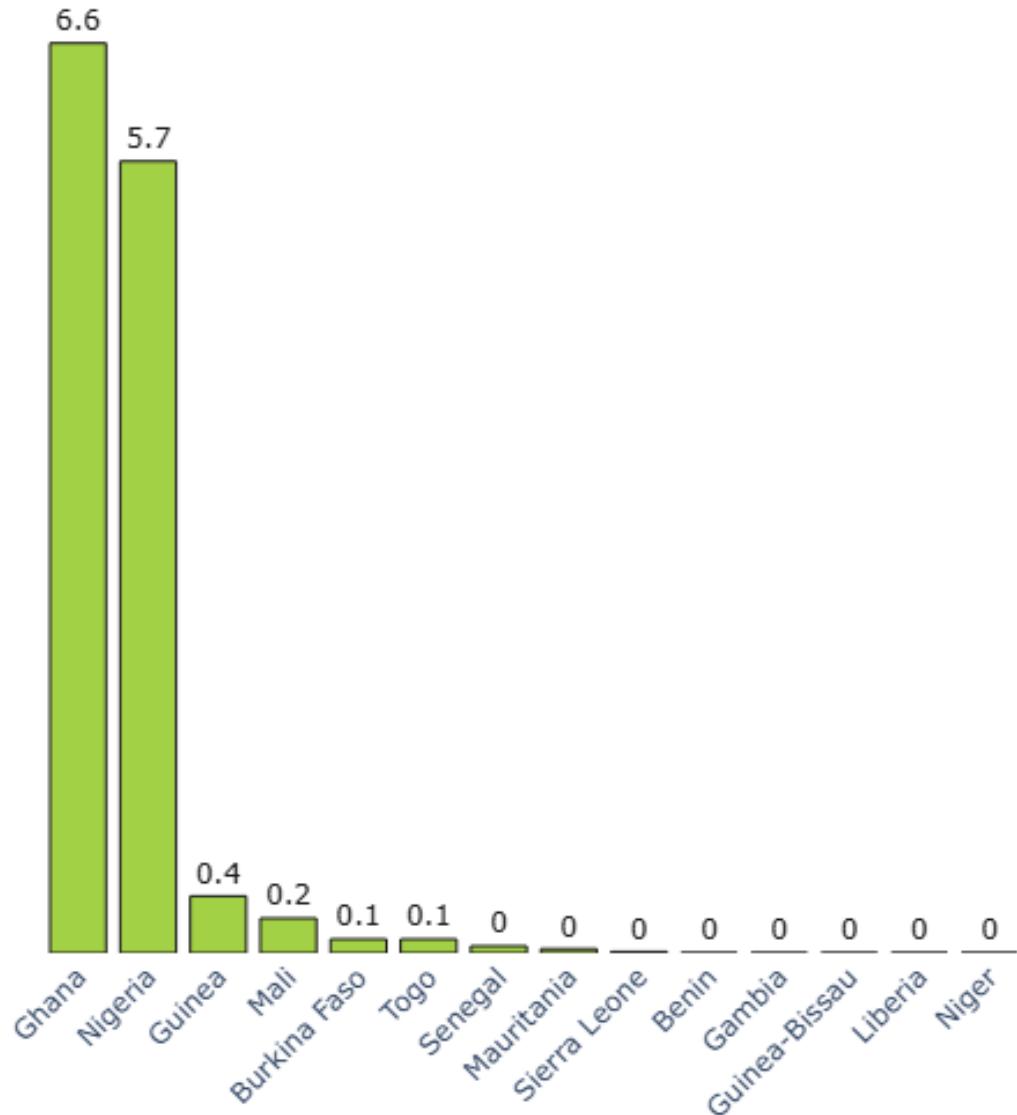
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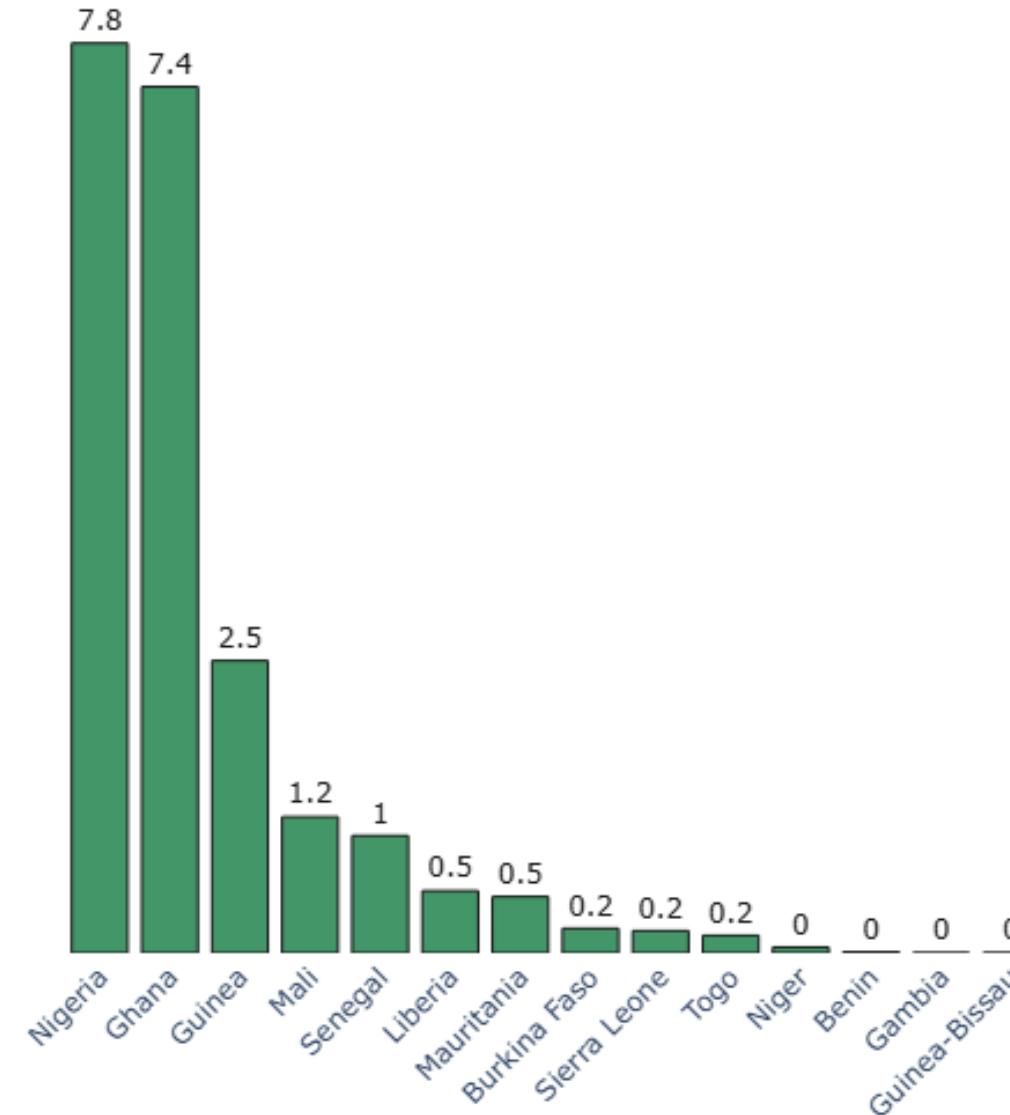
REPORT FINDINGS

