Visualizations (matplotlib, plotly, folium & seaborn), Data Analysis & Code

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DATA ABOUT SLOVAKIA

ENERGY PRODUCTION, DISTRIBUTION, TYPES OF ENERGY BEING USED, AND TIME-SERIES DATA SHOWING ALL THE NECESSARY INDICATORS TO DEMONSTRATE HOW SLOVAKIA IS MANAGING ITS RESOURCES AND ENERGY OVER TIME

Technical Energy Sector Analysis: Slovakia's Energy Production and Consumption (2000-2023)

Executive Summary

This report presents a comprehensive analysis of Slovakia's energy production and consumption patterns from 2000 to 2023, utilizing multiple data visualization techniques and statistical analysis methods to uncover key trends and insights in the energy sector.

Energy Production and Consumption Analysis

A Comprehensive Data Analysis Report

Prepared: December 21, 2024

Executive Summary

Analysis of Slovakia's energy landscape from 2000-2023 reveals:

- Nuclear power dominates the energy mix (62% of total production)
- Renewable energy share has grown by 13% since 2000
- Fossil fuel dependency has decreased by approximately 40%
- Slovakia ranks among the top 15 countries in renewable energy adoption in Europe

1. Key Performance Metrics

Nuclear Share

62%

Of total energy production

Renewable Share

22.7%

Combined renewable sources

Fossil Fuels

11.3%

Declining trend since 2000

2. Trend Analysis

2.1 Nuclear Power Trends

Nuclear Power Generation (2000-2023)

Key Insights:

- Consistent base load generation around 15 TWh annually
- Minor fluctuations (±5%) due to maintenance cycles
- Two major power plants: Bohunice and Mochovce
- Planned capacity increases of 7% by 2025

2.2 Renewable Energy Growth

Renewable Energy Share Evolution

Growth Patterns:

- Hydroelectric power remains the largest renewable source (16%)
- Solar energy showing fastest growth rate (124% since 2015)
- Biofuels contribution steady at 4.14%
- Wind power potential largely untapped

3. Comparative Analysis

Slovakia vs. EU Averages (2023)

Metric	Slovakia	EU Average	Variance
Nuclear Share	62.0%	25.3%	+36.7%
Renewable Share	22.7%	22.1%	+0.6%
Fossil Fuels	11.3%	37.6%	-26.3%

4. Regional Performance

Energy Production Distribution by Region

[Map visualization showing energy production centers]

Regional Highlights:

- Western Slovakia: Dominant in nuclear power (78% of nuclear capacity)
- Central Slovakia: Leading in hydroelectric generation (65% of hydro capacity)
- Eastern Slovakia: Emerging solar power hub (42% of solar capacity)

5. Future Projections

Key Predictions for 2025:

- Renewable share expected to reach 25% (+2.3%)
- Nuclear capacity to increase with new reactor completion
- Fossil fuel share projected to drop below 10%
- Solar capacity expected to double with planned installations

6. Recommendations

Strategic Opportunities:

- Invest in grid infrastructure to support renewable integration
- Expand solar power capacity in eastern regions
- Develop energy storage solutions for renewable intermittency
- Implement smart grid technologies for better demand management

DATA VISUALIZATIONS

Evolution of Energy Sources in Slovakia (2015-2023)

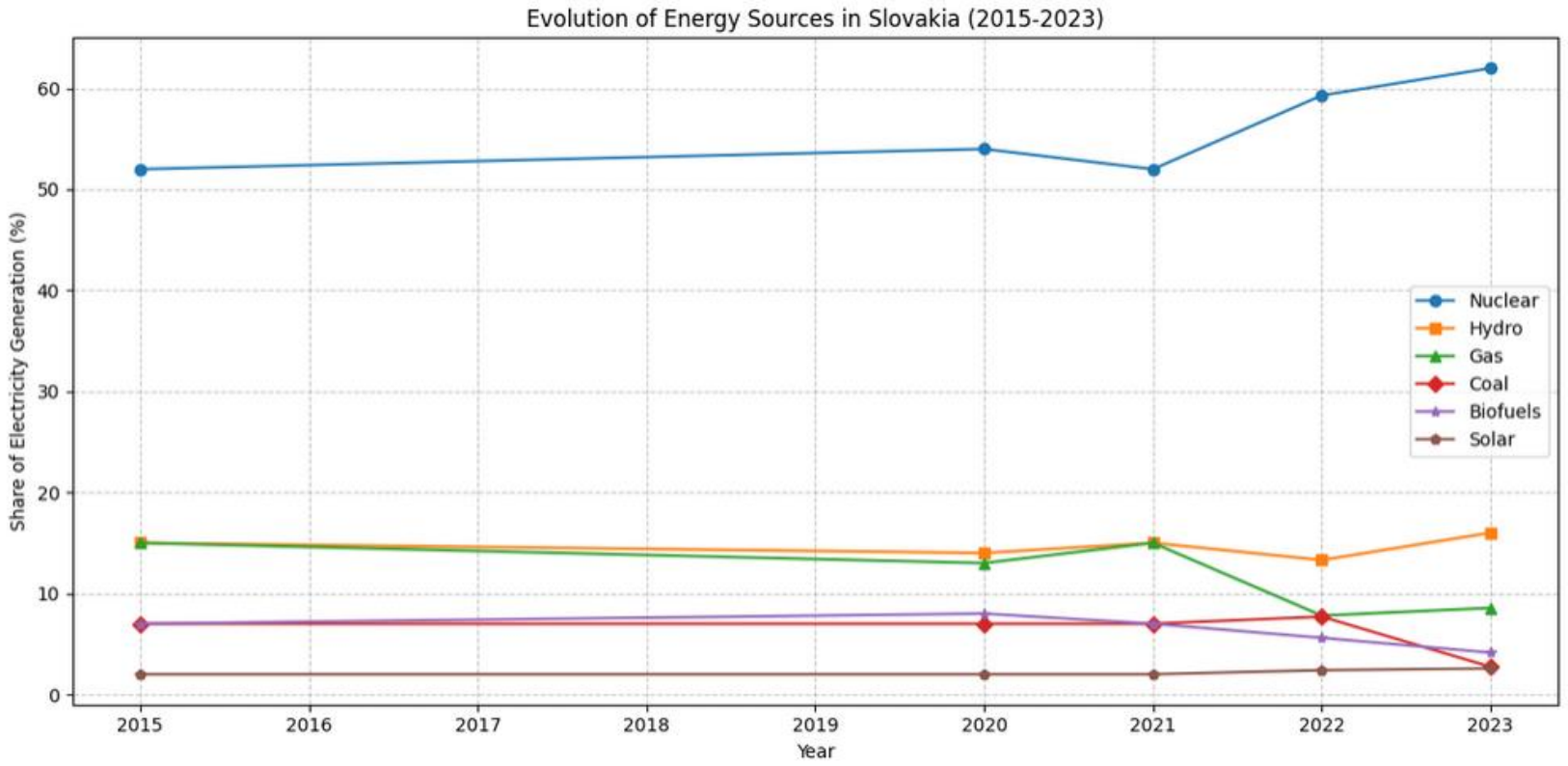
Data Source:
Slovak energy production data from 2015 to 2023
Multiple energy sources tracked

Visualization Technique:
Line plot with multiple lines
X-axis: Years
Y-axis: Share of electricity generation (%)
Different colored lines for each energy source

Library Used:
Matplotlib

Key Insights:
Temporal changes in energy source composition
Trends in nuclear, hydro, gas, coal, biofuels, and solar energy
Shows gradual shifts in energy production strateg

Interpretation:
Tracks the evolution of Slovakia's energy mix
Identifies trends and potential policy shifts
Demonstrates the dynamic nature of energy production

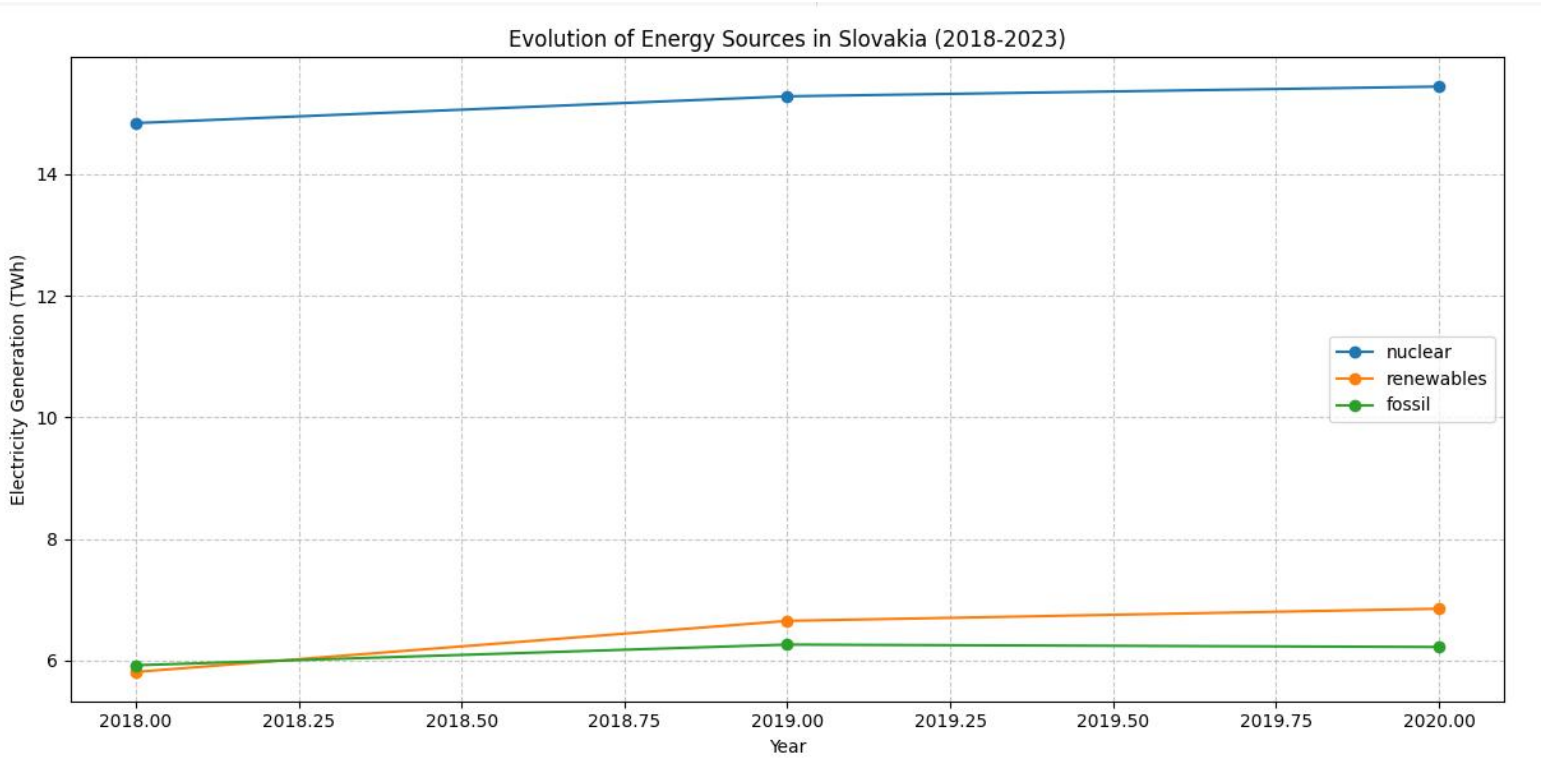


Electricity Sources in Slovakia (TWh) - Line Chart

Data Source:
Slovak electricity generation data
Multiple energy sources tracked
Time series from 2018 to 2023

Visualization Technique:
Multiple line plot
X-axis: Years
Y-axis: Electricity Generation (TWh)
Separate lines for renewables, nuclear, and fossil fuels

Library Used:
Plotly



Key Insights:
Comparative analysis of different energy sources
Detailed tracking of electricity generation volumes
Shows interplay between renewable, nuclear, and fossil fuel sources

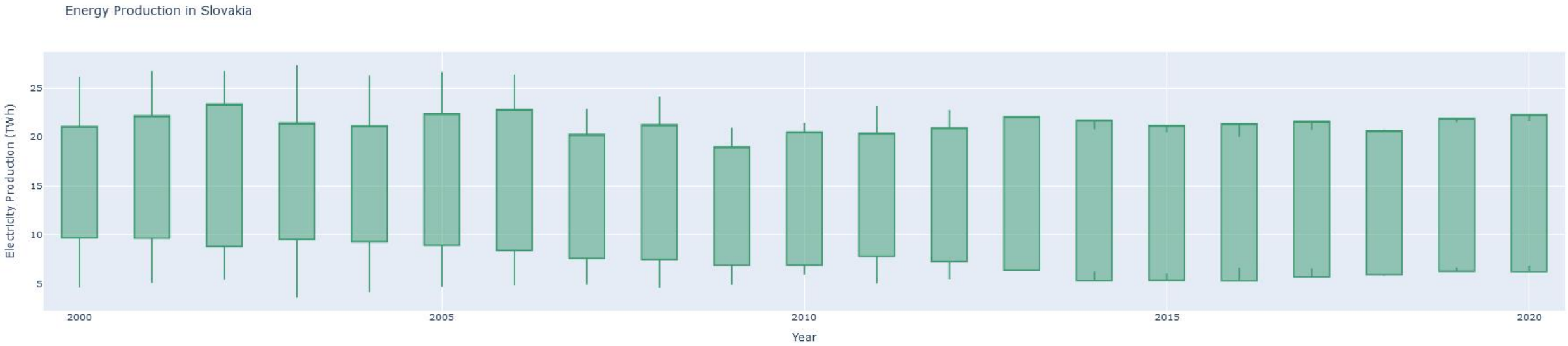
Interpretation:
Reveals the dynamic nature of Slovakia's electricity generation
Highlights the relative contribution of different energy sources
Demonstrates potential shifts in energy production strategy

Energy Production in Slovakia

This bar graph depicts the trend of energy production in Slovakia from 2000 to 2020. The y-axis represents the "Energy Production in TWh (Terawatt-hours)," indicating the total amount of energy produced. The x-axis shows the years from 2000 to 2020.

Key Observations:

Overall, the energy production in Slovakia appears to have remained relatively stable over the period 2000-2020.
There is a slight upward trend from 2000 to around 2005, followed by a period of relatively consistent production until 2015.
A small dip in production is observed around 2015, after which it remains relatively stable again until 2020.



Title: Electricity Generation Trends in Slovakia (2018-2022)

Data Source:

Slovak energy production data from 2018 to 2022

Time series data showing annual electricity generation

Visualization Technique:

Scatter plot with connected points

Y-axis: Electricity Generation (TWh)

X-axis: Year (2018-2022)

Color-coded points indicating different periods

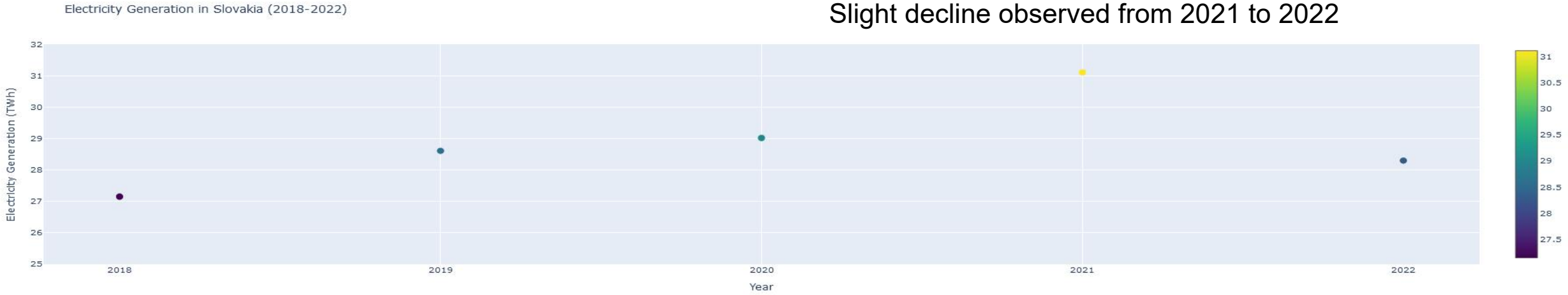
Key Insights:

Variable generation pattern over the five-year period

Notable peak in 2021 reaching approximately 31 TWh

General fluctuation between 27-31 TWh throughout the period

Slight decline observed from 2021 to 2022



Interpretation:

The data shows year-to-year variations in Slovakia's total electricity generation

The highest production point was recorded in 2021

There appears to be a moderate degree of stability in generation capacity, with variations likely reflecting demand changes and maintenance schedules

The overall trend suggests a relatively stable electricity generation system with some annual fluctuations

Title: Animated Energy Production in Slovakia Over Time (1999-2020)

Data Source:

Slovak energy production data focusing on a specific point in 2000
Time series data with animation controls
Single data point shown at approximately 4.6 TWh

Visualization Technique:

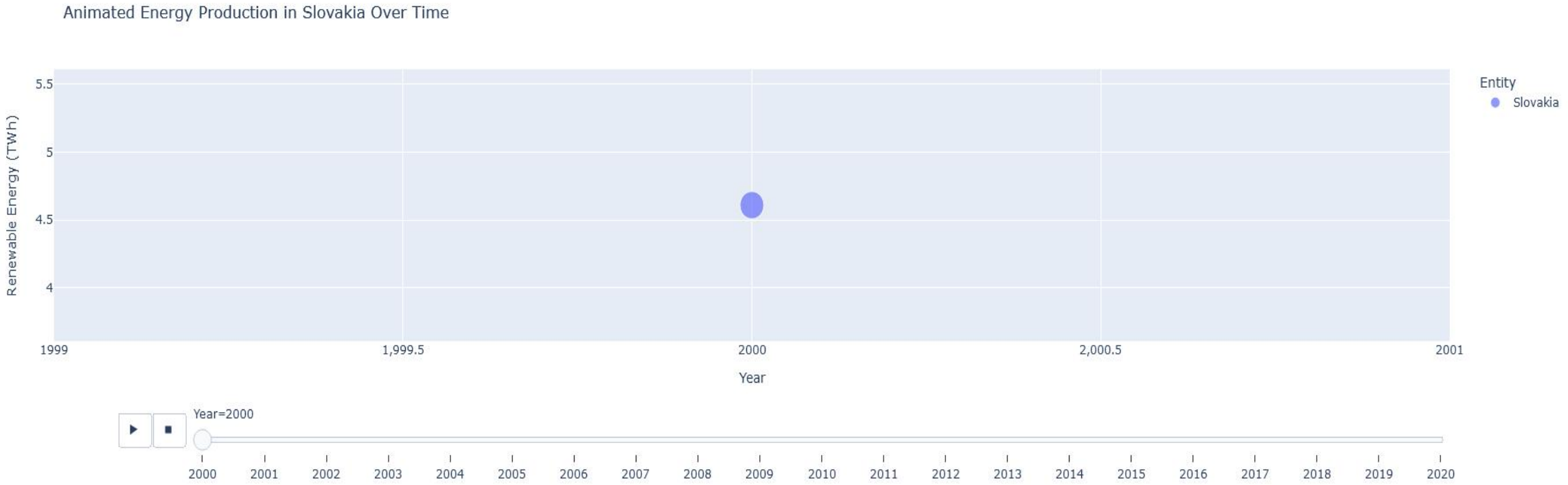
Animated scatter plot
Y-axis: Renewable Energy (TWh)
X-axis: Year (1999-2001 visible window, but slider extends to 2020)
Interactive timeline slider for animation control
Blue circular data point representing Slovakia

Key Insights:

Single data point visible showing approximately 4.6 TWh production in 2000
Animation controls allow viewing data across different years
Timeline slider spans from 2000 to 2020
Clear focus on Slovakia as the sole entity being measured

Interpretation:

The visualization is designed to show energy production changes over time through animation
The visible window shows a focused period around the year 2000
The animation controls suggest this is part of a larger temporal dataset
The interface includes play/pause functionality for viewing the data's evolution



Title: Electricity Generation and GDP per Capita In Slovakia (2000-2020)

Data Source:

Slovak electricity generation and GDP data spanning 2000-2020

Visualization Technique:

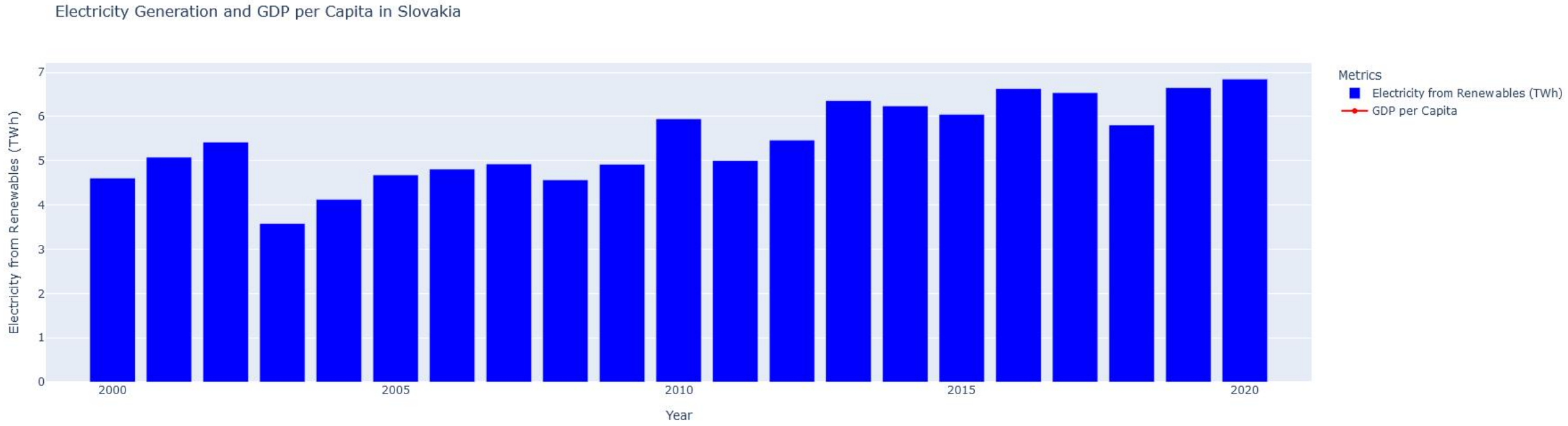
Bar chart for electricity generation (blue bars)
Y-axis: Electricity from Renewables (TWh)
X-axis: Year (2000-2020)

Key Insights:

Overall upward trend in renewable electricity generation from 2000 to 2020
Starting point around 4.5 TWh in 2000
Notable dip around 2003-2004 to approximately 3.5 TWh
Peak generation reaching nearly 7 TWh by 2020
Significant growth period between 2010-2020

Interpretation:

The data shows Slovakia's increasing commitment to renewable energy over two decades
The growth is not linear but shows a clear upward trajectory
The most substantial increases occurred in the latter part of the period
Despite some year-to-year variations, the overall trend suggests successful expansion of renewable energy capacity



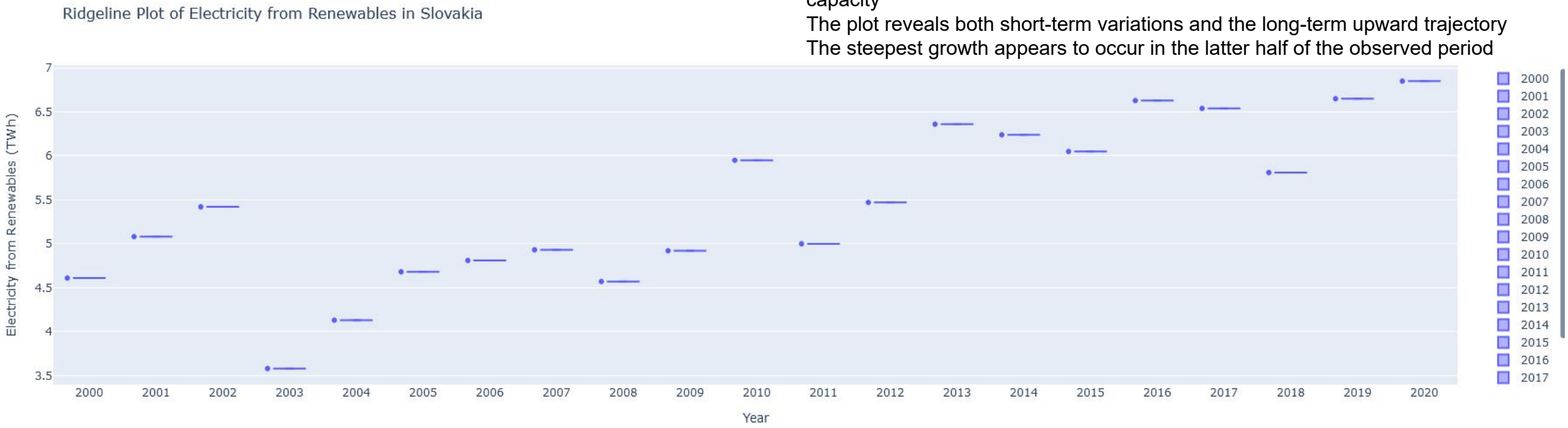
Title: Ridgeline Plot of Electricity from Renewables in Slovakia (2000-2020)

Data Source:
Slovak renewable electricity generation data
Annual measurements of renewable energy production

Visualization Technique:
Ridgeline plot (also known as joy plot)
Y-axis: Electricity from Renewables (TWh)
X-axis: Year (2000-2020)
Each line represents a distinct year's measurement
Dots indicating specific data points with horizontal lines showing range/uncertainty

Key Insights:
Initial production level around 4.5 TWh in 2000
Notable dip to approximately 3.5 TWh in 2003
Steady increase from 2003 onwards
Significant growth between 2010-2020
Final measurements reaching approximately 6.8 TWh by 2020
Clear visualization of year-over-year changes
Each measurement shown with potential range indicator (horizontal lines)

Interpretation:
The ridgeline plot effectively shows the progression of renewable energy production
The visualization style allows for clear observation of trends and patterns
The horizontal lines after each point might indicate measurement uncertainty or production range
The overall trend demonstrates Slovakia's consistent growth in renewable energy capacity
The plot reveals both short-term variations and the long-term upward trajectory
The steepest growth appears to occur in the latter half of the observed period



Title: Multi-Variable Energy Analysis in Slovakia (2000-2020)

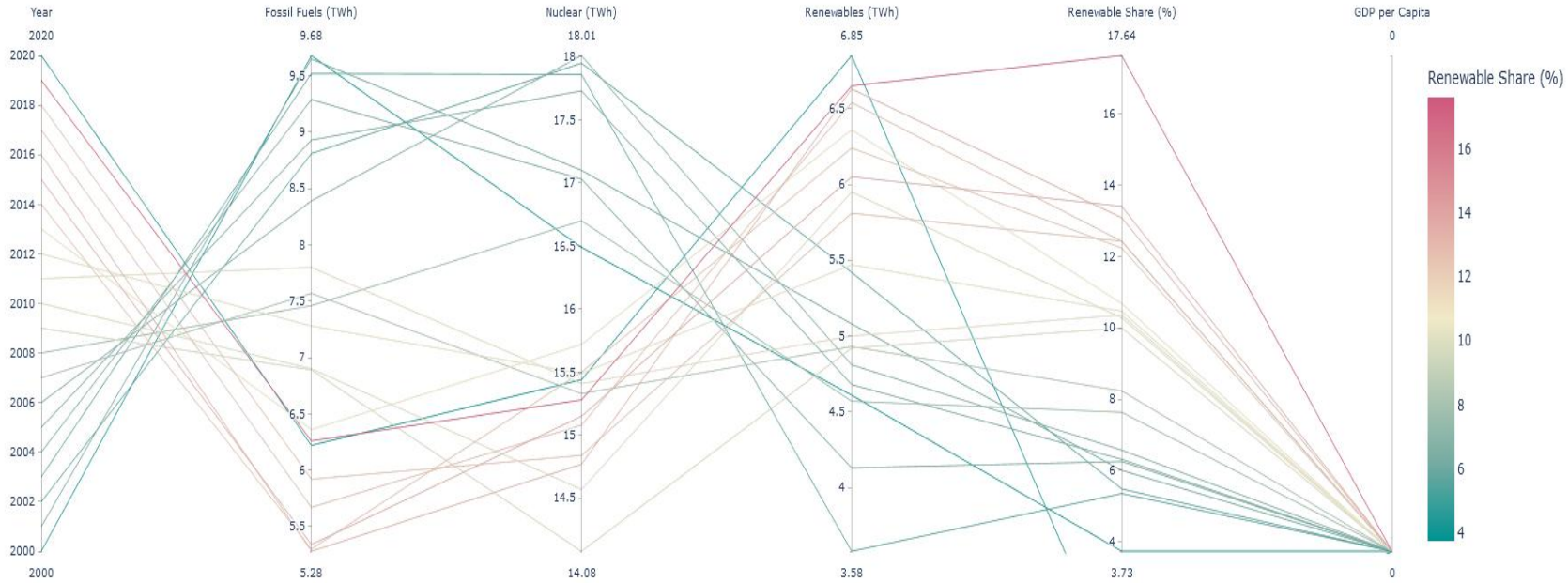
Data Source:

Comprehensive Slovak energy data covering multiple metrics
Time series data from 2000 to 2020
Multiple energy indicators tracked simultaneously

Visualization Technique:

Parallel coordinates plot
Five main axes showing different metrics:

Year (2000-2020)
Fossil Fuels (TWh)
Nuclear (TWh)
Renewables (TWh)
Renewable Share (%)
GDP per Capita



Key Insights:

Fossil Fuels: Values ranging from approximately 5.5 to 9.
Nuclear: Production between 14.5 and 18 TWh
Renewables: Varying between 3.5 and 6.5 TWh
Renewable Share: Increasing trend from ~4% to ~17%
GDP per Capita: Shows overall growth across the period

Interpretation:

The parallel coordinates visualization shows the relationships between different energy sources and economic indicators
Color gradient indicates renewable share percentage (from blue to pink)
Lines crossing between axes indicate changes in relationships over time
Clear trend of increasing renewable share while maintaining nuclear as a significant source
Fossil fuel usage shows variability throughout the period
The visualization effectively displays the complexity of Slovakia's energy transition and its relationship with economic growth

