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Turning point:

China permitted no new coal-based steel projects in H1 2024 as policies drive decarbonisation



CREA

Centre for Research on Energy and Clean Air

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Turning point: China permitted no new coal-based steel projects in H1 2024 as policies drive decarbonisation

This biannual review provides insights into the latest trends of China's steel sector decarbonisation.

Key findings

- 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.
- In the first six months of 2024, provincial governments permitted 7.1 million tonnes per annum of steelmaking capacity, all of which are electric arc furnace projects, which could signify a turning point for the Chinese steel industry in terms of halting new investments in coal-based steelmaking capacity.
- China could cut 200 million tonnes of CO₂ from the steel industry by 2025, which would be a 10% reduction compared to the highest emission levels up to now recorded in 2020 due to measures to cut steel output and increase scrap-based secondary steel from electric arc furnaces.
- China's forecasted CO₂ reductions of 200 million tonnes by 2025 are equivalent to the annual emissions from the EU's steel sector.
- As China's steel demand peaks and more scrap becomes available, there is great potential to shift away from coal-based production, representing a significant opportunity for emissions reduction in the next 10 years.

Policies are driving China's steel industry to reduce carbon emissions in 2024-2025. Strong implementation is key to harnessing the moment and paving the way forward.

Policy drivers

- China's state planner has emphasised reducing carbon emissions from the steel sector in 2024-2025 in a recently released action plan, which aims to reduce a total of 20 million tonnes of standard coal and 53 million tonnes of CO₂ emissions compared to 2023.
- Additionally, the action plan announced strict restrictions on exports of iron and steel products with high energy intensity but low added value. This could potentially limit the volume of Chinese steelmakers' excess production sold overseas.
- Mandates from the central government have seen provincial governments laying out plans to cut steel production in 2024. Provinces with high steel production growth in 2023 and from January to May 2024 might face high pressure to cut their production, such as Anhui, Guangdong, Guangxi, Fujian and Inner Mongolia. The most affected steel mills will be those running blast furnace-basic oxygen furnaces (BF-BOFs) because of their high carbon intensity. Electric arc furnaces (EAFs) will be prioritised to ensure good production rates.
- The Chinese government has issued supporting policies to expand domestic scrap steel supply more rapidly in the coming years, including taxation and financial aid.
- The looming EU Carbon Border Adjustment Mechanism has accelerated efforts to improve carbon accounting measures and include the steel sector in China's national Emission Trading Scheme, both of which have been central policy factors driving the decarbonisation of the sector.

Contents

Key findings	3
Policy drivers	3
Contents	5
Introduction	5
No new permits for coal-based steelmaking projects for the first time in the past three years	6
Large potential to cut carbon emissions	8
Policies are driving carbon reduction	9
National action plan 2024-2025.....	10
Provincial actions.....	11
Challenges for EAF and scrap supply	13
Lack of economic incentives for EAF steel mills.....	13
Government is set to boost the scrap supply.....	13
CBAM accelerated steel decarbonisation efforts	14
Methodology	16

List of figures and tables

Figure 1 - New permits of iron and steelmaking capacity on a half-yearly basis, 2017–2024 H1.....	7
Figure 2 - Projection for carbon reduction by increasing EAF steel share and reducing steel production in 2024-2025.....	8
Figure 3 - China’s crude steel production by processes.....	10
Table 1 - Major steel-producing provinces, 2023 and Jan-May 2024.....	11

Introduction

Decarbonising the steel sector is crucial to both achieving China's climate targets and mitigating global climate risks. In 2023, China's crude steel [production](#) exceeded 1 billion tonnes for the fourth year in a row, which is more than half of the global steel output.

Steel can be produced from iron ore in blast furnace–basic oxygen furnaces (BF–BOFs) using coal as fuel and reductant, or from recycled scrap steel in electric arc furnaces (EAFs)¹. The steel sector in China primarily relies on BF–BOFs, which makes it the country's second-largest CO₂ emitter, following electricity generation.

