

# China continues to lead the world in wind and solar, with twice as much capacity under construction as the rest of the world combined

China is cementing its position as the global leader in renewables development with 180 GW of utility-scale solar and 159 GW of wind power already under construction<sup>1</sup>. The total of the two is nearly twice as much as the rest of the world combined, and enough to power all of South Korea, according to new data from Global Energy Monitor (GEM). The 339 GW of utility-scale solar and wind that have reached the construction stage accounts for one-third of all proposed wind and solar capacity in China, far surpassing the global construction rate of just 7%, according to GEM's latest Global Solar Power Tracker and Global Wind Power Tracker updates.<sup>2</sup> The stark contrast in construction rates illustrates the active nature of China's commitment to building renewables projects.

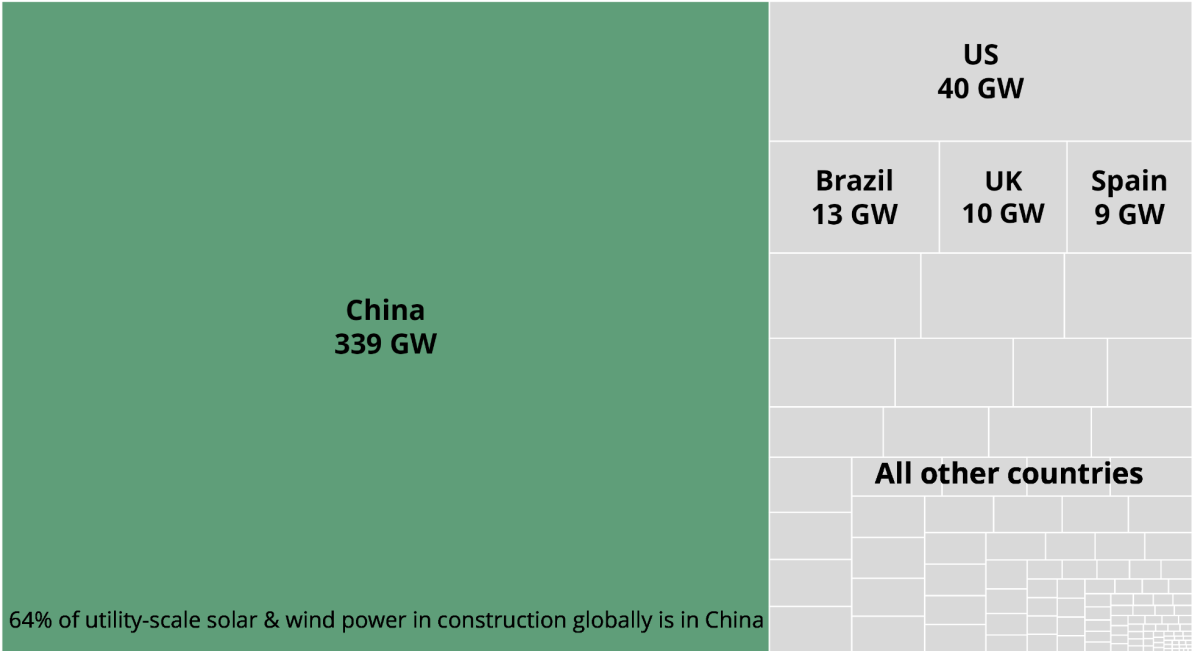
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<sup>1</sup> GEM's solar tracker includes utility-scale solar farm phases with a capacity of 20 MW or greater and wind tracker is specifically focused on wind projects with a capacity threshold of 10 MW or greater.

<sup>2</sup> The solar figures under construction could be even higher, since GEM's utility-scale solar data does not include small scale distributed solar, which has experienced a boom since 2021, and now accounts for 41% of the total solar capacity.

