CREA

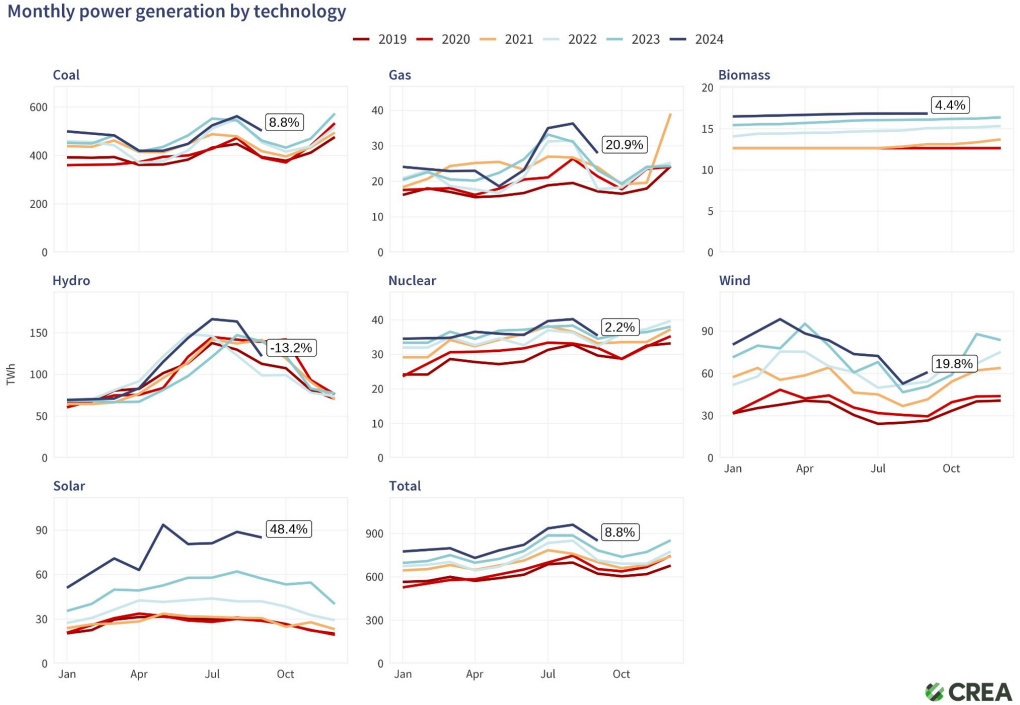
Centre for Research on Energy and Clean Air

China energy and emissions trends

October 2024 snapshot

Power demand growth accelerates amid coal surge and hydropower slump

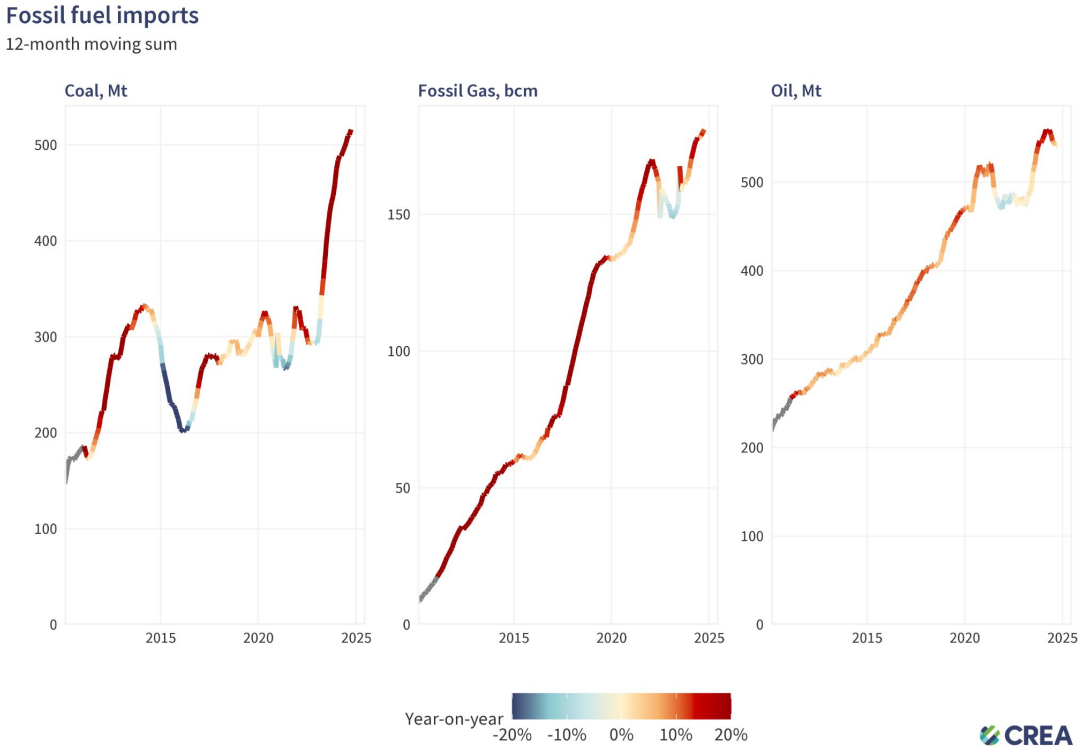
- Total power generation increased by 11%, while overall electricity consumption grew by 8.5%.
- Coal and gas power generation surged by 8.8% and 20.9% respectively, significantly higher than previous growth rates. This increase was driven by accelerating power demand and a 13.2% decline in hydropower generation due to drought conditions.
- Residential electricity consumption surged by 27%, whereas industrial electricity usage grew by only 3.6%.
- The sharp rise in China's residential power demand in September is driven primarily by increased air conditioning ownership and usage, rather than a significant increase in temperatures.
- Wind power generation continued to grow, with an increase of 56.1%, while solar power generation saw an increase of 49.5%.
- 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.

