China energy and emissions trends

November 2023 snapshot
Total power generation growth cooled down to 5% after a big jump in September.

Solar power generation continued strong growth, but wind had a weak month, especially compared to last year when October had very good wind conditions.

Hydropower recovery continued with 22% growth, rebounding from the record low utilisation caused by a historic drought in 2022.

Thermal power generation grew 4% year-on-year.

Labels show year-on-year changes in the latest month of data.
Oil and coal imports balloon, but for different reasons, while gas stumbles

- Crude oil imports increased 14% while net oil product exports fell 29% on year, showing the resurgence of domestic demand.
- Fossil gas imports jumped by 15% in October but year-to-date imports are still down from the 2021 peak, showing the effects of high prices and change in policy towards gas.
- Coal imports climbed 23% year-on-year in October, but with some signs of cooling down compared with the 67% increase year-to-date.
Strong fossil fuel imports due to gap between demand and domestic supply

- Total supply (production plus net imports) continued to increase and hit a new record for all fossil fuels, indicating continued increase in demand.
- Growth is currently supplied mainly by imports for all fuels, with oil output flat and coal 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 supply growth slowed down, reflecting the slowdown in thermal power and steel.

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?
Construction sector continues to contract

- Crude steel output fell 2% year-on-year, pig iron fell 3% and cement by 4% in October, showing the effect of a continued construction slump, as real estate investment contracted further.
- The government reportedly aims to limit full-year crude steel output below 2022 level, but this would require a 8% reduction in Nov–Dec, which is unlikely to be realized.
- Chemical and non-ferrous metals output growth continued strong.
- Steel output has been supported by a sharp increase in exports, which jumped 53% in October, and 35% year-to-date. Growth in investment in railways and industrial machinery offset much of the drop in domestic steel demand for construction.
- Batteries, solar and other cleantech manufacturing is driving demand for related commodities.
- 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 outsized role in China’s emissions and economy.
Crude steel output continues to decline

- Pig iron and crude steel output have continued to slide further in early November.
- Production of steel products used in construction (rebar, wire rod) continues to plumb new lows.
- Steel products output saw a big jump in late October, accompanied by a hike in electric arc furnace operation.
- 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 October–November since at least 2015.
  - 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.

Source: Wind Information
Record solar & wind — and coal — additions

- Strong wind and solar installations continue, with a whopping 129 GW of solar and 34 GW of wind installed in January–September.
- Commissioning of thermal (coal and gas) power plants made a new record for the first nine 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.
Distributed solar and centralized wind boom

- Solar power installations are led by Henan, and Shandong, 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 Xinjiang lead in wind development, aiming for full operation of its large-scale clean energy bases by year-end.

- Thermal (coal) power additions accelerated in Shaanxi, Inner Mongolia and Xinjiang, which are aiming to export power to eastern demand centres. However, Guangdong, Zhejiang and other eastern provinces have started a large wave of new coal power projects, leading to redundancy once plants are completed in a few years.

Read more: [China’s new coal power spree continues as more provinces jump on the bandwagon](#)
Record solar cell and electric vehicle output

- Solar cell production in the past 12 months reached 574 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 an 28% increase year-on-year in October in new energy vehicles, while total vehicle output grew by 9%.

- 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 5.5% a year ago to 8.7% now, shaving approximately 3%-points off gasoline demand growth.
PM2.5 worsened in 60% provincial capitals in October

- PM2.5 level is bouncing back in 2023 especially in northern provincial capitals: Beijing, Tianjin, Lanzhou and Zhengzhou. In October, PM2.5 worsened in Wuhan, Hefei, Tianjin and other 15 provincial capitals, accounting for 60% of the total.
- Provincial capitals located within Fenwei Plain and Beijing-Tianjin-Hebei areas had the highest PM2.5 levels since 2021, showing little sign of improvement in the past two years.
- At the end of this October, 13 out of the 30 provincial capitals exceeded the national PM2.5 air quality standard (35 µg/m³) for their 12-month moving average of PM2.5. Xi’an, Zhengzhou and Shijiazhuang had the worst average PM2.5 levels at 52.1, 46.8 and 45.6 µg/m³, respectively.
- Hefei, Beijing and Xining were at the top of nearly breaking the national standard, with their 12-monthly moving average values at 35.0, 33.9 and 33.5 µg/m³, respectively.
Beijing, Jinan, Tianjin, Shijiazhuang and Zhengzhou have seen a major rebound in their ozone levels, with all cities all but certain to exceed the national air quality standard for ozone this year.

12 out of the 30 provincial capitals violated the national air quality standards for ozone during the past 12 months (160 µg/m³) yet, Among them, Jinan, Tianjin, Shijiazhuang and Beijing had the worst ozone pollution.

All capitals exceeded the WHO’s air quality guidelines, as well as the interim target 1 levels.

Shanghai risks breaching the national air quality standard this year, after achieving compliance in 2020-22.
North and Northwest China had the worst PM2.5 levels in October. Tianjin, Shijiazhuang, capital of Hebei province, both neighboring Beijing, and Taiyuan rose to the top. Followed by Wuhan, Zhengzhou and Hefei.

The worst ozone levels were measured in the capitals of Fujian, Shandong, Shanghai, Nanjing and Hangzhou, focusing in eastern coastal region.

Taiyuan, capital of Shanxi, ranked worst for NO2 levels, and is followed by Tianjin. NO2 contributes to PM2.5 and ozone levels, besides being a dangerous pollutant in its own right.

Northern and Eastern Coastal Region face worst air pollution in October
Emissions of PM2.5-forming pollutants increased the most in the Yangtze River Delta region mainly due to influence of weather. The year-on-year increase in PM2.5 attributed to emissions increases was the most significant in Lhasa (Tibet), Wuhan (Hubei), Jinan (Shandong), as well as in Changchun (Jilin).

Guangzhou, Nanning and Chongqing, saw reductions in ozone levels due to favorable weather conditions, even as our analysis indicates an increase in ozone-forming emissions.

Northern cities including Jinan, Shijiazhuang and Shenyang experienced increased ozone levels mainly due to the influence of weather.

NO2 increase was highest in Lhasa, Urumqi and Hohhot.

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

### PM2.5 (excluding sandstorms)

<table>
<thead>
<tr>
<th>city</th>
<th>province</th>
<th>dates</th>
<th>average concentration</th>
<th>highest daily concentration</th>
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<tbody>
<tr>
<td>Taiyuan</td>
<td>Shanxi</td>
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<td>69</td>
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<tr>
<td>Lanzhou</td>
<td>Gansu</td>
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<tr>
<td>Tianjin</td>
<td>Tianjin</td>
<td>Oct 22 – Oct 28</td>
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<td>Hubei</td>
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### Ozone

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<tr>
<td>Putian</td>
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### Sandstorms (PM$_{2.5}$)

<table>
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<td>Henan</td>
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### NO$_2$

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Unit: µg/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.