

Path of Green Transformation of China's Industrial Enterprises in the Context of "Dual Carbon"

Ziyun Ma *

International Education School, Hebei University of Economics and Business, Shijiazhuang,
050062, China

* Corresponding author: 1811000325@mail.sit.edu.cn

Abstract. China put forward the goals of "peak carbon" and "carbon neutrality" at the Internet conference, and the green transformation of China's industry is a necessary path to realize the "double carbon" goal. This paper focuses on the international and domestic background of the "dual-carbon" goal, the significance of setting the goal, the carbon emission situation of industrial enterprises, the difficulties in the green transformation of industrial enterprises, and the possible paths for the green transformation of industrial enterprises. Since the Second World War, the global industry has been developing rapidly, and nowadays, the excessive carbon emission has caused the common greenhouse effect problem in the world. As a responsible country, China has made a commitment to "double carbon" in the United Nations General Assembly, and has actively carried out carbon emission reduction work. This paper combines the current situation of carbon emissions of industrial enterprises, analyzes the constraints of green transformation of industrial enterprises from the perspectives of the government, enterprises, energy, etc., and analyzes the path of green transformation of industrial enterprises according to their characteristics. This paper looks forward to providing industrial enterprises with certain transformation ideas, to help find a more realistic and feasible path to solve the problem of green transformation of some industrial enterprises in China.

Keywords: Carbon Peak, carbon neutral, industry, green transformation.

1. Introduction

Since the Industrial Revolution, mankind's exploration of energy sources has been increasing, and the degree of energy utilization has continued to grow. Although the Earth is rich in energy, the main sources of energy utilized by mankind are still coal, oil and natural gas. Coal, oil and natural gas are fossil energy sources that produce large amounts of greenhouse gases (GHGs), mainly carbon dioxide, when burned. The production of large quantities of greenhouse gases affects the global ecosystem, and the global greenhouse effect is becoming more and more significant. Today, global carbon emissions remain high, and China, as a responsible country, has clearly proposed the goals of "carbon peaking" by 2030 and "carbon neutrality" by 2060 at the United Nations General Assembly in September 2020 ("dual carbon"). The "dual-carbon" goal is a major task for carbon emission reduction. Among them, the industrial emission reduction task is the most important. Since China's reform and opening up, the rapid development of the industrial sector has made a great contribution to the world's economic growth, but many industries are also characterized by "high energy consumption and high emissions". Although China's industrial carbon emission reduction work is continuing to promote, but due to the large volume of China's industry, the energy structure cannot be quickly optimized, so China's industrial carbon emissions are still increasing trend.

At present, industrial enterprises are also in a critical period of exploring high-quality development, innovative development, green transformation is the carbon emission reduction tasks and industrial enterprises of high-quality development of the road to go through, in the time constraints, the task is heavy under the constraints of the "dual-carbon" target, this transformation is both a challenge and an opportunity, many industrial transformation will promote the related industries to innovate and transform and upgrade. Many industrial transformations will promote the innovation, transformation and upgrading of related industries. In this paper, we will analyze the path of green transformation of China's industry, starting from the understanding of the "double carbon" target, combining the current

situation of carbon emission of industrial enterprises, and analyzing the possible constraints of the green transformation of China's industrial enterprises.

The main purpose of this article is to analyze the path of industrial green transformation in the context of the "dual-carbon" goal, combined with the current situation of industrial carbon emissions. First of all, a brief introduction to the background of the "double carbon", and then from the carbon emission status quo, the transformation constraints for carbon emissions, green transition and other aspects to do a certain analysis. Finally, in view of its characteristics, it lists the green transformation paths of industrial enterprises under three perspectives.

2. Awareness of the "Dual-carbon" Objective

2.1. International

Since the beginning of the industrial revolution in Britain, coal has gradually become the main energy source to continuously promote the development of society, and with the accelerated progress of history, especially after the Second World War, fossil energy sources such as coal and oil have become the main supportive energy source for the progress of human society. However, as a primary energy source, fossil energy will sooner or later face the problem of energy depletion with the increasing use of human society year by year. At the same time, the incomplete combustion of fossil energy generates a large amount of greenhouse gases, which leads to more and more serious global warming and becomes one of the challenges that the whole world is facing together. Therefore, in 1992, the United Nations adopted the United Nations Framework Convention on Climate Change (UNFCCC) to address the problem of global warming, and subsequently formulated the Kyoto Protocol and the Paris Agreement to continue to promote national efforts in this regard.

