Collaborative and Reproducible Practices

Global Renewable Energy Leaders

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1 Executive summary

This report investigates global trends in renewable energy transitions by analyzing the top 10 countries in 2023 and examining the energy sources in the leading country. The analysis uses reliable data from Our World in Data. Among these countries, Norway stands out as a global leader with 72.09% of its primary energy sourced from renewables. These findings offer valuable insights for shaping national strategies toward sustainable energy transitions.

2 Introduction

The global energy landscape has transformed rapidly in the last few decades. Many countries are transitioning toward renewable sources—such as hydropower, wind, and solar—in response to climate change and resource sustainability challenges. Renewables now serve as a critical alternative to fossil fuels, helping to reduce dependence and mitigate greenhouse gas emissions.

Throughout the report, global renewable energy trends are identified, with a focus on the top 10 countries with the highest proportion of renewable energy in total energy consumption in 2023. Norway leads the way, with roughly 72% of its primary energy sourced from renewable. Sweden and Brazil are also undergoing significant transitions, with 53.9% and 50.3% renewable shares, respectively.

A deeper analysis of Norway is conducted to understand how a developed country achieves high renewable integration through energy infrastructure management. Understanding these factors behind Norway's performance can be beneficial for planning and improving renewable energy policies and strategies that could be adapted to different regional and national contexts. This analysis aims to provide a useful insight that can guide future energy transitions globally.

Specifically, the report explores two key questions on why Norway leads in renewable energy share, and whether its dominance reflects real capacity or just proportional advantage.

3 Methodology

The primary dataset, obtained from Our World in Data, includes global and country-level renewable energy statistics. Aggregate regions were excluded to identify the top 10 countries by renewable energy share in 2023.

Norway, ranked first, was selected for focused analysis. Its domestic electricity mix and compares hydropower generation were examined to understand the underlying drivers of its performance. A comparative approach was used to assess whether Norway's leadership is based on share percentage or absolute capacity.

3.1 Top 10 Countries by Renewable Energy Share in 2023

Table 1: *Top 10 Countries by Renewable Energy Share (%) in 2023*

Country	Code	Year	Renewables (%)
Norway	NOR	2023	72.09110
Sweden	SWE	2023	53.89018
Brazil	BRA	2023	50.33141
Denmark	DNK	2023	42.73486
New Zealand	NZL	2023	42.26695
Austria	AUT	2023	40.08019
Switzerland	CHE	2023	38.32534
Portugal	PRT	2023	36.04341
Finland	FIN	2023	35.93626
South and Central America (EI)	NA	2023	35.39018

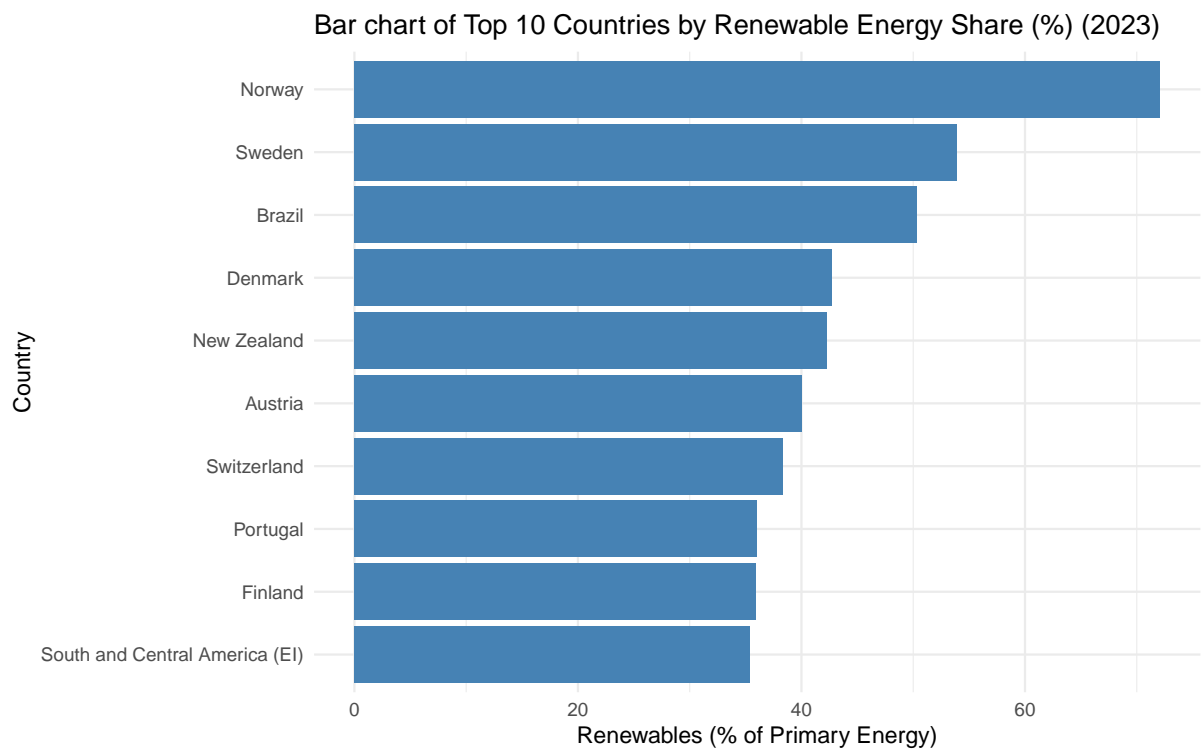Bar chart of Top 10 Countries by Renewable Energy Share (%) (2023)

