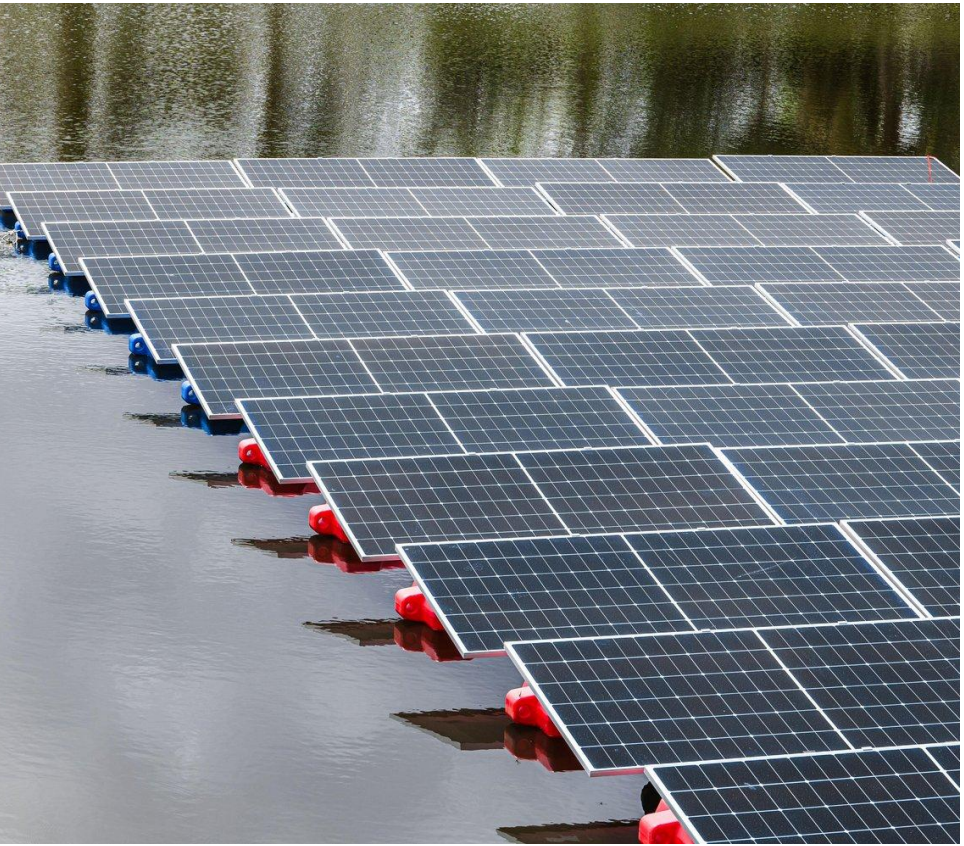


CREA

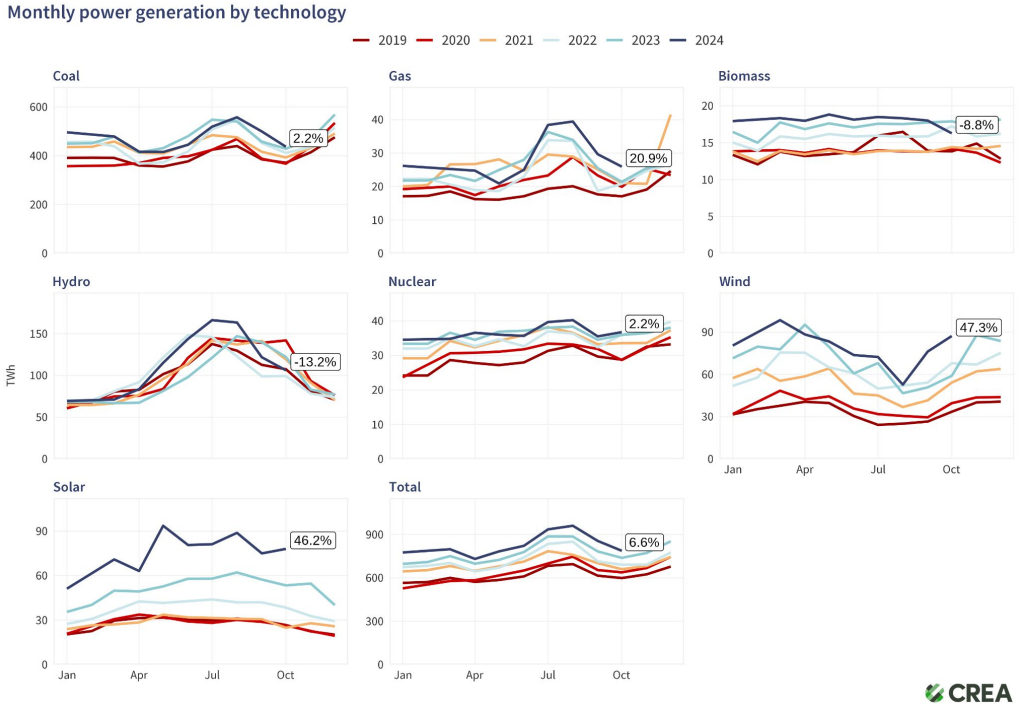
Centre for Research on Energy and Clean Air

China energy and emissions trends

November 2024 snapshot

Hydropower declined while solar and wind continued to grow

- Total power generation increased by 6.6%, while large-scale power generation grew by 2.1%, indicating most power generation growth comes from solar and wind installations that are outside of the industrial production statistics.
- Coal and gas power generation increased by 2.2% and 20.9%, respectively. This increase was driven by power demand growth and a 13.2% decline in hydropower generation due to drought conditions.
- Wind power generation continued to grow, with an increase of 47.3%, while solar power generation saw an increase of 46.2%.
- Nuclear power generation increased by 2.2%.

