

MONTHLY CHINA ENERGY UPDATE | December 2024

China hit new record of solar and wind power capacity additions in 2024

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NEWLY INSTALLED CAPACITY IN CHINA

Figure 1. New Capacity Installed in China in Jan-Dec 2024

		Jan-Dec 24	% Share of total new adds	% yoy change	Dec-24	% Share of new adds
Thermal Power	GW	54.1	13%	-7%	10.2	9%
Hydropower	GW	14.4	3%	79%	3.9	3%
Nuclear Power	GW	3.9	1%	184%	2.8	2%
Wind Power	GW	79.3	18%	5%	28.5	25%
Solar Power	GW	277.2	65%	28%	68.3	61%
Total capacity added	GW	429.0	100%	21%	113.6	100%
Renewable Energy adds	GW	370.9	86%	25%	100.7	89%
Zero Emissions Capacity Adds	GW	374.8	87%	26%	103.4	91%
Total new spent on power grid investment	US\$bn	84.7		15%		

Source: National Energy Administration (NEA), CEF Estimates

In CY2024, China hit a new record of annual net new capacity added to the grid at 429GW, a 21% y-o-y increase. Of this, wind and solar power combined capacity accounted for 83% at 356.5GW, dwarfing the 4% proportion of hydropower and nuclear capacity combined.

Over CY2024, China invested a massive RMB608bn (US\$84.7bn) in grid transmission expansion and modernisation projects, +15% y-o-y, key for grid capacity expansion and to facilitate the connection of 429GW of new capacity to the grid. The national transmission line loss rate was only 4.37%.

December alone saw China add 113.6GW of new capacity, accounting for 30% of the total added capacity over CY2024. 91% of December's added capacity came from zero-emissions sources, totalling 103.4GW.

Solar capacity additions continue to consistently represent the greatest share of new additions. China added 277.2GW of solar capacity to the grid in CY2024, 65% of the total added capacity and a 28% y-o-y increase, which is a remarkable feat building on the doubling of solar installation rate in 2023. 68.3GW of this, being 20% of new solar capacity additions over CY2024, was completed in the month of December alone. This is more than Australia's entire cumulative solar capacity installed in the last few decades. December solar capacity additions accounted for 61% of the month's total new capacity.

In terms of the makeup of the 2024 new solar power capacity additions, 60% came from centralised solar power stations, with the remaining 40% being distributed solar capacity including rooftop.¹

China added 79.3GW of wind capacity in CY2024, 18% of the total new capacity, +5% y-o-y. Like with solar, China represented ~60% of [global wind capacity additions in CY2024](#). December saw China install 28.5GW of new wind, 25% of the month's newly installed capacity.

14.4GW of hydropower capacity was added in CY2024, representing 3% of total new capacity, a 79% y-o-y growth.

3.9GW of nuclear capacity was added to the grid in CY2024, representing 1% of the total new added capacity, a 184% increase on 2023.

While newly added thermal power capacity in CY2024 is showing a 7% decrease y-o-y, there was still 54.1GW of new thermal capacity added (mostly coal, but a fifth of this being new gas peakers), accounting for 13% of the total new capacity, reflective of China's need for flexible power generation to balance the ever-larger share of variable renewable energy, and the need for all of the above as China continues its progressive electrification of everything.

TOTAL CUMULATIVE INSTALLED CAPACITY

As of December 2024, China has a total installed power capacity of 3,349GW, +14.7% y-o-y. 57% is zero-emissions capacity, totalling 1,693GW, a 24.5% y-o-y increase – Figure 2.