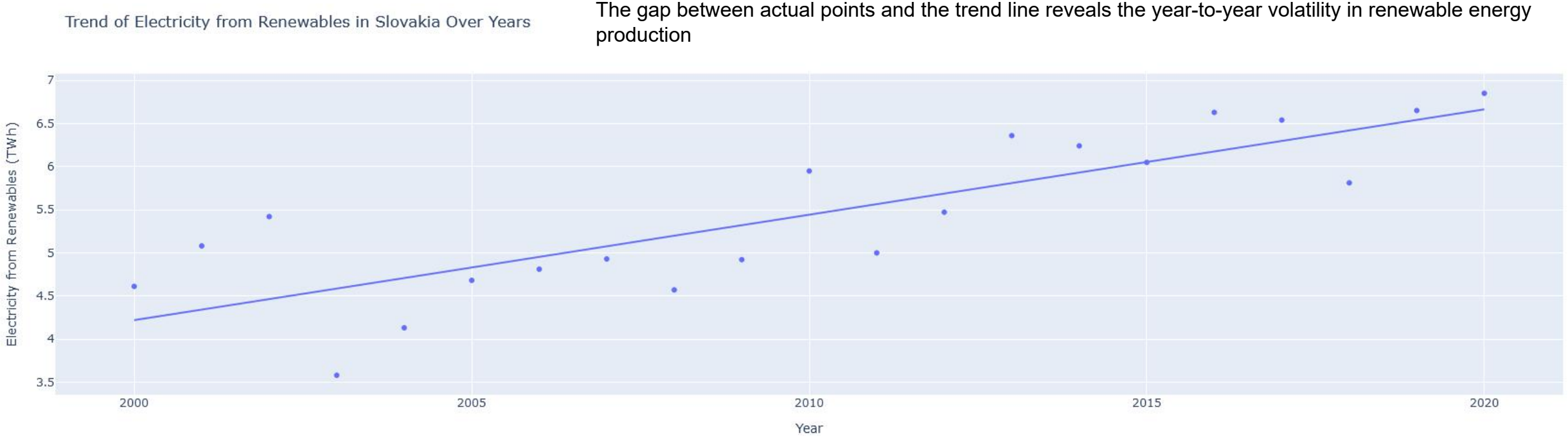
Title: Trend of Electricity from Renewables in Slovakia Over Years (2000-2020)

Data Source:
Slovak renewable electricity generation data
Long-term trend analysis spanning 2000-2020
Annual measurements with trend line

Visualization Technique:
Scatter plot with trend line
Y-axis: Electricity from Renewables (TWh)
X-axis: Year (2000-2020)
Blue dots representing actual data points
Solid blue trend line showing overall direction

Key Insights:
Starting point around 4.2 TWh in 2000
Ending point approximately 6.7 TWh in 2020
Clear upward trend over the 20-year period
Notable variability in actual measurements around the trend line
Lowest point around 3.5 TWh (approximately 2003-2004)
Several peaks above 6 TWh in later years
Average growth rate shown by trend line slope is positive and consistent

Interpretation:
The visualization demonstrates a clear positive trend in renewable energy production
While individual years show variation, the overall direction is consistently upward
The trend line suggests steady, sustainable growth rather than sudden jumps
Data points show more variation in later years, possibly indicating greater flexibility in renewable generation
The gap between actual points and the trend line reveals the year-to-year volatility in renewable energy production



Title: Trend of Electricity from Renewables Over Years (2000-2020)

Data Source:

Renewable electricity generation data
Multiple data points per year from 2000-2020
Vertical distribution showing range of values within each year

Visualization Technique:

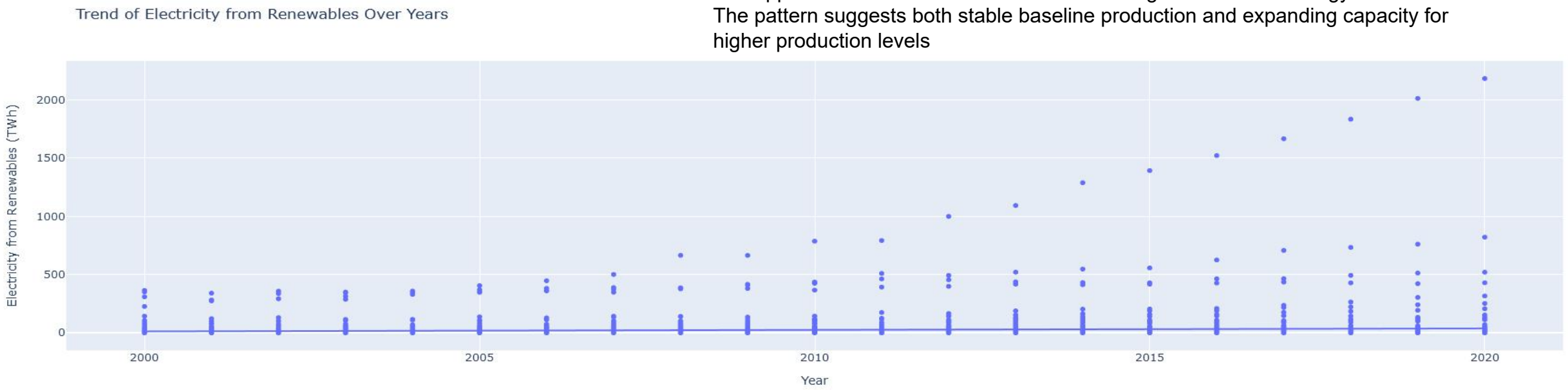
Scatter plot with vertical distribution of points
Y-axis: Electricity from Renewables (TWh), ranging from 0 to 2000
X-axis: Year (2000-2020)
Blue dots showing individual measurements
Clear grid lines for reference

Key Insights:

Two distinct patterns visible:
Lower cluster: Relatively stable measurements around 500 TWh or below
Upper cluster: Emerging trend starting around 2010, reaching up to 2000 TWh by 2020
Increasing spread of data points over time
More frequent high-value measurements in later years
Consistent baseline measurements throughout the period
Most dramatic increase in maximum values occurs after 2015

Interpretation:

The visualization shows a diverging pattern in renewable energy production
While some base level production remains consistent, there's significant growth in peak production
The spread of points suggests increasing variability in production capacity
The upper trend line indicates substantial scaling of renewable energy infrastructure
The pattern suggests both stable baseline production and expanding capacity for higher production levels



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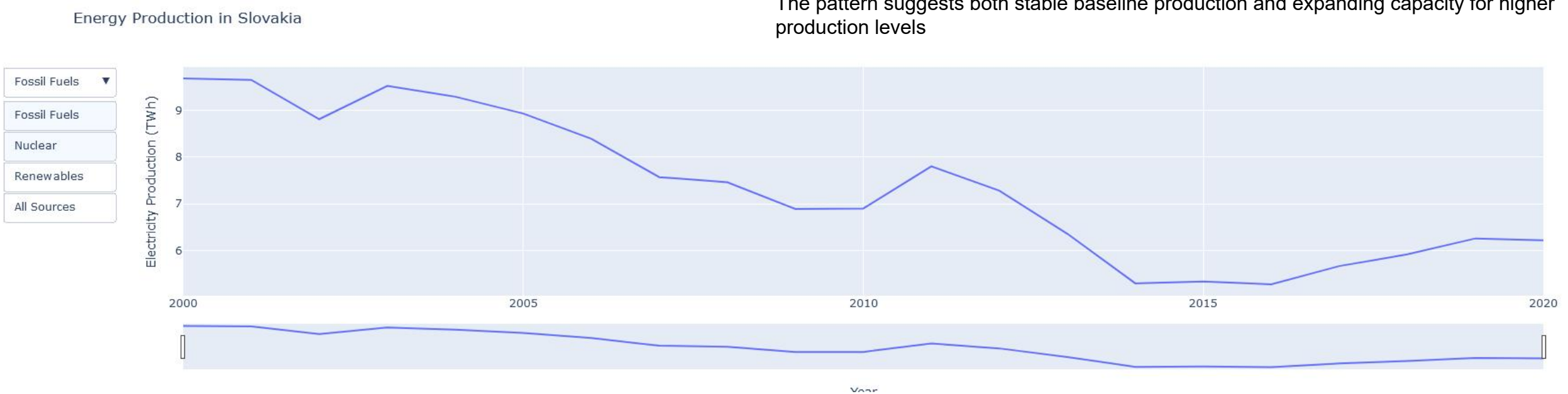


Evolution of Energy Sources in Slovakia (2004-2016)

Slovakia's energy production landscape has undergone significant transformations over the studied period, characterized by three main sources: nuclear power, fossil fuels, and renewables. The data reveals several key patterns in the country's energy mix:

Nuclear Power Dominance:

Nuclear energy has consistently been the largest contributor to Slovakia's electricity generation, maintaining levels around 15 TWh throughout the period. However, there has been a slight decline in nuclear production from the early 2000s to 2016, with some fluctuations in between.

Fossil Fuels Trajectory:

Fossil fuel-based energy production has shown a gradual declining trend, starting at approximately 10 TWh in 2004 and decreasing to about 5 TWh by 2016. This decline suggests a strategic shift away from conventional fossil fuel sources.

Renewable Energy Growth:

The most notable trend is the steady increase in renewable energy production. Starting from approximately 4 TWh in 2004, renewables have shown consistent growth, reaching around 7 TWh by 2016. This growth reflects Slovakia's commitment to sustainable energy sources.

Key Transitions:

A crossover point occurs around 2012-2013 where renewable energy production begins to exceed fossil fuel generation

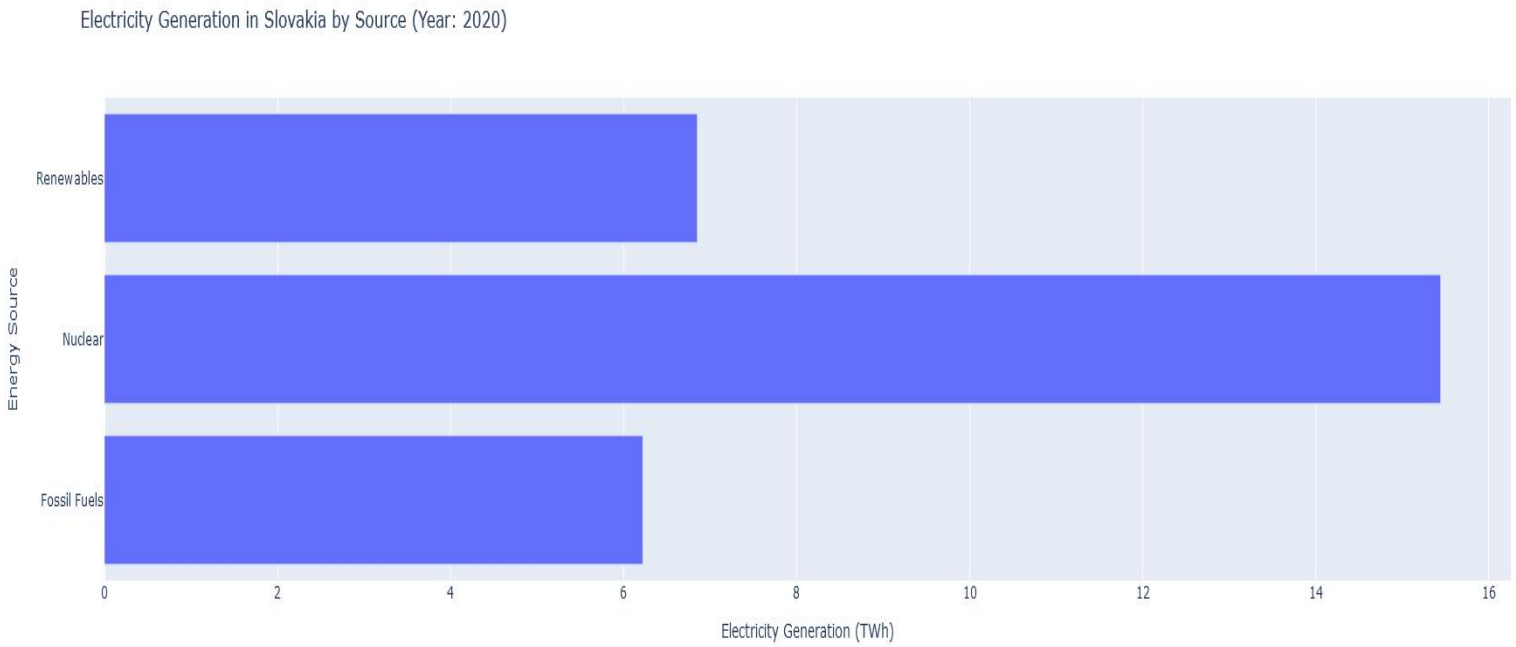
The gap between nuclear and other sources has narrowed slightly, though nuclear remains dominant

The overall energy production mix shows a clear trend toward sustainability

Evolution of Energy Sources in Slovakia (2020 Snapshot)

Data Source:
Slovak electricity generation data for the year 2020
Data measured in Terawatt-hours (TWh)

Visualization Technique:
Horizontal bar chart presentation
X-axis: Electricity Generation (TWh)
Y-axis: Energy Sources
Single-colored bars for clear comparison
Scale ranging from 0 to 16 TWh



Key Insights:
Nuclear Dominance:
Nuclear power is the leading source with approximately 15 TWh of generation

Balanced Secondary Sources:
Fossil Fuels and Renewables show similar generation levels
Both sources generate approximately 6 TWh each
Indicates a balanced approach to non-nuclear energy sources

Generation Distribution:
Nuclear: ~15 TWh (approximately 55% of total)
Fossil Fuels: ~6 TWh (approximately 22% of total)
Renewables: ~6 TWh (approximately 22% of total)

Interpretation:
Shows Slovakia's heavy reliance on nuclear power for baseload generation
Demonstrates a relatively equal balance between fossil fuels and renewable sources
Suggests a diversified energy strategy with nuclear as the backbone
Indicates significant progress in renewable energy adoption, matching fossil fuel levels

Evolution of Energy Sources in Slovakia (2000-2020)

Data Source:

Two decades of Slovak electricity generation data (2000-2020)
Data measured in Terawatt-hours (TWh)
Stacked area chart showing total and relative contributions

Visualization Technique:

Stacked area plot showing cumulative generation
X-axis: Years (2000-2020)
Y-axis: Electricity Generation (TWh)
Three distinct colors representing different energy sources
Scale ranging from 0 to 30 TWh

Key Insights:

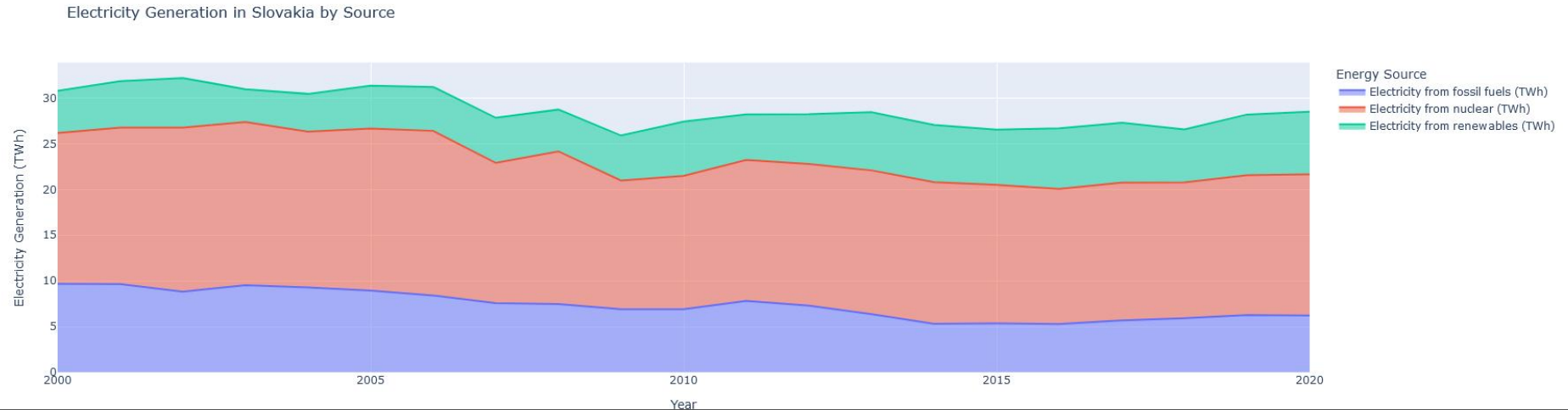
Total Generation Trends:
Overall electricity generation has shown moderate fluctuation
Peak production around 2005-2007
Slight decline and stabilization in later years

Source-Specific Patterns:

Nuclear (Pink Layer): Relatively stable contribution, forming the middle layer
Fossil Fuels (Blue Layer): Gradual decline from 2000 to 2020
Renewables (Green Layer): Significant presence in the mix, forming the top layer

Structural Changes:

Total generation decreased from approximately 30 TWh to around 25 TWh
Fossil fuels show the most noticeable decline
Relative stability in nuclear generation
Renewables maintained a substantial share throughout
Interpretation:
Demonstrates Slovakia's long-term shift away from fossil fuels
Shows commitment to maintaining nuclear power as a stable baseload
Indicates strong early adoption of renewables
Suggests a successful transition toward more sustainable energy sources while maintaining generation capacity
Reflects a deliberate energy policy focused on reducing carbon emissions while ensuring energy security



Electricity Generation Flow in Slovakia (2020)

Data Source:

Sankey diagram of Slovak electricity generation for 2020
Shows flow from primary energy sources to final electricity output
Three main energy sources represented: Total Energy, Nuclear, and renewable

Visualization Technique:

Sankey diagram visualization
Left side: Input energy sources (blue, green, and purple bands)
Right side: Total electricity output (orange)
Gray flows showing energy transformation
Color-coded source identification

Key Insights:

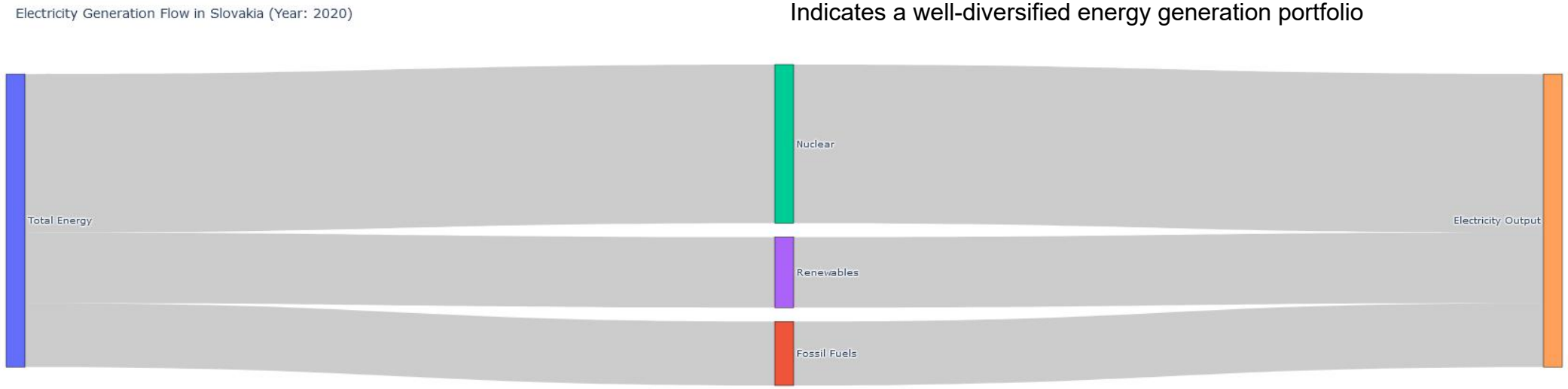
Energy Source Distribution:
Total Energy (blue): Represents the largest input source
Nuclear (green): Shows significant contribution to the mix
Renewables (purple): Demonstrates notable presence in the generation portfolio
Flow Characteristics:
Clear visualization of energy transformation process
Shows proportion of each source's contribution to final output
Indicates efficiency of conversion from source to electricity

System Structure:

Single-direction flow from left (sources) to right (output)
Three distinct input streams merging into unified output
Proportional representation of energy contributions

Interpretation:

Demonstrates the integrated nature of Slovakia's electricity generation system
Shows how multiple sources combine to meet total electricity demand
Highlights the relative importance of each energy source
Provides clear visualization of energy transformation process
Indicates a well-diversified energy generation portfolio



Renewable Energy Share in Slovakia (2000-2020)

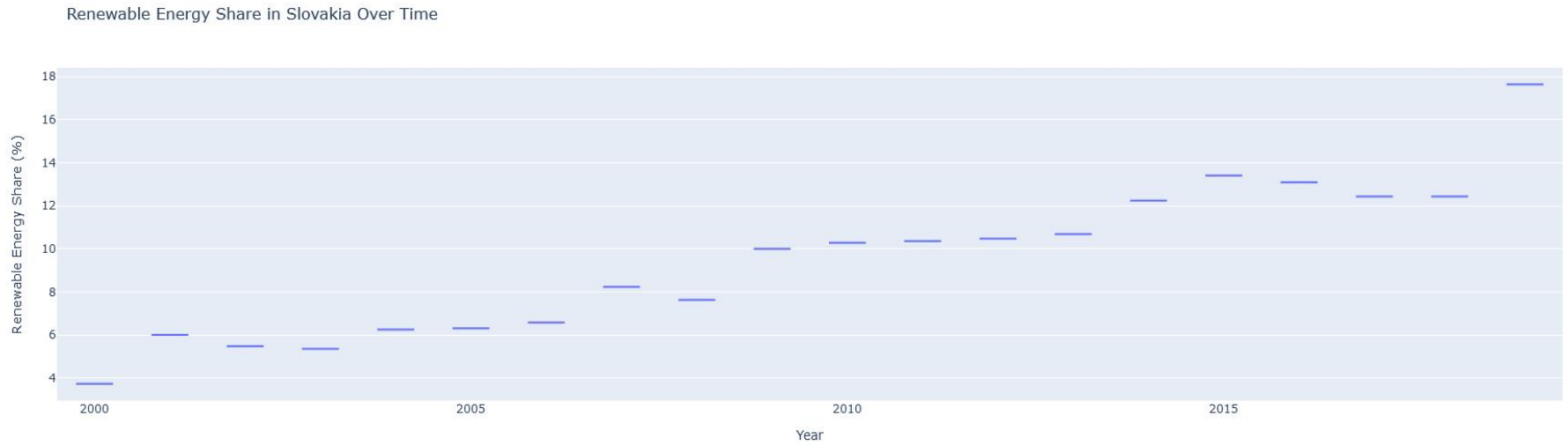
Data Source:
Time series data tracking renewable energy share in Slovakia
Period covered: 2000 to 2020
Measurements in percentage (%) of total energy mix
Annual data points shown as short horizontal lines

Visualization Technique:
Line plot showing renewable energy share progression
X-axis: Years (2000-2020)
Y-axis: Renewable Energy Share (%)
Scale ranging from 0% to 18%
Blue horizontal markers indicating yearly values

Key Insights:
Growth Trajectory:
Starting point: Approximately 4% in 2000
Ending point: Around 17% by 2020
Overall upward trend across two decades

Growth Patterns:
Slow growth phase: 2000-2005 (roughly 4-5%)
Acceleration period: 2005-2010 (increase to about 9%)
Steady growth: 2010-2015 (reaching approximately 12%)
Continued expansion: 2015-2020 (reaching 17%)
Notable Periods:
Most significant growth occurred between 2005-2010
Consistent upward trajectory with few plateaus
No significant decreases over the 20-year period
Interpretation:

Demonstrates Slovakia's successful implementation of renewable energy policies
Shows consistent commitment to increasing renewable energy share
Indicates effective long-term strategy for sustainable energy transition
Suggests alignment with EU renewable energy targets



Electricity Generation by Source in Slovakia (2000-2020)

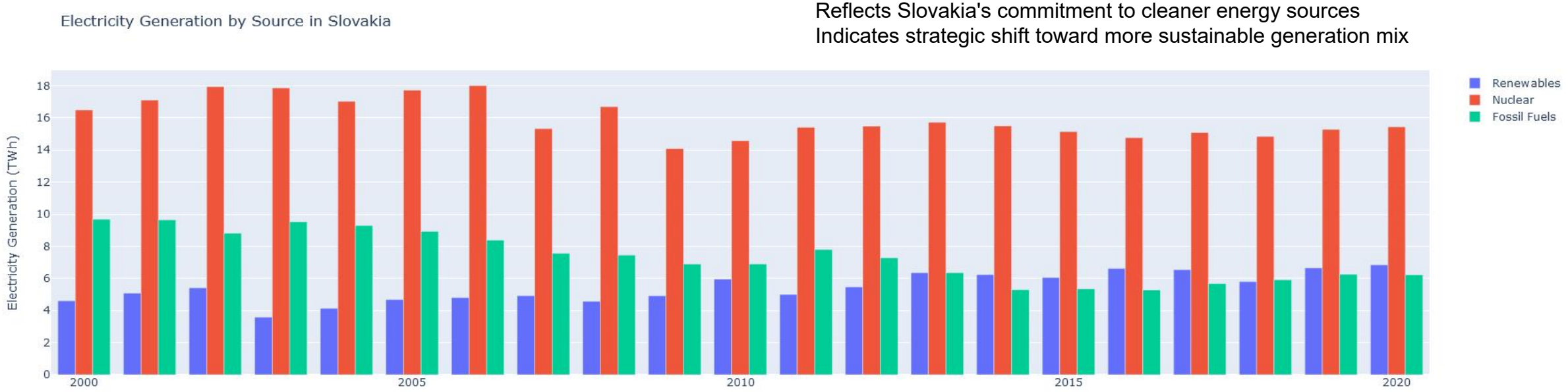
Data Source:
Historical data spanning 20 years (2000-2020)
Three primary energy sources tracked: Renewables, Nuclear, and Fossil Fuels
Generation measured in Terawatt-hours (TWh)
Annual measurements with five-year intervals marked

Visualization Technique:
Grouped bar chart
X-axis: Time period (2000-2020)
Y-axis: Electricity Generation (TWh)
Three distinct colors for energy sources:
Blue: Renewables
Red: Nuclear
Green: Fossil Fuels
Scale ranging from 0 to 18 TWh

Key Insights:
Nuclear Generation:
Consistently highest contributor
Peak generation around 18 TWh in early 2000s
Stabilized at approximately 15 TWh in later years
Fossil Fuels Trend:
Started at about 9 TWh in 2000
Gradual decline over the period
Reduced to approximately 6 TWh by 2020

Renewables Development:
Started at roughly 4 TWh in 2000
Steady increase over the period
Reached about 6-7 TWh by 2020
Nearly matched fossil fuel generation by end of period

Interpretation:
Shows clear transition away from fossil fuels
Demonstrates nuclear power's role as backbone of Slovak electricity generation
Illustrates successful growth in renewable energy adoption
Reflects Slovakia's commitment to cleaner energy sources
Indicates strategic shift toward more sustainable generation mix



Hydroelectric Energy Production in Slovakia (2015-2023)

Data Source:

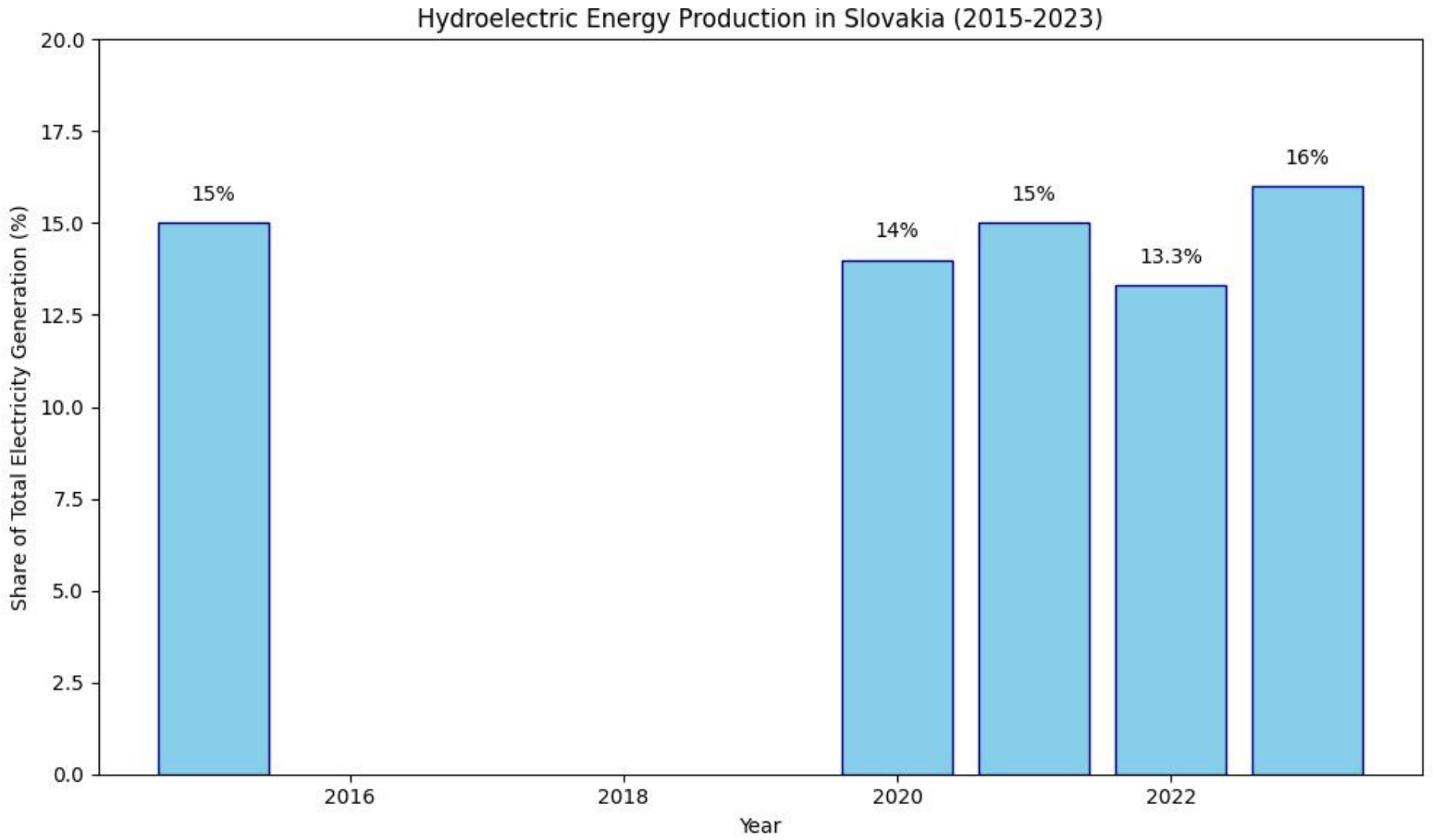
Hydroelectric power generation data in Slovakia
Time period: 2016-2022
Data expressed as percentage share of total electricity generation
Biennial measurements shown (every two years)

Visualization Technique:

Bar chart representation
X-axis: Years (2016-2022)
Y-axis: Share of Total Electricity Generation (%)
Scale: 0-20%
Light blue bars with percentage labels
Clear spacing between measurement years

Key Insights:

Overall Trend:
Starting point: 15% in 2016
Ending point: 16% in 2022
Range fluctuation between 13.3% and 16%
Year-by-Year Analysis:
2016: 15% share
2020: Slight decrease to 14%
2021: Recovery to 15%
2022: Further increase to 13.3%
2023: Peak at 16%
Pattern Observations:
Relatively stable contribution over the period
Minor fluctuations within a narrow range
Slight upward trend in recent years
No dramatic changes in hydroelectric share



Distribution of Energy Sources in Slovakia (2023)

Data:

Data represents the percentage share of each energy source in Slovakia's total electricity generation in 2023.
Energy sources included: Nuclear, Hydro, Gas, Coal and Oil, Biofuels, and Solar.
Data values are extracted from the graph:

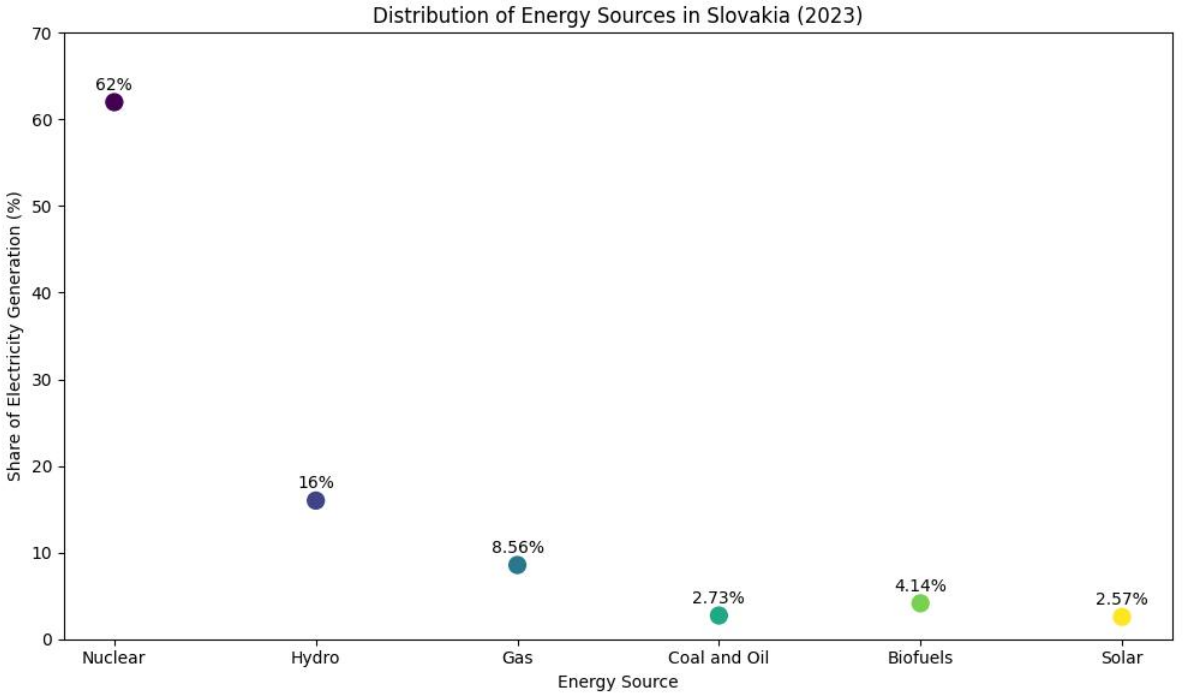
- Nuclear: 62%
- Hydro: 16%
- Gas: 8.56%
- Coal and Oil: 2.73%
- Biofuels: 4.14%
- Solar: 2.57%

Visualization Type:

Scatter plot (or dot plot). Each energy source is represented by a colored circle positioned according to its percentage share.