# China is home to almost two-thirds of world’s utility-scale solar and wind power in construction

Utility-scale solar and wind power capacity in construction, by country



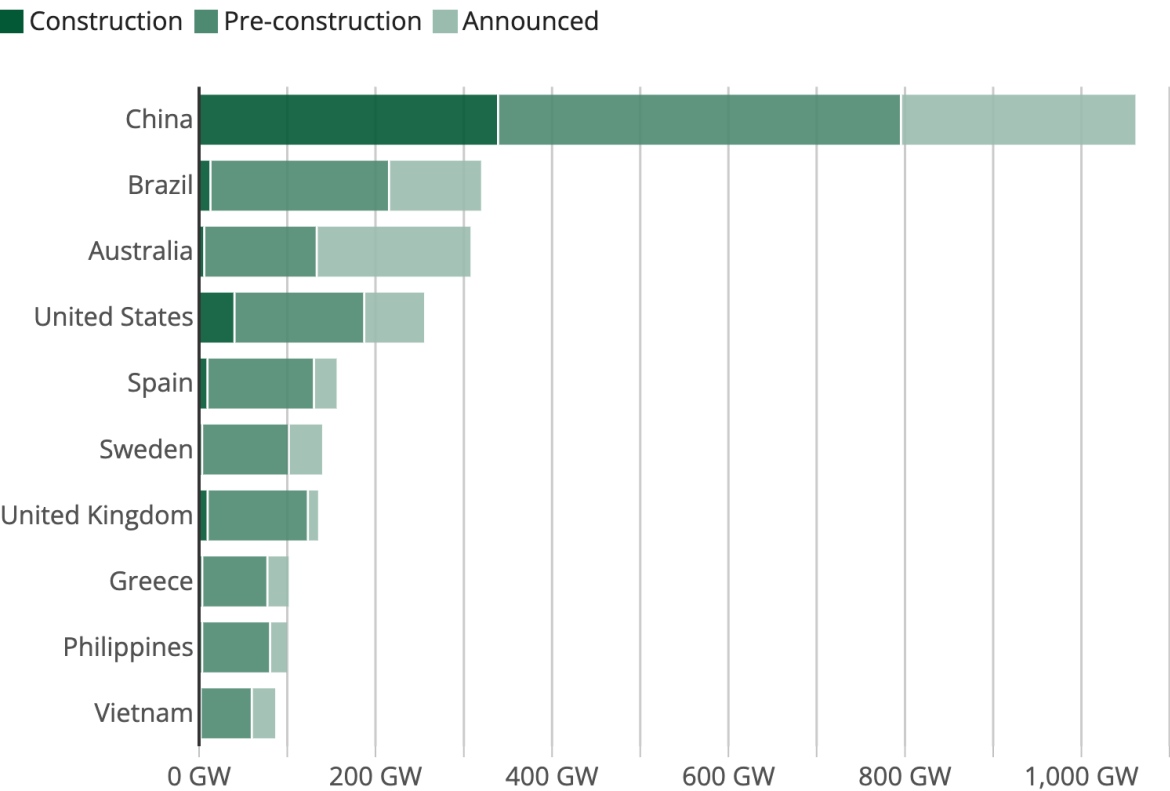
Note: Data includes solar project phases with capacity of 20 megawatts (MW) or more and wind project phases with a capacity of 10 MW or more. Capacity under construction for China and Europe updated in June 2024, while other regions accurate to December 2023.

Source: Global Solar Power Tracker, Global Wind Power Tracker, Global Energy Monitor



# One-third of planned utility-scale solar and wind in China is under construction, far exceeding global average of 7%

Utility-scale solar and wind power capacity in the top ten countries broken down by status, in gigawatts (GW)



Source: Global Solar Power Tracker, Global Wind Power Tracker, Global Energy Monitor

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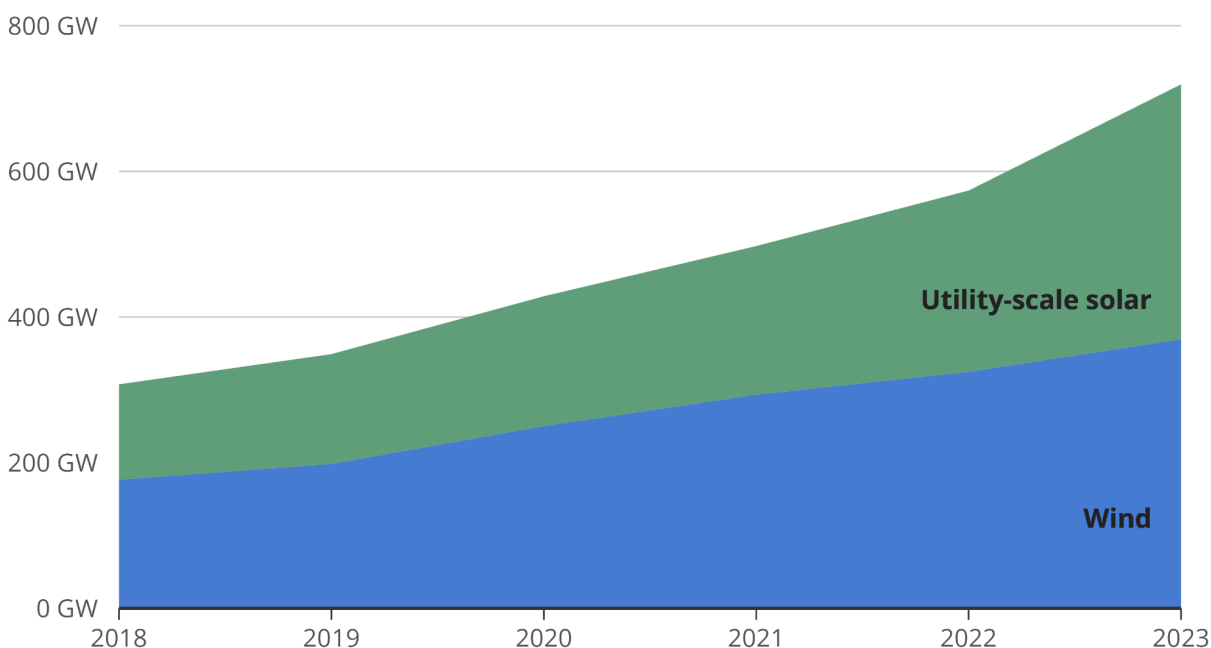