CREA tracks China's steel decarbonisation progress and provides reviews on a biannual basis. Our 2023 H2 [analysis](#) revealed that steel sector decarbonisation in China stalled in 2023.

This analysis for the first half of 2024 sheds light on the latest trends in new project permitting, steel production and policy drivers.

No new permits for coal-based steelmaking projects for the first time in the past three years

There were no new permits issued for coal-based steelmaking projects in the first half of 2024, according to data compiled from Chinese provincial governments (Figure 1). This is the first time on a half-yearly basis that there have been no new permits issued since China announced its '[dual carbon goals](#)' in September 2020.

This might be a turning point for the Chinese steel industry to halt new investments into coal-based steelmaking capacity.

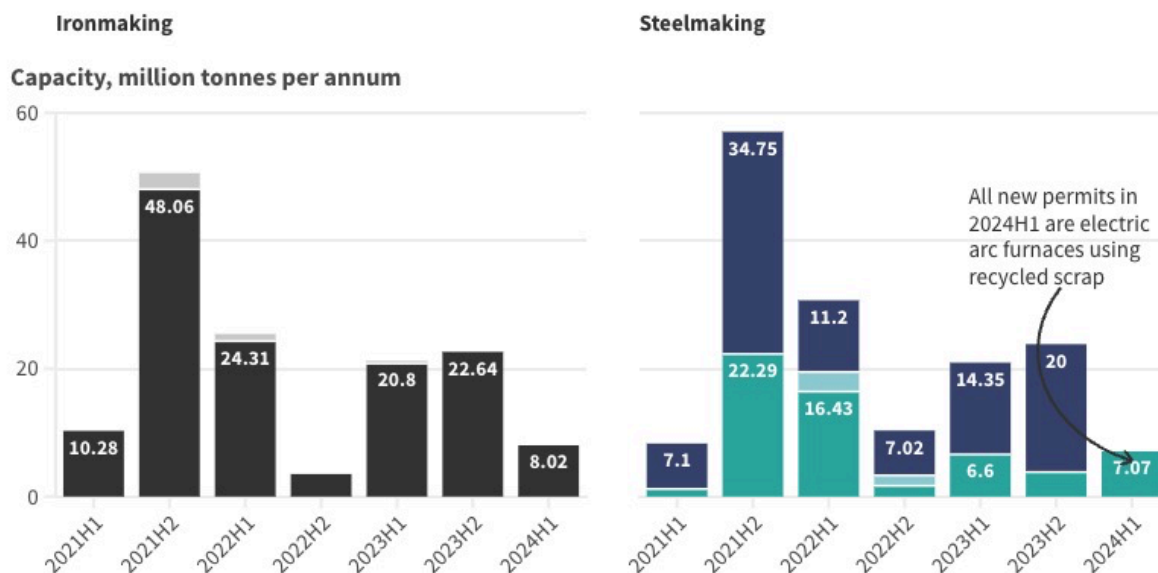
CREA's previous 2023 H2 [analysis](#) revealed that steel firms received approvals for large amounts of new coal-based iron and steelmaking projects in 2017–2023 with 99% of the ironmaking capacity using BFs and 70% of the steelmaking capacity using BOFs.

¹ Steel production follows two primary routes: the blast furnace–basic oxygen furnace (BF–BOF) route and the electric arc furnace (EAF) route. The BF–BOF route relies on iron ore and coke as primary inputs. In this method, coke removes oxygen from the iron ore in a blast furnace, transforming it into pig iron, resulting in significant carbon emissions. The pig iron is then reduced into steel using a basic oxygen furnace. Conversely, the EAF route predominantly utilises scrap steel as raw material, offering the potential to reduce [70%](#) carbon dioxide emissions per tonne of crude steel produced.

New permits of ironmaking and steelmaking projects in China

2021-2024, half-yearly basis

■ BF ■ Non-BF ■ EAF ■ AOD ■ BOF



Source: Provincial government websites, CREA analysis • 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, AOD=argon oxygen decarburisation furnace.



