Briefing, September 2022

China's power and steel industries continue to invest in coal-based capacity, complicating carbon goals

Key findings

- Coal power plant permitting accelerated in the first six months of 2022, demonstrating increased government support for expansion. However, announcements of new projects, construction initiations and completions slowed down, indicating a waning appetite among power generators. Thermal power generation has been steeply loss making since early 2021.
- Steel companies have accelerated investments in new electric arc furnace capacity which will help the sector absorb more scrap steel and support peaking CO2 emissions from steelmaking.
- Investments in wind and solar power have expanded rapidly, approaching the market size needed to peak and reduce CO2 emissions.
- Investments in both new coal-fired power plants and in coal-based ironmaking capacity (blast furnaces) continue at a high level that is not aligned with China's carbon goals. The most likely outcome is the build-up of excess coal-based capacity, and falling utilisation, rather than increased emissions.
    - 15 gigawatts (GW) of new coal-fired power capacity was permitted in the first half of 2022, an uptick compared with last year but less than in 2020.
    - 30 million tonnes per annum (Mtpa) of new blast furnace capacity was announced in the first half of 2022, the largest amount for the first half-year since 2019.
- New investments in coal-based power and steelmaking capacity in the first six months of 2022 will result in $8.5 billion (CNY 82 billion) and $15-22 billion (CNY 100-150 billion) in stranded capacity, respectively, if China's low-carbon transition is successful. The presence of large amounts of newly built coal-based capacity complicates the transition economically and politically.

Policy recommendations

The traditional logic of building more new coal-fired power plants to close the electricity shortage gap is a burden for China when developing a modern power system to achieve its carbon targets. It hinders the transition of coal power from the mainstay of power generation to a supporting role and creates a power sector with more stranded assets in the near future. Meeting peak loads should not only rely on building more capacity but also on reforming the grid operation and increasing flexibility and storage.

China's crude steel output has declined since 2021 due to output control by the government and the decline in downstream demand. However, new investments in iron and steelmaking capacity have so far not adjusted to the new reality. There is an urgent need to align investments in new production capacity in the steel sector with the goal of peaking and reducing CO_2 emissions before 2025.

We therefore propose the following recommendations.

- Enforce the policy of only permitting new coal power for grid stability, taking into account the effect of more flexible grid operation. This policy should also be extended to gas-fired power plants.
- Establish a monitoring system with public access to ensure the coal power permitting policy is strictly implemented and map coal-fired power plants with wind and solar power installations.
- Include the steel sector in China's emissions trading system (ETS) within the 14th five-year-period, and the emissions trading system should shift from an intensity-based allocation to an absolute cap.
- Limit new investments in blast furnace capacity and speed up the adoption of electric arc furnaces and hydrogen-based steelmaking technology, in order to peak CO_2 emissions from the iron and steel sector before 2025.

Introduction

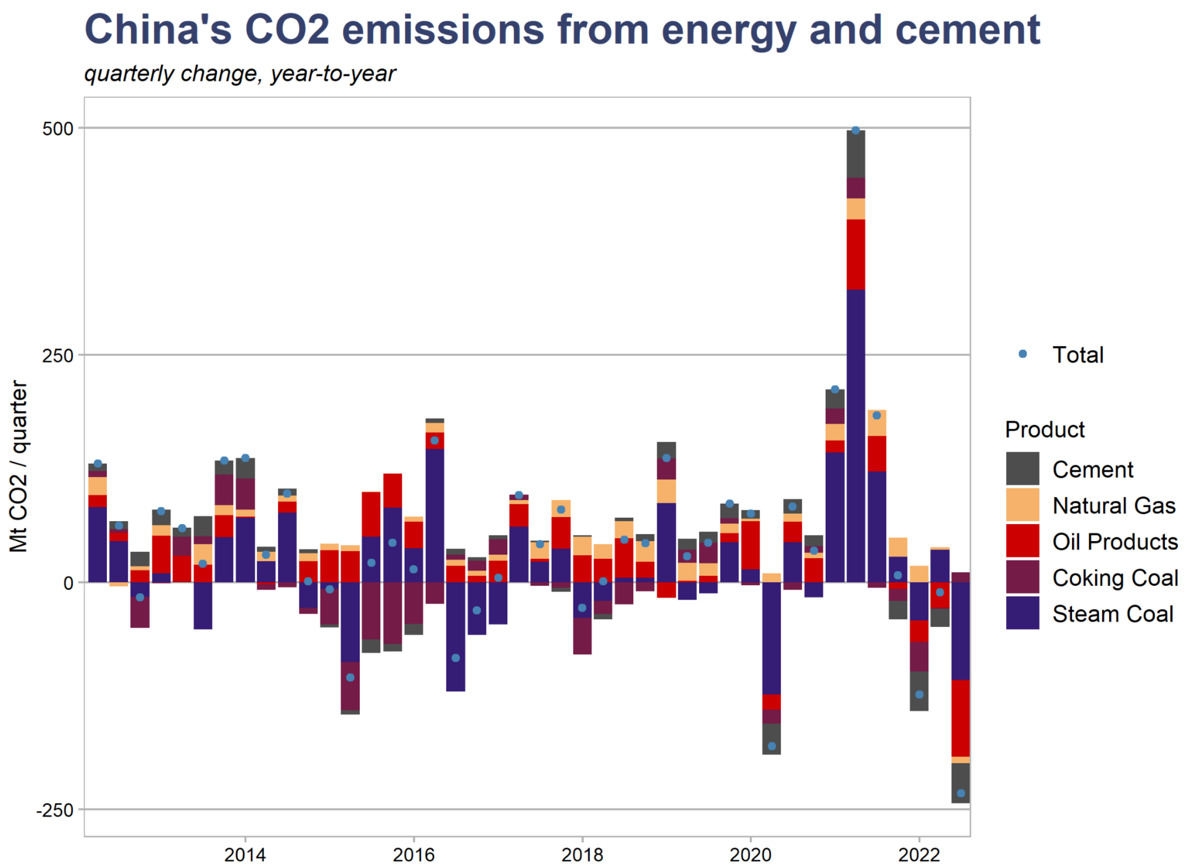
Last summer's record-breaking heatwaves and droughts have once again underscored China's vulnerability to climate change and extreme weather, strengthening the case for the country to act.

The droughts and heatwaves also resulted in electricity shortages in hydropower-reliant provinces of southwest and central China, especially Sichuan. This exposed weaknesses and rigidities in China's electrical grid management: Sichuan continued to export large amounts of electricity to the east, while rationing consumption within the province. There are also indications that coal and gas power plants failed to operate at full capacity during the shortage due to the high fuel prices, contributing to the shortages. The lack of flexible grid management perpetuates reliance on coal power and creates a perceived need to build more of it. Electricity shortages experienced in autumn 2021 led to fast-tracking grid reforms that had been delayed for a long time, and this summer's power crunch is likely to accelerate this process further.

2022 has also seen record-breaking clean energy installations and some promising policy action.

