Renewable energy highlights

11 July 2024

HEADLINE FIGURES

Electricity Generation

8 440 TWh

Renewables in 2022

29.1% | 7.2%

Renewables | YoY Growth

11.7% | 18.2%

Variable Renewables | YoY Growth

Hydro	**4 330** TWh
Wind	**2 098** TWh
Solar	**1 294** TWh
Bioenergy	**619** TWh
Geothermal	**97** TWh
Marine	**1** TWh

Electricity capacity

3 865 GW

Renewables in 2023

43.0% | 14.0%

Renewables | YoY Growth

27.1% | 23.4%

Variable Renewables | YoY Growth

Solar	**1 418** GW
Hydro	**1 265** GW
Wind	**1 017** GW
Bioenergy	**149** GW
Geothermal	**15** GW
Marine	**1** GW

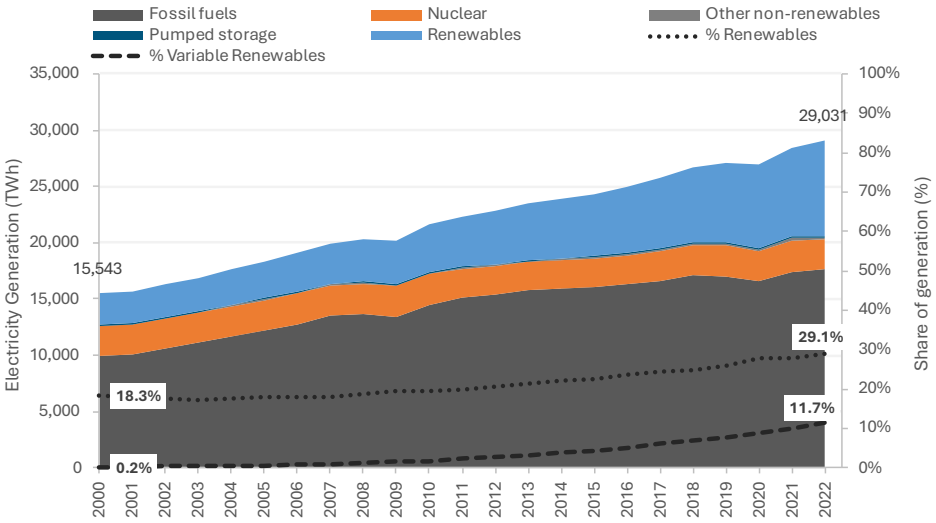
11.17 TW target by 2030

Progress | To go

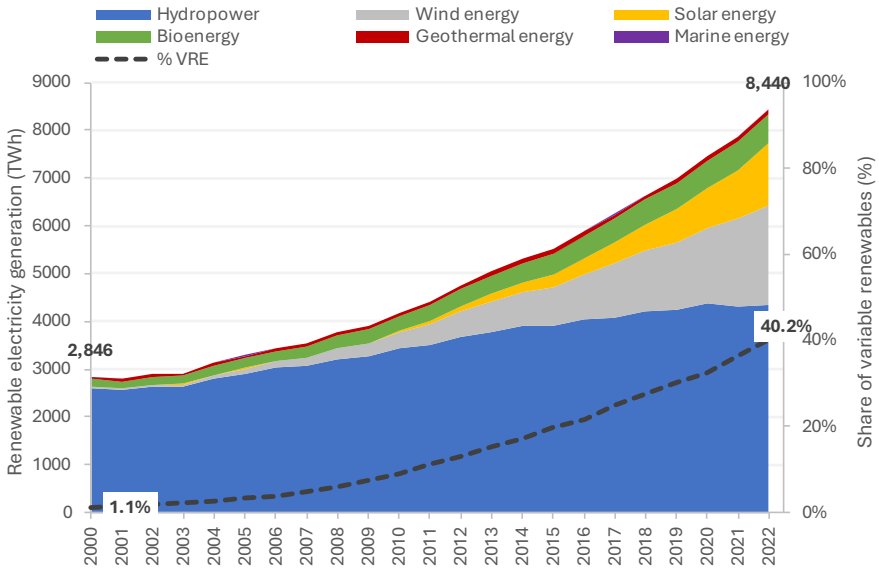
0.47 TW since 2022 | **7.31 TW** to meet target