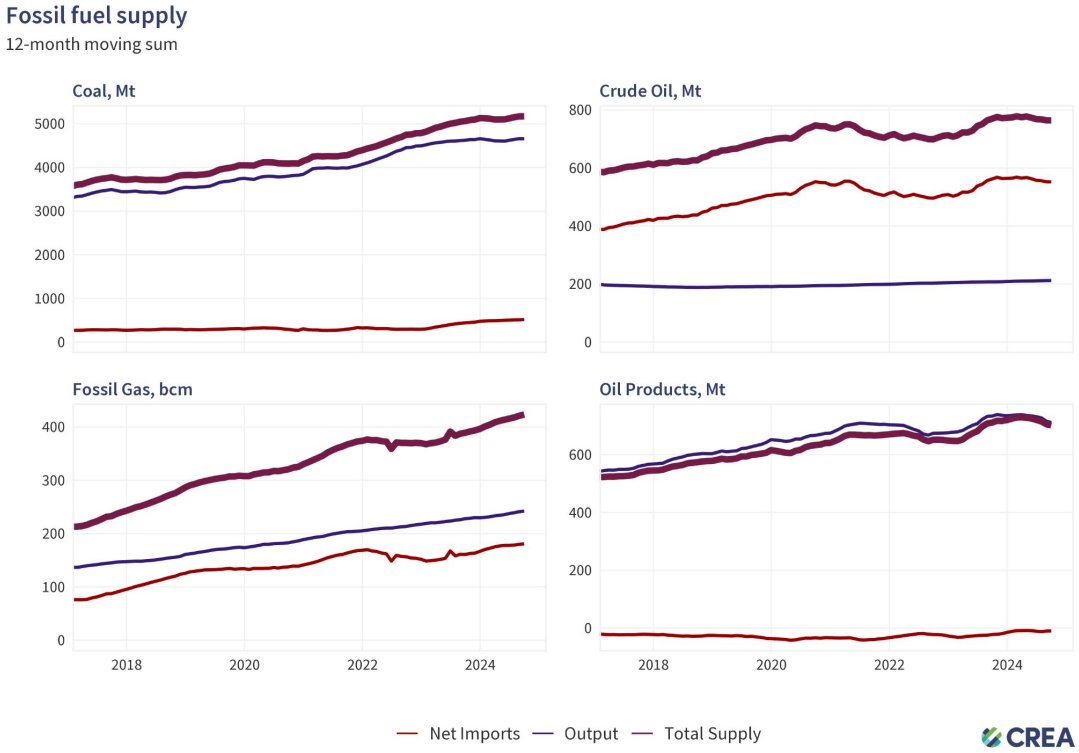
Coal and gas imports continue to increase

- Coal imports in September continued to increase by 13%. 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 September decreased by 0.5%, continuing the downward trend observed in recent months.
- Natural gas imports, which have been growing rapidly this year, increased by 19% in September. From January to September, imports rose by 13% 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.



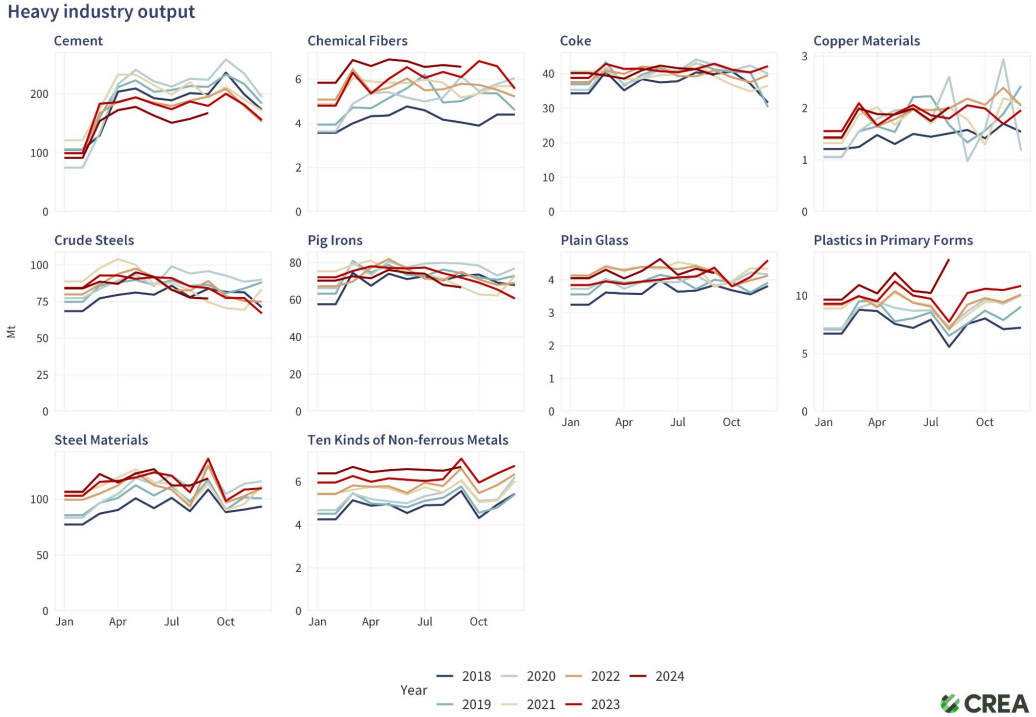
Crude oil and oil refinery supply remained sluggish