Figure 1 - New permits of iron and steelmaking capacity on a half-yearly basis, 2017–2024 H1

However, in the first six months of 2024, provincial governments permitted 7.1 million tonnes per annum (Mtpa) of steelmaking capacity, all of which consists of electric arc furnace (EAF) mills.

Meanwhile, provincial governments permitted eight BFs with a total of 8 Mtpa of ironmaking capacity. Although the ironmaking projects are scheduled to be online in 2025-2026 according to the permits, it is likely that steel firms will obtain the permits as a measure to secure future project construction, but halt construction. There were a few BF projects cancelled in late 2023, such as a 1500 m³ BF by [Hebei Rongxin](#) Steel Company, and another one of the same size by [Hebei Xinda](#) Steel Company.

Blast furnaces cost significant capital investment, about [10 times](#) more than EAFs. China's steel sector is at risk of [falling](#) off a cliff' due to overcapacity and profit slumps. The newly built projects will face immense pressure in terms of their return on investment.

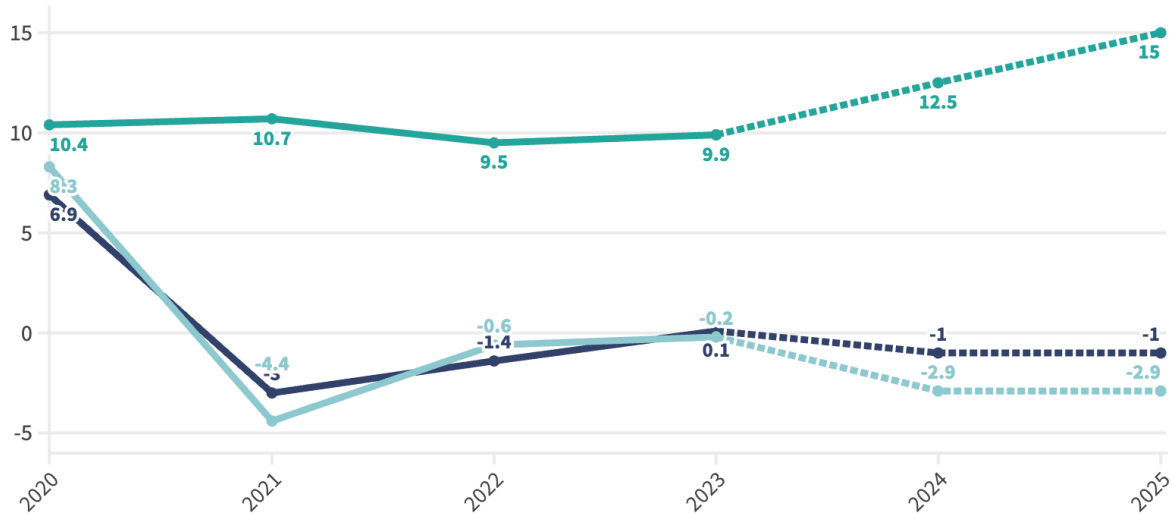
It is worth noting that Shougang, the Beijing Municipality regionally state-owned steel company, applied for a [permit](#) to build a 1.3 Mtpa EAF in April 2024 in Hebei province to replace a BOF with 2 Mtpa steelmaking capacity. This is the first EAF project that Shougang has applied to build, according to data compiled over the past seven years. In [2023](#), Shougang Group produced 33.6 million tonnes of crude steel, ranking ninth among the world’s top steel producers, and sixth in China.

