Steel sector decarbonisation in China stalls, with investments in coal-based steel plants since 2021 exceeding USD 100 billion despite overcapacity and climate goals

Xinyi Shen, March 2024

CREA is an independent research organisation focused on revealing the trends, causes, and health impacts, as well as the solutions to air pollution.
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March 2024

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Key findings

- China’s crude steel production broke 1 billion tonnes again in 2023, for the fourth year in a row. The increase in domestic steel consumption in manufacturing and infrastructure and strong demand from Asia and Africa compensated for the decline in real estate at home.

- Due to heavy reliance on coal-based blast furnace-basic oxygen furnace (BF–BOF) steelmaking and insufficient scrap steel supply, China’s crude steel has the highest carbon intensity among the major steel-producing countries. Progress in shifting to electric arc furnace steel (EAF) steel—a less carbon-intensive product—has been lacking, as EAF steelmaking is less economically competitive than BF-BOF in the Chinese market. Unless this issue is addressed, such as subsidising EAF or adding carbon price, the target of a 15% share by 2025 will be out of reach, even though the required EAF capacity exists.

- Plummeting profitability and continued aggressive spending on new production capacity over the past two years have made the steel sector financially vulnerable and hampered the shift to EAF. A significant number of uncompetitive producers aggravate the problem with excessive capacity.

- New investments in fixed assets\(^1\) are driven by capacity expansion, new mandates on emissions and improving overall production efficiency.

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\(^1\) A fixed asset is a long-term tangible property or piece of equipment that a company owns and uses in its operations to generate income.
Steel firms received approvals from provincial governments for large amounts of new iron and steelmaking projects in 2017–2023 through capacity replacement plans. Capacity replacement requires a larger quantity of existing capacity to be retired and for new capacity to be built. Most of these new projects are planning to commence operations by 2025, renewing about one-third of China’s steelmaking capacity.

In September 2020, China committed to peaking carbon emissions by 2030 and achieving carbon neutrality by 2060. However, newly proposed iron and steel projects are largely coal-based, before and even after the climate commitment. In the past seven years, 99% of this new ironmaking capacity has used blast furnaces, and 70% of the new steelmaking capacity has used basic oxygen furnaces.

Meeting carbon neutrality, in combination with decline in demand, will require these carbon-intensive facilities to be retired earlier than their operational lifetime. BF–BOF projects approved in 2021–2023 alone will face the risk of ending up as stranded assets worth USD 118 billion. If BF–BOF projects approved in 2017–2020 are included, the risk of stranded assets comes to USD 270 billion.

**Policy recommendations**

As China’s demand for crude steel is expected to decline significantly in the coming decades, and the availability of scrap steel to increase, replacing old coal-based steelmaking facilities, such as blast furnaces and basic oxygen furnaces, with new ones could lead to excess capacity. Overcapacity increases the risk of these investments becoming stranded assets, especially when steel prices drop. These financial failures could force the government to provide additional stimulus to revive the dying sector while slowing down the transition to clean and just energy.

In Europe, policymakers want steelmakers to cut emissions, with most funding now being directed into replacing blast furnace technologies with DRI production using green hydrogen to feed EAFs powered by renewable energies.
In China, there is an urgent need to align investments in new production capacity with the national ‘dual carbon’ goals. Financial decision-makers need to be prudent by cutting back on wasteful investments and considering the long-term decline in demand while keeping up with newer technologies to meet climate goals. We therefore propose the following recommendations:

- Include the steel sector in China’s emissions trading system (ETS) within the 14th five-year plan (2021-2025) period. The emissions trading system should shift from an intensity-based allocation to an absolute cap.
- To ensure CO₂ emissions from the iron and steel sector peak before 2025, new investments in blast furnace capacity must be limited. Simultaneously, the adoption of electric arc furnaces and hydrogen-based steelmaking technology must be sped up.
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1. Introduction

China, the world’s biggest steel producer, contributes to more than half of the world’s steel output. Accounting for about 17% of the country’s total carbon emissions, the steel sector is the second largest contributor to carbon emissions after the power sector. When emissions from its electricity use are included, the sector tops the list as the biggest carbon emitter in China.