Figure 1: *Bar chart of Top 10 Countries by Renewable Energy Share (%) (2023)*

Table 1 and Figure 1 show that Norway led in 2023 with 72.09% renewable energy share, ahead of Sweden (53.9%) and Brazil (50.3%). These figures indicate a strong national commitments toward renewable transitions.

3.2 Norway: Global Leader in 2023

To understand Norway's energy landscape, electricity generation by source was analysed.

Table 2: *Norway's Renewable Electricity Generation by Source in 2023 (TWh)*

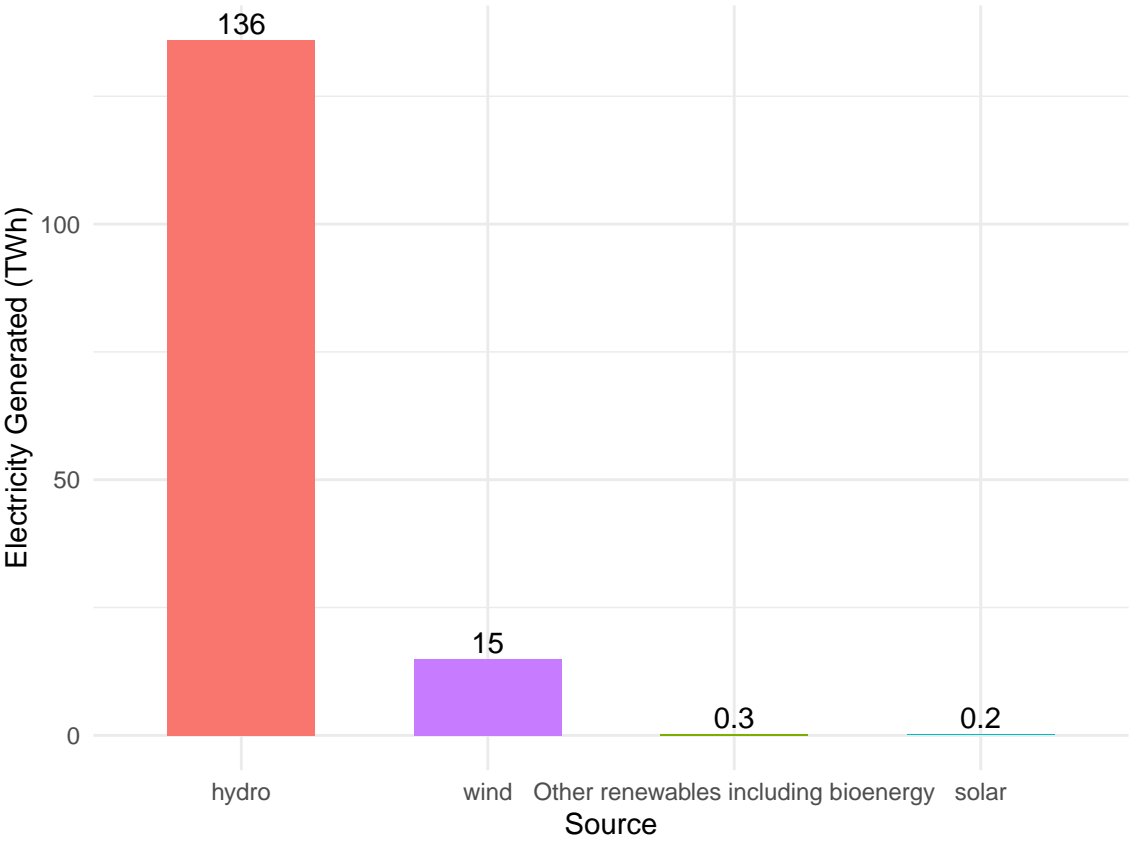| Source	TWh
wind	14.96
hydro	135.96
solar	0.17
Other renewables including bioenergy	0.26

Figure 2: *Norway's Renewable Electricity Breakdown by Source in 2023 (TWh)*

Figure 2 shows that hydropower contributed over 90% of Norway's renewable electricity in 2023 (136 TWh), with smaller shares from wind (15 TWh), solar (0.17TWh), and others like bioenergy (0.26 TWh). This dominance underscores Norway's reliance on single resource, **hydropower**, rather than a diverse portfolio.