Renewable Energy Generation in West African Countries

Renewable Electricity in 2000



Renewable Electricity in 2020



- In 2000, most West African countries generated relatively low levels of renewable electricity, with a few exceptions showing higher output.
- However, by 2020, renewable electricity generation had increased significantly in certain countries (e.g., Nigeria, Ghana, etc.) but remained low in many others.
- There is a noticeable disparity in the adoption of renewable energy among the West African states.



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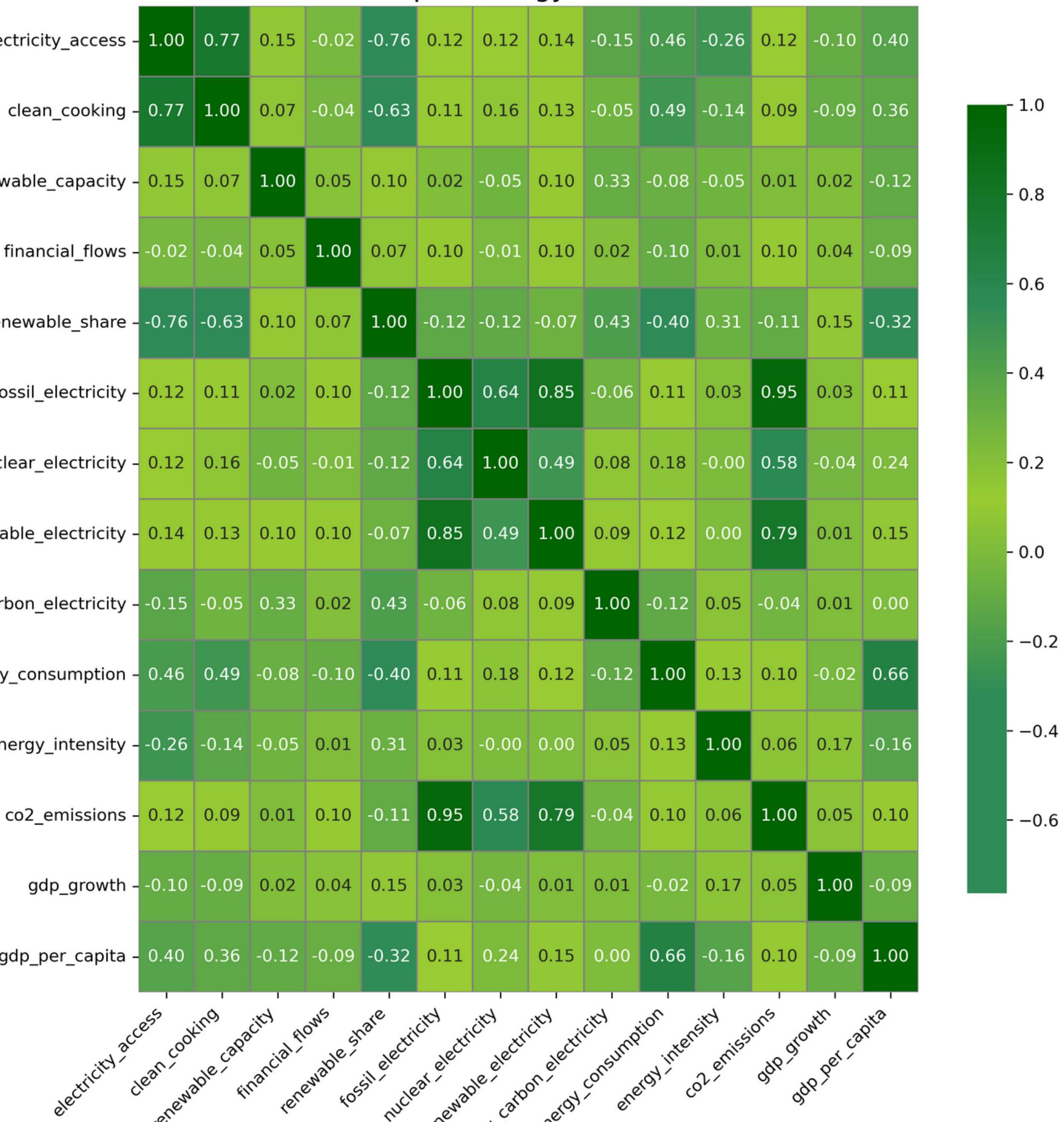
KEY TAKEAWAYS

- The use of more fossil fuels directly correlates with an increase in carbon emissions
- The expansion of electricity access is marked by an increase in the use of clean cooking fuels
- High clean-cooking penetration often coincides with lower 'traditional' bio-fuels in the mix
- As renewables take a bigger slice, absolute fossil generation tends to fall
- Wealthier economies tend to use energy more efficiently
- The external flows and short-term growth rates aren't linearly tied to the big structural energy indicators (Annual GDP v Energy metrics)



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Correlation Heatmap of Energy and Economic Indicators



