

The Sustainable Development Road of Anhui Iron and Steel Industry under the Background of Double Carbon

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Abstract

With global warming, carbon peaking and carbon neutralization have become the goals of global human efforts. The steel industry is a heavy industry with high carbon emissions, and China is a big steel country. How to reduce the carbon emissions of the steel industry has become a thorny issue. This paper mainly uses the literature research method to analyze and research the steel industry in Anhui Province, analyzes the problems in the green transformation of the steel industry in Anhui Province, and analyzes the five aspects of the iron and steel industry in Anhui Province from the aspects of industrial structure, technical level, management level, government policy, and smart steel. The transformation path of the industry is proposed.

Keywords

Iron and Steel Industry; Double Carbon; Sustainable Development; Carbon Neutralization.

1. Introduction

On September 22, 2020, Chinese President Xi Jinping announced at the 75th United Nations General Assembly that China will strive to peak carbon dioxide emissions by 2030 and strive to achieve carbon neutrality by 2060. The proposal of double carbon has established a development goal for Chinese enterprises to adjust and optimize the industrial structure and energy structure, and transform to low carbon and green. For high-carbon-emitting steel companies, realizing green transformation ahead of time will not only contribute to the response to global warming, but also take the initiative in future development. Therefore, this paper focuses on the iron and steel enterprises in Anhui Province and makes research on their low-carbon development.

From previous studies in this area, it can be seen that Li Xuhui (2016) used the SCP framework to use the dynamic panel model to measure the impact of the existence of small and medium-sized iron and steel enterprises on the technical efficiency of the iron and steel industry, and suggested that small and medium-sized iron and steel enterprises should be reduced. Enter the market and encourage horizontal mergers [1]. Li Xinchuang (2019) proposed development paths for the transformation and development of the iron and steel industry, such as technological progress, product structure upgrade, green development, and standard guidance [2]. Li Jin et al. (2022) based on the selection of low-carbon technologies in the steel industry, the path of low-carbon development, the judgment of key parameters in the low-carbon path in different studies, as well as the general understanding and main differences between different studies, and put forward the dual-carbon development of the steel industry [3]. Yue Qiang et al. (2022) used EP method and scenario analysis method to study the impact of scrap steel recycling and DRI production on China's ISI (steel industry) energy demand and carbon

emissions. The results of the analysis of four scenarios show that the short process of electric arc furnace based on scrap steel recovery and direct reduced iron is an extremely important way for the sustainable development of ISI in China in the future [4]. Zheng Mingyue (2022) believes that the implementation path of carbon neutrality in the steel industry is: green layout, green energy, green process, green recycling industry ecology and green low-carbon technology [5]. Sun Xiaoqi et al. (2021) found that the overcapacity reduction policy in the iron and steel industry has a significant effect on energy conservation and emission reduction, affirmed the correctness of the overcapacity reduction policy in the iron and steel industry and put forward relevant suggestions [6]. Yizhan Yu's research is based on the background of the digital economy, and discusses the development path of iron and steel enterprises from the traditional high-energy-consumption, high-pollution industrialization development path to a new industrialization path [7]. Wang Yihan et al. (2022) studied the technical role mechanism of information and communication technology in the industrial sector, revealed the significant effect of ICT, and put forward policy recommendations for its promotion strategy in industrial energy conservation and emission reduction [8].

2. Research Background

2.1. Domestic Background

More than 80% of the energy consumption structure for steel production comes from the combustion of fossil fuels such as coke. The problems of high pollution, overcapacity and poor product quality in the steel industry are becoming more and more serious. In recent years, the government has promulgated a series of policies aimed at the steel industry, such as the "Implementation Measures for Capacity Replacement in the Steel Industry", etc., to resolutely curb the disorderly expansion of steel production capacity, adjust the industrial layout, and encourage mergers and reorganizations. Under the implementation of the above policies, according to the survey results of the National Bureau of Statistics, in 2021, China's crude steel output will reach 1,032.79 million tons, which is about 54.02% of the global crude steel output (1,911.9 million tons). A decrease of 3%, the first negative growth in seven years. In terms of green development of iron and steel enterprises, there are domestic demonstration enterprises such as Tangsteel and Baosteel that are promoting the greening of the iron and steel industry and actively realizing transformation. These enterprises are still in the early stage of transformation in terms of technological progress, industrial structure adjustment, and elimination of outdated production capacity. Stage companies provide a reference. In addition, China's iron and steel industry is also gradually upgrading to intelligent manufacturing, and the level of intelligence and informatization has been significantly improved. However, in 2020, the digitalization degree of enterprises in China's iron and steel industry is only 30%, which is still lower than the world average level and cannot reach the current level. The level of digitalization demand of iron and steel enterprises, intelligent development has a long way to go.