At present, more than one hundred countries in the international arena have put forward the goal of carbon neutrality through legislation and policies, and have carried out carbon reduction work. As shown in Table 1, dozens of countries, including the United States, Canada, the United Kingdom, and Russia, have achieved the carbon peak goal, Suriname and Bhutan have reached the carbon neutral goal, and dozens of other countries are in the carbon neutral platform period. Peak carbon countries are generally characterized by high GDP per capita, decoupling economic growth from carbon emissions, and well-developed tertiary industries [1].

Table 1. Carbon peak in countries and regions and peak time [1].

Countries and regions	Time	Countries and regions	Time	Countries and regions	Time	Countries and regions	Time
Sweden	1970	Romannia	1989	Portugal	2002	Croatia	2007
Britain	1971	Germany	1991	Uzbekistan	2002	Ireland	2007
Gabon	1978	Czech Republic	1992	Finland	2003	Liechtenstein	2007
Belgium	1979	Latvia	1992	Italy	2004	Spain	2007
European Union	1979	Republic of Lithuania	1992	Japan	2004	Barbados	2008
France	1979	Slovakia	1992	Seychelles	2004	Cyprus	2008
Hungary	1984	Ukraine	1992	Andorra	2005	Norway	2008
Nauru	1986	Zimbabwe	1994	Austria	2005	Slovenia	2008
Bulgaria	1987	Denmark	1996	Greece	2005	Syria	2008
Poland	1987	North Macedonia	1998	America	2005	Australian	2009
North Korea	1989	The Faroe Islands	2001	Serbia	2006		

2.2. Domestic

Since China's reform and opening up, its economy has developed rapidly and its demand for energy has gradually increased. In 2007, China surpassed the United States and became the world's largest emitter of carbon dioxide. Since the end of the twentieth century, China has also gradually promoted

the development of a green and high-quality economy, committed to optimizing the energy structure, and constantly exploring new energy economy and industrial green transformation technologies. At the United Nations General Assembly in September 2020, we made a commitment to a "dual carbon" target. However, the green transition is an arduous and lengthy task, and although the emission reduction efforts have been effective, many industries in China are still supported by fossil fuels, so the achievement of the "dual-carbon" target is challenging and urgent. In order to achieve the "dual-carbon" goal, one of the priorities is to reduce industrial carbon emissions, find a path for the green transformation of industry, and help it to complete the green transformation.

2.3. Significance of China's "Double-carbon" Target Formulation

2.3.1. Reflecting our role as a great nation

Since the twentieth century, global temperatures have risen due to the burning of large quantities of fossil energy by humans, which has produced large quantities of greenhouse gases such as carbon dioxide. The rise in temperature has aroused concern on a global scale. As a responsible power, China has always attached great importance to global climate issues, continuously promoted the progress of related work, actively implemented international agreements and strategic plans, and put forward the "dual-carbon" goal in United Nations conferences, which has been highly evaluated by many countries around the world. China adheres to the construction of a community of human destiny, actively develops green renewable energy, increases forest reserves, actively responds to climate change, takes practical action to set an example, makes great contributions to global sustainable development, and shows its ambition as a Chinese country and a great power to take on the role [2].

2.3.2. Contribute to ecological construction

China is actively building a global ecological civilization and adhering to the development concept of harmonious development between human beings and nature. In 2017, General Secretary Xi Jinping pointed out that a mountain of gold is a mountain of green water. China puts the construction of ecological civilization in an important position, especially the proposal of the "double carbon" goal, which confirms that China attaches great importance to ecological civilization and a highly responsible attitude, and at the same time, it also promotes China's industrial optimization, industry innovation, and the development of a green high-quality economy [3].

