



MONTHLY CHINA ENERGY UPDATE |

2023 China Electricity Mix Yearly Review | Massive Decarbonisation Progress is Key Economic Stimulus

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China installed a staggering 292.8GW of variable renewable energy in CY2023, +99% yoy, way beyond any forecasts. China is accelerating electrification of everything, sustaining strong electricity demand growth ahead of the strong +5.2% y-o-y GDP growth delivered.

NEWLY INSTALLED CAPACITY

Figure 1. New Capacity Installed in China in Jan-Dec 2023

		Jan-Dec 2023	Share of new adds (%)	Change (yoy %)	Dec-23	Share of new adds (%)
Thermal Power	GW	57.9	16%	30%	11.5	12%
Hydropower	GW	8.0	2%	-66%	0.2	0%
Nuclear Power	GW	1.4	0%	-77%	0.2	0%
Wind Power	GW	75.9	21%	102%	28.5	31%
Solar Power	GW	216.9	60%	148%	51.9	56%
Total capacity added	GW	360.1	100%	78%	92.2	100%
Variable Renewable adds	GW	292.8	81%	99%	80.4	87%
Zero Emissions Capacity Adds	GW	302.2	84%	92%	80.7	88%

Source: NBS, CEF Estimates

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During the last month of 2023, China added a total of 92.2 gigawatts (GW) of net new capacity, bringing the total newly added capacity in calendar year (CY) 2023 to 360.1GW.

¹ CEF has removed an immaterial rounding error or adjustment in the data definitions disclosed by the NBS between 2022 vs 2023.

Of this CY total, 302.2GW was zero emissions capacity. representing 84% of the newly installed capacity in the grid, a 92% year-on-year (y-o-y) increase.

Solar continues to take the lead in newly installed zero emissions capacity. During 2023, China added 216.9GW of solar capacity in total, accounting for 60% of the annual newly installed capacity and representing a 148% y-o-y increase. In December alone, China added 51.9GW of solar capacity to the grid, representing 56% of the newly added capacity of the month.

The solar boom is followed by significant increase in wind installs. In December, China commissioned 28.5GW of wind capacity, accounting for 31% of total newly added capacity in the month. This brings newly installed wind capacity in 2023 to 75.9GW, 21% of total newly installed capacity, representing a 102% y-o-y increase.

2023 has not been the best year for hydropower. In 2023, China added 8GW of new hydropower capacity, 2% of the total newly installed capacity in the year and representing a 66% y-o-y decrease as China nears hydro capacity saturation.

2023 saw China add only 1.4GW of nuclear capacity, a 77% y-o-y decrease.

Notably, China continues to also add more thermal power capacity. In December, China added 11.5GW of thermal capacity, accounting for 12% of the total newly installed capacity for the month. This brought newly installed thermal capacity to 57.9GW for 2023, 16% of the total newly added capacity, representing a 30% y-o-y increase.

INSTALLED CAPACITY

Figure 2. National Installed Capacity as of Dec 2023

		Dec-23	Share of Capacity	Change (yoy %)	Dec-22
Thermal Power	GW	1,390	47.6%	4.3%	1,332
Hydro Power	GW	422	14.4%	1.9%	414
Nuclear Power	GW	57	1.9%	2.5%	56
Wind Power	GW	441	15.1%	20.8%	365
Solar Power	GW	609	20.9%	55.2%	393
Total of Installed Capacity	GW	2,920		13.9%	2,564
Variable Renewables Capacity	GW	1,051	36.0%	38.6%	758
Zero Emissions Capacity	GW	1,529	52.4%	24.2%	1,232

Source: NBS, CEF Estimates

By the end of 2023, China's national installed zero emissions capacity reached 1529GW, or 52.4% of the total installed capacity, a 24.2% y-o-y increase.

Total installed solar capacity reached 609GW, 20.9% of the total installed capacity, representing a 55.2% y-o-y increase and cementing China's position as the absolute world leader in installed solar capacity, with the US a very distant second.

At the end of 2023, total installed wind capacity surpassed total installed hydropower capacity. Installed wind capacity reached 441GW at the end of 2023, accounting for 15.1% of total installed capacity, representing a 20.8% y-o-y increase.

422GW of hydro capacity is installed nationwide, accounting for 14.4% of the total installed capacity, a 1.9% y-o-y increase.

Total installed nuclear capacity reached 57GW, accounting for 1.9% of total installed capacity, representing a 2.5% y-o-y increase.