- Domestic coal output grew by 4.4%, while imports continued to rise. Year-to-date production from January to September increased by 0.6% year-on-year.
- Fossil gas imports increased by 19% and domestic production grew by 6.8%.
- Crude oil output increased by 1.1%, while import volumes fell by 0.5%. The growth in oil supply remains sluggish, due to weaker economic growth.
- Refinery volumes, an indicator of oil products consumption, fell 5.4%.



Iron, steel, and cement production continue to fall

- In September 2024, crude steel production fell by 6.1% year-on-year, pig iron production fell by 6.7%, and steel product output fell by 2.4 , showing that fixed asset investment continued to slow down and real estate construction starts continued to contract.
- The total output of pig iron and crude steel in the first nine months of 2024 has significantly decreased, contributing to the CO2 emission reduction.
- Real estate investment continued to contract, for the third year, and cement production fell a further 10.3%.
- Chemical and non-ferrous metals output continued to grow in September, but moderately compared with previous months.



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.

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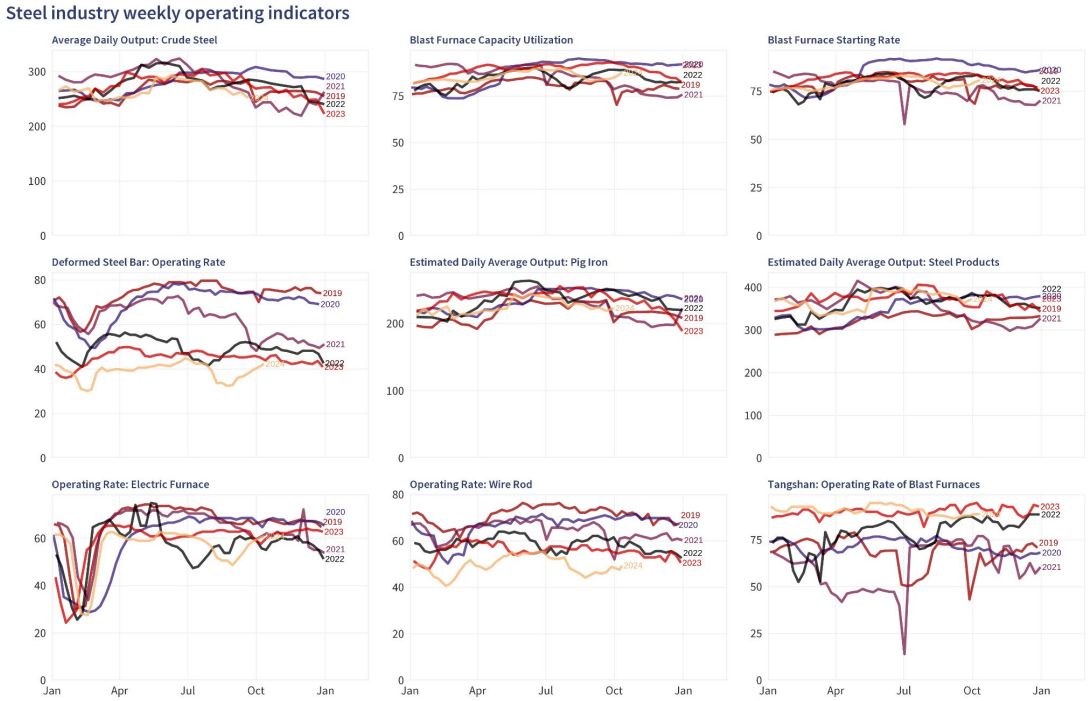
Steel industry remains in a downturn

- Blast furnace starting rates and capacity utilization showed a slight improvement; operating rates of electric furnaces gradually recovered after a sharp decline in recent weeks.
- 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