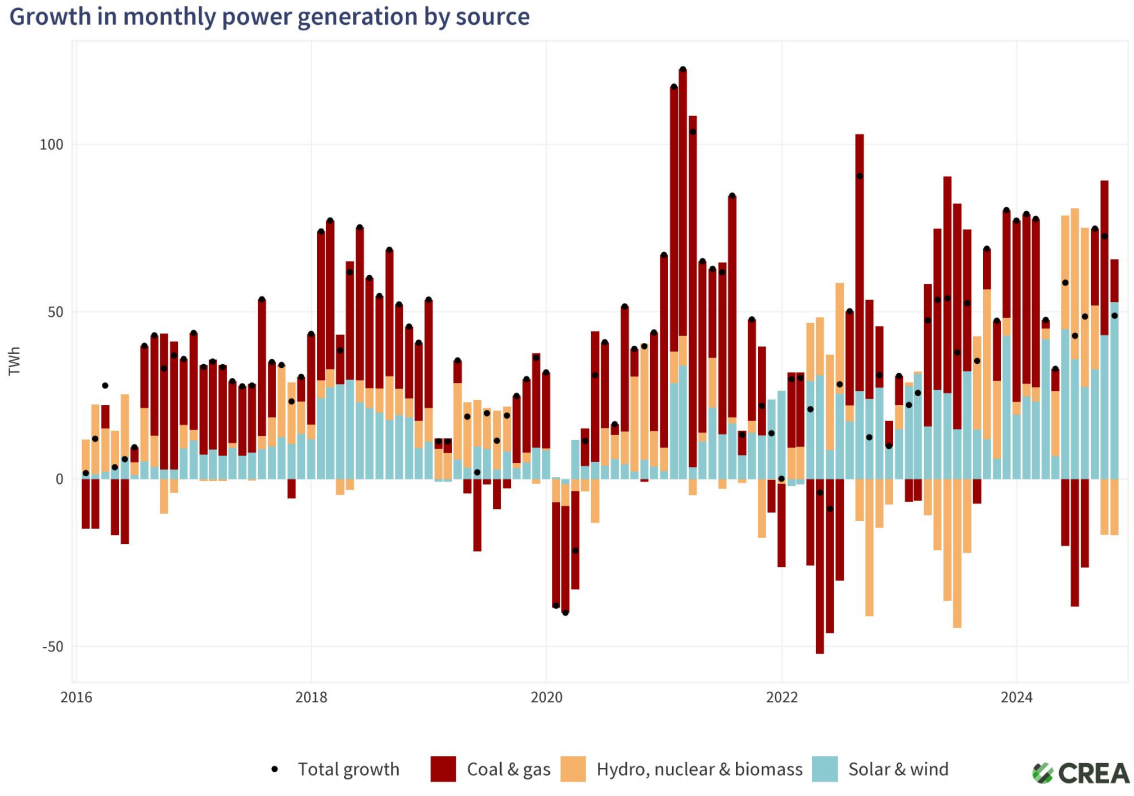


National Bureau of Statistics (NBS) underreports wind and solar generation, particularly from rooftop and smaller solar plants. Find CREA's methodology for power generation here.

Clean energy boom continues to drive power sector emissions peak

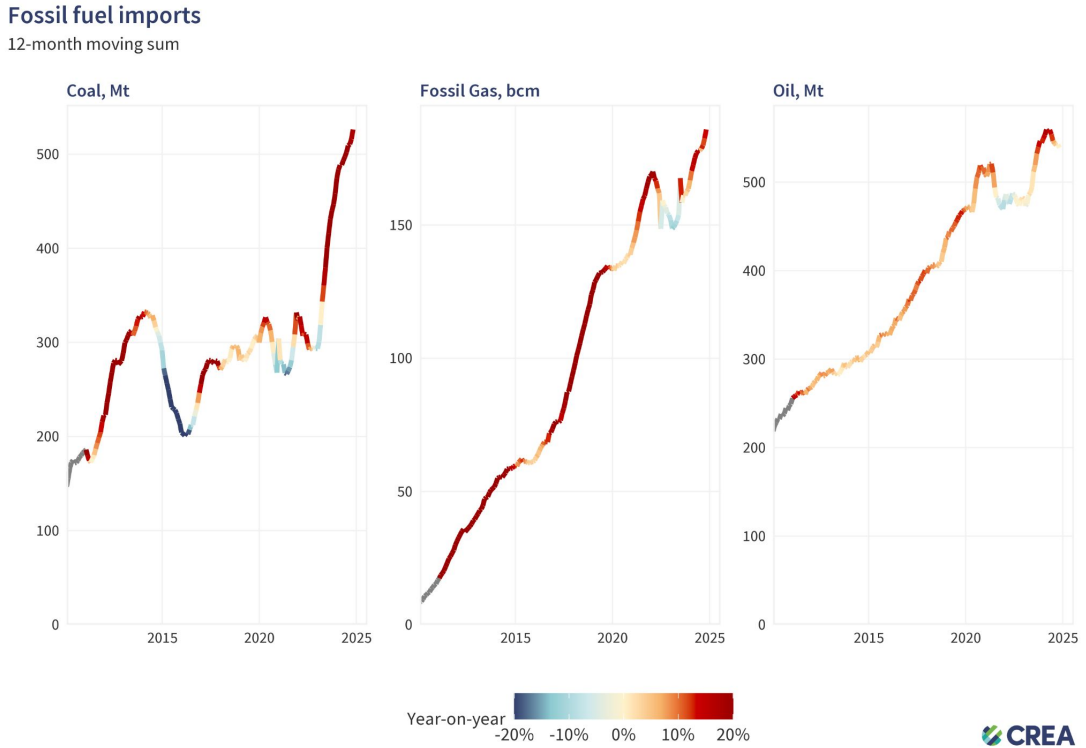
- China's solar and wind power generation growth exceeded total power demand growth in October, showing how the clean energy boom is driving power sector emissions to peak.
- Since May, solar, wind, and hydro have met 99% of the power demand growth. If this trend continues, February 2024 could mark the peak month for China's carbon emissions, with total emissions for 2024 potentially lower than those in 2023.