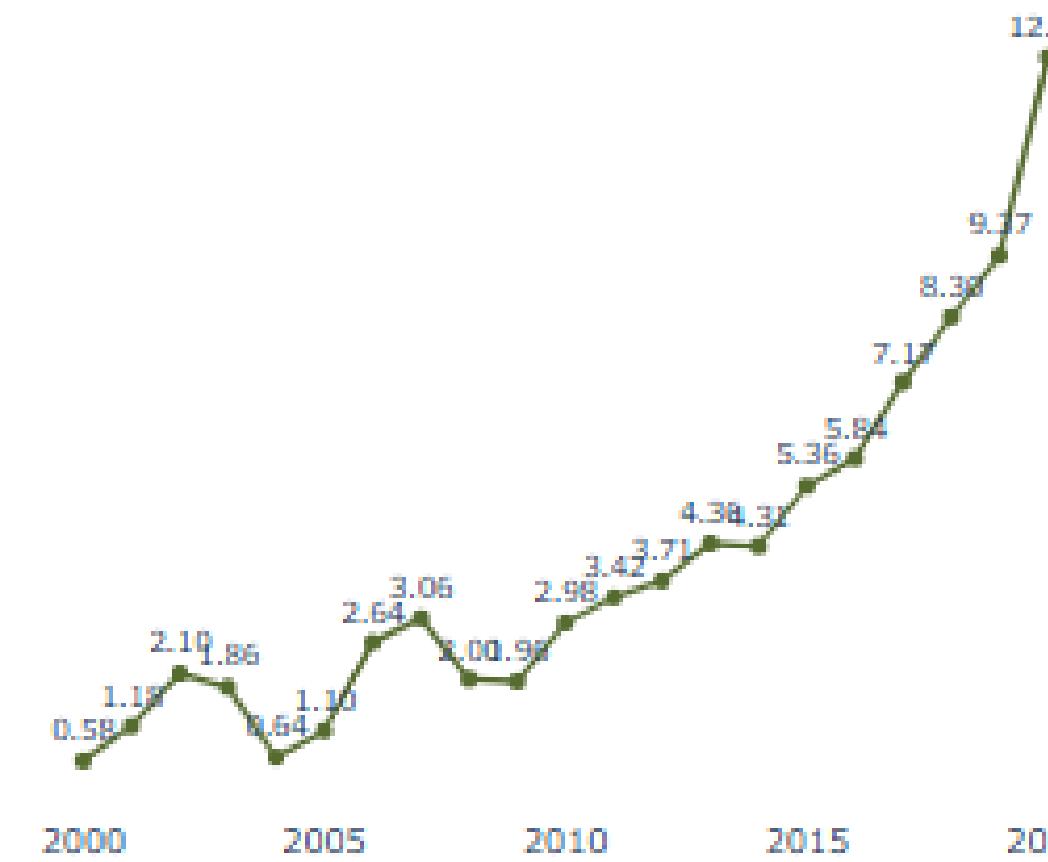


ELECTRICITY GENERATION IN GHANA

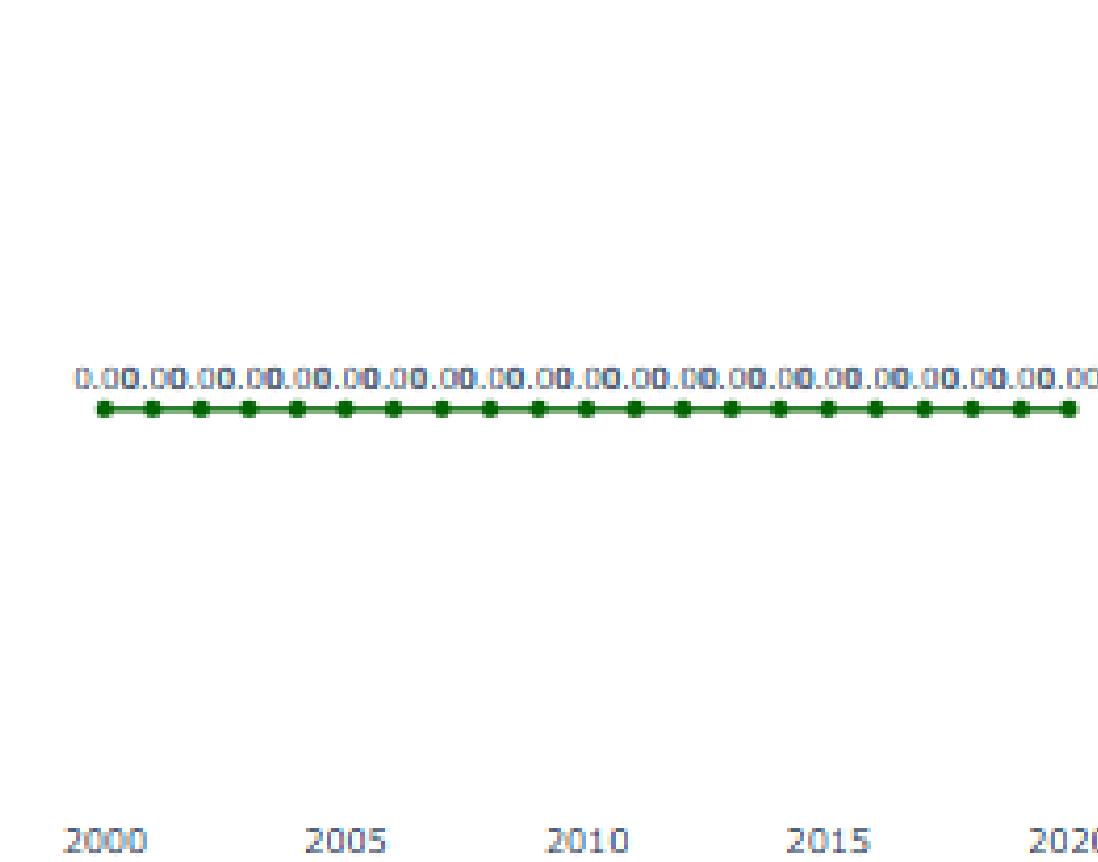
A TREND ANALYSIS (2000-2020)

- Fossil-fuel generation skyrocketed over the 20-year period
- There was no adoption of nuclear energy forms
- While hydroelectricity is the primary source of renewable energy, some regions in Ghana are heavily reliant on fossil fuels.
- Low carbon shares fell as fossil-fuel generation surged