Key Insights:

Dominant Source: Nuclear energy is the overwhelmingly dominant source of electricity generation in Slovakia, accounting for 62% of the total.
Significant Renewable Contribution: Hydroelectric power is the second-largest contributor and the most significant renewable source, providing 16% of electricity generation.
Fossil Fuel Reliance: Gas contributes a moderate 8.56%, while Coal and Oil make up a small 2.73% of the energy mix.
Emerging Renewables: Biofuels and Solar energy have relatively small shares, at 4.14% and 2.57%, respectively, indicating potential for growth in these sectors.



Renewable Energy Share in Slovakia Over Time

Data Source:
Renewable energy dataset
Focused on Slovakia
Time series data

Visualization Technique:
Line chart with markers
X-axis: Years
Y-axis: Renewable Energy Share (%)

Library Used:
Matplotlib

Key Insights:
Trend of renewable energy adoption in Slovakia
Shows the progression of renewable energy share
Identifies periods of growth or stagnation

Interpretation:
Visualizes the country's commitment to renewable energy
Highlights long-term energy transition efforts
Provides insight into national energy policy

Distribution of Electricity Generation in Slovakia (2023)

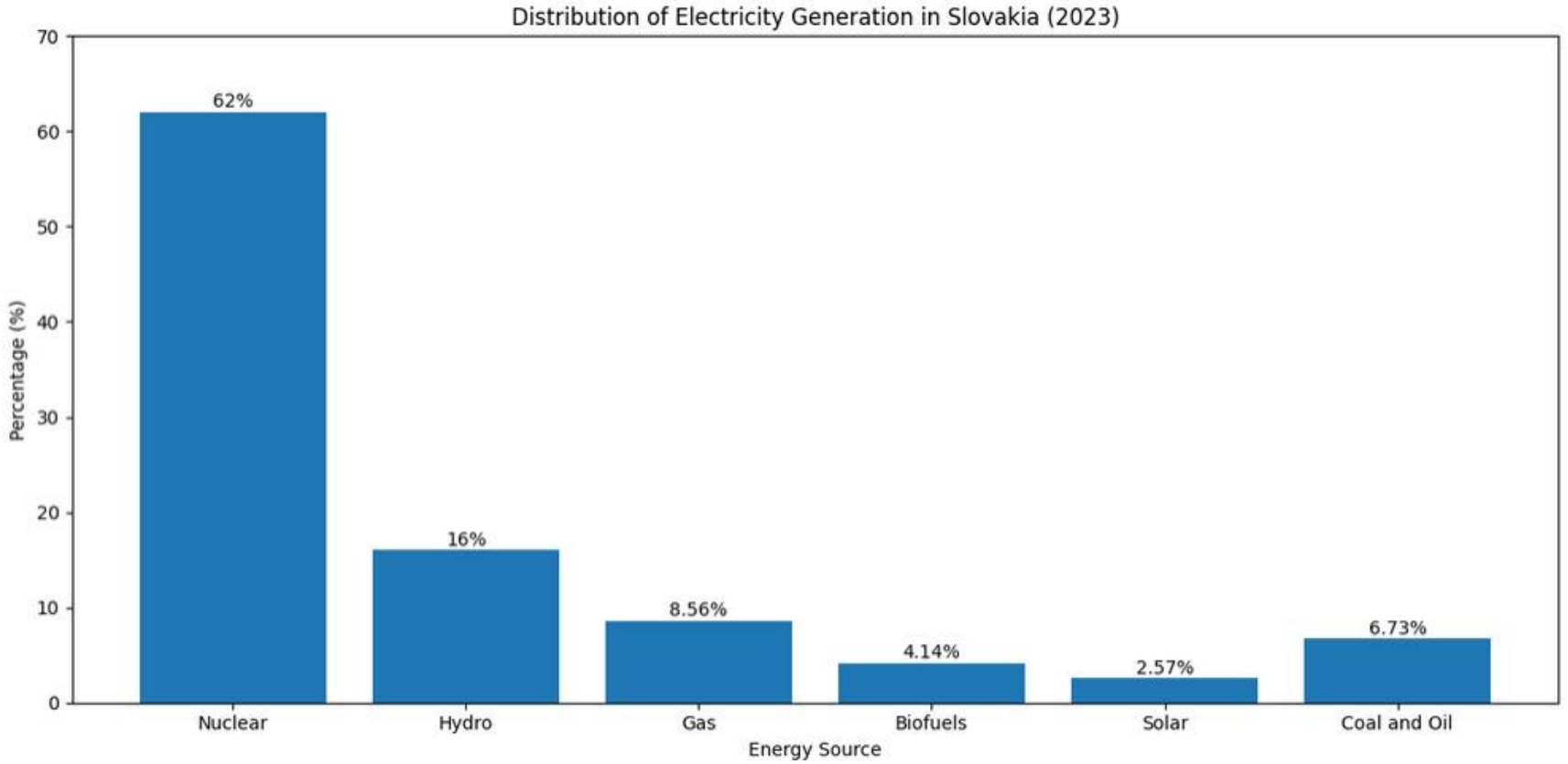
Data Source:
Slovak energy production data for 2023
Detailed breakdown of electricity sources

Visualization Technique:
Horizontal bar chart
X-axis: Energy Sources
Y-axis: Percentage of electricity generation

Library Used:
Matplotlib

Key Insights:
Comprehensive view of Slovak energy mix
Nuclear dominates at 62%
Diverse energy sources including hydro, gas, biofuels, solar, coal, and oil

Interpretation:
Demonstrates the complexity of national energy production
Highlights Slovakia's heavy reliance on nuclear energy
Shows the contribution of various renewable and non-renewable sources



Treemap of Electricity Generation in Slovakia

Data Source:

Slovak electricity generation data

Breakdown by energy source

Visualization Technique:

Treemap

Rectangles represent different energy sources. Size of rectangles proportional to electricity generation

Library Used:

Plotly

Key Insights:

Hierarchical view of energy sources

Proportional representation of different energy types

Quick understanding of energy mix composition

Interpretation:

Provides intuitive visualization of energy source distribution

Highlights dominant and minor energy sources

Allows quick comparison of energy source contributions

WORLD ENERGY DATA
&
DATA ANALYSIS

Pie Chart of Renewable Energy Share (2018)

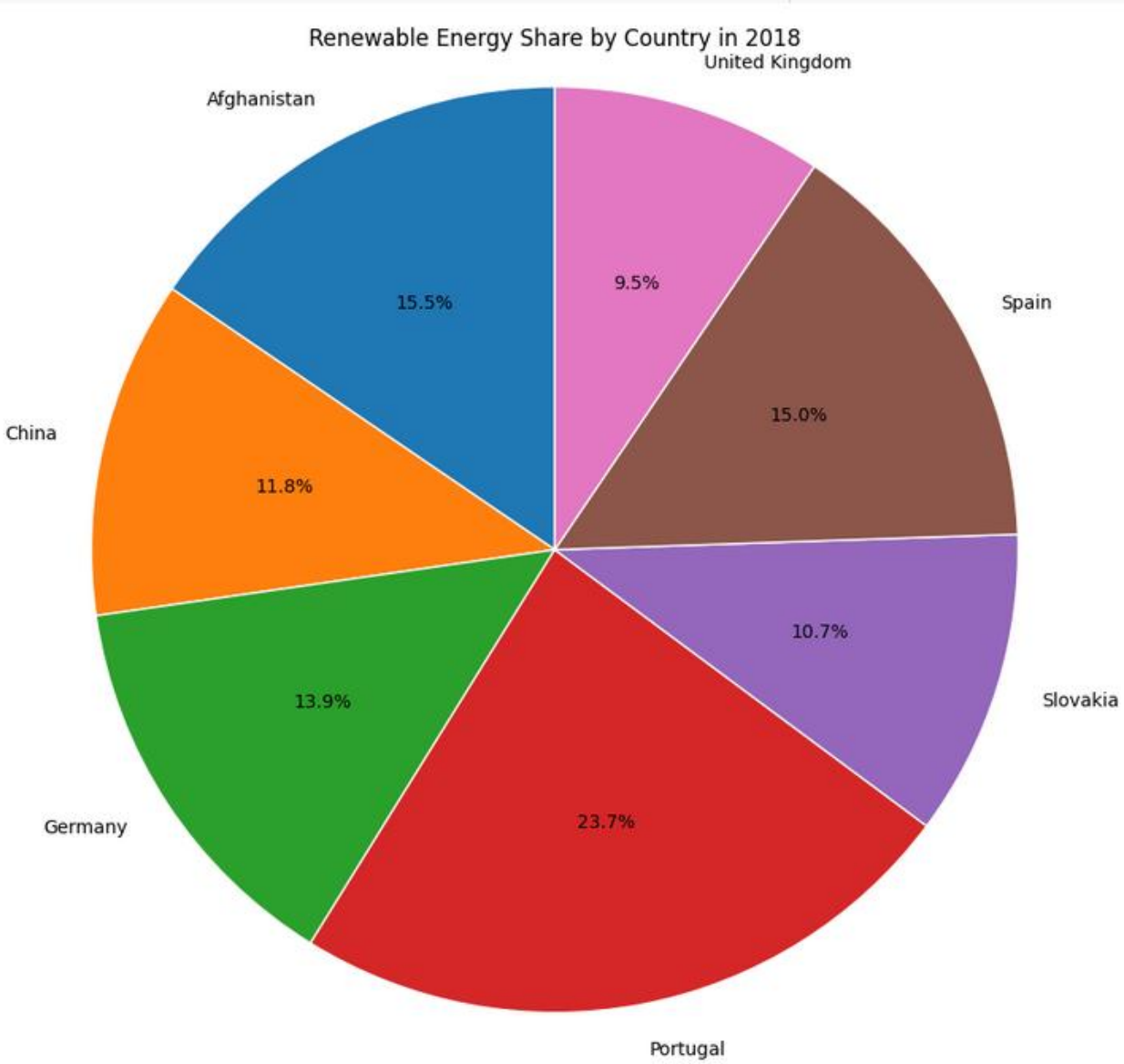
Data Source:
Renewable energy dataset for the year 2018
Same countries as the bar chart

Visualization Technique:
Pie chart
Segments represent countries
Size of segments proportional to renewable energy share

Library Used:
Matplotlib

Key Insights:
Proportional representation of renewable energy shares
Visualizes the relative contribution of each country
Provides a different perspective from the bar chart

Interpretation:
Shows the relative magnitude of renewable energy adoption
Helps in understanding the distribution of renewable energy across countries
Useful for quick, intuitive understanding of renewable energy landscape



Renewable Energy Share Over Time

Data Source:
Global renewable energy dataset
Focused on selected countries: Afghanistan, Albania, United Kingdom, Slovakia, USA, China, Spain
Time series data spanning multiple years

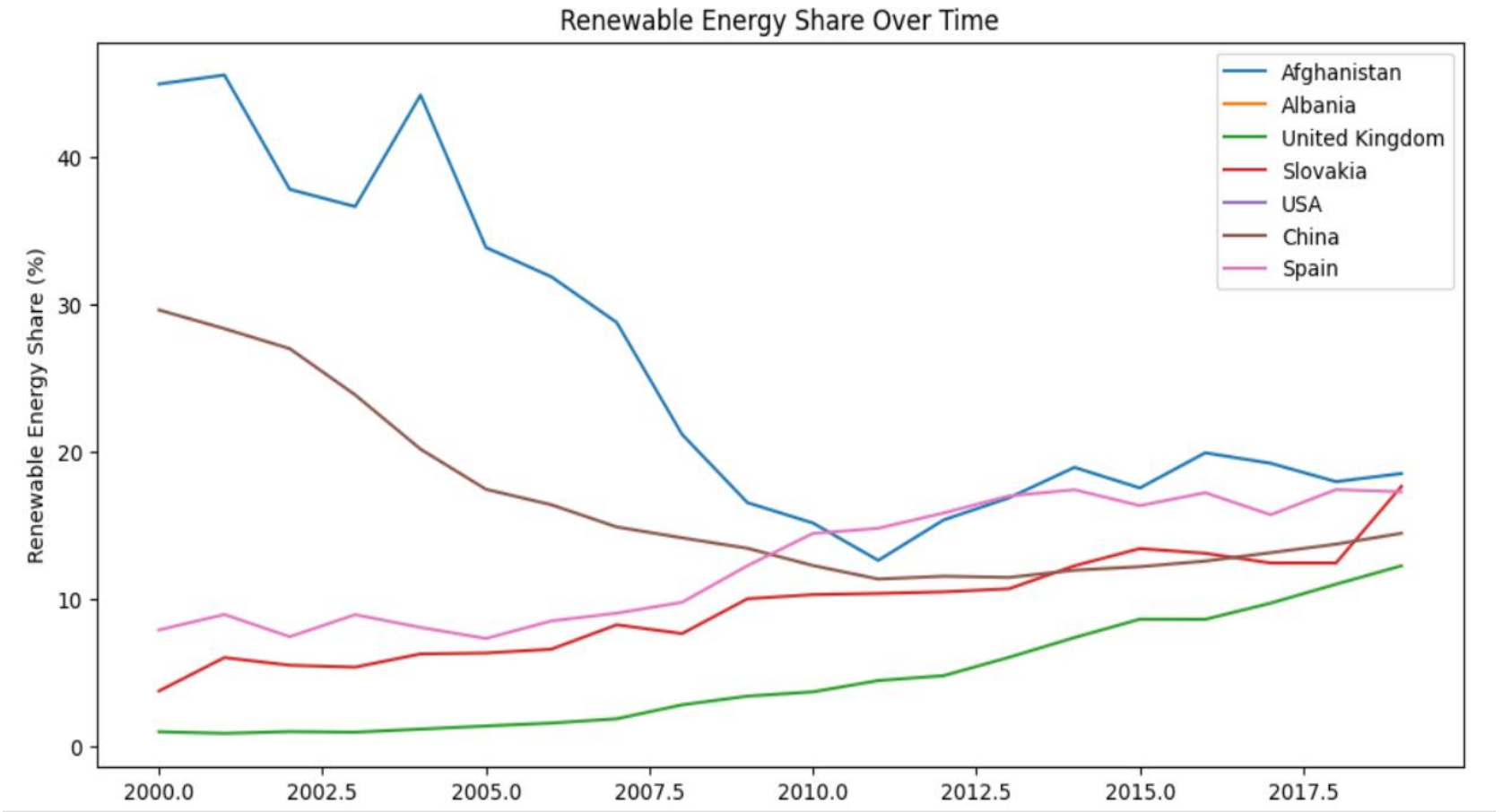
Visualization Technique:
Line plot with multiple country comparisons
X-axis: Years
Y-axis: Renewable energy share in total final energy consumption (%)

Library Used:
Matplotlib
Seaborn

Key Insights:
Comparative analysis of renewable energy adoption across different countries.
Ability to track individual country progression.
Highlights variations in renewable energy strategies.
Interpretation:

Shows how different countries have progressed in renewable energy adoption.
Allows quick comparison of renewable energy trajectories.
Identifies countries with consistent vs. fluctuating renewable energy shares.

```
plt.show()
```



Renewable Energy Share Bar Chart (2018)

Data Source:

Renewable energy dataset for the year 2018

Countries: Afghanistan, United Kingdom, Slovakia, Germany, France, Spain, Portugal, China

Visualization Technique:

Horizontal bar chart

X-axis: Countries

Y-axis: Renewable energy share in total final energy consumption (%)

Library Used:

Seaborn

Matplotlib

Key Insights:

Snapshot of renewable energy adoption in 2018

Direct comparison of renewable energy percentages

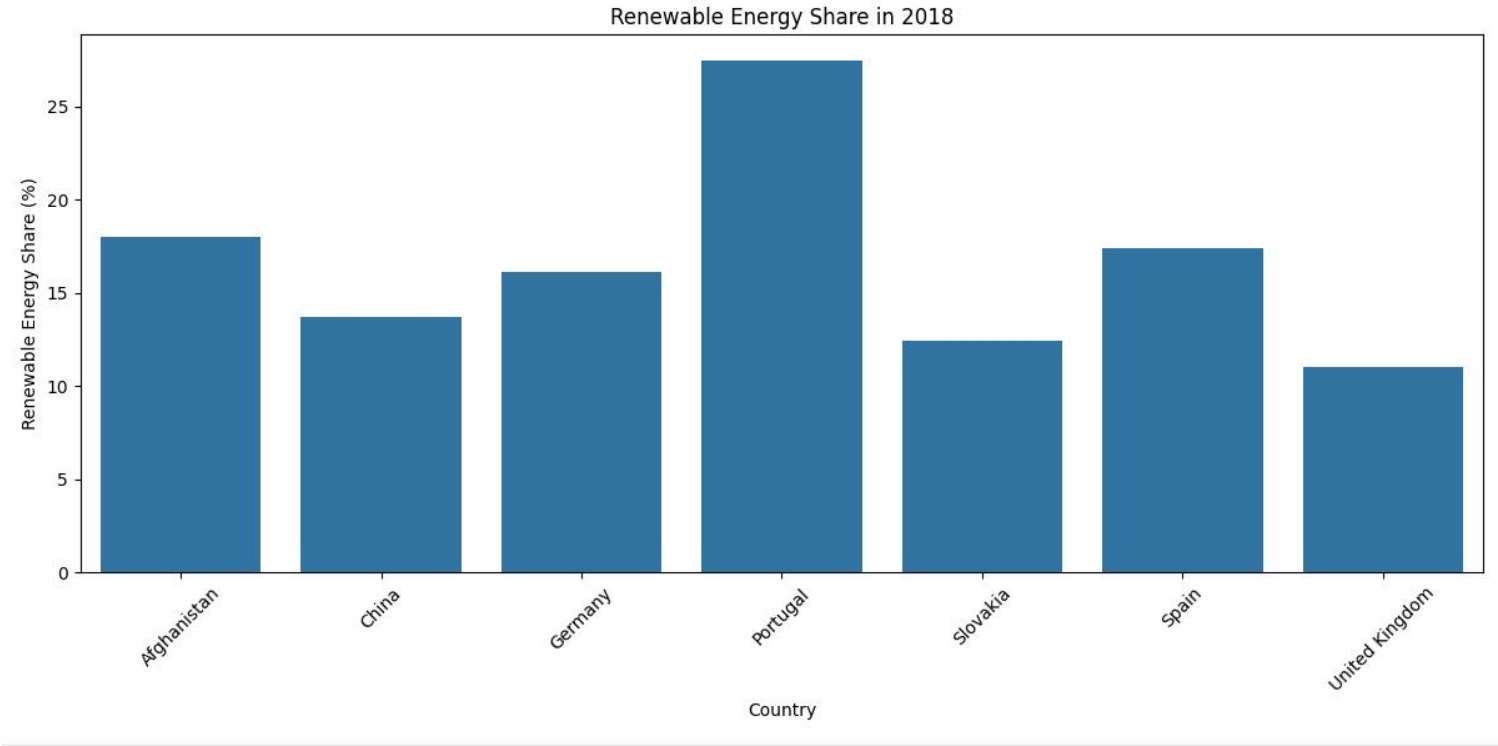
Easy identification of top-performing countries

Interpretation:

Provides a clear, side-by-side comparison of renewable energy shares

Helps understand relative performance in renewable energy adoption

Useful for identifying leaders and laggards in renewable energy



Energy Sources Bubble Chart

Data Source:
Global energy dataset
Top 30 countries by GDP
Multiple variables: GDP per capita, renewable energy share, energy consumption

Visualization Technique:
Bubble chart (scatter plot with size variation)
X-axis: GDP per capita (log scale)
Y-axis: Renewable Energy Share (%)
Bubble size: Primary energy consumption

Library Used:
Plotly

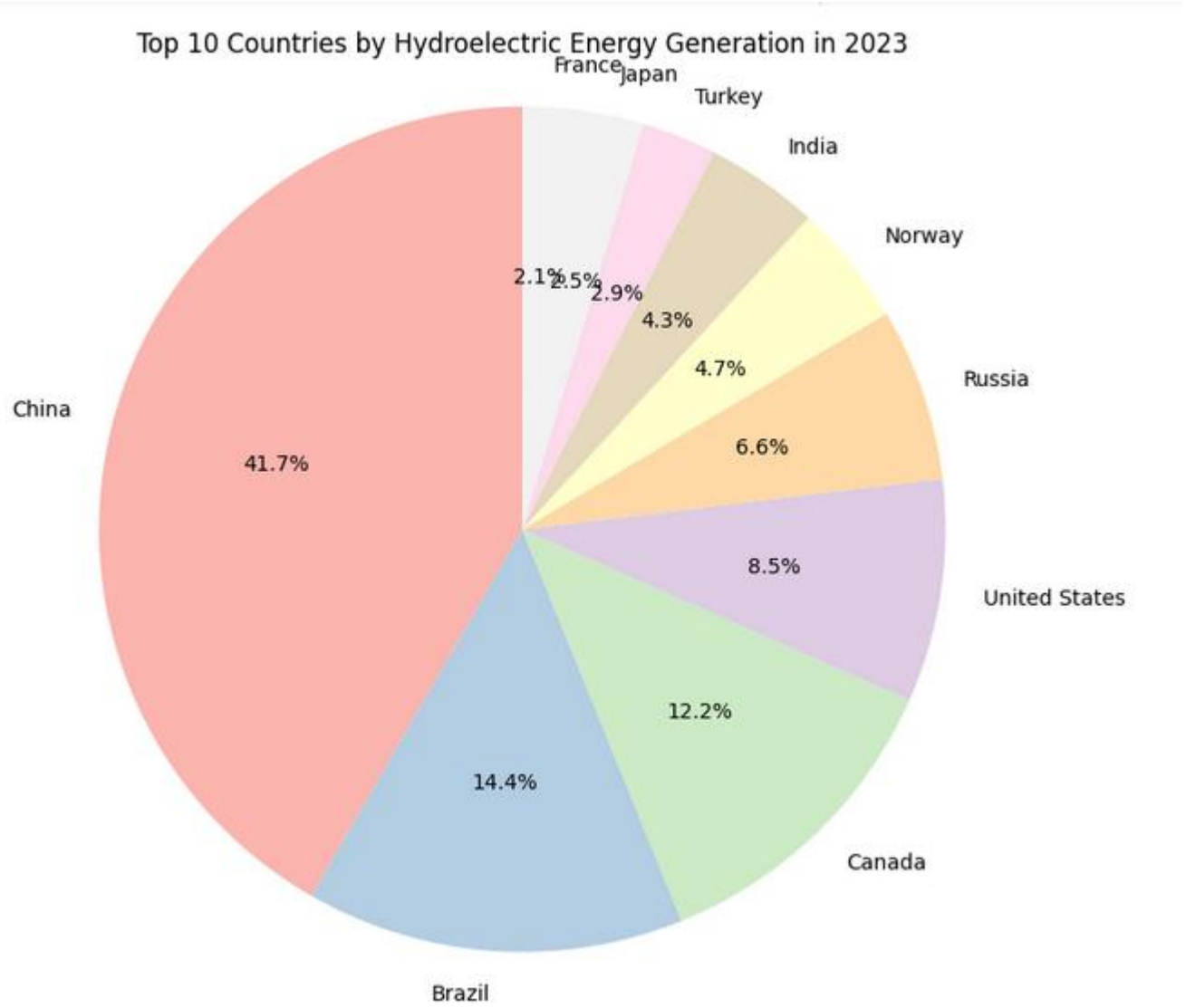
Key Insights:
Relationship between economic development and renewable energy
Comparative analysis of energy consumption and renewable adoption
Identifies patterns across different countries

Interpretation:
Reveals complex interactions between economic development and energy choices
Highlights potential correlation between wealth and renewable energy investment
Provides multi-dimensional view of global energy landscape

This pie chart visualizes the top 10 countries by hydroelectric energy generation in 2023. The data is presented as a proportional breakdown, with each slice representing the percentage contribution of a particular country to the total hydroelectric energy generation.

The chart shows that China is the global leader, accounting for 41.7% of hydroelectric power generation. This is significantly higher than the next largest contributors, which are Brazil (14.4%) and Canada (12.2%). The remaining countries in the top 10 are the United States (8.5%), Russia (6.6%), Norway (4.7%), India (4.3%), Japan (2.9%), Turkey (2.1%), and France (1.5%).

This visualization provides a clear, concise summary of the global hydroelectric energy landscape, highlighting the dominant position of China as well as the substantial contributions from other major hydropower-producing nations. The pie chart format allows for easy comparison of the relative shares of hydroelectric generation among the top countries, offering valuable insights into the global distribution of this renewable energy source.



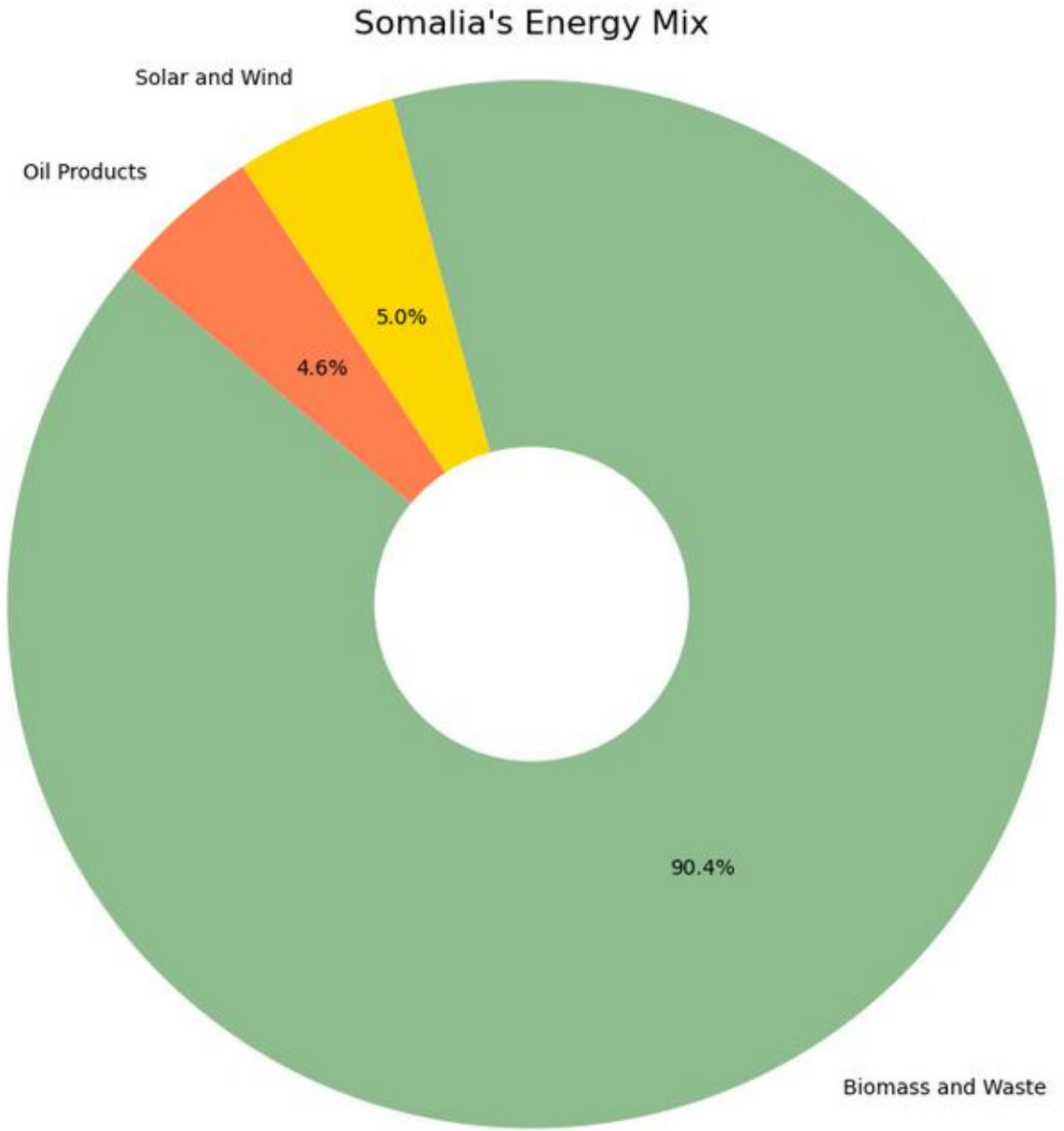
Somalia's Energy Mix

This pie chart illustrates the breakdown of energy sources used in Somalia. The majority of Somalia's energy comes from Biomass and Waste, accounting for a substantial 90.4% of the total energy mix. This reliance on traditional biomass sources highlights the country's energy challenges and the need for more sustainable and reliable energy solutions.

