

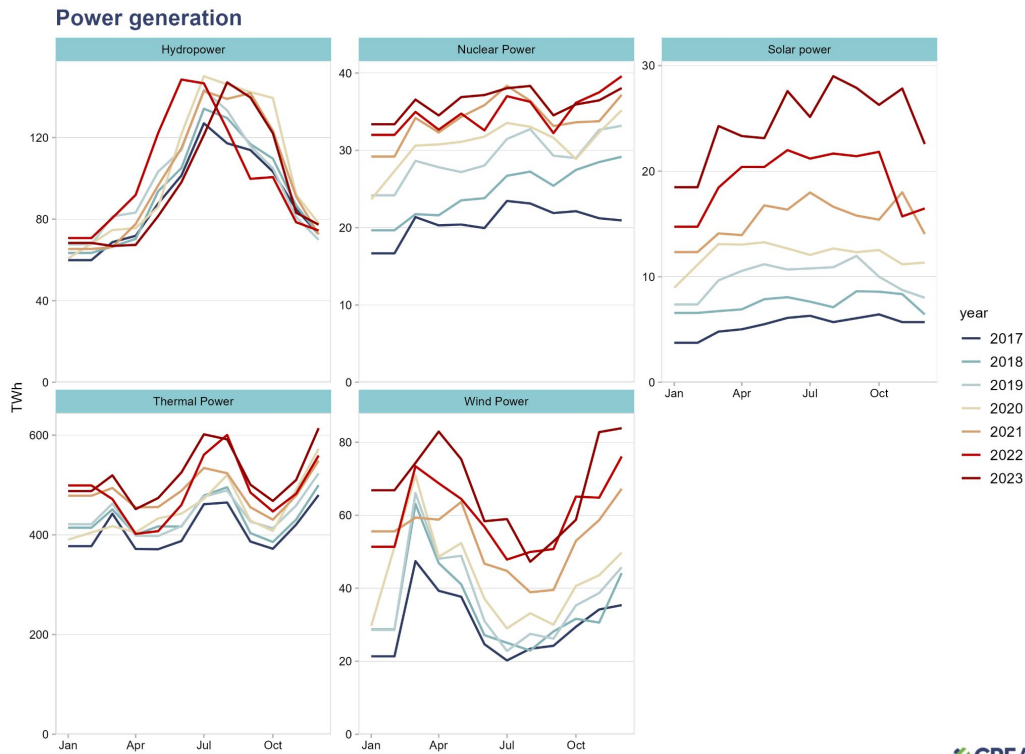
Centre for Research on Energy and Clean Air

China energy and emissions trends

January 2024 snapshot

Thermal power output growth jumped

- December witnessed a 8% increase in total power generation, against a lower baseline, while the total power generation in full year 2023 saw an increase of 5.2%.
- In December, over half of the provinces in the country experienced cities that broke records for the lowest December temperatures.
- The growth rates for hydro power, wind power and solar power generation have declined. Hydro power saw a 2.5% increase, wind power a 7.4% increase and solar power generation rose by 17.2%.
- Hydropower growth slowed, as November usually marks the start of the dry season in China's southwestern region. Power generation from hydro increased 2%, which is less than the increase in capacity over the past year, marking a further fall in utilisation.
- Nuclear power generation saw a 4.2% decrease.
- The growth rate of thermal power generation accelerated, increasing by 9.3%, due to the large increase in demand and weak growth of non-fossil power generation.

