

Renewable Energy Capacity and Production in Hungary and Germany

- Hungary's wind power capacity stands at 329 MW, with recent regulatory reforms aiming to expand this sector.
- Hungary's solar capacity has surged to over 7,550 MW, exceeding 2030 targets early, with 25% of electricity from solar in 2024.
- Germany's wind capacity is robust at ~60 GW onshore and 8 GW offshore, contributing 30% to its electricity mix, with 4 GW added in 2024.
- Germany's solar capacity reached 99.3 GW by end of 2024, generating 72.2 TWh annually, targeting 215 GW by 2030.
- Hydropower capacity is 11.2 GW in Germany and limited in Hungary, with mature infrastructure and modest growth expected.

Introduction

The transition to renewable energy is a critical pillar of climate change mitigation and energy security in Europe. Hungary and Germany, two EU member states with different geographies, economies, and energy histories, provide an interesting comparative case study. This report presents a detailed analysis of the current installed capacity, energy production, and recent trends in wind, solar, and hydropower for both countries. It also includes historical sunshine data for the European Union, essential for understanding solar energy potential over time. The data is drawn from official and reputable sources, including government agencies, research institutions, and international organizations.

Wind Power

Hungary

Hungary's wind power sector remains nascent compared to other European countries. As of 2025, the installed wind capacity is 329 MW, with the largest wind farm being the Ács Wind Farm (74 MW) ^{1 2}. Historically, regulatory barriers have constrained development, notably a 2016 ban on new wind farms within 12 km of populated areas. However, recent legislative reforms have reduced this protection zone to 700 meters and abolished mandatory tendering procedures, signaling a more favorable environment for wind energy expansion ². Despite these changes, wind power's share in Hungary's electricity mix remains low, at approximately 1.3–1.5% ².



Germany

Germany is a European leader in wind energy, with approximately 60 GW of onshore and 8 GW of offshore wind capacity installed, contributing around 30% to the national electricity mix ³. In 2024, Germany added 4 GW of new wind capacity, the most in Europe, reflecting its ongoing rapid expansion and commitment to renewable energy targets ³. The EU-27 collectively installed 12.9 GW of new wind capacity in 2024, with 89% onshore, underscoring Germany's pivotal role in this sector ³. Germany's wind energy sector is well-supported by policy frameworks and investment, with expectations of continued growth through 2030 and beyond.

Solar Power

Hungary

Hungary has experienced remarkable growth in solar power capacity, surpassing 7,550 MW by early 2025, which is 25% higher than the 2030 target set previously ^{4 5}. The country aims to reach 12 GW of solar capacity by the early 2030s ⁵. Solar energy production peaked in June 2025, briefly covering 100% of domestic electricity demand from renewables ⁶. In 2024, solar energy accounted for 25% of Hungary's electricity generation, a significant increase from prior years ⁵. Government programs such as the Solar Energy Plus Programme have driven adoption, with nearly 300,000 household solar systems installed. Hungary is also investing in energy storage to optimize solar fleet utilization ^{4 6}.

Germany

Germany's solar capacity reached 99.3 GW by the end of 2024, generating 72.2 TWh of electricity, accounting for 14% of the country's total electricity output ^{7 8 9}. The German government has set ambitious targets: 40–45% renewable energy share by 2025 and 55–60% by 2035, with solar playing a central role ¹⁰. Germany installed 16.2 GW of new solar capacity in 2024 alone, reflecting rapid market growth ⁹. The country also leads in innovative solar applications, including balcony PV systems, with nearly 800,000 units installed by end of 2024 ⁸. Germany's solar market is supported by strong policy frameworks and a well-developed supply chain.

Hydropower

Hungary

Hungary's hydropower capacity is limited by its geography within the Carpathian Basin. The largest hydroelectric dams are on the Tisza River, with capacities of 12.5 MW and 28 MW ¹. Hydropower contributes a small fraction to Hungary's renewable energy mix, overshadowed by biomass and solar energy ¹¹. The Hungarian government has rejected plans for new dams on the Drava River, which may constrain future hydropower expansion ¹.