2.2. An Overview of the Transformation of Iron and Steel Enterprises in Anhui Province

Anhui Province is a province with large mineral resources, the reserves of coal resources ranks seventh in the country, the reserves of iron ore resources rank fifth in the country, and the iron and steel industry is an important industry in Anhui Province. In 2020, Anhui Province will produce 26.157 million tons of raw iron ore, 25.374 million tons of pig iron, 36.966 million tons of crude steel, and 36.074 million tons of finished steel. Among them, the output of pig iron remained basically unchanged, and the crude steel and finished steel increased by about 14% year-on-year. Ma'anshan City relies on the local Ma'anshan Iron and Steel Group, and its iron and steel product output accounts for more than half of the province (data source: Anhui Provincial Statistical Yearbook), Ma'anshan Iron and Steel The group is at the leading level in

Anhui Province in terms of production technology, management mode, output and other aspects. In 2019, it reorganized with Baosteel Group and realized the adjustment of the company structure. There are 50 ferrous metal mining and processing industries above a certain scale, and 136 ferrous metal smelting and rolling processing industries. The steel industry in each city is geographically clustered and the industry is concentrated geographically. The internal competition of homogeneous products in the steel industry in the same region is not conducive to the development of the overall industry in the region. For enterprises of different types of products, transportation and other costs can be reduced between upstream and downstream industries to achieve coordinated development.

In terms of steel production, steel production and manufacturing enterprises mainly focus on the production of crude steel, pig iron, finished steel and the processing of steel. With the consumption of resources, mineral resources such as iron ore, as non-renewable resources, should find alternative raw materials as soon as possible. As a renewable resource that can replace iron ore, the importance of scrap steel is increasingly apparent; in terms of production equipment used, there are mainly blast furnace, converter, electric furnace and so on. Relevant government agencies in Anhui Province have taken relevant measures to urge qualified iron and steel enterprises to eliminate outdated production capacity, build new production equipment, and gradually transform from blast furnaces, converters, and long processes to electric furnaces and short processes, which greatly reduces the coke in the production process. However, according to the public announcements of various enterprises and the statistics of the main production equipment of enterprises released by the government, the equipment for smelting crude steel in iron and steel enterprises is mainly converters, while the number of more environmentally friendly electric furnaces is still relatively small. In addition, the technical level and production efficiency of the scrap steel industry are not high. The process of intellectualization is slow, and the production of scrap steel short-process electric furnaces is not yet popular in Anhui Province. The types of products of iron and steel enterprises in Anhui Province are relatively wide. The representative Ma'anshan Iron and Steel Group mainly focuses on axles, plates, long products, etc. Lu'an Iron and Steel products cover hot-rolled threaded steel bars, round steel, various types of disc screw, and It can produce all kinds of special steel grades such as high-strength structural steel, cold heading steel, spring steel, hard wire steel, bearing and gear steel. Other iron and steel enterprises in Anhui Province also have relatively rich steel varieties.

3. Problems Encountered in the Transformation of Iron and Steel Enterprises in Anhui Province

3.1. There is a Contradiction between the Small Scale of Enterprises and the High Cost of Green Transformation

Although there are relatively fast-growing and large-scale enterprises such as Maanshan Iron and Steel in Anhui Province, there are also small and medium-sized iron and steel enterprises with small volume, such as Huainan, Lu'an, Bengbu and other cities. These cities have a large number of steel plants. To achieve green transformation, iron and steel enterprises must replace production capacity, eliminate outdated equipment, break technical barriers, change energy structure, conduct worker training, and change the cost of raw materials, all of which increase the transformation cost of these small and medium-sized iron and steel enterprises. Since manufacturers always pursue profit maximization, they are not very enthusiastic about the development method of compressing profits. At the same time, there are many small-scale government enterprises with many and complex businesses, which increases the management cost of the government and makes it difficult for these enterprises to transform.

