

Bleak Future for Shanxi Coke as Hebei Steel Breaks Away from High Carbon

A Preliminary Study on the Urgent Needs for Coordinated Efforts to Decarbonize
Hebei's Steel Sector and Shanxi's Coking Industry
in the Context of Dual Carbon Goals

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Executive Summary

Coke, as the main product of the coking industry, is primarily used in blast furnace smelting, not only providing heat but also acting as a reducing agent and a structural material. Therefore, coke is the main raw material for traditional long-process, which is Blast Furnace-Basic Oxygen Furnace (BF-BOF) steel factories. The coking process accounts for 15% to 30% of the carbon emissions in the steel production process.

Currently, China's steel industry accounts for over 60% of the global steel carbon emissions and approximately 15% of the country's total carbon emissions. For China to achieve its Dual Carbon Goals, i.e. carbon peak by 2030 and carbon neutrality by 2060, the low-carbon green transformation of the steel industry is crucial. The coking industry, which highly depends on the steel industry, could be caught unprepared with stranded assets and jobless workers if it does not improve its adaptability in an informed and timely manner.

Shanxi and Hebei provinces are two neighboring industrial powerhouses in Northern China, with Shanxi as the largest coke producer and Hebei the largest producer of crude steel, each accounting for one fifth of the China's total output of coke and crude steel respectively.

According to the National Bureau of Statistics, Hebei's crude steel production was 210.5063 million tons in 2023. Based on a coke-to-steel ratio of 0.4^①, Hebei's coke demand for the year was approximately 84 million tons. With a total provincial coke capacity of 43.157 million tons, Hebei still had a coke demand gap of about 40 million tons. The primary suppliers to fill this gap are Shanxi, Shaanxi, and Inner Mongolia, with Shanxi as the leading source.

In the decade from 2013 to 2022, 71% to 87% of the coke produced in Shanxi was sold to other provinces. In September 2023, the Shanxi Coking Industry Association reported that "nearly 70% of Shanxi's coke is sold outside the province, with Hebei being the

largest market."

The annual trends of coke demand in Hebei and coke production in Shanxi show significant consistency, which means that Shanxi's coke production is highly sensitive to the changing demand in Hebei's steel industry, as well as national policy change.

The Dual Carbon Goals have set off a wave of industrial transformation to cut carbon emissions across China. Most of the policies to encourage the steel industry's low-carbon transformation focus on large-scale equipment, extreme energy efficiency, adoption of Electric Arc Furnace (EAF) short-process technique and application of hydrogen-based reduction technology. All these carbon reduction pathways lead to less coke use. Given the close ties between the two provinces, Hebei's low-carbon transformation in the steel industry will have a significant impact on Shanxi's coking industry.

Various national policies such as the National Implementation Plan for Carbon Peak in the Industrial Sector (issued by the Ministry of Industry and Information Technology), the National Implementation Plan on Reducing Pollution and Cutting Carbon Emissions (issued by the Ministry of Ecology and Environment and other departments), and the National Plan of Action to Improve Air Quality (issued by the State Council), all have direct impacts on Hebei's steel production. Hebei Provincial Government has also produced series of policies, such as the Hebei Implementation Plan for Carbon Peak in the Industrial Sector (issued by Industry and Information Technology Department of Hebei Province) and the Hebei Implementation Plan on Reducing Pollution and Cutting Carbon Emissions (issued by Department of Ecology and Environment and other departments of Hebei Province), to drive and impel the decarbonization of steel industry in Hebei. Based on these policies and historical industry records and observations, we have set four different scenarios^②:

Acknowledgement

We would like to extend our profoundest gratitude to the following experts (listed in no particular order) for their invaluable suggestions proffered in relation to the research report. In light of the constraints stemming from time, technological limitations, and sundry other factors, this report has regrettably not been able to incorporate all proffered viewpoints. We are committed to persevering in our efforts and proceeding with further in-depth deliberations predicated on these precious suggestions.

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Xiyu Lang, Transition Asia
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^①The Jing-Jin-Ji region and surrounding areas implement the policy of "controlling coking capacity based on steel production capacity," maintaining the ratio of coking capacity to long-process (BF-BOF) steelmaking capacity at approximately 0.4.

^② In these scenarios, electric arc furnace short-process steelmaking refers to a production model that uses scrap steel or products from non-blast furnace ironmaking as raw materials for the electric arc furnace. Non-blast furnace ironmaking is categorized into two types based on process characteristics, product types, and uses: direct reduction ironmaking and smelting reduction ironmaking. These processes do not require the coking, sintering, and pelletizing steps found in traditional long-process steelmaking. Electric arc furnace steelmaking encompasses all scenarios within electric arc furnace short-process steelmaking as well as scenarios involving the installation of electric arc furnace equipment in long-process steel enterprises.

1. By 2025, electric arc furnace steelmaking to account for 10% in Hebei.
2. By 2030, electric arc furnace steelmaking to account for 15% in Hebei.
3. By 2025, electric arc furnace short-process steelmaking to account for 15% in Hebei.
4. By 2030, electric arc furnace short-process steelmaking to account for 20% in Hebei.

Each scenario will result in different levels of CO2 emission cuts and coke demand drops. Under Scenario 4, the most stringent transformation policies for the steel industry, we estimate that by 2030, should the coke ratio remain at 0.34^③, the transformation of Hebei's steel industry will significantly reduce coke use by approximately 22.6387 million tons, avoiding 71.3175 million tons of CO2 emissions.

Historical data show that 78.4% to nearly 100% of Hebei's total coke gap has been filled by coke from Shanxi. Considering the increasing correlation between Hebei's crude steel and Shanxi's coke production as well as the convergence between the two provinces' industrial sector in recent years, we infer that under Scenario 4, Shanxi may lose between 17.7487 million and 22.6387 million tons of coke demand by 2030 due to Hebei's steel industry transformation alone, equivalent to the total annual coke production of Changzhi City (16.63 million tons in 2022), Shanxi's second largest coal producer.

The falling demand in this important market will undoubtedly worsen the serious overcapacity issue already faced by Shanxi's coking industry (with a utilization rate of less than 70%). As low-carbon transformation policies in the steel industry, particularly in Hebei, are further implemented, we predict that by 2030, the excess capacity in Shanxi's coking industry

could reach 66 million to 71 million tons, accounting for nearly half of the total coking capacity of 143.724 million tons mentioned in the Guidelines on Promoting High-Quality Development of the Coking Industry (2022) issued by the Shanxi Provincial Government.

Unfortunately, in our research, we have not yet observed any warning or preparatory measures from Shanxi's coking industry, nor have we seen effective cases or replicable solutions for low-carbon transformation.

Given the rapid advances in emission reduction technologies in the steel industry and the potential impacts of including the steel industry in the emissions trading system, Hebei's steel industry, and even China's overall steel industry, will reduce their coke reliance much sooner, sending tremendous shockwaves onto an poorly prepared coking industry in Shanxi.