China aims to reach its CO₂ emissions peak before 2030, and achieve carbon neutrality before 2060 (coined the ‘dual carbon’ goals), Chinese President Xi Jinping announced in September 2020. The central government has mandated that the steel sector reach its peak along the same timeline as the country’s economy, as detailed in the development guidelines for the sector.

Other key targets on steel sector decarbonisation that are set in the guidelines include raising the proportion of scrap-based secondary steel production to 15% of the total crude steel output by 2025 from 10% in 2020, and to reduce more than 2% of the energy intensity per tonne of crude steel for the sector.

In addition to the challenges in decarbonisation, the steel sector’s excessive supply will lower the returns for all steel producers.

In this briefing, we analyse the production, financial health, and new investment of the Chinese steel sector to examine whether China is on track for steel-industry decarbonisation while maintaining competitiveness.

2. China’s crude steel output remains high, as exports offset drop in domestic demand

To peak emissions from the steel industry, China’s central government has been asking steelmakers to curb output since 2021. Unlike 2021 and 2022, the central government didn’t announce a specific crude steel output control target in 2023, but reported a requirement to limit full-year output at the same level as 2022. In reality, crude steel output in China edged up by 1% year on year (YoY) to 1.02 billion tonnes in 2023 (Figure 1).
2.1. Crude steel output plummeted in last-minute correction to meet output control target

Data from the National Bureau of Statistics (NBS) of China show the country’s crude steel output had increased in the first 11 months of 2023, with monthly output increasing by 4% and monthly year-to-date (YTD)\(^2\) output increasing by 2% (Figure 2), making the control target, to limit full-year output at the same level as 2022, seem out of reach. In December, monthly crude steel production fell by a dramatic 14%, due to an apparent last-minute campaign to meet the target of limiting output to 2022 level.

\(^2\) Year-to-date (YTD) refers to the period from the beginning of the current year to a specified date before the year’s end.
Daily output reflected the same falling trend (Figure 3) as pig iron and crude steel output, which continued to fall for the entire second half of 2023, and took a deep drop in December 2023. Notably, daily crude steel output returned to growth in January 2024,
which was higher than the same period of last year, showing the short-term nature of the clampdown by administrative interventions.

**Figure 3 - Daily average output of pig iron and crude steel, 2018–2024**
2.2. Structural changes in downstream consumption, and increase in exports offset drop in domestic demand

The China Iron and Steel Association estimates that the apparent consumption of crude steel was 0.94 billion tonnes in 2023, a slight decrease from 0.96 billion tonnes in 2022 and a third year of reduction in a row. The real estate sector has dropped from being the second-largest downstream consumer of steel products in 2019 to the third-largest in 2023, according to an analysis from Huatai Futures (Figure 4).

The domestic real estate sector’s drag on steel demand continued through 2023. The floor space of newly started buildings plummeted 20% in 2023, narrowing from the 39% decline in 2022, but continuing to decline in a fourth year. In August 2022, the Chinese government implemented restrictions on borrowing for property developers to cool down the overheated real estate market, which had a profound impact on the real estate sector and the economy.

The consumption of steel products by downstream sectors has been impacted by the economic restructuring. Steel consumption in the real estate sector is declining year by year (Figure 4), accounting for 18.8% of steel product consumption in 2023, down from 36.2% in 2019. The share of steel consumption in infrastructure and manufacturing increased to 22.5% and 52.6% in 2023, up from 16.2% and 42.75% in 2019, respectively, compensating for the demand fall in real estate.

Additionally, the export volume of China’s steel products has grown 36% YoY to 90.3 million tonnes (Mt) in 2023, the most since 2016. The export value of steel products in total reduced 8% YoY, and the average export price reduced 32.7% YoY to USD 936.80 per tonne.

