



## China's Renewable Capacity Expansion to Catch Up with Newly Permitted Coal Power Plants

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To meet increasing electricity demand, China is deploying both more coal power plants and more renewables. However, renewables are now leading China's newly added power capacity.

During the first quarter of 2023, China's decarbonisation trajectory saw a huge acceleration with a record 50 GW of renewable energy (RE) capacity added, 84% of total new installed capacity in the quarter (see Figure 1). Newly added thermal power was 8.1 GW, just a 14% share of newly installed capacity, according to new data from the [National Bureau of Statistics](#) (NBS).

**Figure 1: New Capacity Installed in China in 1QCY2023**

		1Q2023	Share of new adds	Change (yoy %)	1QCY2022
Thermal Power	GW	8.1	14%	39%	5.8
Hydropower	GW	2.7	5%	-21%	3.4
Nuclear Power	GW	1.2	2%	3%	1.2
Wind Power	GW	10.4	18%	32%	7.9
Solar Power	GW	33.7	57%	155%	13.2
Other (Biomass, W2E)	GW	3.0	5%	1200%	0.2
<b>Total capacity added</b>	<b>GW</b>	<b>59.0</b>	<b>100%</b>	<b>86%</b>	<b>31.7</b>
Renewable Energy adds	GW	49.8	84%		24.8
Zero Emissions Capacity Adds	GW	51.0	86%		25.9

*Source: NBS, CEF Estimates*

Electricity demand in China continues to increase in 2023, with the International Energy Agency (IEA)'s [Electricity Market Report of 2023](#), noting that "More than 70% of the increase in global electricity demand over the next three years is [expected to come from China](#), India and Southeast Asia."

1QCY2023 national Chinese electricity demand grew a really modest 2.4% y-o-y - Figure 2. With zero emissions electricity generation growing 8.5% y-o-y in the first three months, this held thermal power generation growth to a modest 1.7% y-o-y.

**Figure 2: China's Electricity Generation Mix in 1QCY2023**

		1Q2023	Share of Generation	Change (yoy %)	1QCY2022
Thermal Power	TWh	1,495	72%	1.7%	1,461
Hydropower	TWh	204	10%	-8.3%	221
Nuclear Power	TWh	103	5%	4.4%	99
Wind Power	TWh	208	10%	18.1%	163
Solar Power	TWh	61	3%	11.8%	48
<b>Total Power Generation</b>	<b>TWh</b>	<b>2,071</b>	<b>100%</b>	<b>2.4%</b>	<b>1,992</b>
Renewable Power Generation	TWh	473	23%	9.5%	432
Zero Emissions Generation	TWh	576	28%	8.5%	531

*Source: NBS, CEF Estimates*

Figure 3 shows the fuel split of the current Chinese electricity capacity as at the end of March 2023. Thermal power (mostly coal) is still dominant at 1,340 GW (a 51% share), with hydro capacity also a world leading 415 GW (including 47 GW of pumped hydro storage (PHS)). Wind and solar capacity reaching 375 GW and 426 GW respectively, giving a combined 30% share of capacity, but far lower utilisation rates means this translates into a far more modest 13% share of generation in 1QCY2023.

**Figure 3: China's Installed Capacity at end March 2023**

		1Q2023	Share of Capacity	Change (yoy %)	1QCY2022
Thermal Power	GW	1,340	51%	3.0%	1,301
Hydropower	GW	415	16%	5.4%	394
Nuclear Power	GW	57	2%	4.3%	54
Wind Power	GW	376	14%	11.7%	336
Solar Power	GW	426	16%	33.7%	319
<b>Total of Installed Capacity</b>	<b>GW</b>	<b>2,623</b>	<b>100%</b>	<b>9.1%</b>	<b>2,405</b>
Renewable Energy Capacity	GW	1,217	46%	16.0%	1,049
Zero Emissions Capacity	GW	1,274	49%	15.4%	1,104

*Source: NBS, CEF Estimates*

The Chinese government has developed two major pathways for dealing with the increasing electricity demand – building more new coal-fired power plants to be operated flexibly to balance out the accelerated scaling up of renewables.