This report finds that typical state-owned enterprises in Hebei Province have already begun to lead the transformation process. Once the share of electric arc furnace short-process steelmaking increases, blast furnace capacity will decline dramatically, leading to a significant reduction in coke demand. The coking industry nationwide, especially in Shanxi Province, must proactively adapt to the changes that may arise in the future and make sound plans. Otherwise, when the short-process production model rolls out at a faster pace, the ill-prepared coking industry will be caught off guard, facing severe economic and social challenges, with a large amount of stranded capacity and an overwhelming number of workers to resettle. This is particularly devastating to some cities in Shanxi Province, where local economies and employment rely heavily on the coking industry with its share of industrial income exceeding 78%.

The Shanxi provincial government must make plans to cope with the fallout from the low-carbon transformation of Hebei's steel industry on Shanxi's coking industry. We propose the following policy recommendations.

1

Assessing Shanxi's coking capacity to be well-prepared for transformation.

A review of Shanxi's coking industry over the past decade shows that the overcapacity issue in Shanxi's coking industry has been seriously neglected, while the

Shanxi provincial government continues to set high capacity targets without thorough assessment and verification. Therefore, Shanxi needs to review the

current capacity verification standards in the first place, develop scientific criteria for capacity assessment that reflect the true capacity of enterprises, and provide effective support for future capacity planning. We recommend that Shanxi establish a survey team to assess the industrial structure, including enterprise scale, market concentration, industrial structure, technological level, industrial chains, regional distribution, environmental protection, and energy consumption. This assessment should lead to the creation of a comprehensive capacity and internally available database that includes capacity distribution

across various cities, capacity changes, coke oven types and capacities, and other capacity data. The survey results should be publicized on the Shanxi Provincial Government website and then submitted to the Department of Industry and Information Technology of Shanxi Province for official announcement. Other relevant departments should use the capacity data from the Department of Industry and Information Technology as the standard. Additionally, through information disclosure and public participation, capacity supervision should be improved.

2

Enhancing regulations to cease approving new projects and phase out excess capacity.

Shanxi must ban additional new coking capacity as per the Guideline on Promoting High-Quality Development of the Coking Industry and the Shanxi Implementation Plan for Establishing a Dual Control System for Carbon Emissions (both issued by the Shanxi Provincial Government), with explicit reiteration and stressing in the upcoming "15th Five-Year Plan". Existing capacity should be steadily controlled and reduced according to the principle of "shutting down the small while maintaining the large

ones^④" and action plans should be developed to promote the transformation of the coking industry. Public participation should be encouraged, policy transparency enhanced, and prompt responses made to public inquiries, reports or suggestions. Relevant departments should eliminate all forms of capacity expansion when assessing, publicizing, or approving the construction of coke ovens, and should carefully review new coking projects.

3

Stay vigilantly informed of coke demand change in provinces down the industrial chain.

We have noticed that both Hebei and Shandong, which used to have self-sufficient coke production capacities, have in recent years been reducing their own coke production due to air quality control pressure as Beijing's neighboring provinces. However, the two provinces have managed to maintain or even increase their crude steel production by increasing their coke supplies from elsewhere.

As most cities in the Beijing-Tianjin-Hebei region have dropped out of the "Top 10 Polluted Cities", such as Hebei and Shandong, in order to alleviate the local environmental pressure, cutting down the coking capacity of the province in advance. Those cities in the Fenwei Plain region, covering Shanxi and Shaanxi

provinces, have risen to take their ranks, a clear relocation of pollution from Hebei and Shandong to Shanxi and Shaanxi.

As the imperative low-carbon transformation of the steel industry takes off, the demand for coke will soon plummet at a faster pace. Shanxi must be vigilant against pollution transfer from other provinces and temporary market fluctuation. If Shanxi continues to develop its coking industry while ignore the increasing environmental pressures and the decreasing coke demand from a transforming steel industry, it will only be further burdened with more stranded assets and unemployment.

^③ Based on blast furnace coke rate data from published EIAs of iron and steel enterprises in Hebei.

^④ Here refers to coke ovens. At present, the coke industry is implementing the policy of "shutting down small coke ovens and putting up large ones", which refers to the elimination of small coke ovens with outdated production capacity, while at the same time supporting the construction of large, modern coke ovens.

4

Making cross-regional policies and sharing information to decarbonize simultaneously

Given the close connections between Shanxi's coking industry and Hebei's steel industry in terms of production processes, assets, distance, output, and demand, it is recommended that the two provinces strengthen policy coordination and information sharing on the steel and coking industries. A multi-stakeholder platform should be jointly established to facilitate exchanges on industrial dynamics, technological innovation, project cooperation, and low-carbon practices, thus building consensus and synergy for low-

carbon development. It is essential to consolidate industry entry and exit standards to prevent the transfer of outdated capacity from Hebei to Shanxi during the industrial migration process, so as to ensure high-quality development of industries within the region. Both provinces should encourage enterprises, research institutions, and social organizations to engage in more collaboration on industrial transformation, technological upgrades, and low-carbon development, in a joint effort to advance low-carbon development.

5

Setting pathways and action plans with clear timelines when making policies on the transformation of the coking industry

Guided and required by both policies and markets, the steel sector is in a critical period of transformation, rapidly darkening the coking industry's future. The Shanxi provincial government should closely monitor the development trends of the steel industry, particularly the introduction and implementation of low-carbon transformation policies and technologies. Early warnings to enterprises who have not developed transformation plans are a must. We have observed that, discouraged by inadequate transformation technologies and funding while encouraged by short-term market demands, there is currently a lack of urgency for proactive transformation in the coking industry in

Shanxi Province, most of whom have generally adopted a wait-and-see passive attitude. Therefore, the Shanxi Government needs to take a holistic approach to planning for the coking industry, encouraging, guiding, and supporting certain enterprises to proactively initiate transformation upgrades or develop exit strategies. Pilot projects with willing enterprises are needed, with a mechanism to share transformation experiences and lessons in the industry. This approach can also help make new policies more rational and workable. Such pilot programs should start with local economies with the lowest reliance on the coking industry, .