Large potential to cut carbon emissions

Projection for carbon reduction by increasing EAF steel share and reducing steel production in 2024-2025

■ Steel production ■ Steel production (Projected) ■ CO2 emissions ■ CO2 emissions (projected) ■ EAF steel% ■ EAF steel% (projected)

Share/ YoY, %



Source: China Steel Yearbook, RMI, CREA analysis • EAF=electric arc furnace



Figure 2 - Projection for carbon reduction by increasing EAF steel share and reducing steel production in 2024-2025

China could lower emissions by as much as the entire annual steel sector emissions of the EU by reducing steel output and raising the share of EAF steel in the next two years. As shown in Figure 2, projection suggests that the Chinese steel industry could achieve a 3% CO₂ reduction annually in 2024-2025, by cutting production at 1% per year and raising the share of EAF steel production to 15%. This would result in a reduction of more than 100

million tonnes of CO₂ emissions in 2025 compared to 2023, or more than 200 million tonnes of CO₂ emissions in 2025 compared to the peak in 2020. This would imply a 10% decline from the peak in 2020, well above the government target, and close to the annual CO₂ emissions of the entire [steel](#) industry of the EU.

Policies are driving carbon reduction

China has [dropped](#) an ambitious push for its steel industry to peak carbon emissions by 2025, pushing the deadline to 2030 in final official steel industry development [guidelines](#).

Nonetheless, the steel industry may have peaked its carbon dioxide emissions in [2020](#) together with its production, primarily due to decreasing market demand. The domestic [apparent consumption](#) of crude steel has been contracting year by year since 2020. China consumed [933](#) million tonnes of crude steel in 2023, representing over 10% reduction from the peak in 2020, and is expected to further decrease this year due to the prolonged real estate crisis. China's Metallurgical Industry Planning and Research Institute (MPI) [predicts](#) a 1.8% year-on-year drop in steel demand this year after a 2.4% decline in 2023.

China's crude steel output from January to May 2024 recorded a 1.4% year-on-year decline and parked at 439 million tonnes, according to China's National Bureau of Statistics (NBS).

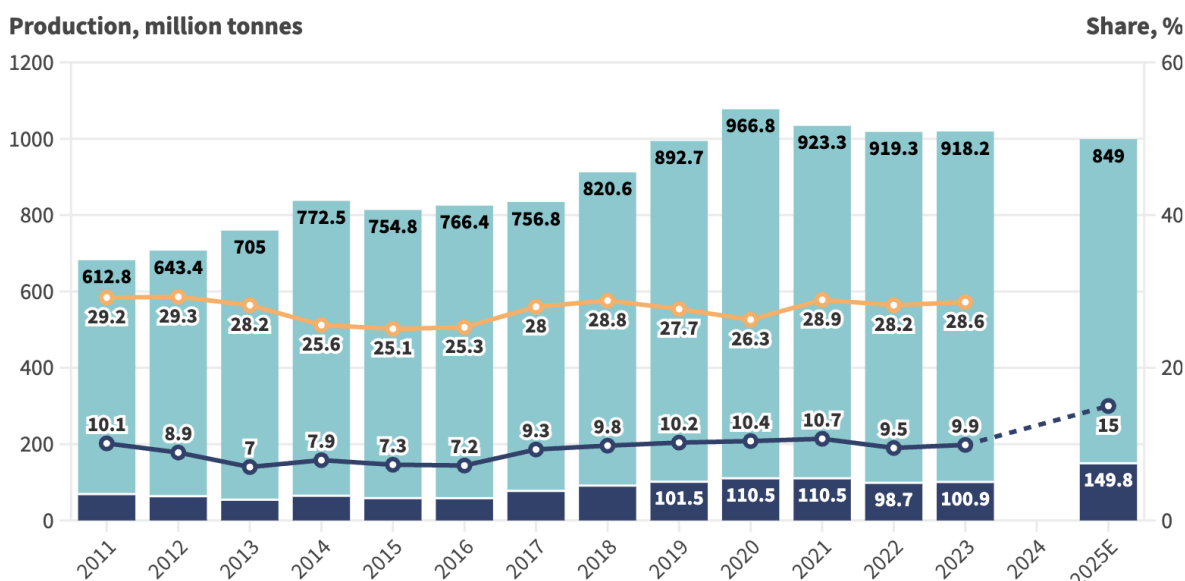
The above-mentioned steel industry development guidelines include two key interim goals for 2025: 1) restructure steel production by increasing the share of EAF steel capacity to 15%, up from the current 10%; 2) boost scrap recycling and increase scrap use to 300 million tonnes.

