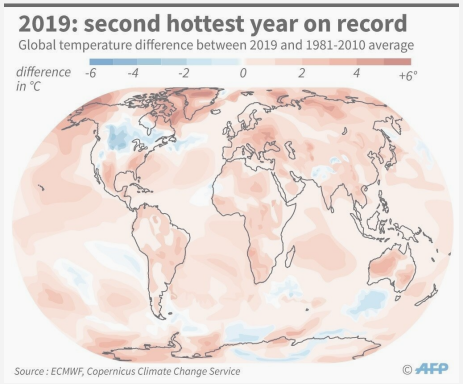


Low-Carbon Electricity and Global Average Temperatures

The relationship between average temperatures and energy consumption, low-carbon electricity, CO2 emissions, in different countries.

A project by Khadija Fahr, Yosieph Fissuh and Danik Lafrance

Project Overview

Why?

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

What?

The primary objective of this data analysis is to investigate if there is any correlation between :

1 - temperature and energy consumption,

2 - temperature and low-carbon electricity .

3 - Co2 emissions & renewable energy .

Overview of Data

We found our data on Kaggle. The datasets chosen were medium to large. The main reason they were chosen is there was a great overlap of information that allowed us to build our own dataset for the project.

Dataset 1

Title: World Population Dataset

Author: Sourav Banerjee

Sources: worldpopulationreview.com

What we used: Country Info, 2020 Population column

What we did: renamed columns, dropped unused columns, kept 2020 population, merged into main dataset

Dataset 2

Title: Global Data on Sustainable Energy (2000-2020)

Author: Ansh Tanwar

Sources: World Bank, International Energy Agency, ourworlddata.org

What we used: this was our main dataset, most energy columns were kept,, latitude, longitude

What we did: renamed columns, dropped NA rows, dropped unused columns, dropped all years but 2019, rounded the CO2 emissions data

Dataset 3

Title: Historical weather data of 194 country capitals

Author: Bala Baskar

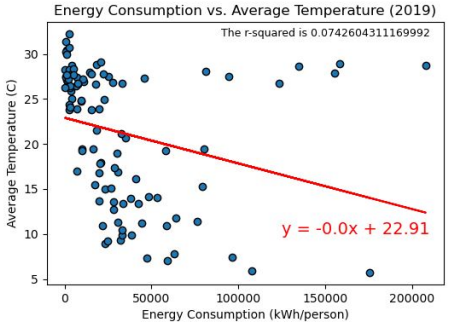
Sources: Meteostat API

What we used: Country info, Temperature info

What we did: kept only data from 2019, averaged out daily average temps for the entire year for each country, dropped NA rows, created new column for "Average Temp"

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

1



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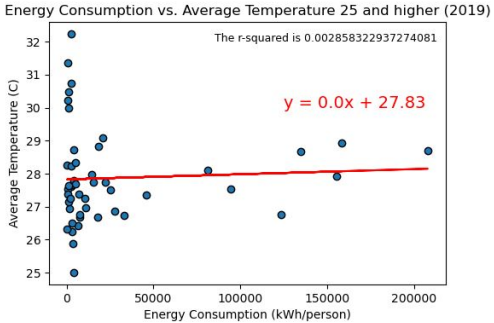

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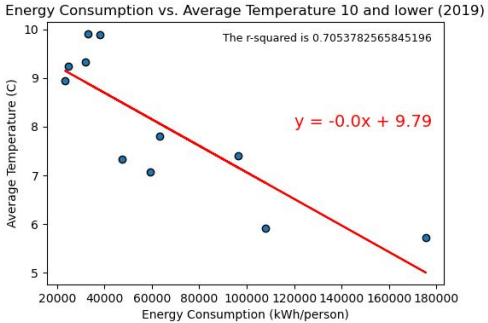

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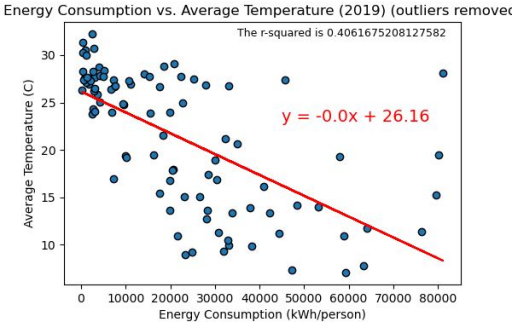


Do higher and lower temperatures have an impact on energy consumption?