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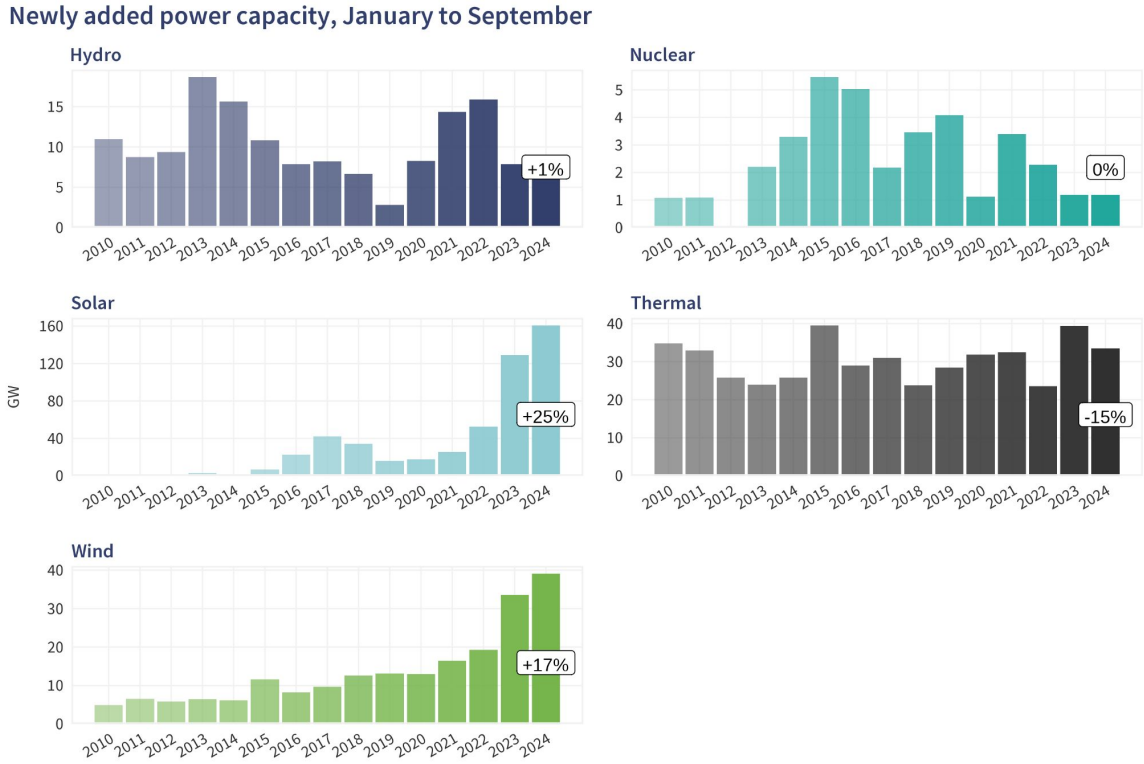
Rapid growth in solar and wind continues

- 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.



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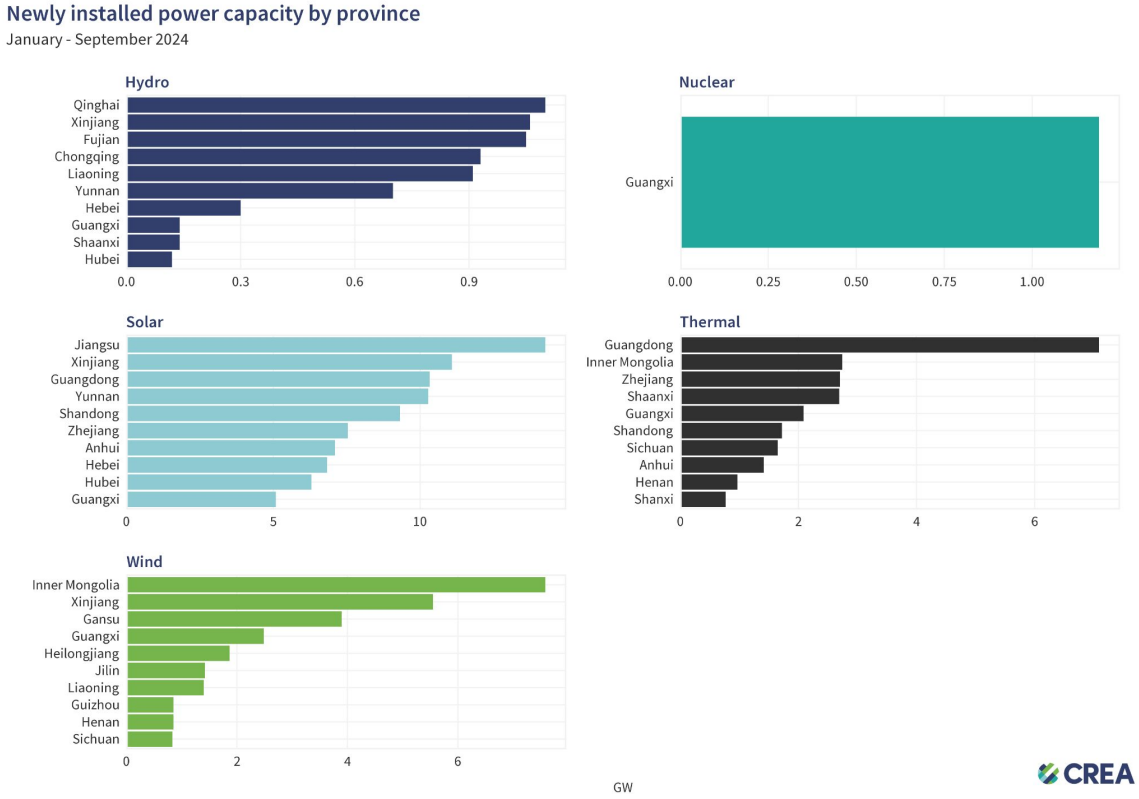
Wind and solar surge in clean energy bases