Reports on China's coal expansions have drawn significant attention globally. According to the Centre for Research on Energy and Clean Air (CREA) and Global Energy Monitor (GEM), China approved [two new coal power plant units per week](#) in 2022, the highest level of approvals since 2015, [even as it prioritised escalating renewables capacity](#). That raises concerns that new coal power plants will continue on the path of declining average national utilisation rates, assisting grid balancing and hence reliability, but leaving a legacy of financial burden.

On a global scale, coal power expansion in China hinders international decarbonisation efforts. China's continued global renewables investment and manufacturing leadership is critical to emissions reduction – and an energy transition pathway aligned with the goal of the Paris Agreement to limit warming to 1.5°C. And it is key that China peak its over-reliance on coal power as soon as possible, and then progressively diversify away to zero emissions alternatives. In the meantime, the portion of zero emissions power generation in China's electricity grid needs to scale up quickly in order to meet domestic energy demand.

For the first time in a long time, during Two Sessions this year China did not set any specific emission reduction targets, aside from the target to continue [reducing](#) the energy intensity of GDP by 2% annually.

Nevertheless, it has already started renewables expansion at an unprecedented scale and speed, with the NBS and NEA [data](#) for the first quarter of 2023 (1QCY2023) manifesting significant growth, especially in wind power and solar power, even as electric vehicle (EV) production continues to lift, with EV penetration reaching [a record 29% in 1QCY2023](#).

## **Photovoltaic (PV) Power Capacity and Generation**

In 1QCY2023, China invested 52.2 billion yuan (\$11.1 billion AUD) in solar power, up 178% y-o-y.

33.7 GW of newly built solar power was connected to the grid nationwide, an increase of 154.8% y-o-y, including 15.5 GW of centralised PV capacity and 18.1 GW of distributed PV.

As a result, by the end of 1QCY2023, the installed capacity of PV power capacity in China reached 426 GW in total, including 249 GW of centralised PV and 176 GW of distributed PV.

The NEA also reports that the Ministry of Natural Resources and the National Forestry and Grassland Administration, jointly issued the "[Notice on Supporting the Development of Photovoltaic Power Generation Industry to Standardize Land Use Management](#)", to ensure the rational layout of solar projects to consider the combined policies focused on food production,

ecological protection, energy development, the double carbon goals and rural revitalization. This prioritises desert areas and protects agricultural, grass and forest lands.

## **Wind Power Capacity and Generation**

In the first quarter of 2023, wind power investment in China reached about 24.9 billion yuan (\$5.3 billion AUD), a year-on-year increase of 15.0%.

The newly added grid-connected capacity of wind power across the country reached 10.4 GW, including 9.89 GW of onshore wind power and 0.51 GW of offshore wind power.

As of the end of the first quarter of 2023, the cumulative installed capacity of wind power across the country reached 376 GW, a year-on-year increase of 11.7%, of which onshore wind power was 345 GW and offshore wind power was 30.9 GW.

China is the world's leading operator of offshore wind, according to the [GWEC](#). China's offshore wind has a capital cost of Rmb5,000/kW of capacity, down by 30% since 2021, but still 67% higher than that for onshore wind at Rmb3,000/kW. Against this, offshore wind delivers substantially higher utilisation rates and geographic diversification for grid reliability. China's global share of total offshore wind is 49%, double the UK's 22% offshore wind share as at the end of 2022. The US has the second largest onshore wind installed base, with a 17% share, less than half China's leading 40% share.

## **Hydro Power Capacity and Generation**

After decades of increasing capacity in hydro power, China has switched its focus away from hydro power additions in 2023, reflective of the approaching capacity limits on remaining rivers.