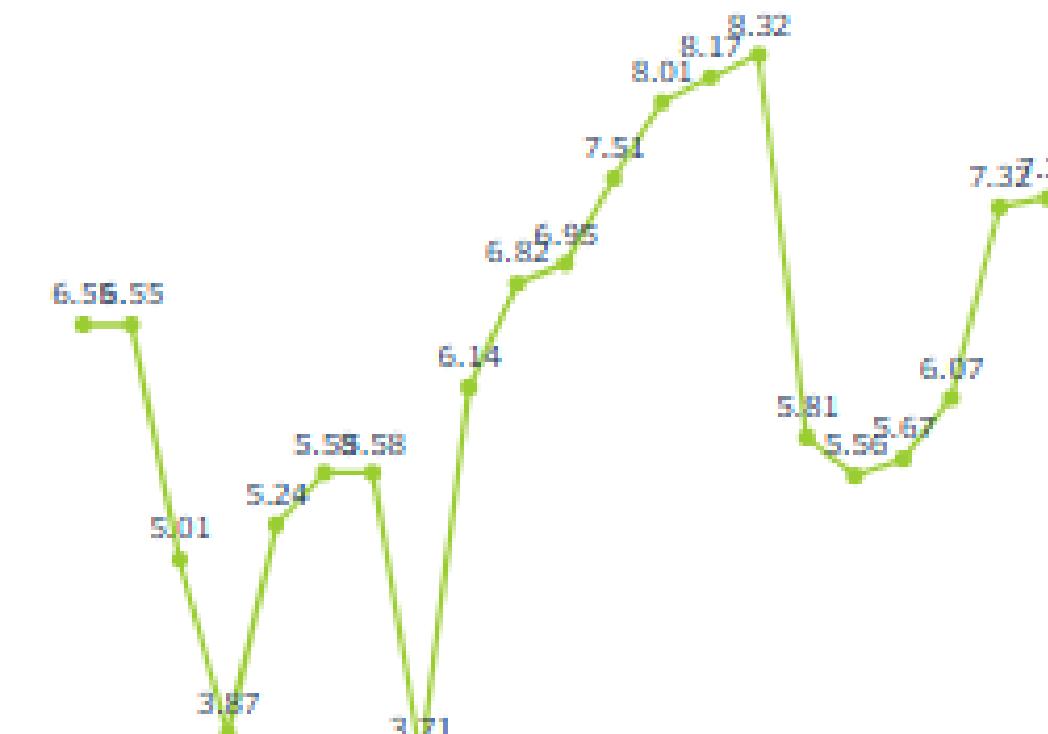
Electricity from Fossil Fuels



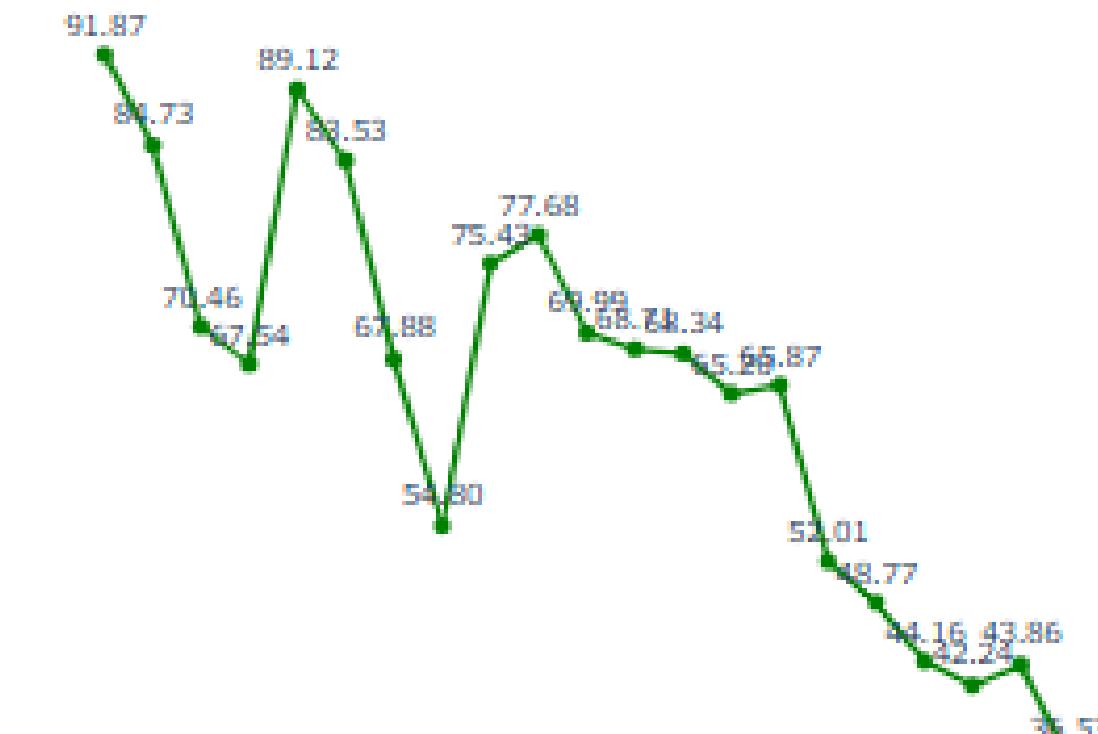
Electricity from Nuclear



Electricity from Renewables