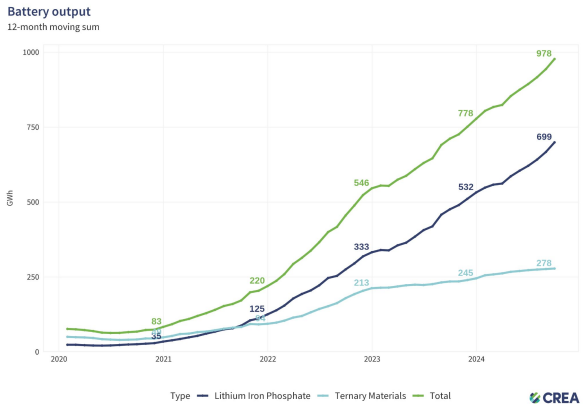
- Solar power installations are led by Jiangsu, Xinjiang, and Guangdong. In Jiangsu, it is mainly distributed solar, while in Xinjiang, it is driven by projects in large-scale clean energy bases.
- Inner Mongolia, Xinjiang and Gansu lead in wind development, also under large-scale clean energy bases 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.

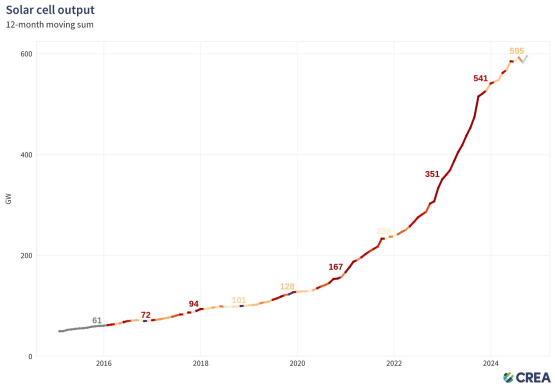
Read more here.



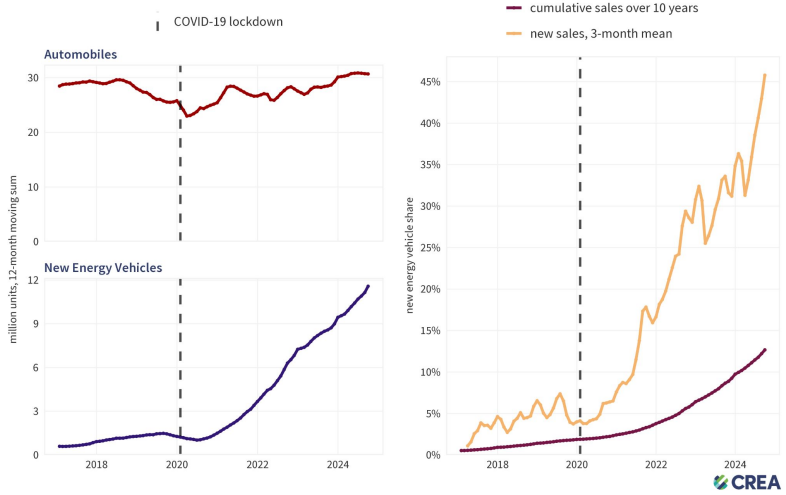
New energy vehicle (NEV) market share continues to increase

- Solar cell 12-month moving sum production reached 595 gigawatts, showing a slight recovery from the previous dip, though industry overcapacity and profitability challenges continue to affect the sector.
- The overall vehicle production in September has seen a slight dip, suggesting that the broader vehicle market is experiencing some downward pressure caused by demand fluctuations.
- In September, China's NEV production surged by 51%, continuing its strong growth trajectory despite a dip in overall vehicle production. This highlights the robust demand for NEVs, even as the broader vehicle market faces challenges. NEVs now account for 46% of all new vehicle sales, indicating a significant market shift towards cleaner energy options.