Read more: *No growth for China's emissions in Q3 2024 despite coal power rebound*



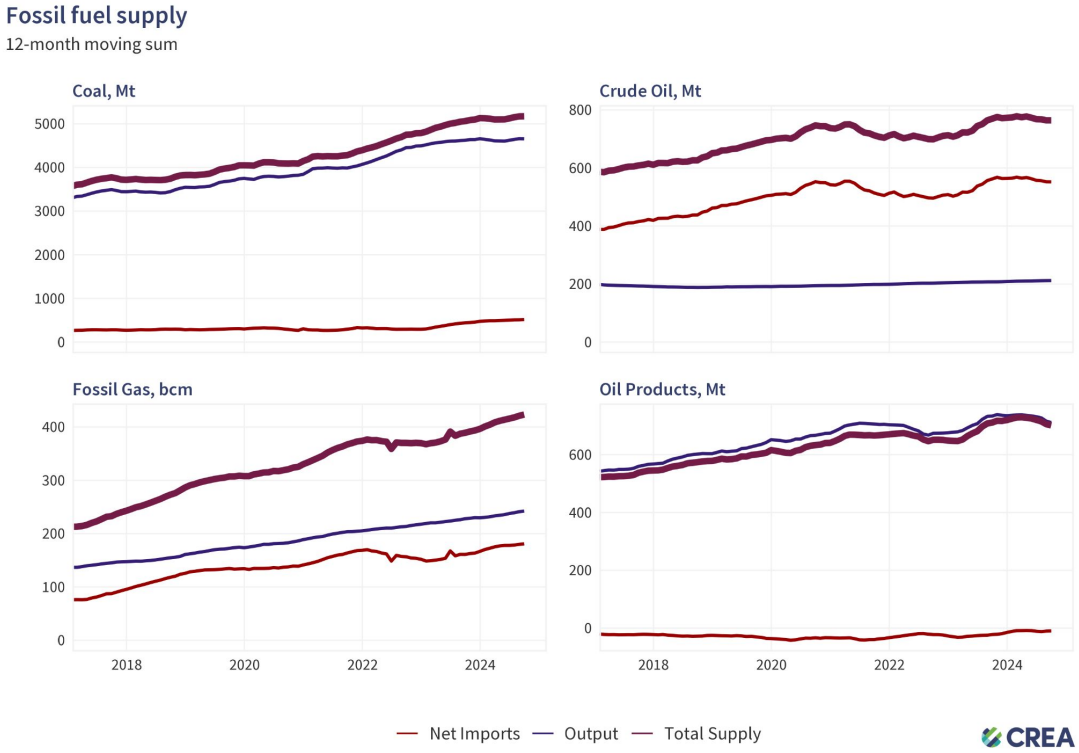
Coal and gas imports continue to increase

- Coal imports in October continued to increase by 28.5%. In the past few months, imported coal has a price advantage over domestic coal, leading to a significant increase in coal imports.
- Crude oil imports in October decreased by 8.7%, continuing the downward trend observed in recent months.
- Natural gas imports, which have been growing rapidly this year, increased by 20.7% in October. From January to October, imports rose by 13.6% compared to the same period last year, mainly driven by increased gas supplies through the China-Russia Eastern Pipeline, and a rise in spot LNG purchases.



Crude oil and oil refinery supply remained sluggish

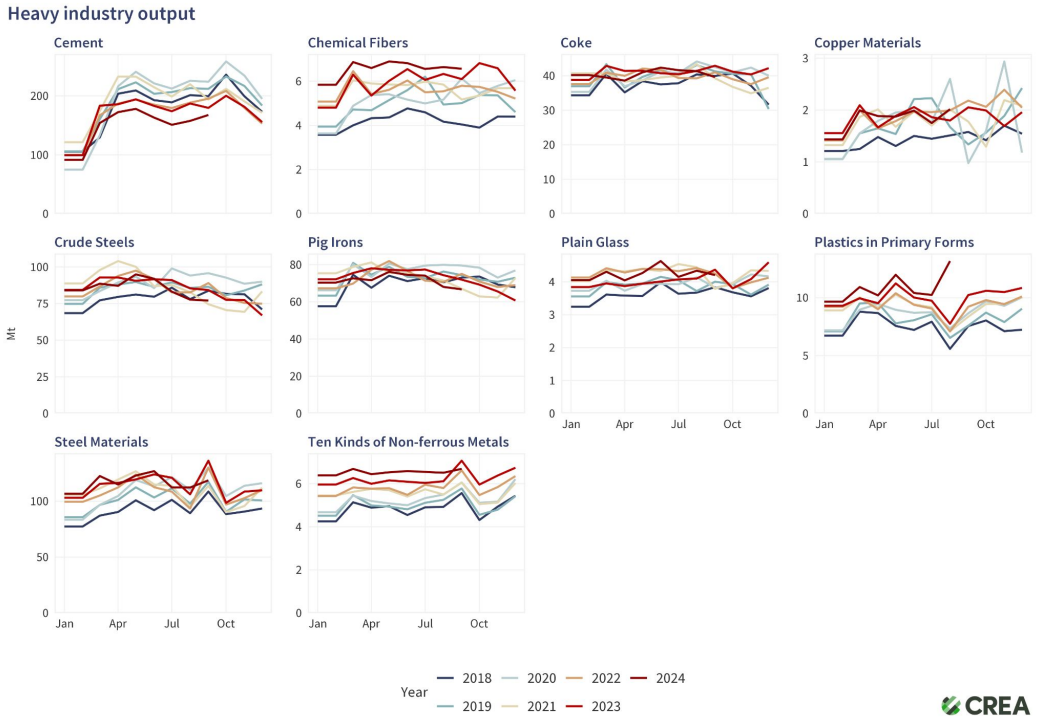
- Domestic coal output grew by 4.6%, while imports continued to rise. Year-to-date production from January to October increased by 1.2% year-on-year.
- Fossil gas imports increased by 20.7% and domestic production grew by 8.4%.
- Crude oil output increased by 2%, while import volumes fell by 8.7%. The growth in oil supply remains sluggish.
- Oil refining volumes continued to decline by 4.6%; oil products consumption has been a key sector where emissions have fallen this year.



Pig iron output saw first increase in 2024, cement continued to fall

- In October, pig iron output saw a 1.4% year-on-year increase, while crude steel and steel product outputs rose by 2.9% and 3.5%, respectively, driven by stimulus measures that boosted prices and expectations for a construction sector recovery.
- The total output of pig iron and crude steel in the first ten months of 2024 has significantly decreased, contributing to the CO2 emission reduction.
- Cement production continued to fall by 8%.
- The output of chemical fibers products and non-ferrous metals continued to grow, albeit at a more moderate pace compared to previous months, with chemical production rising by 4.1% year-on-year and non-ferrous metals by 0.6%.

