Data Analysis Report

Low-Carbon Electricity and Global Average Temperatures

Project Topic :

The relationship between average temperatures in different countries and energy consumption, low-carbon electricity (produce &used), CO2 emissions.

Why we choose this topic:

The relationship between low-carbon electricity usage and global average temperatures is a critical subject in today's world.
Understanding how the low-carbon energy sources can affects global temperatures and CO2 emissions associated is very important for
policymakers, governments, researchers, and the general public.
This data analysis will help to explore this relationship and highlight its significance.

Project Objective

The primary objective of this data analysis is to investigate if there is a correlation between first temperature & energy consumption, second, the low-carbon electricity sources and global average temperatures across 101 different countries. Additionally, the analysis will examine the emissions of CO2 and their impact on temperatures.

Research Questions:

there is any correlation between :
1 - temperature and energy consumption
2 - temperature and low-carbon electricity
3 - Co2 emissions & renewable energy .

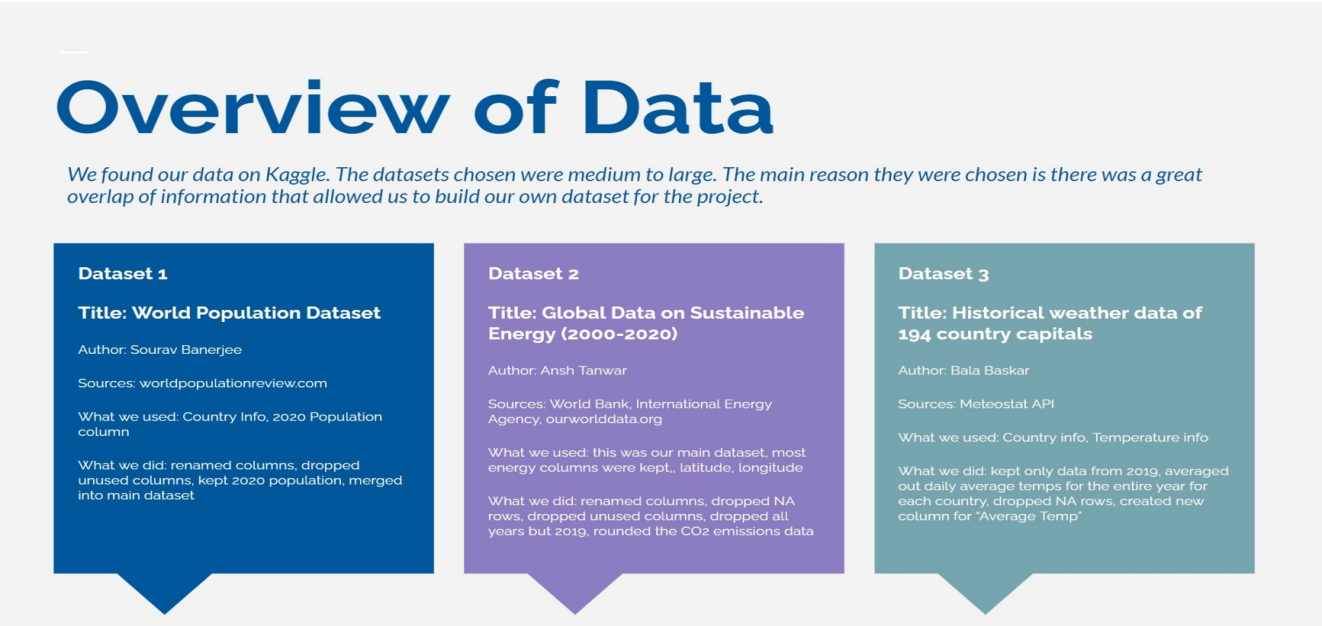
Data analysis process

1-Data Collection :

Collect data on low-carbon electricity percentage usage for each of the 101 countries.
This data may include the percentage of electricity generated from low-carbon sources like wind, solar, hydro, and nuclear power. Gather data on global average temperatures over a specific time period (we choose data in year 2019) .
Collect data on emissions related to the use of energy, CO2 emissions .
Collect the Longitude and latitude value of different countries to make a good map
Collect the population

2-Datasets used:

https://www.kaggle.com/datasets/iamsouravbanerjee/world-population-dataset,
https://www.kaggle.com/datasets/anshtanwar/global-data-on-sustainable-energy,
https://www.kaggle.com/datasets/balabaskar/historical-weather-data-of-all-country-capitals



3-Data processing

`Our CSV file named "project_data.csv" is obtained from merging three datasets, and cleaning them and keeping the data values which we want to use.`
This final dataset contains data related to various countries and their energy-related statistics & temperature averages.

