

World Energy Consumption

Amy Hanks
Eylem Yildirim
Sezer Bozoglan

ENERGY SOURCES

RENEWABLE ENERGY



Wind



Hydropower



Solar



Geothermal

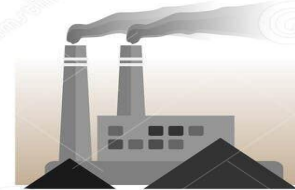


Biomass

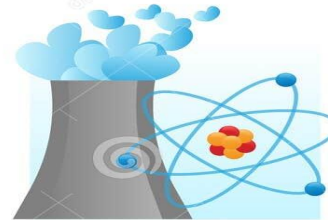
NON-RENEWABLE ENERGY



Oil



Coal



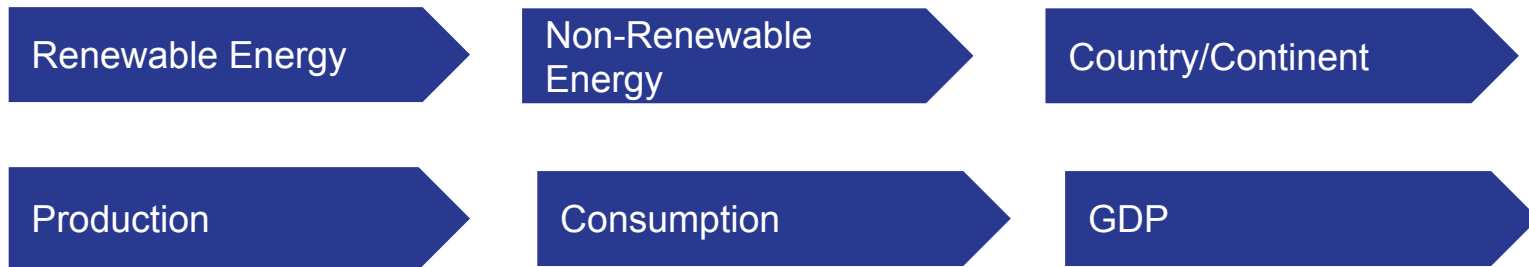
Nuclear



Natural Gas

Our Data: World Energy Consumption

Data Source: [kaggle](#)



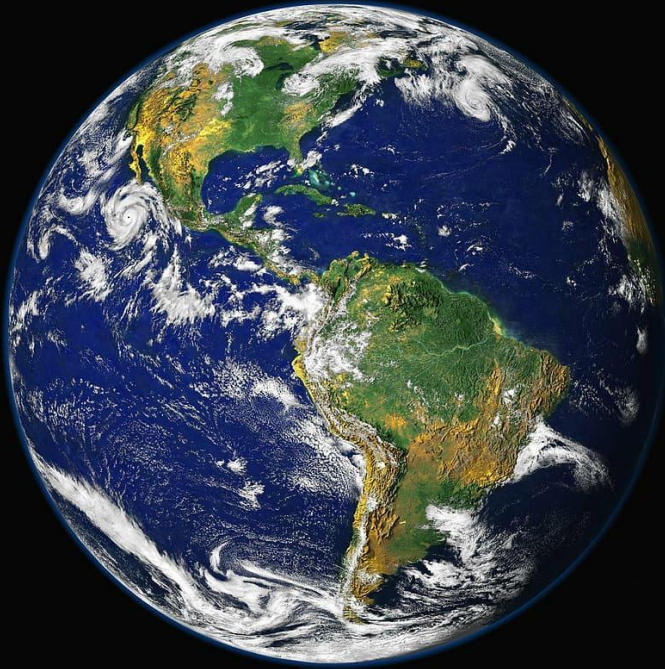
Filtered Data:

- Year: 1985-2022
- Top Countries: 37 countries represented about 90% of World's production/consumption
- Renewable Energy projections used data after 2010

Analysis

1. What is the relationship between energy production per capita and energy consumption per capita across countries?
2. Is there a correlation between renewable energy consumption and GDP?
3. Is there a correlation between total energy consumption per capita and total energy production per capita in different continents?
4. How do energy production and consumption fluctuations correlate with major events?
5. What are the projected renewable energy consumption trends for the next 50 years based on current data?

What is The Relationship Between Energy Production Per Capita and Energy Consumption Per Capita (Country)?