6

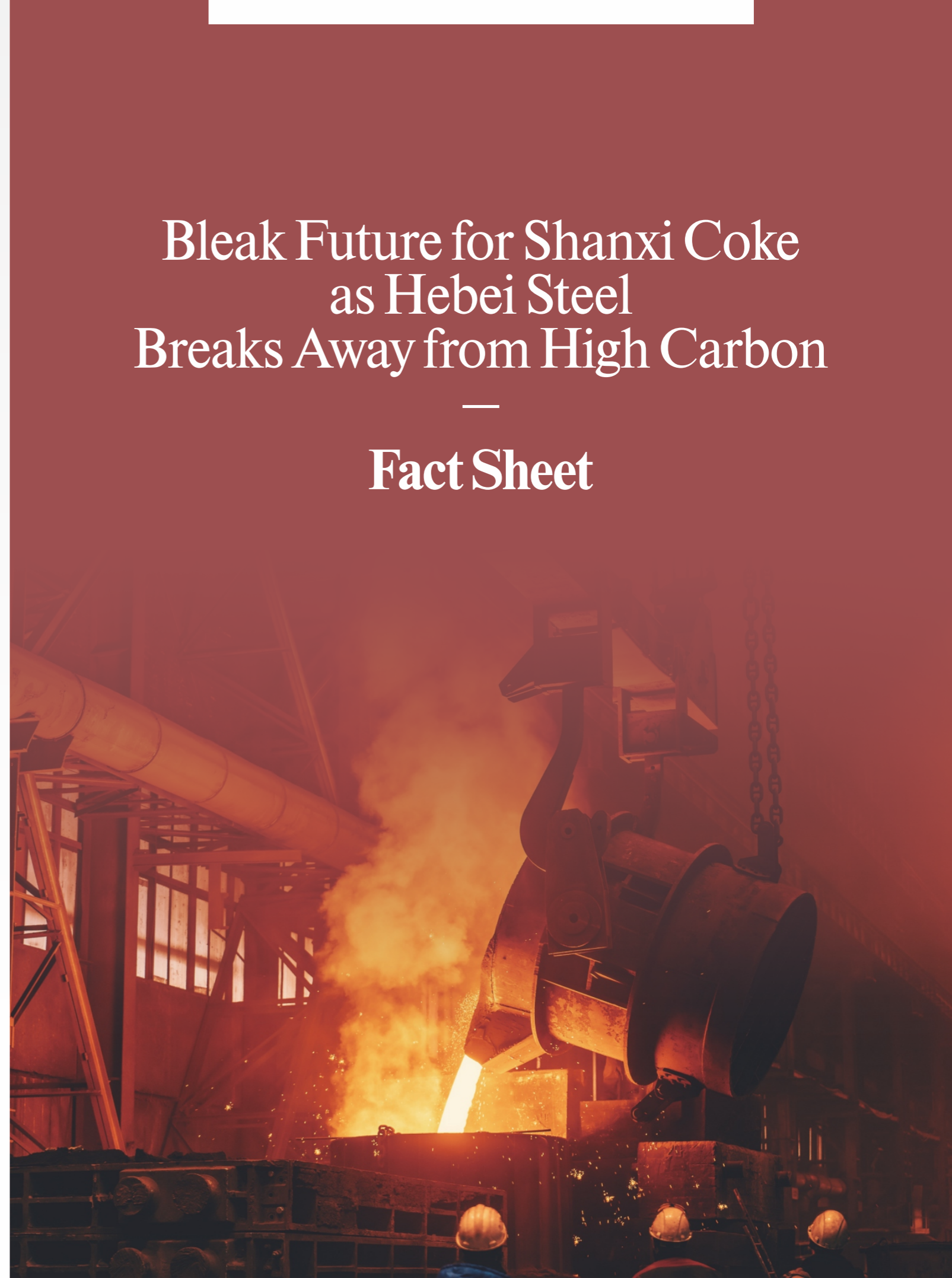
Planning social and financial support systems to encourage re-employment for affected workers.

Training programs for professionals and management personnels in the coking industry should be organized to raise awareness of the Dual Carbon Goals and the importance of early and proactive transformation. Plans could be made to facilitate upskill enhancement for coking industry workers by offering various training courses aimed at existing and future industries, including traditional manufacturing and

service sector. This will ensure that coking industry workers have options for learning and employment. For those interested in starting their own businesses, favorable policies shall be put in place, such as entrepreneurial guidance, start-up subsidies, and guaranteed loans to reduce the barriers and initial costs of starting a business.

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Fact Sheet



01

Climate impact of the global steel industry

Greenhouse gas (GHG) emission:

The steel industry, whose carbon dioxide emissions contribute about 25% of the total industrial emission in the world, is the largest carbon emitter in the global industrial sector^⑤. The global crude steel production hit 1.89 billion tons in 2022, and the total direct carbon emissions from the steel industry reached approximately 3.61 billion tons, accounting for 8.8% of the total global carbon emissions from human activities, according to the statistics of the World Steel Association.



Energy consumption:

The steel industry is a high energy consumer, requiring massive amounts of electricity and fuel. In particular, the use of conventional energy such as coal and coke not only leads to increased GHG emissions, but also exacerbates the consumption of energy. The energy consumption of the steel industry accounts for about 11% of China's total, according to the China Iron and Steel Association.



^⑤National Natural Science Foundation of China, "The Creative Research Group of 'Atmospheric Composition Change and Impacts on Climate and Environment' Makes Progress in Carbon Neutrality Pathway for the Global Steel Industry."

02

The climate impact of China's steel industry and the share of GHG emissions from coke

China's steel industry accounts for over 60% of the global steel carbon emissions and approximately 15% of the country's total carbon emissions.

Coke is the main raw material for traditional long-process steel (BF-BOF) factories. The coking process accounts for 15% to 30% of the carbon emissions in the steel production process.



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03

China's decarbonization policies for the steel industry and specific requirements

Policy	Issuer	Release Date	Specific Requirements
At the national level (crude steel output in 2023 was 1,028.8597 million tons)			
National Implementation Plan on Reducing Pollution and Cutting Carbon Emissions	Ministry of Ecology and Environment, National Development and Reform Commission, Ministry of Industry and Information Technology, Ministry of Housing and Urban-Rural Development, Ministry of Transport, Ministry of Agriculture and Rural Affairs, and National Energy Administration	Jun. 6, 2022	The plan supports electric arc furnace short-process steelmaking. According to the plan, by 2025 and 2030, the proportion of short-process steelmaking in China will be increased to more than 15% and 20%, respectively.
National Implementation Plan for Carbon Peak in the Industrial Sector	Ministry of Industry and Information Technology, National Development and Reform Commission, and the Ministry of Ecology and Environment	Jul. 7, 2022	The plan encourages the moderate and steady development of the advanced electric arc furnace short-process steelmaking. According to the plan, by 2025, short-process steelmaking will account for more than 15% and, by 2030, breakthroughs will be achieved in such technologies as hydrogen-rich carbon recycling blast furnace smelting, hydrogen-based direct reduction of iron in a shaft furnace, and carbon capture, utilization and storage, with the short-process steelmaking accounting for more than 20%.
National Plan of Action to Improve Air Quality	State Council	Dec. 7, 2023	New steelmaking capacity is prohibited. According to the plan, by 2025, short-process steelmaking will account for 15% of the country's total output. Beijing, Tianjin, Hebei and surrounding areas continue to "determine the coking capacity based on the steel industry's demand," with the ratio of the coking capacity to long-process (BF-BOF) steelmaking capacity kept at about 0.4.