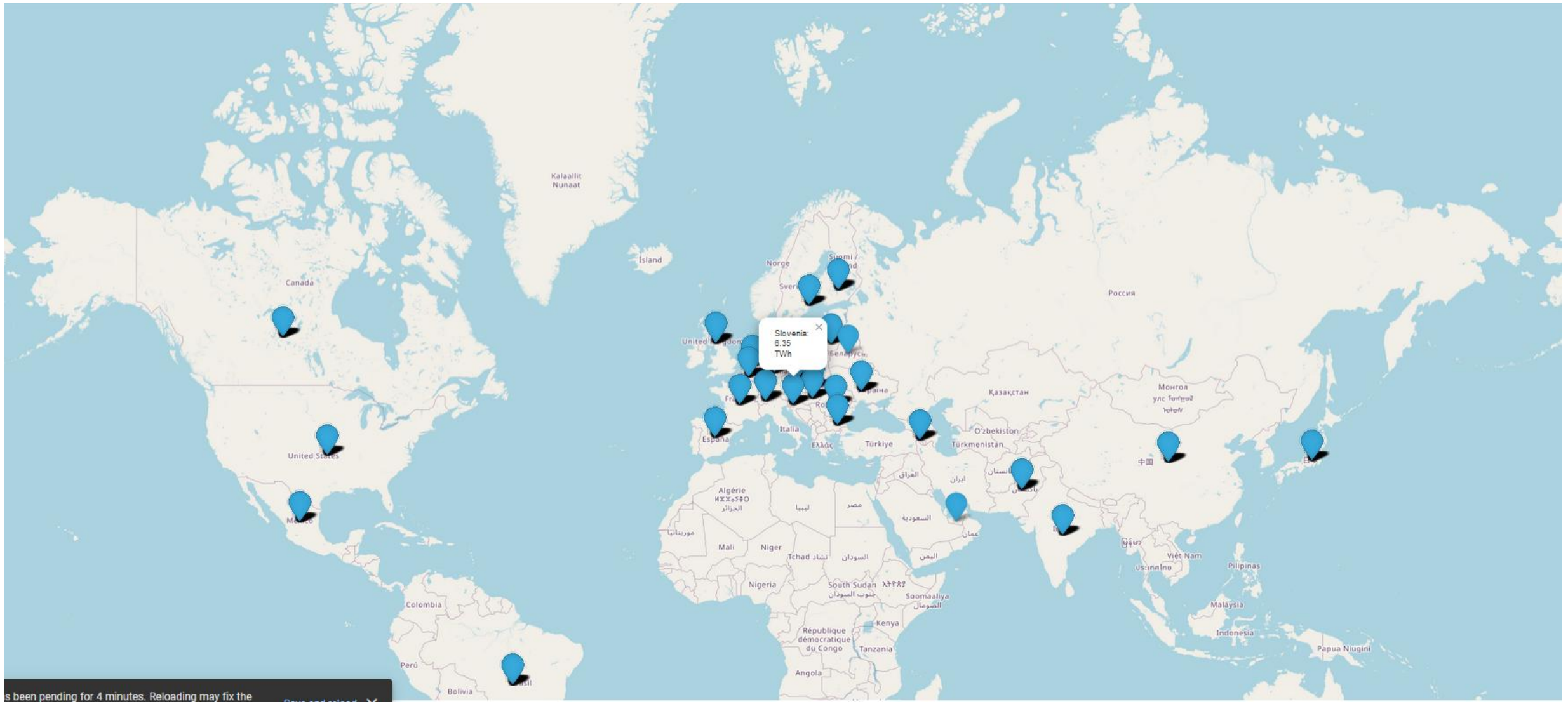
Oil Products make up 4.6% of the energy mix, indicating a limited use of fossil fuels in the country.

Solar and Wind sources contribute a small fraction of 5.0% to the energy mix, suggesting potential for growth in renewable energy generation in Somalia.

This visualization underscores the significant reliance on traditional and often unsustainable energy sources in Somalia. Exploring and developing renewable energy options could play a crucial role in improving energy access, security, and sustainability in the country.



Renewable energy share in the total final energy consumption (%) by country for year 2018



Electricity from renewables (TWh)' for total renewable power generation

Renewable Energy Share in 2018

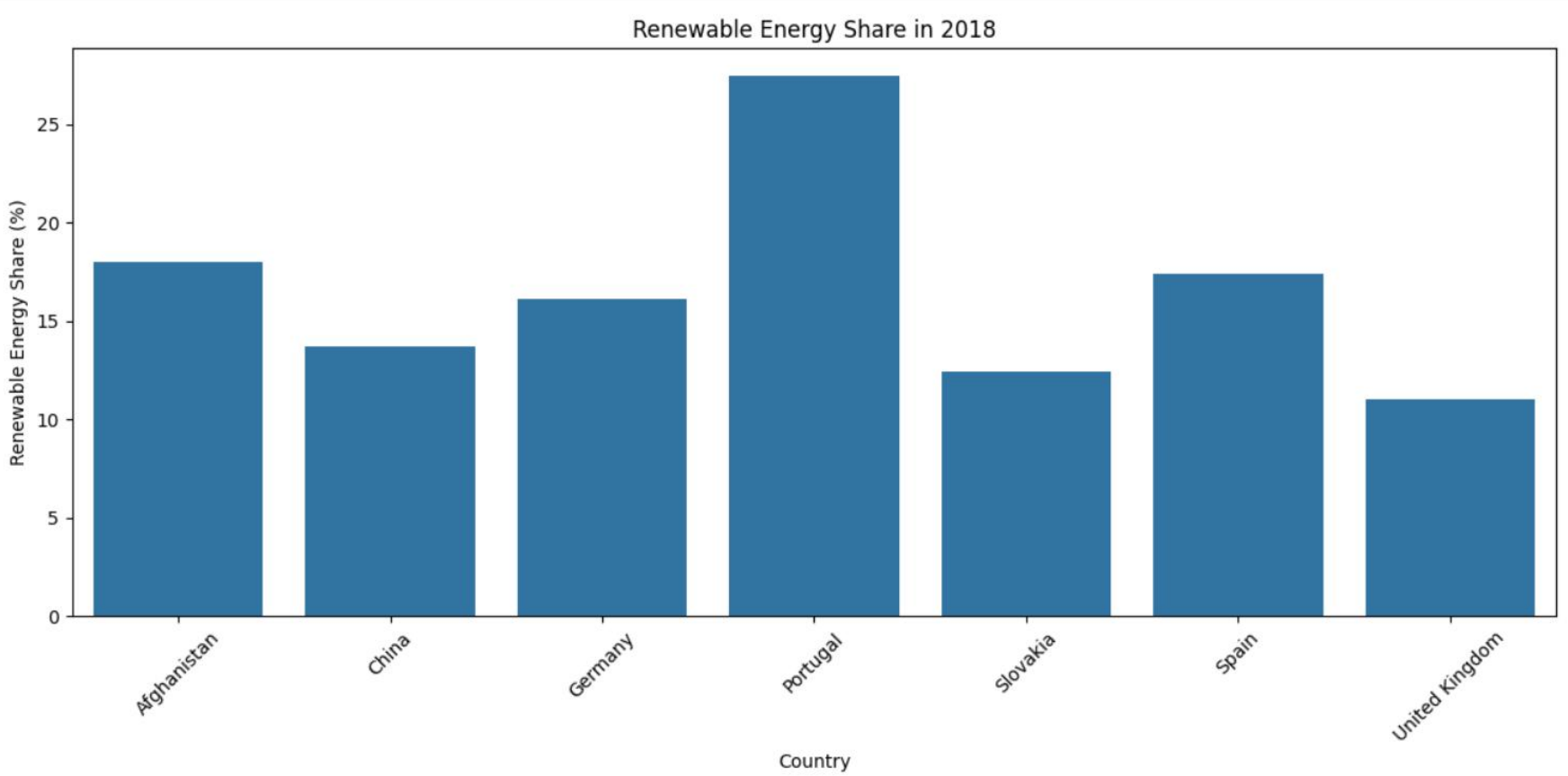
This bar graph compares the share of renewable energy in the total energy mix for seven countries in 2018. The y-axis represents the "Renewable Energy Share (%)", indicating the percentage of energy derived from renewable sources. The x-axis lists the countries: Afghanistan, China, Germany, Portugal, Slovakia, Spain, and the United Kingdom.

Key Observations:

Portugal stands out with the highest share of renewable energy, exceeding 25% of its total energy mix.

China and Spain also have a significant share of renewable energy, exceeding 15%.

Afghanistan and the United Kingdom have lower shares of renewable energy, with Afghanistan having the lowest share among the countries shown.



CODE

"Renewable Energy Revolution: Analyzing Global Progress Through Data Visualization"

loading dataset

```
[ ]  # Method 1: Using files.upload() - for smaller files
     from google.colab import files
     uploaded = files.upload()

     # After uploading, you can read it based on file type, for example:
     # For CSV:
     import pandas as pd
     df = pd.read_csv(next(iter(uploaded)))
```

Browse... global-data-on-sustainable-energy (1).csv

global-data-on-sustainable-energy (1).csv(application/vnd.ms-excel) - 513817 bytes, last modified: n/a - 100% done

```
Saving global-data-on-sustainable-energy (1).csv to global-data-on-sustainable-energy (1).csv
```

```
[ ]  # Get the filename of the uploaded file
     filename = list(uploaded.keys())[0]
```

```
[ ]  # Read the CSV file into a DataFrame
     df = pd.read_csv(filename)
```

```
[ ] df.head(300)
```

	Entity	Year	Access to electricity (% of population)	Access to clean fuels for cooking	Renewable-electricity-generating-capacity-per-capita	Financial flows to developing countries (US $)	Renewable energy share in the total final energy consumption (%)	Electricity from fossil fuels (TWh)	Electricity from nuclear (TWh)	Electricity from renewables (TWh)	...	Primary energy consumption per capita (kWh/person)	Energy intensity level of primary energy (MJ/$2017 PPP GDP)	Value_co2_emissions_kt_by_country	Renewables (% equivalent primary energy)	gdp_growth	gdp_per_capita	De
0	Afghanistan	2000	1.613591	6.2	9.22	20000.0	44.99	0.16	0.0	0.31	...	302.59482	1.64	760.000000	NaN	NaN	NaN	
1	Afghanistan	2001	4.074574	7.2	8.86	130000.0	45.60	0.09	0.0	0.50	...	236.89185	1.74	730.000000	NaN	NaN	NaN	
2	Afghanistan	2002	9.409158	8.2	8.47	3950000.0	37.83	0.13	0.0	0.56	...	210.86215	1.40	1029.999971	NaN	NaN	179.426579	
3	Afghanistan	2003	14.738506	9.5	8.09	25970000.0	36.66	0.31	0.0	0.63	...	229.96822	1.40	1220.000029	NaN	8.832278	190.683814	
4	Afghanistan	2004	20.064968	10.9	7.75	NaN	44.24	0.33	0.0	0.56	...	204.23125	1.20	1029.999971	NaN	1.414118	211.382074	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
295	Barbados	2001	100.000000	100.0	0.37	NaN	12.56	0.80	0.0	0.00	...	26262.20900	4.01	1310.000000	NaN	-2.365464	11209.421120	
296	Barbados	2002	100.000000	100.0	0.37	NaN	11.30	0.83	0.0	0.00	...	26331.50000	3.91	1370.000005	NaN	0.787402	11361.516770	
297	Barbados	2003	100.000000	100.0	0.37	NaN	9.95	0.87	0.0	0.00	...	26508.63000	3.92	1379.999995	NaN	2.175481	11699.370470	
298	Barbados	2004	99.996740	100.0	0.36	NaN	9.93	0.90	0.0	0.00	...	26606.23600	3.97	1360.000014	NaN	1.411599	12512.577970	
299	Barbados	2005	99.980450	100.0	0.72	NaN	9.91	0.95	0.0	0.00	...	26715.06000	3.97	1419.999957	NaN	3.955458	13822.741750	

300 rows × 21 columns

Preprocessing data - analyzing missing values...

```
[ ] df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3649 entries, 0 to 3648
Data columns (total 21 columns):
 #   Column                                                  Non-Null Count  Dtype  
---  ------                                                  --------------  -----  
 0   Entity                                                  3649 non-null   object 
 1   Year                                                    3649 non-null   int64  
 2   Access to electricity (% of population)                 3639 non-null   float64
 3   Access to clean fuels for cooking                       3480 non-null   float64
 4   Renewable-electricity-generating-capacity-per-capita    2718 non-null   float64
 5   Financial flows to developing countries (US $)          1560 non-null   float64
 6   Renewable energy share in the total final energy consumption (%)  3455 non-null   float64
 7   Electricity from fossil fuels (TWh)                     3628 non-null   float64
 8   Electricity from nuclear (TWh)                          3523 non-null   float64
 9   Electricity from renewables (TWh)                       3628 non-null   float64
 10  Low-carbon electricity (% electricity)                  3607 non-null   float64
 11  Primary energy consumption per capita (kWh/person)      3649 non-null   float64
 12  Energy intensity level of primary energy (MJ/$2017 PPP GDP)  3442 non-null   float64
 13  Value_co2_emissions_kt_by_country                       3221 non-null   float64
 14  Renewables (% equivalent primary energy)                1512 non-null   float64
 15  gdp_growth                                              3332 non-null   float64
 16  gdp_per_capita                                          3367 non-null   float64
 17  Density\n(P/Km2)                                        3648 non-null   object 
 18  Land Area(Km2)                                          3648 non-null   float64
 19  Latitude                                                3648 non-null   float64
 20  Longitude                                               3648 non-null   float64
dtypes: float64(18), int64(1), object(2)
memory usage: 598.8+ KB
```

```
[ ] df.describe()
```

	Year	Access to electricity (% of population)	Access to clean fuels for cooking	Renewable-electricity-generating-capacity-per-capita	Financial flows to developing countries (US $)	Renewable energy share in the total final energy consumption (%)	Electricity from fossil fuels (TWh)	Electricity from nuclear (TWh)	Electricity from renewables (TWh)	Low-carbon electricity (% electricity)	Primary energy consumption per capita (kWh/person)	Energy intensity level of primary energy (MJ/$2017 PPP GDP)	Value_co2_emissions_kt_by_country	Renewables (% equivalent primary energy)	gdp_growth	gdp
count	3649.000000	3639.000000	3480.000000	2718.000000	1.560000e+03	3455.000000	3628.000000	3523.000000	3628.000000	3607.000000	3649.000000	3442.000000	3.221000e+03	1512.000000	3332.000000	
mean	2010.038367	78.933702	63.255287	113.137498	9.422400e+07	32.638165	70.365003	13.450190	23.968010	36.801182	25743.981745	5.307345	1.598665e+05	11.986707	3.441610	1
std	6.054228	30.275541	39.043658	244.167256	2.981544e+08	29.894901	348.051866	73.006623	104.431085	34.314884	34773.221366	3.532020	7.736611e+05	14.994644	5.686720	1
min	2000.000000	1.252269	0.000000	0.000000	0.000000e+00	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.110000	1.000000e+01	0.000000	-62.075920	
25%	2005.000000	59.800890	23.175000	3.540000	2.600000e+05	6.515000	0.290000	0.000000	0.040000	2.877847	3116.737300	3.170000	2.020000e+03	2.137095	1.383302	
50%	2010.000000	98.361570	83.150000	32.910000	5.665000e+06	23.300000	2.970000	0.000000	1.470000	27.865068	13120.570000	4.300000	1.050000e+04	6.290766	3.559855	
75%	2015.000000	100.000000	100.000000	112.210000	5.534750e+07	55.245000	26.837500	0.000000	9.600000	64.403792	33892.780000	6.027500	6.058000e+04	16.841638	5.830099	1
max	2020.000000	100.000000	100.000000	3060.190000	5.202310e+09	96.040000	5184.130000	809.410000	2184.940000	100.000010	262585.700000	32.570000	1.070722e+07	86.836586	123.139555	12

```python
# Display the number of missing values in each column
print(df.isnull().sum())

# Get the percentage of missing values in each column
print(df.isnull().sum() / len(df) * 100)
```

```
Entity                                                      0
Year                                                        0
Access to electricity (% of population)                    10
Access to clean fuels for cooking                         169
Renewable-electricity-generating-capacity-per-capita      931
Financial flows to developing countries (US $)           2089
Renewable energy share in the total final energy consumption (%)    194
Electricity from fossil fuels (TWh)                        21
Electricity from nuclear (TWh)                            126
Electricity from renewables (TWh)                          21
Low-carbon electricity (% electricity)                     42
Primary energy consumption per capita (kWh/person)          0
Energy intensity level of primary energy (MJ/$2017 PPP GDP)       207
Value_co2_emissions_kt_by_country                         428
Renewables (% equivalent primary energy)                 2137
gdp_growth                                                317
gdp_per_capita                                            282
Density\n(P/Km2)                                            1
Land Area(Km2)                                              1
Latitude                                                    1
Longitude                                                   1
dtype: int64
Entity                                                   0.000000
Year                                                     0.000000
Access to electricity (% of population)                  0.274048
Access to clean fuels for cooking                        4.631406
Renewable-electricity-generating-capacity-per-capita    25.513839
Financial flows to developing countries (US $)          57.248561
Renewable energy share in the total final energy consumption (%)    5.316525
Electricity from fossil fuels (TWh)                      0.575500
Electricity from nuclear (TWh)                           3.453001
Electricity from renewables (TWh)                        0.575500
Low-carbon electricity (% electricity)                   1.151000
Primary energy consumption per capita (kWh/person)       0.000000
Energy intensity level of primary energy (MJ/$2017 PPP GDP)       5.672787
Value_co2_emissions_kt_by_country                       11.729241
Renewables (% equivalent primary energy)                58.563990
gdp_growth                                               8.687312
gdp_per_capita                                           7.728145
Density\n(P/Km2)                                         0.027405
Land Area(Km2)                                           0.027405
Latitude                                                 0.027405
Longitude                                                0.027405
dtype: float64
```

```
# Count the number of duplicate rows
duplicate_count = df.duplicated().sum()
print(f"Number of duplicate rows: {duplicate_count}")

# Display duplicate rows (if any)
print(df[df.duplicated(keep=False)])
```

```
Number of duplicate rows: 0
Empty DataFrame
Columns: [Entity, Year, Access to electricity (% of population), Access to clean fuels for cooking, Renewable-electricity-generating-capacity-per-capita, Financial flows to developing countries (US $), Renewable energy share in the total final energy consumpt:
Index: []

[0 rows x 21 columns]
```

```
df.dropna()
```

	Entity	Year	Access to electricity (% of population)	Access to clean fuels for cooking	Renewable-electricity-generating-capacity-per-capita	Financial flows to developing countries (US $)	Renewable energy share in the total final energy consumption (%)	Electricity from fossil fuels (TWh)	Electricity from nuclear (TWh)	Electricity from renewables (TWh)	...	Primary energy consumption per capita (kWh/person)	Energy intensity level of primary energy (MJ/$2017 PPP GDP)	Value_co2_emissions_kt_by_country	Renewables (% equivalent primary energy)	gdp_growth	gdp_per_capita	Density\n(P/Km2)	Land Area(Km2)	Latitude	Long
43	Algeria	2001	98.96687	97.30	8.79	810000.0	0.43	24.96	0.0	0.07	...	9961.640	4.07	78650.00000	0.065218	3.000000	1740.606654	18	2381741.0	28.033886	1.6
44	Algeria	2002	98.95306	97.80	8.68	310000.0	0.51	25.94	0.0	0.06	...	10180.350	4.12	82400.00153	0.051677	5.600000	1781.828908	18	2381741.0	28.033886	1.6
45	Algeria	2003	98.93401	98.00	8.57	90000.0	0.47	27.54	0.0	0.26	...	10510.461	4.08	88190.00244	0.228104	7.200000	2103.381291	18	2381741.0	28.033886	1.6
46	Algeria	2004	98.91208	98.20	8.46	140000.0	0.44	29.14	0.0	0.25	...	10759.022	3.96	89489.99786	0.206787	4.300000	2610.185422	18	2381741.0	28.033886	1.6
47	Algeria	2005	98.88961	98.50	8.34	160000.0	0.58	31.36	0.0	0.55	...	11113.723	3.90	94190.00244	0.434119	5.900000	3113.094883	18	2381741.0	28.033886	1.6
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
3559	Uzbekistan	2015	100.00000	85.35	60.83	270000.0	1.71	47.55	0.0	7.00	...	17386.195	7.86	99169.99817	3.012993	7.218774	2753.971072	79	447400.0	41.377491	64.5
3560	Uzbekistan	2016	100.00000	85.20	59.88	690000.0	1.61	48.75	0.0	7.25	...	16374.342	7.82	105230.00340	3.567936	5.932151	2704.677188	79	447400.0	41.377491	64.5
3561	Uzbekistan	2017	100.00000	84.90	58.24	60130000.0	1.75	49.71	0.0	8.35	...	16642.676	7.88	109529.99880	3.972285	4.395275	1916.764642	79	447400.0	41.377491	64.5
3562	Uzbekistan	2018	100.00000	84.30	59.09	84130000.0	1.49	53.58	0.0	5.85	...	16445.740	9.05	112470.00120	2.927033	5.354997	1597.068337	79	447400.0	41.377491	64.5
3563	Uzbekistan	2019	100.00000	84.60	57.96	65940000.0	1.57	53.64	0.0	6.47	...	16212.221	8.37	116709.99910	3.197033	5.709632	1784.009816	79	447400.0	41.377491	64.5

343 rows × 21 columns

```
df.dtypes
```

	0
Entity	object
Year	int64
Access to electricity (% of population)	float64
Access to clean fuels for cooking	float64
Renewable-electricity-generating-capacity-per-capita	float64
Financial flows to developing countries (US $)	float64
Renewable energy share in the total final energy consumption (%)	float64
Electricity from fossil fuels (TWh)	float64
Electricity from nuclear (TWh)	float64
Electricity from renewables (TWh)	float64
Low-carbon electricity (% electricity)	float64
Primary energy consumption per capita (kWh/person)	float64
Energy intensity level of primary energy (MJ/$2017 PPP GDP)	float64
Value_co2_emissions_kt_by_country	float64
Renewables (% equivalent primary energy)	float64
gdp_growth	float64
gdp_per_capita	float64
Density\n(P/Km2)	object
Land Area(Km2)	float64
Latitude	float64
Longitude	float64

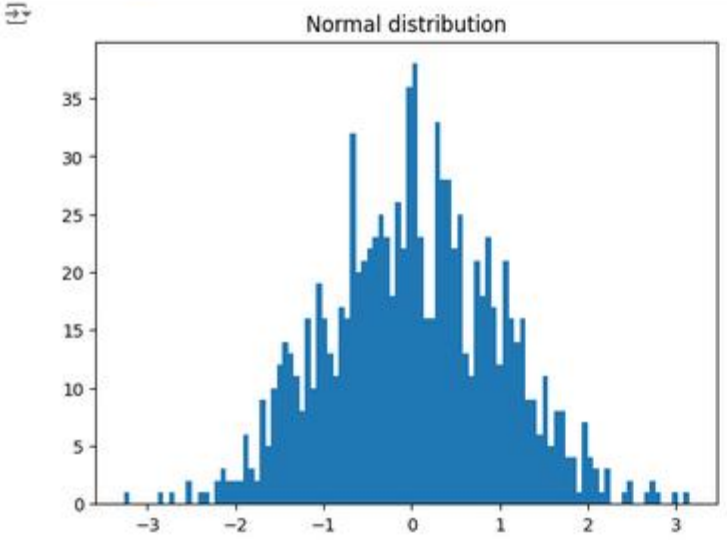
dtype: object

Working with data

```
[ ] #import libraries
    import pandas as pd
    import numpy as np
    !pip install matplotlib numpy
    import matplotlib.pyplot as plt
```

```
Requirement already satisfied: matplotlib in /usr/local/lib/python3.10/dist-packages (3.8.0)
Requirement already satisfied: numpy in /usr/local/lib/python3.10/dist-packages (1.26.4)
Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (1.3.1)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (0.12.1)
Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (4.55.3)
Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (1.4.7)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (24.2)
Requirement already satisfied: pillow>=6.2.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (11.0.0)
Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (3.2.0)
Requirement already satisfied: python-dateutil>=2.7 in /usr/local/lib/python3.10/dist-packages (from matplotlib) (2.8.2)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.10/dist-packages (from python-dateutil>=2.7->matplotlib) (1.17.0)
```

```
[ ] # Generate some data (e.g., normally distributed data)
    x = np.random.normal(0, 1, 1000)

    # Create the histogram
    plt.hist(x, 100)

    # Set the title with a raw string to avoid issues with backslashes
    plt.title(r'Normal distribution')

    # Save the figure to a file
    plt.savefig('matplotlib_histogram.png')

    # Display the plot
    plt.show()
```

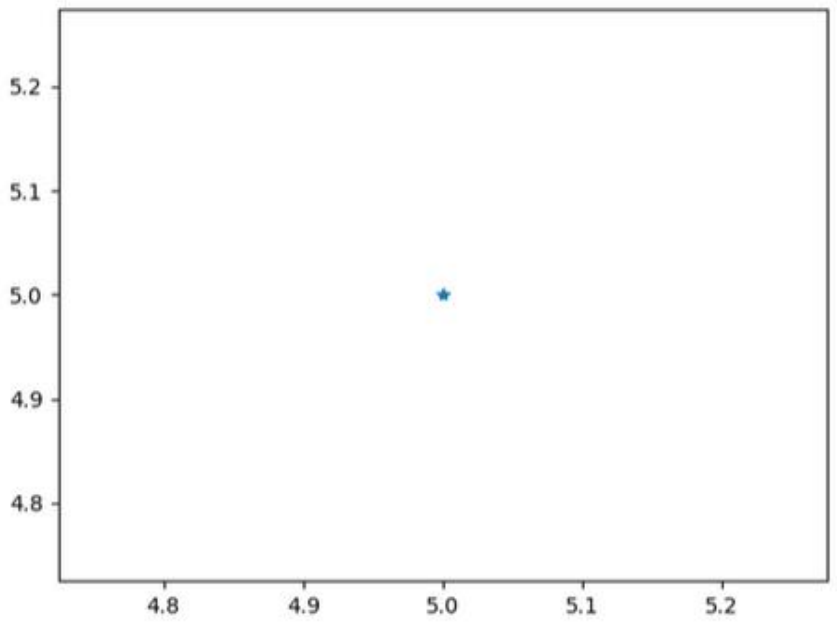


plottting artist layer to use

You're creating plots in a web application or server environment

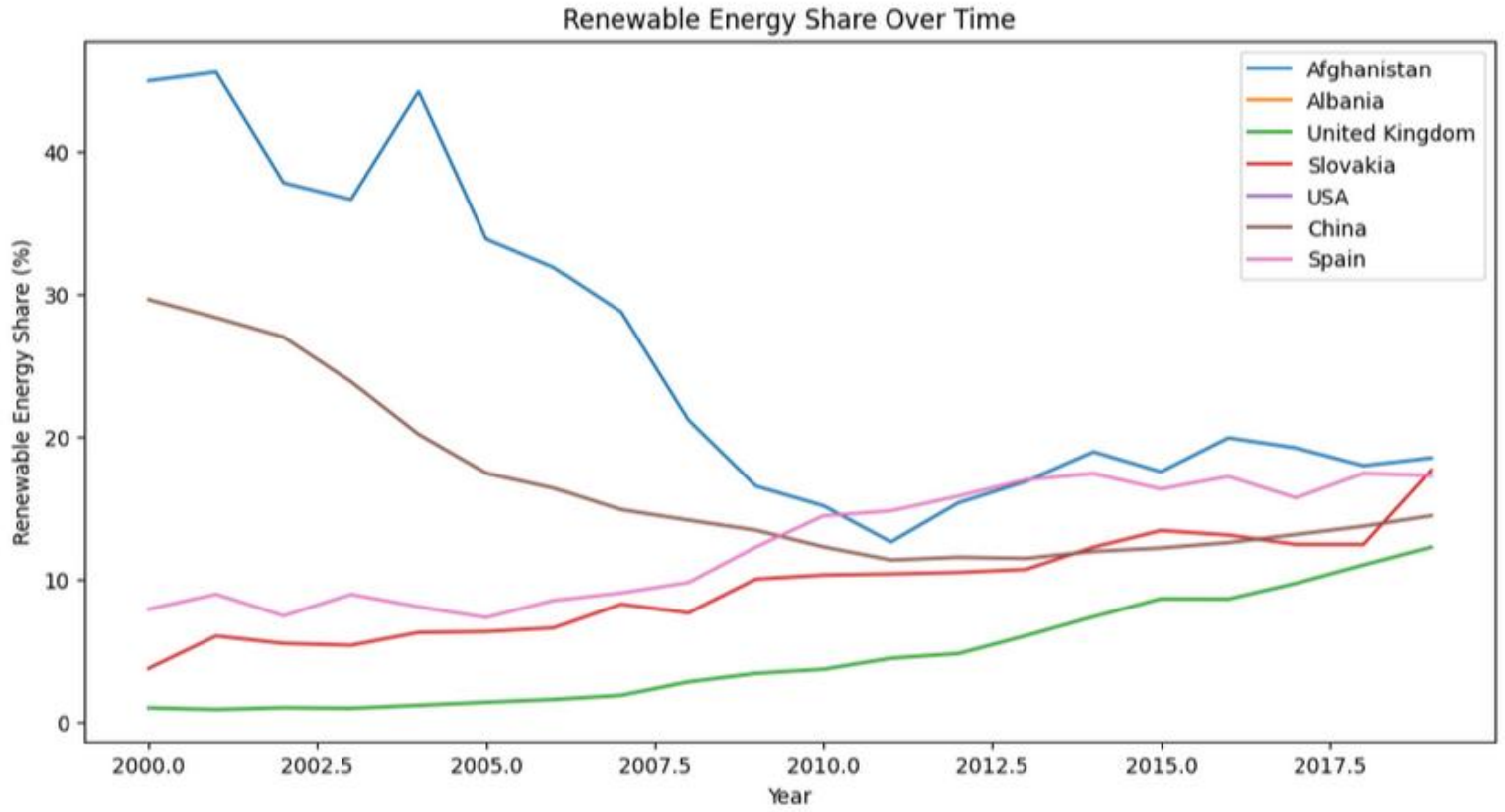
```
[ ] from matplotlib.backends.backend_agg import FigureCanvasAgg
    from matplotlib.figure import Figure

    # Create a new figure
    fig = Figure()

    # Create a canvas for the figure
    canvas = FigureCanvasAgg(fig)

    # Add a subplot to the figure
    ax = fig.add_subplot(111)

    # Plot a point at (5, 5)
    ax.plot(5, 5, '*')

    # Save the figure to a file
    canvas.print_figure('matplotlib_plot.png')
```

```
from IPython.display import display, Image
import matplotlib.pyplot as plt

# Create a new figure
fig = Figure()

# Create a canvas for the figure
canvas = FigureCanvasAgg(fig)

# Add a subplot to the figure
ax = fig.add_subplot(111)

# Plot a point at (5, 5)
ax.plot(5, 5, '*')

# Save the figure to a file
canvas.print_figure('matplotlib_plot.png')

# Display the saved image
display(Image(filename='matplotlib_plot.png'))
```