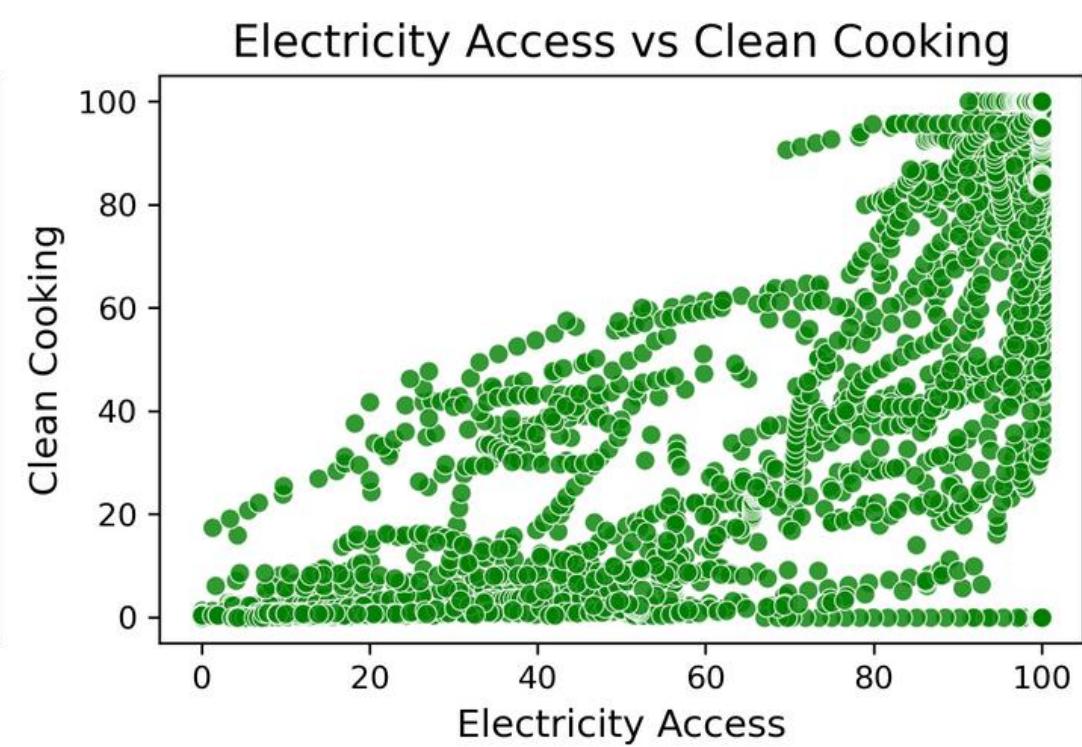
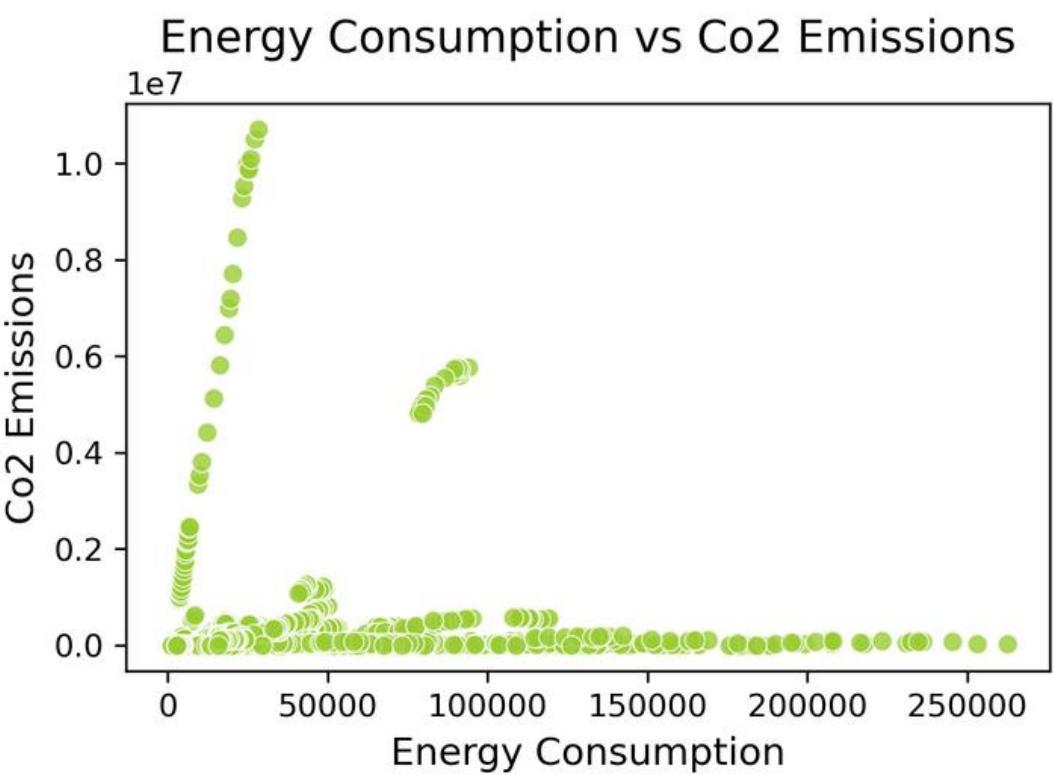
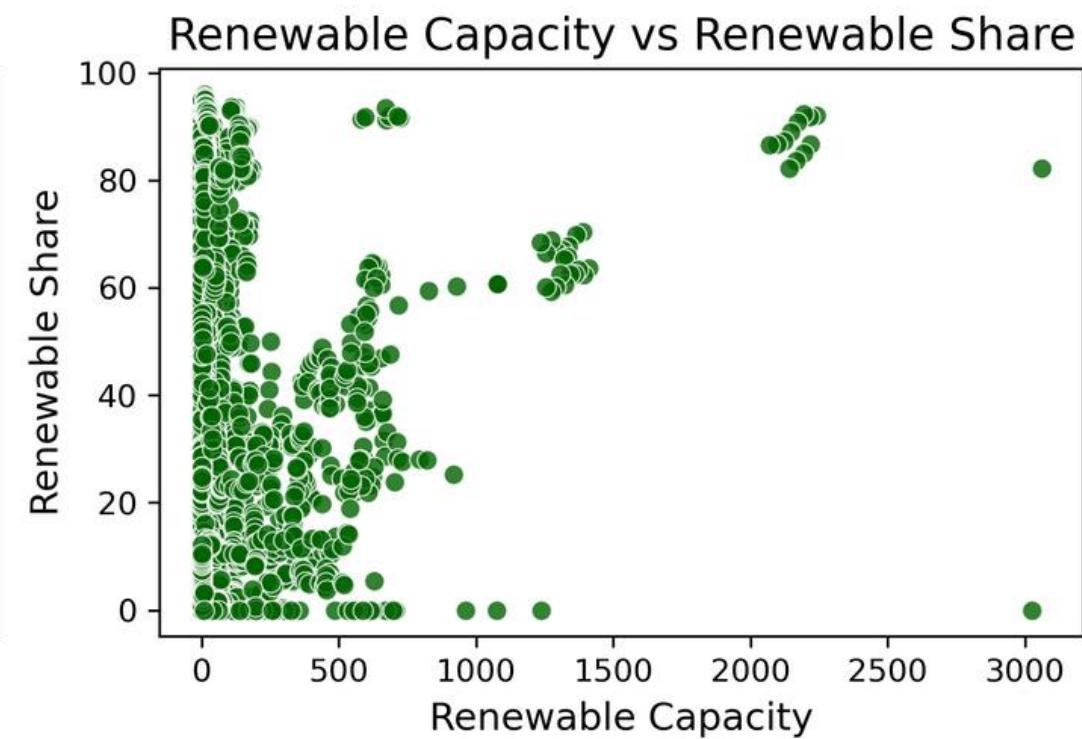
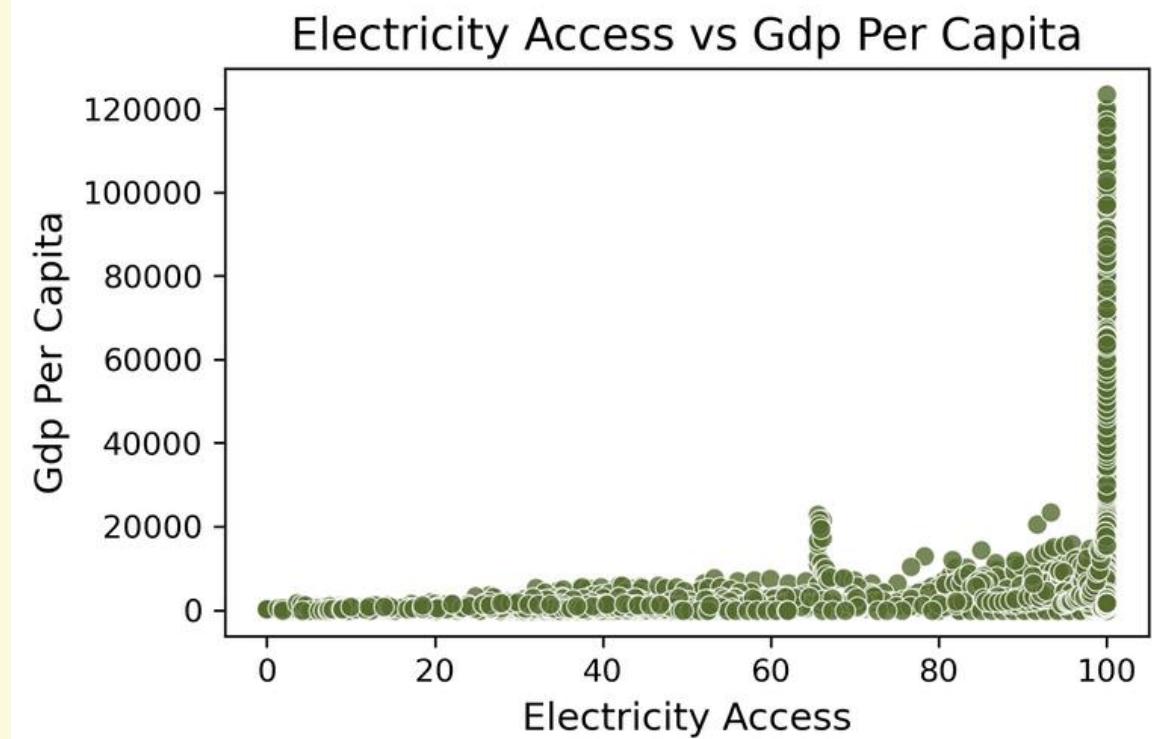
Low-carbon Electricity (%)