## What happened in the past year?

China added almost twice as much utility-scale solar and wind power capacity in 2023 than in any other year.<sup>3</sup> By the first quarter of 2024, China's total utility-scale solar and wind capacity reached 758 GW, though data from China Electricity Council put the total capacity, including distributed solar, at [1,120 GW](#). Wind and solar now account for 37% of the total power capacity in the country, an 8% increase from 2022, and widely expected to surpass coal capacity, which is 39% of the total right now, in 2024.

### China's solar boom driving huge renewables expansion

Cumulative utility-scale solar & wind power capacity in China by year, in gigawatts (GW)



Note: Data includes solar project phases with a capacity of 1 megawatt (MW) or more and wind project phases with a capacity of 10 MW or more. Graphic does not include 21 GW of solar capacity and 20 GW wind capacity without a known start year.

Source: Global Solar Power Tracker, Global Wind Power Tracker, Global Energy Monitor



<sup>3</sup> GEM's solar tracker includes large utility-scale solar farm phases with a capacity of 20 MW or greater and wind tracker is specifically focused on wind projects with a capacity threshold of 10 MW or greater.

Between March 2023 and March 2024, China installed more solar than it had in the previous three years combined, and more than the rest of the world combined for 2023. Solar capacity first surpassed wind in 2022, and the gap has grown significantly larger, thanks to the massive expansion of distributed solar. Nearly half of the distributed solar added in [2023](#) was installed on residential rooftops, largely driven by China's "[whole county solar](#)" model. Distributed solar accounts for 41% of the total solar capacity and has experienced a higher growth rate than centralized solar since 2021. The growth is attributed to the advantages of [lower investment costs](#), easy installation, and [strong policy support](#), making it more popular in the market.

Newly installed wind also doubled in growth over the 12 months year on year. After a brief slowdown in 2022 due to the [end](#) of central government feed-in tariff subsidies, they bounced back in 2023. GEM's Global Wind Power Tracker has documented a 51 GW wind capacity increase since 2023 — this growth itself exceeds the total operating capacity of any country, except the United States.

The combined capacity at pre-construction and announced stages for utility-scale solar power reaches 387 GW and 336 GW for wind. This includes the second and third waves of "mega wind & solar bases" with a combined capacity of approximately 503 GW, which will come online between 2025 and 2030. The first wave of "[mega wind and solar bases](#)" was announced in 2021 and spanned across 19 provinces. Most of the 97 GW in this first wave began operating in 2023 as scheduled, accounting for a third of China's newly-operating capacity, pointing to a promising future for the second and third waves.

On the province level, GEM's data reveals that the northwest and north provinces continue dominating large-scale solar and wind installation. Meanwhile, distributed solar is rapidly transforming the landscape in central and southern provinces. According to the National Energy Administration, this trend has elevated Henan,

Jiangsu, and Zhejiang, into the top five for solar capacity compared to the beginning of 2023.

Provincial leaders of distributed & utility-scale solar in China

Total operating solar capacity per province, in megawatts (MW)

| Distributed solar | Capacity | Utility-scale solar | Capacity |
|-------------------|----------|---------------------|----------|
| Shandong          | 40,988   | Xinjiang            | 38,020   |
| Henan             | 30,940   | Qinghai             | 27,708   |
| Jiangsu           | 29,469   | Shanxi              | 25,189   |
| Zhejiang          | 26,896   | Inner Mongolia      | 23,485   |
| Hebei             | 23,926   | Ningxia             | 21,302   |

Source: Distributed solar capacity data from National Energy Administration (NEA), 2023 and utility-scale solar capacity data from Global Energy Monitor, Global Solar Power Tracker.