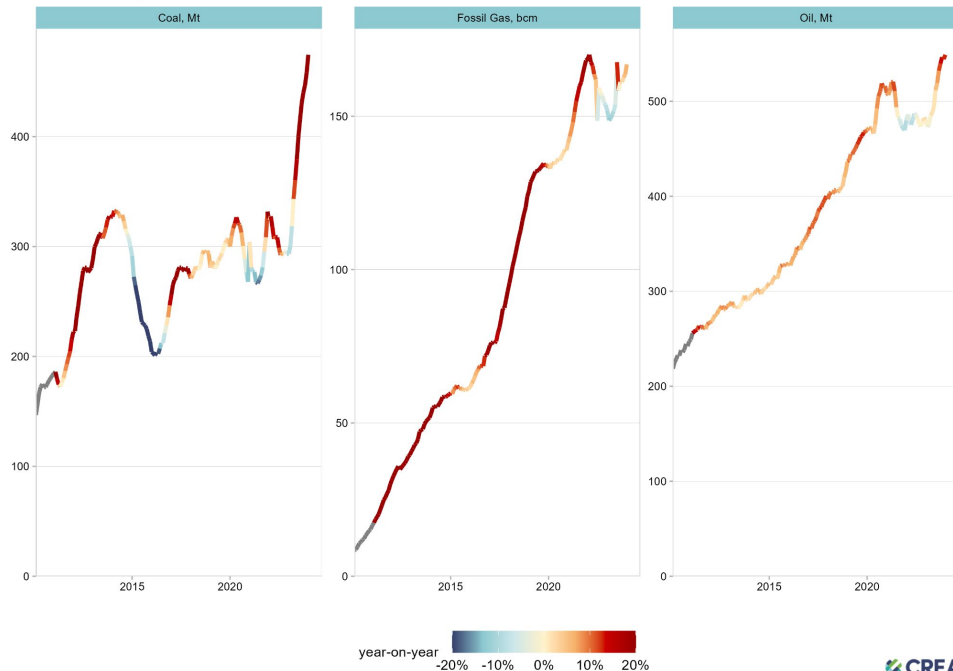


Coal imports surge due to end of zero-tariff policy

- Due to China ending its zero-tariff policy on coal imports on 1 January 2024, coal imports soared in December, showing a 53% increase. The total coal imports in 2023 increased by 61.8%.
- In December, fossil gas imports increased by 23%, pushing the full-year number up to a 9.9% rise. The growth can be attributed to the expanding domestic demand coupled with easing of international gas prices.
- Crude oil imports increased by just 0.6% in December. Driven by a surge in the first half of the year, the total crude oil imports for 2023 saw an 11% increase compared to the previous year, showing the resurgence of domestic demand.

Fossil fuel imports

12-month moving sum



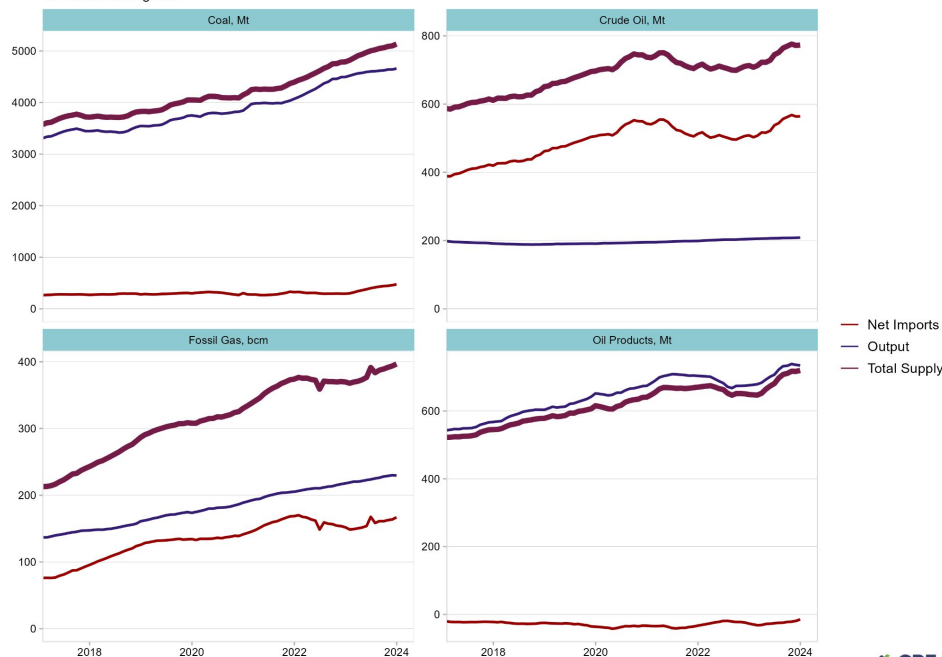
Fossil fuels supply growth driven by imports

- The growth rate of fossil fuels total supply (production plus net imports) rebounded after the fall in November, except for crude oil
- Growth is currently supplied mainly by imports for all fuels, with domestic coal, oil and gas output increasing much slower than implied demand.
- In the case of gas, imports are still down from their peak due to an increase in domestic output since 2021, but current rebound in demand is resulting in increases in imports.
- Coal output growth slowed down, reflecting the limitations of domestic supply, despite higher demand.

The government engaged in a major push to increase domestic coal production and suppress high prices in 2021–22. The result was a massive increase in the tonnage of coal produced, but at the cost of deteriorating coal quality, which means that the energy content of the coal produced didn't increase correspondingly. Coastal users shifted to imported coal en masse, which led to a surge in imports in 2023. The failure of the domestic coal mining push has major implications for China's approach to energy security. Read more: [What is causing the record rise in both China's coal production and imports?](#)