An important milestone for China's CO2 peaking target is that the first industrial sectors have had their specific emissions peaking target years confirmed. The iron and steel sector is due to peak before 2025, and the cement sector before 2023. This is highly significant, as the iron and steel sector and cement are the second and third largest carbon emitters in China, respectively, after power generation.

Despite continuous reports about China 'going back to coal', coal consumption and coal-fired power generation have been falling in the country since the summer of 2021. In July and August, emissions from power generation rebounded as the record heatwave increased electricity demand for air conditioning and droughts affected hydropower generation at a time that usually has plentiful available water. The more salient trends that drove emissions reductions for the past year up to June are however continuing.



Source: CREA. Note: Emissions are estimated from National Bureau of Statistics data on production of different fuels and cement, China Customs data on imports and exports and WIND Information data on changes in inventories, applying IPCC default emissions factors and annual emissions factors per tonne of cement production until 2019. Monthly values are scaled to annual data on fuel consumption in annual Statistical Communiques and National Bureau of Statistics annual Yearbooks.

Figure 1. Year-on-year changes in China's quarterly CO2 emissions from fossil fuels and cement, %

Power sector

Coal power generation and installation of new capacity fell in the first half of 2022

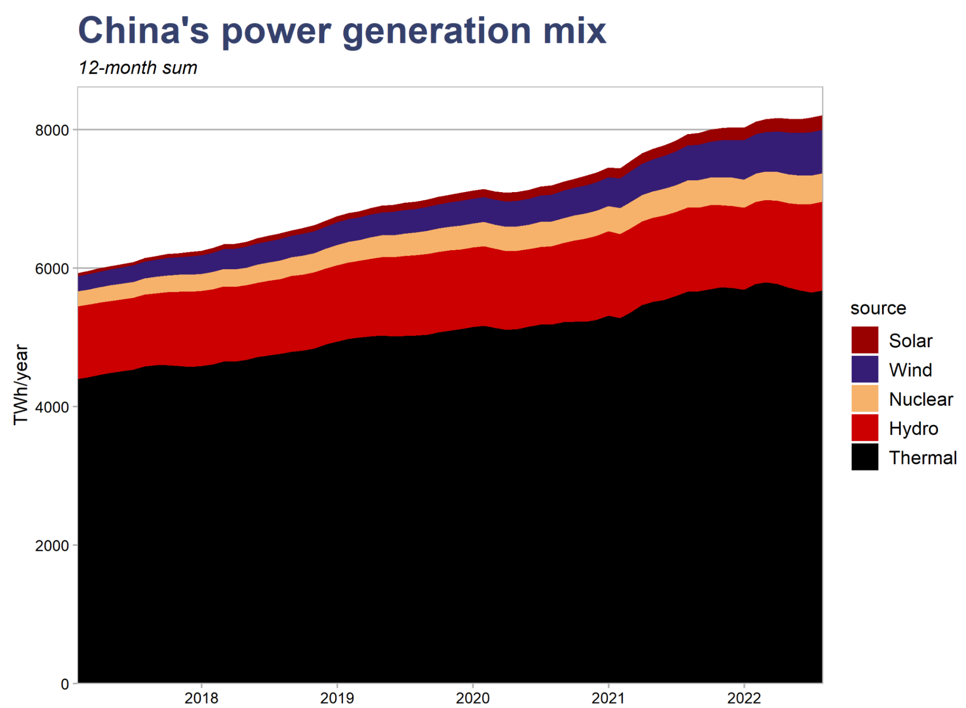
China's power generation growth slowed down sharply in the first six months of 2022, rising only 0.7% year-on-year (YoY). The growth in generation was provided by non-fossil fuels, with solar, wind, nuclear and hydro increasing[1] by 13.5%, 7.8%, 2.0% and 20.3% YoY, respectively, while thermal power fell by 3.9%.

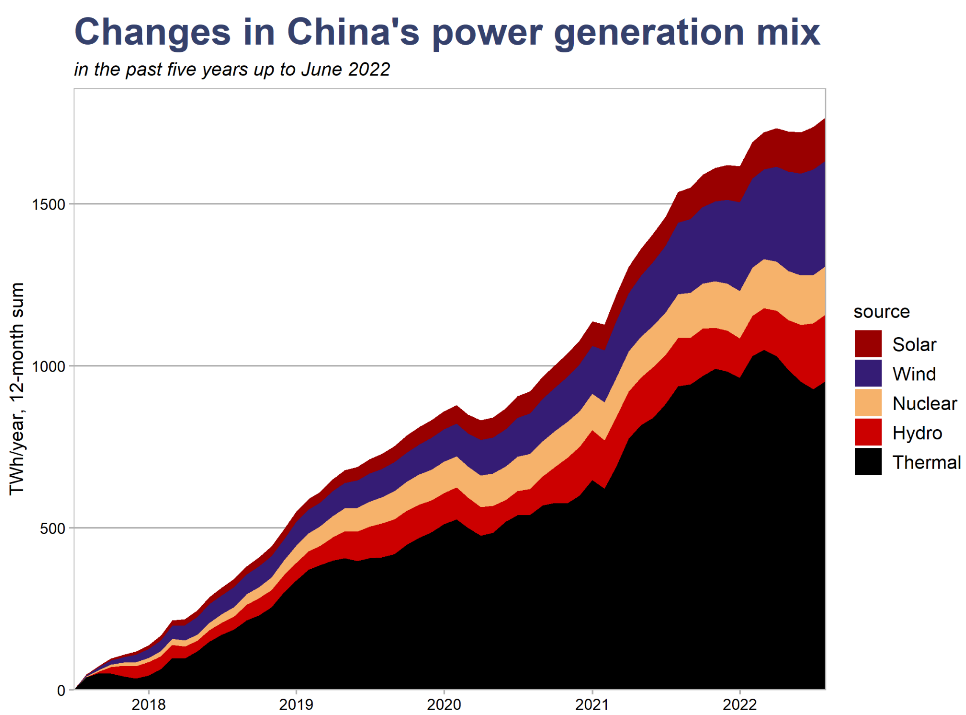
According to the China Electricity Council, China's coal-fired power generation declined by 4% YoY in the first half of 2022. The dramatic slowdown in real estate construction, along with lockdowns to contain COVID-19, dented industrial energy demand and coal consumption. Strong outputs from hydro and solar also contributed to the drop of electricity from coal.

As of the end of June, the installed power generation capacity totalled 2440GW, of which non-fossil installed capacity was 1180GW, a year-on-year increase of 14.8%, accounting for 48.2% of the total installed capacity.

Renewable energy installation has had a remarkable 53.22GW rise in the first six months of 2022, accounting for 77% of total power generation additions. Hydropower, with 9.4GW new installed capacity, accounted for 13.6% of the total added installed capacity. Wind power added 12.94GW of capacity, taking up 18.7% of the total. Newly installed solar capacity in China surged 137% from a year earlier with a whopping addition of 30.88GW in the first six months of 2022. Of these, almost 19.65GW of new solar panels are installed on rooftops as distributed solar and 11.23GW are added to power generation stations.