The steel and cement industries are the largest CO2 emitters in China, when emissions from their electricity use are included. They are also bellwethers of real estate, infrastructure and other fixed asset investments that play an outsized role in China's emissions and economy.

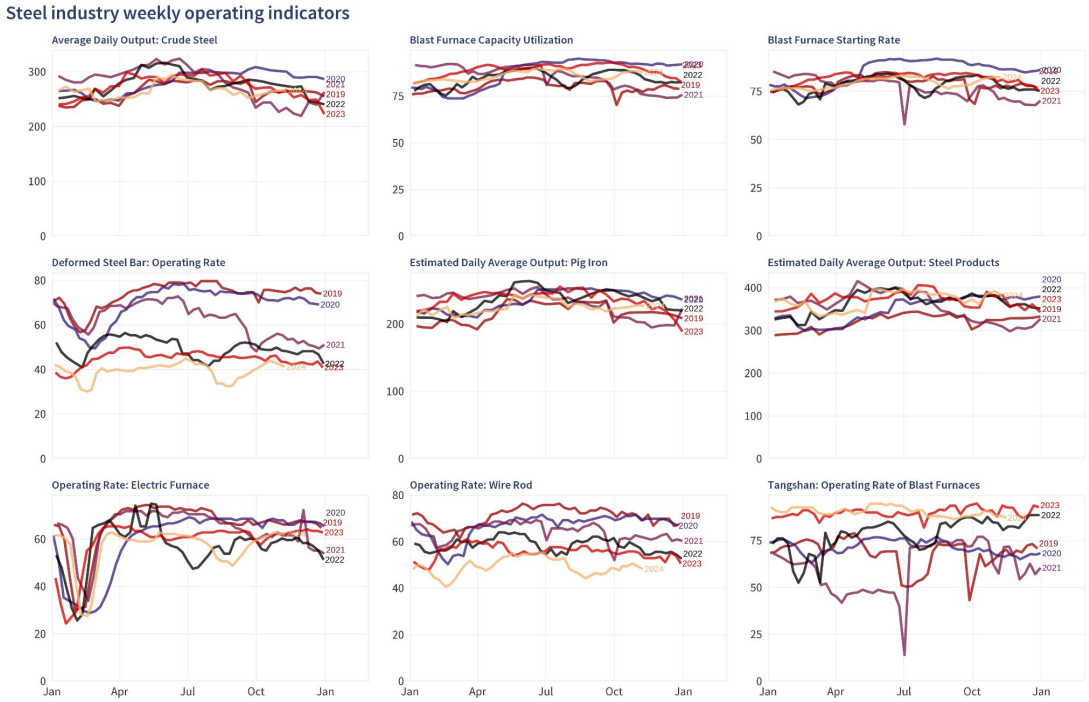


CREA

Steel industry continues to grapple with challenges

- Blast furnace starting rates and capacity utilization showed a slight improvement; operating rates of electric furnaces gradually recovered after a sharp decline but remained sluggish.
- After H1 2024 saw no new permits issued for coal-based steel plants, China issued a policy in August suspending all new steel plant permits.
- After maintaining high levels for an extended period, the operating rate of blast furnaces in Tangshan, China's 'steel capital' and a significant source of air pollution in Beijing, has started to show a downward trend as the city begins to regulate crude steel production due to failing air quality standards.
    - Hebei industrial output is a bellwether of national priorities: when air quality and emissions are the priority, it is the most tightly regulated area due to its impact on Beijing's pollution levels.

There were no new permits for coal-based steelmaking projects in the first half of 2024 for the first time since China announced its 'dual carbon goals' in September 2020. Read more here.