Fossil fuel supply

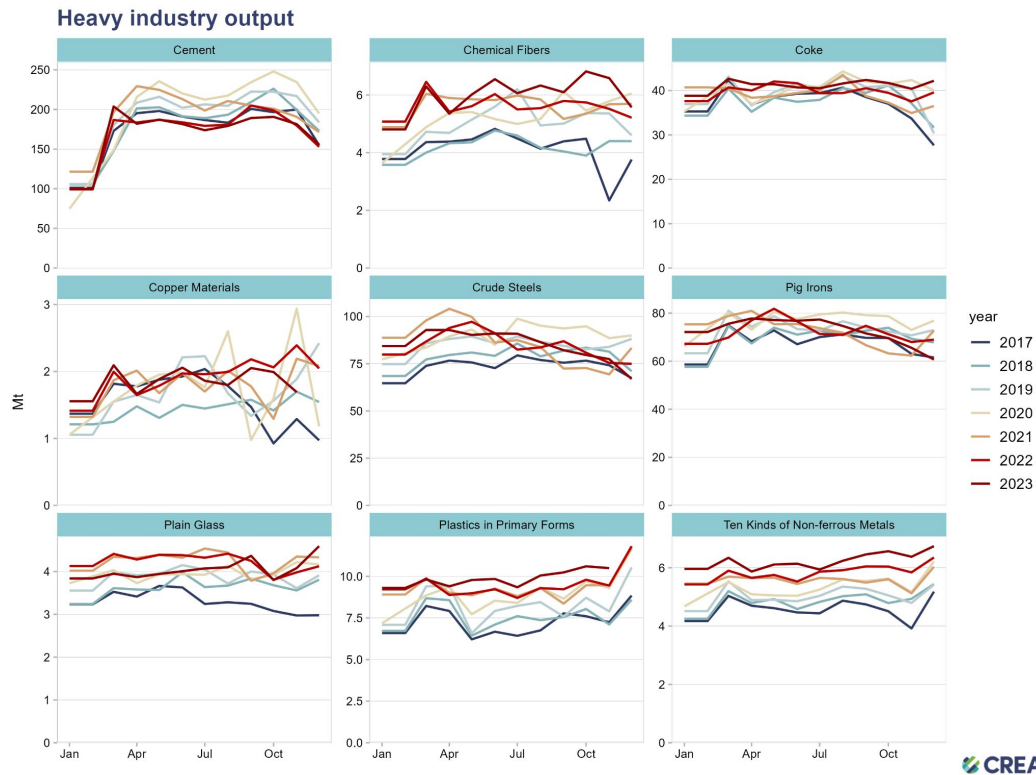
12-month moving sum



Crude steel output plummeted in last-minute correction to meet control target

- In December, crude steel production fell by a dramatic 15%, due to an apparent last minute campaign to hit the target of limiting output to 2022 level.
- Steel output had increased in the first 11 months, making the control target seem out of reach.
- The production of steel products increased, indicating that producers ran down crude steel inventories to maintain supply.
- Pig iron fell 12% and cement by 1% in December, showing the real estate investment contracted further.
- Chemical and non-ferrous metals output growth continued strong.
- Cement output has been declining since 2020, leaving the industry with overcapacity and testifying to declining construction volumes.

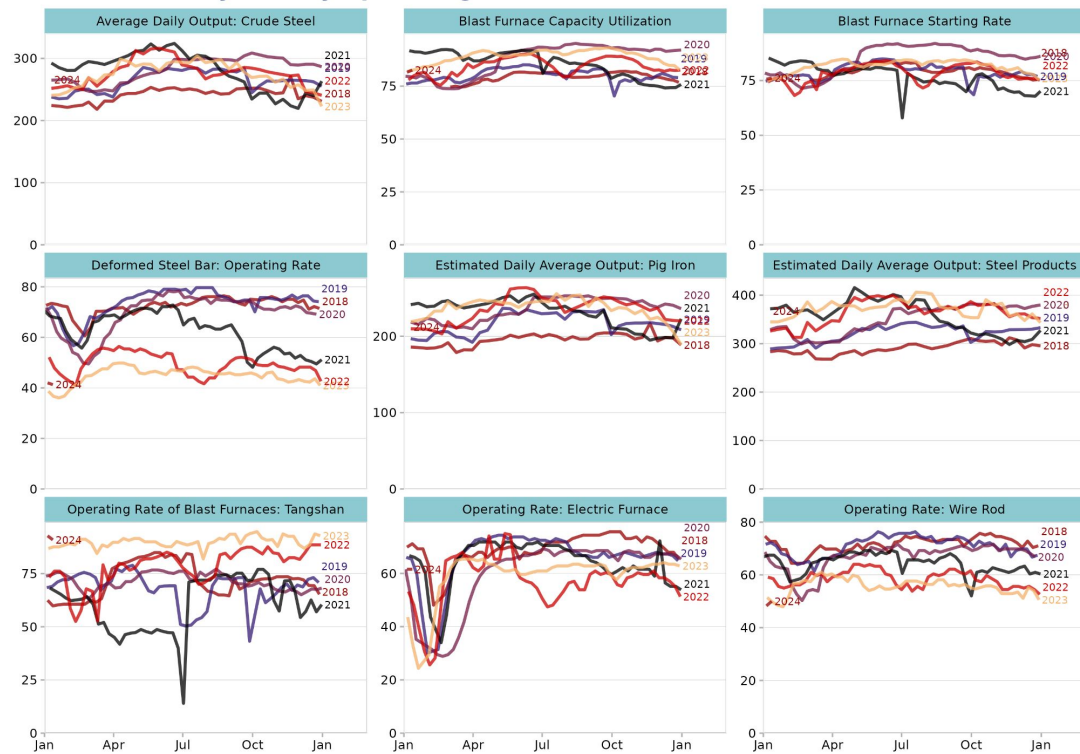
The steel and cement industries are the largest CO₂ emitters in China, when emissions from their electricity use are included. They are also bellwethers of real estate, infrastructure and other fixed asset investment which play an outsize role in China's emissions and economy.