Strong demand—mostly from Asia and Africa—helped keep a lid on stocks and allowed steel mills to continue operations. The Chinese government has discouraged the export of primary steel products. It has imposed higher export tariffs on iron and eliminated tax refunds for a range of iron and steel products from 2021. The weakening yuan and competitive prices help the world’s biggest producer offload surplus metal due to weak demand at home.

Considering trade frictions and rising global supply, analysis forecasts steel exports to fall in 2024.
Figure 4 - China’s steel products consumption by downstream sectors
3. Low share of electric arc furnace (EAF) steel in China threatens 2025 EAF-steel targets

Steel is produced by two main routes: the blast furnace-basic oxygen furnace (BF–BOF) route; and the electric arc furnace (EAF) route. The BF–BOF route mainly uses iron ore and coke as raw materials. Coke strips oxygen from the iron ore in a blast furnace, and this process generates substantial carbon emissions. In contrast, the EAF route mainly uses scrap steel as raw materials, which could save as much as nearly 90% of the carbon dioxide to produce one tonne of crude steel.

In 2022, 71.5% of global crude steel production, totalling 1.34 billion tonnes, used the BF–BOF route, and 28.2% came from the EAF route powered by electricity. The majority of EAF-steel came from scrap steel, and the rest from the direct reduced iron and electric arc furnace (DRI-EAF) process.

Figure 5 - China’s crude steel production by processes

Source: CREA analysis, World Steel Association, China Steel Yearbook • BOF=basic oxygen furnace, EAF=electric arc furnace. EAF steel and BOF steel production data in 2023 and 2025 are based on estimation.
With scrap steel in limited supply, the share of EAF in steel production has remained low in China. Dependence on BF-BOF processes is the main reason for the sector's high carbon emissions. As shown in Figure 5, China's EAF steel production fluctuated and grew rather slowly. Of the 1 billion tonnes of China's crude steel output in 2023, EAF steel is estimated to account for about 10%, which is 3% higher than the historical low of 7%. But this is still low compared with the world average of about 30%, nearly 70% in the United States, and about 50% in other regions outside China.

The weighted (weighted based on the % split between the BF-BOF and EAF) average carbon emission intensity of crude steel in China is close to 2 tonnes of carbon dioxide per tonne (tCO₂/t), ranking as one of the highest among the major steel producers in the world. In the United States, the intensity is less than 1 tCO₂/t. The global average is 1.91 tCO₂/t. This is mainly due to the high carbon intensity and volume of steel made in China.

3.1. Insufficient scrap supply and low competitiveness led to EAFs running at low rate and threatening 15% EAF-steel share by 2025 target

Scrap supply in China exceeded 200 million tonnes in 2018 and kept steady growth at about 20 million tonnes annually. Technically, steel made by the BF-BOF route also needs, on average, 125 kg of scrap to produce one tonne of crude steel. But Chinese BF-BOF steelmakers are using much more than that, up to 219 kg of scrap for one tonne of crude steel in 2020, and about two-thirds of the scrap is consumed by BF-BOF route steelmaking every year, according to the data from China Steel Yearbook.

Insufficient scrap steel supply has limited EAF steelmaking in the past decades. In contrast to other countries, the production cost of EAF steelmaking is higher than the BF-BOF route in the Chinese market, roughly 200 CNY/t, which leads to lower profitability.

A research report by Guosheng Securities analysed the turning points of production interacting with profit for producers using the BF-BOF route and EAF route. Compared to BF-BOF, EAF-steel producers are more sensitive to the changes of profit due to their higher production cost. They're likely to cut production if the profit becomes negative because they're more flexible and less costly in terms of start and stop, or ramp up and ramp down. For BF-BOF steel producers, their fixed cost is higher than EAF. In order to dilute fixed cost, they are more likely to stay in operation despite running at low or negative profit margins. The high cost of start and stop is also one of the factors that BF-BOF steel producers would consider for their production decisions.
Figure 6 - Capacity utilisation rate of blast furnace and electric arc furnace, 2018–2023

Figure 6 shows the weekly capacity utilisation rate of BF and EAF in 2018-2023. We didn’t see a distinct shrink in capacity utilisation rate of BF in 2022 and 2023 when the sectors’ profit dropped sharply (see the section on profitability for more details). The EAF owners
ramped down their production in 2022-2023, as indicated by their lower capacity utilisation rates.