Electricity generation by energy source

Renewable energy sources accounted for 29.1% of electricity generation globally in 2022, totalling 8 440 TWh. The other 70.9% (20 591 TWh) corresponded to fossil fuels, nuclear energy, pumped storage and other non-renewables, bringing global electricity generation from all sources to 29 031 TWh in 2022.



Total electricity generation increased by 2.4% annually since 2011. Renewables contributed at a rate of 6.1%, while non-renewables showed a 1.3% growth rate. In 2022 alone, renewable electricity grew by 7.2% over 2021. However, there have been similar and larger annual growth rates over the past decades. Since 2010, the largest growth in renewable electricity has been driven by solar and wind energy (variable renewables), which reached 11.7% of the global electricity mix in 2022 with a growth of 18.2% from 2021.



Renewable electricity generation by energy source

Over the past decades, the profile of renewable energy sources has significantly diversified. While hydropower* continues to provide the bulk of electricity generation, variable renewables have steadily increased their share in the global electricity mix, growing from 1.1% of renewable generation in 2000 to 40.2% in 2022.

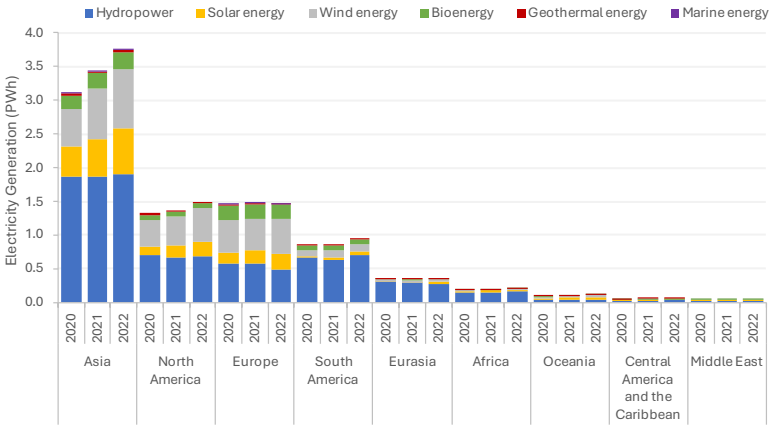
In 2022, hydropower remained the largest source of renewable electricity, generating 4 330 TWh, a modest 0.8% increase over 2021. Wind energy follows, producing 2 098 TWh, marking a 14.0% increase compared to 2021. Solar energy, the fastest-growing renewable energy source in recent years, generated 1 294 TWh, a year-on-year increase of more than one quarter (25.6%). Bioenergy produced 619 TWh, growing by 1.5%, while geothermal energy contributed 97 TWh and marine energy was close to 1 TWh.