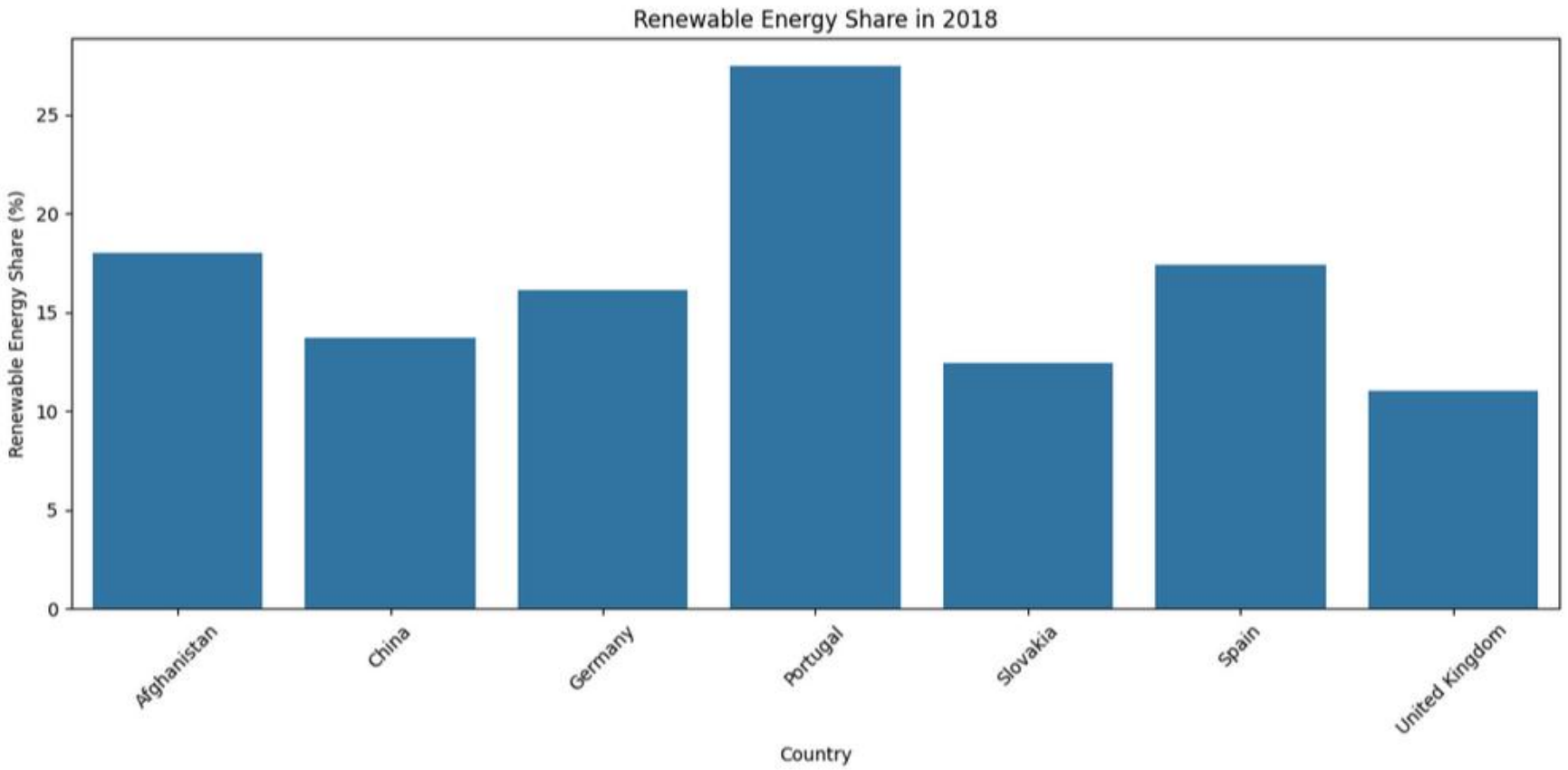


Visualizations

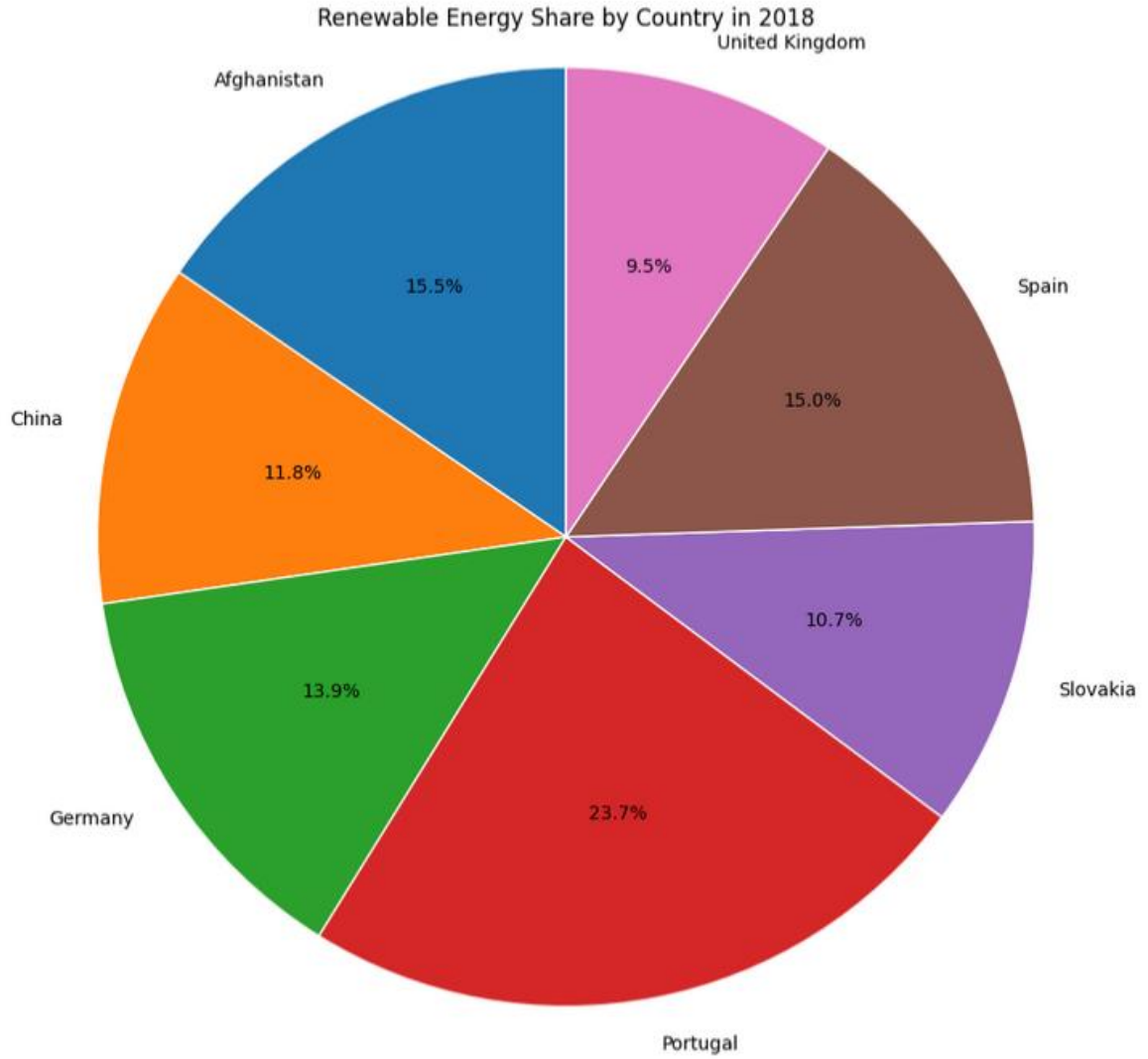
```
#import library
import seaborn as sns

# Plot renewable energy share for selected countries
countries = ['Afghanistan', 'Albania', 'United Kingdom','Slovakia','USA','China','Spain']
plt.figure(figsize=(12, 6))
for country in countries:
    country_data = df[df['Entity'] == country]
    plt.plot(country_data['Year'], country_data['Renewable energy share in the total final energy consumption (%)'], label=country)

plt.title('Renewable Energy Share Over Time')
plt.xlabel('Year')
plt.ylabel('Renewable Energy Share (%)')
plt.legend()
plt.show()
```



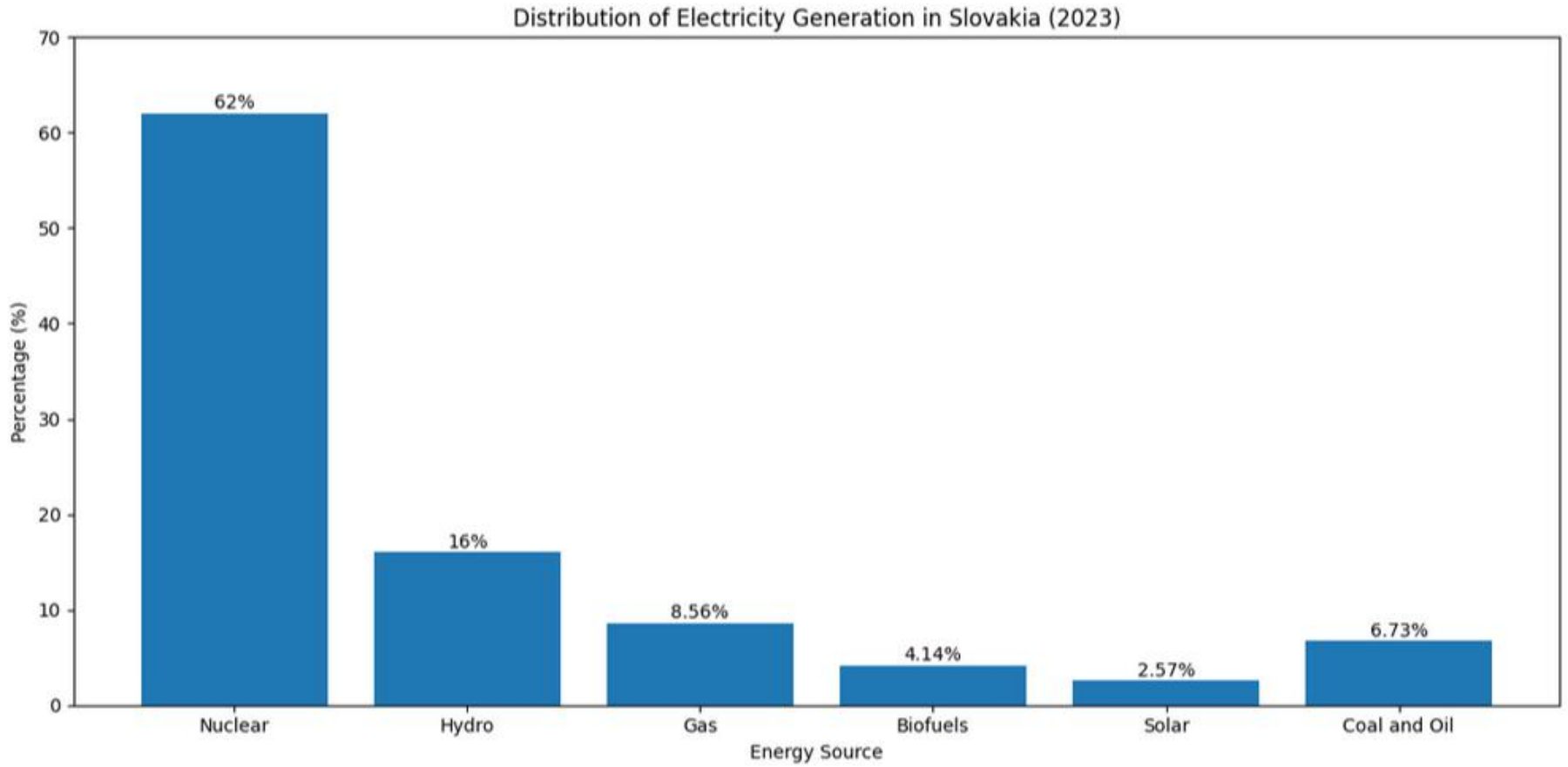
```python
# Select a specific year for the bar chart
year = 2018

# Filter data for the selected year and countries
countries = ['Afghanistan', 'United Kingdom', 'Slovakia','Germany','Franece','Spain','Portugal','China']
data_for_chart = df[(df['Entity'].isin(countries)) & (df['Year'] == year)]

# Create the bar chart
plt.figure(figsize=(12, 6))
sns.barplot(x='Entity', y='Renewable energy share in the total final energy consumption (%)', data=data_for_chart)

plt.title(f'Renewable Energy Share in {year}')
plt.xlabel('Country')
plt.ylabel('Renewable Energy Share (%)')
plt.xticks(rotation=45)  # Rotate x-axis labels for better readability
plt.tight_layout()  # Adjust layout to prevent clipping of labels
plt.show()
```



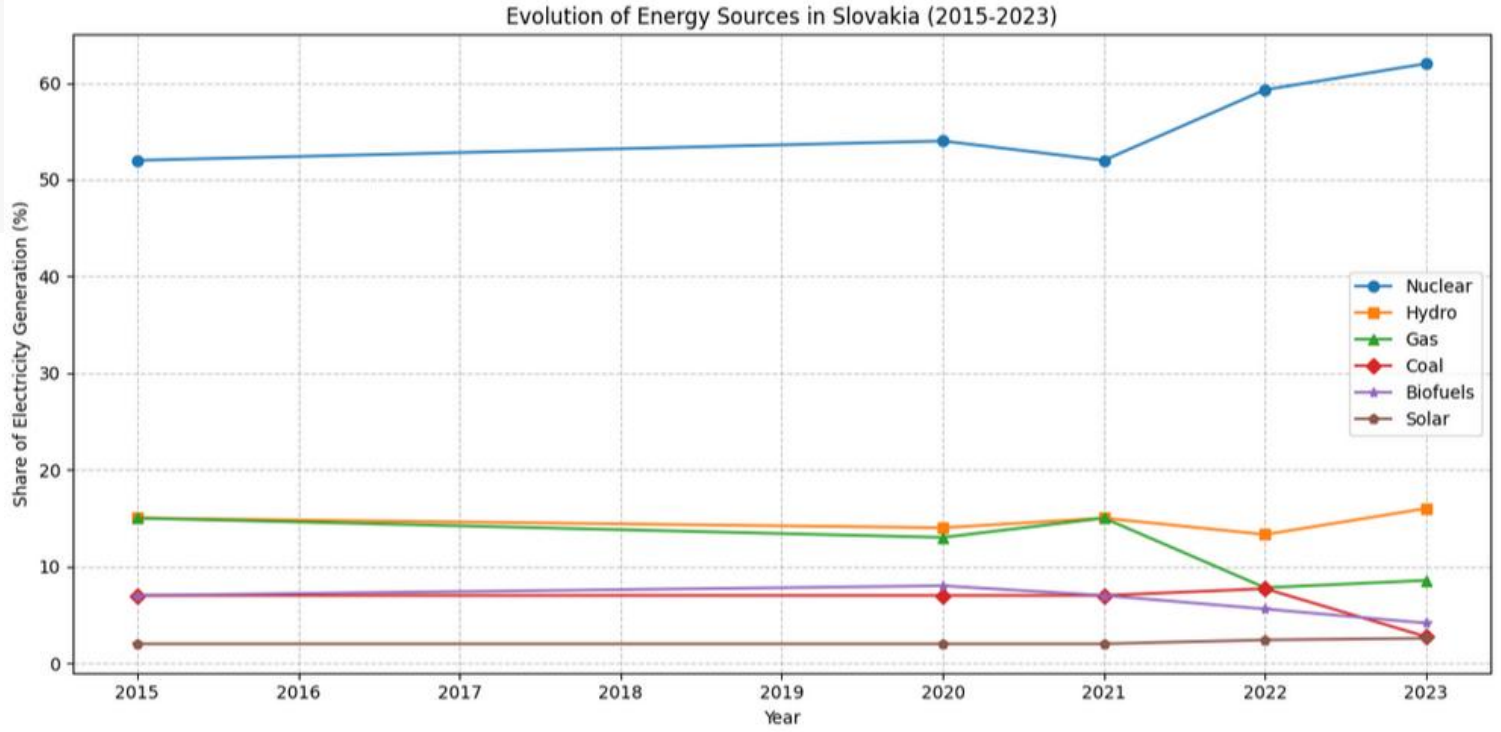
```python
# Create the pie chart
# setting up the value of the year
year = 2018
plt.figure(figsize=(10, 8))
plt.pie(data_for_chart['Renewable energy share in the total final energy consumption (%)'],
        labels=data_for_chart['Entity'],
        autopct='%1.1f%%',
        startangle=90,
        wedgeprops={'edgecolor': 'white'})

plt.title(f'Renewable Energy Share by Country in {year}')
plt.axis('equal')  # Equal aspect ratio ensures that pie is drawn as a circle
plt.tight_layout()
plt.show()
```



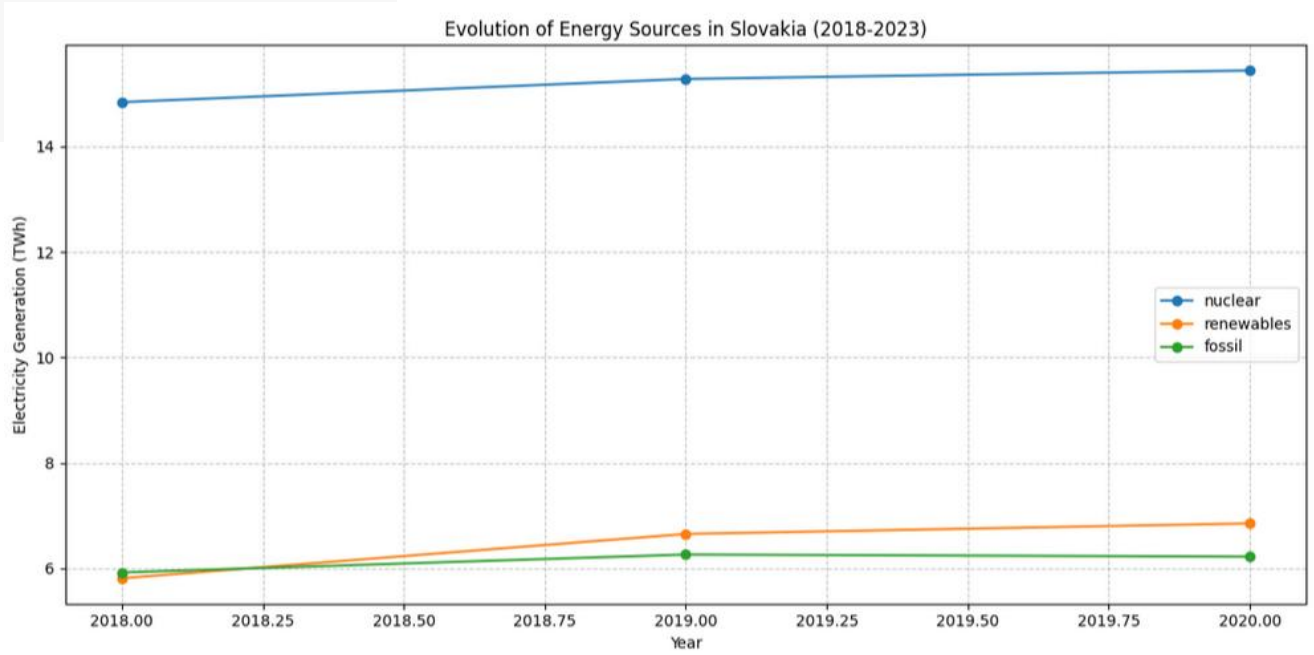
```python
#Distribution of Electricity Generation in Slovakia
sources = ['Nuclear', 'Hydro', 'Gas', 'Biofuels', 'Solar', 'Coal and Oil']
percentages = [62, 16, 8.56, 4.14, 2.57, 6.73]

plt.figure(figsize=(12, 6))
plt.bar(sources, percentages)
plt.title("Distribution of Electricity Generation in Slovakia (2023)")
plt.xlabel("Energy Source")
plt.ylabel("Percentage (%)")
plt.ylim(0, 70)

for i, v in enumerate(percentages):
    plt.text(i, v + 0.5, f'{v}%', ha='center')

plt.tight_layout()
plt.show()
```



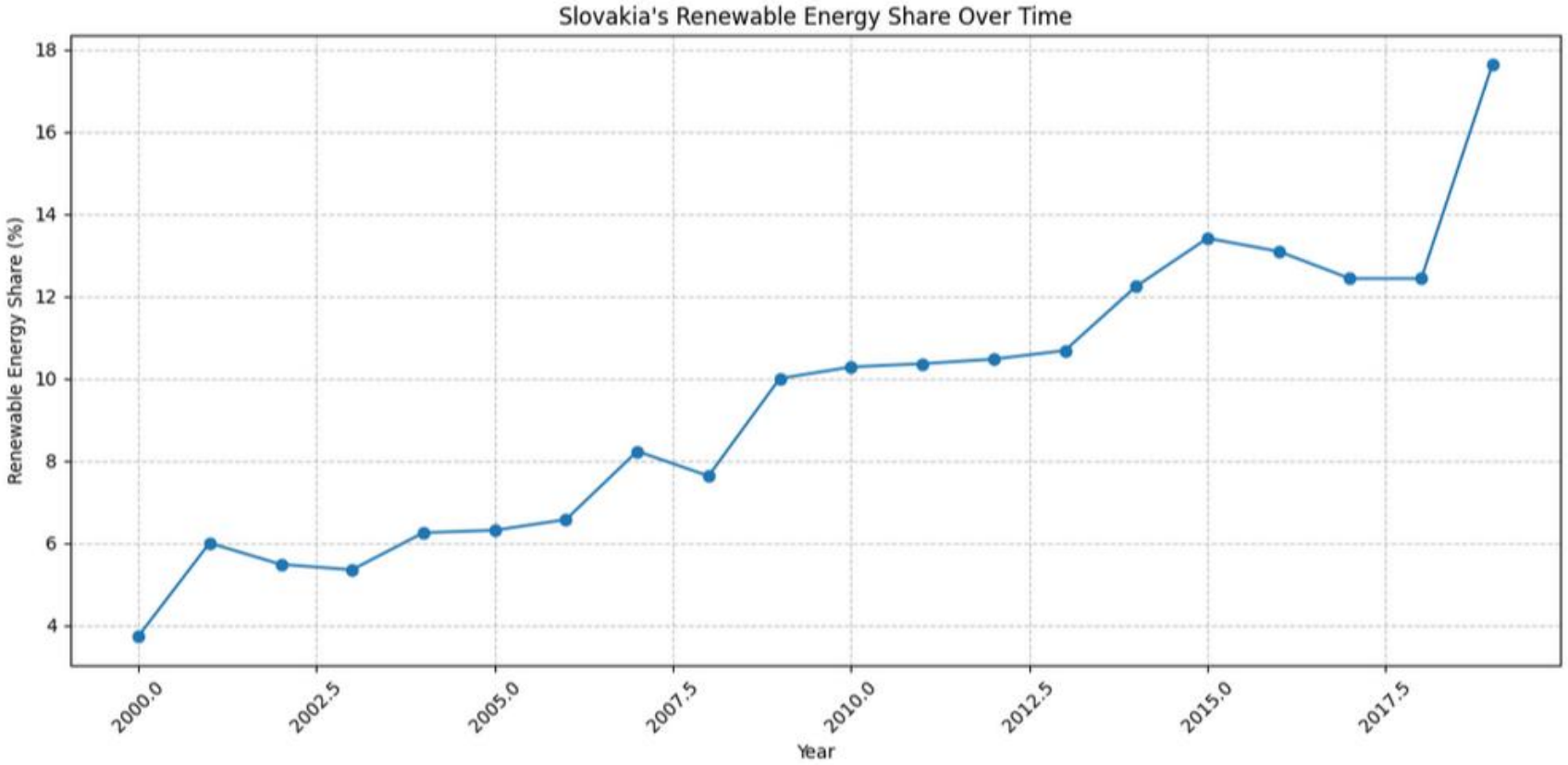
```python
#Distribution of the energy production in Slovakia over time
years = [2015, 2020, 2021, 2022, 2023]
nuclear = [52, 54, 52, 59.3, 62]
hydro = [15, 14, 15, 13.3, 16]
gas = [15, 13, 15, 7.8, 8.56]
coal = [7, 7, 7, 7.7, 2.73]
biofuels = [7, 8, 7, 5.6, 4.14]
solar = [2, 2, 2, 2.4, 2.57]

plt.figure(figsize=(12, 6))
plt.plot(years, nuclear, marker='o', label='Nuclear')
plt.plot(years, hydro, marker='s', label='Hydro')
plt.plot(years, gas, marker='^', label='Gas')
plt.plot(years, coal, marker='D', label='Coal')
plt.plot(years, biofuels, marker='*', label='Biofuels')
plt.plot(years, solar, marker='p', label='Solar')

plt.title("Evolution of Energy Sources in Slovakia (2015-2023)")
plt.xlabel("Year")
plt.ylabel("Share of Electricity Generation (%)")
plt.legend()
plt.grid(True, linestyle='--', alpha=0.7)
plt.tight_layout()
plt.show()
```



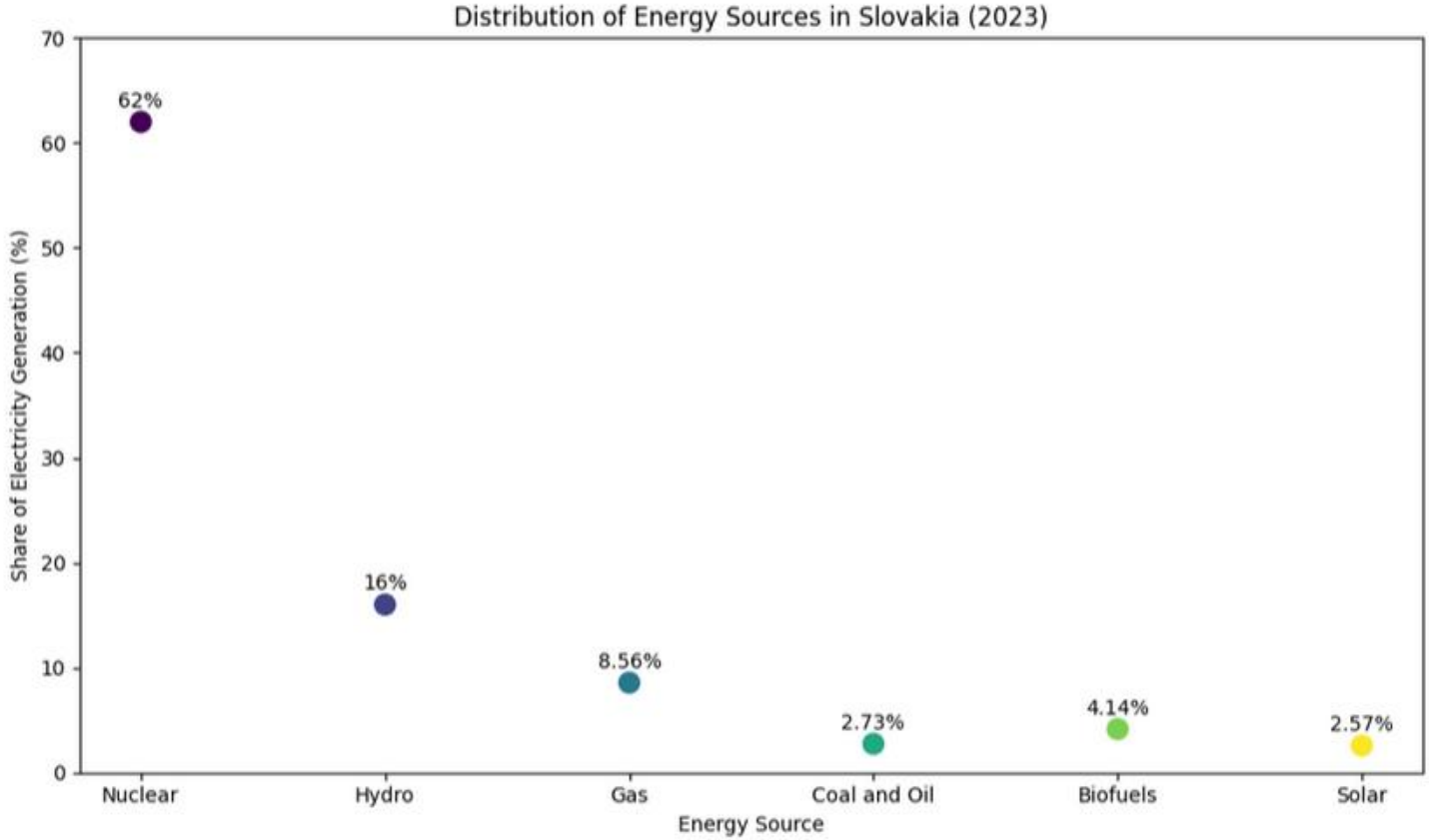
```python
import matplotlib.pyplot as plt
import pandas as pd

# Filter the data for Slovakia and the years 2018-2023
slovakia_data = df[(df['Entity'] == 'Slovakia') & (df['Year'].between(2018, 2023))]

# Create the line plot
plt.figure(figsize=(12, 6))

# List of energy sources to plot
energy_sources = [
    'Electricity from nuclear (TWh)',
    'Electricity from renewables (TWh)',  # This includes hydro, solar, biofuels, etc.
    'Electricity from fossil fuels (TWh)',  # This includes gas, coal, and oil
    'Electricity from gas (TWh)',
    'Electricity from coal (TWh)',
    'Electricity from biofuels (TWh)',
    'Electricity from oil (TWh)'
]

# Plot each energy source
for source in energy_sources:
    if source in slovakia_data.columns:
        plt.plot(slovakia_data['Year'], slovakia_data[source], marker='o', label=source.split(' ')[2] if len(source.split(' ')) > 2 else source)

plt.title("Evolution of Energy Sources in Slovakia (2018-2023)")
plt.xlabel("Year")
plt.ylabel("Electricity Generation (TWh)")
plt.legend()
plt.grid(True, linestyle='--', alpha=0.7)
plt.tight_layout()
plt.show()

# Print the data for verification
print(slovakia_data[['Year'] + [source for source in energy_sources if source in slovakia_data.columns]])
```