## Operating solar farms in China

Locations of operating solar power installations, circles sized by megawatt (MW) capacity



Note: Data includes solar project phases with a capacity of 1 megawatt (MW) or more

Source: Global Solar Power Tracker, Global Energy Monitor



The top six provinces for wind installation, Inner Mongolia, Xinjiang, Hebei, Shanxi, Shandong, and Gansu account for 43% of the total in the country, according to GEM. Although the onshore wind's distribution among provinces has seen minimal change, offshore wind is rapidly advancing, with Jiangsu continuing to lead the country. Fujian witnessed eleven 16 MW wind turbines, the largest capacity for a single wind turbine in the world, go into [operation](#) in the Pingtan offshore wind farm in 2023. The rapid growth of offshore wind capacity in Guangdong, Zhejiang, Fujian and Hainan is expected to shift the provincial ranking, potentially replacing Jiangsu as the number one offshore wind province within the next five years.

## Operating wind farms in China

Locations of operating wind power installations, circles sized by megawatt (MW) capacity



Note: Data includes wind project phases with a capacity of 10 MW or more

Source: Global Wind Power Tracker, Global Energy Monitor



## What is China on track for?

Looking ahead, if all proposed utility scale solar and wind projects come online as intended, China could easily reach 1,200 GW of installed wind and solar capacity by the end of 2024, six years ahead of the [pledge](#) made by President Xi Jinping and one year earlier than GEM's forecast [last year](#).

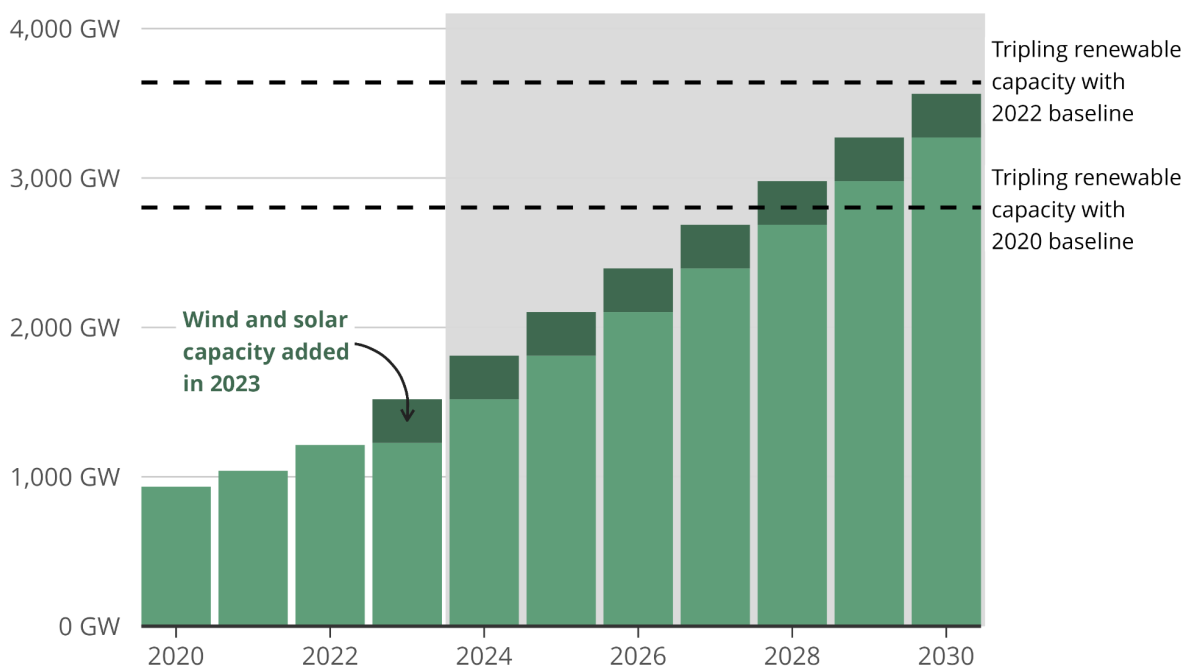
While China never signed the tripling renewables commitment at COP28, it did support the pledge in the [Sunnylands Statement](#) between China and the U.S. government in early 2023 to triple renewables energy capacity globally, and intends to sufficiently accelerate renewable energy deployment in their respective economies through 2030 from 2020 levels. If wind and solar keep adding 200 GW annually as the authorities [planned](#) for 2024, tripling renewable capacity by the end of 2030, based on the 2020 baseline of [934 GW](#), is well within reach even without any new hydropower additions. Tripling on the 2022 baseline, as [advocated](#) by the International Renewable Energy Agency (IRENA), can also be achieved if they are installed at a slightly higher growth rate in 2023 as the authority [announced](#). China should consider a more ambitious renewable target in its Nationally Determined Contributions to the Paris Agreement submission to the UN next year.