Renewable electricity generation by region

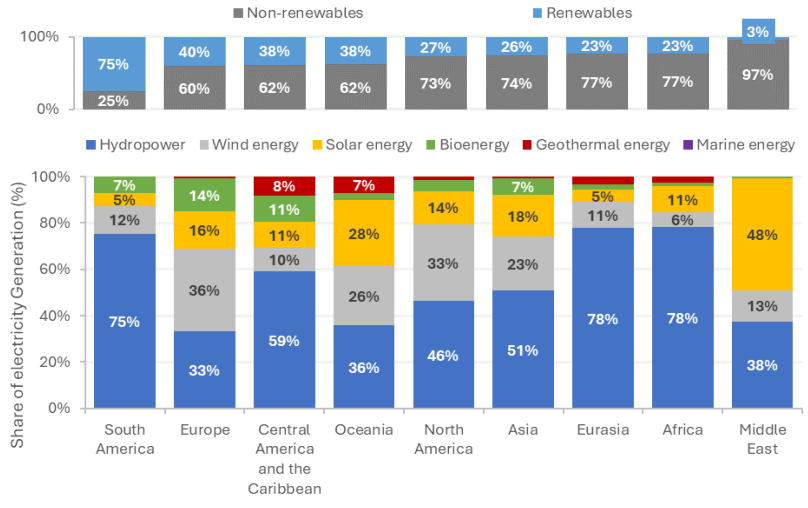
In absolute terms of renewable electricity generation, Asia led the world in 2022, generating 3 749 TWh, a 9.3% increase driven by solar and hydropower, both offsetting declines in wind energy and bioenergy.

North America came in second for the first time, with 1 493 TWh, up by 8.6% across energy sources, despite a drop in bioenergy. Europe generated 1 462 TWh a small 0.6% decrease from 2021. South America generated 940 TWh, showing an 11.9% increase from 2021 due to a hydropower recovery and a greater role of solar energy.

Eurasia produced 363 TWh, growing slightly by 2.5%, with solar and wind making up for continuous declines in hydropower. Africa generated 205 TWh, showing a modest growth of 3.5% across all sources. Oceania generated 125 TWh, a robust 14.1% increase across energy sources. Central America and the Caribbean followed with 57 TWh with a 1.3% growth. Lastly, the Middle East generated 47 TWh, seeing a 16.9% rise due to new wind energy additions and ongoing solar expansion.



In terms of the electricity mix by region, South America leads the way with 75.0% of its electricity coming from renewable sources, predominantly hydropower, which accounts for three-quarters of their renewable energy. Europe follows with 40.5% of its electricity from renewables, characterized by a more varied mix: 35.7% wind energy, 33.3% hydropower, 16.1% solar, 14.0% bioenergy and 0.8% geothermal. Central America and the Caribbean, along with Oceania, both generate close to 38% of their electricity from renewables.



In North America, renewables contribute to 27.0% of the electricity mix, while in Asia, the figure is 26.2%. Eurasia had 23.5% renewable electricity, while Africa had 22.8%. Lastly, the Middle East lags significantly behind, with just 3.4% of its electricity generated from renewables.

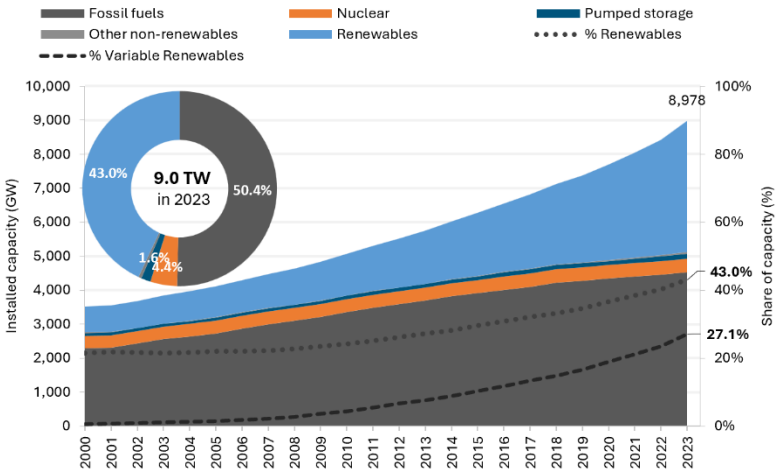
* hydropower (excluding pumped storage)

The G20 and G7 countries generated mostly non-renewable electricity in 2022 and less renewable electricity than the global 29.1%. G20 countries produced 28.9% of their electricity with renewable sources, while the G7 generated 28.5% renewable electricity. Both groups have similar breakdowns in renewable sources. Out of all renewable electricity generated in 2022, G20 countries had 46.3% hydropower, 28.4% wind energy, 16.5% solar energy, 7.9% bioenergy and traces of geothermal energy. G7 countries had 36.6% hydropower, 33.1% wind energy, 18.0% solar energy, 9.5% bioenergy and 1.2% of geothermal energy.