As of the end of the first quarter of 2023, the cumulative installed capacity of hydropower in the country reached 415 GW, of which 368 GW were conventional hydropower and 46.99 GW were pumped storage, which shows a 5.4% year-on-year increase. However, the newly added grid-connected hydropower capacity has declined to 2.7 GW in 1QCY2023, a 21% year-on-year decrease, of which conventional hydropower was 1.21 GW and PHS was 1.5 GW.

New investment for hydro power capacity in China during the first quarter of 2023 has dropped 7.8% to 16.8 billion yuan (\$3.6 billion AUD).

## **Nuclear Power Capacity and Generation**

China is also expected to become the world's largest generator of nuclear power before 2030 says [Economic Information Daily](#).

The China Nuclear Energy Development Report (2023) (so-called Blue Book), released at the 2023 Spring International Summit of the China Nuclear Energy Sustainable Development Forum in April, [found](#) that China's nuclear power installed capacity is expected to further expand in the

future, and the nuclear technology application industry is expected to become an economic growth point within China.

At present, there are 24 nuclear power units under construction in China, with a total installed capacity of about 26.8 GW, and the overall scale of the expansion continues to rank first in the world; there are 54 commercial nuclear power units in mainland China, with a total installed capacity of 56.8 GW, ranking third in the world. The total installed capacity of nuclear power accounts for 2.2% of the total installed electricity capacity in the country.

In 1QCY2023 there was 1.2 GW of newly installed nuclear power capacity in China, an increase of 2% on the first quarter of 2022. The total installed nuclear capacity during the first quarter of 2023 reached 56.8 GW which represents a 4% y-o-y increase.

## **Biomass Power Capacity and Generation**

Aside from the major renewable energy expansions mentioned above, China is also scaling up its biomass power generation. In 1QCY2023, the country's biomass power generation added 630 MW to the grid, and the cumulative installed capacity reached 41.95 GW, a year-on-year increase of 8%.

## **Storage Capacity**

The [National Energy Administration](#) (NEA) reports that pumped hydro storage (PHS) increased by 1.5 GW in 1QCY2023 to reach 47 GW in total, putting China as by far the largest operator of PHS in the world, [more than double Japan](#), the second largest, with 22 GW (and US third with 19 GW). PHS and batteries will both play an increasingly critical role in ensuring grid reliability as the penetration of variable renewable energy continues to increase.

The NEA reports that new energy storage (principally batteries) reached 8.7 GW by the end of 2022, +110% y-o-y. This puts China on track for its [50GW of battery capacity by 2025 target](#), second only to the US.

## **Electric Vehicle Penetration Continues to Rise**

Beyond the staggering numbers around renewable power generation expansion, China has also been massively electrifying its mobility. A recent [report](#) by CEF's Global EV Supply Chain Analyst Matt Pollard indicated that in 1QCY2023 China's auto-export market grew 71% year-on-year to almost 1 million vehicles, with 25% electric, while EVs reached a 29% market share of passenger vehicle sales. China surpassed Germany to become the second-largest auto-exporter, behind Japan.

With a global EV race developing, Chinese EV manufacturers BYD and SAIC lowered their prices to compete against Tesla, which reduced the prices of its EVs in both China and the US this year. China's dramatically escalating uptake of EVs is taking place in the context of transformative

global policy developments by major nations and blocs designed to accelerate domestic production of EVs, EV batteries, and battery precursors, and encourage uptake of EVs, from the landmark US [Inflation Reduction Act](#) (IRA) to the EU's [Net Zero Industry Act](#) (NZIA) and Critical Raw Materials Act (CRMA).

China continues to lead the world in all aspects of the global development of zero emissions industries of the future, both in terms of domestic deployment and manufacturing supply chains, both for domestic and export purposes. The IRA has really elevated the US investment in both deployments and manufacturing capacity, resulting in an accelerating global ambition commensurate with the urgency underlying the conclusions of the climate science. Assuming this accelerating global ambition is sustained, this is starting to put the world on the trajectory solely needed. Long may this investment trend continue!

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