

STUDY ON THE TRANSFORMATION OF THE COKING INDUSTRY IN SHANXI PROVINCE UNDER THE “DUAL CARBON GOALS” OF CARBON EMISSIONS PEAK AND CARBON NEUTRALITY EXECUTIVE SUMMARY



Executive Summary

Coking has long been a leading industry in Shanxi Province, with the amount of coke production ranking the first in China. In 2020, at the provincial level, coking accounted for 9.2 percent of the revenues of industrial enterprises, and contributed 4.3 percent to fiscal revenues and 5.1 percent to employment, all among the top five across all industries, boosting the socio-economic development of Shanxi Province. Besides, 79.1 percent of coke produced in Shanxi Province was exported outside the Province to support the growth of the iron and steel industry of China. The coal consumption and energy consumption of the coking industry accounted for 35.6 percent and 9.3 percent of the provincial total respectively, and the coking industry’s carbon emissions made up 8.2 percent of the provincial total, which makes the coking industry a key industry in Shanxi Province’s efforts to achieve the carbon emissions peak and carbon neutrality goals.

The goal of “having carbon dioxide emissions peak by 2030 and achieving carbon neutrality by 2060” poses grave challenges to the coking industry of Shanxi Province. The report considers both external environmental factors of decreasing downstream demand for iron and steel and the development of electric arc furnace steel and hydrogen metallurgy technologies, and the internal drivers of the coking industry upgrading and green development, and based on the perspective of supply-demand balance, the report attaches equal importance to both development and emissions reduction, makes assumptions of the carbon emissions peak and carbon neutrality scenarios, and discusses pathways and produces policy recommendations for achieving carbon emissions peak and realizing steady transformation and growth of the coking industry in a high-quality manner. The major conclusions are as follows.

1. Total carbon emissions and contribution ratio of the coking industry are both on the rise

As the only province with a coking capacity of over 100 million tonnes in China, Shanxi Province reduced its coking capacity to 146.6 million tonnes in 2020, accounting for 23.2 percent of the nation’s total; and coke output amounted to 104.937 million tonnes, accounting for 22.3 percent of the nation’s total. Carbon emissions of the industry increased as coke output in the Province rose, contributing 8.2 percent to Shanxi Province’s total carbon emissions in 2020, up from 6.8 percent in 2015. Sources of carbon emissions mainly include coal burning from coal-fired boilers owned by enterprises, gas burning from coke ovens, and power consumption, etc.

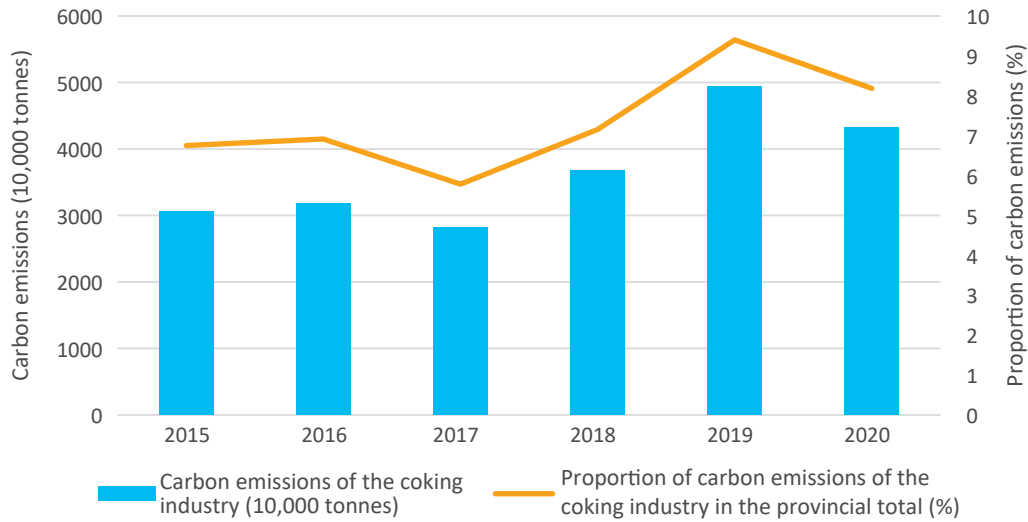


Figure 1. Total carbon emissions of the coking industry in Shanxi Province and percentage changes of carbon emissions of the coking industry in Shanxi Province

Source: Estimates by the research group.

2. The coking industry is in the middle of dynamic adjustment and optimization, and its level of development will be significantly enhanced

During the 13th Five-Year Plan period, the coking industry in Shanxi Province faced problems of path dependence, excess production capacity, low percentage of advanced production capacity, and inefficient comprehensive utilization of resources. The 14th Five-Year Plan period is crucial for the transformation and development of Shanxi Province’s coking industry. The technological level of its equipment will be improved at a faster pace by eliminating outdated capacity and reducing overcapacity, executing production capacity replacement, introducing energy-efficient power plants while shutting down some small thermal power plants, and relocating some steel projects and mills.

