

# CAPPING COAL CONSUMPTION IN SHANXI IN THE 14<sup>th</sup> FYP PERIOD

A PATHWAY TO ACHIEVE DUAL GOALS OF PEAKING CARBON DIOXIDE EMISSIONS AND IMPROVING AIR QUALITY



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# Executive Summary

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Since the start of the 13<sup>th</sup> Five Year Plan (FYP) period, China has been tightening controls on coal consumption. Eight cities in Shanxi Province, including Taiyuan and Changzhi, were designated as national key areas for coal consumption control. However, energy statistics have shown that coal consumption has not decreased in these areas — it has actually increased. As of 2019, Shanxi consumed 350 million tons of coal (measured in physical quantity, same below), roughly 63.91 million more than in 2015. Shanxi is also home to five of the 20 cities with the worst air quality in China, according to the ranking released by Ministry of Ecology and the Environment in 2020. These realities spell out a concerning outlook for coal controls and pollution reductions in the province.

In order to achieve its climate goals to peak emissions before 2030 and achieve carbon neutrality by 2060, China will strictly control increases in coal consumption during the 14th FYP period and strive to gradually reduce it during the 15th FYP period. As a major coal consuming province and an important energy hub, Shanxi must optimize its energy consumption structure, control coal consumption, and reduce carbon emissions. These measures are essential for the province to realize high-quality transformation and reach the national climate goals.

The 14th FYP period is the critical window for Shanxi to achieve the initial success of its transformation and to advance its “Beautiful Shanxi Initiative.” It is also important for the “peak emissions and carbon neutrality” objectives. From the perspective of peaking carbon emissions and improving air quality, this report endeavors to discuss medium and long-term goals and pathways for Shanxi’s coal consumption.

## Reasons why coal consumption increased during the 13th FYP period

- Economic growth and coal consumption remain coupled

Shanxi’s rapid economic growth is primarily powered by its seven energy-intensive industries, , including coal, coking, steel, nonferrous metals, electric power, chemicals, and building materials, remain the key industries for economic and social development, accounting for roughly 28% the province’s economy. Emerging strategic industries and new energy resources are still unable to support Shanxi’s economic and social development. Thus, economic growth will inevitably drive increases in coal consumption.