At the local level: Hebei (crude steel output in 2023 was 210.5063 million tons)			
Hebei Implementation Plan on Reducing Pollution and Cutting Carbon Emissions	Hebei Provincial Department of Ecology and Environment, Hebei Provincial Development and Reform Commission, Hebei Provincial Department of Industry and Information Technology, Hebei Provincial Department of Housing and Urban-Rural Development, Hebei Provincial Department of Transportation, and Hebei Provincial Department of Agriculture and Rural Affairs	Feb. 7, 2023	The plan aims to strictly implement the capacity swap policy for industries such as steel, cement, flat glass, and coking, and promoting the transition from the BF-BOF long-process steelmaking to electric arc furnace short-process steelmaking. According to the plan, by 2025, the production of electric arc furnace steelmaking will account for 5%-10% in Hebei Province.
Hebei Implementation Plan for Carbon Peak in the Industrial Sector	Hebei Provincial Department of Industry and Information Technology, Hebei Provincial Development and Reform Commission, and Hebei Provincial Department of Ecology and Environment	Mar. 22, 2023	The plan encourages the moderate and steady development of the advanced electric arc furnace short-process of steelmaking, and driving the demonstration and promotion of low-carbon ironmaking technology. According to the plan, by 2025, the proportion of electric arc furnace steelmaking will reach 5%-10% and, by 2030, breakthroughs will be achieved in the application of technologies such as hydrogen-rich carbon recycling blast furnace smelting, hydrogen-based direct reduction of iron in shaft furnace, and carbon capture, utilization and storage, with electric arc furnace steelmaking accounting for more than 15%.
Hebei Implementation Plan for the Action to Improve Air Quality	Hebei Provincial People's Government	Apr. 26, 2024	The plan encourages the upgrading of the steel industry while prohibiting new steel capacity in order to promote steady integration of steel, coking and sintering; guiding the orderly transition from BF-BOF long-process steelmaking to electric arc furnace short-process steelmaking, and accelerating the integration and upgrading of basic oxygen furnace below 100 tons and blast furnaces below 1,000 cubic meters. According to the plan, by 2025, the production of short-process steelmaking will account for more than 5%.

At the local level: Jiangsu (crude steel output in 2023 was 118.5915 million tons)			
Jiangsu Implementation Plan for Carbon Peak in the Industrial Sector and Key Industries	Jiangsu Provincial Department of Industry and Information Technology, Jiangsu Provincial Development and Reform Commission, and Jiangsu Provincial Department of Ecology and Environment	Jan. 12, 2024	The plan strictly prohibits new steel capacity and continues to promote upgrading. Efforts shall be made to increase the proportion of short-process steelmaking to more than 20% by 2025. Green and low-carbon technologies will be promoted. In the field of process flow, emphasis will be put on applying hot charging and delivery, and ultra-thin strip, and tackling low-carbon technologies such as endless rolling, high-proportion pellet smelting, full-oxygen blast furnace smelting, oxygen-enriched combustion, and hydrogen metallurgy, to accelerate the promotion and application of advanced and applicable low-carbon technologies.
Jiangsu Implementation Plan for the Action to Improve Air Quality	Jiangsu Provincial People's Government	Jul. 11, 2024	The plan prohibits approval of new capacity in industries such as steel (steelmaking, and ironmaking), and coking, with the production of short-process steelmaking increased to more than 20% in 2025.
At the local level: Shandong (crude steel output in 2023 was 74.559 million tons)			
Shandong Work Plan for Carbon Peak in the Industrial Sector	Shandong Provincial Department of Industry and Information Technology, Shandong Provincial Development and Reform Commission, and Shandong Provincial Department of Ecology and Environment	Apr. 28, 2023	The plan aims to control steel capacity, improve industrial layout, accelerate the construction of the two major steel industry bases of "Rizhao-Linyi" and "Laiwu-Tai'an" to increase the proportion of steel capacity in coastal areas, promote the transition of steelmaking process by encouraging the development of electric arc furnace short-process steelmaking process, and improving the utilization of steel scrap. According to the plan, by 2030, breakthroughs will be achieved in technologies such as hydrogen-rich carbon recycling blast furnace smelting, hydrogen-based direct reduction of iron in shaft furnace, and carbon capture, utilization and storage, with the comprehensive energy consumption per ton of steel significantly reduced.

<p>Shandong Implementation Plan for the Action to Improve Air Quality and the Third Round of “Four Reductions and Four Increases”</p>	<p>Shandong Provincial People's Government</p>	<p>Jul. 12, 2024</p>	<p>The plan aims to implement the national goal of crude steel production control by promoting the integration of steel, coking and sintering, and guiding the orderly transition from the BF-BOF long-process steelmaking to electric arc furnace short-process steelmaking.</p> <p>According to the plan, by 2025, the production of electric arc furnace steelmaking will account for about 7%.</p> <p>By the end of 2024, Ji'ning, Binzhou, and Heze will complete the exit and shutdown of coking plants, and by the end of Jun. 2025, Ji'nan, Zaozhuang, Weifang, Tai'an, Rizhao, and Dezhou will complete the exit and shutdown of coking plants, with the capacity of the coking plants in the province reduced to about 33 million tons.</p>
<p>At the local level: Liaoning (crude steel output in 2023 was 73.4409 million tons)</p>			
<p>Liaoning Implementation Plan for the Action to Improve Air Quality</p>	<p>Liaoning Provincial People's Government</p>	<p>Jul. 1, 2024</p>	<p>The plan promotes the orderly transition from the BF-BOF long-process steelmaking to electric arc furnace short-process steelmaking process. According to the plan, by 2025, the proportion of steel scrap in steelmaking raw materials will reach more than 15%. The coking capacity will be determined based on the steel industry's demand, with the ratio of coking capacity to the process long steelmaking capacity maintained at about 0.4.</p>
<p>At the local level: Shanxi (crude steel output in 2023 was 62.9202 million tons)</p>			
<p>Shanxi Implementation Plan for Carbon Peak in the Industrial Sector</p>	<p>Shanxi Provincial Department of Industry and Information Technology, Shanxi Provincial Development and Reform Commission, and Shanxi Provincial Department of Ecology and Environment</p>	<p>Jun. 26, 2023</p>	<p>The plan encourages the development of electric arc furnace steelmaking in an orderly manner, and supports steel companies to take the lead in establishing large-scale steel scrap recycling, processing and distribution enterprises, to promote scrap recycling and processing. According to the plan, by 2025, the annual capacity of approved steel scrap processing businesses will exceed 15 million tons, the proportion of short-process steelmaking will be improved to more than 5%; by 2030, breakthroughs will be achieved in the application of technologies such as hydrogen-rich carbon recycling blast furnace smelting, hydrogen-based direct reduction of iron in shaft furnace, and carbon capture and utilization, with the production of short-process steelmaking accounting for more than 10%.</p>

<p>Shanxi Implementation Plan for the “National Plan of Action to Improve Air Quality”</p>	<p>Shanxi Provincial People's Government</p>	<p>Mar. 8, 2024</p>	<p>The plan promotes the optimization and upgrading of key industries by encouraging capable businesses to transform from the BF-BOF long-process steelmaking to electric arc furnace short-process steelmaking process. According to the plan, by the end of 2025, Shanxi will try to increase short-process steelmaking to more than 5%. The assessment of high-quality green development of the coking industry will be carried out to improve the energy conservation, environmental protection and safety in the coking industry.</p>
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04 Hebei's Steel Sector and Shanxi's Coking Industry: Historical Ties and Current Dilemma

A Output and distribution of crude steel in Hebei and coke in Shanxi (2022)

● Hebei's steel sector

Hebei is the largest producer of crude steel in China, its output always accounting for more than one-fifth of the country's total. In 2022, the crude steel output in the province reached 211.945 million tons, accounting for 20.82% of China's total. Tangshan and Handan were the top two producers across the province, with an output of 124.135 million tons and 38.761 million tons, respectively.