Revisions to renewable generating capacity

IRENA's latest statistics include some minor revisions to the 2023 renewable generating capacity reported in March 2024. Total renewable generating capacity in 2023 has been revised downwards by 5.2 GW to 3 865 GW. The decrease occurred due to revisions in hydropower and bioenergy power plants.

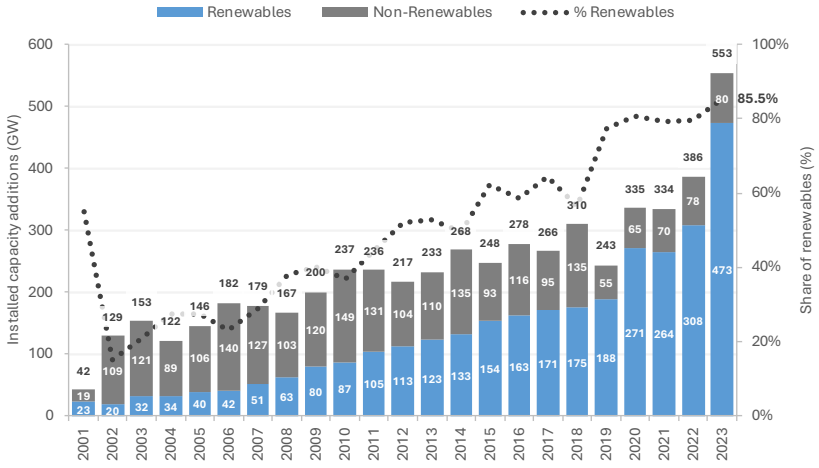
The revised figures show that at the end of 2023, renewable capacity accounted for 3.9 TW or 43.0% out of the 9.0 TW of global total capacity including non-renewables. It indicates an unprecedented 14.0% increase from 2022. Such growth established a recent trend of 10.0% compound annual growth rate (from 2017-2023). Within renewables, variable renewable capacity grew by 23.4% over 2022 to reach 27.1% of total capacity.



The rest of installed capacity amounts to 5.1 TW (57.0%) of non-renewable power comprised of 4.5 TW (50.4%) of fossil fuels, 398 GW (4.4%) of nuclear energy, 142 GW (1.6%) of pumped storage and 45 GW (0.5%) of other non-renewables. The recent trend sets renewables as the fastest growing capacity source combined with a slowdown of non-renewables and even large decommissioning of fossil fuel plants in several countries.