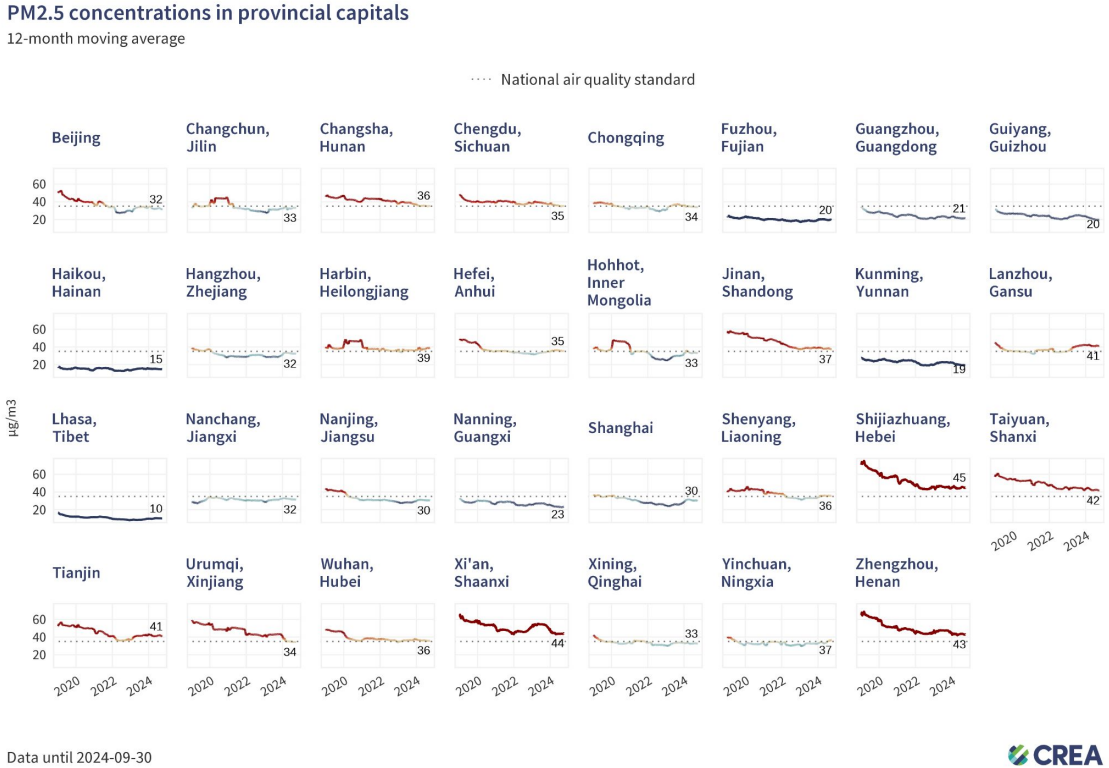


Vehicle production



By the end of third quarter, about 40% of provincial capitals risk not meeting national standard for PM2.5 for 2024

- By the end of this September, 12 out of 31 provincial capitals' 12-month averages exceeded the national standard for PM2.5 of 35 ug/m3, and the number increased by 2 cities compared to last month.
- The largest 12-month average PM2.5 values were in the north, in the provincial capitals of Hebei, Shaanxi, Henan, Shanxi and Gansu, and they were 45, 44, 43, 42 and 41 ug/m3, respectively.
- Changsha, the provincial capital of Hunan, was the only capital city that had an increase in yearly PM2.5 values compared to the previous month.