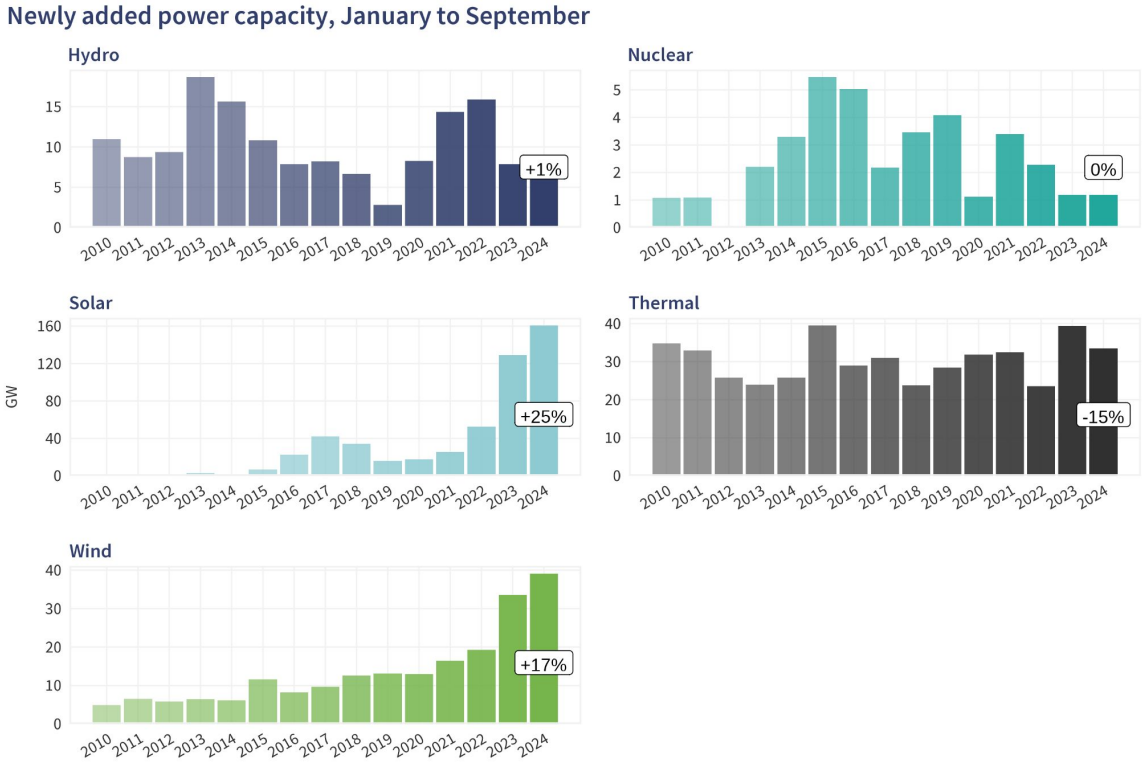
Source: Wind Information

CREA

Rapid growth in solar and wind continues

- In September, China added 20.6 GW of solar power capacity, up 31% from last year. A total of 161 GW was added in January to September, up 25% from last year.
- In September, China added 5.5 GW of wind power capacity, up 14.0% from last year. A total of 39.12 GW was added in January to September, up 17% from last year.
- In September, China added 4.2 GW of thermal power capacity, down -37% from last year. A total of 33.43 GW was added in January to September, down -15% from last year.
- In September, China added 1.9 GW of hydro power capacity, up 236% from last year. A total of 7.97 GW was added in January to September, up 1% from last year.
- In September, China added 0 GW of nuclear power capacity, unchanged from last year. A total of 1.2 GW was added in January to September, same as last year.

Read more here.

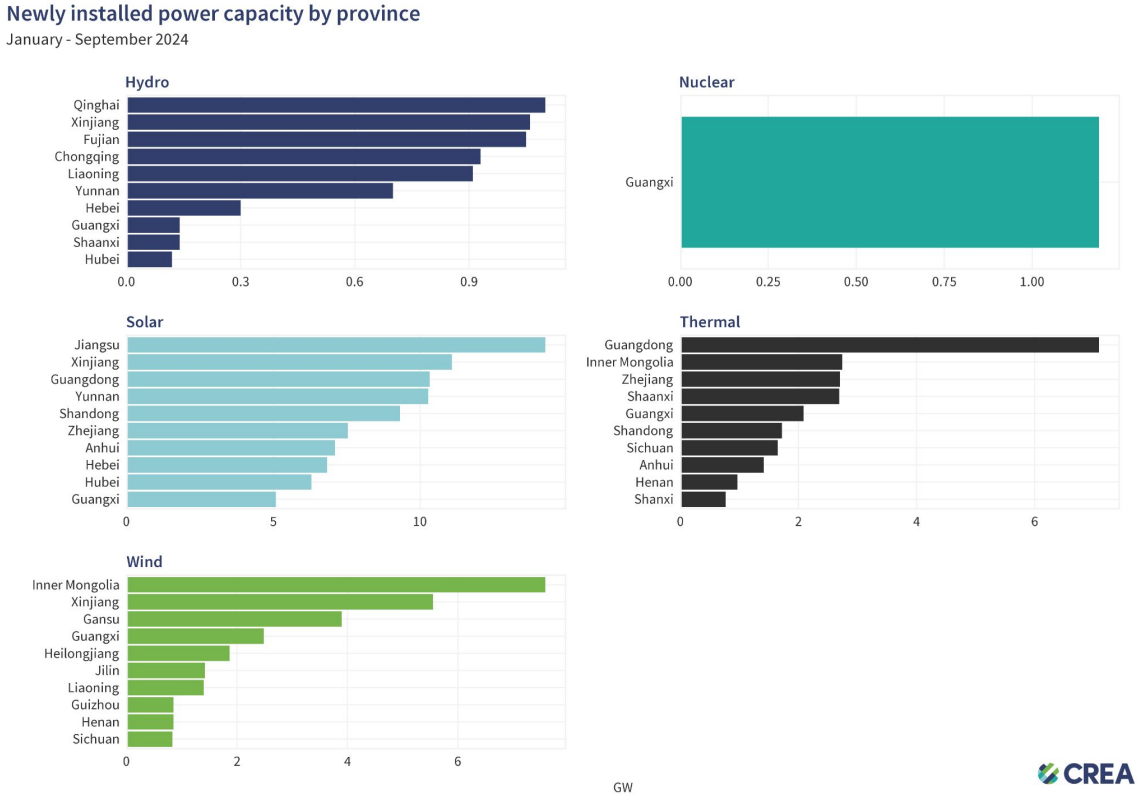


CREA

Wind and solar surge in clean energy bases

- Solar power installations are led by Jiangsu, Xinjiang, and Guangdong. In Jiangsu, it is mainly distributed solar, while in Xinjiang, it is driven by projects in large-scale clean energy bases.
- Inner Mongolia, Xinjiang and Gansu lead in wind development, also under large-scale clean energy bases initiative. Heilongjiang, a key province in the Songliao clean energy base, is rich in wind power resources.
- Thermal (coal) power additions accelerated in Guangdong, Inner Mongolia and Zhejiang. Eastern demand centres are rising in thermal power capacity at the same speed as western provinces, which are aiming to export power. A redundancy may be anticipated once plants are completed in a few years.

Read more here.