Japan

Germany

Sweden

Indonesia

Kazakhstan

Kuwait

Spain

Venezuela

Turkey

Algeria

China

United States

Brazil

Canada

Russia

India

Qatar

Saudi Arabia

Australia

Canada

France

Iran

South Africa

South Korea

Iraq

Italy

Mexico

Netherlands

Nigeria

Norway

Poland

United Kingdom

Spain

Taiwan

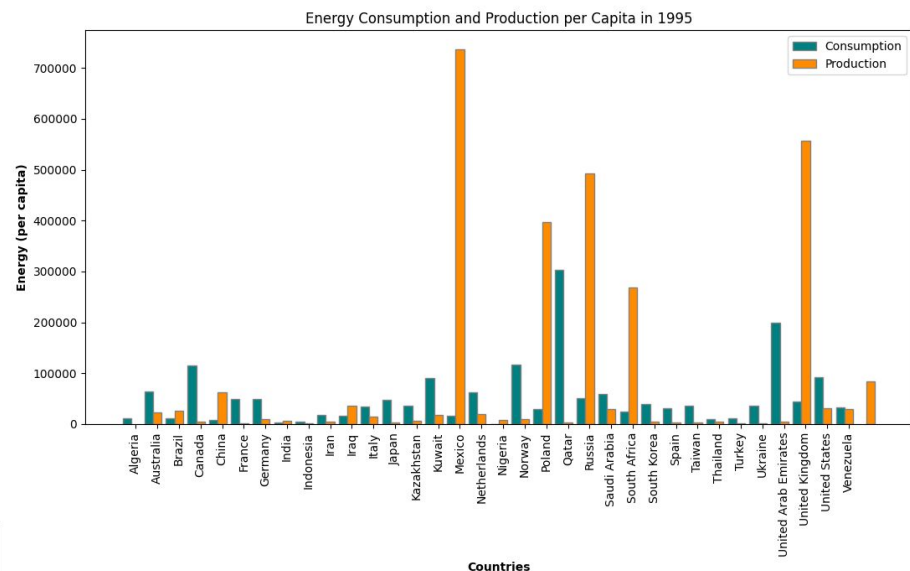
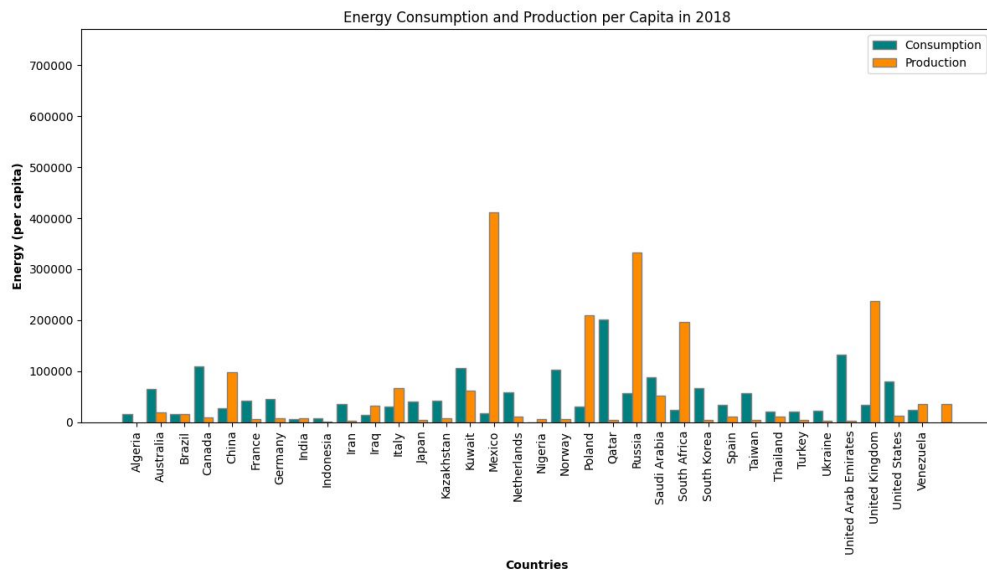
Thailand

Ukraine

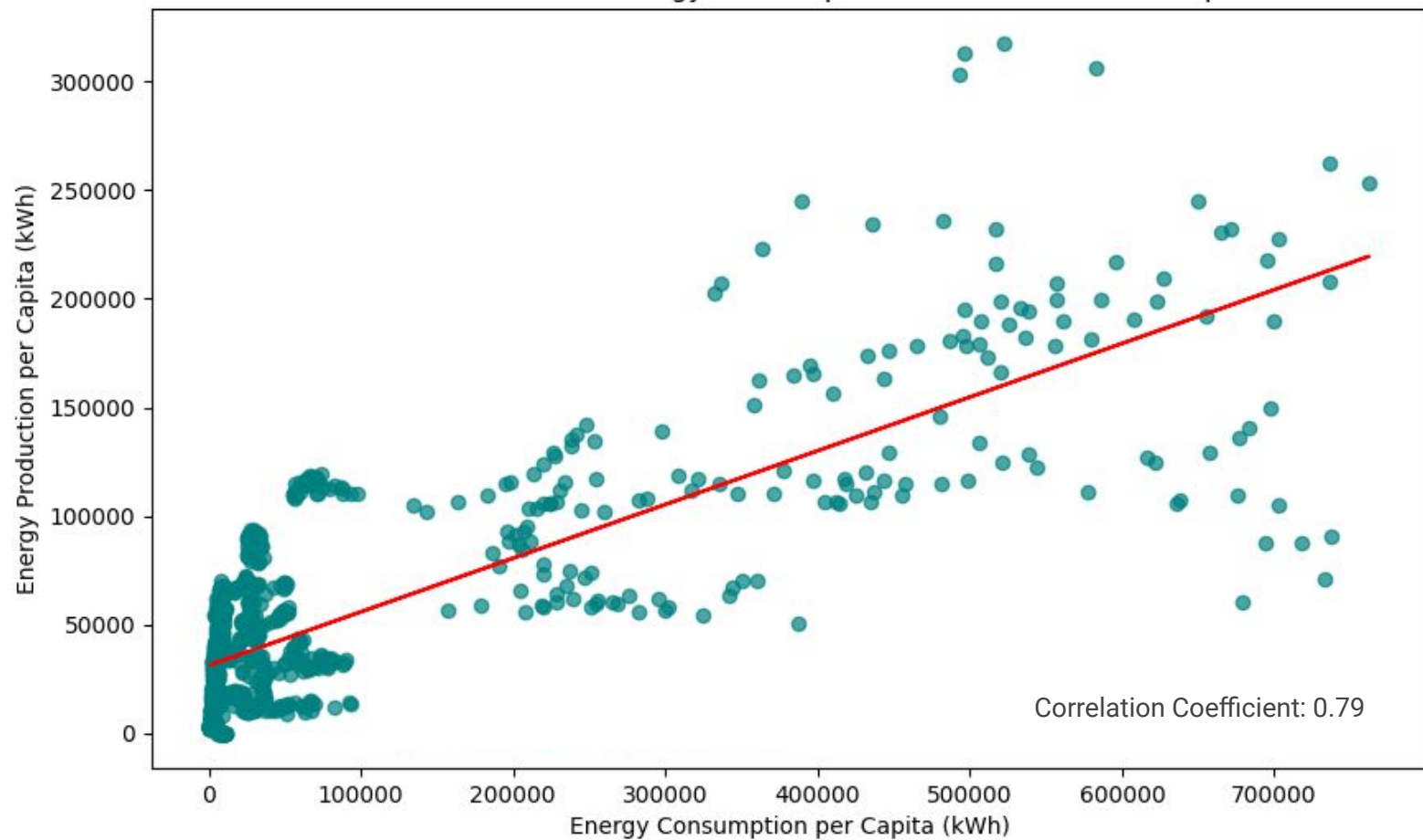
United Arab

Emirates

Energy Consumption Per Capita & Energy Production Per Capita for Top Countries (a snapshot)