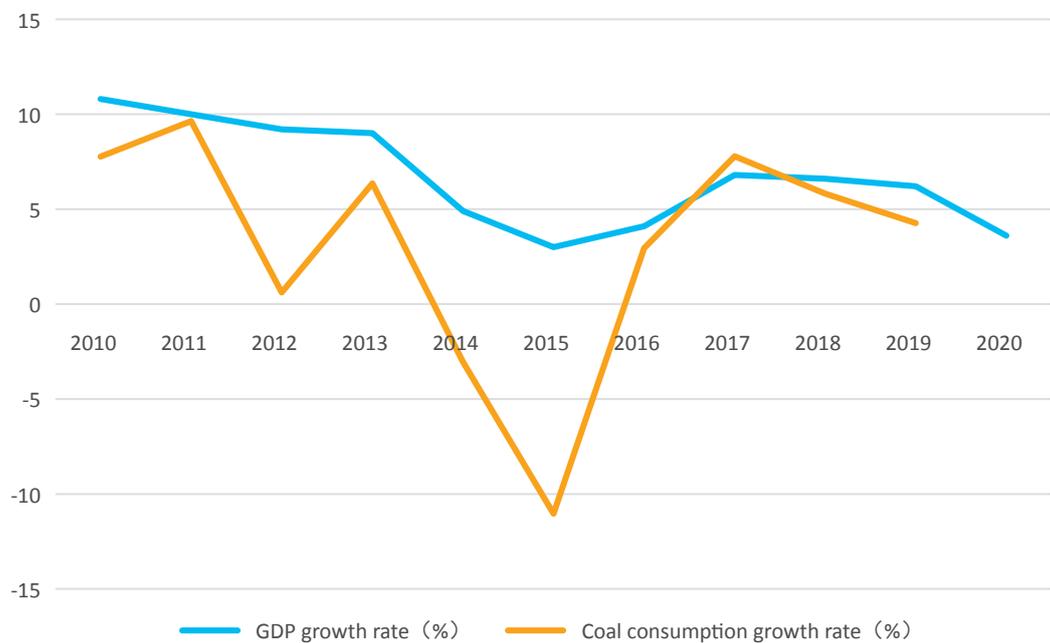


Figure 1 The growth rates of GDP and coal consumption in Shanxi

- Demand for Shanxi’s coal, coke, and coal power remains high in other provinces

Shanxi’s coal consumption is highly concentrated in power, coking, metallurgy, and other key industries. In addition to covering internal demand, a significant portion of production from these industries is exported to other provinces. In 2019, roughly 58% of coal, 79% of coal coke, and 30% of coal electricity was exported outside of the province, representing increases from 2015 of 2%, 30%, and 38%, respectively.

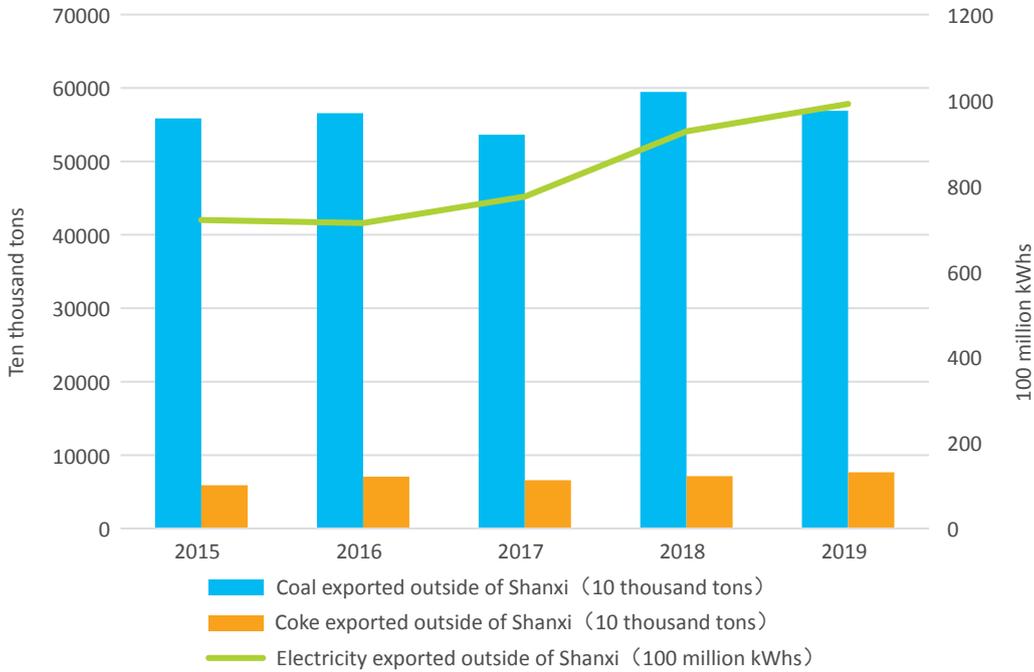


Figure 2 2015-2019 The growth of coal, coke and electricity exported outside of Shanxi

- Projects approved during previous Five-Year-Plan periods are driving increases in Shanxi’s coal consumption

Shanxi initiated efforts to control coal consumptions in key areas in 2017, before which the province did not require new, updated, or expanded projects to reduce or offset increases in their coal consumption. As a result, the commissioning of projects that were approved or had construction during the 12<sup>th</sup> and 13<sup>th</sup> FYP period is inevitably driving coal consumption across local regions.

- Renewable resources cannot fulfill new energy demand in the short term

From 2015 to 2020, the share of renewables in energy capacity rose from 14.7% to 33.8%, and the share of renewables in power generation rose from 5.6% to 11%. However, in 2020, increases in renewable power generation only accounted for 55% of the province’s new electricity demand. The current scale of installed renewable energy capacity is insufficient to meeting the additional demand that will be brought by social and economic development.