Installed thermal capacity is both exceptionally high, and continuing to grow at unsustainable rates if the climate science is to be delivered on, reaching 1390GW, representing a 4.3% y-o-y increase.

At the end of 2023, installed thermal capacity was 47.6% of total installed capacity, a decline compared to thermal's share of installed capacity at the end of [1QCY2023](#) of 51%. However, it should be noted that generation share is more important, given materially different capacity utilisation rates.

ELECTRICITY GENERATION MIX

Figure 3. China's Electricity Generation Mix in Jan-Dec 2023

		Jan-Dec 2023	Share of Generation	Change (y-o-y %)	Dec-23	Change (y-o-y %)
Hydropower	TWh	1,141	13%	-5.1%	78	3.7%
Thermal Power	TWh	6,232	70%	6.5%	611	10.1%
Nuclear Power	TWh	433	5%	3.7%	38	-4.2%
Wind Power	TWh	809	9%	17.8%	81	12.6%
Solar Power	TWh	294	3%	28.4%	21	30.3%
Total Power Generation	TWh	8,909	100%	6.2%	829	9.4%
Variable Renewable Generation	TWh	1,103	12%	20.5%	916	15.9%
Zero Emissions Power Generation	TWh	2,677	30%	5.6%	751	7.5%

Source: NBS, CEF Estimates

In December, China's national electricity demand increased by 9.4% y-o-y, reaching 829 terawatt hours (TWh).

Solar power generation reached 21TWh in December, a 30.3% y-o-y increase. During CY2023, total solar power electricity generation reached 294TWh. Whilst solar represents 20.9% of installed capacity at the end of 2023, solar's share of generation is just 3% of the total, even with a 28.4% y-o-y increase, reflecting the abnormally low solar capacity utilisation rates, an area we will undertake further analysis on in our forthcoming China Electricity Model to 2040 report.

Wind power generation reached 81TWh in December, a 12.6% y-o-y increase, which brings the total wind power generation in 2023 to 809TWh, accounting for 9% of the total electricity generation, a 17.8% y-o-y increase.

In December, hydropower generated 78TWh of electricity, a 3.7% y-o-y increase, bringing the total hydropower generation in 2023 to 1,141TWh, 13% of total generation, a 5.1% y-o-y decrease.

Nuclear power generation reached 38TWh in December, representing a 4.2% y-o-y decrease. During CY2023, the whole year nuclear power generation reached 433TWh, accounting for 5% of the total power generation, showing a 3.7% y-o-y increase.

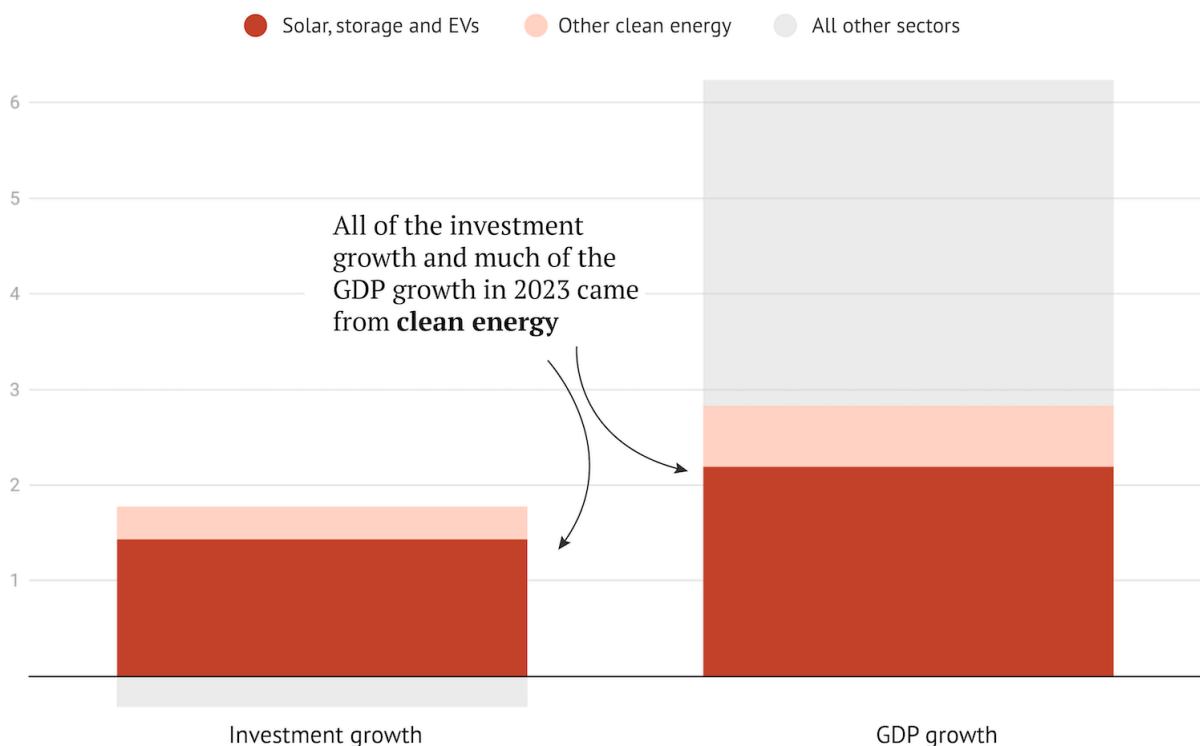
Thermal power generation still represents an unsustainable 70% of the total power generation in 2023, reaching 6232TWh during January to December, representing a 6.5% y-o-y increase. December alone saw 611TWh of electricity generation from thermal power, a 10.1% y-o-y increase.