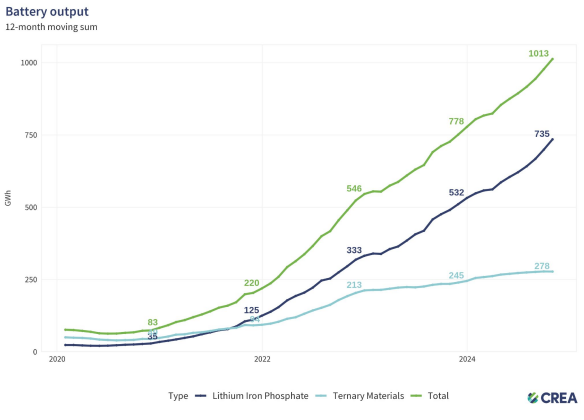


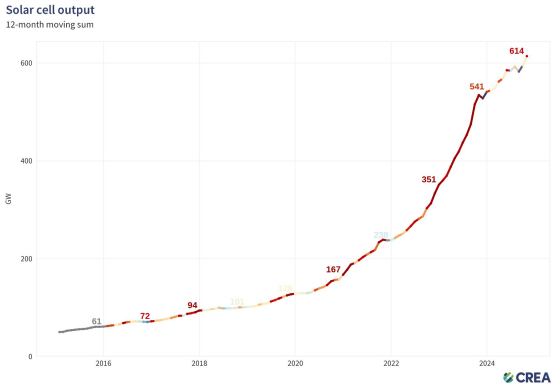
CREA

CREA

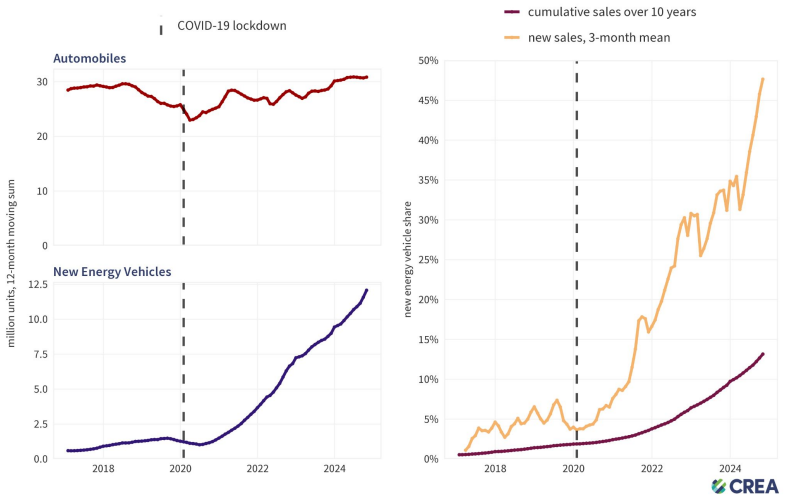
New energy vehicle (NEV) market share continues to increase

- The 12-month moving sum production of solar cells has reached 614 gigawatts, reflecting a continued recovery from the previous dip.
- In October, NEV production continued the rapid growth seen in September, with a year-on-year increase of 48%. China's NEV production has surpassed 10 million units this year.
- Driven by economic stimulus policies, NEV sales in October experienced a year-on-year increase of 57%, with the market share for new sales (based on a 3-month mean) approaching 50%. The sales trend of ‘declining ICE vehicles and rising NEVs’ has solidified, with NEVs driving growth by capturing ICE vehicles share.



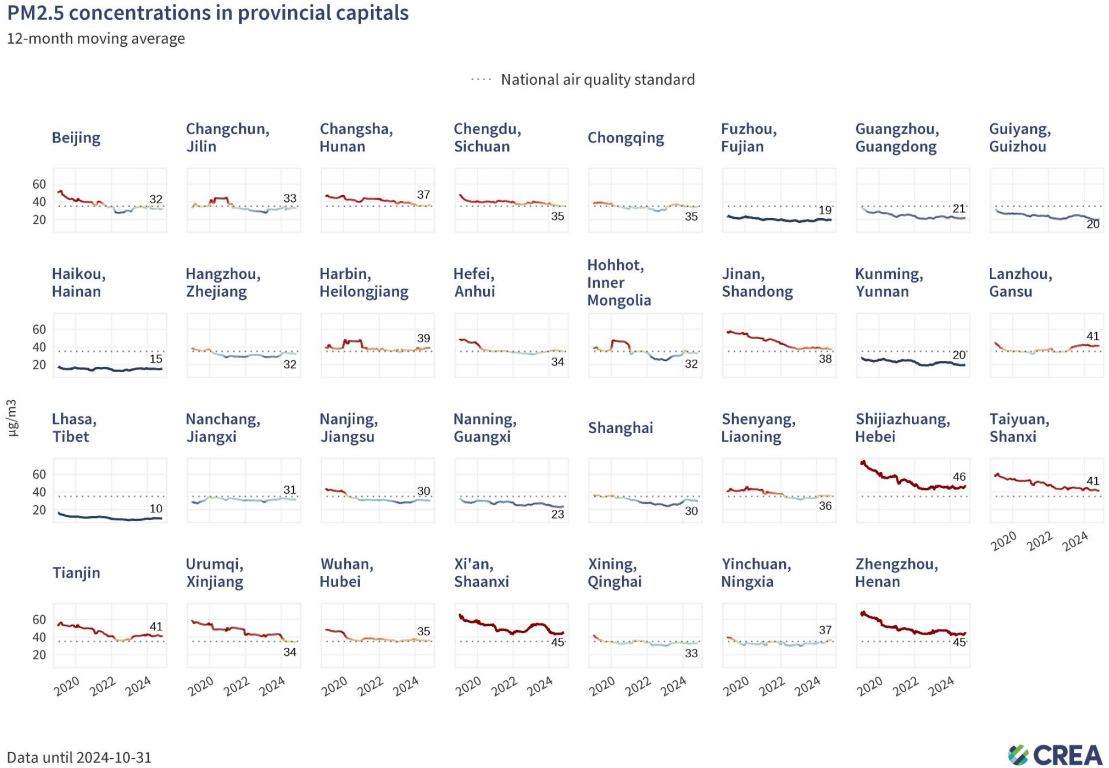


Vehicle production



By the end of October, 35% of provincial capitals risk not meeting the national standard for PM2.5 for 2024

- 11 out of 31 provincial capitals' 12-month average exceeded the national standard for PM2.5 of 35 ug/m3, and the number decreased by 1 city compared to last month.
- The largest 12-month average PM2.5 values were in the provincial capitals of Hebei, Henan, Shaanxi, Shanxi and Gansu, focused in northern China, with 46, 45, 45, 41 and 41 ug/m3, respectively.
- Seven capital cities had an increase in yearly PM2.5 values compared to the previous month, among which Henan of Zhengzhou had the largest increase.