EAF steelmaking is three times less carbon intensive than the coal-based BF-BOF route. EAF steelmaking, with electricity as its main energy source, emits about [0.6](#) tonnes of CO₂ per tonne of steel, while the BF-BOF route uses coal as the main energy source and reduction agent, emitting about [2 tonnes](#) of CO₂ per ton of steel.

The high carbon footprint of China's steel sector is mainly due to its heavy reliance on coal-based steelmaking. BOF accounted for 90% of the annual crude steel output of more than 1 billion tonnes in 2020-2023, while EAF steel only accounted for about 10% (Figure 3). This is low compared with the world average of about [30%](#), and nearly 70% in the [United States](#).

China's crude steel production by processes and the share of crude steel from electric arc furnace and its 2025 target

■ EAF steel share ■ EAF steel share target ■ World EAF steel share ■ EAF steel ■ BOF steel



Source: China Steel Yearbook, World Steel Association, CREA analysis • BOF=basic oxygen furnace, EAF=electric arc furnace. E=estimate.



Figure 3 - China's crude steel production by processes

National action plan 2024-2025

China's state planner, the National Development and Reform Commission (NDRC), has emphasised reducing carbon emissions from the steel sector in 2024-2025 in a recently released [action plan](#), which aims to reduce a total of 20 million tonnes of standard coal and 53 million tonnes of CO₂ emissions compared to 2023.

The NDRC action plan mapped out several measures to reduce CO₂ emissions in the steel sector, including output and capacity control, energy efficiency improvements, and promoting EAF and other low-carbon steelmaking technologies.

Raising energy efficiency in steel production by upgrading and retrofitting equipment requires significant investment. As the steel sector is burdened with [debts](#) and historically low profitability, it is more feasible to control the output and ramp up EAF steelmaking in

order to meet government targets rather than investing in energy efficiency improvements, according to industrial [insights](#).

Additionally, the action plan announced imposing strict restrictions on exports of iron and steel products with high energy intensity but low added value. This might narrow the space of Chinese steelmakers to offload their overproduction overseas.

China's steel [exports](#) increased by more than one third last year to the highest level since 2016, up to 90.26 million tonnes, close to one-tenth of China's steel production. The surge in exports can be attributed to weak domestic demand and oversupply in the market, and foments [dumping](#) concerns.

The growth in exports continued in the first five months of 2024, as shown by the latest [data](#) available.

Provincial actions

Following the NDRC's mandates to cut carbon emissions, the Fujian provincial government [announced](#) in June that it will enforce crude steel production cuts between June and December this year, with output not to exceed 85% of its annual capacity of 35.98 Mtpa, according to a [media](#) report. This is the first disclosed production control plan for 2024 set by a provincial government. The most affected steel mills will be those running BF's because of their high carbon intensity. EAFs will be prioritised to ensure good production rates, according to the notice.

In 2023, Fujian province, in southeastern China, ranked tenth among the top steel producing provinces in China and produced 34.1 million tonnes of crude steel (Table 1). In the first five months of 2024, the province's output reached 16.5 million tonnes, reflecting a 17.5% year-on-year increase. If the Fujian provincial government policy is implemented, crude steel production in Fujian province in 2024 will be 3.5 million tonnes lower than 2023, or a 10% reduction.