STIMULATING ECONOMIC GROWTH THROUGH OPPORTUNITIES IN DECARBONISATION

Leading China energy analyst Lauri Myllyvirta of the Centre for Research on Energy and Clean Air (CREA) [argues](#) clean energy was the top driver of China’s 2023 economic growth.

Clean energy was the top driver of China’s economic growth in 2023

Investment growth (left) and GDP growth (right) by sector, trillion yuan



Source: CREA analysis for Carbon Brief



While many were sceptical about China’s economic resilience as the residential real estate market crumbled in the past year, this report shows a globally significant macroeconomic strategic pivot in 2023 to stimulate the country’s economic recovery by accelerating investment into zero-emissions industries of the future, both in terms of manufacturing for domestic deployment, and, increasingly, to leverage the structural growth in green energy system exports led by solar, batteries and EVs.

The CREA report highlights that clean energy emerged as the primary driver of China's overall economic expansion, accounting for approximately 40% of the annual growth in GDP across all sectors, while all of the investment growth in 2023 came from clean energy.

This pivot is no more obvious than in the country's investment trend in 2023, which flowed from the real estate sector into manufacturing, especially clean energy sector manufacturing.

Investment in the real estate sector fell by 10% y-o-y in 2022 and another 9% y-o-y in 2023. In contrast, investment in manufacturing increased by 9% y-o-y in 2023, with investment in the power and heat sector increasing by 23% y-o-y due to the large allocation of capital into the clean energy sector.

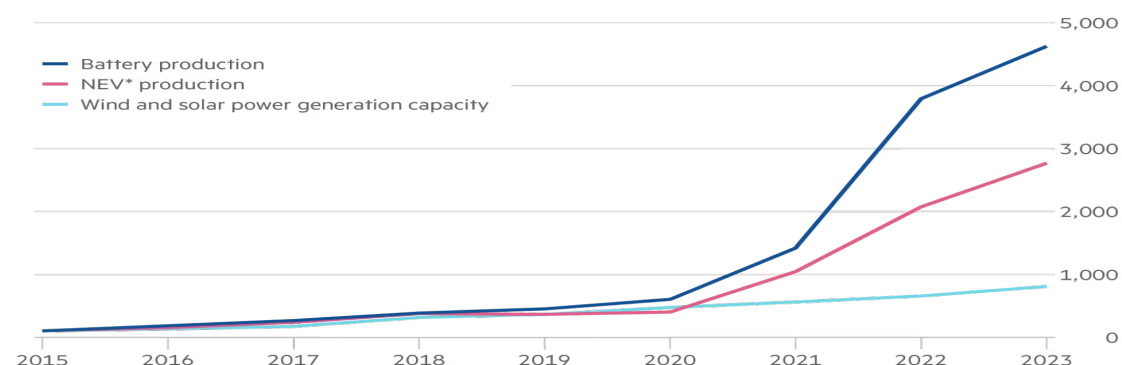
This trend can also be tracked within China's major energy State Owned Enterprises' (SOEs) investments. As we highlighted in our recent [report](#) 'Decarbonising China & the World: Chinese Energy SOEs Supercharge Renewable Investment in Response to the 14th Five Year Plan', all 5 of the largest Chinese energy SOEs examined in the report are aligning their capital expenditure (capex) trends, at the consolidated parent entity level, with the Chinese Government's central national energy policy set out in its [14th Five Year Plan](#) (FYP) [2021-2025]. This targets a 50% increase in renewable energy generation and directs that 50% of incremental electricity consumption (increase in demand) come from renewables over the period 2021-2025.