All data included are in the same period "2019", with the exception of data of country population "2020".
the first column contain 101 countries sorted by alphabet.
The columns in our dataset are:

1. Country
2. Average Temperature in 2019
3. Renewable Energy Share in the Total Final Energy Consumption (%)
4. Electricity from Fossil Fuels (TWh - Terawatt-hours)
5. Electricity from Nuclear (TWh)
6. Electricity from Renewables (TWh)
7. Low-carbon Electricity (% of Electricity)
8. Primary Energy Consumption per Capita (kWh/person)
9. CO2 Emissions (Metric Tons per Capita)
10. Latitude
11. Longitude
12. 2020 Population

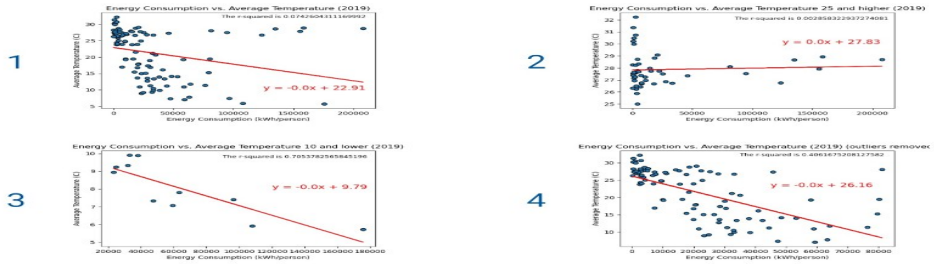
4 -Data Analysis (code) :

To explore the different aspects of the data and meet our primary objects . we develop our python code , do different calculation and a variety of visualizations, including bar char ,scatter plots, box plots, linear regression and map plots, finally make some hypotisis and ttest

5 -Data Analysis (Results) :

1 - Temperature & energy consumption

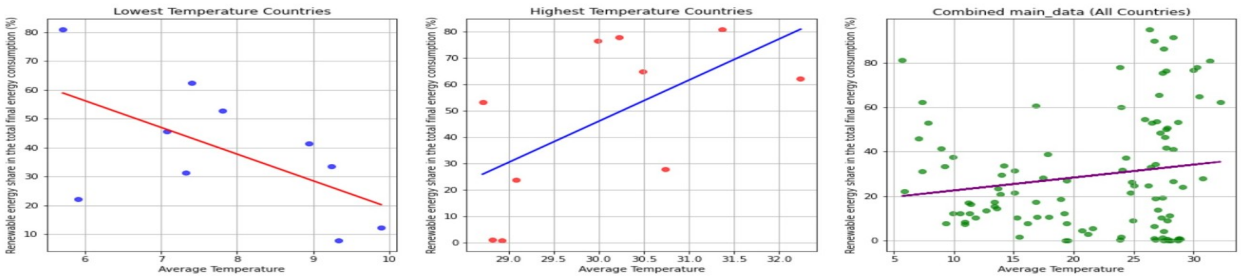
Do higher and lower temperatures have an impact on energy consumption?