The sheer amount of prospective capacity under development in China provides further evidence for the forecast that the power sector's carbon emissions may peak [earlier](#) than the promised timeline, which is "before 2030." In fact, the [May 2024 study](#) by Lauri Myllyvirta, a senior fellow at Asia Society Policy Institute and lead analyst at the Centre for Research on Energy and Clean Air, even suggests that China's overall CO2 emissions may have already peaked in 2023, citing that 90% of power demand increases have been met by wind and solar generation, as well as the decline in housing construction activity.

China's energy officials, however, have [expressed](#) no intention to reach the peak earlier than its official goal. Some argued that the power sector's [postponed](#) peak would help other sectors' electrification and avoid early [sunk costs](#) from the coal power industry.

## China could triple its renewable capacity by adding the same amount of wind and solar each year as it did in 2023

Renewable power capacity in China if wind and solar capacity additions continue at same rate as 2023 every year from 2024 to 2030



Source: China National Energy Administration



## What are the obstacles?

Despite progress in installations, the question of how China's coal-centered grid absorbs the unprecedented renewable surge and delivers the additional power to the demand region remains a challenge. Although there is [fast](#) growth in power storage capacity, China's grid heavily relies on coal power to mitigate the intermittency of renewables, casting a shadow on wind and solar's achievements.

For example, in the [plan](#) for the second wave of mega wind and solar bases for the period of the 14th Five Year Plan (2021-2025), 30% of the proposed capacity is actually from coal power, including 28 GW of new coal, among which 10 GW are already under

construction according to GEM's Global Coal Plant Tracker. These coal projects are happening under the name of intermittency mitigation for wind and solar.

Transmission of electricity presents another potential challenge: Utility-scale solar and wind power are largely deployed in north and northwest regions and heavily rely on Ultra High Voltage (UHV) transmission lines to deliver the power to the demand centers in central, southern and east China. Currently, [ten](#) UHV transmission lines are under construction or preparing to enter construction, but they are far from enough for a continuous surge in renewable power. The lags in transmission line completion also bottleneck the transmission of wind and solar power.

Due to the limitation of the transmission capacity and the intermittency mitigation ability, curtailment resurfaced after some years of calm. In March 2024, the curtailment rate of solar power exceeded 5% nationwide, an alarming line set by the government in 2018. Seven provinces and regions, most with large wind and solar capacity in the northwest and north, exceeded 10% of curtailment in February 2024, [according to](#) the National Renewable Energy Monitor Center (全国新能源消纳监测预警中心).

In the East China region, where distributed solar is widespread, the regional grid and power distribution network are [unprepared](#) for the distributed solar boom. Since late 2023, the [curtailment](#) and temporary [suspension](#) of distributed solar applications has risen significantly in several of the eastern provinces, which could constrain future distributed solar installations if the ability to absorb solar power is not improved quickly.

All told, 2023 saw unprecedented wind and solar growth in China. The unabated wave of construction guarantees that China will continue leading in wind and solar installation in the near future, far ahead of the rest of the world. However, China still needs to turn the massive renewables buildup into power generation, replace fossil

fuels, and reach the “tipping point” so as to peak its carbon emissions as early as possible.

## About the Global Solar and Wind Power Trackers

The Global Wind Power Tracker is a worldwide dataset of utility-scale, on- and offshore wind facilities. It includes wind farm phases with capacities of 10 megawatts (MW) or more. The Global Solar Power Tracker is a worldwide dataset of utility-scale solar photovoltaic (PV) and solar thermal facilities. It covers operating solar farm phases with capacities of 1 megawatt (MW) or more and all announced, pre-construction, construction, and shelved projects with capacities greater than 20 MW.

## About Global Energy Monitor

Global Energy Monitor (GEM) develops and shares information in support of the worldwide movement for clean energy. By studying the evolving international energy landscape and creating databases, reports, and interactive tools that enhance understanding, GEM seeks to build an open guide to the world’s energy system. Follow us at [www.globalenergymonitor.org](http://www.globalenergymonitor.org) and on X (formerly Twitter) [@GlobalEnergyMon](https://twitter.com/GlobalEnergyMon).

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