Data until 2024-09-30

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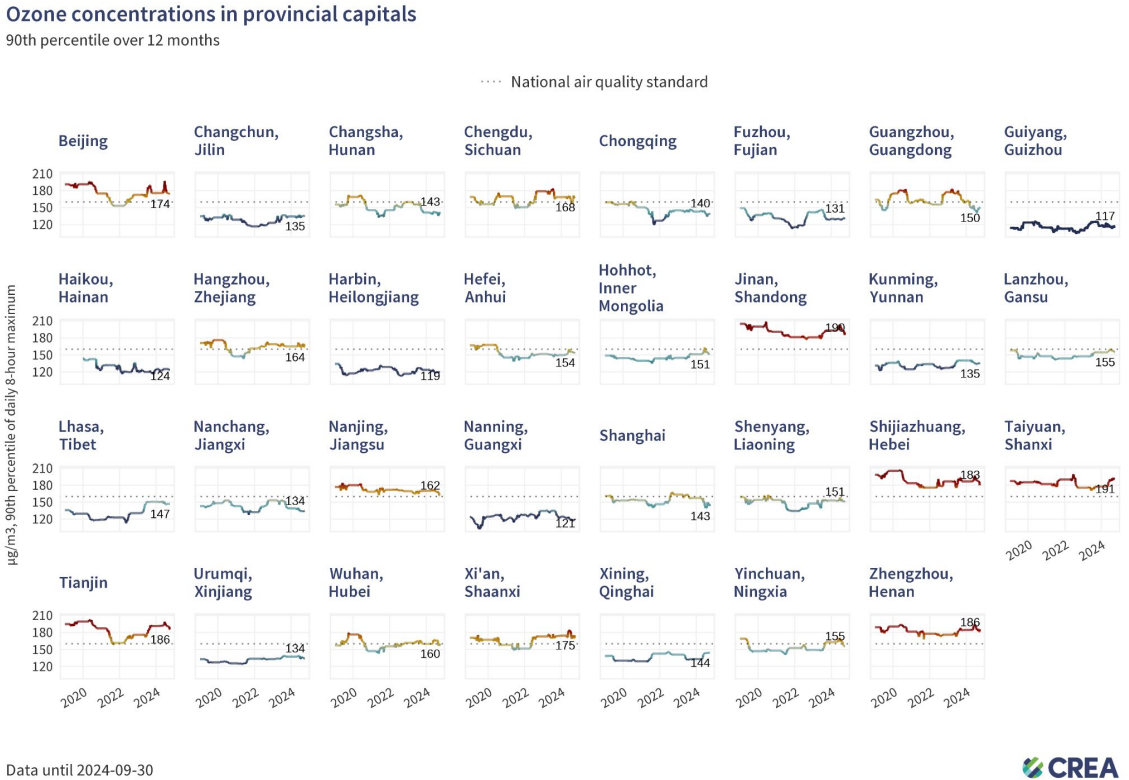
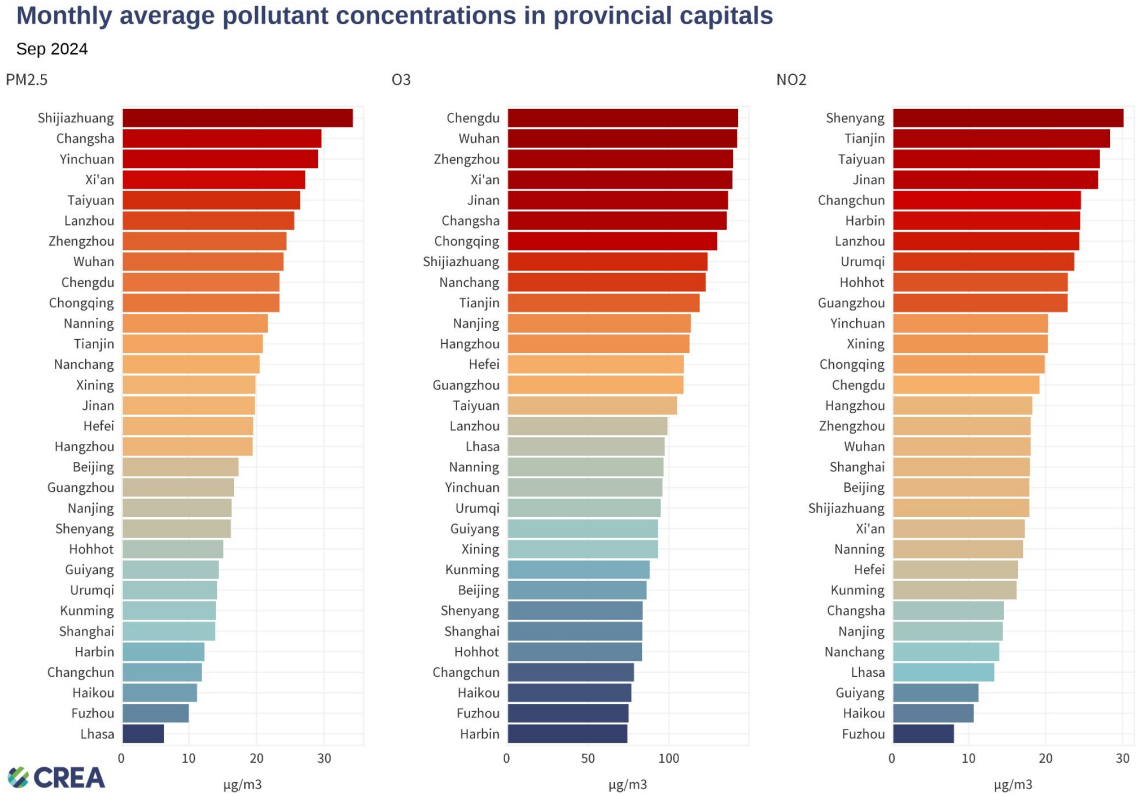
Beijing-Tianjin-Hebei and the surrounding areas had the worst yearly average concentrations of ozone by September

- In September, 10 out of 31 provincial capitals exceeded the yearly standard for ozone of 160 ug/m3, the same 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 the surrounding areas, at 191, 190, 186, 186 and 183 ug/m3, respectively.
- 9 provincial capitals have increased the yearly ozone concentration this September compared to the previous month. Among them, Changsha, the provincial capital of Hunan in the Southwest, had the largest increase.



Worst PM2.5 and NO2 levels were measured in northern China, while highest ozone concentrations were focused in central China