3.3 Global Hydropower Generation by Country (2023)

While Norway's renewable share is impressive, percentage alone may not reflect actual capacity. A high share could result from low overall demand.

Therefore, absolute generation was compared with other major economies to determine whether its position is based on scale, not proportion.
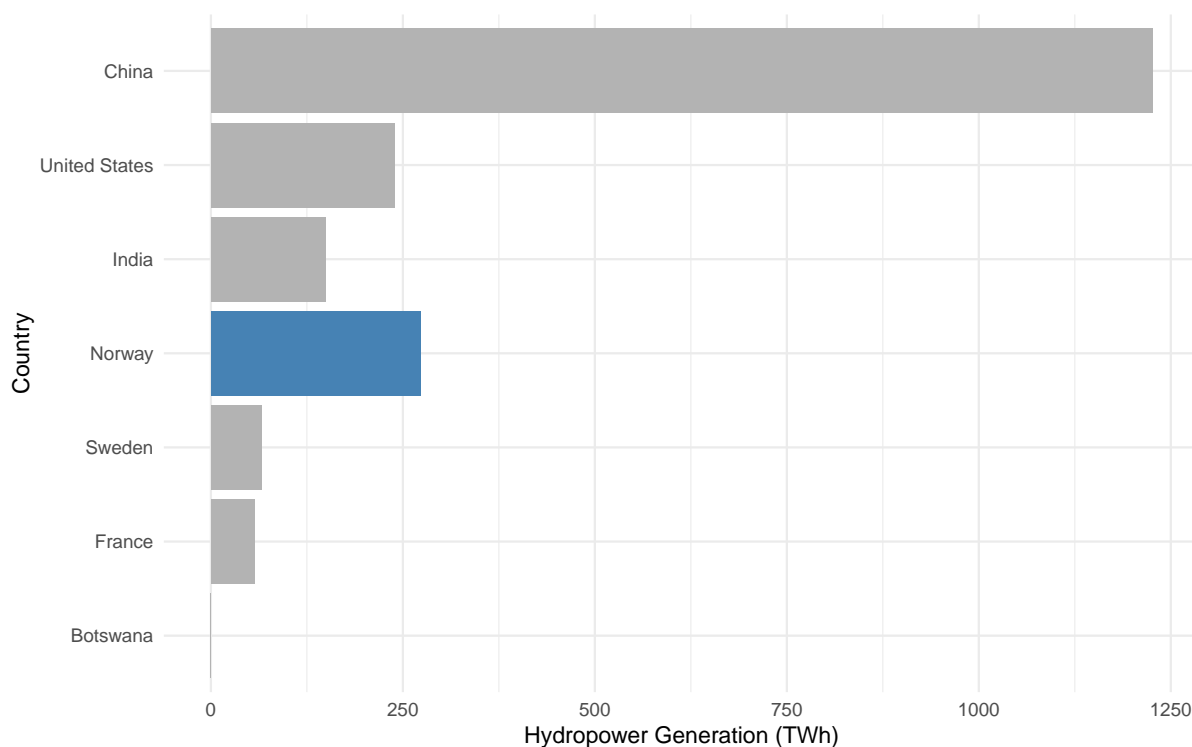

Figure 3: *Global Hydropower Generation (TWh) in 2023 by Country*

Figure 3 reveals Norway's hydropower generation (270 TWh) surpassed the U.S. (239 TWh) and India (149 TWh), despite its smaller size. This confirms Norway's leadership is not only proportional but also based on substantial capacity and infrastructure.

4 Results

In 2023, Norway led globally with 72.09% of its primary energy sourced from renewables, followed by Sweden (53.9%) and Brazil (50.3%) as shown in Table 1. This highlights clear margin by which Norway outpaces others.

Figure 1 further illustrates this dominance. Norway's exceptional performance reflects its sustained investment and advanced energy infrastructure.

Table 2 and Figure 2 reveal that over 90% of Norway's electricity in 2023 came from hydropower, with limited contributions from wind, solar, and bioenergy.

As shown in Figure 4, Norway has maintained a renewable shares above 60% for two decades, indicating a consistent national strategy and resilient infrastructure.