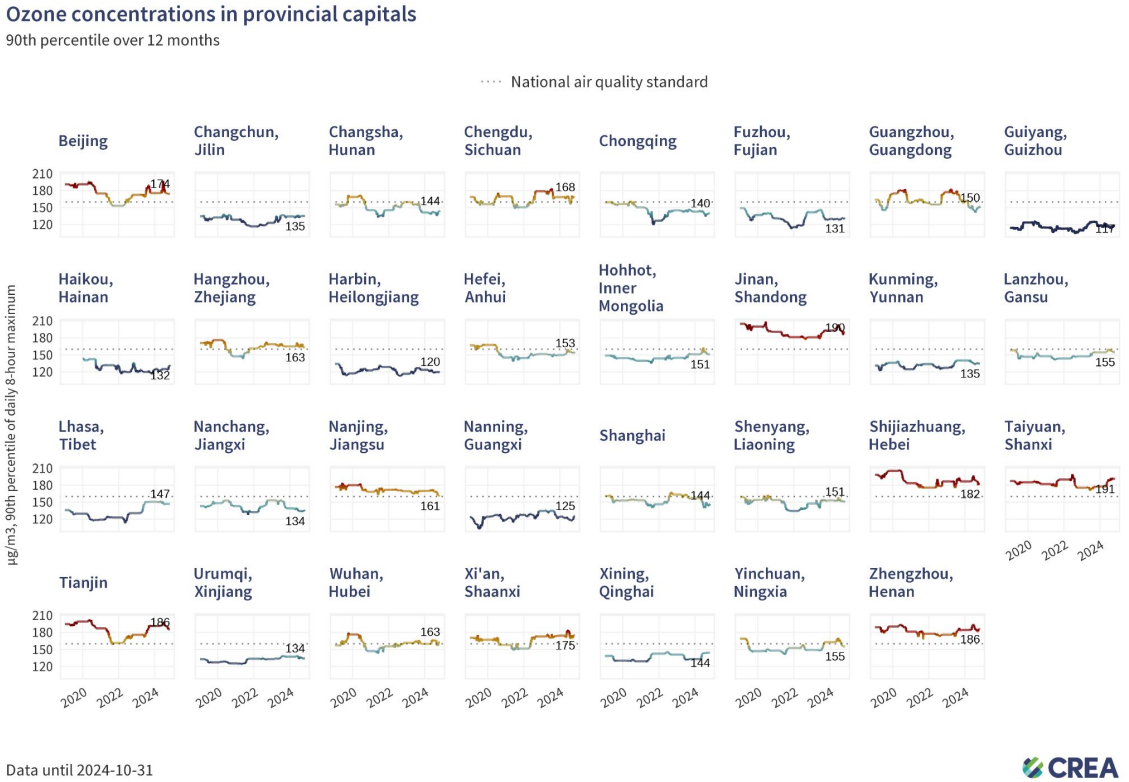


Data until 2024-10-31

CREA

Beijing-Tianjin-Hebei and the surrounding areas had the worst yearly average concentrations of ozone by October

- In October, 11 out of 31 provincial capitals exceeded the yearly standard for ozone of 160 ug/m3, an increase of one city compared to last month.
- The largest 90th percentiles of ozone over 12 months were in the capitals of Shanxi, Shandong, Henan, Tianjin, and Hebei, focused in the Beijing-Tianjin-Hebei and surrounding areas, at 191, 190, 186, 186, and 182 ug/m3, respectively.
- Six provincial capitals have increased the yearly ozone concentration by this October compared to the previous month. Among them, Haikou of Hainan had the largest increase.



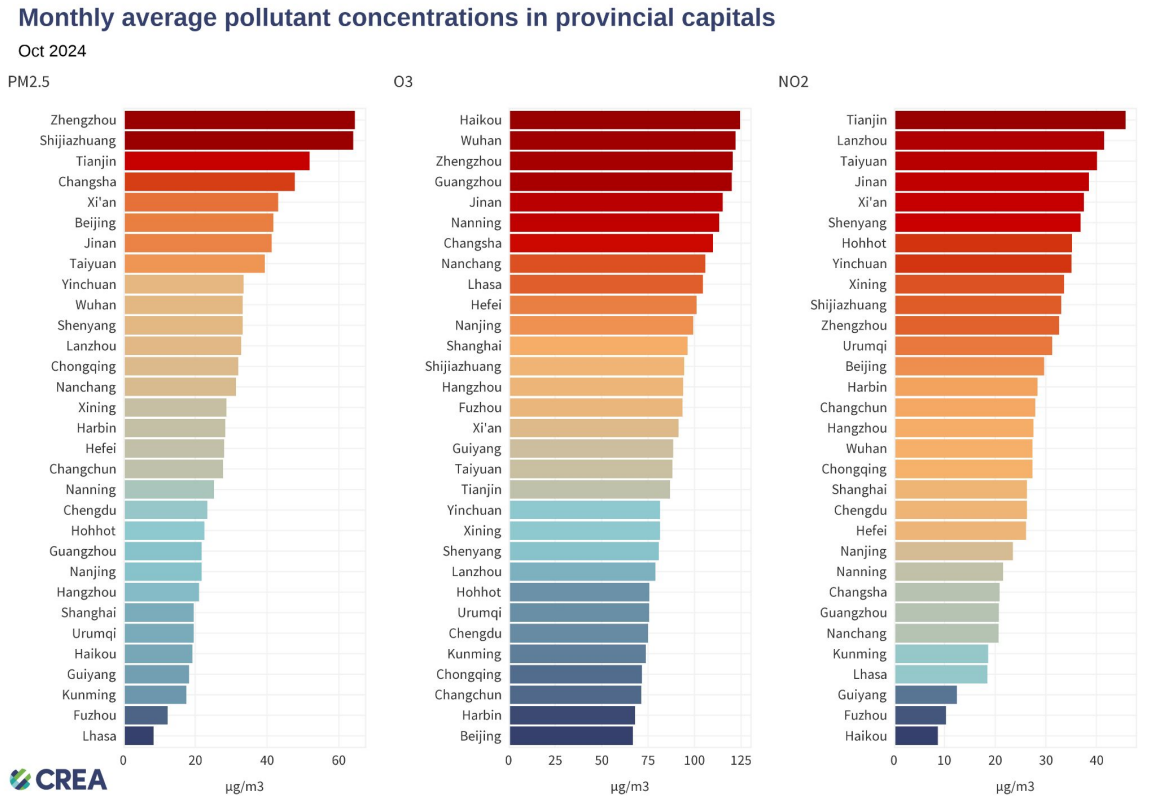
Data until 2024-10-31

CREA

The Beijing-Hebei-Tianjin region in China recorded the highest levels of PM2.5 and NO2, leading to intense smog formation

- The worst PM2.5 levels were concentrated in northern China in October. The capital of Henan province, Zhengzhou, and the capital of Hebei province, Shijiazhuang, rose to the top, both with a monthly concentration of 64 ug/m3. They were followed by the capitals of Tianjin, Hunan and Shaanxi provinces, with monthly concentrations of 52, 48 and 43 ug/m3, respectively.
- The worst ozone levels were measured in the southernmost provincial capital of Hainan at 125 ug/m3. It was followed by other provincial capitals of Hubei, Henan and Guangdong, with monthly concentrations of 122, 121 and 120 ug/m3.
- Tianjin rose to rank worst for NO2 levels, with a monthly concentration of 46 ug/m3. It was then followed by the provincial capitals of Gansu, Shanxi and Shandong in northern China.