The Chinese government targets increasing the share of EAF-steel to 15% by 2025 from 10% in 2020. The average capacity utilisation rate of EAF was around 50% in 2023.

To meet the 2025 target, consulting company Mysteel estimates that the capacity utilisation rate of EAF will need to be raised to 75% in 2025. As EAF steelmaking is less economically competitive than BF-BOF in the Chinese market. Unless this issue is addressed, such as subsidising EAF or adding carbon price, the target of a 15% share by 2025 will be out of reach, even though the required EAF capacity exists.

The energy intensity of Chinese major steel producers dropped 0.4% YoY in 2021, yet increased 1.7% YoY in 2022 and 1.6% YoY in 2023. In summary, the energy intensity of the major steel producers increased 2.9% in 2023 against the base in 2020, which is far from the 2% reduction target by 2025 against the 2020 baseline.

4. **Low profitability and liabilities impact finances, posing high risks**

The total profit of China’s steel sector increased 157% compared to one year ago to CNY 56 billion in 2023 (Figure 7). The operating profitability increased 0.3% over 2022, standing at 0.8%, far below sustainable levels. The total profit and profitability are in the second year of a historical low, raising concerns over the sector’s financial status.

The average profit margins for steel producers in the past decade reached their lowest in 2022, and much lower than international levels (Figure 7). Chinese steel producers with poor performance operated with negative sales margins in the past decade and dragged down the average sales margins. The negative sales margins indicate that a significant number of Chinese producers are uncompetitive, but they continue to be present in the market and aggravate the problem of excess capacities.
The steel industry is a capital intensive sector. The asset-liability ratio of China’s steel sector has remained above 60% in the past decade (Figure 8). The sector started to deleverage from 2016, yet total liabilities have kept increasing in the past three years. The total liabilities jumped 7.6% YoY to nearly CNY 4800 billion in 2023, which led to the
asset-liability ratio increasing to 64%. This leverage level is approximately 10% higher than that of the average of global listed steel companies, according to data from the OECD.

Figure 8 - Liabilities of China’s steel sector, 2011–2023

From the changes of total liabilities and its ratio to asset, we estimate that the total asset of China’s steel sector increased 4.3% YoY in 2023, driven by adding liabilities. Considering the thin profitability, the increasing leverage poses extreme high financial risk for China’s steel industry.

5. Investments driven by capacity expansion, environmental and energy efficiency improvement, and production improvement

Annual fixed asset investments (FIA) of the Chinese steel sector have exceeded 790 billion CNY in each of the past three years (Figure 9), standing at a record high, despite the sector's
gloomy financial status. The annual FIA is 14 times the sector’s total profit in 2023. Steel companies didn’t intend to become more cautious in front of the diminishing profits because joint policies tackle overcapacity, air pollution and energy efficiency also play a role.

![Fixed asset investment of China’s steel sector (yearly)](image)

Source: CREA analysis, WIND, National Bureau of Statistics of China • Data here refer to smelting and pressing of ferrous metals sector. FAI=Fixed asset investment.

**Figure 9 - Fixed asset investment of China’s steel sector, 2011–2023**

In addition to capacity replacement policy, the National Development and Reform Commission (NDRC) releases a ‘Guidance catalogue for industrial restructuring’, which is updated on a regular basis. The guidance requires phasing out steelmaking capacity that is non-compliance with the emission standards and of low efficiency, e.g. blast furnaces with size below 1200 m³.