[1] An English version of this release is available, but the year-to-date numbers for solar power are incorrect.





Source: CREA analysis of China Electricity Council [Data](#)

Figure 2. Overview of China's changing power generation mix

Yet new coal power plant permitting accelerated

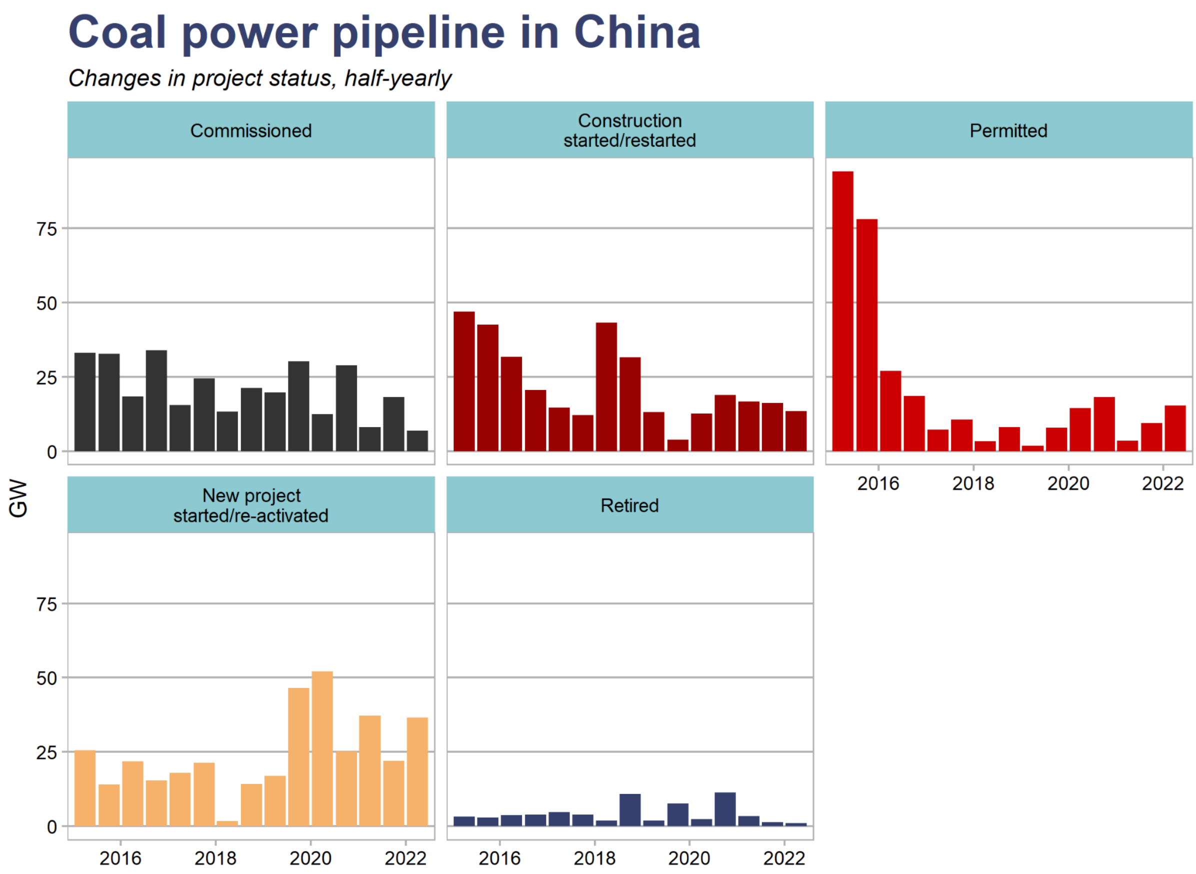
The first six months of 2022 saw 13.2GW of new thermal power added to the grid according to China National Energy Administration, of which 7.3 GW was coal-fired based on Global Energy Monitor data. The amount of thermal power added to the grid fell 25% year-on-year.

Nine new coal power projects with a total capacity of 13GW were announced in the first half of the year and 20GW of projects started the pre-permit preparation process. Permission was granted to build 15GW of new coal power capacity, an increase over 2021. 13GW of power plants began construction, a slight slowdown. The permitted projects, if completed, would be expected to result in $8.5 billion (CNY 60 billion) in stranded capacity[2] . For the 7.4GW of coal power that entered operation, the unrecoverable capital investment alone would cost approximately $4.3 billion (CNY 30 billion) and the capital investment for the 13GW under construction plants would be $7.4 billion (CNY 52 billion).

One way in which new coal power projects are being justified is by framing them as a part of a clean energy programme, such as phase 2 Datang Fuzhou power plant and Lufeng Jiahuwan power plant. However, both coal plants have 2 x 1000MW capacity, ostensibly to “support” 500MW of renewable energy sources. The ratio of coal power to renewable capacity is much higher than in the central government-sanctioned ‘mega’ wind and solar projects, which also have “supporting” coal-fired capacity.

Interestingly, construction initiation, completion and new project announcements, all of which are project steps controlled by the power companies, slowed down. Only the issuing of permits, the step controlled by the government, accelerated. This appears to be a natural development since coal power has been grossly unprofitable for the past year, but the government seeks to promote increased capacity.

[2] The average cost to build a typical 600MW or 1000MW ultra-supercritical coal power unit in China is 4,000CNY/kW.



Source: CREA analysis of [Global Coal Plant Tracker](#) data.

Figure 3. Changes in coal power plants and status of new coal power projects by half-year period

The perceived need for more coal-fired capacity is also leading to a slowdown or even reversal of plant retirements. For example, 2 x 300MW units of Huaneng Liancheng power plant and 2 X 330MW units of Datang Gansu Gangu power plant had been shut down but were allowed to restart in March this year.

Provinces with the greatest new project activity

While the largest amount of coal-fired power capacity is under construction in the western provinces of Inner Mongolia and Shaanxi, the largest new project activity in 2022 has been found in the coastal provinces of Zhejiang, Fujian and Guangxi, and in the central provinces of Jiangxi and Hubei.

Zhejiang province ranks fourth out of China's most economically developed provinces. Its electricity consumption also ranks number four with 551TWh in 2021, almost twice as much as the UK. Although its electricity production of 402TWh is ranked seventh, Zhejiang province still has not become self-sufficient with electricity and recorded a 150TWh power shortage in 2021, amongst the bottom three in China.

Zhejiang does not have abundant energy resources to support its vast economy and energy security is always one of the factors to be considered when drawing up the provincial development plan. Zhejiang is going to install 14GW of nuclear power and 20GW of wind and solar, however, coal power is its cornerstone to ensuring power supply and has been developing rapidly in the first six months of this year.