Germany

Germany's hydropower capacity was 11,164 MW as of 2023, accounting for 4% of total installed capacity and 3% of electricity generation ^{12 13}. The country has 26 pumped storage hydro power stations with a combined capacity of 6.3 GW, and this capacity is projected to grow by 1.4 GW by 2030 ¹⁴. Hydropower in Germany is a mature sector with limited growth potential but remains an important component of the renewable energy mix and grid stability.

Historical Sunshine Data for the European Union

Data Sources and Methodologies

Historical sunshine data for Europe is primarily available through satellite-based climate data records. Key datasets include:

- **CM SAF Sunshine Duration Climate Data Record:** Provides 35 years (1983–2017) of sunshine duration data based on satellite observations from EUMETSAT's Satellite Application Facility on Climate Monitoring (CM SAF). This dataset is part of the SARA-2.1 product and offers daily and monthly time scales, enabling analysis of anomalies and trends across Europe ^{15 16}.
- **HelioClim Databases:** Offer daily and monthly surface solar irradiance data from 1985 onwards, derived from Meteosat satellite imagery. HelioClim-1 covers 1985–2005, while HelioClim-3 provides higher resolution (3 km) data from 2004 onwards. These databases are freely accessible and widely used for climate and renewable energy applications ^{17 18}.
- **Copernicus Climate Change Service:** Provides maps and visualizations of sunshine duration anomalies, highlighting regional variations and trends. For example, 2018 saw widespread anomalies exceeding 20% more sunshine than average in central and northern Europe, while southern Europe experienced below-average sunshine ^{15 19}.
- **European State of the Climate Reports:** Detail annual and seasonal sunshine duration anomalies relative to reference periods (e.g., 1991–2020), showing spatial distributions and trends across Europe ^{20 19}.
- **Solargis and Vivid Maps:** Offer solar resource maps and visualizations based on meteorological station data and satellite observations, providing insights into regional sunshine patterns and their influencing factors such as latitude, topography, and ocean currents ^{21 22 19}.

Trends and Patterns

- Europe's average annual sunshine duration is approximately 2,335 hours, with significant regional variability ¹⁵.



- Central and northern Europe have experienced increasing sunshine duration anomalies, with some regions recording up to 40% more sunshine than average in recent years ^{15 19}.
- Southern Europe generally has higher annual sunshine hours but has seen below-average sunshine in some years due to increased cloud cover and precipitation ^{15 19}.
- Climate change projections suggest a trend toward increased sunshine in southern Europe and relatively stable or slightly decreasing sunshine in northern Europe, influenced by changing cloud cover and atmospheric conditions ^{21 19}.

Summary Table of Key Renewable Energy and Sunshine Data

Parameter	Hungary	Germany	Notes
Wind Power			
Installed Capacity (MW)	329	~68,000 (60 GW onshore + 8 GW offshore)	Germany's wind capacity is among the highest in Europe ³
Annual Energy Production (GWh)	~1,000 (estimated)	~150,000 (estimated)	Hungary's wind share ~1.3–1.5% vs. Germany's 30% ^{13 2}
Recent Trends	Regulatory reforms reducing protection zones; slow growth	Rapid expansion, 4 GW added in 2024; EU leader ^{3 2}	
Solar Power			
Installed Capacity (MW)	>7,550	99,300	Hungary exceeded 2030 solar target early; Germany targets 215 GW by 2030 ^{4 5 7 9}
Annual Energy Production (GWh)	~10,000 (25% of electricity)	72,200 (14% of electricity)	Hungary's solar share rapidly growing; Germany's solar output increasing with capacity ^{4 5 8 9}
Recent Trends	Strong government support; energy storage investments	Balcony PV growth; 16.2 GW installed in 2024 ^{4 6 8 9}	
Hydropower			
Installed Capacity (MW)	~40 (limited)	11,164	Hungary's hydropower limited by geography; Germany's capacity mature ^{1 12 14}