Crude steel output continues to decline

- Pig iron and crude steel output took a deep drop in December, continuing the trend of falling for the entire second half of 2023.
- Crude steel output went back into growth in January, showing the short-term nature of the clampdown.
- Production of steel products used in construction (rebar, wire rod) in December was maintained at a similar level as was in November, and similar to the same time last year.
- The operating rate of blast furnaces in Tangshan, China's "steel capital" and an important source of air pollution in Beijing, reached the highest rate for November–December since at least 2014.
 - 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.

Steel industry weekly operating indicators

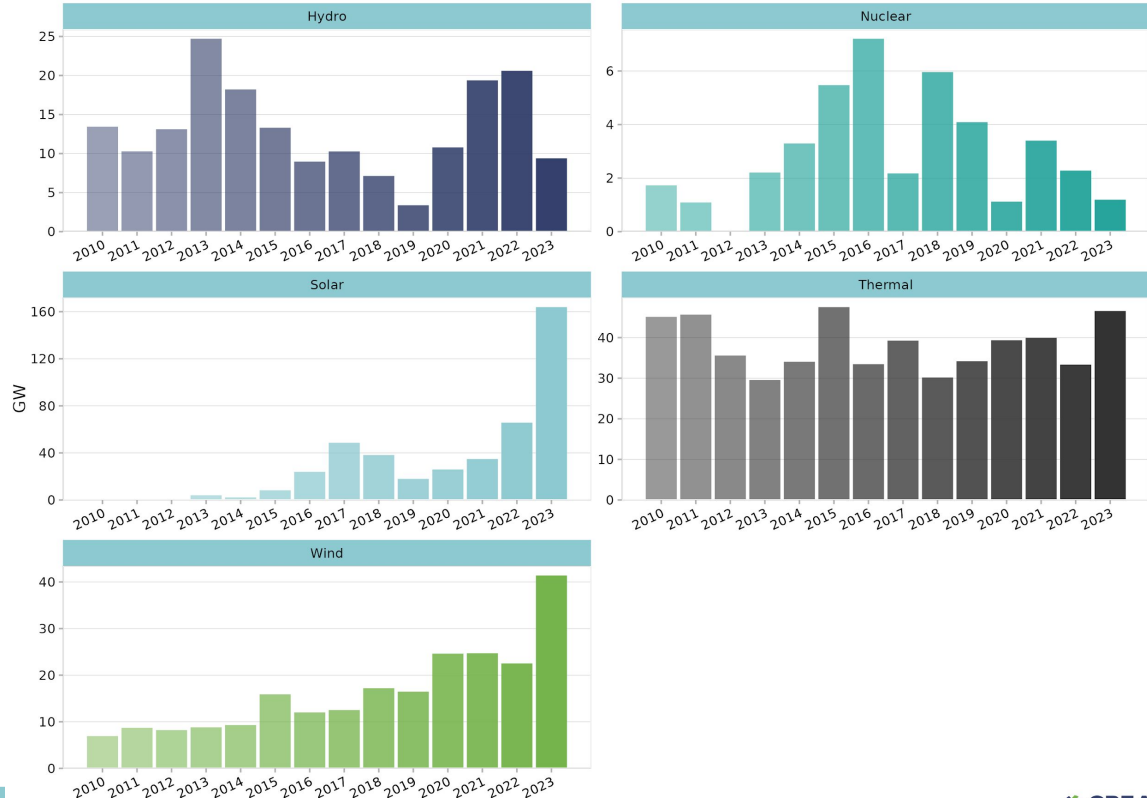


Source: Wind Information

Record solar&wind — and coal — additions

- Strong wind and solar installations continue, with a whopping 164 GW of solar and 41 GW of wind installed in January–November.
- Commissioning of thermal (coal and gas) power plants made a new record of 47GW for the first eleven months of the year, since at least 2009. This is due to coal power projects being started or restarted in 2020 entering operation, showing the urgent pace of construction.
- China introduced coal power capacity payment mechanism, with implementation scheduled for 1 January, 2024.