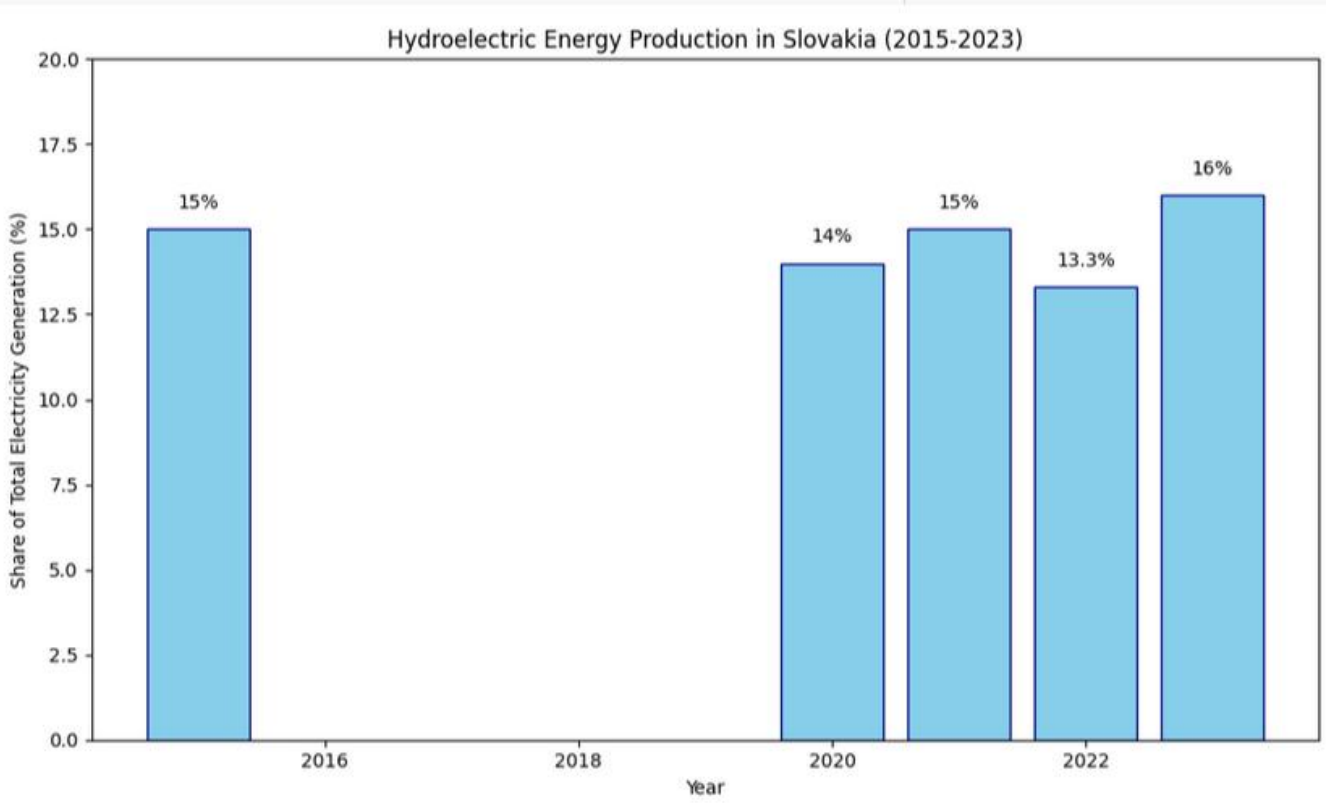
```python
#Slovakia Renewable Energy Share over time
# Filter data for Slovakia
slovakia_data = df[df['Entity'] == 'Slovakia']

# Sort data by year
slovakia_data = slovakia_data.sort_values('Year')

# Create the line chart
plt.figure(figsize=(12, 6))
plt.plot(slovakia_data['Year'], slovakia_data['Renewable energy share in the total final energy consumption (%)'], marker='o')

plt.title("Slovakia's Renewable Energy Share Over Time")
plt.xlabel('Year')
plt.ylabel('Renewable Energy Share (%)')
plt.grid(True, linestyle='--', alpha=0.7)

# Improve x-axis readability
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
```



```python
# Data for Slovakia's energy sources in 2023
sources = ['Nuclear', 'Hydro', 'Gas', 'Coal and Oil', 'Biofuels', 'Solar']
percentages = [62, 16, 8.56, 2.73, 4.14, 2.57]

plt.figure(figsize=(10, 6))
plt.scatter(sources, percentages, s=100, c=range(len(sources)), cmap='viridis')

plt.title("Distribution of Energy Sources in Slovakia (2023)")
plt.xlabel("Energy Source")
plt.ylabel("Share of Electricity Generation (%)")
plt.ylim(0, 70)

for i, txt in enumerate(percentages):
    plt.annotate(f'{txt}%', (sources[i], percentages[i]), xytext=(0, 5),
                 textcoords='offset points', ha='center', va='bottom')

plt.tight_layout()
plt.show()
```



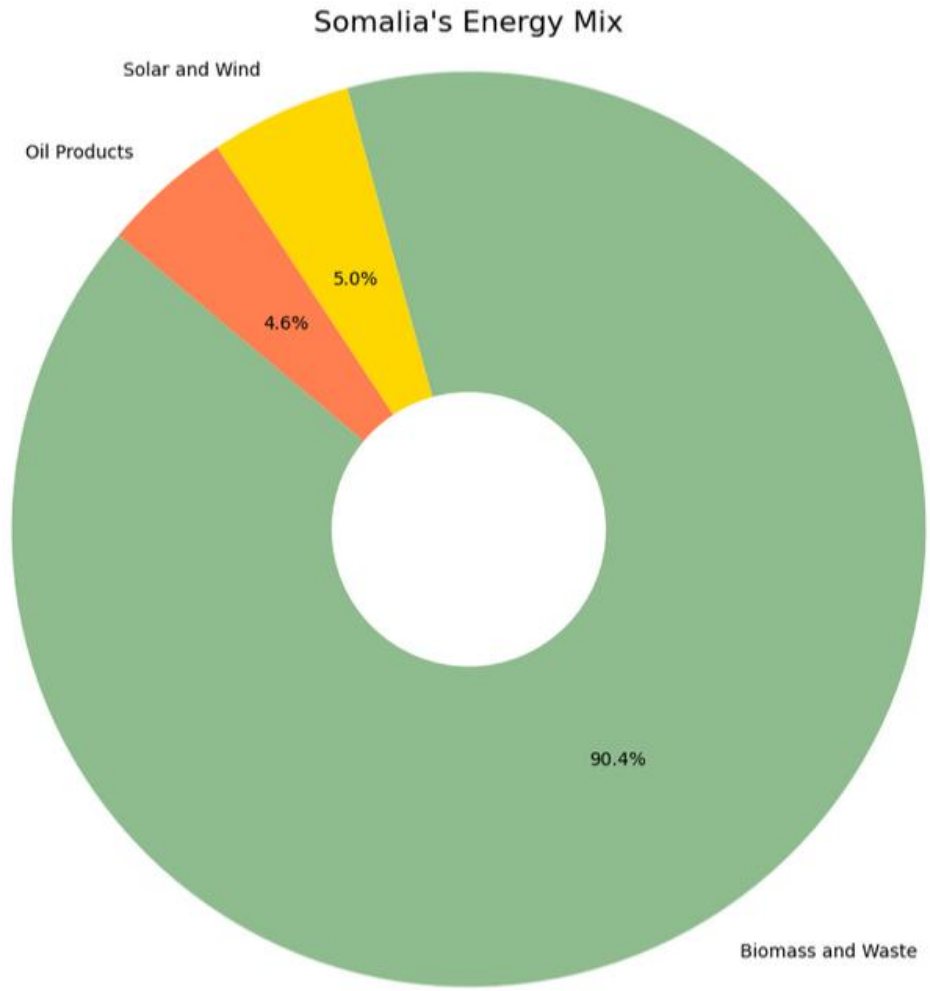
```python
# Hydroelectric Energy Production in Slovakia over time
years = [2015, 2020, 2021, 2022, 2023]
hydro_production = [15, 14, 15, 13.3, 16]

plt.figure(figsize=(10, 6))
plt.bar(years, hydro_production, width=0.8, color='skyblue', edgecolor='navy')

plt.title("Hydroelectric Energy Production in Slovakia (2015-2023)")
plt.xlabel("Year")
plt.ylabel("Share of Total Electricity Generation (%)")
plt.ylim(0, 20)

for i, v in enumerate(hydro_production):
    plt.text(years[i], v + 0.5, f'{v}%', ha='center', va='bottom')

plt.tight_layout()
plt.show()
```



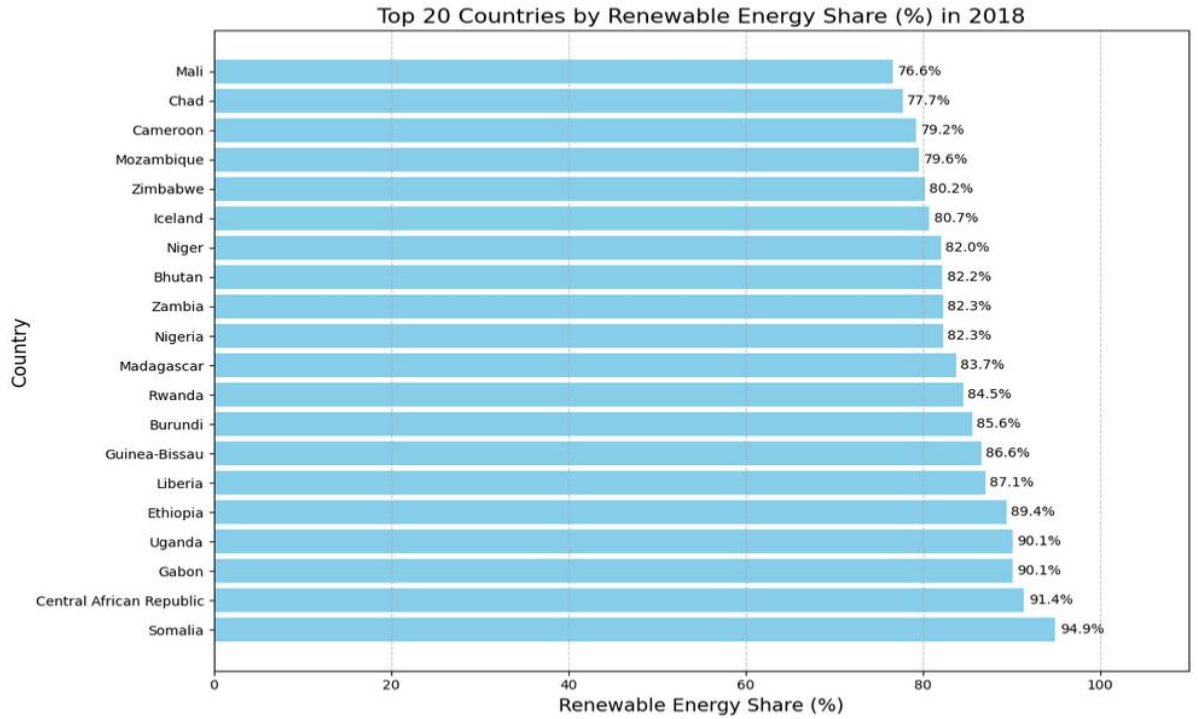
```python
import pandas as pd

def top_5_renewable_contributors(df):
    # Group by 'Entity' and get the maximum renewable energy share for each country
    max_renewable = df.groupby('Entity')['Renewable energy share in the total final energy consumption (%)'].max()

    # Sort in descending order and select top 5
    top_5 = max_renewable.sort_values(ascending=False).head(5)

    return top_5

# Call the function and display results
top_5_results = top_5_renewable_contributors(df)
print(top_5_results)
```

```
Entity
Burundi                     96.04
Ethiopia                    95.55
Uganda                      95.35
Central African Republic    95.08
Somalia                     95.03
Name: Renewable energy share in the total final energy consumption (%), dtype: float64
```

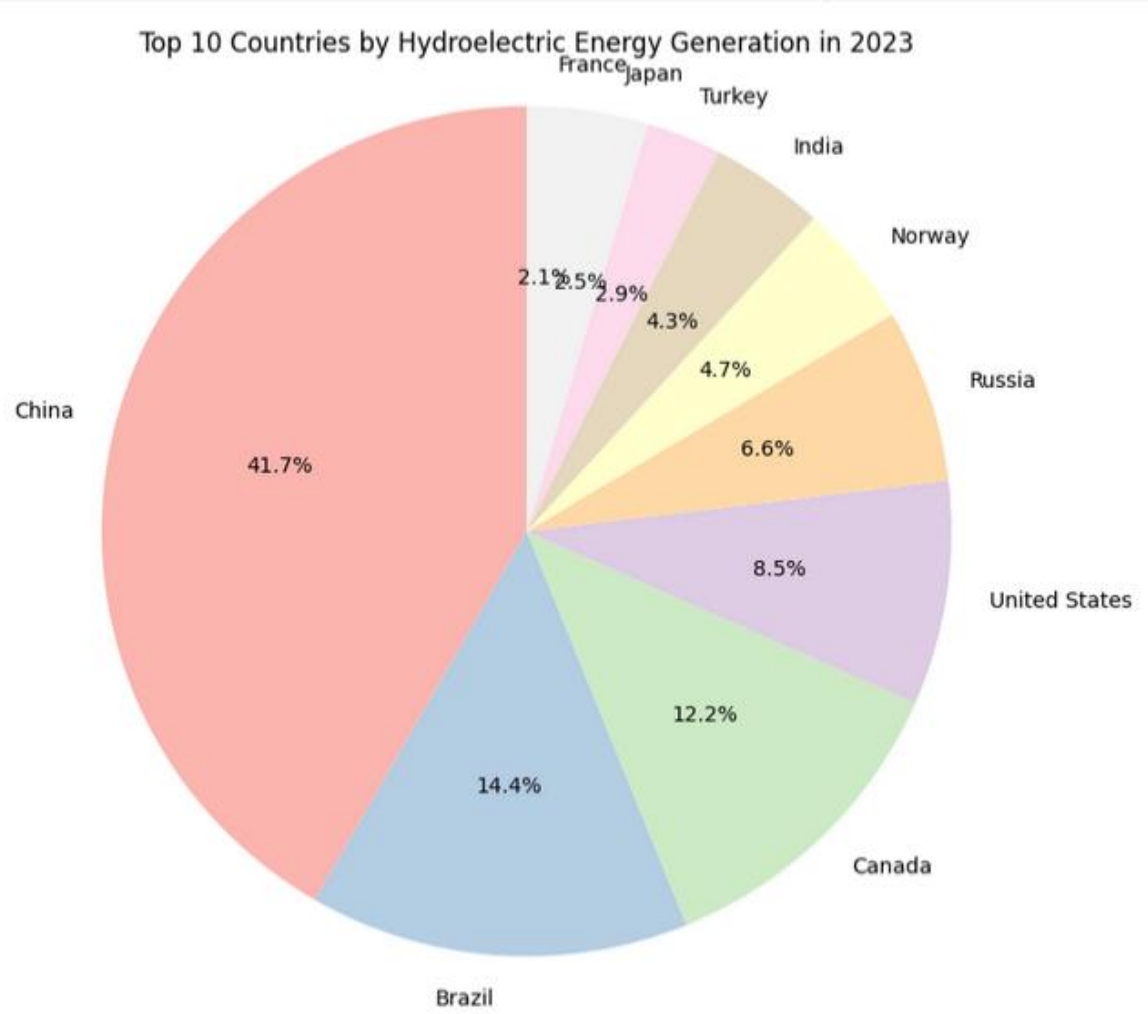
```python
#Pie chart visualization of the energy production in Somalia
# Data for Somalia's energy mix
energy_types = ['Biomass and Waste', 'Solar and Wind', 'Oil Products']
percentages = [90.4, 5, 4.6]  # Estimated breakdown

# Colors for the pie chart
colors = ['#8fbc8f', '#ffd700', '#ff7f50']

# Create the pie chart
plt.figure(figsize=(10, 8))
plt.pie(percentages, labels=energy_types, colors=colors, autopct='%1.1f%%', startangle=140)
plt.title("Somalia's Energy Mix", fontsize=16)

# Add a circle at the center to make it a donut chart (optional)
centre_circle = plt.Circle((0,0), 0.30, fc='white')
fig = plt.gcf()
fig.gca().add_artist(centre_circle)

# Equal aspect ratio ensures that pie is drawn as a circle
plt.axis('equal')
plt.tight_layout()
plt.show()
```



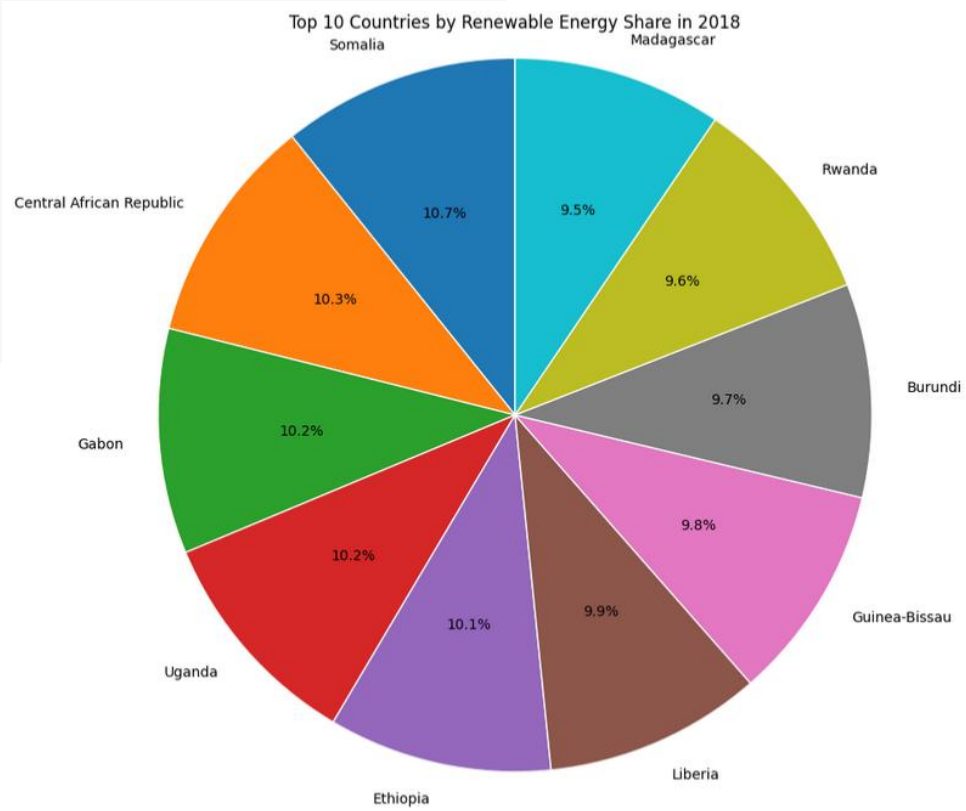
```python
# Filter the data for the year 2018
df_2018 = df[df['Year'] == 2018]

# Sort by Renewable Energy Share in descending order and get top 20
top_20 = df_2018.sort_values('Renewable energy share in the total final energy consumption (%)', ascending=False).head(20)

# Create a bar chart
plt.figure(figsize=(12, 8))
plt.barh(top_20['Entity'], top_20['Renewable energy share in the total final energy consumption (%)'], color='skyblue')
plt.title('Top 20 Countries by Renewable Energy Share (%) in 2018', fontsize=16)
plt.xlabel('Renewable Energy Share (%)', fontsize=14)
plt.ylabel('Country', fontsize=14)

# Add value labels to each bar
for index, value in enumerate(top_20['Renewable energy share in the total final energy consumption (%)']):
    plt.text(value + 0.5, index, f'{value:.1f}%', va='center')

plt.xlim(0, 110)  # Set x-axis limit to accommodate labels
plt.grid(axis='x', linestyle='--', alpha=0.7)
plt.tight_layout()
plt.show()

# Print the data for verification
print(top_20[['Entity', 'Renewable energy share in the total final energy consumption (%)']])
```



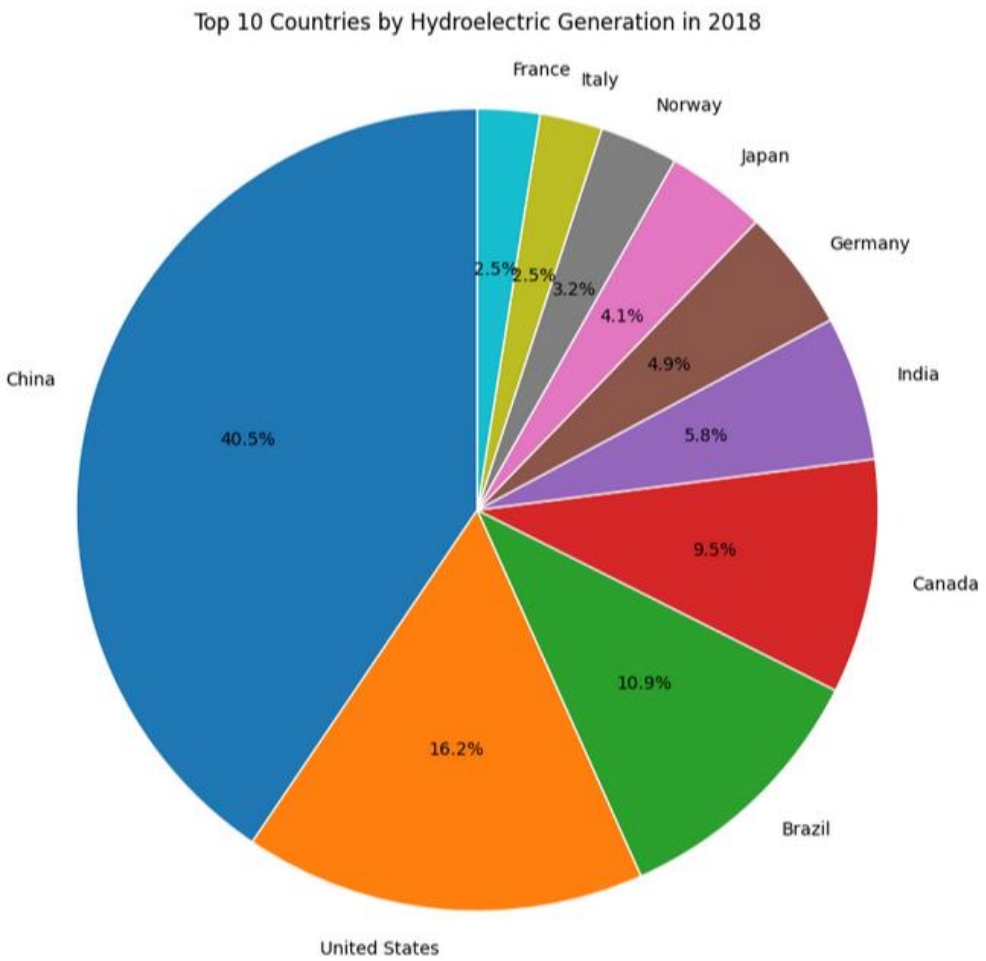
```python
# Data for top 10 countries using hydroelectric energy in 2023
countries = ['China', 'Brazil', 'Canada', 'United States', 'Russia', 'Norway', 'India', 'Turkey', 'Japan', 'France']
hydro_generation = [1245.17, 431.28, 365.39, 254.79, 197.41, 139.23, 129.75, 85.22, 74.38, 63.58]

# Create a pie chart
plt.figure(figsize=(12, 8))
plt.pie(hydro_generation, labels=countries, autopct='%1.1f%%', startangle=90, colors=plt.cm.Pastel1(np.arange(len(countries))))
plt.title('Top 10 Countries by Hydroelectric Energy Generation in 2023')
plt.axis('equal')
plt.show()
```



```python
import pandas as pd
import matplotlib.pyplot as plt

# Setting up the value of the year
year = 2018

# Filter the data for the specified year
data_for_year = df[df['Year'] == year]

# Sort and get top 10 countries by renewable energy share
data_for_chart = data_for_year.sort_values('Renewable energy share in the total final energy consumption (%)', ascending=False).head(10)

# Create the pie chart
plt.figure(figsize=(12, 8))
plt.pie(data_for_chart['Renewable energy share in the total final energy consumption (%)'],
        labels=data_for_chart['Entity'],
        autopct='%1.1f%%',
        startangle=90,
        wedgeprops={'edgecolor': 'white'})

plt.title(f'Top 10 Countries by Renewable Energy Share in {year}')
plt.axis('equal')  # Equal aspect ratio ensures that pie is drawn as a circle
plt.tight_layout()
plt.show()

# Print the data for verification
print(data_for_chart[['Entity', 'Renewable energy share in the total final energy consumption (%)']])
```



```python
import pandas as pd
import matplotlib.pyplot as plt

# Setting up the value of the year
year = 2018

# Filter the data for the specified year
data_for_year = df[df['Year'] == year]

# Sort and get top 10 countries by hydroelectric generation
data_for_chart = data_for_year.sort_values('Electricity from renewables (TWh)', ascending=False).head(10)

# Create the pie chart
plt.figure(figsize=(8, 8))
plt.pie(data_for_chart['Electricity from renewables (TWh)'],
        labels=data_for_chart['Entity'],
        autopct='%1.1f%%',
        startangle=90,
        wedgeprops={'edgecolor': 'white'})

plt.title(f'Top 10 Countries by Hydroelectric Generation in {year}')
plt.axis('equal')  # Equal aspect ratio ensures that pie is drawn as a circle
plt.tight_layout()
plt.show()

# Print the data for verification
print(data_for_chart[['Entity', 'Electricity from renewables (TWh)']])
```



Working with a map

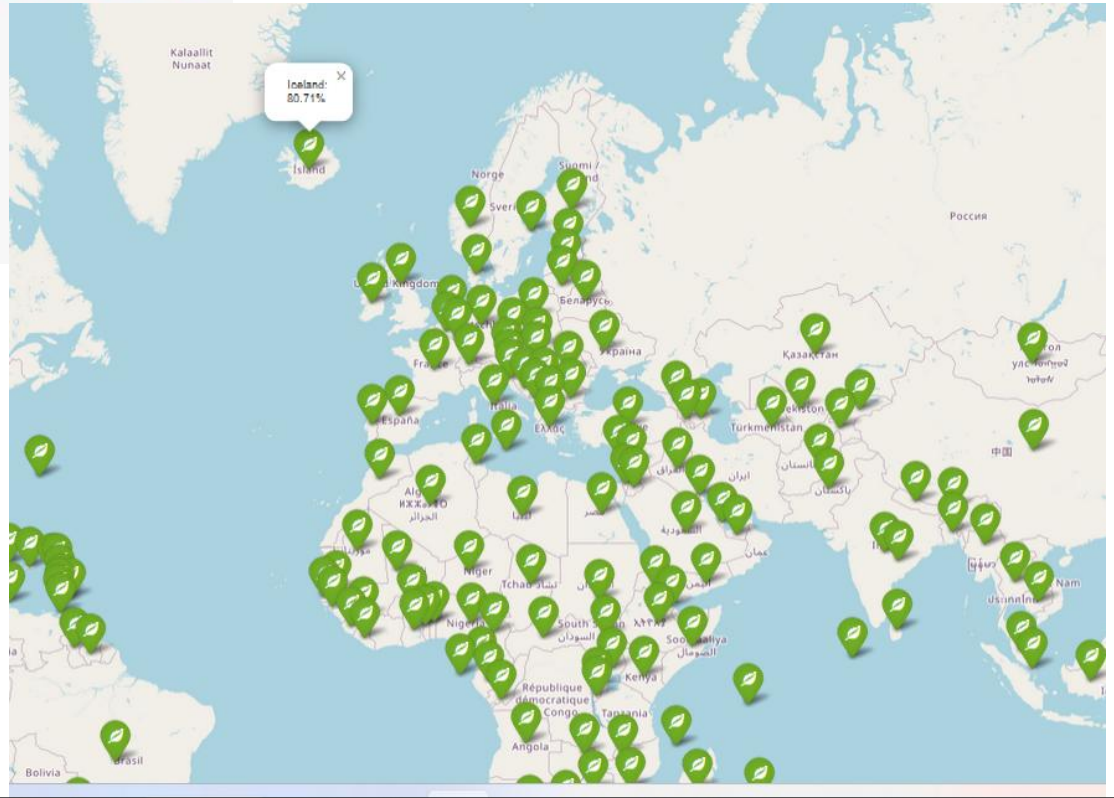
```
[ ]  pip install folium
```

```
Requirement already satisfied: folium in /usr/local/lib/python3.10/dist-packages (0.19.2)
Requirement already satisfied: branca>=0.6.0 in /usr/local/lib/python3.10/dist-packages (from folium) (0.8.1)
Requirement already satisfied: jinja2>=2.9 in /usr/local/lib/python3.10/dist-packages (from folium) (3.1.4)
Requirement already satisfied: numpy in /usr/local/lib/python3.10/dist-packages (from folium) (1.26.4)
Requirement already satisfied: requests in /usr/local/lib/python3.10/dist-packages (from folium) (2.32.3)
Requirement already satisfied: xyzservices in /usr/local/lib/python3.10/dist-packages (from folium) (2024.9.0)
Requirement already satisfied: MarkupSafe>=2.0 in /usr/local/lib/python3.10/dist-packages (from jinja2>=2.9->folium) (3.0.2)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.10/dist-packages (from requests->folium) (3.4.0)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.10/dist-packages (from requests->folium) (3.10)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.10/dist-packages (from requests->folium) (2.2.3)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.10/dist-packages (from requests->folium) (2024.12.14)
```

```python
import folium
import pandas as pd

# Assuming 'df' contains the relevant data with columns 'Entity' for country names and 'Electricity from nuclear (TWh)' for nuclear power generation.
# Filter the DataFrame for countries with nuclear power production
nuclear_data = df[df['Electricity from nuclear (TWh)'] > 0]

# Create a base map centered around a global view
world_map = folium.Map(location=[20, 0], zoom_start=2)

# Add markers for each country with nuclear power production
for index, row in nuclear_data.iterrows():
    folium.Marker(
        location=[row['Latitude'], row['Longitude']],
        popup=f"{row['Entity']}: {row['Electricity from nuclear (TWh)']} TWh",
        icon=folium.Icon(color='blue', icon='bolt')
    ).add_to(world_map)

# Save the map to an HTML file
world_map.save("nuclear_power_map.html")

# Display the map in a Jupyter Notebook (if applicable)
world_map
```