These SOEs have adopted various strategies to meet the 14th FYP energy targets, which operate in the context of China's overarching double carbon goals – to peak CO2 emissions before 2030 and achieve carbon neutrality by 2060.

SOEs are significantly ramping up their investments in renewable energy and actively pursuing diversification by expanding their business ventures into a broader array of renewable energy sources. Further, to align with the central energy policy and boost the proportion of clean energy in their portfolios, SOEs are implementing strategic acquisition programs at the parent company level. This concerted effort reflects their commitment to meeting the central government's policy goals and driving energy transition.

Rapid growth in China's 'new three' industries

Rebased (2015=100)



* New energy vehicle

Sources: NBS; Goldman Sachs Global Investment Research
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China's strong domestic EV uptake has also disrupted the global EV industry landscape. US-based think tank CSIS [estimated](#) that Beijing's total spending on the EV industry

exceeded \$125bn between 2009 and 2021. China has [overtaken](#) Japan to be the world's largest vehicle exporter, and China's BYD has surpassed Tesla to become the world's biggest EV maker.

SOME LESSONS FROM CHINA'S DECARBONISATION PROGRESS IN 2023

Decarbonisation is a deep and complicated process. It requires solid science-backed policy initiative at government and corporate level, ambition, determination, and, critically, substantial capital investment. It also requires long-term strategic thinking, anticipating market trends in the next decade or two to effectively transition entire economies towards an inevitable net-zero future.

As noted above, China's staggering progress in decarbonisation is the #1 driver of investment and GDP growth. It is also creating the jobs of the future.

While job security is key and Australia has been historically dependent on fossil fuel exports, the fact is that the fossil fuel industry has [passed its prime](#), and the policy failure and inertia of a decade of the federal LNP has left Australia limited time to transition to a decarbonised workforce – a challenge which the incumbent Albanese government has yet to fully address.

There may be lessons from China, which is facing a similar challenge. Shanxi is the country's biggest coal mining province, arguably the equivalent of NSW, though on a much larger scale. Caixin has [reported](#) that around 250,000 jobs in Shanxi are forecast to be lost by 2050 with the shift to renewable energy.

In China, there is a clear shift already evident in the workforce. For example, [according](#) to China's online recruitment platform Zhilian Zhaopin, jobs posted in the new energy industry grew 36% during 1H CY2023 alone. Positions for wind power engineers saw a remarkable 738% y-o-y increase, driven by the booming clean energy sector. This surge is driven by the growing number of wind power projects, necessitating more engineers for research, design, construction, and maintenance. Engineering supervision positions saw a massive 322% y-o-y growth in the first half of 2023, aligning with the rapid expansion of new-energy projects.

Australia, too, has the potential to enjoy the job and economic benefits of a new energy economy. For example, the ACTU/BCA/WWF/ACF [Sunshot report](#) projects 400,000 jobs to 2040 in renewables export industries, and the NAB/Deloitte Powering Up report identifies a [green industrial export opportunity worth \\$420bn by 2050](#).

Australia has superabundant sun and wind for renewable energy generation and some of the world's leading reserves of the critical minerals and energy transition materials that underpin the transformation of the global economy. Climate Energy Finance and its partners including the Climate Capital Forum have urged the government to [rapidly scale its energy transition policy and investment ambition](#) to crowd-in hundreds of billions in private capital, and leverage the nation's generational opportunity to establish itself as a zero-emissions trade and investment power. This is particularly pressing in the light of China's leadership and landmark global moves toward decarbonisation such as President Biden's ~US\$1tn Inflation Reduction Act, which is driving re-industrialisation and economic and jobs growth in the US.

Meanwhile, although China still has a long way to go to green its entire national grid, its workforce – and its massive economy – the country has effectively consigned high-emissions industries to obsolescence over time. China’s investment priorities show the future powered by clean energy, and is seizing the opportunity to develop, lead and dominate the global renewable energy market.

Achieving decarbonisation requires more than just an eye to short-term financial gain; fundamental structural reform within the country’s economy is the precondition to thrive from decarbonisation both environmentally and economically. In China, this is underpinned by the accelerating energy system transition that our analyses have tracked, as the world’s second biggest economy pushes even further ahead of the rest of the world.

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[Previous Monthly China Energy Updates here.](#)

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