KEY TAKEAWAYS

- Richer countries sit near 100% electrification; poorer ones often have large gaps.
- The more renewables you install, the bigger their slice of your total energy mix.
- Higher energy use almost always means higher carbon emissions.
- As more homes get power, more families switch to clean cooking fuels.

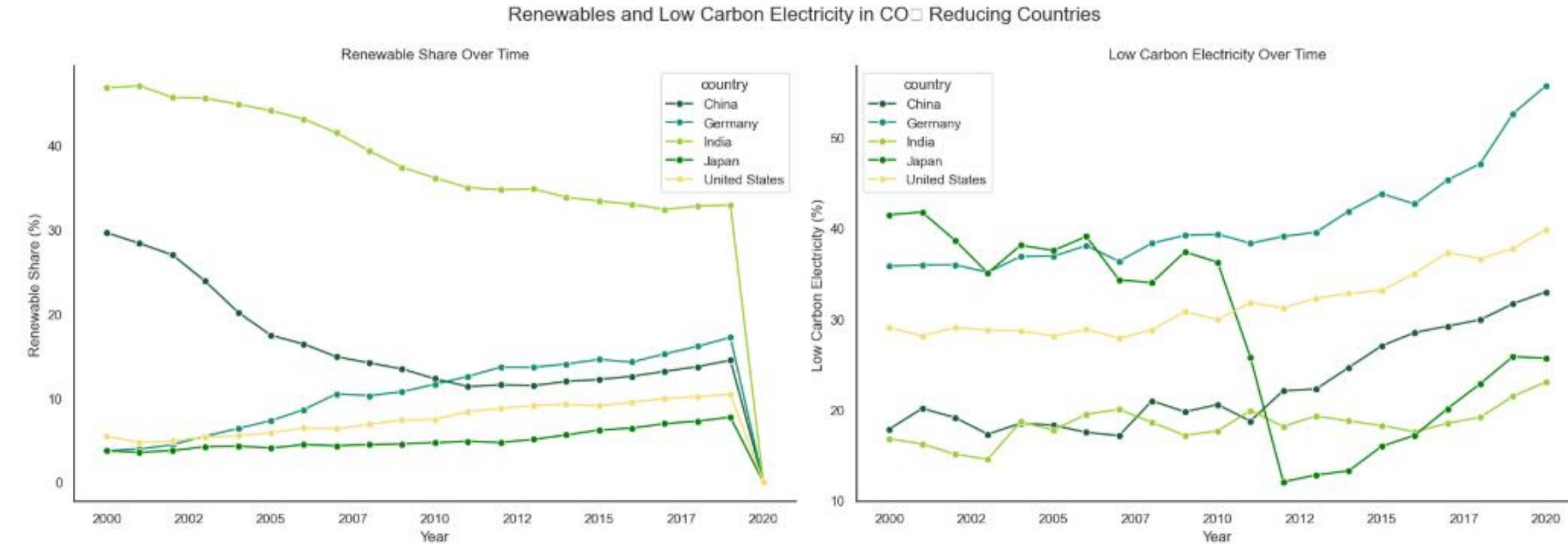




Countries with strong CO₂ reduction efforts also show consistent increases in renewable and low-carbon electricity shares.

There's clear evidence that policy support and clean energy transitions go hand-in-hand.