Correlation between Energy Consumption and Production Per Capita

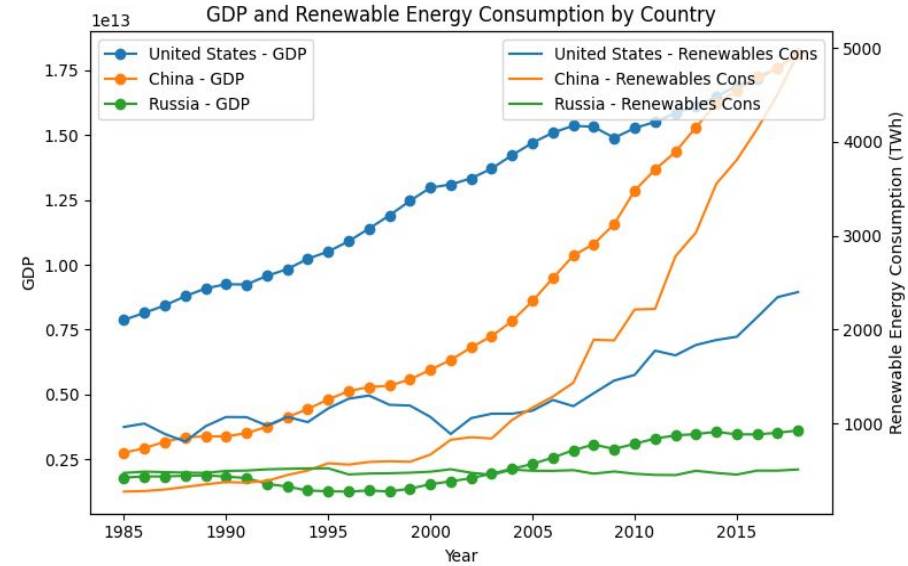
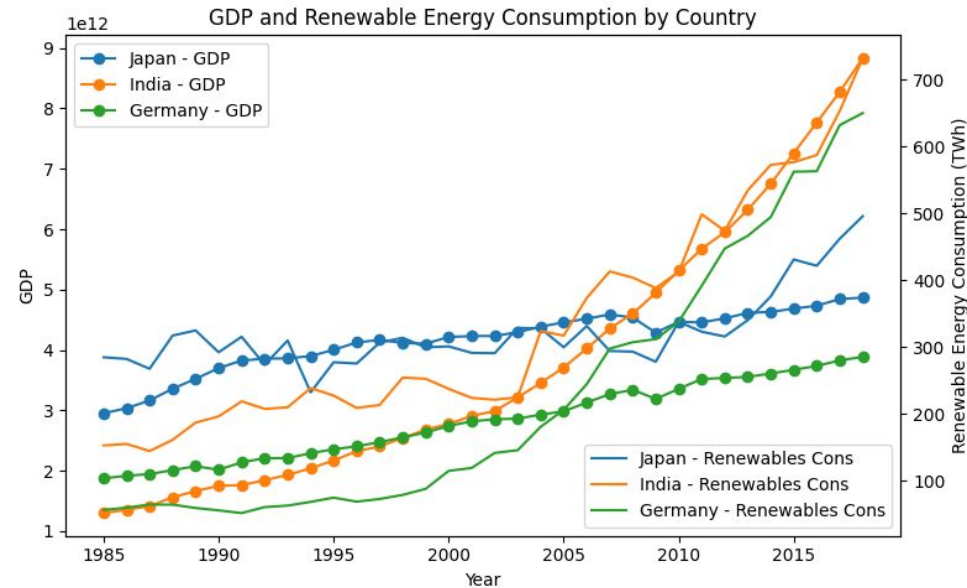