3. Shanxi Province’s coking industry is expected to reach carbon emissions peak in the later period of the 14th Five-Year Plan

Given the development trends of China’s iron and steel industry and Shanxi Province’s coking industry, we develop carbon emissions peak scenarios. In the baseline scenario, Shanxi Province’s coking industry will reach a carbon emissions peak of 51 million tonnes in 2025; in the low-carbon scenario, Shanxi Province’s coking industry will reach a carbon emissions peak of 49 million tonnes in 2024; and in the enhanced low-carbon scenario, Shanxi Province’s coking industry will reach a carbon emissions peak of 47 million tonnes in 2023. This report recommends that Shanxi Province’s coking industry reach carbon emissions peak around 2024 to leave enough time for the industry to transform.

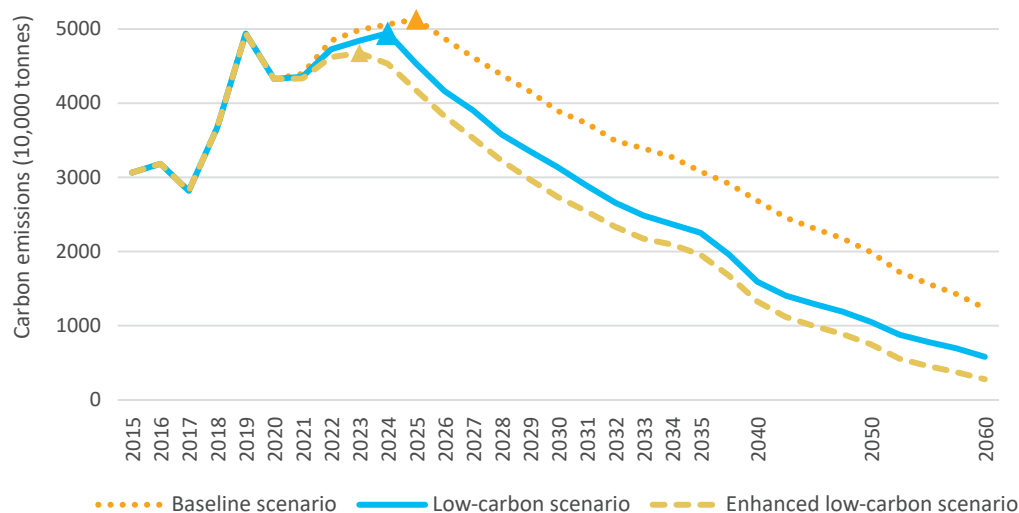


Figure 2. Carbon emissions measurement of Shanxi Province's coking industry in different scenarios

Source: Estimates by the research group.

4. Suggestions on low-carbon transformation pathway for the coking industry

As a key production and supply base of coke in China, Shanxi Province provides a strong energy guarantee for the growth of the iron and steel industry. With the development of the mini-mill, all-scrap electric steelmaking and hydrogen steelmaking technologies, the demand for coke during the 14th Five-Year Plan period will steadily decrease. The future of Shanxi Province's coking industry therefore hinges on green, low-carbon and high-quality development. The major pathways are as follows.

The first is to strictly control coke capacity and output, and improve capacity structure and layout. During the 14th Five-Year Plan period, coke production capacity should be strictly limited to 146.6 million tonnes or less, by reducing production capacity by capacity type, and under-construction, large mechanical coke oven projects 5.5 meters tall and above should be put into production as soon as possible. Coke capacity should continue to steadily decrease during the 15th and 16th Five-Year Plan periods. Capacity restructuring should be accelerated by fully eliminating coke ovens 4.3 meters tall or less in coking chambers by 2023 and ensuring that the percentage of advanced capacity exceeds 95 percent by 2025 and 100 percent during the 15th and 16th Five-Year Plan periods. Coking enterprises in heavily-polluted areas in the Fenhe River valley should be relocated or reconstructed based on atmospheric diffusion conditions, environmental carrying capacity, and economic development level. This is also expected to promote the development of coking industry clusters and industrial parks.

The second is to optimize the use of coke oven gas and develop carbon sequestration products. The rich-hydrogen and low-carbon property of coke oven gas can be used, with carbon coupling technologies, to develop carbon sequestration chemical products and promote the development and utilization of hydrogen energy. The proportion of coke oven gas in power generation and heat supply should be reduced, and priority should be given

to developing high-end products with a high rate of carbon sequestration. Moreover, the CO, CO₂ and methane contained in coke oven gas can be used in demonstration projects of carbon capture and utilization.

The third is to promote the application of key technologies, and reduce pollution and carbon emissions in a coordinated manner. During the 14th Five-Year Plan period, well-developed technologies such as waste heat recovery, dry quenching, automatic coal moisture control, and self-heating optimal control should be applied in the technological upgrading of large mechanical coke ovens and heat recovery coke ovens with coking chambers with a height of 5.5 meters or above. Smart manufacturing should be enhanced by developing information and intelligent technologies in the coking process. During and after the 15th Five-Year Plan period, priority should be placed on the pilot application of advanced technologies. During technological upgrading, equal attention should be attached to meeting the transformation demand for super low emissions and satisfying the requirement of energy conservation and carbon emissions reduction in the coking industry, while ensuring coordinated development.