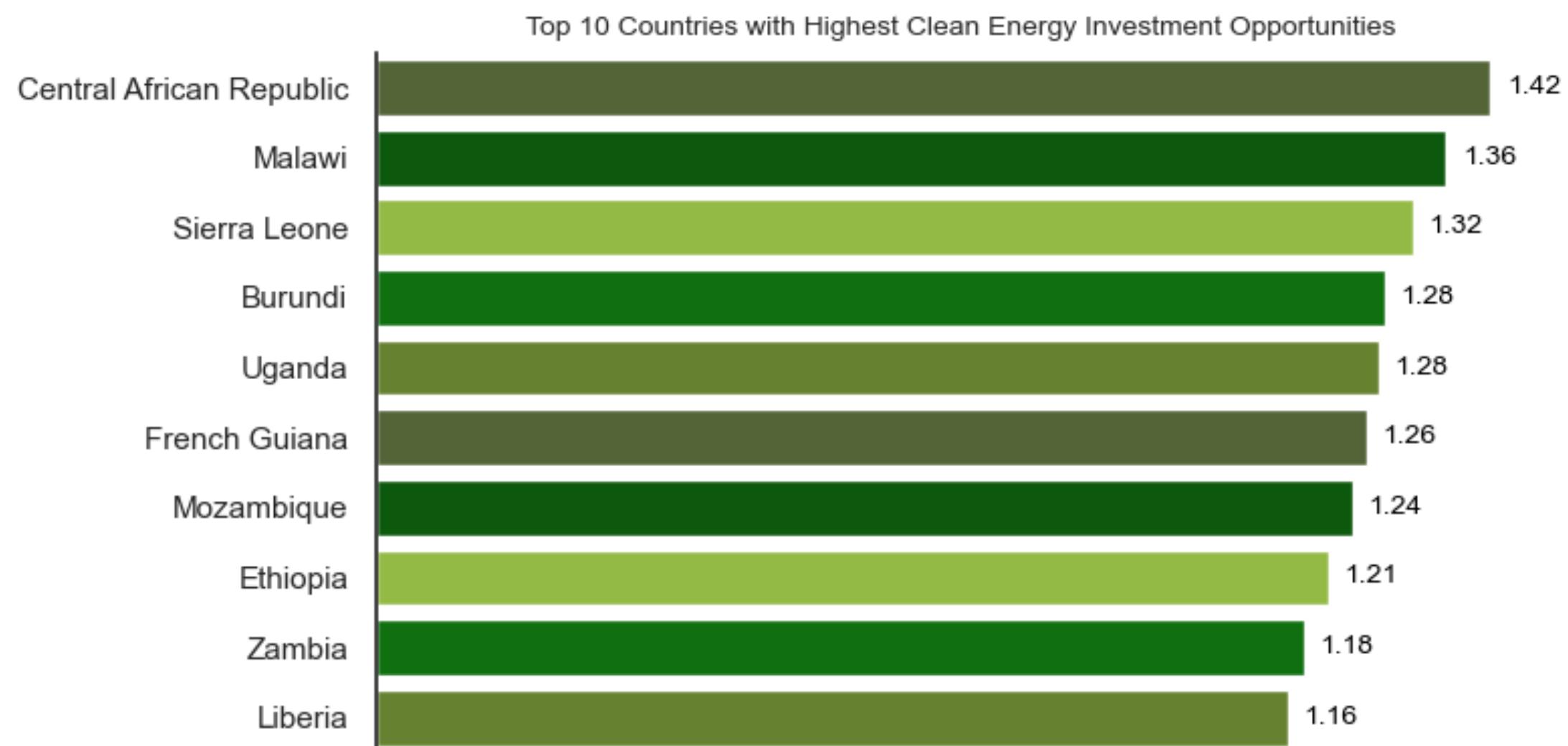
For example, countries like Sweden and Denmark exhibit both strong emission reductions and rising clean energy trends.





