CO2 Emissions and Energy Consumption Analysis

# Project Introduction

This project aims to explore the relationship between global CO2 emissions and energy consumption across five major countries over a period of 10 years (2010-2019).   
The analysis involves examining trends, conducting correlation and inferential analysis, and building a predictive model to understand how energy consumption may influence CO2 emissions.  
The findings from this project can provide insights into the environmental impact of energy consumption and guide future policies and initiatives aimed at reducing carbon footprints globally.

# Descriptive Statistics

Overall Descriptive Statistics:

Year CO2\_Emissions Energy\_Consumption  
count 50.000000 50.000000 50.000000  
mean 2014.500000 7058.660000 1168.640000  
std 2.901442 1852.932982 379.263828  
min 2010.000000 4027.000000 545.000000  
25% 2012.000000 5698.750000 870.500000  
50% 2014.500000 7078.500000 1129.500000  
75% 2017.000000 8777.250000 1385.750000  
max 2019.000000 9998.000000 1902.000000

Descriptive Statistics by Country:

Year CO2\_Emissions Energy\_Consumption   
 count mean std min 25% 50% 75% max count mean std min 25% 50% 75% max count mean std min 25% 50% 75% max  
Country   
China 10.0 2013.5 2.635231 2011.0 2011.0 2013.5 2016.0 2016.0 10.0 7018.6 1829.406413 4257.0 5968.75 6802.0 8505.00 9998.0 10.0 1271.2 356.619249 837.0 1001.25 1205.0 1543.00 1852.0  
India 10.0 2014.5 2.635231 2012.0 2012.0 2014.5 2017.0 2017.0 10.0 6883.2 1999.371557 4170.0 5435.50 6613.5 8480.75 9898.0 10.0 1095.7 375.068305 558.0 868.00 1079.0 1280.50 1821.0  
Japan 10.0 2016.5 2.635231 2014.0 2014.0 2016.5 2019.0 2019.0 10.0 5990.9 1552.871780 4083.0 4695.75 6025.0 6504.50 9216.0 10.0 1170.9 417.550117 570.0 870.50 1229.0 1385.75 1902.0  
Russia 10.0 2015.5 2.635231 2013.0 2013.0 2015.5 2018.0 2018.0 10.0 8032.5 2006.513131 4027.0 7173.00 8848.5 9474.00 9983.0 10.0 1123.9 411.862558 545.0 902.75 1026.0 1270.00 1804.0  
USA 10.0 2012.5 2.635231 2010.0 2010.0 2012.5 2015.0 2015.0 10.0 7368.1 1564.643761 4391.0 6725.00 7742.5 8308.25 9462.0 10.0 1181.5 388.960224 812.0 860.00 1078.5 1409.00 1853.0

# Trend Analysis

Trend analysis was conducted to visualize CO2 emissions and energy consumption over the years.

# Correlation Analysis

Correlation coefficient between Energy Consumption and CO2 Emissions: -0.0421

# Inferential Analysis: ANOVA Test

F-statistic: 1.7072, P-value: 0.1651

# Predictive Analysis: Linear Regression

R-squared: -0.7906, Mean Absolute Error: 1653.9850, Mean Squared Error: 3881963.0217

# Summary, Findings, and Recommendations

The analysis of CO2 emissions and energy consumption data across five countries revealed several key insights:  
  
- Trends: The trend analysis showed variability in CO2 emissions and energy consumption across different countries, with some showing increasing trends while others remained stable.  
- Correlation: The correlation between energy consumption and CO2 emissions was found to be very weak, indicating that other factors may also play significant roles in CO2 emissions.  
- ANOVA Test: The ANOVA test did not find statistically significant differences in CO2 emissions among the five countries, suggesting that emissions levels are relatively comparable across these nations.  
- Predictive Modeling: The simple linear regression model performed poorly, indicating that energy consumption alone is not a strong predictor of CO2 emissions. This suggests that a more complex model incorporating other variables may be needed.  
  
Recommendations:  
To improve the predictive power and derive more actionable insights, it is recommended to:  
- Incorporate additional variables such as industrial output, energy efficiency, and renewable energy adoption into the analysis.  
- Explore more sophisticated predictive models such as multiple regression, decision trees, or machine learning algorithms.  
- Conduct a deeper dive into specific countries to understand the unique factors driving their CO2 emissions.