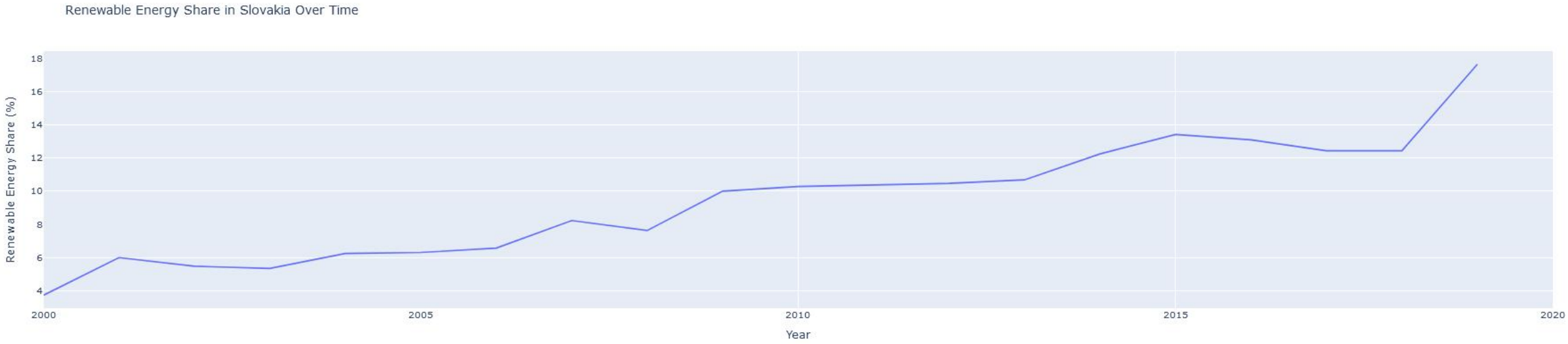
```python
# Assuming 'df' contains the relevant data with columns 'Entity' for country names,
# 'Electricity from renewables (TWh)' for total renewable power generation,
# and 'Latitude' and 'Longitude' for geographical coordinates.
# Filter the DataFrame for countries with hydroelectric generation
# Note: Replace 'Electricity from renewables (TWh)' with the actual column name for hydro generation if different.
hydro_data = df[df['Electricity from renewables (TWh)'] > 0]

# Create a base map centered around a global view
world_map = folium.Map(location=[20, 0], zoom_start=2)

# Add markers for each country with hydroelectric generation
for index, row in hydro_data.iterrows():
    # Assuming you have a specific column for hydro generation, replace if necessary
    hydro_generation = row['Electricity from renewables (TWh)']  # Adjust this if you have a specific column for hydro
    folium.Marker(
        location=[row['Latitude'], row['Longitude']],
        popup=f"{row['Entity']}: {hydro_generation} TWh",
        icon=folium.Icon(color='blue', icon='leaf')
    ).add_to(world_map)

# Save the map to an HTML file
world_map.save("hydro_power_map.html")

# Display the map in a Jupyter Notebook (if applicable)
world_map
```

```python
#Renewable energy share in the total final energy consumption (%) by country for year 2018
import folium
import pandas as pd

# Assuming 'df' contains the relevant data with columns 'Entity' for country names,
# 'Renewable energy share in the total final energy consumption (%)' for investment percentage,
# and 'Latitude' and 'Longitude' for geographical coordinates.
# Filter the DataFrame for countries with renewable energy investment data for 2018
renewable_data_2018 = df[df['Year'] == 2018]

# Create a base map centered around a global view
world_map = folium.Map(location=[20, 0], zoom_start=2)

# Add markers for each country with renewable energy investment
for index, row in renewable_data_2018.iterrows():
    if row['Renewable energy share in the total final energy consumption (%)'] > 0:
        folium.Marker(
            location=[row['Latitude'], row['Longitude']],
            popup=f"{row['Entity']}: {row['Renewable energy share in the total final energy consumption (%)']}%",
            icon=folium.Icon(color='green', icon='leaf')
        ).add_to(world_map)

# Save the map to an HTML file
world_map.save("renewable_energy_investment_map_2018.html")

# Display the map in a Jupyter Notebook (if applicable)
world_map
```



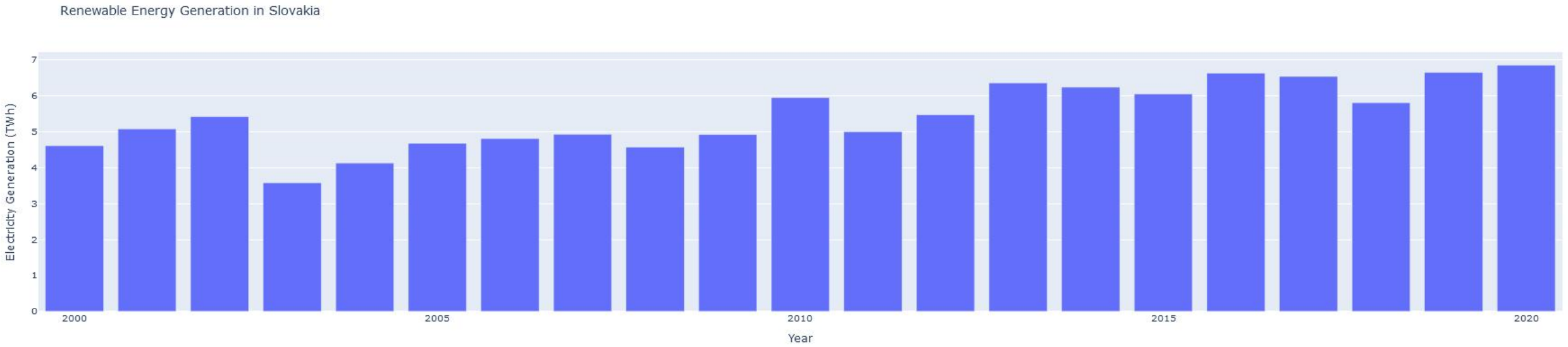
Working with plotly - more interactive visualisations

```
[ ] #line chart with data over time
    import plotly.express as px

    # Filter data for Slovakia
    slovakia_data = df[df['Entity'] == 'Slovakia']

    # Create a line plot of renewable energy share over time
    fig = px.line(slovakia_data,
                  x='Year',
                  y='Renewable energy share in the total final energy consumption (%)',
                  title='Renewable Energy Share in Slovakia Over Time')

    # Customize the layout
    fig.update_layout(
        xaxis_title='Year',
        yaxis_title='Renewable Energy Share (%)',
        hovermode='x unified'
    )

    # Show the plot
    fig.show()
```

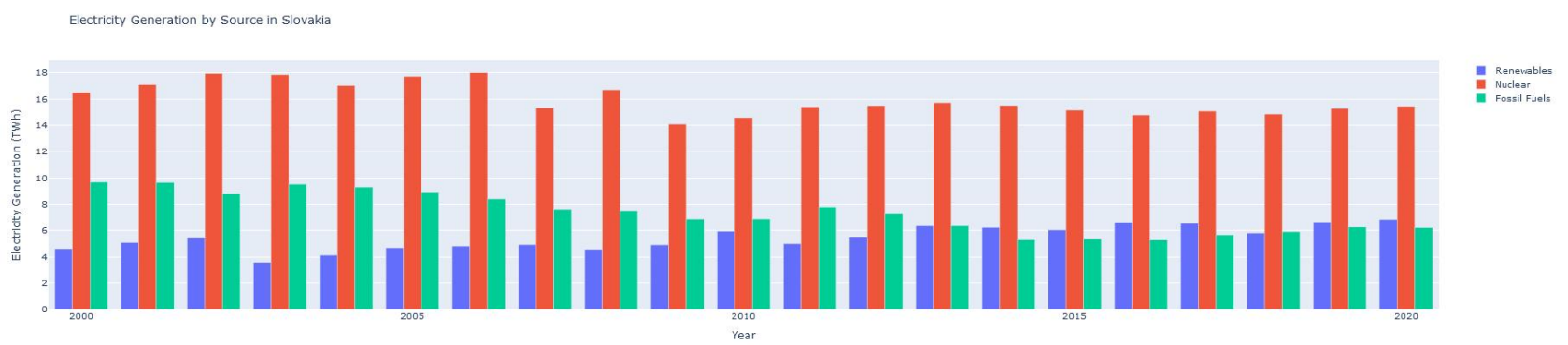


```python
#line chart
import plotly.graph_objects as go

# Filter data for Slovakia
slovakia_data = df[df['Entity'] == 'Slovakia']

# Create a figure with multiple traces
fig = go.Figure()

# Add trace for renewable energy
fig.add_trace(go.Scatter(
    x=slovakia_data['Year'],
    y=slovakia_data['Electricity from renewables (TWh)'],
    mode='lines+markers',
    name='Renewables'
))

# Add trace for nuclear energy
fig.add_trace(go.Scatter(
    x=slovakia_data['Year'],
    y=slovakia_data['Electricity from nuclear (TWh)'],
    mode='lines+markers',
    name='Nuclear'
))

# Add trace for fossil fuels
fig.add_trace(go.Scatter(
    x=slovakia_data['Year'],
    y=slovakia_data['Electricity from fossil fuels (TWh)'],
    mode='lines+markers',
    name='Fossil Fuels'
))

# Update layout
fig.update_layout(
    title='Electricity Generation by Source in Slovakia',
    xaxis_title='Year',
    yaxis_title='Electricity Generation (TWh)',
    hovermode='x unified'
)

# Show the plot
fig.show()
```

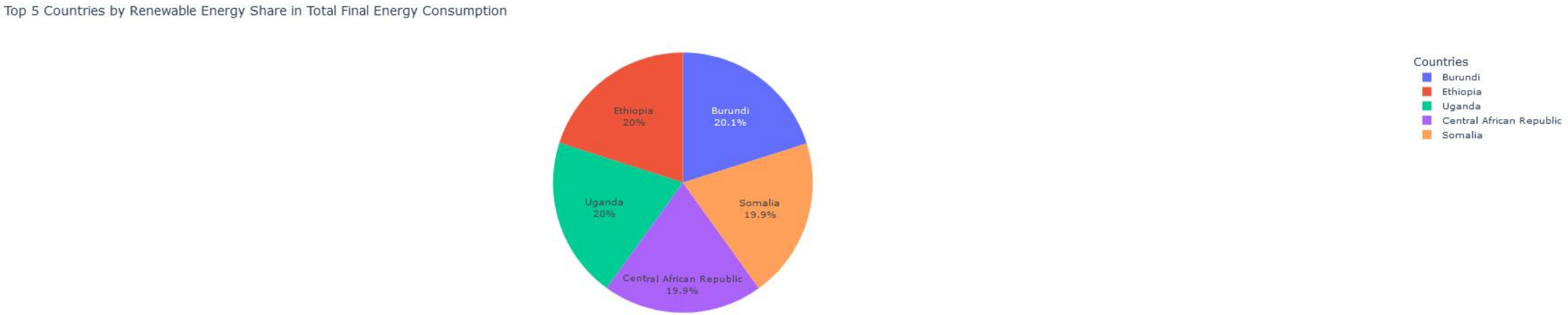
```
] #bar chart
  import plotly.express as px

  # Assuming 'df' is your DataFrame containing Slovakia data
  slovakia_data = df[df['Entity'] == 'Slovakia']

  # Create a bar chart
  fig = px.bar(slovakia_data,
               x='Year',
               y='Electricity from renewables (TWh)',
               title='Renewable Energy Generation in Slovakia')

  # Customize the layout
  fig.update_layout(
      xaxis_title='Year',
      yaxis_title='Electricity Generation (TWh)',
      bargap=0.2
  )

  # Show the plot
  fig.show()
```



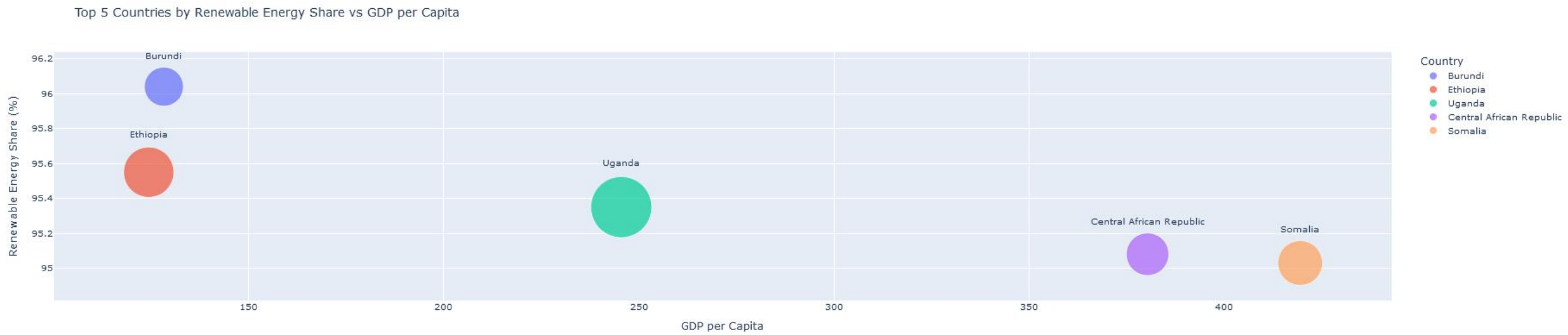
```python
#creating bar chart with multiple bars representing difference source of energy for the exact year
import plotly.graph_objects as go

# Filter data for Slovakia
slovakia_data = df[df['Entity'] == 'Slovakia']

# Create a figure with multiple traces
fig = go.Figure()

# Add trace for renewable energy
fig.add_trace(go.Bar(
    x=slovakia_data['Year'],
    y=slovakia_data['Electricity from renewables (TWh)'],
    name='Renewables'
))

# Add trace for nuclear energy
fig.add_trace(go.Bar(
    x=slovakia_data['Year'],
    y=slovakia_data['Electricity from nuclear (TWh)'],
    name='Nuclear'
))

# Add trace for fossil fuels
fig.add_trace(go.Bar(
    x=slovakia_data['Year'],
    y=slovakia_data['Electricity from fossil fuels (TWh)'],
    name='Fossil Fuels'
))

# Update layout
fig.update_layout(
    title='Electricity Generation by Source in Slovakia',
    xaxis_title='Year',
    yaxis_title='Electricity Generation (TWh)',
    barmode='group'
)

# Show the plot
fig.show()
```



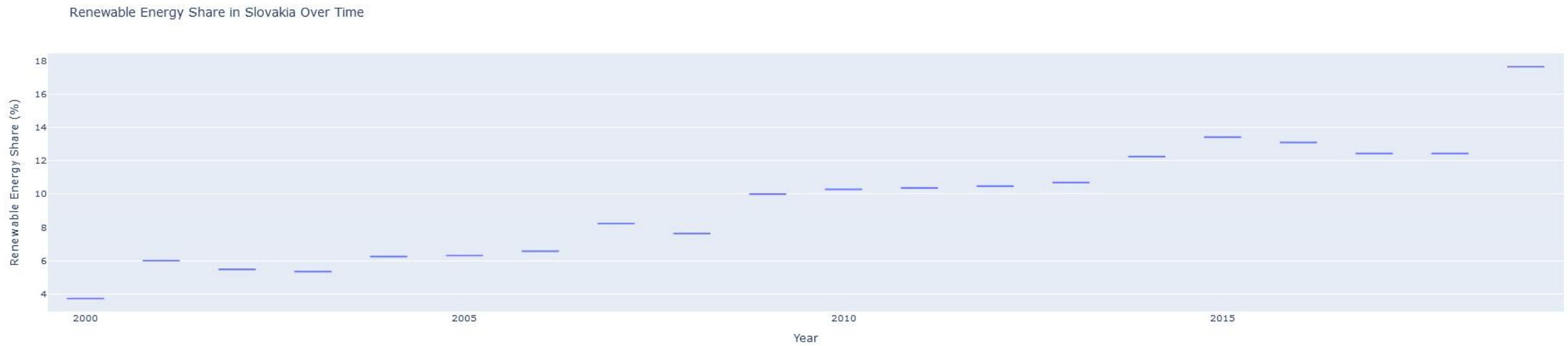
```python
import plotly.express as px

# Sort the DataFrame by renewable energy share and select top 5 countries
top_5_countries = df.sort_values('Renewable energy share in the total final energy consumption (%)', ascending=False).drop_duplicates('Entity').head(5)

# Create the pie chart
fig = px.pie(top_5_countries,
             values='Renewable energy share in the total final energy consumption (%)',
             names='Entity',
             title='Top 5 Countries by Renewable Energy Share in Total Final Energy Consumption')

# Customize the layout
fig.update_traces(textposition='inside', textinfo='percent+label')
fig.update_layout(
    legend_title_text='Countries',
    uniformtext_minsize=12,
    uniformtext_mode='hide'
)

# Show the plot
fig.show()
```



```python
#Creating ScatterPlot
# Sort the DataFrame by renewable energy share and select top 5 countries
top_5_countries = df.sort_values('Renewable energy share in the total final energy consumption (%)', ascending=False).drop_duplicates('Entity').head(5)

# Create the scatter plot
fig = px.scatter(top_5_countries,
                 x='gdp_per_capita',
                 y='Renewable energy share in the total final energy consumption (%)',
                 size='Primary energy consumption per capita (kWh/person)',
                 color='Entity',
                 hover_name='Entity',
                 text='Entity',
                 size_max=60,
                 title='Top 5 Countries by Renewable Energy Share vs GDP per Capita')

# Customize the layout
fig.update_traces(textposition='top center')
fig.update_layout(
    xaxis_title='GDP per Capita',
    yaxis_title='Renewable Energy Share (%)',
    legend_title='Country'
)

# Show the plot
fig.show()
```

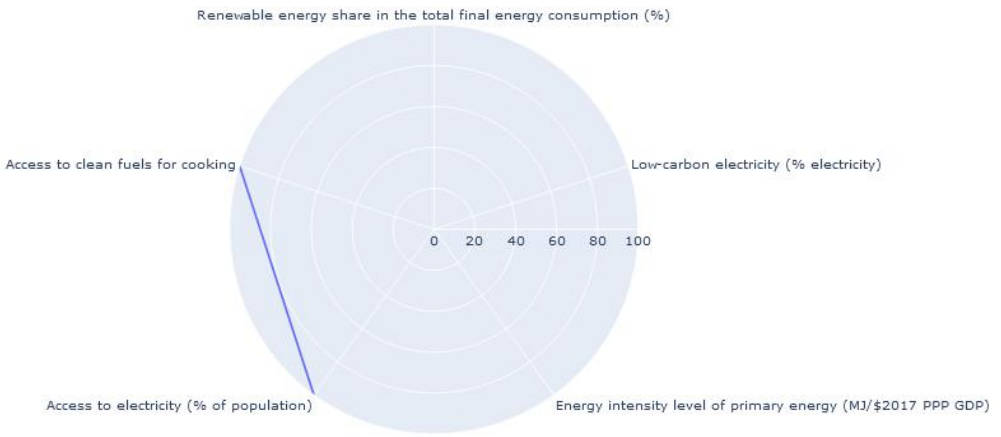


```python
#boxplot
# Filter data for Slovakia
slovakia_data = df[df['Entity'] == 'Slovakia']

# Create the boxplot
fig = px.box(slovakia_data,
             x='Year',
             y='Renewable energy share in the total final energy consumption (%)',
             title='Renewable Energy Share in Slovakia Over Time')

# Customize the layout
fig.update_layout(
    xaxis_title='Year',
    yaxis_title='Renewable Energy Share (%)',
    showlegend=False
)

# Show the plot
fig.show()
```

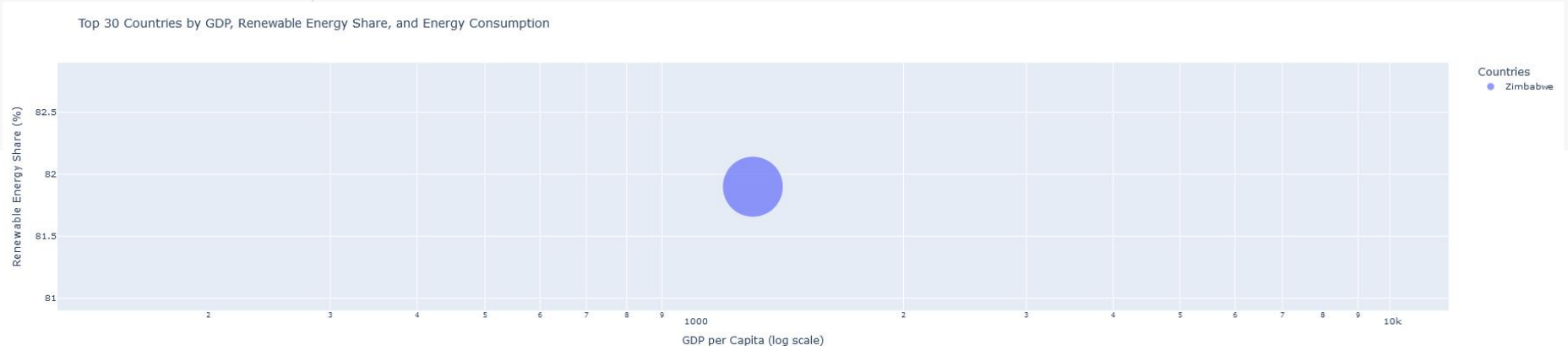


```python
#Radar chart
import plotly.express as px

# Filter data for Slovakia
slovakia_data = df[df['Entity'] == 'Slovakia'].iloc[-1]  # Get the most recent year

# Select relevant features for the radar chart
features = ['Renewable energy share in the total final energy consumption (%)',
            'Low-carbon electricity (% electricity)',
            'Energy intensity level of primary energy (MJ/$2017 PPP GDP)',
            'Access to electricity (% of population)',
            'Access to clean fuels for cooking']

# Create a DataFrame for the radar chart
radar_data = pd.DataFrame(dict(
    r=slovakia_data[features].values,
    theta=features
))

# Create the radar chart
fig = px.line_polar(radar_data, r='r', theta='theta', line_close=True)

# Customize the layout
fig.update_traces(fill='toself')
fig.update_layout(
    title='Energy Profile of Slovakia',
    polar=dict(
        radialaxis=dict(visible=True, range=[0, 100])
    )
)

# Show the plot
fig.show()
```

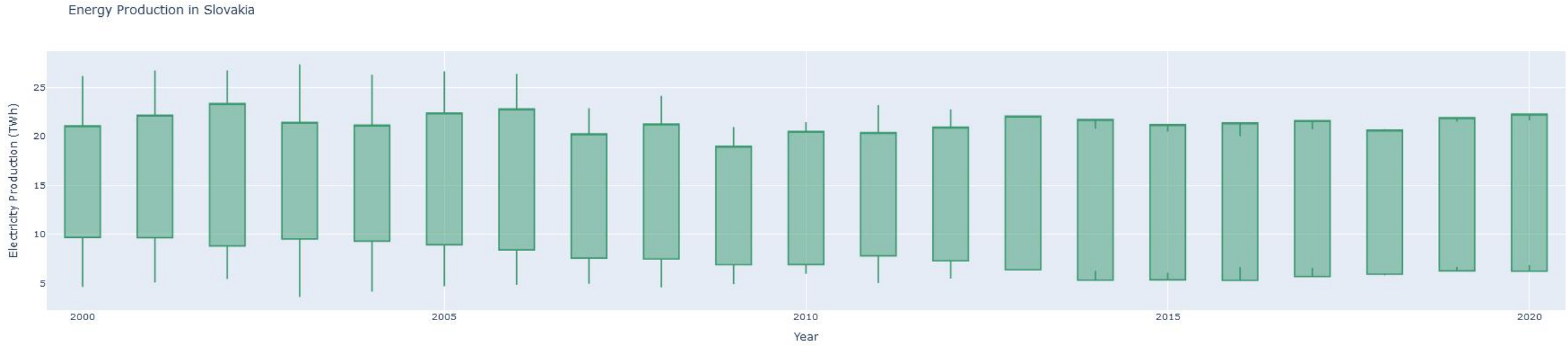
Energy Profile of Slovakia



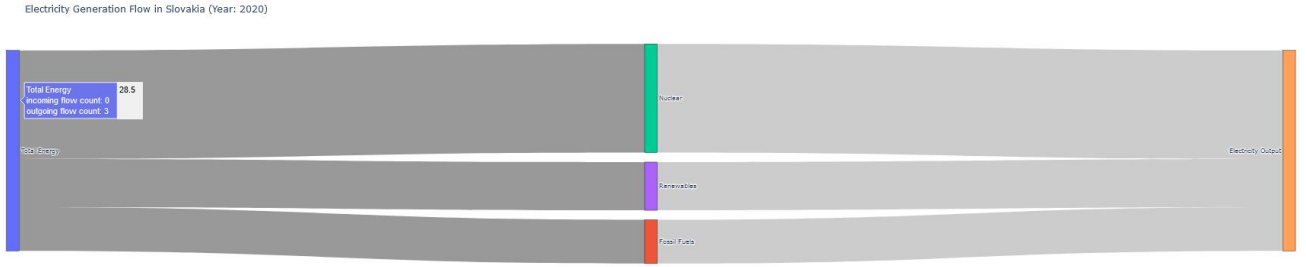
```python
import plotly.express as px

# Filter the data for the most recent year and remove any rows with missing values
recent_data = df[df['Year'] == df['Year'].max()].dropna(subset=['gdp_per_capita', 'Renewable energy share in the total final energy consumption (%)', 'Primary energy consumption per capita (kWh/person)'])

# Select top 30 countries by GDP per capita to reduce clutter
top_30_countries = recent_data.nlargest(30, 'gdp_per_capita')

# Create the bubble chart
fig = px.scatter(top_30_countries,
                 x='gdp_per_capita',
                 y='Renewable energy share in the total final energy consumption (%)',
                 size='Primary energy consumption per capita (kWh/person)',
                 color='Entity',
                 hover_name='Entity',
                 log_x=True,  # Use log scale for GDP per capita
                 size_max=60,  # Maximum size of bubbles
                 title='Top 30 Countries by GDP, Renewable Energy Share, and Energy Consumption')

# Highlight Slovakia if it's in the top 30
slovakia_data = top_30_countries[top_30_countries['Entity'] == 'Slovakia']
if not slovakia_data.empty:
    fig.add_trace(px.scatter(slovakia_data,
                             x='gdp_per_capita',
                             y='Renewable energy share in the total final energy consumption (%)',
                             size='Primary energy consumption per capita (kWh/person)',
                             color_discrete_sequence=['red'],
                             hover_name='Entity').data[0])

# Customize the layout
fig.update_layout(
    xaxis_title='GDP per Capita (log scale)',
    yaxis_title='Renewable Energy Share (%)',
    showlegend=True,
    legend_title_text='Countries'
)

# Show the plot
fig.show()
```



```python
#Candle sticks chart
# Filter data for Slovakia
slovakia_data = df[df['Entity'] == 'Slovakia'].sort_values('Year')

# Create the candlestick chart
fig = go.Figure(data=[go.Candlestick(
    x=slovakia_data['Year'],
    open=slovakia_data['Electricity from fossil fuels (TWh)'],
    high=slovakia_data['Electricity from fossil fuels (TWh)'] + slovakia_data['Electricity from nuclear (TWh)'],
    low=slovakia_data['Electricity from renewables (TWh)'],
    close=slovakia_data['Electricity from renewables (TWh)'] + slovakia_data['Electricity from nuclear (TWh)']
)])

# Customize the layout
fig.update_layout(
    title='Energy Production in Slovakia',
    xaxis_title='Year',
    yaxis_title='Electricity Production (TWh)',
    xaxis_rangeslider_visible=False
)

# Show the plot
fig.show()
```



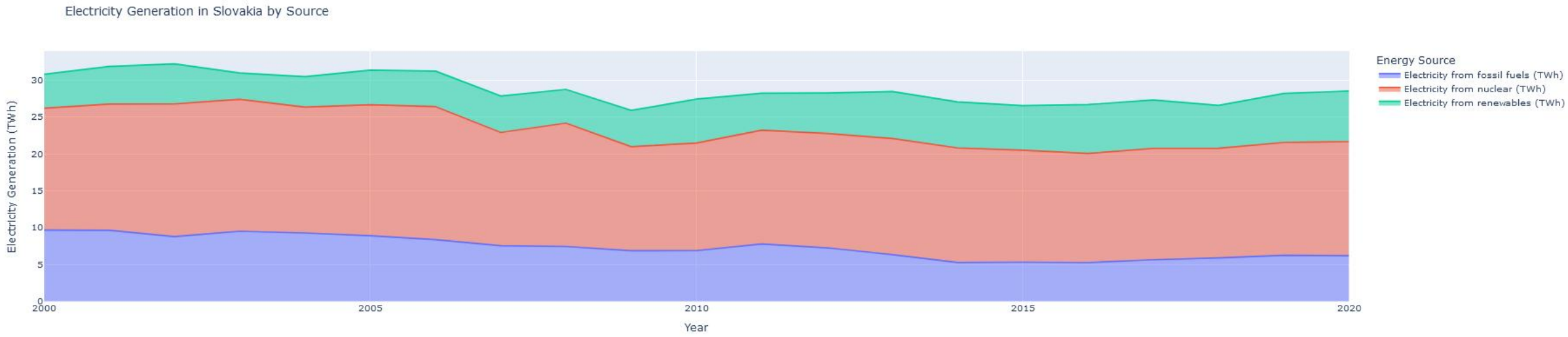
```python
#Using Sankey diagram
import plotly.graph_objects as go
import pandas as pd

# Filter data for Slovakia and get the most recent year
slovakia_data = df[df['Entity'] == 'Slovakia'].sort_values('Year', ascending=False).iloc[0]

# Prepare data for Sankey diagram
label = ["Total Energy", "Fossil Fuels", "Nuclear", "Renewables", "Electricity Output"]
source = [0, 0, 0, 1, 2, 3]
target = [1, 2, 3, 4, 4, 4]
value = [
    slovakia_data['Electricity from fossil fuels (TWh)'],
    slovakia_data['Electricity from nuclear (TWh)'],
    slovakia_data['Electricity from renewables (TWh)'],
    slovakia_data['Electricity from fossil fuels (TWh)'],
    slovakia_data['Electricity from nuclear (TWh)'],
    slovakia_data['Electricity from renewables (TWh)']
]

# Create color scale
color_scale = ['#636EFA', '#EF553B', '#00CC96', '#AB63FA', '#FFA15A']

# Create the Sankey diagram
fig = go.Figure(data=[go.Sankey(
    node = dict(
      pad = 15,
      thickness = 20,
      line = dict(color = "black", width = 0.5),
      label = label,
      color = color_scale
    ),
    link = dict(
      source = source,
      target = target,
      value = value
  ))])

# Update the layout
fig.update_layout(
    title_text=f"Electricity Generation Flow in Slovakia (Year: {slovakia_data['Year']})",
    font_size=10
)

# Show the plot
fig.show()
```