Newly added power capacity, January to November



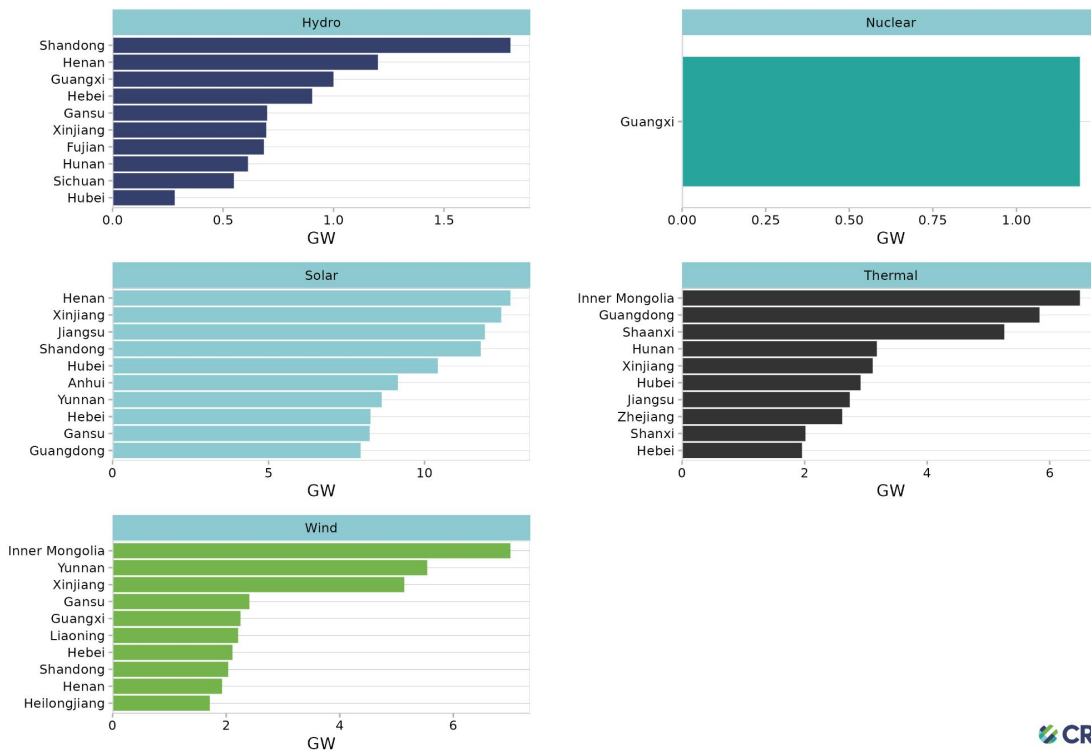
Distributed solar and centralized wind boom

- Solar power installations are led by Henan and Xinjiang, which have ambitious rooftop solar policies (known as “whole-county distributed solar”), striving to meet rooftop solar installation targets by the end of 2023.
- Inner Mongolia and Yunnan lead in wind development, after of large-scale wind energy bases in gigawatts have been put into operation in December.
- Thermal (coal) power additions accelerated in Inner Mongolia, Guangdong and Shaanxi. Eastern demand centres are rising in thermal power capacity at the same speed with western provinces which are aiming to export power. A redundancy maybe anticipated once plants are completed in a few years.

Read more: [China's new coal power spree continues as more provinces jump on the bandwagon](#)

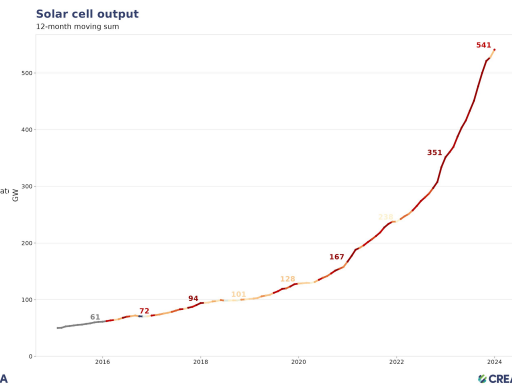
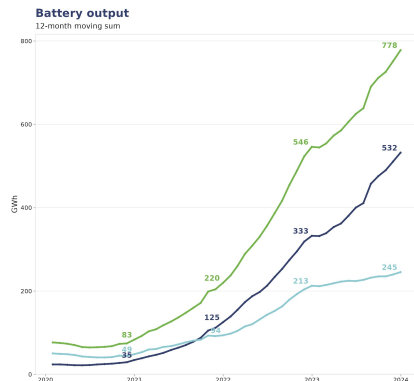
Newly installed power capacity by province