Energy Consumption per Capita and Energy Production Per Capita Stats

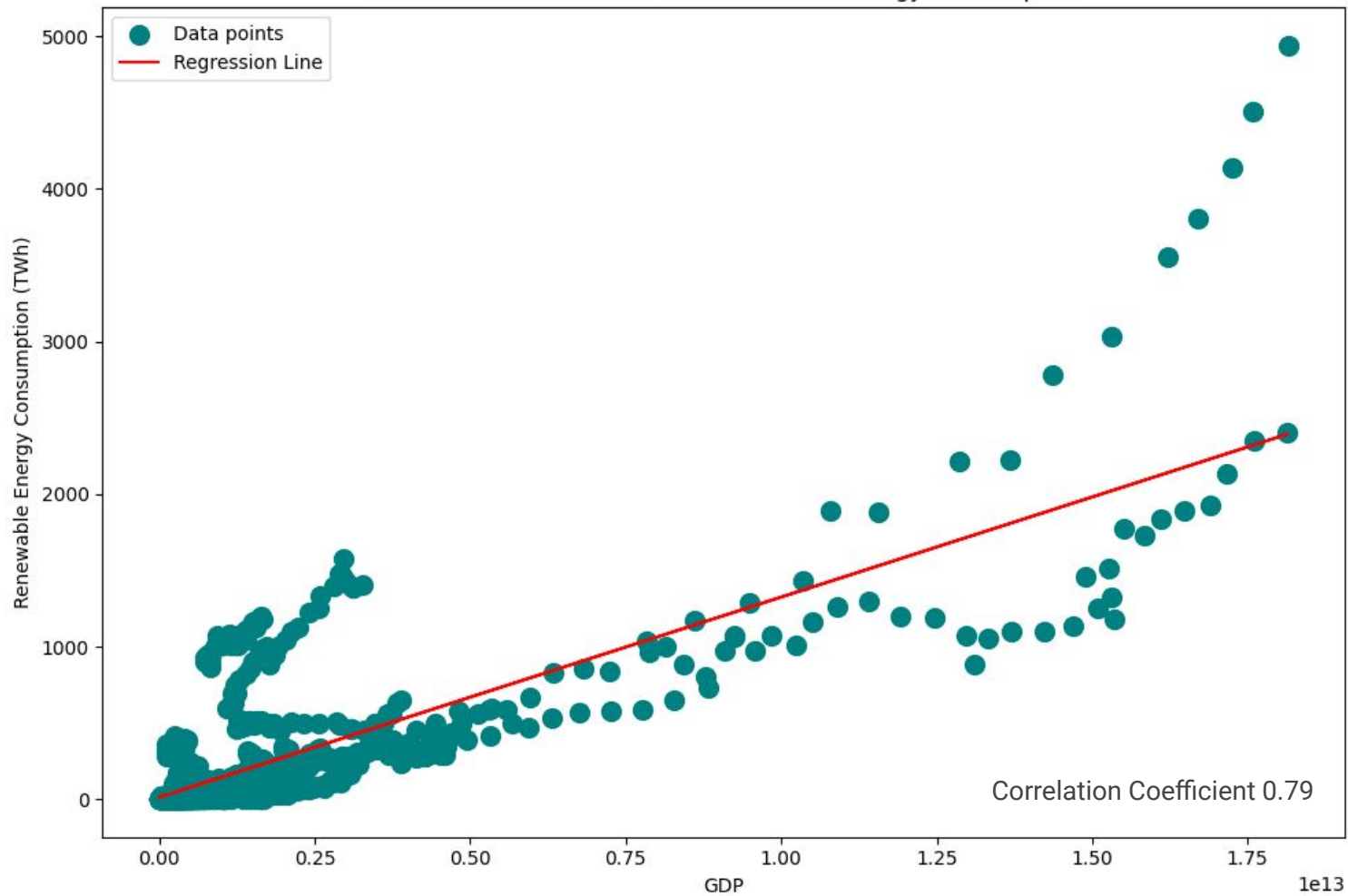
T-statistic	p-value	Consumption ANOVA:	Production ANOVA:
5.30	$1.3704e^{-07}$	F-Statistic: 0.0143 P-value: 0.9999	F-Statistic: 0.0457 P-value: 0.9999

- The positive T-statistic and the very small p-value indicate there is a statistically significant positive difference between energy production per capita than the energy consumption per capita across the countries in our dataset.
- The ANOVA results indicate that energy consumption per capita and energy production per capita been been relatively stable across the years 2008-2018

Is There Correlation Between Renewable Energy Consumption and GDP?