¹ China Photovoltaic Industry Association, [The National Energy Administration released the construction status of photovoltaic power generation in 2024. In 2024, the newly installed photovoltaic capacity will be 277.57GW](#), 6 February 2025

Figure 2. Total Installed Capacity as of December 2024 in China

		As of Dec-2024	% Share of Total Capacity	Change (yoy %)	As of Dec-2023
Thermal Power	GW	1,444	43%	3.9%	1,390
Hydro Power	GW	436	13%	3.4%	422
Nuclear Power	GW	61	2%	6.9%	57
Wind Power	GW	521	16%	18.0%	441
Solar Power	GW	887	26%	45.5%	609
Total Installed Capacity	GW	3,349	100%	14.7%	2,920
Renewable Energy Capacity	GW	1,843	55%	25.2%	1,472
Zero Emissions Capacity	GW	1,904	57%	24.5%	1,529

Source: NEA, CEF Estimates

Combined total solar and wind power capacity hit a new record at 1,407GW, exceeding China's [14th Five Year Plan for Renewable Energy Development](#) 2030 target of 1,200GW six years early. Solar power comprises the majority of zero-emissions capacity, reaching 887GW as of the end of December 2024 and representing 26% of China's total installed capacity, a massive 45.5% y-o-y increase. This is followed by wind power capacity, which reached 521GW, comprising 16% of total installed capacity, a substantial 18% y-o-y increase.

Since 2013, installed wind power capacity in China has increased sixfold, with an average annual growth of 20%, while installed solar power capacity has increased more than 180 times, with an average annual growth of about 60%. China's annual newly installed solar and wind power capacity accounts for more than 40% of global newly installed capacity.²

The traditional pillar of China's zero-emissions power – hydropower – has a total installed capacity of 436GW as of December 2024, 13% of total installed capacity, +3.4% y-o-y. Whilst China is running out of new rivers to dam, the December 2024 announcement of a plan for a 60GW new dam system on the Tibetan plateau (nearly three times the size of China's Three Gorges Dam, the largest power plant in operation in the world today) suggests China still seeks scope to add new hydro capacity,³ and with a significantly elevated focus more recently on pumped hydro storage (PHS) for grid firming, which reached 58.7GW of installed capacity by the end of 2024.⁴

China has a total installed nuclear power capacity of 61GW, a 2% of China's total capacity, a 6.9% y-o-y increase.

² NEA, [China's wind and solar power generation utilization rate remains above 95%](#), 20 December 2024

³ ENR, [China Announces It Will Build Controversial 60GW Mega-Dam in Tibet](#), 16 January 2025

⁴ China Electricity Council, [China Electricity Council released the "2024-2025 National Electricity Supply and Demand Situation Analysis and Forecast Report"](#), 24 January 2025

43% of China's total installed capacity is thermal power, reaching 1,444GW, +3.9% y-o-y.

Since China's 14th Five-Year Plan, the installed capacity of new energy power has increased by 157%, with an average annual growth of 26.7%. During this period, the installed capacity of fossil energy power increased by 15%, with an average annual growth of 3.6%.⁵ At the end of 2024, the installed capacity of new energy power, including wind, solar and biomass power, reached 1,450GW, exceeding the scale of coal power capacity for the first time.

ELECTRICITY GENERATION MIX

Figure 3. China's Electricity Generation Mix in Jan-Dec 2024

		Jan-Dec 2024	% Share of Jan-Dec generation	% Change yoy	Dec- 2024	% Change yoy
Thermal Power	TWh	6,171	62%	1.7%	583	-2.0%
<i>Coal</i>	TWh	5,871	59%	2.0%	555	-2.0%
<i>Gas</i>	TWh	283	3%	-4.8%	27	-2.0%
<i>Other Thermal</i>	TWh	17	0%	2.0%	2	-1.9%
Bioenergy	TWh	193	2%	-2.5%	18	-2.0%
Hydropower	TWh	1,285	13%	4.8%	84	6.5%
Nuclear Power	TWh	444	4%	2.2%	42	11.4%
Wind Power	TWh	989	10%	11.6%	100	11.3%
Solar Power	TWh	853	9%	46.1%	72	58.6%
TOTAL POWER GENERATION	TWh	9,936	100%	5.7%	899	3.9%
Variable Renewable Generation	TWh	1,842	19%	25.3%	172	27.2%
Zero Emissions Power Generation	TWh	3,764	38%	13.1%	316	17.0%