3.2. Green Production Equipment and Clean Energy have Not Been Widely Promoted.

At present, the intermediate frequency furnace and related equipment in Anhui Province have been basically eliminated, and the steel production process is basically the long process of the blast furnace. The comprehensive energy consumption accounts for about 20% of the blast furnace-converter long process, so the energy consumption of iron and steel production using electric circuits is relatively low. However, the short-flow electric furnace is difficult to be widely used by iron and steel enterprises due to the high price of raw material scrap and the low degree of standardization of the scrap market. In addition, due to the inability to make breakthroughs in technical factors, the electric furnace produces less steel varieties, and manufacturers have different product varieties. Abundance will lead to product competitiveness is not strong, thereby reducing profits. This is also the reason why steel mills are reluctant to replace electric furnaces. In terms of energy, most of the energy used in the production process is mainly fossil fuel coke, and hydrogen is used for smelting. The related technologies of photovoltaic power generation are still immature, and due to competition reasons, related technologies cannot be exchanged between enterprises, resulting in enterprises of different scales. The degree of application is different and the overall application scope is not wide. Many small-scale enterprises have not yet started to use new energy for production due to technical barriers.

3.3. There are Problems in the Management of the Steel Industry

In the process of transformation and development of the iron and steel industry in Anhui Province, the provincial government only made requirements for iron and steel enterprises in accordance with the documents issued by the state. In fact, there was a lack of research on iron and steel enterprises in various regions of Anhui Province, and the policies could not be more refined and targeted. In addition, the relevant standards for evaluating the degree of low-carbon development of iron and steel enterprises are not yet complete, and the relevant support policies for different enterprises are still unclear, resulting in iron and steel enterprises having no definite goals and standards in terms of green development and transformation. For iron and steel enterprises, in order to achieve the goal of energy saving, emission reduction and green production, changes should be made in the management. However, many iron and steel enterprises cannot balance the relationship between green development and economic benefits in the company's strategic management and decision-making. The management still adheres to the previous concept and adheres to the decision-making method focusing on economic benefits. In order to cope with the government's inspection, only "Superficial effort", or copying the environmental protection policies of other successful companies without considering their own situation, has resulted in a passive state in the process of green transformation.

4. Transformation Path of Iron and Steel Enterprises in Anhui Province

4.1. Actively Carry Out Mergers and Acquisitions among Enterprises to Enhance Industrial Concentration.

The iron and steel industry has always had the problem of low industrial concentration. To improve the industrial concentration, it is necessary to speed up the merger and reorganization of the iron and steel industry. In this regard, the reorganization of China Baowu and Ma'anshan Iron and Steel Group and the acquisition of Walton by Ma'anshan Iron and Steel Group have provided an example for the development of the industry. Enterprises in the iron and steel industry should pay attention to the demonstration role of large iron and steel enterprises such as Ma'anshan Iron and Steel, and fully promote the development of the industry. Resource restructuring and business integration level of the steel industry in Anhui Province. According

to the business type, geographical location and other factors of iron and steel enterprises in various regions, large enterprises acquire small enterprises, and small enterprises realize horizontal mergers. For small and medium-sized steel enterprises that are unable to acquire and reorganize themselves, or to achieve their own transformation, take measures to shut down and ban them to realize the orderly exit of surplus production capacity. In the process of merger and reorganization, the enterprise can integrate the original own technology and management experience with the resources of other enterprises to build the core competitiveness of the enterprise. With the expansion of the enterprise scale, the enterprise can realize the optimization of product structure in procurement, production, R&D, sales, etc., the promotion of green technology, enhance the bargaining power in the upstream and downstream enterprises in the industry, form economies of scale, reduce costs and increase efficiency, achieve sustainable development.

4.2. Achieve Both Green Development and Economic Benefits, Dare to Bite the Hard Bones in "Technology".

The transition from long process to short process and the use of clean energy are the key technical factors that promote the transformation of steel enterprises to low carbon in the world. To reduce the combustion of fossil fuels and reduce carbon emissions in the production process, cleaner The Anhui provincial government should promulgate relevant policies, build a platform for scientific and technological cooperation, attract more social capital and high-end talents, and form an innovative joint force among enterprises, universities and the government to jointly promote low-carbon technology. Innovation; increase investment in the research and development of hydrogen smelting, steel materials and other technologies, and break the core technical problems of green development of the steel industry. For the "three wastes" generated in iron and steel production, it is necessary to improve the recycling technology, maximize the utilization value of resources, reduce economic losses, reduce the degree of pollution, and provide enough space for the development of dual carbon.

4.3. Improve the Use of Green Production Equipment and Energy-saving Materials.

Under the supervision of the government, enterprises should actively formulate production capacity replacement policies according to their own conditions, and promote the orderly withdrawal of backward production capacity from the market. Dismantling converters, building electric furnaces, and increasing the proportion of electric furnace short-process steelmaking methods, electric furnaces have the advantages of less pollution, high thermal efficiency, and high metallurgical quality, which can effectively reduce the use of coal resources and CO₂ emissions. The government should also discover the problems encountered by enterprises in capacity replacement in a timely manner, and improve the standards and policies for capacity replacement. In addition, attention should also be paid to the development of related upstream and downstream related industries after the electric furnace production capacity is put into production. For example, the raw material for steelmaking using electric furnaces is mainly scrap steel. The government should regulate various standards in the scrap steel market, stabilize scrap steel prices, and strictly control the quality of scrap steel production, so that enterprises can be guaranteed on the raw materials of electric furnace steelmaking.