Correlation between GDP and Renewable Energy Consumption

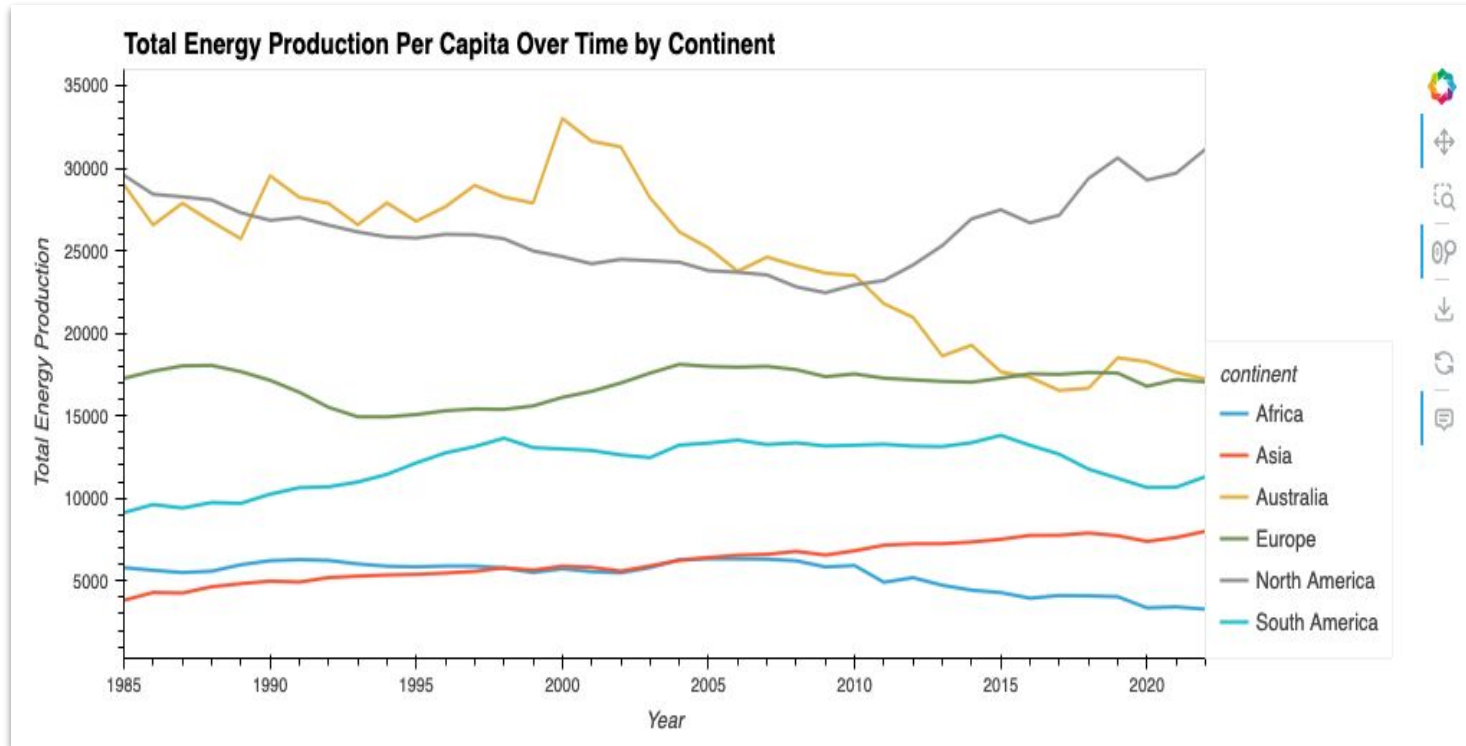


GDP and Renewables Consumption Statistics

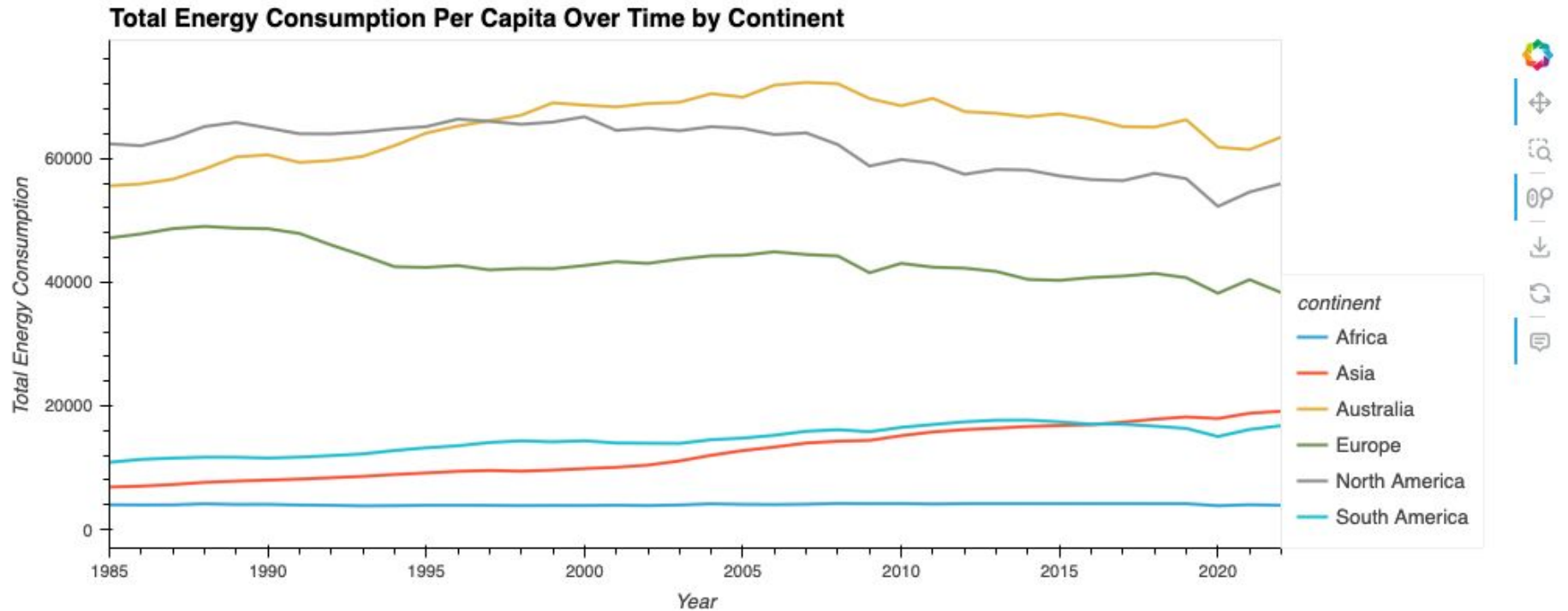
T-statistic	p-value	GDP ANOVA:	Renewables Consumption ANOVA:
20.764	$1.246e^{-81}$	F-Statistic: 0.1444 P-value: 0.9991	F-Statistic: 0.3126 P-value: 0.9777

- The positive T-statistic and the very small p-value indicate there is a statistically significant positive difference between GDP and renewables consumption across the countries in our dataset.
- The ANOVA results indicate that gdp and renewables consumption been been relatively stable across the years 2008-2018

Is There a Correlation Between Total Energy Consumption Per Capita and Total Energy Production Per Capita (Continents)?

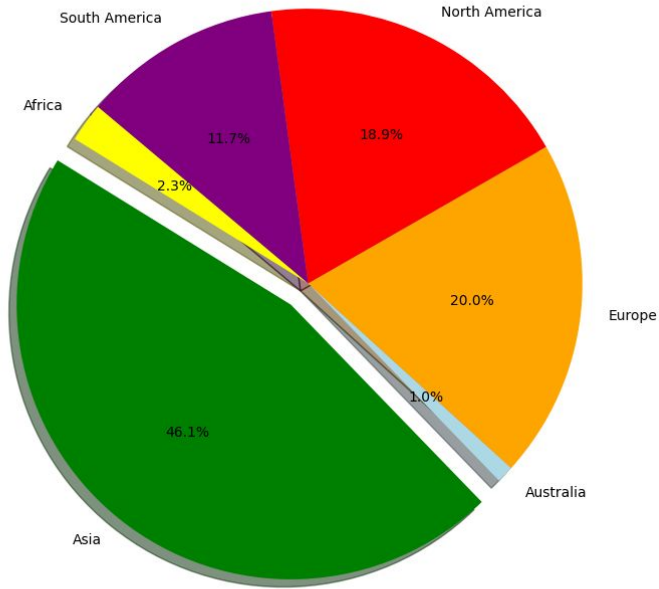


Total Energy Production Per Capita Over Time by Continent: This plot displays energy production per capita trends across continents from 1985 to 2022.



Total Energy Consumption Per Capita Over Time by Continent: This plot shows the trend of energy consumption per capita across different continents from 1985 to 2022.