Source: Ember, CEF Estimates

In CY2024, Ember estimates China generated total electricity of 9,936TWh, a 5.7% y-o-y increase. China's NEA puts this increase at a stronger +6.8% yoy - we will work to reconcile this inconsistency. December saw power generation reach 899TWh, a slower 3.9% y-o-y increase, even as China reported an acceleration in quarterly GDP growth to end the 2024 year.

38% of China's power generation over CY2024 came from zero-emissions energy sources, reaching 3,764TWh, a 13.1% y-o-y increase. December saw China generate 316TWh of electricity from zero-emissions energy, a 17% y-o-y increase.

⁵ China Electricity Council, [China Electricity Council released the "2024-2025 National Electricity Supply and Demand Situation Analysis and Forecast Report"](#), 24 January 2025

A record 19% of the total power generation in CY2024 came from variable renewable energy (VRE), reaching 1,842TWh, a 25.3% y-o-y increase.

Hydropower generated 1,285TWh of electricity over CY2024, 13% of total power generation, a 4.8% y-o-y increase.

This is followed by wind power generation, reaching 989TWh over CY2024, 10% of the total power generation, an 11.6% y-o-y increase. December saw 100TWh of wind power generated, an 11.3% y-o-y increase.

After years of massively expanding solar power capacity, China's solar power generation is showing significant growth this year. In 2024, total solar power generation increased 46.1% y-o-y, reaching 853TWh, accounting for 9% of China's total power generation (inclusive of China's rapidly growing distributed solar generation). December saw China generate 72TWh of electricity from solar power, +58.6% y-o-y.

In 2024, China generated 4% of its total electricity from nuclear power, reaching 444TWh, a 2.2% y-o-y increase. December alone saw China generate 42TWh of electricity from nuclear power, +11.4 % y-o-y.

Bioenergy generated a total of 193TWh of electricity, representing 2% of the total power generated, down 2.5% y-o-y.

Still, a dominant 62% of China's total annual power generation came from thermal power, reaching 6,171TWh, a 1.7% y-o-y decrease. 59% of this 62% share came from coal.