January - November 2023

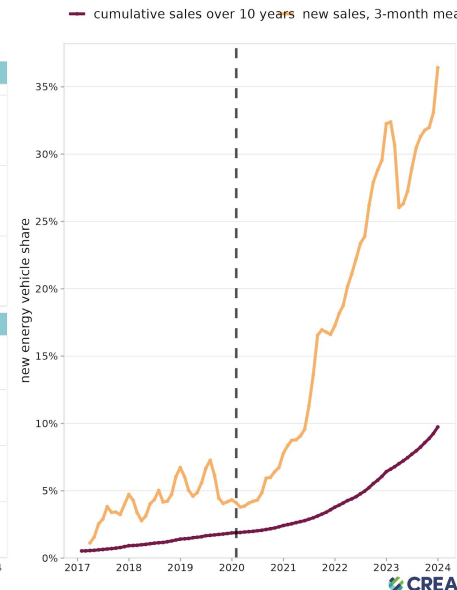
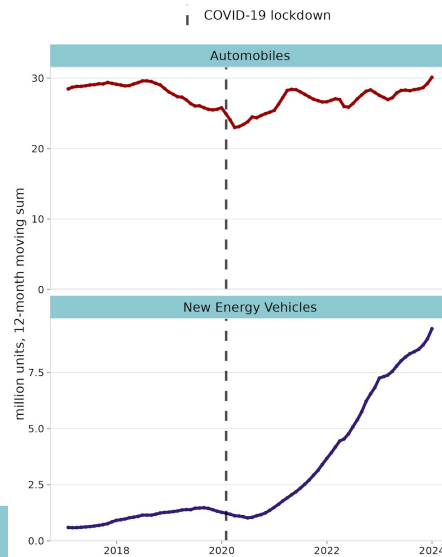


Record solar cell and electric vehicle output

- Solar cell production in the past 12 months reached 541 gigawatts, doubling in the past two years and predicting rapid growth in global solar power installations. One more doubling will take solar cell output to the level needed to cut global emissions in line with Paris agreement.
- EV production continued to gain share, with a 44% increase year-on-year in December in new energy vehicles, while total vehicle output grew by 25%.
- The strong growth in EVs is making a dent in gasoline demand for the first time. The share of EVs of all vehicles on the road increased from 6.4% a year ago to 9.7% now, shaving approximately 3%-points off gasoline demand growth.



Vehicle production

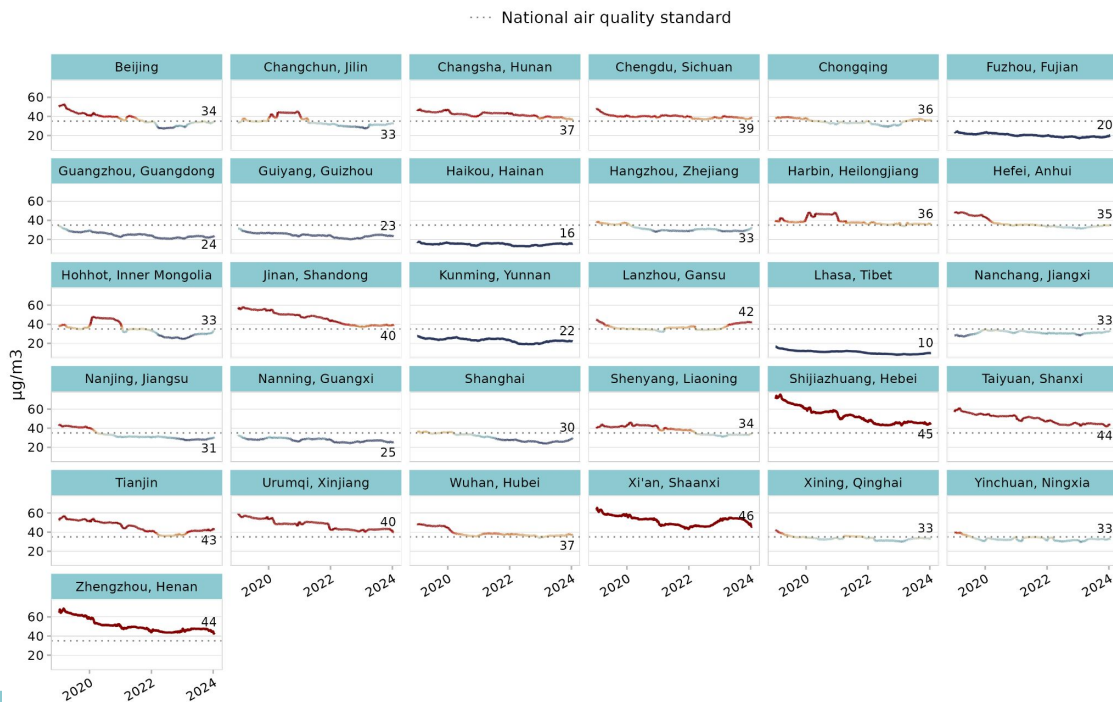


Widespread smog took place in eastern China this December, 13 provincial capitals not meeting national standard for PM2.5