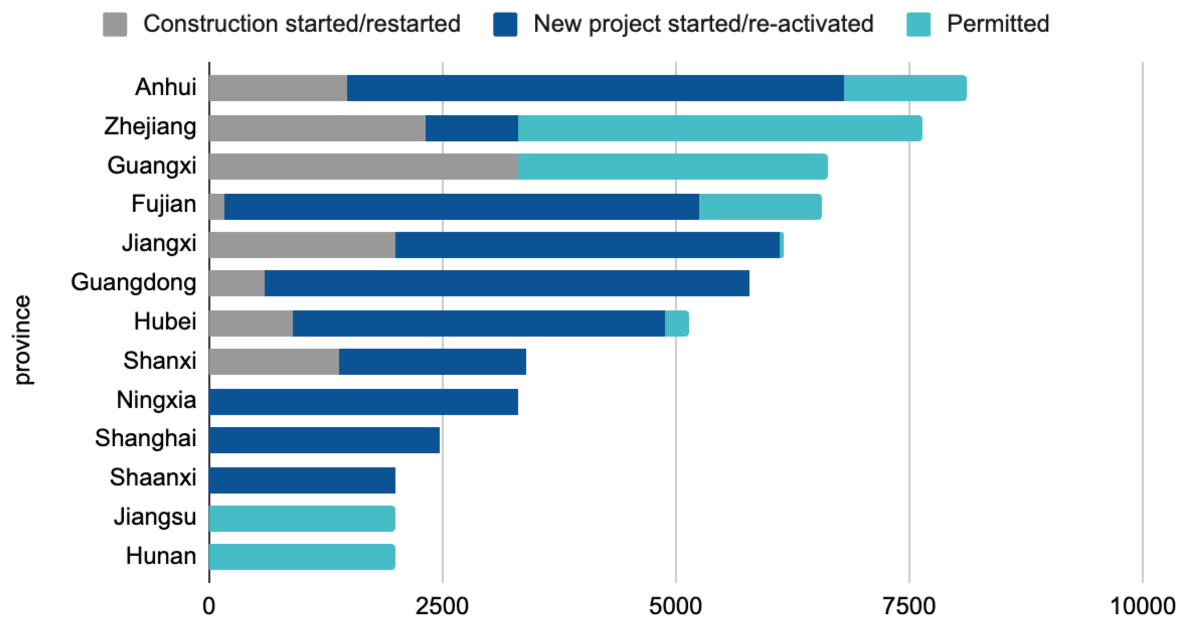
Following the groundbreaking ceremony for unit 5 on 30 July 2021, construction on unit 6 of Zheneng 2 x 1000MW Yueqing power station began. Expansion of Guohua Zhoushan power station 2 x 660MW has also started.

Permission has been granted to build 4320MW of new coal power capacity, including phase 2 of the Zheneng Liuheng power station (2 x 1000MW) and phase 3 of the Guohua Zhoushan power station (2 x 660MW). The plan for a 2 x 1000MW expansion of the Cangnan power station was proposed in June 2014. With no movement for a few years, the project appeared to have been cancelled until unit 3 was given permission to begin construction in June of this year while unit 4 is still waiting for permission to start construction.

Interestingly, Fujian province has reactivated a collection of cancelled projects, totalling 6040MW. Of the 5000MW of permitted projects in the first half of 2022, 4720MW are previously cancelled projects. Four large coal-fired power plants, CR Quanhui power station (2 x 660MW), Fuzhou Kemen power station (2 x 1000MW), Fuzhou Jiangyin power station (2 x 660MW), and Huaneng Gulei power station (2 x 660MW), are all reactivated projects. There is no indication that the plants are to support renewable energy installations.

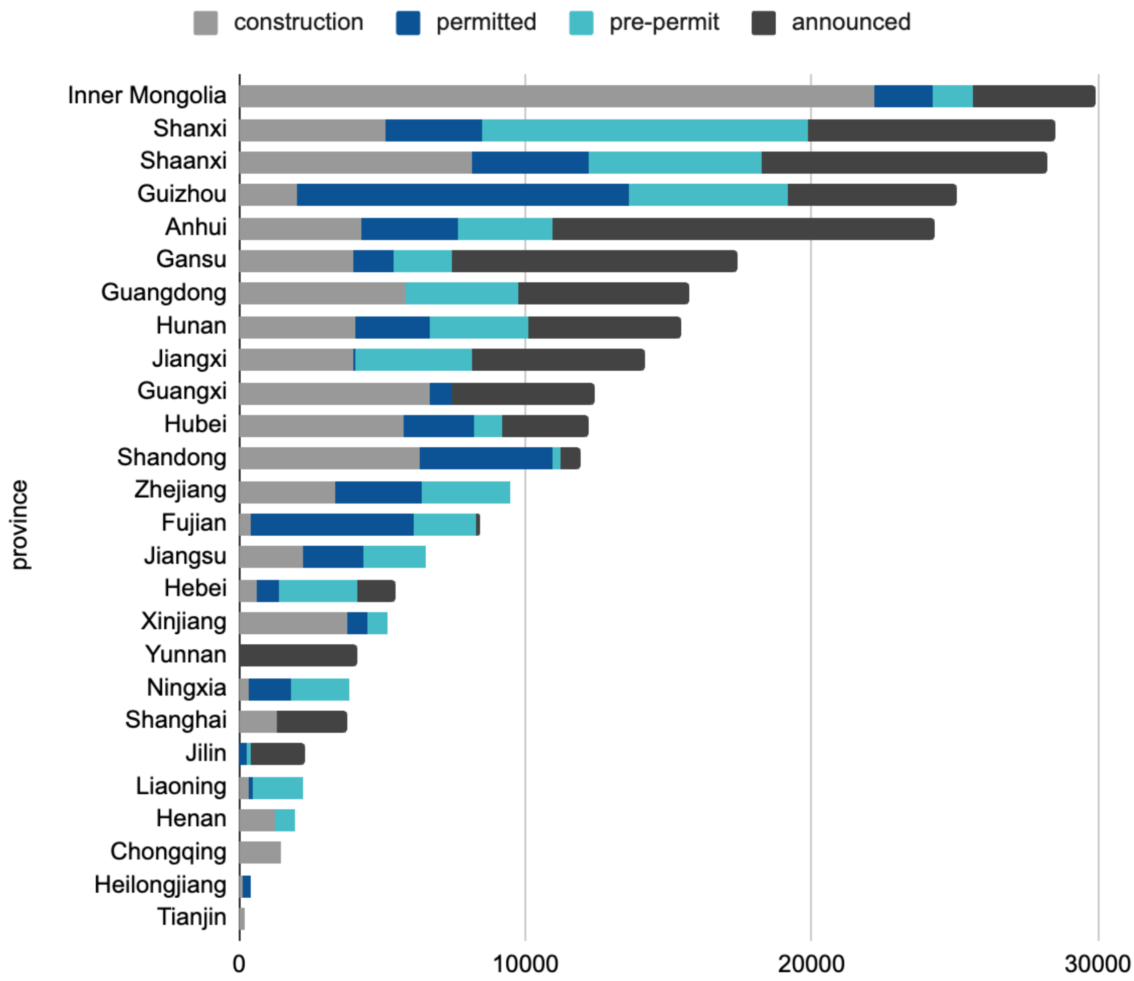
During the 13th Five Year Plan (FYP) period, Fujian province only permitted combined heat and power (CHP) plants, resulting in 1840MW of cogen plants appearing in the pipeline in the first six months of 2022. Units 3 and 4 of Guodian Jiangyin cogen power station are large sizes with 660MW each. The remaining 520MW are small captive plants. The proposed two 65MW units and two 75MW units of Gulei Petrochemical Base South Cogen power station were granted permission to construct. The two permitted 80MW units of Fujian Putian Shimen'ao Cogen power station have started construction. Unit 2 of the Luoyuan Bay power station has started operations.