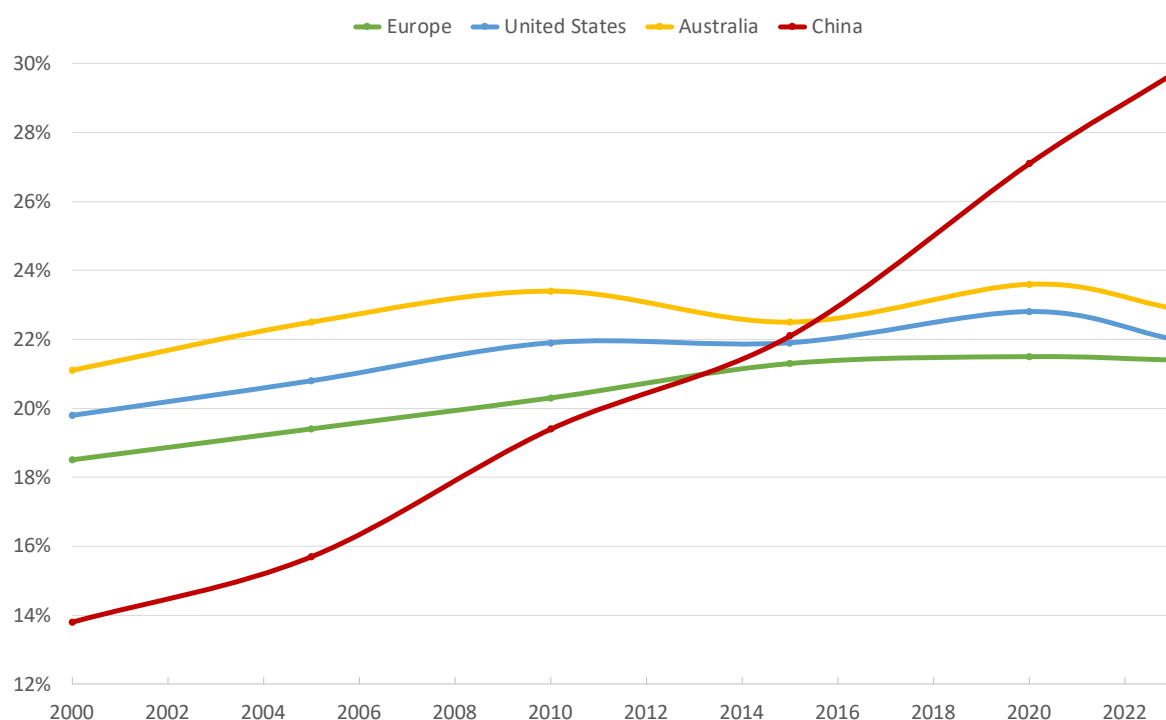
According to a February 2025 report by the Centre for Research on Energy and Clean Air (CREA) and Global Energy Monitor (GEM), in 2024 "94.5GW of new coal power projects started construction and 3.3GW of suspended projects resumed construction, the highest level since 2015," while just 2.5GW of coal projects were retired. China now accounts for 93% of global construction starts for coal power in 2024. This resurgence of new coal plant construction, fuelled by coal mining industry investments, and combined with structural policies that entrench coal's dominance in the energy system and limit renewables' integration, risks undermining China's carbon reduction goals. Strong policy direction in 2025 would be needed to phase down coal and thereby better enable an expanded role for renewables in the energy system, leveraging China's world leadership in battery energy storage system (BESS), PHS and national grid T&D connectivity.⁶

⁶ Centre for Research on Energy and Clean Air and Global Energy Market, [When coal wont step aside: The challenge of scaling clean energy in China](#), 13 February 2025

China's acceleration of whole-of-economy electrification

China's total electricity consumption in 2024 was 9.94 trillion kWh, a yoy increase of +5.7% according to Ember, although we note the NEA reported a higher +6.8% yoy. China alongside Japan lead the world in continuing a progressive electrification of everything strategy to permanently reduce reliance on imported fossil fuels. Its proportion of electricity in final energy consumption (28%) is much higher than that of the United States (22%) and the European Union (21%).⁷ The China Electricity Council (CEC) forecasted in 2022 that by 2025, the proportion of national electricity in final energy consumption would increase to 31.2%.⁸ At the beginning of the 2000s, China's electricity as a percentage of total final energy consumption was 30% below that evident in the US, and by 2022 it was 30% higher than the US, as shown in the graph below.⁹

Figure 4: Share of electricity in final energy consumption



Source: Enerdata, CEF calculations

Figure 4 also shows that Australia has not made any noticeable progress as yet in terms of a progressive electrification of everything, and continues to fall behind China. Our \$30bn annual oil import bill should provide a strong economic incentive for accelerated government policy impetus, as does our need to improve our energy security.

⁷ Sina Finance, [Global electricity demand will maintain rapid growth in the next three years](#), 18 February 2025

⁸ The Paper, [Report: By 2025, the proportion of electricity in national terminal energy consumption will increase to 31.2%](#), 24 February 2023

⁹ Enerdata, [Share of electricity in total final energy consumption](#)

Since 2018, China's growth rate of electricity consumption has been slightly higher than the growth rate of GDP. This is due to rising electrification levels in the primary and tertiary industries and in rural and urban households, driving the overall upward trend in electricity consumption per unit of GDP. Notably, internet and data services such as big data processing, cloud storage, and cloud computing had an average annual growth of 29.2% in electricity consumption from 2018 to 2023, and an increase of 30.9% y-o-y in 2024.¹⁰