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

Null Hypothesis: Average country temperatures above 25 degress celsius and below 10 degress celsius have no impact on energy consumption.

Alternative Hypothesis: Average country temperatures above 25 degress celsius and below 10 degress celsius might play a factor in energy consumption.

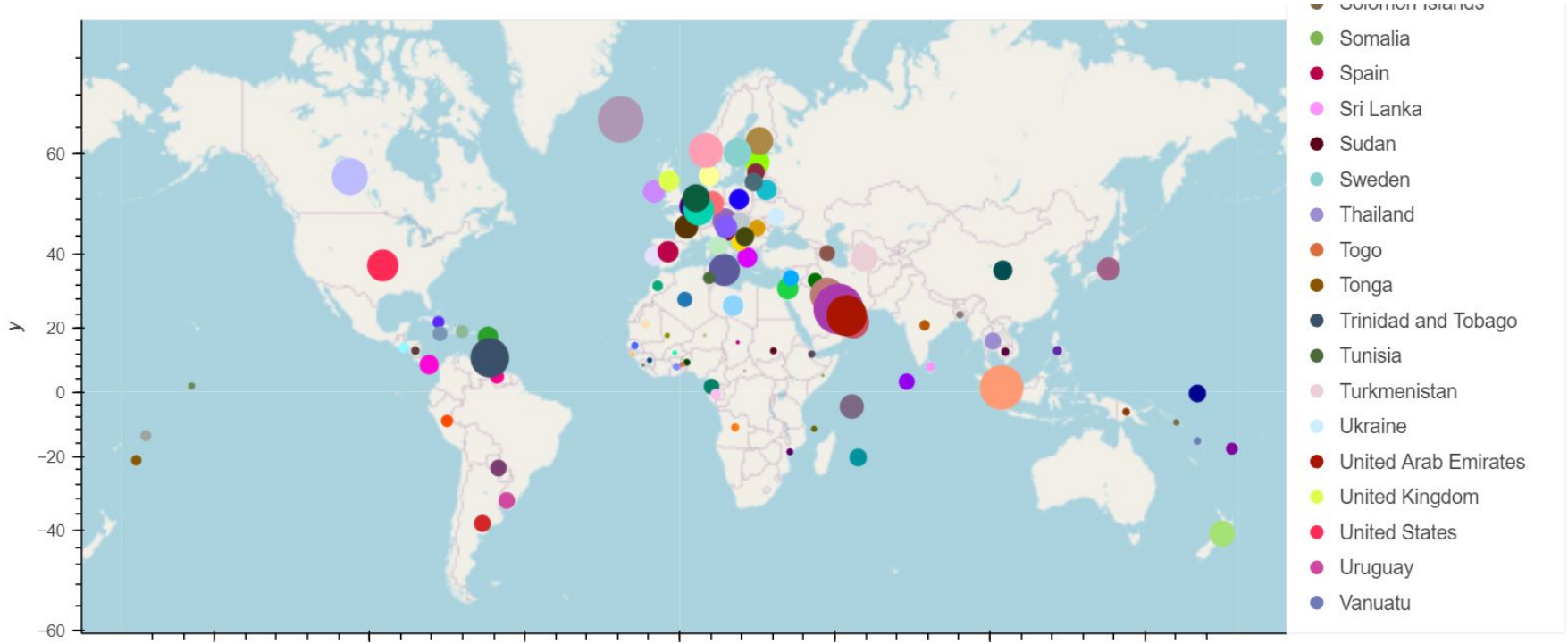
```
#define samples
group1 = main_data.loc[main_data['Average Temp'] >= 25]
group2 = main_data.loc[main_data['Average Temp'] <= 10]

#perform independent two sample t-test
ttest_ind(group1['Primary energy consumption per capita (kWh/person)'], group2['Primary energy consumption per capita (kWh/person)'])
```

✓ 0.0s

```
Ttest_indResult(statistic=-2.2483778025923717, pvalue=0.028435494666494792)
```

Since the p-value is less than .05, we reject the null hypothesis of the t-test and conclude that there is sufficient evidence to say that temperatures might play an impact on energy consumption.