Table 1 - Major steel-producing provinces, 2023 and Jan-May 2024

million tonnes, crude steel production

Province	Rank	2023		Jan-May 2024	
		Tonnage	YoY, %	Tonnage	YoY, %
Hebei	1	210.5	-0.7%	94.1	-2.3%
Jiangsu	2	118.6	-0.4%	52.4	-0.7%

Shandong	3	74.6	-1.9%	31.3	-1.1%
Liaoning	4	73.4	-1.4%	29.6	-7.6%
Shanxi	5	62.9	-2.0%	25.7	-9.9%
Anhui	6	38.9	4.9%	15.6	-2.8%
Guangxi	7	38.2	0.6%	19.4	17.6%
Guangdong	8	36.9	3.4%	18.3	19.7%
Hubei	9	36.4	-0.4%	15.6	3.9%
Fujian	10	34.1	6.5%	16.5	17.5%
Inner Mongolia	11	32.7	10.5%	13.2	0.8%
Henan	12	32.6	2.4%	13.2	-13.7%
Sichuan	13	26.9	-3.5%	10.9	-10.0%
Jiangxi	14	26.6	-1.2%	11.5	2.1%
Hunan	15	24.2	-7.5%	10.0	-8.7%

Source: National Bureau of Statistics, WIND, CREA analysis. YoY=year on year. Rank in 2023 is based on production volume.

Provinces that increased steel production in 2023 and Jan-May 2024 might face high pressure to cut their production for the remaining months of 2024, such as Anhui, Guangdong, Guangxi, Fujian, and Inner Mongolia (Table 1). These provinces are either located in economic powerhouses with high demand for steel, such as the Yangtze River Delta (cities near Shanghai) and the Greater Bay Area (cities near Guangzhou), or close to cheap coal resources, like Inner Mongolia.

Moreover, the five aforementioned provinces were all outside the regions for air pollution control in the winter season. China's Ministry of Ecological Environment released an [action plan](#) to reduce air pollution in the key regions in the winter of 2023-2024, including Beijing, Tianjin, a number of cities in Hebei, Shandong, Henan, Shanxi and Shaanxi. The action plan mandated steel plants in these locations to halt production during heavy pollution days, and control coal consumption.

Five provinces all ramped up their steel production in the last three months of 2023, with the only exception being Guangxi in December, according to their monthly output data from NBS. The monthly steel output of Fujian province in April to September 2023 showed

negative growth, but significantly jumped by 227%, 268% and 302% in October, November and December 2023, respectively.

Challenges for EAF and scrap supply

To meet the 2025 goal, total crude steel production should be cut to below 1 billion tonnes. In the meantime, EAF steel mills will need to raise about half of their output compared to the current level, up to 150 million tonnes.

It is possible to accomplish this by ramping up EAF mills' capacity [utilisation](#) rate from the current 50% to 75%, according to industrial experts. China has more than 200 Mtpa EAF steelmaking capacity in operation.

Lack of economic incentives for EAF steel mills

Despite policy goals and production capacity being in place, raising capacity for EAF mills is still challenging. Insufficient scrap steel supply and [higher](#) operation costs have limited EAF steelmaking in the past decades. The production cost of EAF steelmaking in China is roughly 200 yuan [higher](#) than the BF-BOF route per tonne of steel produced.

The situation becomes more challenging when the sector is caught in overcapacity. The [profitability](#) of the Chinese steel industry plummeted to below 1% in 2022-2023, far below a sustainable level, and has not recovered in 2024 yet.

BF-BOF mills strive to keep running with low [profit](#), while EAF mills were running at a [loss](#) for most of the period between January and June 2024. The [loss](#) for EAF mills widened up to 177 yuan per tonne of steel in late June, according to analysts.

The steel industry is a capital intensive sector with high fixed costs. In order to dilute fixed costs, steelmakers are more likely to stay in operation despite running at a loss for a while. However, it is not promising to force the EAF mills to keep running at a loss, to meet the government goal.

Government is set to boost the scrap supply

China's [scrap](#) steel consumption was around 250 million tonnes in 2022-2023. The scrap [supply](#) is estimated to increase to 300-320 million tonnes by 2025, and 350-380 million tonnes by 2030, according to the China Scrap Steel Association (CSSA).

As China's steel demand peaks and more scrap becomes available, there is great potential to shift away from coal-based production. By 2030, [half](#) of the steel production could be fed by scrap. This represents a significant opportunity for emission reduction in the next 10 years.