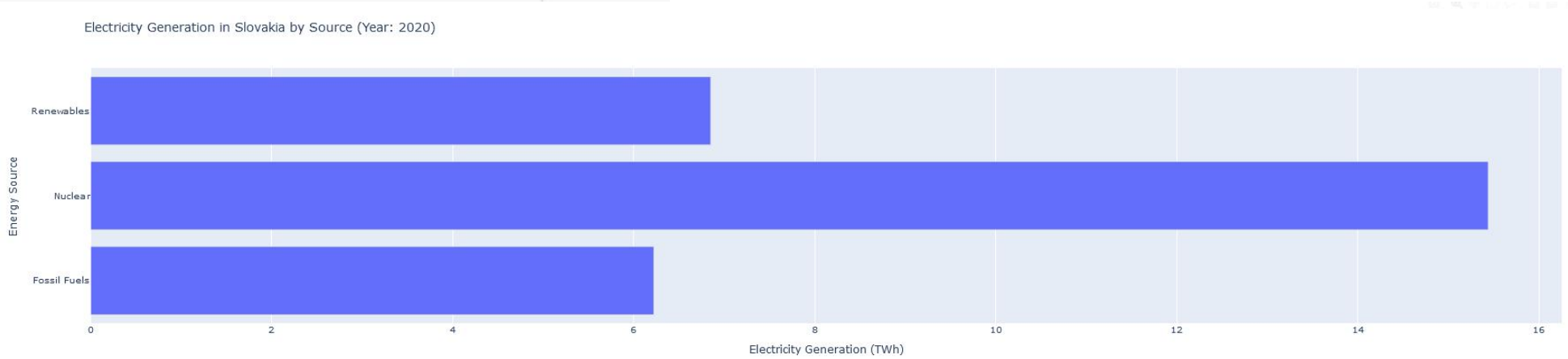
```python
#Using Treemap to visualize data
# Filter data for Slovakia and get the most recent year
slovakia_data = df[df['Entity'] == 'Slovakia'].sort_values('Year', ascending=False).iloc[0]

# Prepare data for Treemap
treemap_data = pd.DataFrame({
    'Energy Source': ['Total', 'Fossil Fuels', 'Nuclear', 'Renewables'],
    'Parent': ['', 'Total', 'Total', 'Total'],
    'Value': [
        slovakia_data['Electricity from fossil fuels (TWh)'] +
        slovakia_data['Electricity from nuclear (TWh)'] +
        slovakia_data['Electricity from renewables (TWh)'],
        slovakia_data['Electricity from fossil fuels (TWh)'],
        slovakia_data['Electricity from nuclear (TWh)'],
        slovakia_data['Electricity from renewables (TWh)']
    ]
})

# Create the Treemap
fig = px.treemap(treemap_data,
                 path=['Parent', 'Energy Source'],
                 values='Value',
                 title=f"Electricity Generation in Slovakia (Year: {slovakia_data['Year']})")

fig.update_traces(root_color="lightgrey")
fig.update_layout(margin=dict(t=50, l=25, r=25, b=25))

fig.show()
```

```python
#Dot plot
# Extract relevant data for Slovakia
years = [2018, 2019, 2020, 2021, 2022]
electricity_generation = [27.15, 28.61, 29.02, 31.11, 28.3]

# Create the dot plot
fig = go.Figure()

fig.add_trace(go.Scatter(
    x=years,
    y=electricity_generation,
    mode='markers',
    marker=dict(
        size=10,
        color=electricity_generation,
        colorscale='Viridis',
        showscale=True
    ),
    text=[f'{y:.2f} TWh' for y in electricity_generation],
    hoverinfo='text+x'
))

# Customize the layout
fig.update_layout(
    title='Electricity Generation in Slovakia (2018-2022)',
    xaxis_title='Year',
    yaxis_title='Electricity Generation (TWh)',
    xaxis=dict(tickmode='linear'),
    yaxis=dict(range=[25, 32])
)

# Show the plot
fig.show()
```

```python
#Area Plot
# Filter data for Slovakia
slovakia_data = df[df['Entity'] == 'Slovakia'].sort_values('Year')

# Create the filled area plot
fig = px.area(slovakia_data,
              x='Year',
              y=['Electricity from fossil fuels (TWh)',
                 'Electricity from nuclear (TWh)',
                 'Electricity from renewables (TWh)'],
              title='Electricity Generation in Slovakia by Source',
              labels={'value': 'Electricity Generation (TWh)', 'variable': 'Source'})

# Customize the layout
fig.update_layout(
    xaxis_title='Year',
    yaxis_title='Electricity Generation (TWh)',
    legend_title='Energy Source'
)

# Show the plot
fig.show()
```



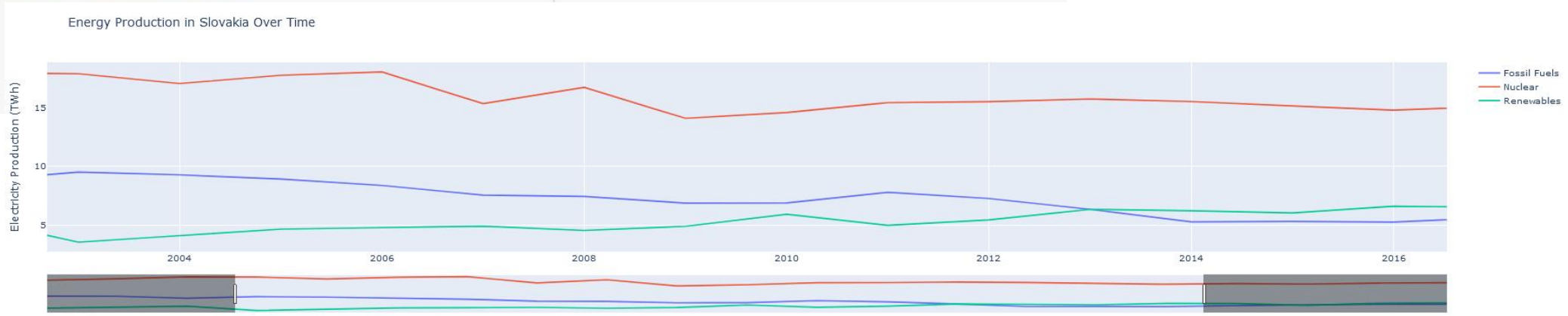
```python
#Horizontal bar chart
# Filter data for Slovakia and get the most recent year
slovakia_data = df[df['Entity'] == 'Slovakia'].sort_values('Year', ascending=False).iloc[0]

# Prepare data for horizontal bar chart
energy_sources = ['Fossil Fuels', 'Nuclear', 'Renewables']
values = [
    slovakia_data['Electricity from fossil fuels (TWh)'],
    slovakia_data['Electricity from nuclear (TWh)'],
    slovakia_data['Electricity from renewables (TWh)']
]

# Create the horizontal bar chart
fig = px.bar(
    x=values,
    y=energy_sources,
    orientation='h',
    title=f"Electricity Generation in Slovakia by Source (Year: {slovakia_data['Year']})"
)

# Customize the layout
fig.update_layout(
    xaxis_title='Electricity Generation (TWh)',
    yaxis_title='Energy Source'
)

# Show the plot
fig.show()
```



```
] pip install --upgrade plotly
```

```
Requirement already satisfied: plotly in /usr/local/lib/python3.10/dist-packages (5.24.1)
Requirement already satisfied: tenacity>=6.2.0 in /usr/local/lib/python3.10/dist-packages (from plotly) (9.0.0)
Requirement already satisfied: packaging in /usr/local/lib/python3.10/dist-packages (from plotly) (24.2)
```

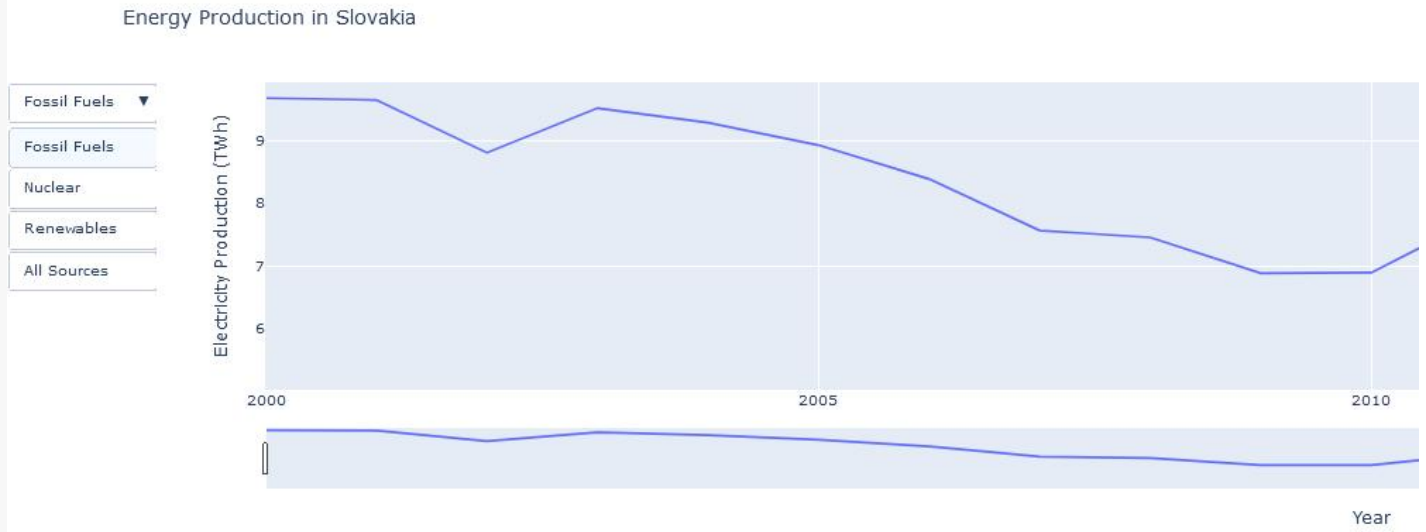
```python
#Creating a chart with sliders
import plotly.graph_objects as go

# Assuming df is your DataFrame with Slovakia data
slovakia_data = df[df['Entity'] == 'Slovakia']

# Create the figure
fig = go.Figure()

# Add traces for different energy sources
fig.add_trace(go.Scatter(x=slovakia_data['Year'], y=slovakia_data['Electricity from fossil fuels (TWh)'], name='Fossil Fuels'))
fig.add_trace(go.Scatter(x=slovakia_data['Year'], y=slovakia_data['Electricity from nuclear (TWh)'], name='Nuclear'))
fig.add_trace(go.Scatter(x=slovakia_data['Year'], y=slovakia_data['Electricity from renewables (TWh)'], name='Renewables'))

# Update layout with slider
fig.update_layout(
    title='Energy Production in Slovakia Over Time',
    xaxis=dict(
        rangeslider=dict(visible=True),
        type='date'
    ),
    yaxis=dict(title='Electricity Production (TWh)'),
    hovermode='x unified'
)

# Show the plot
fig.show()
```



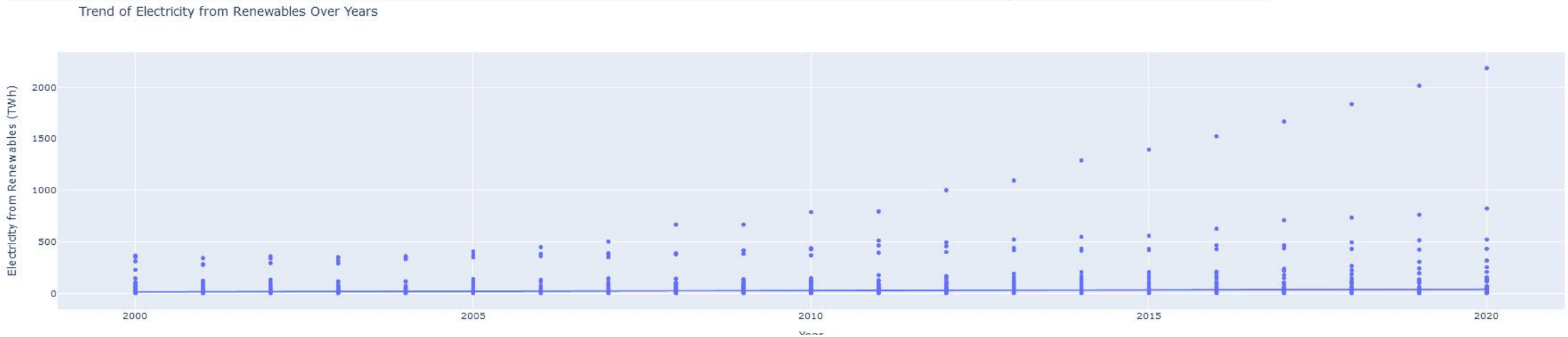
```python
import pandas as pd
import plotly.graph_objects as go

# Filter data for Slovakia
slovakia_data = df[df['Entity'] == 'Slovakia']

# Create the figure
fig = go.Figure()

# Add traces for each energy source
fig.add_trace(go.Scatter(
    x=slovakia_data['Year'],
    y=slovakia_data['Electricity from fossil fuels (TWh)'],
    name='Fossil Fuels',
    visible=True  # Initially visible
))

fig.add_trace(go.Scatter(
    x=slovakia_data['Year'],
    y=slovakia_data['Electricity from nuclear (TWh)'],
    name='Nuclear',
    visible=False  # Initially hidden
))

fig.add_trace(go.Scatter(
    x=slovakia_data['Year'],
    y=slovakia_data['Electricity from renewables (TWh)'],
    name='Renewables',
    visible=False  # Initially hidden
))

# Update layout with dropdown menu
fig.update_layout(
    title='Energy Production in Slovakia',
    xaxis_title='Year',
    yaxis_title='Electricity Production (TWh)',
    updatemenus=[
        {
            'buttons': [
                {
                    'label': 'Fossil Fuels',
                    'method': 'update',
                    'args': [{'visible': [True, False, False]}, {'title': 'Fossil Fuels Production'}]
                },
                {
                    'label': 'Nuclear',
                    'method': 'update',
                    'args': [{'visible': [False, True, False]}, {'title': 'Nuclear Production'}
```

```python
                {
                    'buttons': [
                        {
                            'label': 'Fossil Fuels',
                            'method': 'update',
                            'args': [{'visible': [True, False, False]}, {'title': 'Fossil Fuels Production'}]
                        },
                        {
                            'label': 'Nuclear',
                            'method': 'update',
                            'args': [{'visible': [False, True, False]}, {'title': 'Nuclear Production'}]
                        },
                        {
                            'label': 'Renewables',
                            'method': 'update',
                            'args': [{'visible': [False, False, True]}, {'title': 'Renewable Production'}]
                        },
                        {
                            'label': 'All Sources',
                            'method': 'update',
                            'args': [{'visible': [True, True, True]}, {'title': 'Energy Production in Slovakia'}]
                        }
                    ],
                    'direction': 'down',
                    'showactive': True,
                }
            ]
        )

        # Show the plot
```

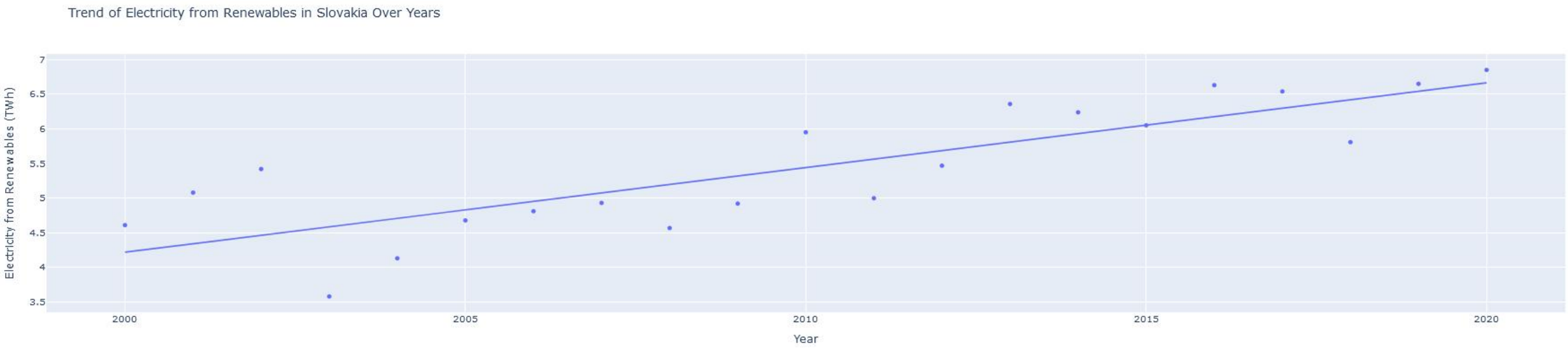
```python
#Dropdown menu combined with a sidebar from previous code
# Filter data for Slovakia
slovakia_data = df[df['Entity'] == 'Slovakia']

# Create the figure
fig = go.Figure()

# Add traces for each energy source
fig.add_trace(go.Scatter(
    x=slovakia_data['Year'],
    y=slovakia_data['Electricity from fossil fuels (TWh)'],
    name='Fossil Fuels',
    visible=True  # Initially visible
))

fig.add_trace(go.Scatter(
    x=slovakia_data['Year'],
    y=slovakia_data['Electricity from nuclear (TWh)'],
    name='Nuclear',
    visible=False  # Initially hidden
))

fig.add_trace(go.Scatter(
    x=slovakia_data['Year'],
    y=slovakia_data['Electricity from renewables (TWh)'],
    name='Renewables',
    visible=False  # Initially hidden
))

# Update layout with dropdown menu and slider
fig.update_layout(
    title='Energy Production in Slovakia',
    xaxis_title='Year',
    yaxis_title='Electricity Production (TWh)',
    xaxis=dict(
        rangeslider=dict(visible=True),
        type='linear'  # Ensure it's a linear scale for years
    ),
    updatemenus=[
        {
            'buttons': [
                {
                    'label': 'Fossil Fuels',
                    'method': 'update',
                    'args': [{'visible': [True, False, False]}, {'title': 'Fossil Fuels Production'}]
                },
                {
                    'label': 'Nuclear',
                    'method': 'update',
                    'args': [{'visible': [False, True, False]}, {'title': 'Nuclear Production'}]
                },
                {
                    'label': 'Renewables',
                    'method': 'update',
                    'args': [{'visible': [False, False, True]}, {'title': 'Renewable Production'}]
                },
                {
                    'label': 'All Sources',
                    'method': 'update',
                    'args': [{'visible': [True, True, True]}, {'title': 'Energy Production in Slovakia'}]
                }
            ],
            'direction': 'down',
            'showactive': True,
        }
    ]
)
```



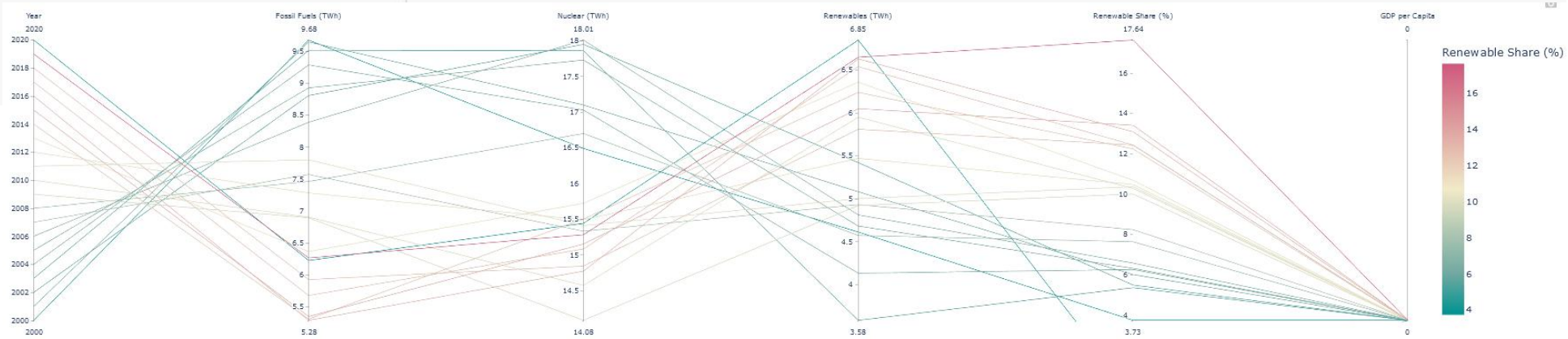
```python
# Create a scatter plot with a trend line
fig = px.scatter(
    df,
    x='Year',
    y='Electricity from renewables (TWh)',
    trendline='ols',  # Ordinary Least Squares regression for trend line
    title='Trend of Electricity from Renewables Over Years',
    labels={'Electricity from renewables (TWh)': 'Electricity from Renewables (TWh)', 'Year': 'Year'}
)

# Show the plot
fig.show()
```



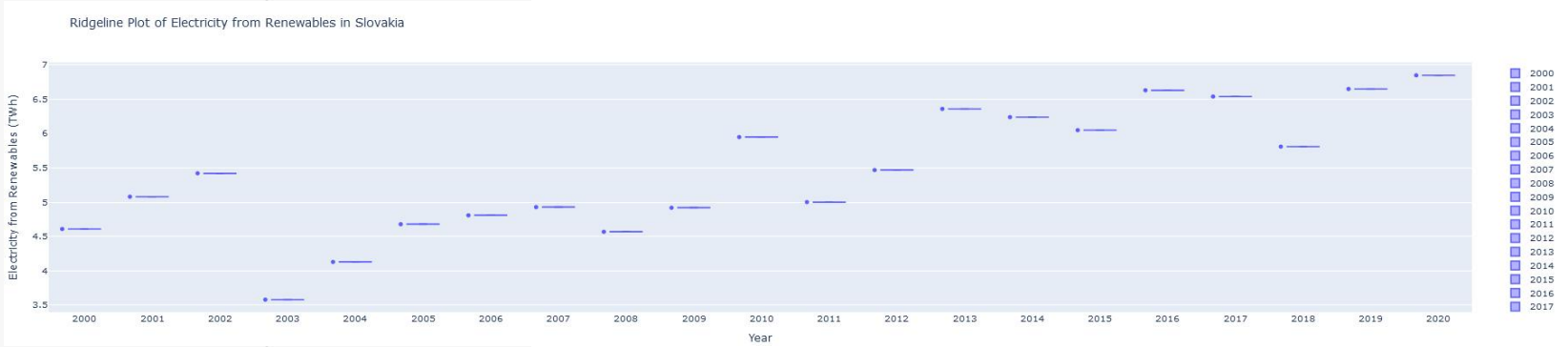
```python
#chart with a trendline

# Filter the DataFrame for Slovakia
slovakia_data = df[df['Entity'] == 'Slovakia']

# Create a scatter plot with trend lines for different energy types
fig = px.scatter(
    slovakia_data,
    x='Year',
    y='Electricity from renewables (TWh)',  # Change this to other columns as needed
    trendline='ols',  # Ordinary Least Squares regression for trend line
    title='Trend of Electricity from Renewables in Slovakia Over Years',
    labels={'Electricity from renewables (TWh)': 'Electricity from Renewables (TWh)', 'Year': 'Year'}
)

# Show the plot
fig.show()
```



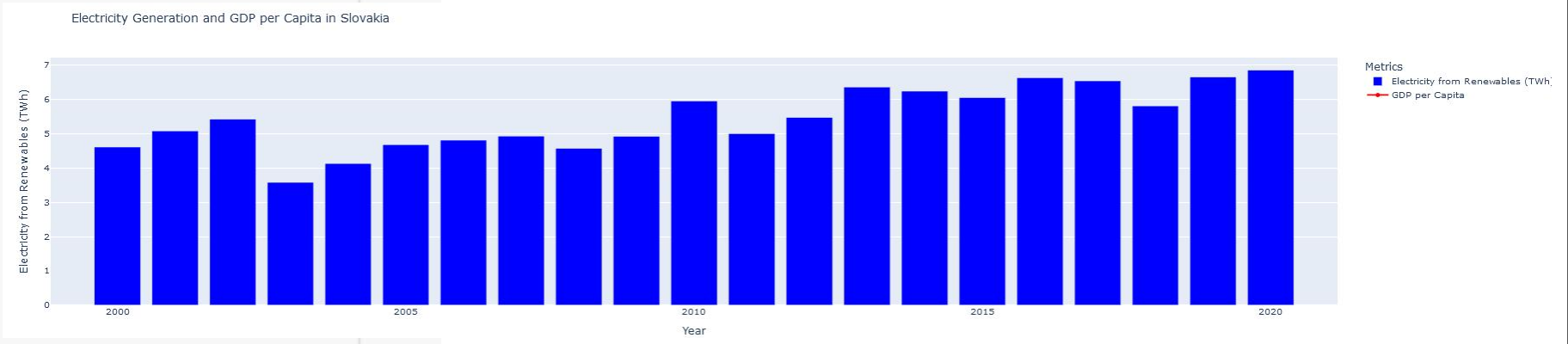
```python
# Parallel Coordinates Plot:
#The px.parallel_coordinates() function creates the plot.
#The color parameter is set to Renewable energy share in the total final energy consumption (%), allowing you to visualize how this variable changes across different years and energy types.
#The color_continuous_scale parameter sets the color gradient used for the lines.
# Filter the DataFrame for Slovakia
slovakia_data = df[df['Entity'] == 'Slovakia']

# Select relevant columns for the parallel coordinates plot
# Adjust the columns based on your interest and data availability
dimensions = [
    'Year',
    'Electricity from fossil fuels (TWh)',
    'Electricity from nuclear (TWh)',
    'Electricity from renewables (TWh)',
    'Renewable energy share in the total final energy consumption (%)',
    'gdp_per_capita'
]

# Create parallel coordinates plot
fig = px.parallel_coordinates(
    slovakia_data,
    dimensions=dimensions,
    color='Renewable energy share in the total final energy consumption (%)',  # Color by renewable share
    color_continuous_scale=px.colors.diverging.Tealrose,
    labels={
        'Electricity from fossil fuels (TWh)': 'Fossil Fuels (TWh)',
        'Electricity from nuclear (TWh)': 'Nuclear (TWh)',
        'Electricity from renewables (TWh)': 'Renewables (TWh)',
        'Renewable energy share in the total final energy consumption (%)': 'Renewable Share (%)',
        'gdp_per_capita': 'GDP per Capita'
    }
)

# Show the plot
fig.show()
```



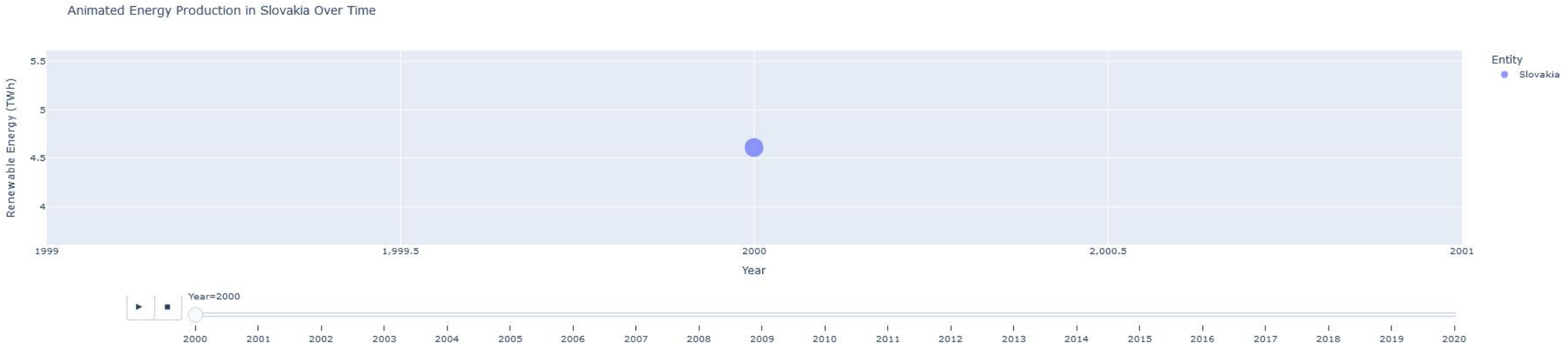
```python
#Working with Ridgeline charts
# Filter the DataFrame for Slovakia
slovakia_data = df[df['Entity'] == 'Slovakia']

# Select relevant columns for the ridgeline plot
# Here we will use 'Year' and 'Electricity from renewables (TWh)' as an example
years = slovakia_data['Year'].unique()
data_dict = {}

# Prepare data for ridgeline plot
for year in years:
    # Filter data for each year
    yearly_data = slovakia_data[slovakia_data['Year'] == year]['Electricity from renewables (TWh)']
    data_dict[year] = yearly_data

# Create a figure
fig = go.Figure()

# Add traces for each year's data
for year, values in data_dict.items():
    # Create a density trace for each year
    fig.add_trace(go.Violin(
        y=values,
        name=str(year),
        box_visible=True,
        line_color='blue',
        opacity=0.6,
        points='all',  # Show all points
        showlegend=True,
        scalegroup=str(year),  # Group by year to overlay them correctly
        spanmode='hard'
    ))

# Update layout to make it look like a ridgeline plot
fig.update_layout(
    title='Ridgeline Plot of Electricity from Renewables in Slovakia',
    yaxis_title='Electricity from Renewables (TWh)',
    xaxis_title='Year',
    yaxis=dict(zeroline=True),
    showlegend=True,
)

# Show the plot
fig.show()
```



```python
#Plotly that combines multiple chart types
# Filter the DataFrame for Slovakia
slovakia_data = df[df['Entity'] == 'Slovakia']

# Create a bar chart for electricity generation from renewables
bar_chart = go.Bar(
    x=slovakia_data['Year'],
    y=slovakia_data['Electricity from renewables (TWh)'],
    name='Electricity from Renewables (TWh)',
    marker_color='blue'
)

# Create a line chart for GDP per capita
line_chart = go.Scatter(
    x=slovakia_data['Year'],
    y=slovakia_data['gdp_per_capita'],
    name='GDP per Capita',
    mode='lines+markers',
    marker=dict(color='red')
)

# Create a figure and add both charts
fig = go.Figure()

# Add bar and line charts to the figure
fig.add_trace(bar_chart)
fig.add_trace(line_chart)

# Update layout for better visualization
fig.update_layout(
    title='Electricity Generation and GDP per Capita in Slovakia',
    xaxis_title='Year',
    yaxis_title='Electricity (TWh) / GDP per Capita',
    legend_title='Metrics',
    yaxis=dict(title='Electricity from Renewables (TWh)', side='left', showgrid=True),
)

# Show the plot
fig.show()
```



```python
import pandas as pd
import plotly.express as px

# Assuming df is your DataFrame and it contains relevant columns
# Filter for Slovakia if necessary
slovakia_data = df[df['Entity'] == 'Slovakia']

# Example: Create an animated scatter plot
fig = px.scatter(
    slovakia_data,
    x='Year',  # Replace with the appropriate x-axis variable
    y='Electricity from renewables (TWh)',  # Replace with the appropriate y-axis variable
    animation_frame='Year',  # Column for animation frames
    animation_group='Entity',  # Grouping variable, if applicable
    size='Electricity from nuclear (TWh)',  # Size of markers based on another variable, if desired
    color='Entity',  # Color by entity (if you have multiple entities)
    hover_name='Entity',  # Hover information
    title='Animated Energy Production in Slovakia Over Time',
    labels={'Electricity from renewables (TWh)': 'Renewable Energy (TWh)', 'Year': 'Year'}
)

# Show the plot
fig.show()
```



THANK YOU