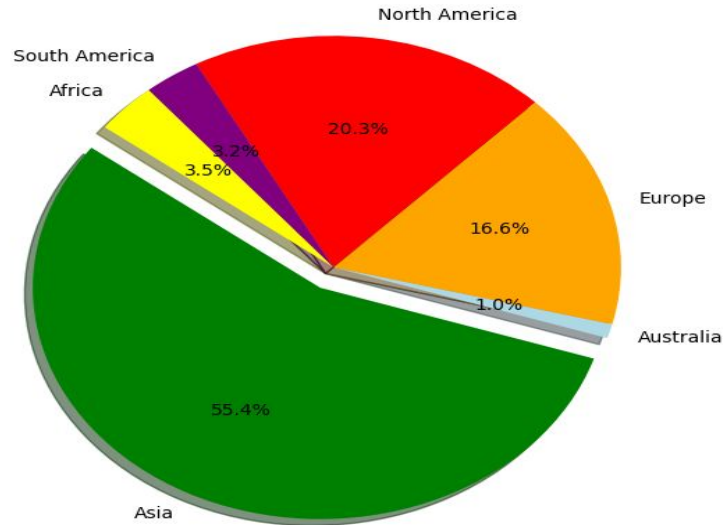
Renewable Energy Consumption by Continent in 2022



Renewable Energy Consumption:

- **Asia** leads with the highest share of renewable energy consumption at 46.1%, followed by **Europe** at 20.0% and **North America** at 18.9%.
- **Africa** and **South America** have smaller contributions, with **Africa** accounting for only 2.3%.
- This distribution indicates that **Asia** relies heavily on renewable energy sources, likely driven by significant investments in renewable technologies.

Non Renewable Energy Consumption by Continent in 2022



Non-Renewable Energy Consumption:

- **Asia** also has the largest share of non-renewable energy consumption at 55.4%, which is higher than its share of renewable energy consumption.
- **North America** and **Europe** follow with 20.3% and 16.6%, respectively, showing that these regions also rely considerably on non-renewable sources.
- **Africa** and **South America** maintain small shares, similar to their renewable energy distribution, but slightly higher than in renewable consumption.

❑ **Question :** Is there a correlation between total energy consumption per capita and total energy production per capita in different continents?

❑ **Answer:** Correlation between total energy consumption per capita and total energy production per capita: 0.9294352556530326

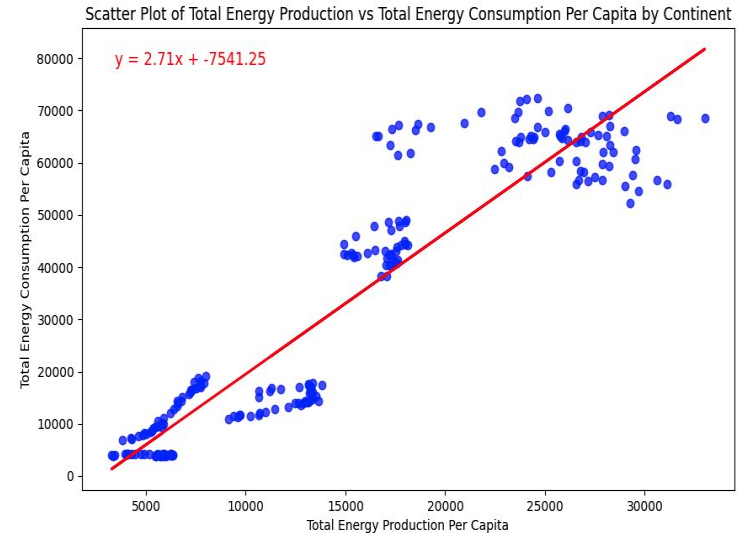
❑ The correlation value between total energy consumption per capita and total energy production per capita is **0.93**, which indicates a **strong positive correlation**.

Figure 21

T-test and Anova Test

→ **T-statistic:** -10.633693692517605, p-value: 2.0983809186947106e-22

→ **F_onewayResult**(statistic=0.0066544684672841525, pvalue=0.999999999535522)