Jiangxi is an energy-deprived province. It lacks coal resources with no oil and gas and has very little water for hydropower. During the 14th FYP, it will have 60GW wind and solar installations. However, Jiangxi province has 8.4GW of new coal-fired power plants in the pipeline. The 2 x 1000 MW Datang Xinyu-2 started construction on 15 June. There have been no updates since the announcement of the two units of the 2104MW Guohua Jiujiang power plant in 2019 but the project showed signs of progress in February this year. A further 6GW of new coal power has been announced.



Source: CREA analysis of [Global Coal Plant Tracker](#) data.

Figure 4. Changes in project status in the first six months of 2022, by province



Source: CREA analysis of [Global Coal Plant Tracker](#) data.

Figure 5. New coal power capacity and project status, by province

Drought and heatwave driving a bounce in coal power

From June to August, much of China was suffering from an extreme, record-breaking heatwave, and the Central China grid region, where much of the country's hydropower capacity is located, was affected by drought. This meant surging electricity demand for air conditioning. August is usually a part of the rainy season with an abundant supply of water. However, some rivers dried up in Sichuan province, and the rainfall was 60% lower than the seasonal norm. At the peak of the drought, Sichuan's daily hydropower generation plummeted from about 900 million kWh in the same period to 440 million kWh, a drop of over 50%.

As China's largest hydropower-producing province, the weak hydropower output led to a severe power shortage in Sichuan, with factories ordered to either close down completely or limit production, and households and services urged to save power. Other provinces in central China were implementing similar measures.

However, in light of reported peak load and available capacity numbers, the Central China Grid region would have been able to meet local power demand comfortably, if it wasn't for one factor: the region continued to export very large amounts of hydropower to eastern provinces under inflexible, fixed contracts. In Sichuan, according to Northern China Power University professor Yuan Jiahai, 15GW of hydropower was exported at the peak of the power crunch, while the capacity shortfall was 13GW.

Furthermore, even taking into account the export commitments, the existing coal power capacity and available hydropower capacity would have been sufficient to meet local peak loads, if all thermal power plants were operating at full power when needed and electricity was dispatched efficiently across provinces.

Sichuan's thermal power plants were reportedly generating 12.75GW of electricity with the province's 18.25GW installed capacity, a rate of 70% at a time when the shortage was at its worst, a situation where 100% would be expected. This indicates that high fuel prices and regulated electricity prices, which make thermal power generation unprofitable, were a part of the problem. When shortages are not caused by a lack of capacity, but by the failure of existing capacity to operate when called upon, building more capacity is not going to solve the issue.

The power shortages will speed up grid reforms — and coal power investments

The new round of electricity shortages exposed weaknesses in China's grid management, as the drought-hit, hydropower-rich provinces continued to export large volumes of electricity while rationing local consumption. The shortages led to renewed calls for reforming the electricity system and, on the other hand, for more coal power capacity to be added. Both responses will likely be realised.

The Sichuan power shortage once again revealed the rigid and inefficient way China's vast power grid is being operated. Since generation isn't dispatched flexibly between provinces, the only way local officials can avoid power shortages is to build large amounts of dispatchable capacity, which in practice means coal and gas.

The situation is therefore highlighting the need to reform China's grid operation. These reforms face tremendous resistance because they would mean that higher-cost coal power generators would operate at very low utilisation, leading to large losses of revenue.

These shortages will speed up reforms to grid operation and planning. This has happened already as a result of the widespread shortages in autumn 2021.

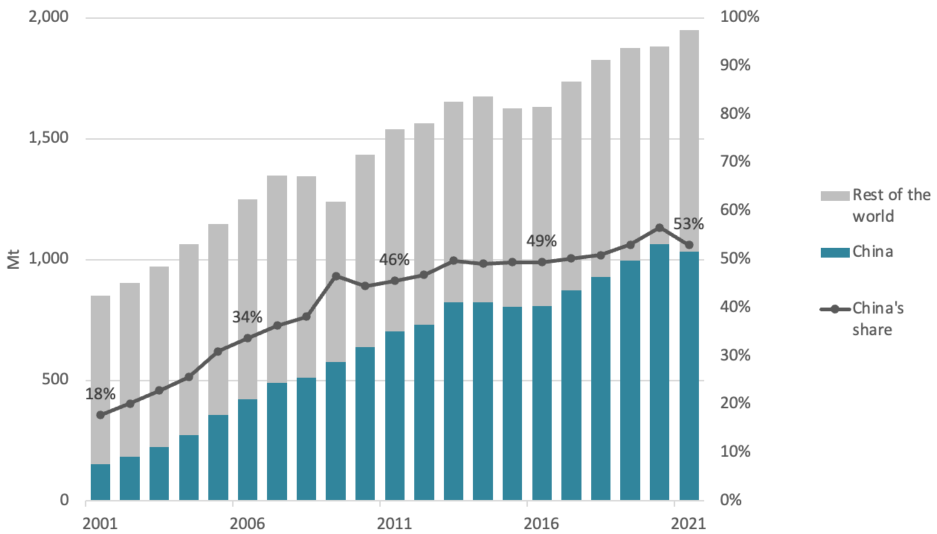
The causes of last year's shortages were different — high fuel prices and regulated power prices — but resulted in fast-tracking reforms that had been stuck for years, and created momentum for new reforms. A high-level policy on reforming electricity systems and, importantly, institutions is expected late this year.

Making grid operation more flexible is the key to avoiding electricity shortages, reducing the need for coal-fired power as a backup and transitioning to a clean energy grid. Using coal power as a supporting pillar to provide a flexible energy supply should only be a short-term solution. A long-term plan should be made to promote the uptake of clean flexibility technologies.

Steel sector

China has been the dominant steel producer in the world since the mid-2010s, producing over half of the world's steel. Its crude steel annual production climbed to a record high of 1,065 million tonnes in 2020, in response to a quick recovery in construction and manufacturing demand after Covid-19 lockdowns. In September of the same year, President Xi Jinping pledged that China would reach its carbon emissions peak in 2030 and become carbon neutral before 2060 (known as 'dual carbon' goals). Following Xi's announcement, the state planner stepped up efforts to cut the output to reduce pollutants and greenhouse gas emissions in its mammoth ferrous sector. China's annual crude steel production fell 2.8% in 2021, the first year-on-year drop in six years, and the government is targeting a further reduction in 2022, with output falling 6.5% in the first half of the year.