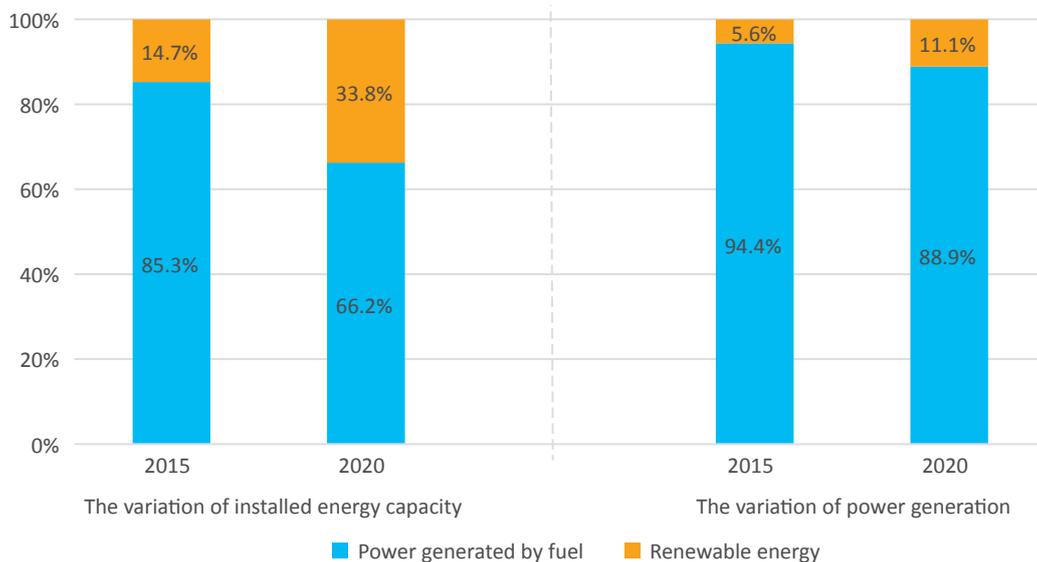


Figure 3 The variations of renewables installed capacity and power generation in Shanxi in 2015 and 2020

## Current Conditions and Targets for Coal Reduction in Shanxi During the 14<sup>th</sup> Five-Year-Plan Period

Shanxi's economic development is lagging relative to that of other provinces. In 2020, Shanxi's GDP per capita ranked 26th in the nation. Meanwhile, the province had the seventh highest total CO<sub>2</sub> emissions, as well as the fourth highest carbon intensity (measured in emissions per GDP and per capita). In provinces whose economies are less developed than Shanxi's, such as Yunnan and Guizhou, carbon intensity and total emissions levels are significantly below Shanxi's. Furthermore, apart from Ningxia, Inner Mongolia, and Xinjiang, carbon intensity is lower than Shanxi in provinces whose economies are more advanced than Shanxi's. Put simply, Shanxi faces severe challenges to achieve its carbon peaking and carbon neutrality targets.