According to the National Bureau of Statistics, Hebei's crude steel output was 210.5063 million tons in 2023. Based on a coke-to-steel ratio of 0.4, Hebei's coke need for the year was approximately 84 million tons. With 43.157 million tons of coke locally produced, Hebei had a gap of about 40 million tons, primarily filled by Shanxi, Shaanxi, and Inner Mongolia, with Shanxi as the leading source.

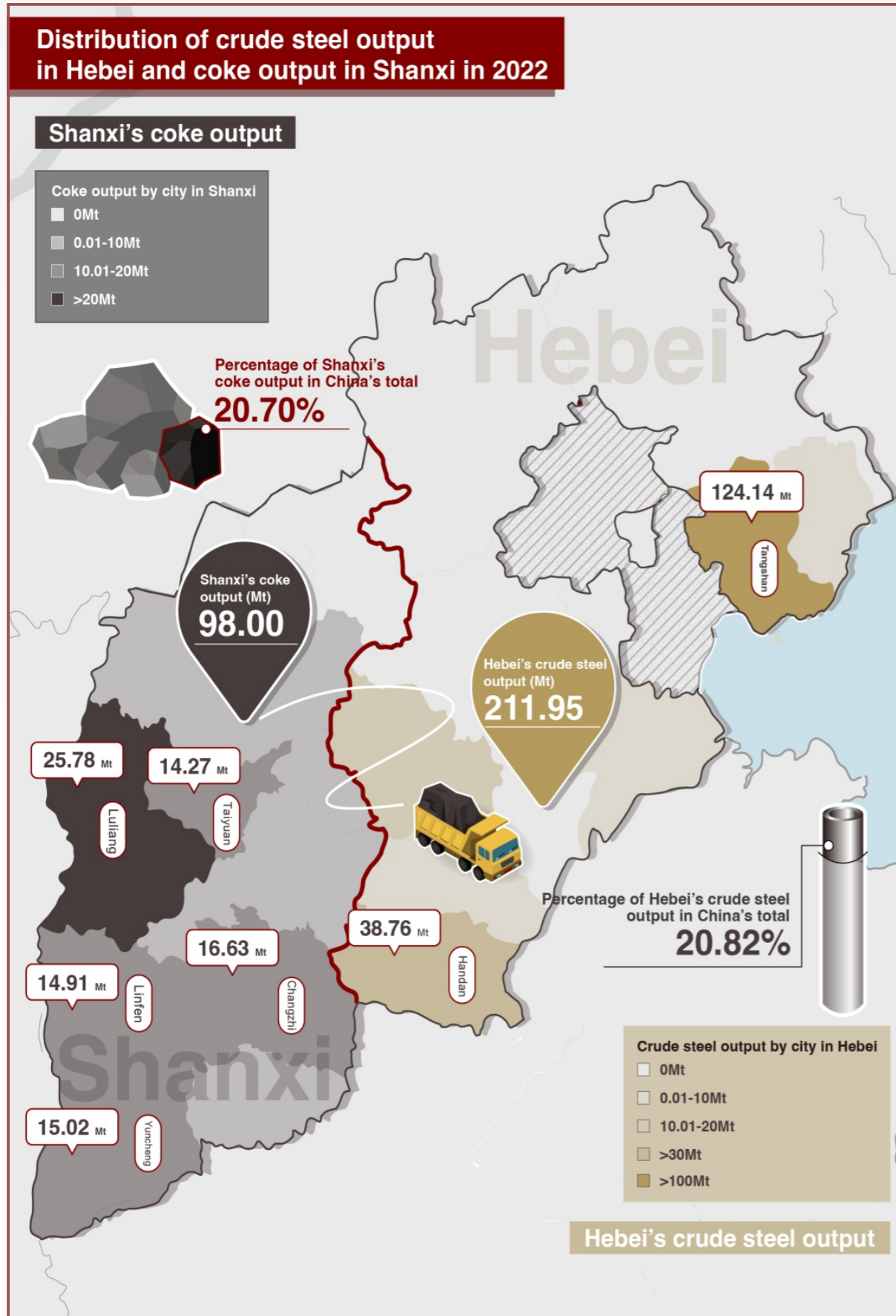
● Shanxi's coking sector

Shanxi is the largest coke producer in China, its coke output accounting for about one-fifth of the national total. In 2022, the coke output in the province was 97.997 million tons, accounting for 20.7% of the country's total. Luliang, Changzhi and Yuncheng are the top three producers across the province, with 25.784 million tons, 16.63 million tons and 15.023 million tons respectively.

In the decade from 2013 to 2022, Shanxi sold 71% to 87% of its coke to other provinces. In September 2023, the Shanxi Coking Industry Association stated that “nearly 70% of Shanxi's coke is sold to other provinces, with Hebei being the largest market.”