The Ministry of Ecology and Environment expanded the ultra-low emissions retrofitting program from the coal power sector to the steel sector in 2019, and requires 80% of the steelmaking capacity to meet the ultra-low emissions standards by 2025. The accumulated investment in the retrofitting program of the steel sector is estimated to be CNY 200 billion
by mid 2023, which covers 270 steel companies with a total of 760 million tonnes per annum (Mtpa) steelmaking capacity.

Moreover, the energy efficiency improvement program launched in December 2022 by the China Iron & Steel Association (CISA) targets improvement in energy efficiency by the sector, requiring 430-600 Mtpa of the steelmaking capacity to meet benchmarks in 2023–2025.

Data from member companies of the CISA in 2018-2021 indicate that the increasing FIA of steel producers are driven by the expenditures in capacity expansion, environmental and energy efficiency improvement, and production and product improvement (Figure 10).

Latest available data from 2022 shows the expenditures of the member companies of CISA in capacity expansion went down 29.1% YoY, accounting for 11.5% of their total FIA. While expenditures in environmental and energy efficiency improvement, and production and product improvement increased 12% and 14% YoY, and their shares in FIA are 29.2% and 31.2%, respectively, in 2022.

However, steel demand in China is expected to decline significantly in the coming decade. Based on RMI’s model, in the zero-carbon scenario, China’s crude steel production will gradually decline to 621 million tonnes by 2050, about 58% of the 2020 level. At the same time, it will require a major shift in steelmaking from BF–BOF to EAF and/or DRI.

Financial decision-makers are in a key position to push for cutting back wasteful or superfluous investments.
Fixed asset investment of the member companies of China Iron & Steel Association specified by purpose
2018-2021

- Increasing production capacity
- Increasing new products
- Improving technique & processes
- Decreasing consumption of power & material
- Improving quality of products
- Environmental protection
- Other

FAI, billion CNY

Source: CREA analysis, China Steel Yearbook

Fixed asset investment of the member companies of China Iron & Steel Association specified by investment in processes
2018-2021

- Iron ore mining & dressing
- Sintering
- Pellet
- Ironmaking
- Steelmaking-EAF
- Steelmaking-BFG
- Continuously casting
- Steel rolling
- Ferroalloy
- Coking
- Refractory
- Carbon
- Metal products
- Others

Source: CREA analysis, China Steel Yearbook

Figure 10 - Fixed asset investment of member companies of China Iron & Steel Association, 2018–2021
6. New proposed iron and steelmaking projects dominated by coal-based steelmaking

China’s crude steel output experienced double digital growth in the early 20th century (Figure 1), together with the tremendous expansion of the production capacity. Excessive supply of crude steel has become a problem embraced with the economic and demand fluctuation since 2006.

The wild growth of crude steel production and excessive emissions from steel mills also caused serious air pollution in the early 2010s, especially in northern provinces around Beijing, as they accounted for half of the national crude steel output.

To tackle overcapacity in the steel sector and air pollution, the government started to take measures to cut steel production and capacity. One of the measures is the capacity replacement policy, which was introduced by the Ministry of Industry and Information Technology (MIIT) in 2014. Capacity replacement requires a larger quantity of existing capacity to be retired and for new capacity to be built. New iron and steelmaking projects must get permission for capacity replacement before construction.

CREA keeps monitoring new iron and steelmaking project proposals disclosed by provincial governments that are regulated by the capacity replacement policy. Our most recent analysis reveals that steel firms continue to actively apply for new projects, even as the issue of excessive supply worsens. The steel sector stands as China's second-largest contributor to China’s carbon dioxide emissions. Despite the nation’s commitment to carbon neutrality and the prevailing overcapacity within the steel sector, there are no strong indications to stop investments in coal-based iron and steelmaking capacities.

Table 1 - Exit and addition of iron and steelmaking capacity announced through capacity replacement plan, 2017–2023, Mtpa

<table>
<thead>
<tr>
<th>Year</th>
<th>2017</th>
<th>2018</th>
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Specifically, our analysis shows:

1. Steel firms received approvals from provincial governments for large amounts of new iron and steelmaking projects in 2017–2023 through capacity replacement plans. The majority of these new projects are planning to commence operations by 2025, which will renew about one-third of China’s steelmaking capacity.