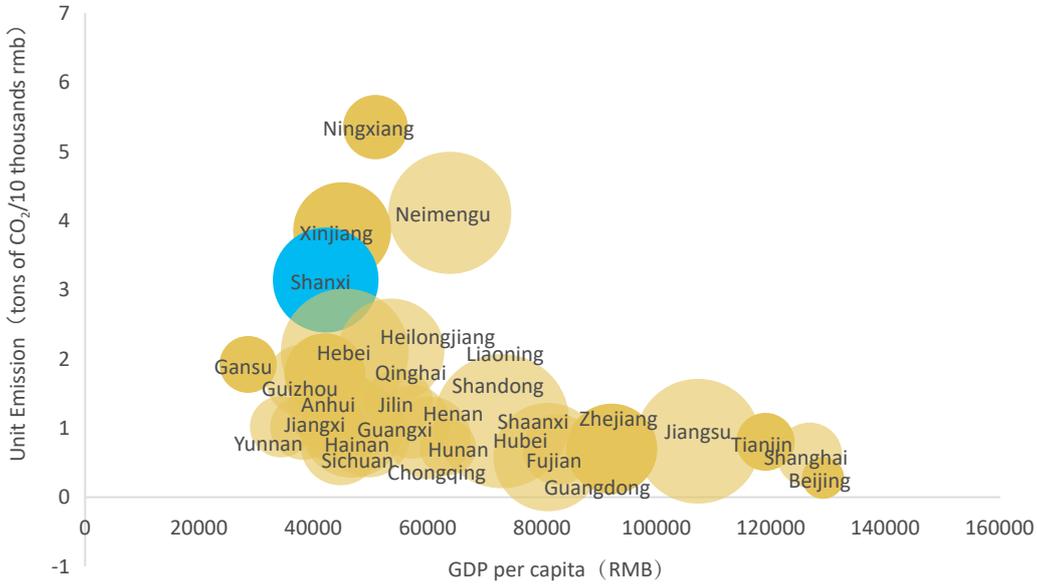


Figure 4 Carbon emission in Shanxi in 2017

(The size of the bubble represents the total amount of carbon emissions, estimated by the research team. )

In 2020, the concentration of major air pollutants in Shanxi greatly exceeded the nation's average levels. In particular, PM<sub>2.5</sub>, PM<sub>10</sub>, SO<sub>2</sub>, NO<sub>2</sub>, O<sub>3</sub> concentrations were 11 $\mu$ g/m<sup>3</sup>, 27 $\mu$ g/m<sup>3</sup>, 9 $\mu$ g/m<sup>3</sup>, 11 $\mu$ g/m<sup>3</sup>, and 31 $\mu$ g/m<sup>3</sup> above the national average, respectively. Of 20 worst cities for air pollution in China, five are in Shanxi — namely Taiyuan, Linfen, Yuncheng, Yangquan, and Jincheng — and the outlook for air pollution control remains grim.

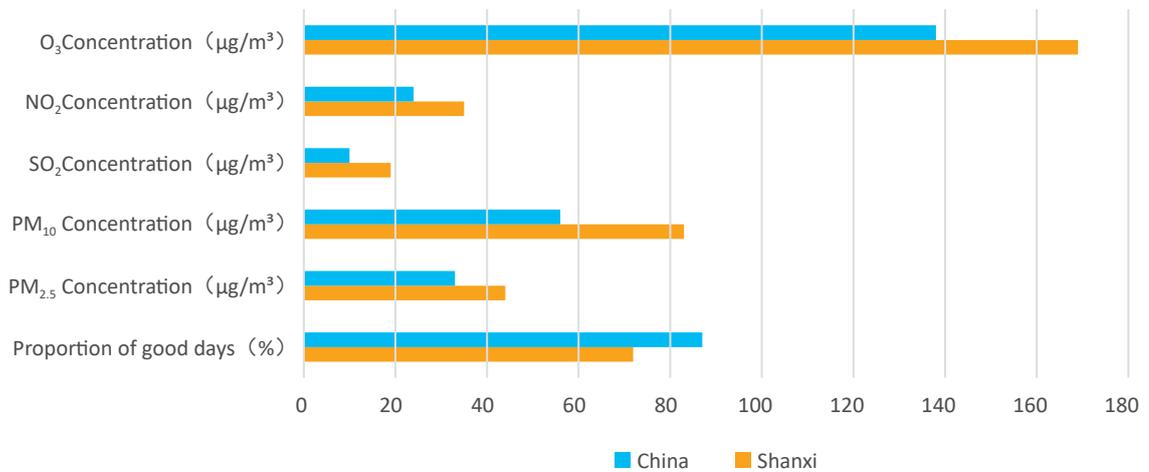


Figure 5 Comparison of Air Quality in Shanxi and China in 2020

As a less developed region and energy supply base for the nation, Shanxi must produce sufficient energy to meet the demands of economic and social development and to bolster national energy security during the 14<sup>th</sup> FYP period. At the same time, the province faces pressure to respond to climate change and to continue improving its air pollution control. This report explores Shanxi’s coal consumption under the 14 FYP through the lens of carbon peaking and air pollution control.