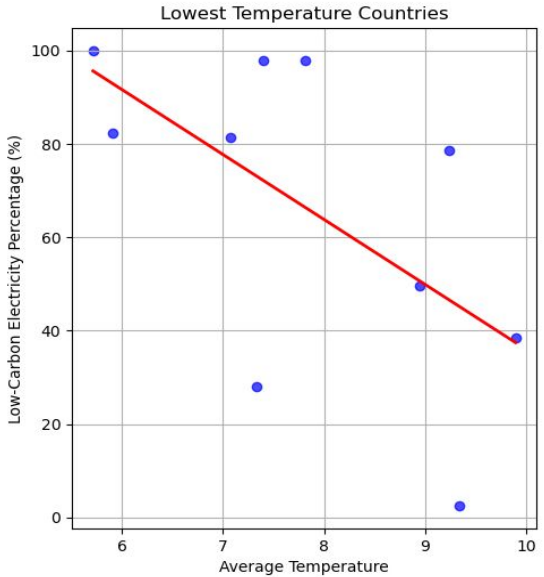
What is the relation between low-carbon electricity and the average temperature in the hottest and coldest countries?

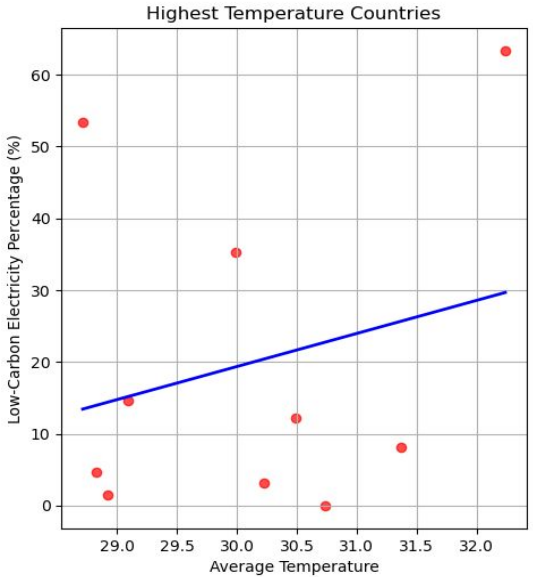


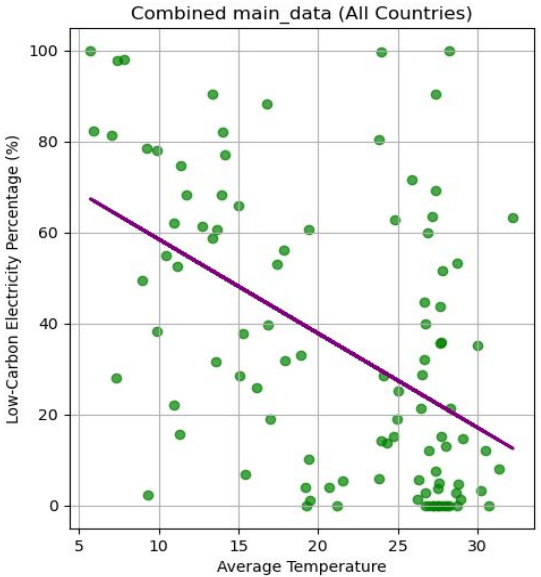
The low carbon electricity percentage in the Hottest country "SUDAN" is 63.34%

The low carbon electricity percentage in the Coldest country "ICELAND" is 100.00%

What is the relation between low-carbon electricity and the average temperature in the hottest and coldest countries?