In total, more than 390 Mtpa new ironmaking and more than 440 Mtpa new steelmaking capacity have been approved in the past seven years, with 73 Mtpa and 77 Mtpa net reduction in ironmaking and steelmaking capacity, respectively, by replacing old facilities (Table 1).

On average, approximately 30 Mtpa of steelmaking capacity was approved every six months (Figure 11) in the past seven years, which is almost equal to the total existing steelmaking capacity of Germany. The approved capacities in the past four-and-a-half-years are slightly below average.

We didn’t see a policy signal of halting new project approvals. However, a few steelmakers withdrew their capacity replacement plans for building new BF in 2023, which might be due to unpromising profitability.
We mapped newly approved projects according to the estimated commission year stated in the replacement announcements (Figure 12). Most newly permitted iron and steel projects will commence operations by 2025. China’s existing steelmaking capacity is estimated to be 1.2 billion tonnes per annum. In other words, about one-third of existing steelmaking capacity is in the process of renewal.

2. **Newly approved iron and steel projects in 2017–2020 are largely using the coal-based BF–BOF route, which is the most polluting and carbon-intensive steelmaking process.** The same situation continues for projects approved in 2021-2023 after China’s carbon neutrality pledge. These BF–BOF projects approved after 2020 will face the risks of ending up as stranded assets worth USD 118 billion, because meeting carbon neutrality in combination with the demand decline will require carbon-intensive facilities to be retired early.

After the announcement of China’s ‘dual-carbon’ goals in 2020, there was an increase in deployment of low-carbon iron- and steelmaking technologies. In 2021, 2.5 Mtpa new ironmaking projects using non-BF and 23.5 Mtpa new steelmaking projects using EAF were announced (Table 1).

However, we didn’t see an uptake of that trend in the two years that followed. The capacities of new proposed non-BF and EAF projects are 0.4 Mtpa and 12.8 Mtpa in 2023. Their share in the new proposed ironmaking and steelmaking projects also declined. On the contrary, there was a total of 130 Mtpa BF and 94 Mtpa BOF capacity approved in 2021-2023.
In the past seven years, 99% of the newly proposed ironmaking capacity is using BF, and 70% of the newly proposed steelmaking capacity is using BOF. The majority of the exit ironmaking and steelmaking capacity is replaced by new facilities that are still using the same coal-based route through capacity replacement plans. The continued use of coal won’t change the big picture of China’s steel sector with high...
carbon intensity, and will lead to about one-quarter of China's steelmaking capacity being further locked in carbon intensive production during their 40-year lifespan.

For the steel sector, a reported initially proposed emission target is for CO₂ emissions to peak by 2025 and then fall by 30% from their peak level by 2030. This is only possible through a major shift towards steelmaking from scrap and/or direct reduced iron making (DRI), as the scope for a further decrease in emissions per tonne in coal-based ironmaking is limited. This means, in effect, that blast furnace output has to fall by more than 30% by 2030 to realise a 30% reduction in CO₂ emissions.

Unfortunately, China has scrapped the ambitious push for its steel industry to peak carbon emissions by 2025, pushing the deadline back five years in its final guidelines. The steel sector will now have until 2030 to peak its emissions, which is in line with China's broader national target.

There is still a lack of an official timeline for China's steel sector to become carbon neutral. To meet the national broader 2060 carbon neutrality goal in combination with the demand decline will require early retirement of carbon-intensive facilities. Therefore, the new BF–BOF projects approved in 2021–2023 alone will face the risks of ending up as stranded assets worth CNY 850 billion (USD 118 billion)³. If BF–BOF projects approved in 2017–2020 are included, there will be CNY 1,956 billion (USD 270 billion) more risks in stranded assets.