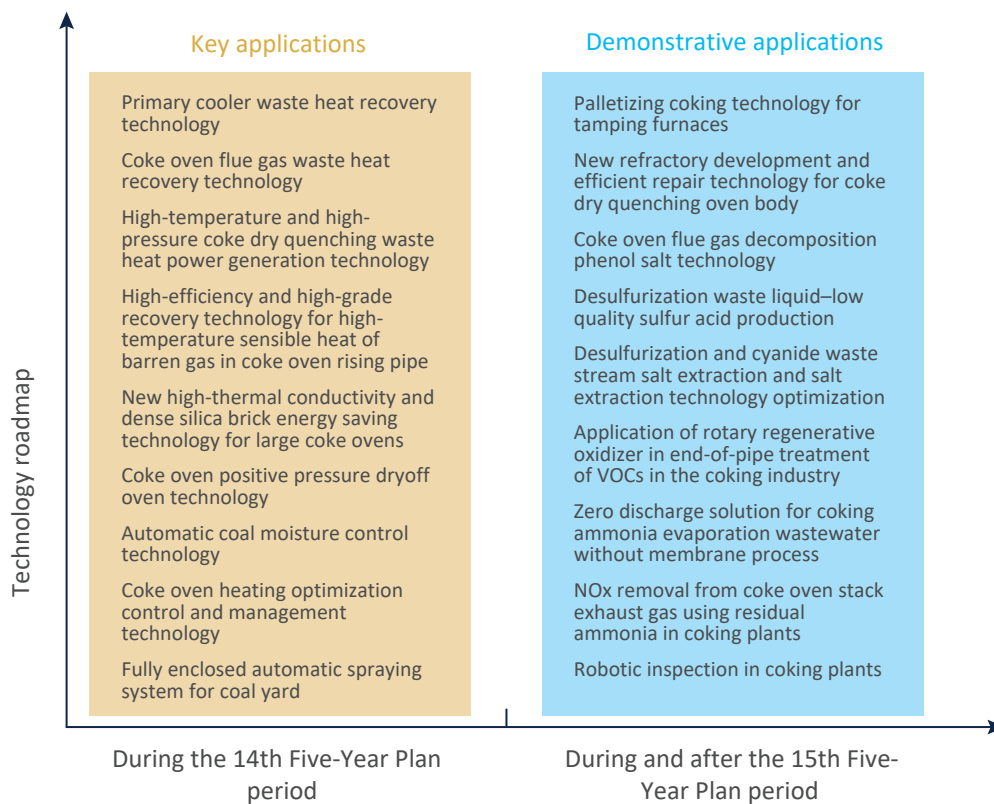


Figure 3. Technology roadmap of the coking industry

The fourth is to encourage enterprises to build distributed photovoltaic projects to increase the use ratio of green power. Coking enterprises should be encouraged to develop distributed photovoltaic projects in coal sheds or on office building roofs in an appropriate manner. This can be achieved through either energy performance contracting



or self-construction and operation. In this way, the use ratio of green power in enterprises can be increased and carbon emissions from power consumption can be reduced.

5. Policy recommendations

First, accelerating industrial upgrading. The total coking capacity should be strictly controlled, 4.3 m-tall coke ovens should be classified and gradually abandoned, and the construction of major mechanical coke oven projects should be expedited. For coking capacities which must be built, procedures including capacity replacement, coal consumption reduction, energy conservation assessment, and environmental impact assessment should be followed, to make sure that newly-built coke ovens are up to advanced national standards.

Second, setting the baseline for energy consumption per unit product. Efforts should be devoted to organizing regular inspection of enterprises' energy consumption, setting a baseline for the energy consumption per unit coke product, and putting in place a reward and punishment mechanism to force enterprises into technological upgrading. In addition, a fault-tolerant mechanism should be established to encourage enterprises to be bold in using new technologies.

Third, tightening management on carbon emissions of the industry. It is recommended that carbon emissions impact be included in the environmental impact assessment, thus raising the threshold of market entry. The coking industry should be included in carbon emissions inspections to provide the data foundation for carbon emissions trading. A system of low-carbon development standards for the coking industry should be established, and tiered management should be adopted.

Fourth, supervision and assistance for enterprises' transformation should be enhanced. Independent private enterprises own 80 percent of the coking capacity in Shanxi Province. Since they are usually weak in talent attraction and corporate management, it is recommended that the government should enhance supervision and guidance, and provide assistance in publicizing the carbon emissions peak and carbon neutrality goals, introducing and training professional talent, and giving guidance for staff resettlement and reemployment.

CONTACT US

TAIKANG FINANCIAL TOWER, SUITE 1706,
NO.38 DONGSANHUAN BEI ROAD, CHAOYANG,
BEIJING, CHINA

T +86 (10) 5927-0688

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