Overall, these findings suggest that Norway's leadership is not just proportional but also supported by substaintial generation. The case demonstrates how favorable geography, policy stability, and long-term planning can enable successful robust renewable energy integration.
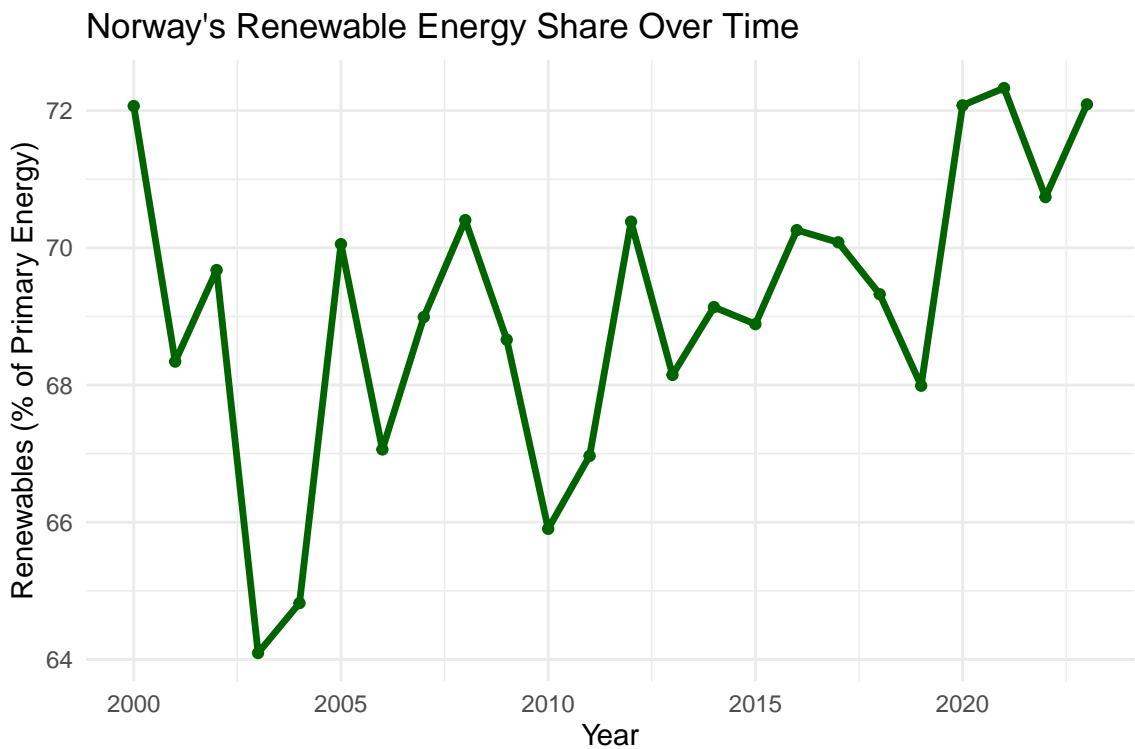

Figure 4: *Norway's Renewable Energy Share (2000–2023)*

5 Conclusion

The findings shed light on the structural factors driving Norway's renewable energy leadership. Its top ranking is the result of long-term investment in hydropower, supported by favorable geography and consistent national policy. Norway's energy profile—dominated by hydropower—demonstrates how natural resources can be effectively leveraged for a low-emission energy transition.

Nevertheless, dependence on a single energy source introduces potential risks. Climate variability—such as droughts and shifting precipitation patterns—could significantly reduce hydroelectric output. Additionally, Norway's limited deployment of wind, solar, and bioenergy reveals an untapped opportunity for further diversification of its renewable portfolio.

The international comparison further reinforces that Norway's renewable dominance is not just proportional but also absolute. This rare combination of high renewable share and significant generation volume underscores the success of sustained, resource-aligned energy strategies.

In conclusion, Norway's case exemplifies how geographic advantages, when matched with consistent national policy and infrastructure investment, can result in world-leading performance in renewable energy integration.

A key limitation of this study is its focus on quantitative data, without capturing differences in policy or social context. Future research could explore how governance, incentives, and behavior shape renewable adoption. Studying other high-performing countries may also offer valuable policy insights.

Recommendations

- *Diversify energy sources*: Invest in wind and solar to reduce over reliance on hydropower.
- *Modernize energy infrastructure*: Improve grid flexibility to integrate more variable renewables.
- *Export expertise*: Share Norway's policy, regulatory, and engineering frameworks with other nations.
- *Support adaptive policy*: Prepare for climate risks by developing redundancy and storage solutions.

6 References

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