- Beijing, Changchun, Chengdu, Chongqing, Hohhot, Shanghai, Shenyang, Taiyuan, Tianjin had the worst December for PM2.5 pollution since 2019.
- Due to weak atmospheric dispersion conditions in late December, more fog and haze weather took place compared to the previous month especially in northern area, northeastern area, Sichuan basin and Huanghuai region, leading to a rebound of PM2.5 level in these areas. Strong cold air started to come in January, showing a trend of pollution going down.
- For the entire 2023, 13 out of 31 provincial capitals exceeded the national PM2.5 air quality standard (35 $\mu\text{g}/\text{m}^3$) for their 12-month moving average of PM2.5. Xi'an, Shijiazhuang, Zhengzhou, Taiyuan and Tianjin ranked the top of PM2.5 pollution, their 12-month average concentrations were 49, 45, 45, 44 and 43 respectively.
- Compared to the same time of last year, 22 out of 31 provincial capitals increased 12-month moving average of PM2.5.

PM2.5 concentrations in province capitals

12-month moving average

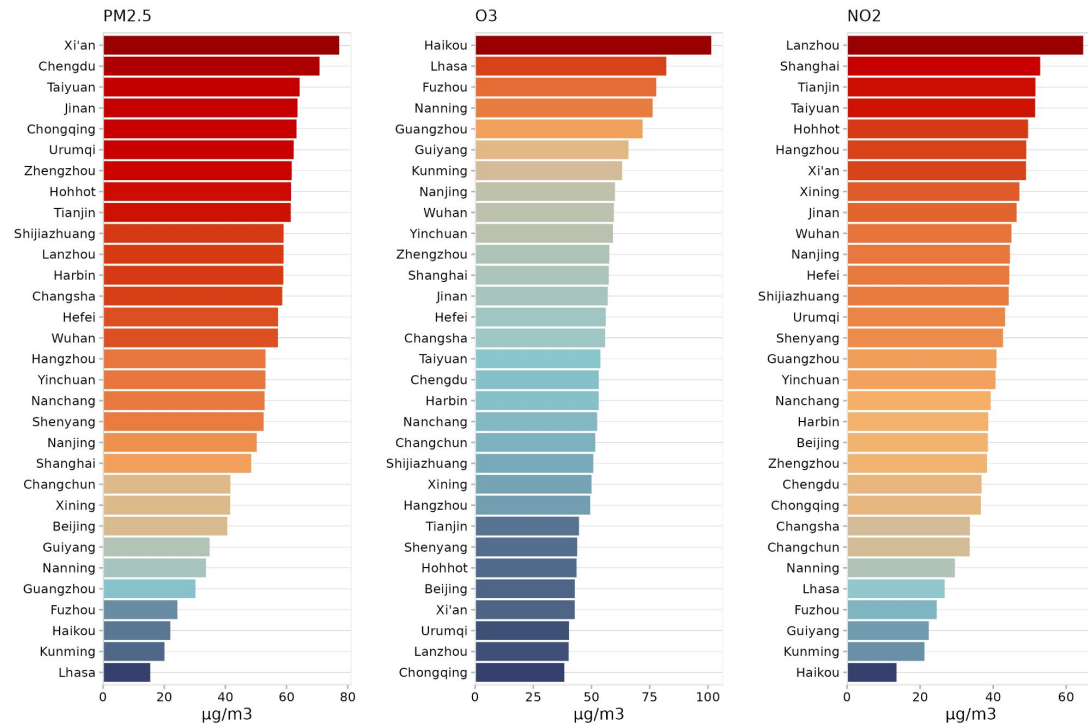


PM2.5 pollution concentrated in Fenwei plain and Sichuan basin, while NO2 pollution rose in Lanzhou and Shanghai

- Worst PM2.5 levels were especially focused in Fenwei plain and Sichuan basin in December. Xi'an, capital of Shaanxi province, Chengdu and Taiyuan rose to the top. Followed by Jinan, Chongqing and Urumqi.
- Ozone levels are overall low in the winter. The worst ozone levels were measured in the capitals of Hainan, Tibet, Fujian, Guangxi and Guangdong, focusing in southern region where has warmer weather.
- Lanzhou, capital of Gansu, ranked worst for NO2 levels, and is followed by Shanghai and Tianjin. NO2 contributes to PM2.5 and ozone levels, besides being a dangerous pollutant in its own right.