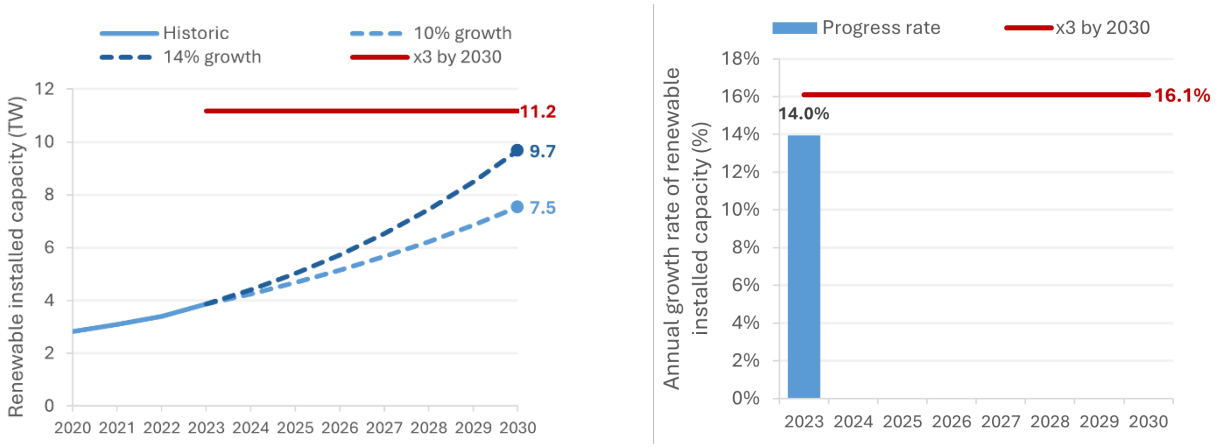
In 2023, solar energy was the largest source of renewable capacity at 36.7% or 1 418 GW, followed by 32.7% hydropower (1 265 GW), 26.3% wind energy (1 017 GW), 3.9% bioenergy (149 GW) and traces of geothermal and marine energy. The share of variable renewables (wind and solar) has increased to 63.0% of renewable capacity, indicating a shift towards these more intermittent energy sources. The status of solar energy as the main source of capacity is likely to remain in future years, also reflected by its predominance in 347 GW out of 473 GW of renewable power additions in 2023.

Renewable capacity additions had a notable increase over the past 23 years, with 2023 seeing a peak of 473 GW of new renewable capacity. Moreover, the share of renewables in annual capacity additions has steadily increased, reaching 85.5% in 2023. Non-renewable capacity additions have remained relatively constant or decreased over the years, staying below 80 GW annually since 2019.



Reaching the global tripling target of 11.174 TW by 2030

The 473 GW of renewable capacity added in 2023 marked a 14.0% increase and the largest annual growth since 2000. However, this rate is insufficient to meet the tripling renewable capacity target of at least 11 TW by 2030. Maintaining this growth would yield only 9.7 TW of renewables by 2030, falling 1.5 TW (13.5%) short of the target.



If the historic growth rate of 10.0% since 2017 continues, the world would achieve only 7.5 TW of renewables, missing the target by 3.7 TW (32.6%). To meet the target required a minimum annual growth rate of 16.1% from 2022 through to 2030. Despite the unprecedented growth in 2023, we still fell short of the growth required to meet the target. With 2023 as the first year of progress, the world fell short by 2.1 percentage points; this means that during the remaining years of the target period, renewable capacity must now grow by more than the original target rate of 16.1% to compensate for this shortfall. A growth rate of 16.4% is now required over the remaining 7 years.

Heat generation

Commercial heat is used for various purposes, and in energy statistics we account for this heat in terms of joules of sold heat. Among electricity capacity, electricity generation, and heat generation, the latter typically lags in terms of renewable energy penetration. In 2022, only 6.3% of global heat generation came from renewable sources, totalling 936 PJ. The remaining 93.7% (13 886 PJ) was generated from fossil fuels, with traces of nuclear and other non-renewable sources.

The share of renewable heat generation has increased from 2.5% in the year 2000, albeit at a significantly slower growth rate than electricity. Bioenergy holds the largest share, contributing 91.6% of renewable heat in 2022, with similar historical rates. Other significant sources include geothermal and solar thermal energy. Europe leads the way in renewable heat generation, accounting for 92.1% of the global renewable heat generation and with a renewable share of 10.7% of the 8 028 PJ of heat generated in the region. Asia generated 6 351 PJ of heat in 2022, but less than 1% came from renewable sources. Finally, the Americas produced 443 PJ of heat in 2022, with 9.2% from renewable sources.

Other renewable energy information

IRENA produces renewable energy balances for a select number of countries. These are available for the latest two years of information (2021 and 2022) in the report and for a wider number of years on the online tools. Finally, data for the SDG indicators 7.a.1 (international public financial flows toward renewables) and 7.b.1 (renewable installed capacity per capita) are also included in the report.

For any inquiries or questions, please contact us at statistics@irena.org.