In spite of the falling output, announcements of new coal-based (blast furnace) capacity for producing pig iron increased in the first half of 2022 from the level seen in the past two years. More electric arc furnace capacity was also announced than in previous years, but this is mainly replacing older electric arc capacity, not shifting the mix of capacity, which is less than 10% electric arc furnace (EAF) based production. Interest in building new electric arc furnaces still indicates that the industry is starting to prepare for the shift implied by the carbon targets.



Source: CREA, World Steel Association, National Bureau of Statistics of China

Figure 6. Crude steel production in China and the rest of the world

New investment follows capacity swap scheme

New iron and steel projects follow the policy of 'capacity swaps'. The policy requires that a larger amount of existing capacity is retired for all new capacity added. The ratio between retiring capacity and new capacity is called the 'swap ratio', which depends on the facilities' location and type.

The capacity swap scheme is the most important policy intervention in the China steel industry. It was first introduced by the Ministry of Industry and Information Technology (MIIT) in 2014 to alleviate the overcapacity of steel, aluminium, cement and glass in China.

In theory, the policy, in place since 2014, should have ensured that total steelmaking capacity falls year by year. MIIT published its 'steel industry adjustment and upgrading plan' for 2016-2020 back in 2017. It set a target of cutting steelmaking capacity from 1,130 million tonnes (Mt) in 2015 to less than 1,000Mt in 2020. However, China produced a record-breaking 1,065Mt of crude steel in 2020. The estimated gap between the capacity control targets and steel capacity presumed to be operating has widened to well over 200Mt. The discrepancy may be caused by unreported capacity expansions, higher production efficiency and revival of low-quality steel production.

As the enforcement of the earlier policy failed, MIIT halted steel swap project approval from late January of 2020, with the ministry denouncing earlier 'number games' with capacity, heralding tougher enforcement. An updated scheme with stricter swap ratios was instituted in April 2021 and took effect two months later.

As of the end of June 2022, the updated steel industry capacity swap scheme has been in force for over one year. The Centre for Research on Energy and Clean Air (CREA) has been tracking and analysing the new iron and steel investment on a regular basis[3].

A mapping of new steelmaking projects by CREA shows steel companies continue to invest in new projects at alarming rates. The steel sector is China's second largest emitter of CO2, and there is no sign of investment in coal-based capacity being scaled back yet, despite the country's carbon neutrality targets.

Specifically, our analysis shows:

[3] See our previous analysis: China's Power & Steel Firms Continue to Invest in Coal even as Emissions Surge Cools Down; Investments in coal power and coal-based steelmaking accelerated in China in 2021, dwarfing the rest of the world

- During 2017-2022 H1, provincial governments approved 356.7 million tonnes per annum (Mtpa) of new ironmaking capacity, including 352.43 Mtpa blast furnaces (BF) and 4.27 Mtpa non-blast furnaces. Correspondingly, 423.1 Mtpa of old ironmaking facilities were set to retire after the new facilities were completed, a net 66.4 Mtpa capacity decrease.
- As a part of the swap arrangement, 393.8 Mtpa steelmaking capacity was approved in 2017-2022H1, including 114.6 Mtpa electric arc furnace (EAF) and 279.2 Mtpa basic oxygen furnace (BOF) capacity, which will replace totally 475.3 Mtpa old ones, a net 81.4 Mtpa capacity reduction.
- Due to the temporary sixteen-month approval halt from late January 2020 to May 2021, the approvals in 2020 and the first half of 2021 are much lower than the rest periods, but shot up soon after approval resumed. In 2021, the new approval by each province added up to 65.8 Mtpa ironmaking and 72.2 Mtpa steelmaking capacity. While in the first half of 2022, the aggregated new approval came to 30.8 Mtpa of ironmaking and 34.2 Mtpa steel making capacity, that is close to half of the 2021 yearly summation. In the regular years, the sum of the approved capacity in the second half of the year is usually higher than the first half of the same year, hence it is possible that the total approvals of 2022 might be higher than that of 2021.
- Notably, new iron and steel capacity continued to be dominated by the coal-based BF-BOF route, the most polluting steelmaking process, throughout the past five and a half years, with a total capacity of 352.4 Mtpa of BF (99% of the approved new ironmaking capacity) and 279.2 Mtpa of BOF (71% of the approved new steelmaking capacity). That is to say, at least one quarter of China's existing steelmaking capacity has been renewed to further lock in carbon intensive production during their 40-year lifespan. New investments in coal-based steelmaking capacity in the first six months of 2022 only, 29.7 Mtpa BF and 14.7 Mtpa BOF, would result in $15-22 billion (CNY 100-150 billion)[4] in stranded capacity, if China's low-carbon transition is successful.

However, 2021 and 2022H1 saw some promising progress on shifting investments away from the coal-based route:

- New electric arc furnace (EAF) capacity swap announcements significantly increased in 2021 and 2022H1, which is promoted by the updated swap scheme. A total of 27.3 Mtpa of EAF steelmaking capacity was announced in 2021, and 19.6

[4] The capital cost of a new integrated BF-BOF steelmaking facility is approximately 1–1.5 billion USD/Mtpa.

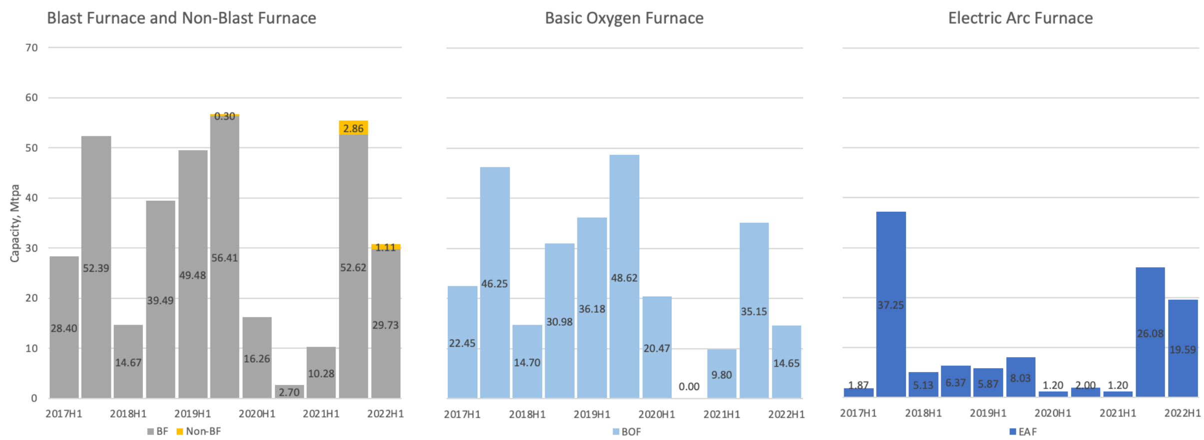
Mtpa in 2022H1. The share of EAF in the newly announced steelmaking capacity increased to 37.8% in 2021, and 57.2% in 2022H1.