Monthly average pollutant concentrations in province capitals

Dec 2023

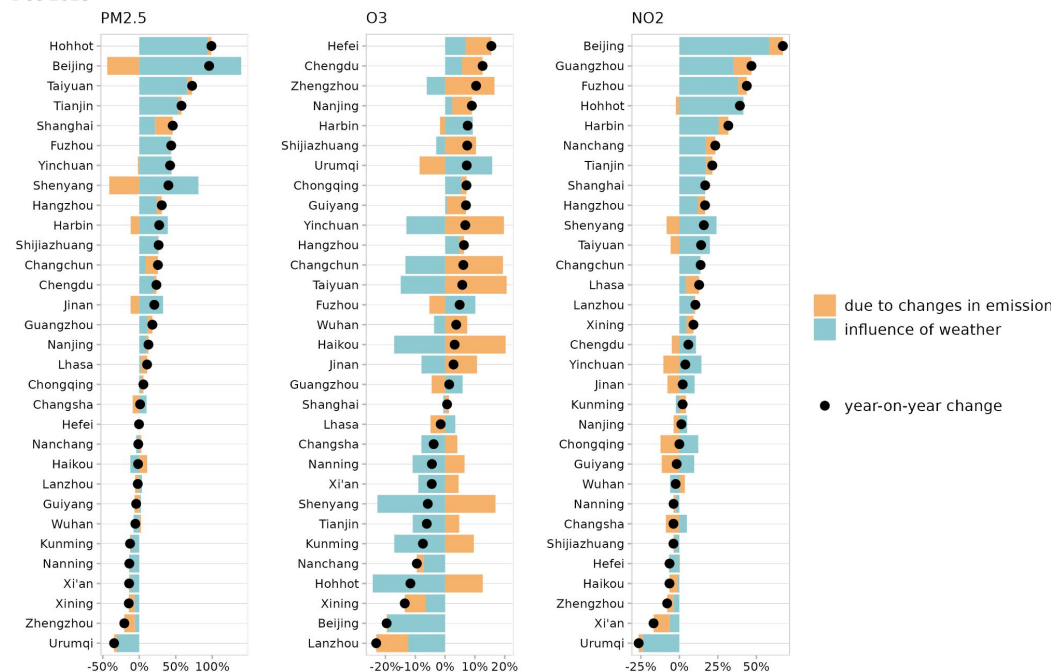


Weather conditions heavily influenced PM2.5 and NO2 pollution to increase in December, while ozone increased on year the most in Huanghuai area due to emissions

- Emissions of PM2.5-forming pollutants increased the most in Hohhot (of Inner Mongolia) and Beijing in the northern China mainly due to influence of weather. The year-on-year increase in PM2.5 attributed to emissions increases was the most significant in Shanghai, Changchun (Jilin), Lhasa (of Tibet), as well as in Taiyuan (of Shanxi).
- Ozone-contributing emissions increased in 21 provincial capitals in December, however counteracting weather influence brought down the ozone levels in most of them. Hefei (of Anhui), Chengdu (of Sichuan) and Zhengzhou (of Henan) topped year-on-year increases contributed mostly by emissions, which were 15.5%, 12.6% and 10.4% respectively.
- NO2 increase was highest in Beijing, Guangzhou (of Guangdong) and Fuzhou (of Fujian), mainly due to weather influence.

Year-on-year changes in pollutant concentrations in province capitals

Dec 2023



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 variation that cannot be explained by weather conditions is attributed to changes in emissions.

Worst 7-day air pollution episodes by pollutant

PM_{2.5} (excluding sandstorms)

city	province	dates	average concentration	highest daily concentration
Wujiaqu	Xinjiang Uygur	Dec 23 – Dec 29	170	210
Xianyang	Shaanxi	Dec 24 – Dec 30	161	230
Xinzhou	Shanxi	Dec 24 – Dec 30	159	251
Shihezi	Xinjiang Uygur	Dec 23 – Dec 29	157	196
Weinan	Shaanxi	Dec 24 – Dec 30	150	221

Sandstorms (PM_{2.5})

city	province	dates	average concentration	highest daily concentration
Wuhai	Nei Mongol	Dec 01 – Dec 07	21	67
Bayan Nur	Nei Mongol	Dec 01 – Dec 07	20	63
Qingyang	Gansu	Nov 30 – Dec 06	15	75
Shuozhou	Shanxi	Nov 30 – Dec 06	14	99
Wulanchabu	Nei Mongol	Dec 02 – Dec 08	14	53

Ozone

city	province	dates	average concentration	highest daily concentration
Zhuhai	Guangdong	Nov 25 – Dec 01	134	171
Jiangmen	Guangdong	Nov 25 – Dec 01	133	208
Zhanjiang	Guangdong	Nov 25 – Dec 01	130	164
Shanwei	Guangdong	Nov 27 – Dec 03	128	138
Zhaoqing	Guangdong	Nov 25 – Dec 01	127	206

NO₂

city	province	dates	average concentration	highest daily concentration
Xinzhou	Shanxi	Dec 24 – Dec 30	85	109
Lanzhou	Gansu	Dec 24 – Dec 30	84	94
Huzhou	Zhejiang	Dec 24 – Dec 30	79	103
Nantong	Jiangsu	Dec 03 – Dec 09	77	111
Langfang	Hebei	Dec 24 – Dec 30	77	98

Unit: µg/m³

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](#).