In 2024, China's total electricity consumption increased by 6.8% y-o-y,¹¹ ahead of total energy demand, and its CY2024 GDP growth of 5%. This was primarily driven by increased electricity consumption in the primary (+6.3% y-o-y) and tertiary (+9.9% y-o-y) industries, and in rural and urban households (+10.6% y-o-y).¹²

According to the *China Electricity Council 2024-2025 National Electricity Supply and Demand Situation Analysis and Forecast Report*, total national electricity consumption is expected to increase by 6% y-o-y in 2025.¹³ The China Electricity Council (CEC) predicts that during the next 15th Five-Year Plan period, the proportion of national electricity in final energy consumption will continue to increase at an annual rate of about one percentage point, reaching 34% by 2030.¹⁴

The CEC also forecasted an ambitious total installed wind capacity of 640GW by the end of 2025, implying a world record +119GW of new wind capacity in CY2025. This would mean a 50% increase on CY2024's +79GW addition. Total installed grid-connected solar capacity was forecasted to reach 1,100GW by the end of 2025, implying at least 213GW of new solar capacity in CY2025, down from the 277GW added in 2024.¹⁵

Grid stability to optimise RE integration and utilisation will be a key focus in 2025

China is also ramping up investment in modernising grid infrastructure to keep pace with record high renewable energy capacity and generation. In 2024, China's national investment in power grid construction was 608b yuan (US\$83.4b), a y-o-y increase of 15.3%, breaking the record 5.4% y-o-y growth rate in 2023.¹⁶ Investment in DC projects increased by 227.5% y-o-y, most of which were long-distance ultra-high voltage (UHV) transmission line

¹⁰ China Report, [9.85 trillion kWh! The growth in electricity consumption shows the vitality of the economy](#), 13 February 2025

¹¹ NEA, [In 2024, the total electricity consumption of the society increased by 6.8% year-on-year](#), 20 January 2025

¹² China Report, [9.85 trillion kWh! The growth in electricity consumption shows the vitality of the economy](#), 13 February 2025

¹³ China Electricity Council, [China Electricity Council released the "2024-2025 National Electricity Supply and Demand Situation Analysis and Forecast Report"](#), 24 January 2025

¹⁴ China Report, [9.85 trillion kWh! The growth in electricity consumption shows the vitality of the economy](#), 13 February 2025

¹⁵ Xinhua New Agency, [China Electricity Council: It is expected that the total electricity consumption in society will increase by about 6% year-on-year in 2025](#), 24 January 2025

¹⁶ China News Network, [Report: China's grid infrastructure investment will exceed 530 billion yuan in 2024](#), 26 July 2024

construction projects to bring power from mega-bases in western China to the country's urban population centres. Three of these projects were put into operation in 2024, contributing to an increase in electricity transmitted across regions and provinces by 9.0% and 7.1% y-o-y respectively.¹⁷ In January 2025, China's State Grid announced it would invest a record 650 billion yuan (US\$88.7 billion) in the country's power grid in 2025.¹⁸

At the end of 2024, the total installed capacity of new energy storage projects that have been built and put into operation nationwide reached a record 74GW/168GWh, a y-o-y increase of over 130%. The annual investment in new energy storage construction also hit a record high of 76.7 billion yuan, a y-o-y increase of more than 150%.¹⁹ Of these projects, those with a capacity of 100MW and above accounted for 62.3%, an increase of about 10% from 2023, reflecting the trend of new energy storage power stations becoming more centralized and large-scale.²⁰ In terms of new BESS installations, China added 36GW in 2024, representing 49% of global additions.²¹ Meanwhile, energy storage technological innovation continues to make breakthroughs, such as the 300 MW compressed air energy storage power station²² or the 400MW Rudong integrated solar-hydrogen-storage project, both recently connected to the grid and becoming the largest of its kind in the world.²³

CEF is of the view that grid stability will be a key focus in 2025 given our expectation of continued strong electricity demand growth and even stronger VRE expansion, and another record year of new zero emissions capacity additions. As such, China's global leadership in deploying both pumped hydropower storage and BESS is highly likely to continue in 2025 as is its massive US\$84bn per annum investment in modernisation and expansion of inter-provincial grid T&D.