NO2 contributes to PM2.5 and ozone levels, besides being a dangerous pollutant in its own right.

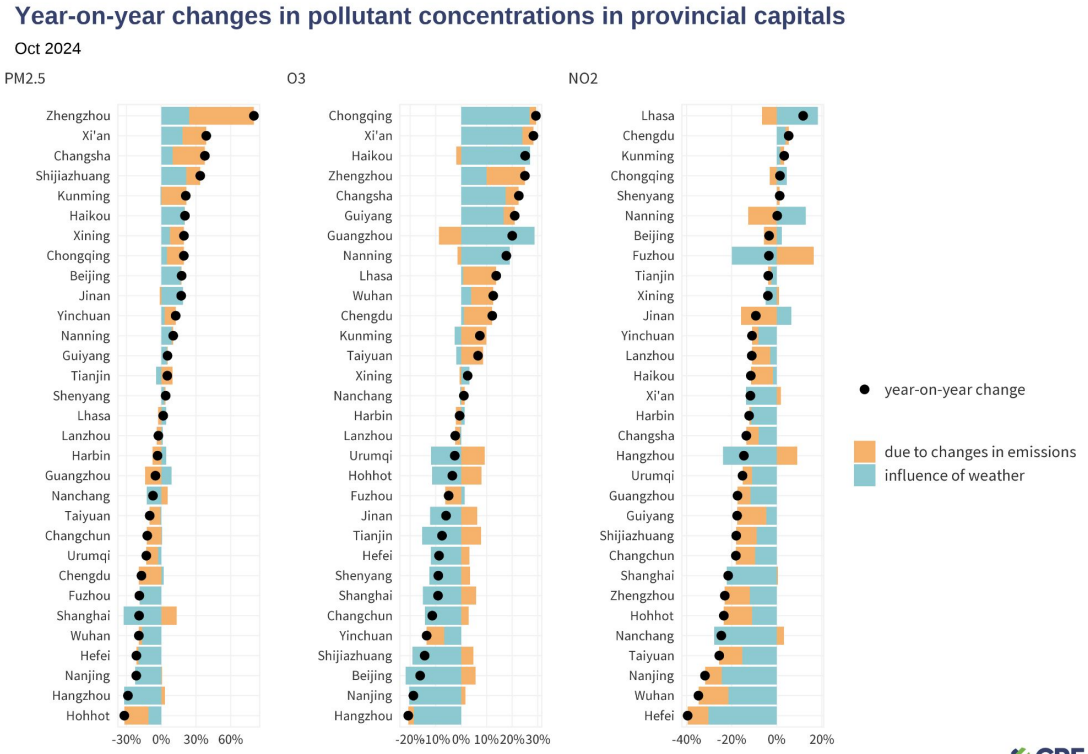


CREA

The capital city of Henan had the largest PM2.5 year-on-year increase in October, with contributions mainly from anthropogenic emissions

- PM2.5 pollution increased the most year-on-year in the provincial capitals of Henan, Shaanxi, Hunan and Hebei, by 80%, 39%, 38% and 34%, respectively, leading to severe smog.
- The largest year-on-year PM2.5 increases, driven by higher emissions, were in the capital cities of Henan, Hunan, Yunnan, and Shaanxi.
- The largest ozone year-on-year increases in October were observed in the capital cities of Chongqing, Shaanxi, and Hainan, mainly affected by unfavourable weather conditions.
- Year-on-year NO2 increases were highest in the capital cities of Tibet, Sichuan, and Yunnan in October.

Our analysis projects the influence of weather conditions on air pollution levels using a machine-learning model trained on actual data for each city. The variations that cannot be explained by weather conditions is attributed to changes in emissions.



CREA

CREA

Worst 7-day air pollution episodes by pollutant

PM2.5 (excluding sandstorms)

city	province	dates	average concentration	highest daily concentration
Xinxiang	Henan	Oct 25 – Oct 31	117	171
Anyang	Henan	Oct 25 – Oct 31	116	174
Xuchang	Henan	Oct 26 – Nov 01	112	159
Hebi	Henan	Oct 25 – Oct 31	110	161
Handan	Hebei	Oct 25 – Oct 31	107	168

Ozone

city	province	dates	average concentration	highest daily concentration
Jiangmen	Guangdong	Oct 07 – Oct 13	192	207
Zhaoqing	Guangdong	Oct 11 – Oct 17	184	244
Zhongshan	Guangdong	Oct 07 – Oct 13	180	199
Zhuhai	Guangdong	Oct 04 – Oct 10	178	198
Foshan	Guangdong	Oct 07 – Oct 13	175	226

Sandstorms ($PM_{2.5}$)

city	province	dates	average concentration	highest daily concentration
Jiuquan	Gansu	Oct 14 – Oct 20	34	117
Zhangye	Gansu	Oct 14 – Oct 20	24	85
Sanmenxia	Henan	Oct 10 – Oct 16	14	101
Yuncheng	Shanxi	Oct 10 – Oct 16	14	97
Jinchang	Gansu	Oct 13 – Oct 19	7	51

NO_2

city	province	dates	average concentration	highest daily concentration
Tianjin	Tianjin	Oct 24 – Oct 30	56	69
Tangshan	Hebei	Oct 24 – Oct 30	53	63
Baoding	Hebei	Oct 24 – Oct 30	53	62
Zibo	Shandong	Oct 25 – Oct 31	52	61
Xinxiang	Henan	Oct 09 – Oct 15	51	73

Unit: μg/m³

CREA

Data sources

- Industrial output, power generation and power capacity additions, as well as fuel imports and exports, are based on Chinese government data, through Wind Financial Terminal. Some of the data is not included in public releases.
- Measured air quality data is compiled from Chinese government air quality monitoring stations. Weather-controlled air quality is derived from CREA's deweathering algorithm.