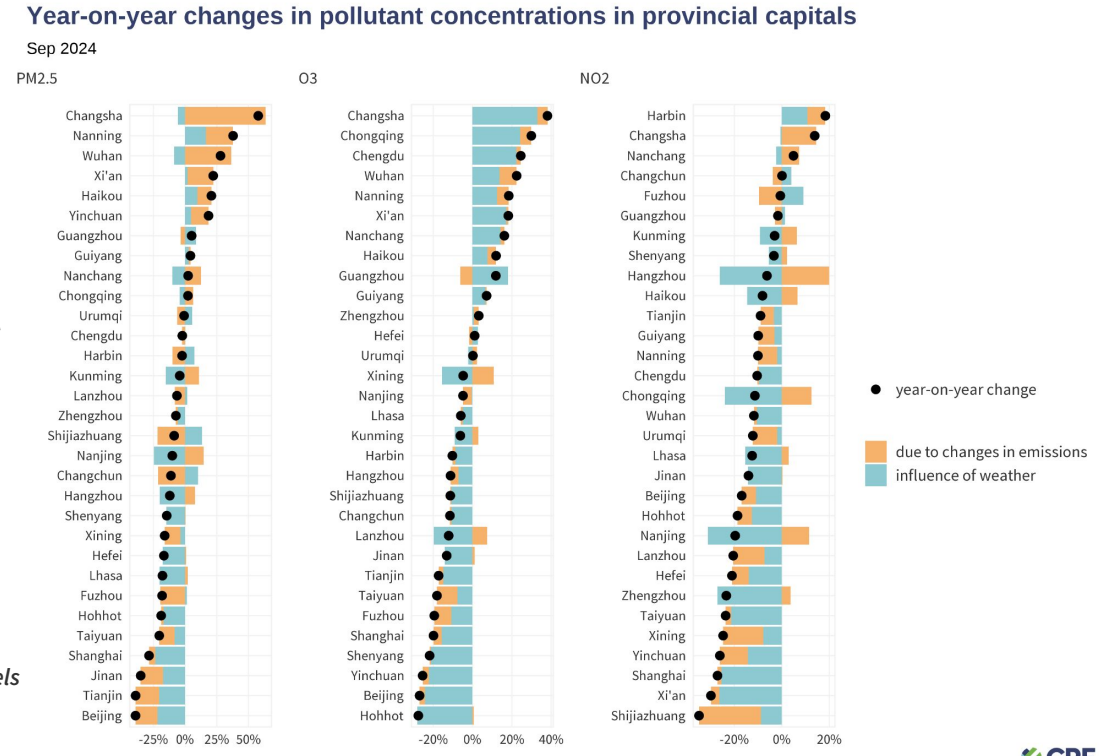
- Worst PM2.5 levels were concentrated in northern China in September. Capital of Hebei province, Shijiazhuang, rose to the top, with a monthly concentration of 34 ug/m3. It was followed by the capitals of Hunan, Yinchuan and Shaanxi provinces, with monthly concentrations of 30, 29 and 27 ug/m3, respectively.
- The worst ozone levels were measured in the provincial capital of Sichuan at 143 ug/m3, which is located in southwest China. It was followed by other provincial capitals of Hubei, Henan and Shaanxi, with monthly concentrations of 142, 140 and 139 ug/m3.
- Shenyang, capital of Liaoning province, rose to rank worst for NO2 levels, with monthly concentration of 30 ug/m3. It was then followed by provincial capitals of Tianjin, Shanxi and Shandong in northern China. NO2 contributes to PM2.5 and ozone levels, besides being a dangerous pollutant in its own right.



PM2.5 and ozone rose fast in western and central regions, while emissions contributing to NO2 increased the most in eastern China

- PM2.5 pollution increased the most year-on-year in provincial capitals of Hunan (58%), Guangxi (38%), Hubei (28%), and Shaanxi (22%); Hunan's capital city, Changsha, also led in ozone increase.
- The largest year-on-year PM2.5 increases, driven by higher emissions, were in Changsha, Wuhan, and Nanchang.
- Most central China provincial capitals saw ozone level increases in September due to unfavourable weather and higher emissions, with Hunan's capital leading (38%), followed by Chongqing (30%), and the capitals Chengdu (25%), and Hubei (22%).
- Year-on-year NO2 increases were highest in Harbin (18%), Changsha (14%), and Nanchang (5%) in September.

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.



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Worst 7-day air pollution episodes by pollutant

PM2.5 (excluding sandstorms)

city	province	dates	average concentration	highest daily concentration
Shijiazhuang	Hebei	Sep 23 – Sep 29	69	93
Xingtai	Hebei	Sep 23 – Sep 29	68	90
Changde	Hunan	Sep 23 – Sep 29	68	97
Jingzhou	Hubei	Sep 23 – Sep 29	62	79
Handan	Hebei	Sep 23 – Sep 29	62	94

Ozone

city	province	dates	average concentration	highest daily concentration
Jingmen	Hubei	Sep 23 – Sep 29	186	218
Jingzhou	Hubei	Sep 23 – Sep 29	185	220
Xianyang	Shaanxi	Sep 22 – Sep 28	185	222
Wuhan	Hubei	Sep 23 – Sep 29	182	228
Yibin	Sichuan	Aug 26 – Sep 01	182	208

Sandstorms ($PM_{2.5}$)

city	province	dates	average concentration	highest daily concentration
Jinchang	Gansu	Sep 18 – Sep 24	10	69
Wuwei	Gansu	Sep 18 – Sep 24	9	61
Bayan Nur	Nei Mongol	Sep 03 – Sep 09	6	43

Note: No sandstorms in other cities.

NO_2

city	province	dates	average concentration	highest daily concentration
Jinan	Shandong	Sep 22 – Sep 28	40	51
Taiyuan	Shanxi	Sep 22 – Sep 28	40	60
Liaocheng	Shandong	Sep 22 – Sep 28	39	48
Yingkou	Liaoning	Sep 22 – Sep 28	36	47
Shenyang	Liaoning	Sep 23 – Sep 29	36	44

Unit: $\mu g/m^3$

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.