There is a weak correlation between energy consumption and temperature for all countries (outliers removed). The correlation is non-existant when all countries are included in the data.
However, for countries with an average temperature of 10 or lower, there is a moderate to strong correlation

2 - Temperature & Renewable energy

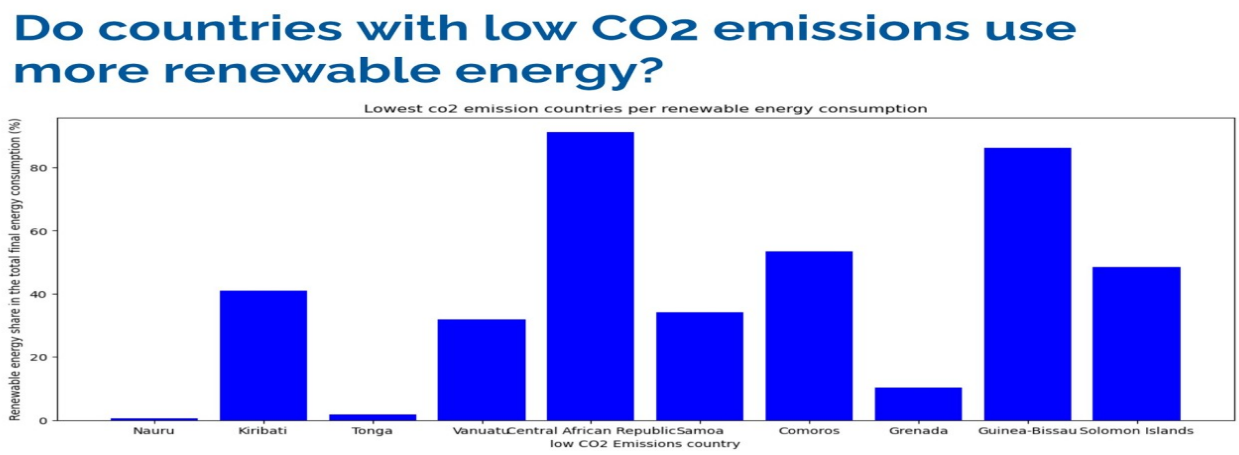
What is the relation between renewable energy used and the average of temperature in the hottest and coldest countries?



Coldest Countries: slope= -9.2526 Hottest Countries: slope= 15.5854 All Countries: slope= 0.58

For the coldest countries, we had a notable negative coefficient of -9.25. This suggests that in colder regions, there is a tendency to rely more extensively on renewable energy sources.
In contrast, among the hottest countries, a strong correlation coefficient of 15.58 indicates that these regions tend to make greater use of renewable energy sources.
This implies that extreme temperatures, whether extremely cold or hot, are associated with a heightened reliance on renewable energy sources.
Expanding our perspective to global data, we observe a positive regression between the percentage of renewable energy used and the average temperature. This implies that as average temperatures increase globally, there is a corresponding increase in the adoption of renewable energy sources.
This could be attributed to the growing recognition of the environmental benefits of renewables in mitigating climate change, as well as the increased availability of renewable energy technologies in warmer climates.

3 -Co2 emissions & renewable energy



We have a correlation between low CO2 emissions and higher use of renewable energy,
The countries that produce more renewable energy generate less CO2 .
it's essential to remember that each country's energy mix and emissions profile are influenced by unique factors, including geography, natural resources, economic conditions, and government policies.

Conclusion

This data analysis sheds light on the complex interplay between temperature, energy consumption, low-carbon electricity usage and Co2 emission.
We can conclude that There is a strong correlation between Temperature and energy consumption in countries with an average temperature of 10 degrees or less.
Overall, there is a weak correlation.
Our findings emphasize the role of temperature as a significant factor influencing the choice and adoption of renewable energy sources.
Colder countries lean towards renewable, possibly due to a desire for sustainability in harsh climates, while hotter countries increasingly embrace renewable as a means to address climate challenges and meet their energy needs.
Also we found that There is a strong correlations between CO2 emission and renewable energy produce or used which is logical

Finally,Understanding these dynamics is crucial for addressing climate change, optimizing energy resources, and making informed decisions regarding energy policy and sustainability initiatives.
Further research and investigation into specific regions and policy interventions may be necessary to develop targeted strategies for reducing carbon emissions and promoting clean energy adoption.

Recommendations

Our recommendations for future research in this area are:

1- New analysis of different factors on low-carbon and/or renewable energy (geography, socioeconomic, land mass, GDP, population, etc.)

2- Assessment of specific countries/regions overall climate impact

3- Forecast trends of how countries are improving their low-carbon electricity %

4- Predict future energy needs, and weather impact

5- Create targets for low-carbon electricity and track progress