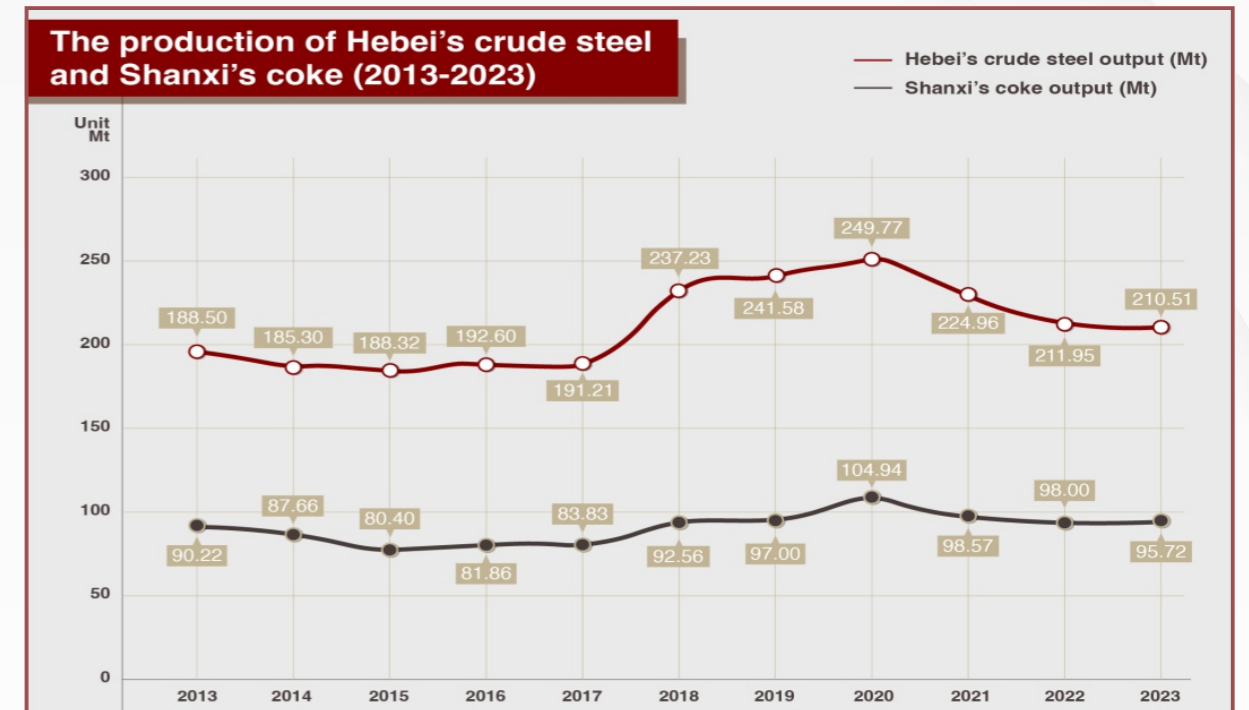


Coal trucks from Jinzhong, Shanxi, are heading to Shijiazhuang, Hebei. © 2024 People of Asia for Climate Solutions



B Hebei's crude steel output and Shanxi's coke output (2013-2023)

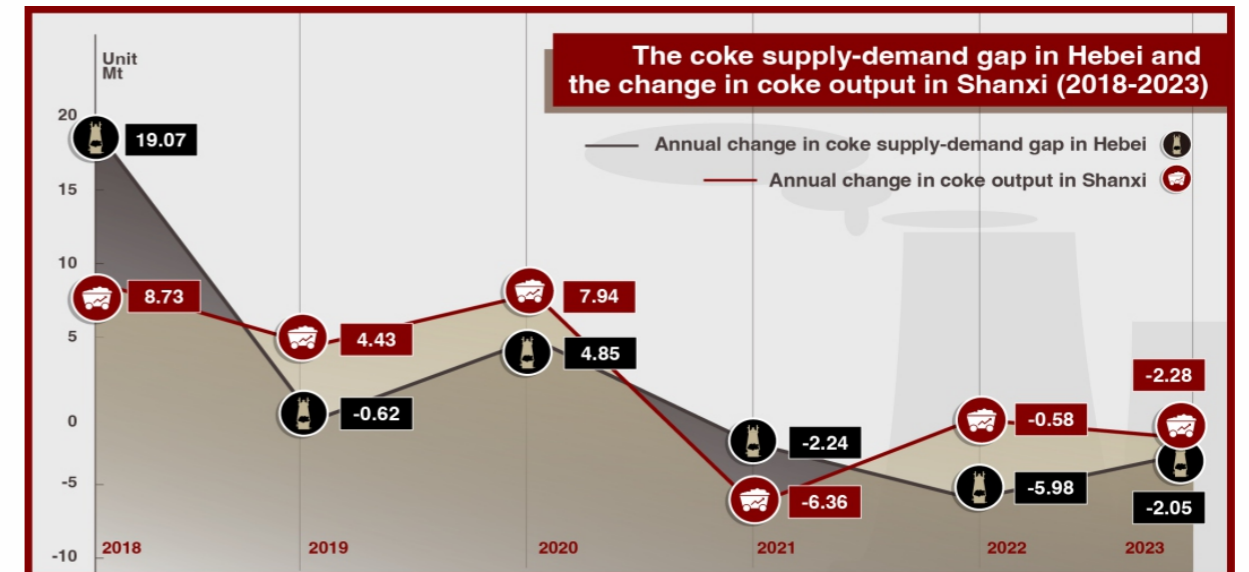
The crude steel output in Hebei Province had a significant impact on the coke production in Shanxi Province.



C Hebei's coke supply-demand gap and Shanxi's coke production (2017-2023)

The coke output in Shanxi is highly sensitive to the changing demand of Hebei's steel industry. There is significant consistency between the demand for coke in Hebei and the output of coke in Shanxi. From 2017 through 2020, Hebei's demand for coke perfectly coincided with the growth trend of coke output in Shanxi.

From 2021 to 2023, the implementation of the national "flat control" policy on steel production had a direct impact on the demand for coke in Hebei, and consequently the coke output in Shanxi decreased by a total of 9.295 million tons during the same period.