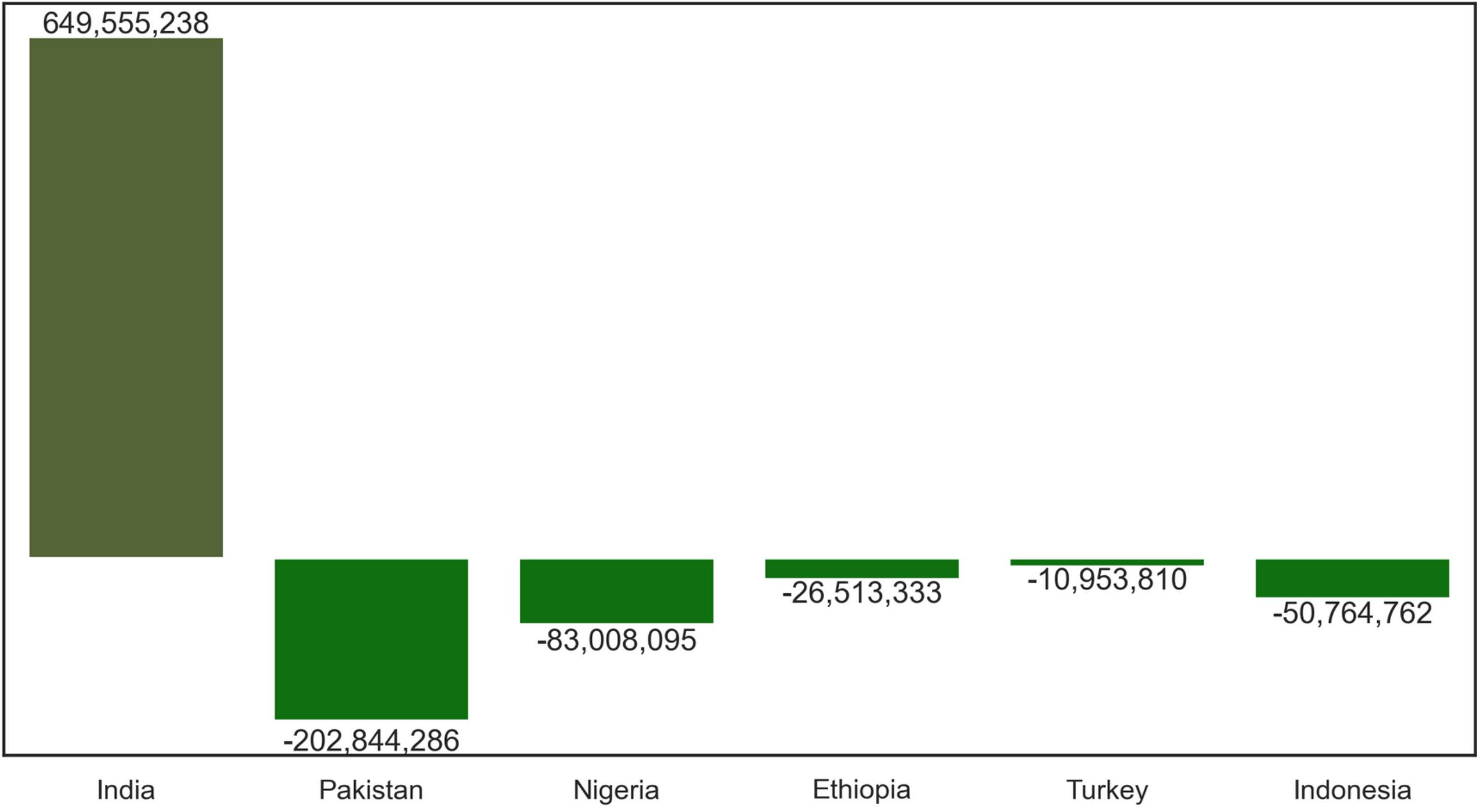
REVIEW FINDINGS

- High need (low electricity access and clean cooking access)
- High potential (high renewable capacity, renewable share, and low-carbon electricity)
- Low current financial flows
- These countries are underserved by current financial flows, yet show both urgency and potential for clean energy transformation.
- They represent strategic opportunities for targeted investments to yield outsized clean energy impacts.



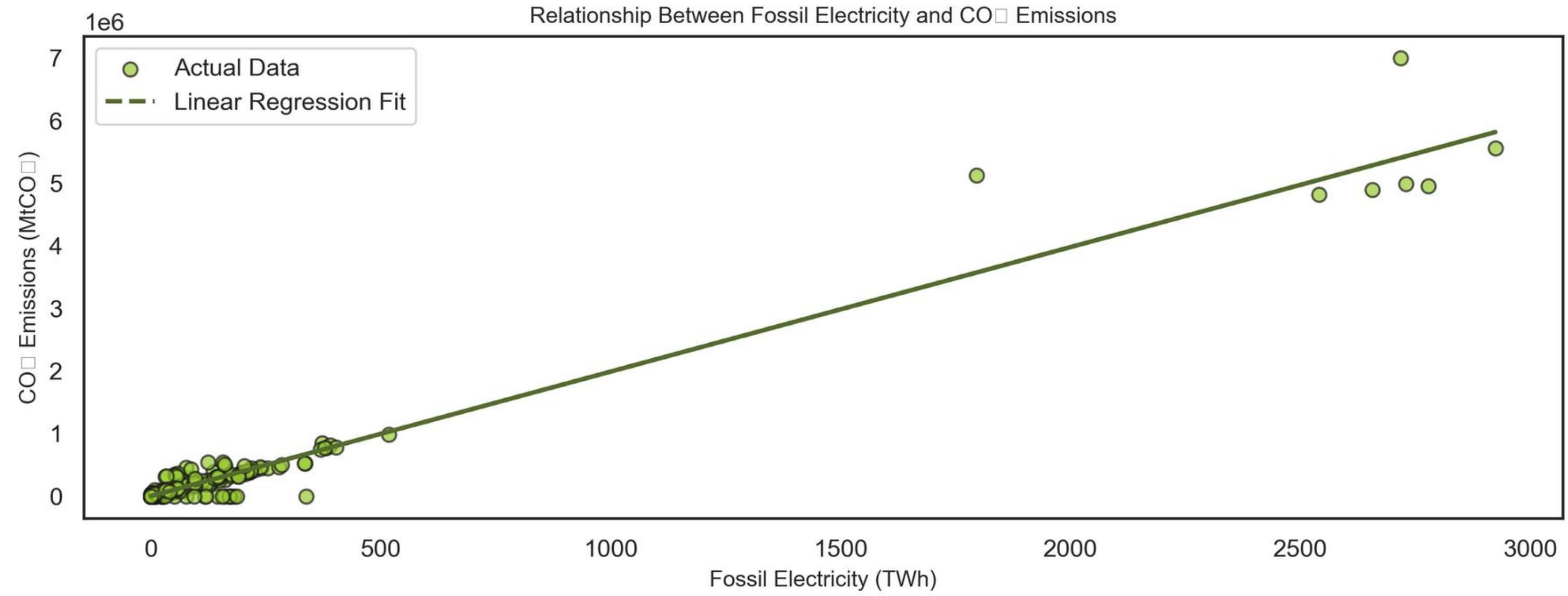


Financial Flows Across Selected Countries



FINDINGS

- India had a big increase in financial flows, gaining over \$649 million.
- In contrast, countries like Pakistan, Nigeria, and Indonesia saw a drop in financial support.
- This suggests that India is becoming a more attractive destination for investment or aid, while others may be experiencing reduced funding.



- The positive slope of the regression line suggests a direct correlation between fossil-based electricity generation and CO₂ emissions meaning, as fossil electricity increases, CO₂ emissions generally rise.
- The R² Score (96) tells us how well this model explains the variation in CO₂ emissions.

RECOMMENDATIONS

Where do you go from here?
Energy transition reports are not just
about looking back,
but also looking forward.

01

Target Underserved but High-Potential Countries

Focus investments on countries with low financial flows but high renewable potential to unlock major clean energy gains.

02

Replicate Success Models

Study and adapt India's success in attracting financial flows and boosting clean energy—especially for similar developing economies.

03

Strengthen Clean Cooking & Electrification

Support clean cooking solutions and electricity access in low-income countries to reduce emissions and improve quality of life.

04

Accelerate Fossil to Renewable Shift

Promote renewable energy scaling where fossil fuel reliance is growing especially in regions like West Africa to curb CO₂ emissions.



CONCLUSION



There is a clear gap between need, potential, and financial support in many developing countries. While countries like India are making major strides in clean energy, others with strong potential remain underfunded.



To meet global climate goals, strategic investment in high-need, high-potential countries is essential.



Accelerating clean energy access, especially through renewables and clean cooking solutions, can deliver big wins for both people and the planet.

REFERENCES

Data Source: Kaggle.

Tools: Python (Pandas, NumPy, Matplotlib/Seaborn & Scikit-Learn)

Process:

- Data Cleaning (Python)
- Exploratory Data Analysis (Python)
- Data Visualization (Python)



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