- A few non-BF projects with a total capacity of 4.3 Mtpa, which applied incremental technology to cut part of the carbon emission or applied full-decarbonised technology in the steelmaking process, were announced in 2019, 2021 and 2022H1. We could see both private and state-owned enterprises (SOEs) are investing in these low-carbon technologies, including HIsmelt, hydrogen plasma smelting reduction (HPSR), and hydrogen direct reduction (HDRI).

Table 1. Capacity swap announcements 2017-2022H1, Mtpa

		Year	2017	2018	2019	2020	2021	2022H1	Total
Ironmaking	Addition	BF	80.8	54.2	105.9	19.0	62.9	29.7	**352.4**
		Non-BF	0.0	0.0	0.3	0.0	2.9	1.1	**4.3**
	Exit	BF	108.3	64.1	117.7	18.2	77.8	35.6	**421.6**
		Non-BF	0.0	0.0	1.5	0.0	0.0	0.0	**1.5**
	Net change		-27.5	-9.9	-13.0	0.7	-12.0	-4.7	**-66.4**
Steelmaking	Addition	BOF	68.7	45.7	84.8	20.5	45.0	14.7	**279.2**
		EAF	39.1	11.5	13.9	3.2	27.3	19.6	**114.6**
	Exit	BOF	116.4	64.0	110.1	25.1	66.2	20.3	**402.1**
		EAF	29.4	3.8	8.9	3.4	15.3	12.4	**73.2**
	Net change		-38.0	-10.6	-20.3	-4.8	-9.3	1.6	**-81.4**
	EAF % in the Addition		36.3%	20.1%	14.1%	13.5%	37.8%	57.2%	**29.1%**

Source: CREA, provincial government websites. Note: Data includes announcements made during 2017-2022H1. As a certain number of exit capacities of one furnace were divided for several capacity swap projects, and may be announced in different years, we count the divided capacity into the major part of the exit capacity as a whole. BF=blast furnace, Non-BF=non-blast furnace (here includes hydrogen-based direct reduction plant, Hydrogen plasma smelting reduction plant and HIsmelt plant), BOF=basic oxygen furnace, EAF=electric arc furnace.



Source: CREA, provincial government websites. Note: Data includes announcements made during 2017-2022H1. BF=blast furnace, Non-BF=non-blast furnace (here includes hydrogen-based direct reduction plant, Hydrogen plasma smelting reduction plant and HIsmelt plant), BOF=basic oxygen furnace, EAF=electric arc furnace.

Figure 7. New iron & steelmaking capacity additions in 2017-2022H1 under capacity swap announcements (half-yearly)

Table 2. Announced non-blast furnace projects in 2017-2022H1

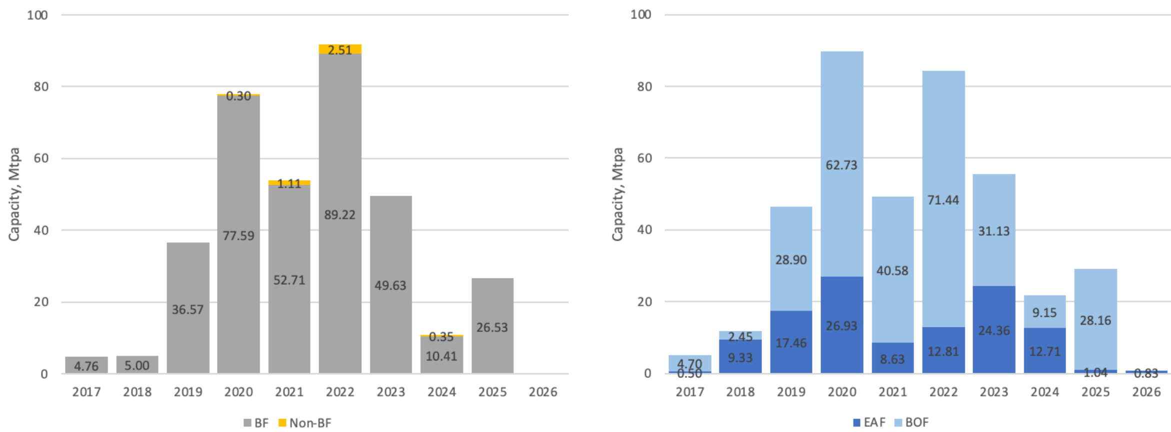
Project developer	Anc. year	Tech.	Tech. type	Mitigation potential[5]	Capacity, Mtpa	Est.oper. year	Parent corp.	Parent corp. type
Inner Mongolia Saisip Technology Co., Ltd.	2019	HPSR	full-decarbonised	95%	0.3	2021	Jianlong	Private
Xingtai Iron & Steel Co., Ltd.	2021	HIsmelt	incremental	20% (80% with CCS)	1.65	2023	Xingtai Iron & Steel	Private
Baosteel Zhanjiang Iron & Steel Co., Ltd.	2021	HDRI	full-decarbonised	95%	0.856	2023	Baowu Steel	Central SOE
Fushun New Steel Co., Ltd.	2021	HIsmelt	incremental	20% (80% with CCS)	0.35	2025	Jianlong	Private

[5] https://rmi.org/insight/pursuing-zero-carbon-steel-in-china/

Hebei Zhangxuan High Tech Co., Ltd.	2022	HDRI	full-decarbonised	95%	1.11	2022	HBIS Group	Regional SOE

Source: CREA, provincial government websites, RMI. Note: Data includes announcements made during 2017-2022H1. SOE = State-owned enterprise, HPSR = Hydrogen plasma smelting reduction, HDRI = hydrogen direct reduction, CCS = carbon capture and storage

We also mapped the above announced new projects according to their estimated operation year stated in the swap announcements. The result indicated almost all new capacity will be put online by 2025.



Source: CREA, provincial government websites. Note: Data includes announcements made during 2017-2022H1. BF=blast furnace, Non-BF=non-blast furnace (here includes hydrogen-based direct reduction plant, Hydrogen plasma smelting reduction plant and HIsmelt plant), BOF=basic oxygen furnace, EAF=electric arc furnace.

Figure 8. New iron & steelmaking capacity additions by their estimated completion year

World steel giants' decarbonisation journey

China's policymakers have been busy creating a '1+N' policy framework to guide the country's decarbonisation journey for the next four decades. The '1' stands for a top-level Guiding Opinion, while the 'N' refers to a set of sector-specific decarbonisation plans.

As part of the '1+N' climate policy framework, three central government ministries released a 'guiding opinion' document on 'high quality development' in the steel industry in February 2022, which suggested the sector should target peak carbon emissions 'before 2030', rather than 2025 as its industry association had earlier indicated.

The easing timetable was partly targeted at giving the steel sector more room for transforming into a low-carbon industry, and also to tame market talks over steel output cuts that have caused price volatility. Experts estimated that China's peak steel emissions could still be achieved well before that and may have already been reached in 2020 owing to the output curbing and declining demand since 2021.