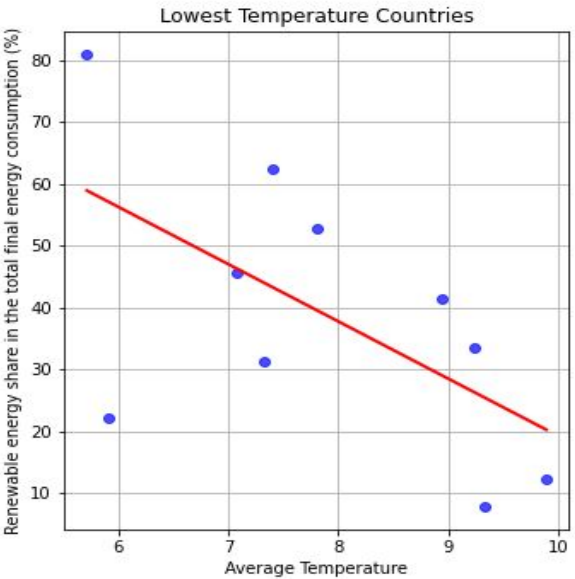


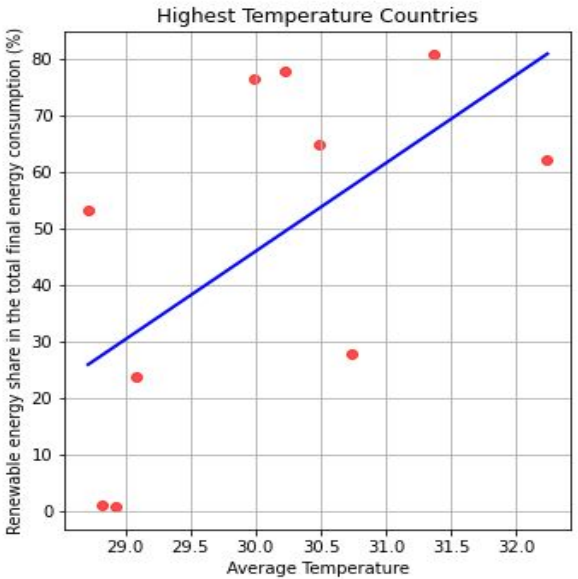


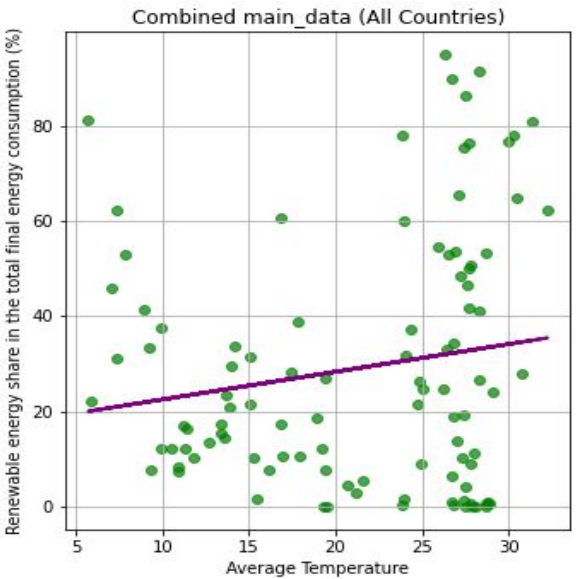


Coldest Countries: coeif= -13.9328 **Hotest Countries: coeif= 4.6044** **Global Countries: coeif= -2.07**