Rho Motion [reports](#) China installed a world record 9.3TWh of new BESS just in the single month of January 2025, representing 68% of the global BESS installs of 13.6TWh, which was up a staggering 94% y-o-y.

China's CO2 emissions have plateaued since February 2024

According to a Carbon Brief [analysis](#) by Lauri Myllyvirta from the Centre for Research on Energy and Clean Air (CREA), China's CO2 emissions have plateaued since February 2024 – while China's CO2 emissions in 2024 grew by an estimated 0.8% year-on-year, emissions

¹⁷ China Electricity Council, [China Electricity Council released the "2024-2025 National Electricity Supply and Demand Situation Analysis and Forecast Report"](#), 24 January 2025

¹⁸ Reuters, [China's State Grid outlays record \\$88.7 bln investment for 2025](#), 15 January 2025

¹⁹ China Energy News, [China's new energy storage installed capacity exceeds 70 million kilowatts](#), 24 January 2025

²⁰ NEA, [Transcript of the National Energy Administration's press conference for the first quarter of 2025](#), 23 January 2025

²¹ Volta Foundation, [Battery Report \(2024\)](#)

²² PV magazine, [World's largest compressed air energy storage facility commences full operation in China](#), 10 January 2025

²³ Asian Power, [China's largest offshore solar-hydrogen project connects to grid](#), 8 January 2025

were lower than in the 12 months to February 2024. This was driven by record growth in power generation from non-fossil sources, growing more than 500TWh compared with 2023, which had already been a record year. Solar power generation was responsible for half of the increase in clean power supply.

China's first energy law

Ensuring energy security as a top priority became enshrined in legislation when China's first [Energy Law](#) entered into force on 1 January 2025. This is part of a suite of legal and policy reforms aimed at ushering in a 'modern energy system'. Its provisions aim to optimise energy development and utilization, reserve management, supply and consumption, and emergency management systems. Article 22 provides for "priority development and utilization of renewable energy, the rational development and clean and efficient utilization of fossil energy, the promotion of the safe, reliable and orderly replacement of fossil energy with non-fossil energy (Article 22), and the Government will formulate and implement a minimum proportion target of renewable energy in energy consumption (Article 23).

Other notable features of the law include:

- accelerate the construction of a new power system, strengthen the coordinated construction of power sources and power grids, promote the intelligent transformation of power grid infrastructure and the construction of smart microgrids, and improve the power grid's ability to accept, configure and regulate renewable energy (Article 31)
- promote the construction of a unified national trading market for coal, electricity, oil, fossil gas and other energy (Article 42) and the establishment of an energy price formation mechanism (Article 45)
- strengthen energy science and technology research and innovation capabilities (Chapter 6)
- promote international investment and trade cooperation in the energy sector, and prevent and respond to risks in the international energy market (Article 46).