4.4. Improve the Management Level of Green Development in the Steel Industry

The government should conduct in-depth investigations on the production capacity, environmental protection level, and product quality of steel enterprises in Anhui Province, so as to understand the development status of the steel industry in Anhui, and then establish an

evaluation mechanism for the degree of green transformation of enterprises, and improve the product quality of steel enterprises, pollution degree and other indicators of evaluation criteria. It not only provides a standard for the management of enterprises by the government, but also points out the direction for the transformation of enterprises. In addition, it is necessary to make full use of digital methods to establish an information system for the information of iron and steel enterprises in various places, solve the clutter of enterprise business, investigate difficult problems, and strengthen the assistance and supervision of green transformation of small and medium-sized iron and steel enterprises. Improve the review of energy consumption, emissions, pollution control and other aspects in the steel production process. On the enterprise side, iron and steel enterprises should choose professional talents when making strategic decisions, and formulate a transformation strategy in line with their own development according to the company's own situation. It is also necessary to pay attention to the improvement of corporate culture, system specifications and other aspects. Only by grasping the initiative on the road of green transformation can enterprises be competitive in the future development.

4.5. Give Full Play to the Government's Intervention Role in the Market, Which is Beneficial to Steel Enterprises that are Actively Transforming.

The green transformation of iron and steel enterprises requires the efforts of the government and enterprises. In the process of transformation, some additional costs are bound to occur. In order to improve the enthusiasm of enterprises for transformation, the government should play the role of government policies in allocating industry resources and take measures to promote iron and steel enterprises. Transformation: First, make rational use of fiscal funds, give full play to the influence of fiscal and taxation policies on social capital, and promote the flow of capital in the steel industry towards green development. Second, the Anhui provincial government should speed up the construction and operation of the carbon trading market, so that it can give full play to the role of the market, so that enterprises that reduce carbon can obtain more benefits and realize the rational allocation of environmental resources. The third is to pay attention to the equipment resources that are withdrawn after the capacity replacement. For the smelting equipment that is forcibly dismantled before its service life, avoid direct dismantling and find ways to use it. At the same time, government subsidies are provided to the capacity replacement enterprises to avoid the waste of corporate resources and costs caused by the implementation of policies. Fourth, the government also needs to pay attention to the pressure on the steel industry brought about by changes in investment and economic growth in the post-epidemic era, ensure the investment and demand of the steel industry, and drive the growth of the steel industry.

4.6. Leveraging the Digital Economy to Improve the Upstream and Downstream Development of the Steel Industry

With the development of digital industrialization, advanced technologies such as intelligence, big data, and AI have entered all walks of life. In the steel industry, first, it is necessary to realize intelligent manufacturing in the steel production process, and use technologies such as robots, 5G+, and intelligent detection to conduct data detection and collection in all aspects of production, and unmanned management. Find the technology, management, quality, cost and other pain points in the greening process of the steel industry, save labor costs, improve management efficiency, and provide space for the green transformation of steel enterprises. Promote the transformation of the steel industry from labor-intensive to technology-intensive. The second is to strengthen the construction of the Industrial Internet of Things from the perspective of the entire industrial chain of the iron and steel industry, and build a new raw material procurement platform and product sales platform, so that the upstream and

downstream enterprises in the industrial chain can be interconnected. Interconnection and integration of upstream and downstream resources in the steel industry chain.

5. Conclusion

Under the background of global warming, protecting the environment, green production, and realizing transformation are the only way for steel enterprises to develop healthily in the future. Based on the policy background of double carbon, this paper proposes suggestions for the sustainable development of the steel industry from the actual situation of Anhui Province. Firstly, the green transformation of domestic and Anhui iron and steel industries is analyzed from the aspects of production methods, technical level, industrial structure, and degree of intelligence. It is concluded that Anhui iron and steel industry has low industrial concentration, unreasonable energy structure, and management system. Subsequently, six suggestions were put forward for the sustainable development of the iron and steel industry in Anhui Province, namely, adjusting the industrial structure, improving the technical level, improving the technical equipment and production raw materials, improving the management level, giving play to the government's supporting role, and leveraging the digital economy.

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