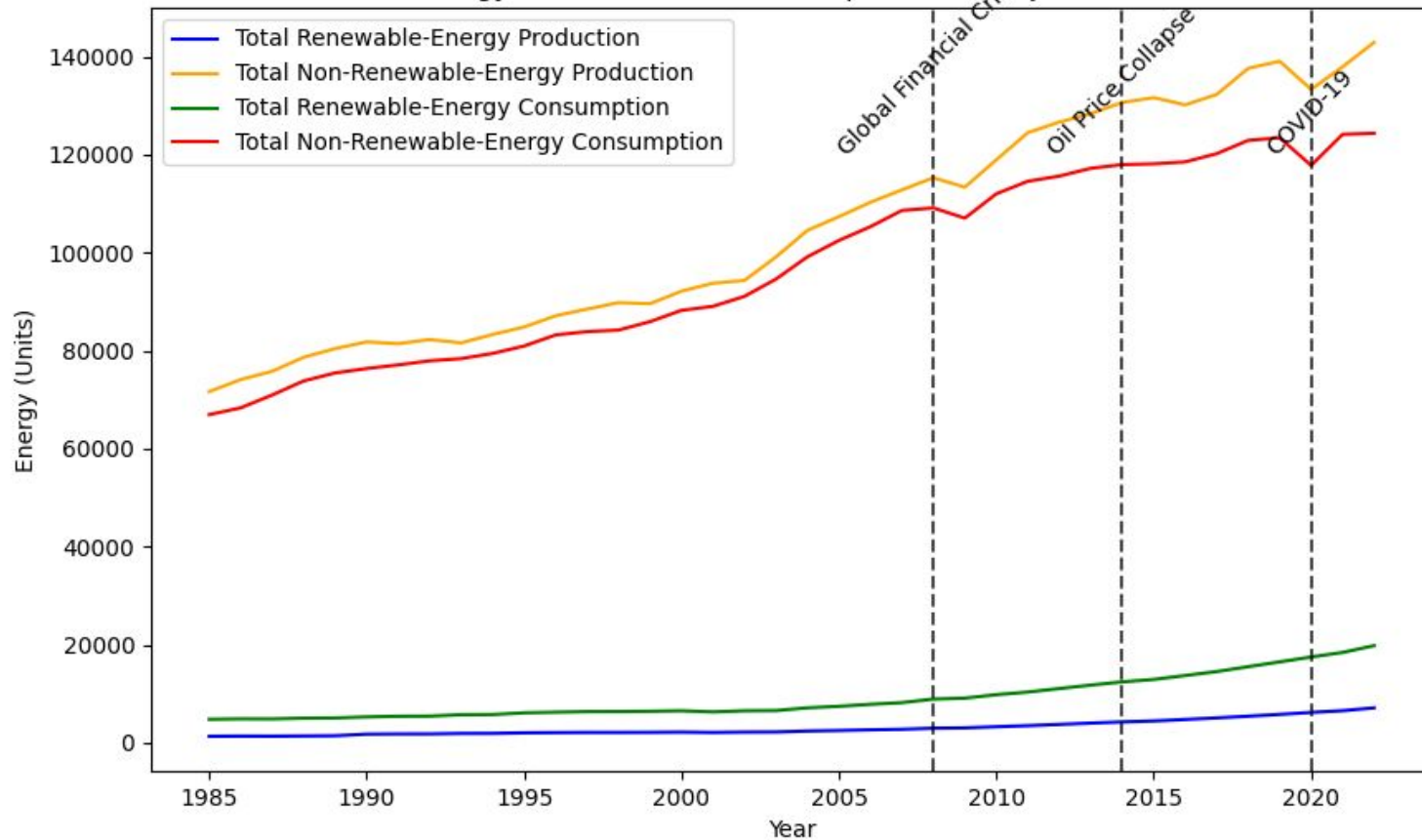
How Do Non-Renewable Energy Production and Consumption Fluctuate with the Major Events?

Major Events

- 2008: Global Financial Crises
- 2014: Oil Price Collapse
- 2019: COVID-19

We not only analyzed the data from the years in which major events occurred, but also examined the effects in the years that follow, to capture any delayed or lingering impacts.

Energy Production and Consumption with Major Events



Regression Results for Non-Renewable Energy Production

R-squared: 0.327	t-stat	p-value
Year 0	2.599	0.014
Year 1	2.409	0.022
Year 2	2.657	0.012

- $p < 0.05$ means there is a significant change in the production around the major events
- Lower t value suggests a notable difference between energy production levels around these events
- R-squared value of 0.327 suggests that 32.7% of the variance in energy production is explained by the major events

Conclusion:

T-statistic and p-value indicate a statistically significant relationship. R-squared is not very high but there is still meaningful correlation between the major events and changes in the non-renewable energy production

Regression Results for Non-Renewable Energy Consumption

R-squared: 0.322	t-stat	p-value
Year 0	2.559	0.015
Year 1	2.303	0.028
Year 2	2.698	0.011

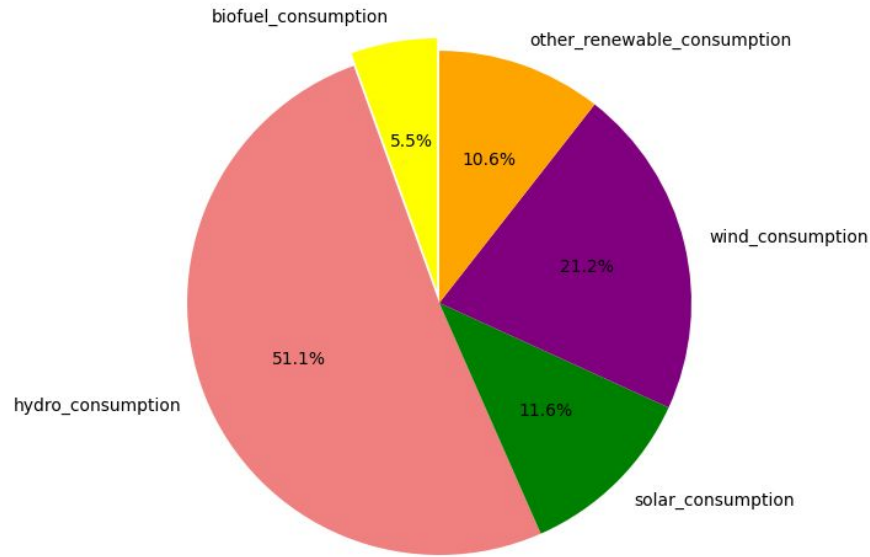
- $p < 0.05$ means there is a significant change in the consumption around the major events
- Lower t value suggests a notable difference between energy consumption levels around these events
- R-squared value of 0.322 suggests that 32.2% of the variance in energy consumption is explained by the major events