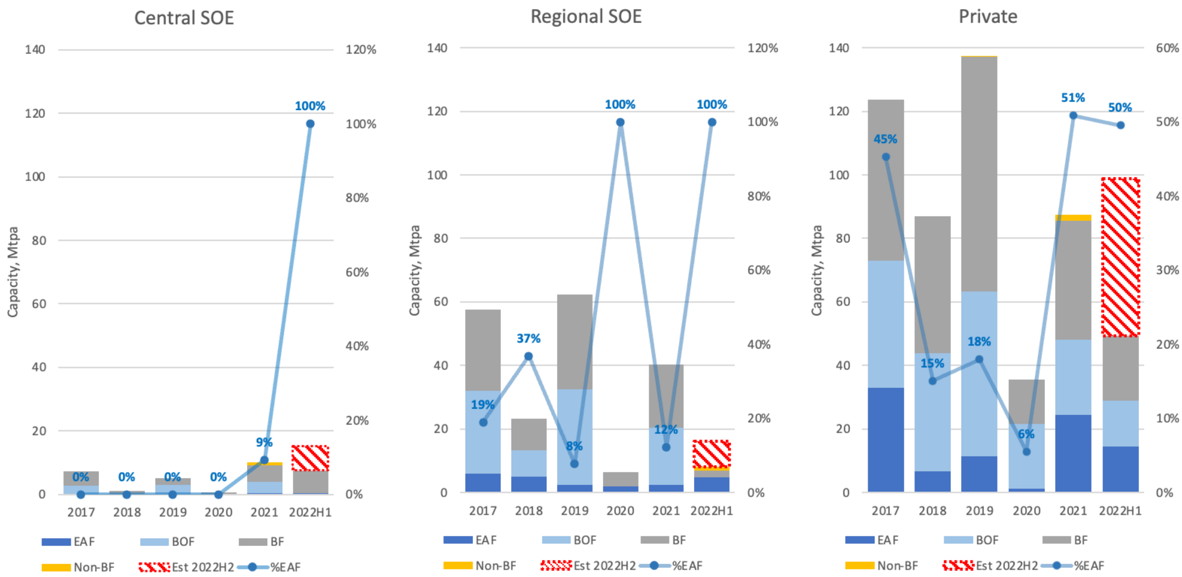
Neither the Chinese government nor its steel industry association had proposed a plan for the sector to achieve carbon neutrality before 2060. In contrast, four Chinese steel giant companies, Baowu, HBIS, Baotou Steel, and Ansteel, which together accounted for 23% of China's total production in 2021, have put forward more ambitious targets. They aim to peak emissions well before 2025, to significantly reduce emissions by 2030, and become net-zero by 2050.

By analysing the parent corporations of each new iron & steel project announced from 2017 to the first half of 2022 (Figure 9), we divided the project's ownership into three types – central state-owned enterprises (SOEs), regional SOEs and private enterprises.

We found that private steel companies are the most active developers. Private companies make up 68% of the total new ironmaking capacity and 71% of the new steelmaking capacity, followed by regional SOEs and central SOEs.

Based on the fact that during regular years, the sum of the approved capacity in the second half of the year is usually twice that of the first half of the same year, we estimated the yearly approvals in 2022 by doubling the amount of its first half (red bar in Figure 9). We could see that regional SOEs seem to scale down their new investment, but not central SOEs and private companies.

New iron and steel projects of the three-type corporations have been mostly dominated by coal-based BF-BOF steelmaking facilities in recent years. The share of EAF in steelmaking capacity shows an obvious increase among private companies after the swap scheme adjusted to promote low carbon technology in 2021. Half of the new steel capacity in 2021 and 2022H1 is EAF, using steel scrap as feedstock.



Source: CREA, provincial government websites. Note: Data includes announcements made during 2017-2022H1. BF=blast furnace, Non-BF=non-blast furnace (here includes hydrogen-based direct reduction plant, Hydrogen plasma smelting reduction plant and HIsmelt plant), BOF=basic oxygen furnace, EAF=electric arc furnace, %EAF = the share of EAF in the steelmaking capacity, SOE = State-owned enterprise.

Figure 9. New iron & steelmaking capacity additions in 2017-2022H1 under capacity swap announcements by central SOEs, regional SOEs and private companies

Methodology

The changes in coal power project status analysed for this briefing are based on the latest July 2022 update of the Global Energy Monitor's Global Coal Plant Tracker (GCPT), with complementary data on retirements compiled from the provincial Development and Reform Commission and National Development and Reform Commission in China. GCPT is the most detailed dataset available on the global coal power fleet, and has provided biannual updates on coal-fired generating capacity since 2015. GCPT data is used by the International Energy Agency (IEA), the OECD Environment Directorate, UN Environment Programme, U.S. Treasury Department, and the World Bank. GCPT data is licensed by Bloomberg LP and UBS Evidence Lab, and is used by the Economist Intelligence Unit and Bloomberg New Energy Finance.

Information on new iron and steel projects was compiled from the websites of provincial Industrial and Information Technology Bureaus and Ecology and Environment Bureaus, which are responsible for implementing steel overcapacity and capacity replacement policies, and environmental permitting of new steel plants, respectively. New project announcements were mapped systematically, and total blast furnace, basic oxygen furnace and electric arc capacity, as well as capacity being replaced, was captured for each project. Duplicates were removed from the analysis.

The capital cost of coal power was calculated based on the average cost of 4,000CNY/kW to build a typical 600MW or 1000MW ultra-supercritical coal power unit in China. This data was provided by various experts residing in China who have experience in building new coal-fired power plants in recent years. The cost of iron and steel projects was estimated based on Global Energy Monitor's report. These cost levels are indicative, as capital costs vary due to a host of factors including unit size; location; boiler, pollution control, cooling etc. technology employed; and whether the plant is a combined heat and power or an electricity-only plant. The way in which the impact of asset stranding is realised in the economy can include unrecoverable initial investment, unpaid interest to bank loans, and the unrecoverable expected returns to equity due to forced early retirement and/or underutilization of new or existing assets. Soon the carbon price and CCS cost also need to be added on.

About Global Energy Monitor

Global Energy Monitor (GEM) develops and shares information on energy projects in support of the worldwide movement for clean energy. Current projects include the Global Steel Plant Tracker, Global Coal Mine Tracker, Global Coal Plant Tracker, Global Fossil Infrastructure Tracker, Europe Gas Tracker, CoalWire newsletter, Global Gas Plant Tracker, Global Registry of Fossil Fuels, Latin America Energy Portal, and GEM.wiki.

www.globalenergymonitor.org

About Centre for Research on Energy and Clean Air (CREA)

CREA is an independent research organisation focused on revealing the trends, causes, and health impacts, as well as the solutions to air pollution. We use scientific data, research and evidence to support the efforts of governments, companies and campaigning organisations worldwide in their efforts to move towards clean energy and clean air.

www.energyandcleanair.org