3. The energy efficiency and environmental performance of new ironmaking and steelmaking facilities improve through capacity replacement plans.

Small size facilities are replaced by larger ones with higher energy efficiency and fewer pollutant emissions. A total of 345.6 Mtpa BFs with sizes smaller than 1200 m³ are retired, accounting for 75% of the exit capacity (Figure 13). While the majority of the new BFs fall in groups of 1200–2000 m³ and 2001–3000m³, accounting for 84% in total.

³ The capital cost for a typical 4.0 Mt per annum integrated steelmaking facility is in the order of US$4 billion.
The scaling up of the production facilities might reduce the flexibility of steel producers in optimising their operations. They will tend to stay in operation to dilute their fixed cost even if they risk losing money.

**Figure 13 - Furnace size changes in exit and addition iron- and steelmaking facilities, in 2012–2023**

4. The majority, specifically 68%, of new iron- and steelmaking projects are spearheaded by private steel enterprises, followed by regional state-owned enterprises (regional SOEs) and central state-owned enterprises (central SOEs), accounting for 26% and 6%, respectively.
Private steel firms play an important role in China’s steel sector, accounting for more than 60% of China’s steel production. In the main steel production province, Hebei, private steel firms make up 70% of the provincial steelmaking capacity.

Our analysis found that the majority, specifically 68%, of new iron and steel projects are spearheaded by private steel enterprises, followed by regional state-owned enterprises and central state-owned enterprises (Figure 14).

A key impetus behind this trend lies in the fact that private steel firms possess a substantial number of small size iron and steelmaking furnaces. As environmental and energy efficiency standards intensify, these facilities are compelled to either cease operations or undergo capacity replacements to procure superior equipment.
Figure 15 - Newly approved blast furnace capacity announced in capacity replacement plans by provinces, 2017–2023
5. About half of the newly proposed blast furnace capacities in 2017-2023 are concentrated in the top three provinces (Figure 15), led by Hebei province, the heart of China’s steel industry, with approximately 100 Mtpa.

Hebei province is the biggest steel production province in China. More than 20% of the country’s crude steel is produced within this province, which accounts for less than 2% of the country's total land area. This has led to high levels of air pollution in the cities of Hebei province, as well as the neighbouring city of Beijing.

These new capacities might be at risk of becoming stranded assets and hinder low carbon transition in these provinces.

7. Policy recommendations

Since the announcement of China’s ‘dual carbon’ goals in 2020, we haven’t seen structural improvements in China’s steel industry in its climate transition. The production of crude steel is dominated by the coal-based BF–BOF route, which is the most carbon intensive process, and the share of EAF-steel, which is less carbon intensive, remained low. The majority of new approved projects in the past seven years also use the BF–BOF route, which further locks in high carbon emissions in their life-span.

As the demand for crude steel is expected to decline significantly in the coming decade in China, and the availability of scrap steel to increase, replacing retiring blast furnaces with new ones could lead to an overcapacity situation. This may result in new blast furnaces and basic oxygen furnaces becoming stranded assets if and when steel prices drop and operators of these recently built facilities experience financial difficulties. A decline in demand for crude steel could potentially force the government to delay the transition or consider implementing additional domestic stimulus measures to support the heavy industry sector.

In Europe, policymakers want steelmakers to cut emissions, with most funding now being directed into replacing blast furnace technologies with DRI production using green hydrogen to feed EAFs powered by renewable energies.

In China, there is an urgent need to align investments in new production capacity with the national ‘dual carbon’ goals. We therefore propose the following recommendations.
include the steel sector in China’s emissions trading system (ETS) within the 14th five-year-plan 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 CO₂ emissions from the iron and steel sector before 2025.

8. Methodology

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

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 cost of iron and steel projects was estimated based on BHP data, which might be higher than the actual cost in China. These cost levels are indicative, because capital costs vary due to a host of factors including unit size; location and pollution control technology employed. 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. In future, the carbon price and the cost of carbon capture and storage will need to be included.