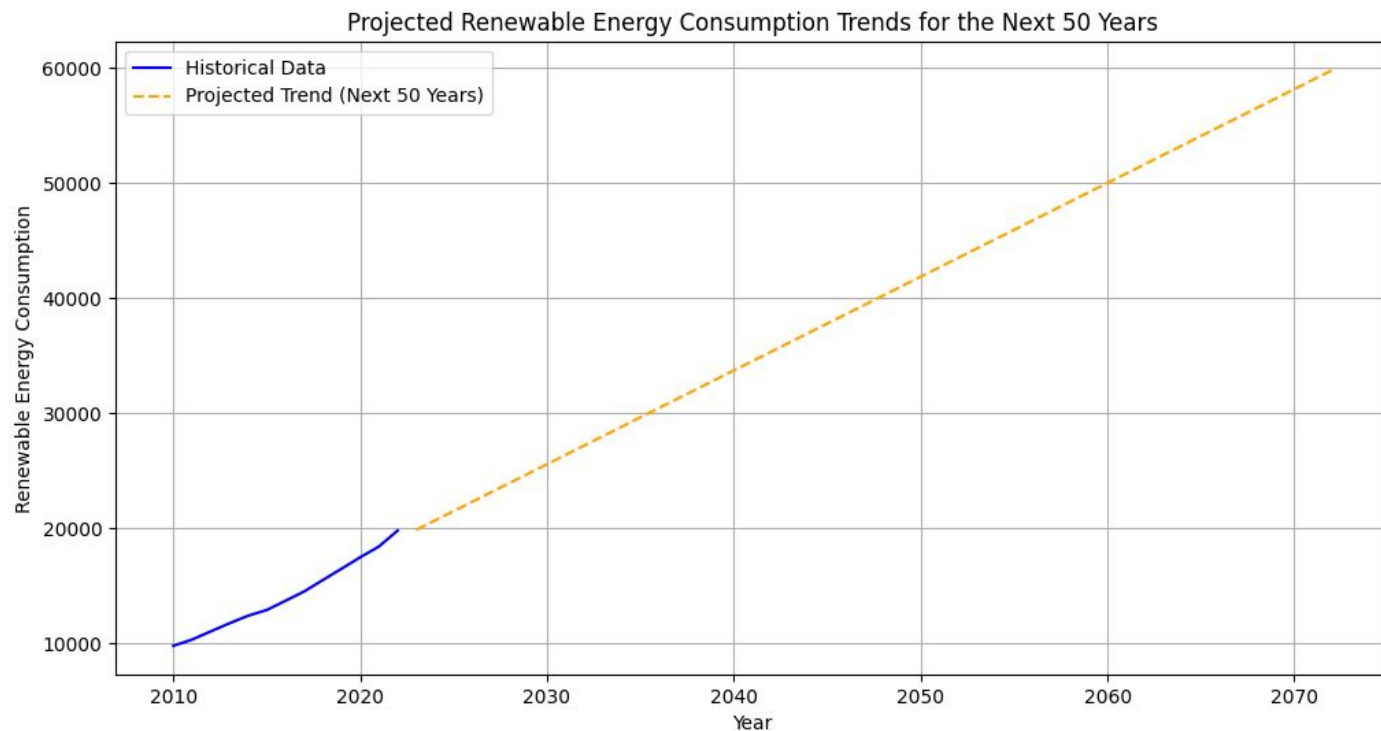
Conclusion:

T-statistic and p-value indicate a statistically significant relationship. R-squared is not very high but there is still meaningful correlation between the major events and changes in the non-renewable energy consumption

What Are The Projected Renewable Energy Consumption Trends For The Next 50 Years?

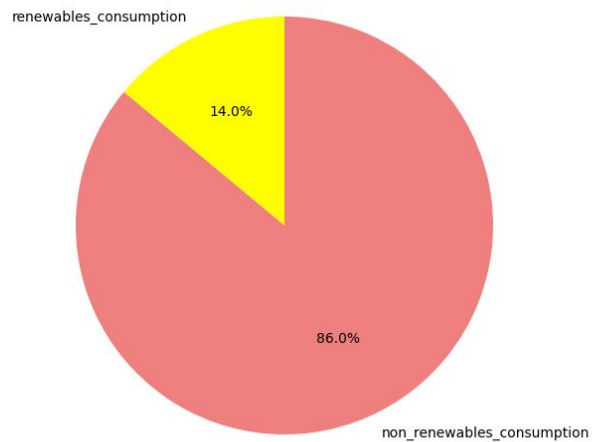
Current Outlook for Renewable Energy Distribution (2018-2022)



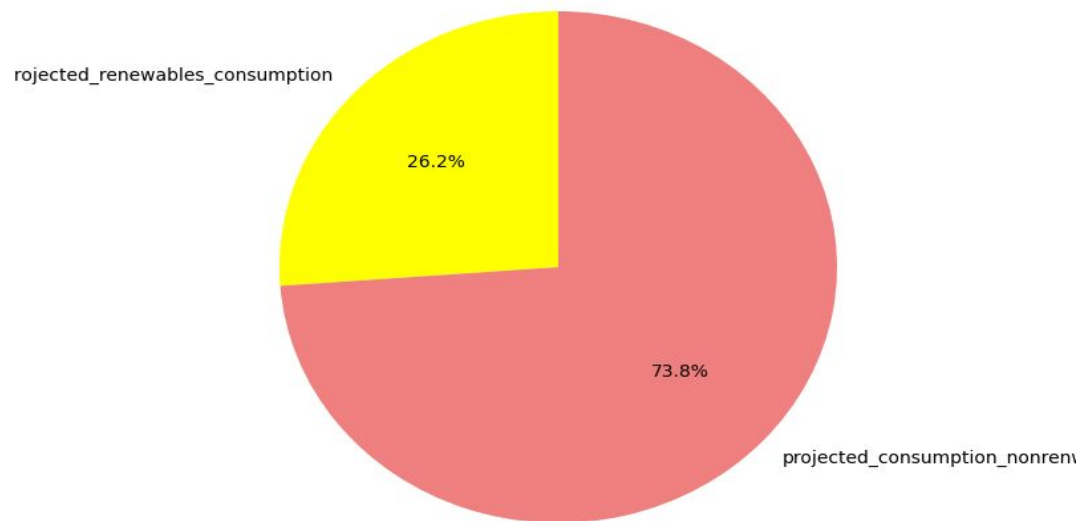


Estimated 2072 Renewable Energy Consumption Increase:
A projected rise of 201.83% compared to 2022 levels

Renewable vs Non-Renewable Energy Consumption (2022)



Renewable vs Non-Renewable Energy Consumption (Projected 2072)





Thank you!