Parameter	Hungary	Germany	Notes
Annual Energy Production (GWh)	~200 (estimated)	~20,000	Hydropower contributes 3–4% to Germany's electricity mix ^{23 14}
Recent Trends	No major new dams planned	Pumped storage capacity to grow by 1.4 GW by 2030 ^{1 14}	
Historical Sunshine (EU)			
Average Annual Sunshine (hours)	~2,300 (Hungary)	~1,716 (Germany)	Regional variability due to climate and geography ^{24 25 19}
Sunshine Anomalies	Positive anomalies in east	Up to 40% positive anomalies in 2018; sunniest year recorded ^{15 19}	
Data Sources	CM SAF, HelioClim, Copernicus	CM SAF, HelioClim, Copernicus	Satellite-based, high-resolution datasets ^{15 16 17 18 19}

Conclusion

Hungary and Germany exhibit contrasting profiles in renewable energy development and solar resource availability. Hungary, despite its smaller size and historical regulatory constraints, has made remarkable strides in solar energy capacity and production, exceeding 2030 targets early and achieving a 25% solar share in electricity generation. Wind power remains underdeveloped but shows signs of regulatory easing. Hydropower plays a minor role due to geographical limitations.

Germany, a European renewable energy leader, boasts a well-established wind sector with 30% of electricity from wind and significant offshore and onshore capacity. Its solar sector is also robust, with nearly 100 GW installed and ambitious targets for 2030. Hydropower capacity is mature and stable, contributing modestly to the energy mix.

Historical sunshine data from satellite records and climate services reveal that Europe's solar resource varies significantly by region, with central and northern Europe experiencing increasing sunshine anomalies, while southern Europe shows more stable or slightly decreasing trends. These datasets provide essential context for renewable energy planning and climate modeling.

Overall, both countries demonstrate strong commitment to renewable energy expansion, with Hungary rapidly growing its solar capacity and Germany maintaining leadership in wind and solar sectors. The historical sunshine data underscores the importance of regional climate



patterns in shaping renewable energy potential and the need for continued investment in sustainable energy infrastructure.

[1](#) [3](#) [2](#) [4](#) [5](#) [6](#) [7](#) [10](#) [8](#) [9](#) [12](#) [13](#) [23](#) [14](#) [15](#) [20](#) [21](#) [22](#) [16](#) [17](#) [18](#) [24](#) [25](#) [19](#)

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 - [\[2\] Green light to Hungarian wind energy! – An update 8 months in - Bird & Bird](#)
 - [\[3\] Wind energy in Europe: 2024 Statistics and the outlook for 2025-2030 | WindEurope](#)
 - [\[4\] Hungary Leads Europe in Solar Energy Production - Hungarian Conservative](#)
 - [\[5\] How Hungary became the world's solar energy leader](#)
 - [\[6\] Hungary's solar capacity surpasses 8 GW](#)
 - [\[7\] Bundesnetzagentur - Press - Growth in renewable energy in 2024](#)
 - [\[8\] Germany hits 62.7% renewables in 2024 electricity mix, with solar contributing 14% – pv magazine International](#)
 - [\[9\] Germany deploys 16.2 GW of solar in 2024 – pv magazine International](#)
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 - [\[14\] German government says pumped hydro power capacity to grow by 1.4 GW by 2030 | Clean Energy Wire](#)
 - [\[15\] Sunshine duration](#)
 - [\[16\] About the data and analysis | Copernicus](#)
 - [\[17\] The HelioClim Project: Surface Solar Irradiance Data for Climate Applications](#)
 - [\[18\] \(PDF\) HelioClim: a long-term database on solar radiation for Europe and Africa](#)
 - [\[19\] ESOTC 2022 | Europe Wind and solar energy resources](#)
 - [\[20\] Clouds and sunshine duration](#)
 - [\[21\] Europe's Sunshine Map - Vivid Maps](#)
 - [\[22\] Solar resource maps & GIS data for 200+ countries | Solargis](#)
 - [\[23\] Higher than average precipitation drives up German hydropower generation | Clean Energy Wire](#)
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 - [\[25\] Climate comparison: Germany / Hungary](#)