Table 1 Coal Consumption Estimation in Shanxi during the 14th FYP

| Constraints    | Scenarios  | Coal Control Targets in 2025 |
|----------------|--|------------------------------|
| Carbon Peaking | <b>Baseline:</b> Not consider carbon peaking'  | 39 million tons              |
|                | <b>CoalControl:</b> carbon peaking around 2028   | 36 million tons              |
|                | <b>Strengthen coal control:</b> carbon peaking around 2025                                 | 34 million tons              |
| Air Quality    | <b>Baseline:</b> Shanxi's PM2.5 concentration reaches the standard in 2030                 | 34 million tons              |
|                | <b>Coal-Control:</b> Shanxi's PM2.5 concentration reaches the standard during 2025 to 2030 | 32 million tons              |

Based on the conclusions of our research and the current state of coal consumption in Shanxi, **this report recommends that Shanxi caps its total coal consumption between 320-340 million tons by 2025**, a reduction of 10-30 million tons compared with 2019 consumption levels. Such a cap will ensure progress towards both carbon peaking and improved air quality.

In order to reduce coal consumption below 330 million tons by 2025 — a 20-million-ton reduction compared with 2019 — we analyzed the combined economic, industrial, energy, and environmental characteristics of 11 cities and recommend the following coal control targets for each:

Table 2 Suggestions of coalcontrol target for 11 cities in Shanxi Recommended coal control target for 11 cities in Shanxi

| Cities   | Target level | Cumulative decline rate in 2025 compared to 2019 |
|--|--------------|--|
| Datong, Shuozhou, Xinzhou                      | low          | 4%   |
| Jincheng, Yuncheng, Yangqvan                   | medium       | 5%   |
| Taiyuan, Jinzhong, Linfeng, Changzhi, Lyuliang | high         | 6%   |
| Shanxi   |              | 5%-6%  |



## Pathways for Reducing Coal Consumption in Shanxi Under the 14<sup>th</sup> FYP

Shanxi currently faces several challenges in reducing coal consumption, such as its industries being energy-intensive, its energy coming mainly from coal, and its energy efficiency being low. To promote coal reduction during the 14th FYP period, our research team recommends the following four pathways.

1. **Strengthen industrial restructure and reposition its economy with low-carbon development as the core.** Shanxi should leverage its role in China's major development plans, such as *High-Quality Development of the Yellow River Basin*, *Coordinated Development of the Beijing-Tianjin-Hebei Region*, and *the Bohai Rim Region Cooperation Development*, to achieve "initial success of the transformation." In doing so, Shanxi should consider transitioning to industries such as tourism, information technology, environmental conservation, health care, biopharmaceuticals, smart agriculture, the digital economy, etc., to facilitate coal reductions.
2. **Focus on the green transformation of key industries on the base of energy efficiency.** Take further steps to phase-out outdated production capacity. Control new capacity in energy-intensive industries, in order to accelerate the transition to more advanced industrial structures; Bolster the remodeling of traditional industries to achieve energy savings and efficiency, and guarantee that industries, such as steel, cement, chemical production, and building materials, peak emissions ahead of other industries; Accelerate electrification across all areas of the demand side, and develop green architecture in schools, hospitals, and other public buildings, as well as energy saving retrofits in rural buildings.
3. **Promote a systematic change in energy production.** Advance the reform of renewable energy development and promote the deployment of both centralized and distributed energy production, increasing the application of distributed solar, wind, biomass energy, geothermal, and other energy systems. Take advantage of Shanxi's coalbed methane resources, break through the bottleneck of unconventional natural gas technology development. Bolster innovation efforts in hydrogen energy production and storage technology, develop the hydrogen industry with green hydrogen as the orientation.
4. **Advance the management of dispersed coal reduction with improved livelihood and the environment as the guiding objectives.** The industrial sector should promote the replacement of coal with other fuels in heat generation. In terms of residential use, improving the coverage of district heating service should be the primary task, with a focus on optimizing the process for clean heating retrofits, innovating new business models, and establishing targeted subsidies.

## Measures to Reduce Coal Consumption in Key Coal-Consuming Industries

Coal power and coal coke are the key industries driving Shanxi's coal consumption and carbon emissions. This report recommends the following specific measures for reducing coal use in each industry:

### 1. Coal Power Industry

Shanxi must accelerate its phase-out of outdated coal power units. At the same time, it must increase the utilization of existing "coal power + UHV" resources, limit the quantity of power that is sent out-of-province, and strictly control new coal power capacity. To do so, we recommend that Shanxi caps its installed coal power capacity at approximately 70 GW by 2025.