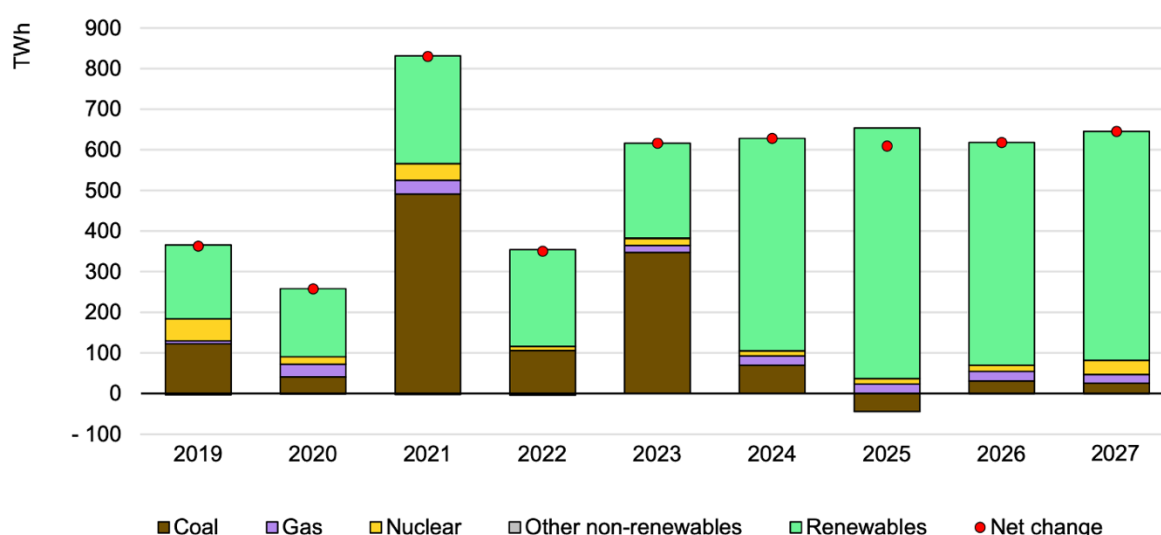
International Energy Agency Electricity 2025 Report

February 2025 saw the [IEA report](#) that in China, both electricity demand and GDP rose on average by 6.5% annually during 2016-2019. However, in 2020 electricity demand growth exceeded GDP growth, a trend which continues. Chinese electricity consumption in 2023 and 2024 was particularly strong, with annual growth rates of 7%. During the same period, GDP is estimated to have grown an average of 5%. Heatwaves and the resulting need for cooling have driven up electricity consumption in recent years. However, the main drivers of growth progressive electrification of everything, both residential demand and heavy industries, including the electricity needed to support China's rapidly growing exports (led by EVs, solar modules, fertilisers, aluminium & steel).

China leads the world in progressive electrification of everything, driven by the need to get off their economic addiction to fossil fuel imports. As climate deniers point to China's continued construction of flexible coal fired power plants (designed to balance VRE), they ignore that China's imported oil use in transport probably peaked in 2024, a decade ahead of most forecasters.

Interesting to see the IEA forecasts renewable energy will provide almost 100% of China's increased electricity demand over 2025-2027. Nuclear's addition is hard to see, and gas plays a rounding error role. Meanwhile, the IEA forecasts China's coal power generation plateaus at the 2024 peak, six years ahead of China's peak emissions pledge.²⁴

Figure 5: Change in Electricity Generation by Fuel Type in China, 2019-2027



Source: IEA Electricity 2025

The IEA notes global emissions intensity from electricity generation is on a sharply contracting trend, with a record 3% reduction in 2024. China accounted for a substantial share of the global decline in 2024, with emissions intensity of power generation falling by 5% y-o-y due to the very strong variable renewable energy growth. Over the outlook period, emissions intensity in China is projected to decrease by an average 5.3% annually, reaching 480g CO₂/kWh by 2027, down from 565g CO₂/kWh in 2024.

New Market Pricing Approach for Renewable Energy in China

February 2025 saw China's National Development and Reform Commission and the National Energy Administration jointly announce a new offtake pricing regime for renewable energy generators effective for new capacity built post 1 June 2025. This announcement is the biggest change to the sector since 2021, and we agree with [Lantau's David Fishman](#) that this will have profound and far-reaching impacts on the long-term development of renewable

²⁴ IEA, [Electricity 2025: Analysis and forecast to 2027](#), February 2025

energy in China. It is a breakthrough that reflects a continued push by Chinese authorities to shift the maturing renewable energy sector away from subsidies.

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

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