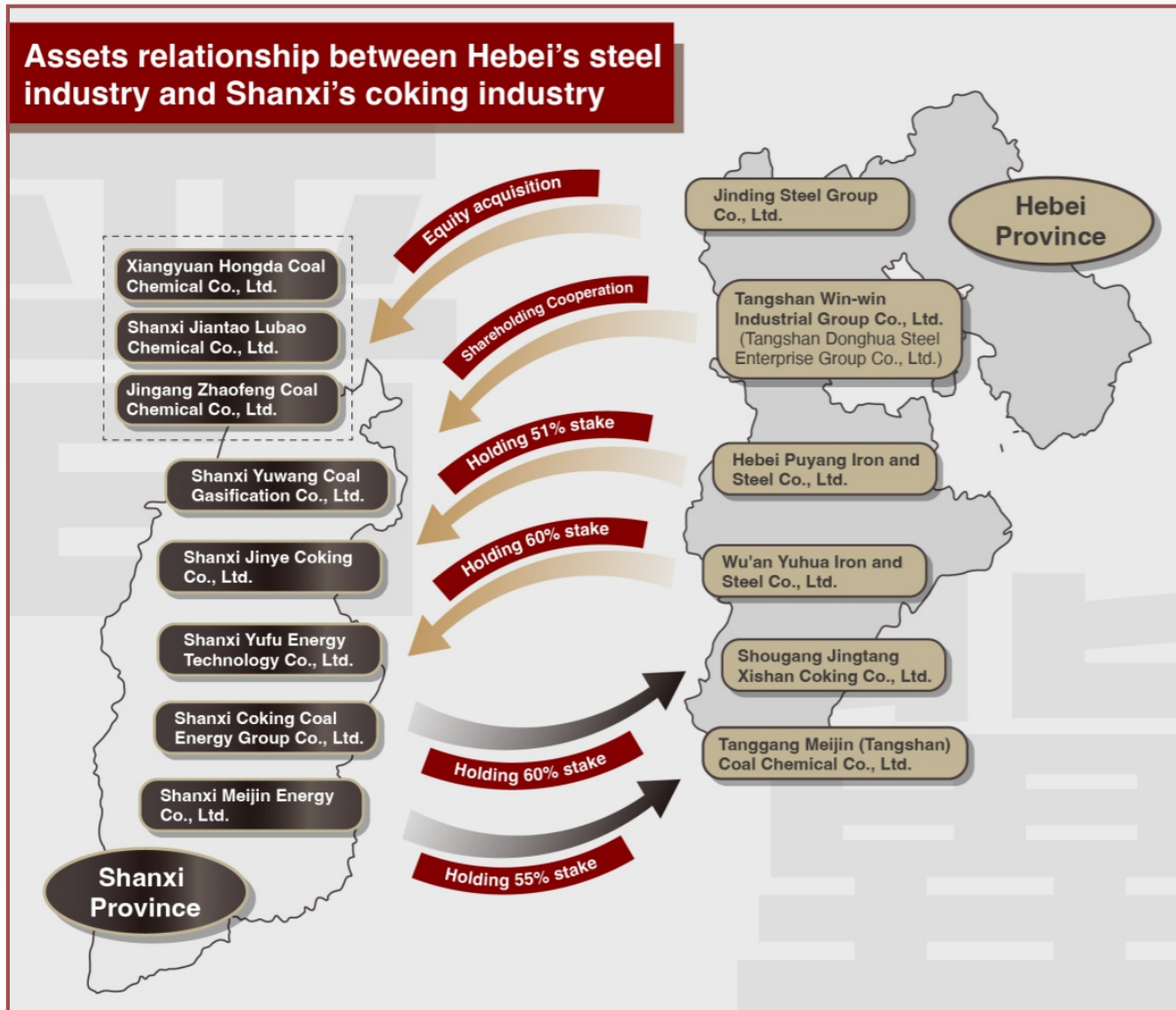


D Assets and equity relationship

On the one hand, some iron and steel businesses in Hebei, in an effort to guarantee high-quality coke supply, have made foray into the coking industry in Shanxi by way of acquisition, shareholding, consolidation and

reorganization.

On the other hand, some Shanxi coking businesses, in an effort to guarantee high-quality downstream users, have opted to hold stakes in steel businesses in Hebei.



05

The process and goals of steel decarbonization in Hebei (different scenarios)

Four scenarios are set based on national and provincial policy documents that set specific requirements for and have considerable impacts on the low-carbon transformation of Hebei's steel industry. These policies include, on a national level, the National Implementation Plan for Carbon Peak in the Industrial Sector (issued by the Ministry of Industry and Information Technology), the National Implementation Plan on Reducing Pollution and Cutting Carbon Emissions (issued by the Ministry of

Ecology and Environment and other departments), and the National Plan of Action to Improve Air Quality (issued by the State Council), and on the provincial level the Hebei Implementation Plan for Carbon Peak in the Industrial Sector (issued by Industry and Information Technology Department of Hebei Province) and the Hebei Implementation Plan on Reducing Pollution and Cutting Carbon Emissions (issued by Department of Ecology and Environment and other departments of Hebei Province):

Scenario 1: By 2025, electric arc furnace steelmaking to account for 10% in Hebei.

Scenario 2: By 2030, electric arc furnace steelmaking to account for 15% in Hebei.

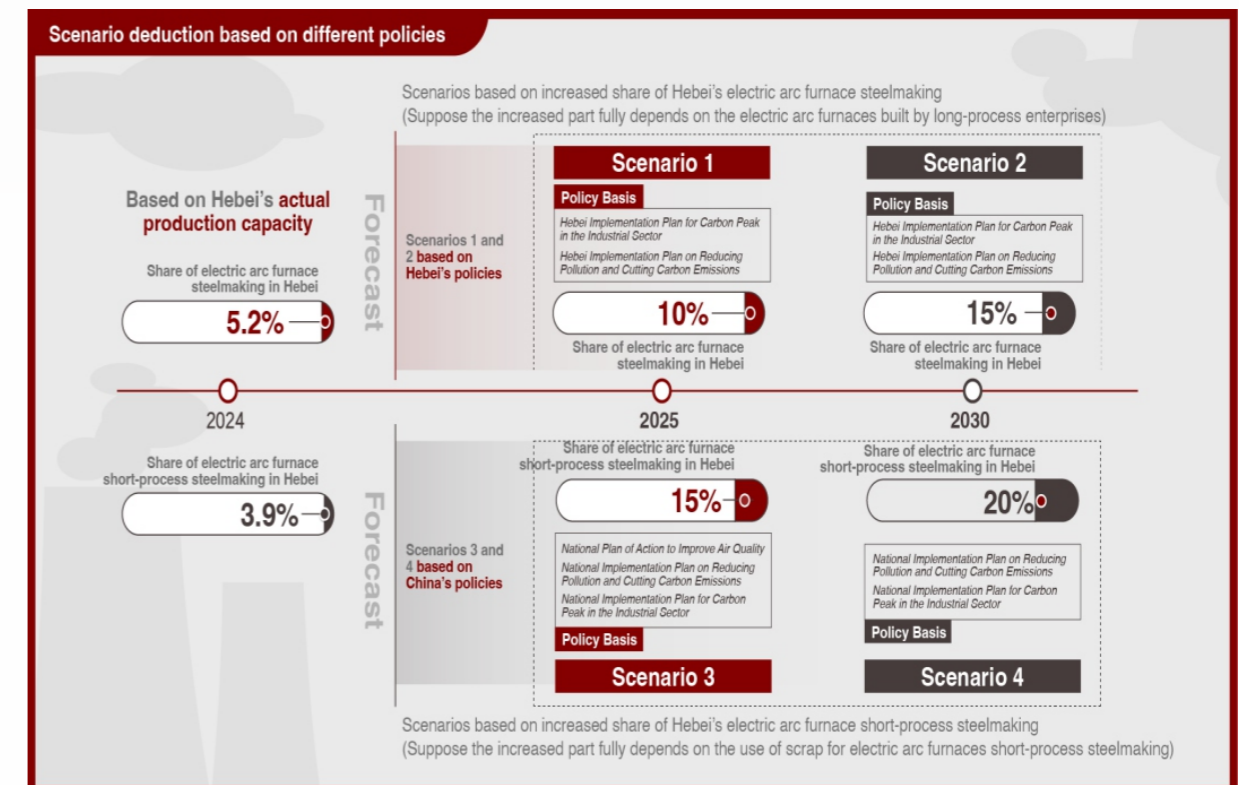
Scenario 3: By 2025, electric arc furnace short-process steelmaking to account for 15% in Hebei.