The central government initiated an [action plan](#) in March 2024 to encourage large-scale equipment renewals and replacements of consumer goods, as a measure to boost investment and consumption.

The plan outlines that by 2027, the recycling volume of scrapped vehicles is expected to double compared to the levels in 2023. Furthermore, the recycling of used household appliances is set to rise by 30% by 2027 as compared to 2023.

The plan was followed by supporting measures including taxation and financial aid with significant [implications](#). The State Taxation Administration implemented [reverse invoicing](#) for companies engaged in scrap metal recycling. As a result, resource recycling companies that purchase from informal scrap collectors may receive a 13% VAT tax break, which enables recyclers to offer better prices for scrap and traded-in goods.

Moreover, the Ministry of Finance and four other departments jointly introduced a policy to [subsidise](#) the interest on equipment renewal loans. Central finance will provide a subsidy of 1% on the principal of bank loans, for a duration of up to two years, which could accelerate the uptake of retrofitting and generate more scrap.

With these measures, China is expected to see the domestic scrap steel supply expand more rapidly in the coming years.

CBAM accelerated steel decarbonisation efforts

Efforts to improve carbon accounting measures and the accelerated expansion of the Emission Trading Scheme (ETS) have been central policy factors driving the decarbonisation of the steel sector. The incoming EU [Carbon Border Adjustment Mechanism](#) (CBAM) has arguably accelerated these efforts.

The EU's CBAM has elevated efforts to decarbonise China's steel sector to comply with international standards. With the introduction of the carbon levy, the EU aims to tackle potential issues of 'carbon leakage', where companies move their production processes from regions with strict emission regulations to regions with more lax regulations to avoid higher costs in compliance. With the new measure coming into force in 2026, the costs of

Chinese steel exports to Europe could increase by 4%-6%, [according](#) to the China Iron and Steel Association (CISA). This could lead to a decrease of 32% in export volume and a loss of 58% in export profits for China's steel exporters, according to [estimates](#) by the Beijing Institute of Technology.

To avoid increased costs and losses, the sector is moving faster towards decarbonisation and improving carbon accounting. While CBAM has led to much criticism from Chinese stakeholders, it has significantly accelerated efforts to strengthen carbon accounting in affected sectors, including the steel sector. The government has sped up plans to expand the national ETS to include the steel sector by the [second half of 2024](#). Establishing the underlying data for carbon trading in the steel sector is challenging due to the complex production process with different input materials. Most steel companies lack practical experience in carbon trading. However, [80 steel companies](#) making up 13% of the current steel output, including Baosteel and Shougang, are already taking part in provincial ETS pilots and have gained experience with the market. While there are some [concerns](#) over higher costs amid thin profit margins, the inclusion of the steel sector in the national ETS is expected to accelerate decarbonisation significantly.

Beyond the expansion of the ETS, the government [relaunched](#) China's voluntary carbon market, the China Certified Emission Reduction (CCER) scheme, at the beginning of 2024. The [CCER](#) is supplementary to the ETS and allows companies to acquire further certificates if they exceed their emission quota under the ETS. This will likely [help](#) companies comply with the EU's CBAM and ensure that revenues from companies acquiring certificates remain in China and can fund further innovation into green technologies.

Furthermore, the Environmental Product Declaration (EPD) platform for the Chinese steel industry [launched](#) by CISA is another initiative to help companies improve emissions reporting. The EPD aims to quantify the environmental impacts of iron and steel products and through that, speed up the industry's decarbonisation. The EPD is meant to provide yet another instrument to comply with the EU's CBAM and [enhance](#) the understanding of competitors and downstream consumers in other countries about low carbon standards in China's steel industry.

Methodology

Data for the analysis of steel production and finance were compiled from data from China's National Bureau of Statistics, China Customs, and WIND Information, an industry data provider.

Information on new ironmaking and steelmaking 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 (BF), basic oxygen furnace (BOF), and electric arc furnace (EAF) capacity, as well as capacity being replaced, was captured for each project. Duplicates were removed from the analysis.