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

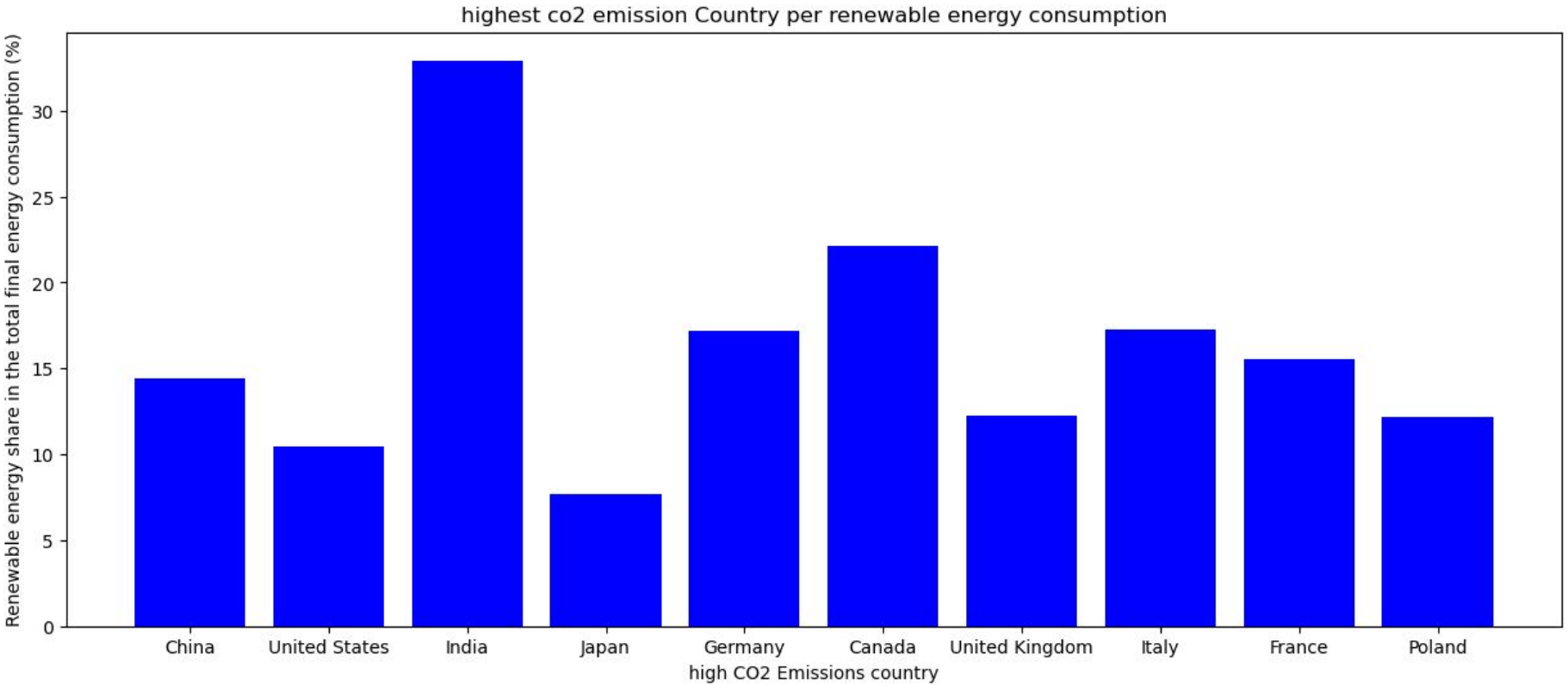




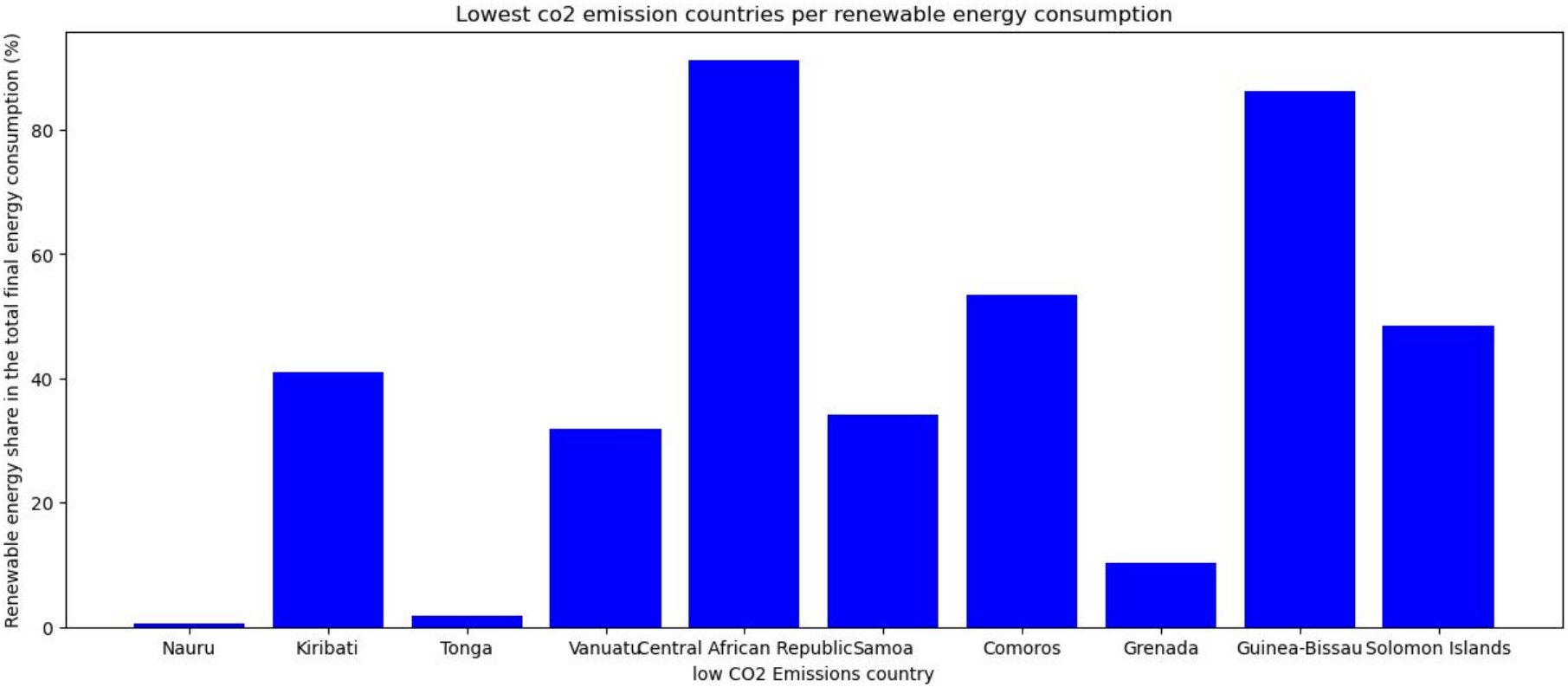


Coldest Countries: slope= -9.2526 **Hottest Countries: slope= 15.5854** **All Countries: slope= 0.58**

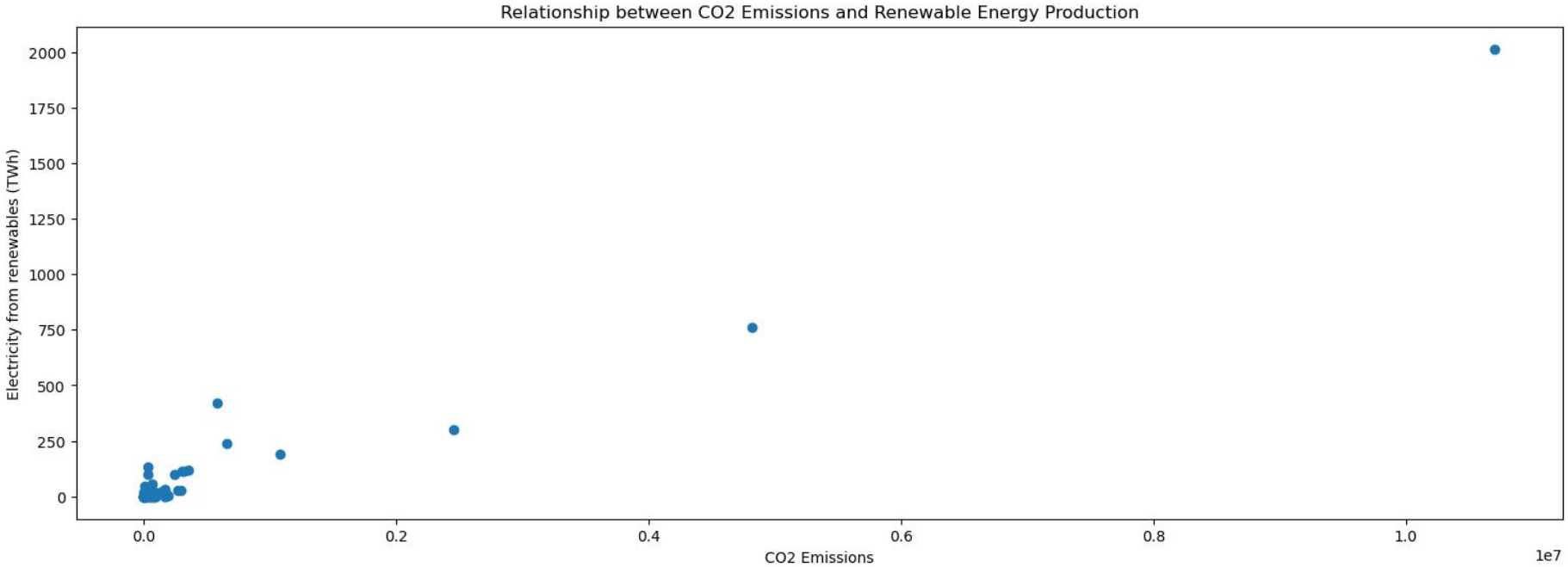
Do countries with high CO2 emissions use less renewable energy?



Do countries with low CO2 emissions use more renewable energy?



Correlation between CO2 emissions and renewable energy produced



Project Summary

This data analysis sheds light on the complex interplay between temperature, energy consumption, low-carbon electricity usage and Co2 emission.

The final analysis about our primary objective :

1 - Temperature & energy consumption

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.

2 - Temperature & the low-carbon electricity sources

The Coldest countries tend to generate a greater proportion of low-carbon electricity compared to their warmer countries with some exceptions.

3 - Co2 Emission & renewable energy produced

The countries that produce more renewable energy generate less Co2 .

Next Steps

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