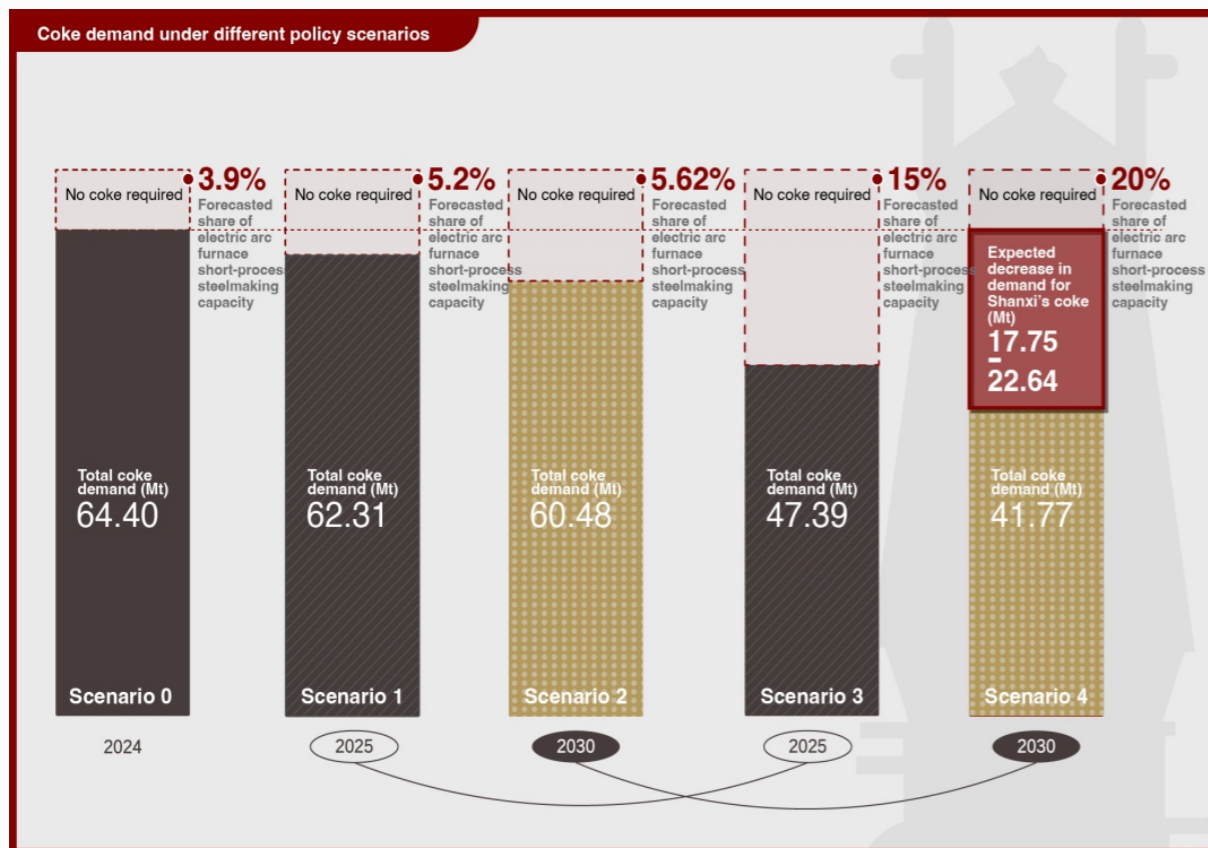
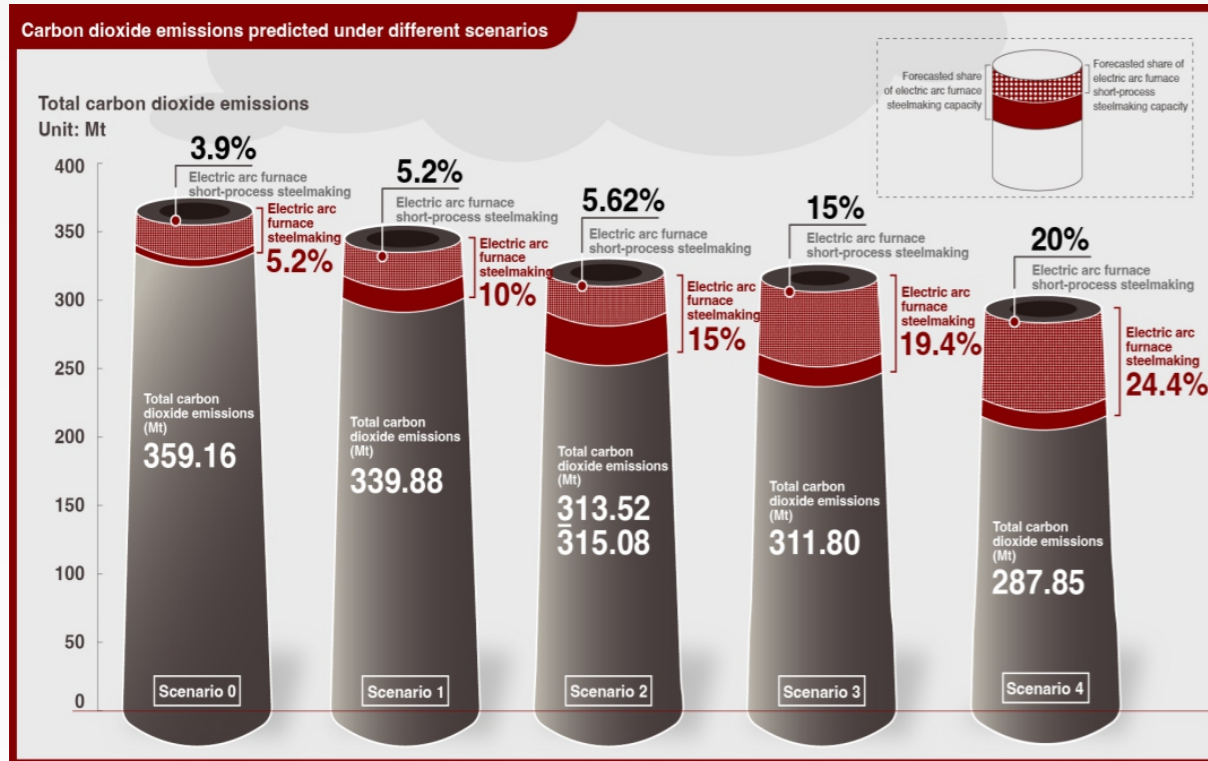
Scenario 4: By 2030, electric arc furnace short-process steelmaking to account for 20% in Hebei.

Scenario 0 refers to the current state.

Under Scenario 4, the most ambitious policy for the steel industry's low-carbon transformation, by 2030, Hebei's steel industry reduce the use of coke by approximately 22.6387

million tons, based on the ore/coke ratio of 0.34 in the blast furnace. This reduction would suggest the prevention of 71.3175 million tons of carbon dioxide emissions.





06 Future challenges to Shanxi's coking industry

Based on national and provincial policies regarding steel decarbonization in Hebei's steel industry, by 2030, as the result of Hebei steel industry's decarbonization efforts alone, Shanxi's total loss of coke market could range from 17.7487 to 22.6387 million tons, equivalent to the total coke output of Changzhi in one year (16.630 million tons in 2022), and even close to the total output of Luliang (25.784 million tons in 2022), the top coke producer in the province.

The above scenarios are based on currently existing policies regarding the low-carbon development of China's

steel industry. It is safe to predict that China's steel industry will move faster down the low-carbon path, considering other related factors, such as the EU's Carbon Border Adjustment Mechanism (CBAM), the new Nationally Determined Contributions (NDCs) that China will submit in 2025, the inclusion of China's steel industry in its carbon emissions trading system, and the technological innovations and development. The steel industry in Hebei, and even the whole country, will soon cut its ties with coke substantially. It is imperative for Shanxi to get well prepared early for the shocks to come.