Shanxi can accomplish this by implementing efficiency retrofits on coal power generation units above 300 MW, improving the quality of coal used in furnaces, optimizing the power system, and adjusting how it operates, tapping heat and gas supply resources, and striving to increase the efficiency of coal power by cutting 8-10 grams of standard coal per kWh. The province can also leverage the market to accelerate fundamental adjustments to the role of coal power, from traditionally being the primary generation and capacity resources to providing reliability and peak-valley shaping services. Finally, Shanxi should explore mechanisms for withdrawing from coal power, including setting standards for compensating units that retire early, encouraging companies to exchange new equipment with old units, providing compensation for the withdrawal of old coal-fired power units, and establishing capacity pricing mechanisms for units that provide backup services and undergo flexibility retrofits.

**2. Coal Coke Industry**

Currently, the main factors influencing the coal consumption of the coking industry are the amount of coke production and coal consumption per ton of coke production. Due to market demand, industrial policies, resource reserves, and other important influencing factors, coke production levels are highly uncertain and unpredictable. Furthermore, due to the inherent properties of the process used to produce coke, there is limited room for reducing the coal required to produce a ton of coke. Because of this, there are two pathways for reducing the coking industry’s overall coal consumption. First, is to control the absolute amount of coal that the coking industry consumes. Second, is to tap the potential of energy efficiency to reduce coal consumption across the entire lifecycle. This report recommends that Shanxi 1) strictly controls coke production capacity to within 110 million tons by 2025, 2) implements tailored management, and regulates coke production; 3) advances research and innovation in key technologies to reduce the ratio of coke used in downstream industries, and 4) promotes the use of larger and more efficient coal oven equipment.

**Recommendations**

**1. Strengthen high-level planning and scientifically determine 2025 targets for controlling coal coke consumption.**

We recommend that Shanxi clarifies its 2025 goals for controlling coal consumption across all sectors. These high-level goals should be further decomposed and implemented in the previously identified 11 key cities, as well as in key industries and companies. Important metrics, including total coal consumption targets, coal consumption per unit of GDP, and other relevant standards, should be included into Shanxi’s Energy Development Plan. From the perspective of strategic planning, there should be efforts to promote the development of coal control work that spans the entire province. We further recommend that by 2025, Shanxi limits its total coal consumption to within 330 million tons — a 10% reduction compared to coal’s current share of primary energy consumption. As for key coal-intensive industries, by 2025, the installed capacity of coal power should be capped at roughly 70 GW, and coking capacity should be capped at 110 million tons.

**2. Implement regionally tailored management and improve effectiveness of coal reduction and replacement.**

We recommend that during the 14<sup>th</sup> FYP period, the 11 key cities should be divided into three levels. Level 1 includes cities that should implement relatively high reduction targets, namely Taiyuan, Jinzhong, Linfen, Zhangzhi. Level 2 includes cities that should implement medium reduction targets, namely Yangquan, Jincheng,



and Yuncheng. And Level 3 includes cities that can implement relatively low reduction targets, namely Datong, Shuozhou, and Xinzhou. In addition to these cities, areas with appropriate circumstances should be encouraged to establish stricter reduction targets.

**3. Leverage market-based mechanism to cut coal use in key sectors**

To control energy consumption and particularly coal use, Shanxi should determine standards and quotas for energy use and coal consumption for key coal consuming industries and companies. These standards and quotas should be scientifically developed to suit Shanxi's real-world conditions. Energy trading systems, like energy rights, coal rights, should be tailored to meet local needs. Energy and coal use targets must be well-coordinated with carbon emissions quotas in terms of implementation.

**4. Strengthen the development of policies and mechanisms for capping coal consumption and guarantee their efficacy**

Strengthen the coordination of coal control work and develop guiding principles and oversight for regional coal control efforts. Introduce policies, such as *Methods for Reducing and Displacing Coal Use in Shanxi*, to refine coal use management and empower the review and approval process of coal use projects. Establish stricter production control policy and standards for energy use and control the development of carbon-intensive industries. Introduce tailored electricity pricing, financial and tax support, coal pricing mechanisms, coal bed methane pricing mechanisms, heat supply pricing mechanisms, and other economic policies to encourage the withdrawal of coal consumption.

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