2.3.3. Promoting the green and high-quality development of China's industrial economy

Since the reform and opening up, China has experienced rapid economic growth. However, China's industry is more dependent on coal-based fossil energy sources, and under the "dual-carbon" goal, China's industry is undergoing green transformation and upgrading. In the overall planning of governments at all levels and the continuous innovation and upgrading of industrial technology, the green transformation of China's industry has begun to bear fruit, and the structure of energy consumption is constantly being optimized. At the same time, under the leadership of the "dual-carbon" goal, new economic growth points have been formed in the fields of green innovation and renewable energy, which have injected new vitality into China's economy, to a certain extent weakened the negative impact of carbon reduction, and further promoted the high-quality and sustainable development of China's economy, and improved its competitiveness in the international market. Competitiveness in the international market has also been improved.

3. Carbon Emissions from Industrial Enterprises

China is a major manufacturing country, ranking first in the world for many consecutive years, and has made outstanding contributions to our economic development. However, China's industry is characterized by "all but not good", which needs to consume a large amount of energy and emit a large amount of carbon dioxide. Direct emission, indirect emission and process emission are the three ways of carbon emission in industrial enterprises [4]. Among them, direct emissions mainly refer to carbon dioxide emissions from burning fossil fuels (e.g., coal, etc.), which is the highest proportion

of industrial carbon emissions, and with the transformation of electrification in recent years, the direct carbon emissions have been on a downward trend. The number of carbon emissions is also very different between different industries, according to Fig. 1, carbon emissions are mainly concentrated in electric power, iron and steel, building materials, petrochemical and other industries [5]. It is predicted that the overall industrial carbon dioxide emissions in China will achieve carbon peak in 2024 [6].

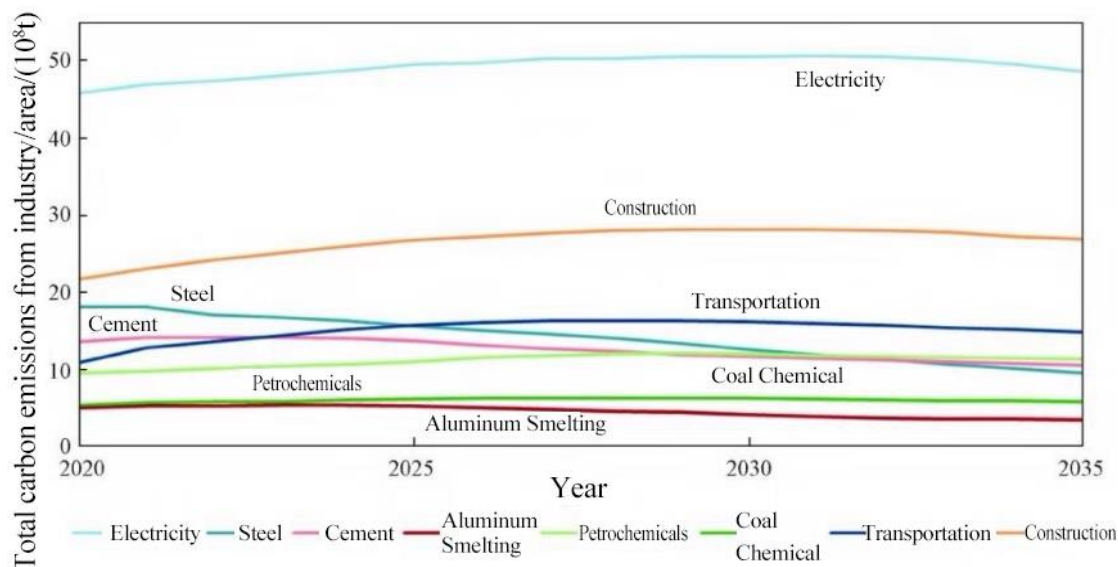


Figure 1. Projection of total CO₂ emissions from key sectors from 2020 to 2035 in China.

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4. Constraints to Green Transformation of Industrial Enterprises

4.1. Relevant Governmental System Is Not Yet Perfect

Under the active promotion of the State, many relevant policies and systems have been introduced to facilitate the green transformation of enterprises. However, in practice, there are problems such as unclear institutional boundaries and implementation effects that have not met expectations. For example, small and medium-sized microenterprises residing in localities, although they account for a relatively large number in China, the government has relatively few incentive policies and constraint systems for them, and focuses more on the transformation of centralized state-owned enterprises [4]. In addition, China's green financial financing is relatively difficult, and the green financial market has not yet been fully established.

Although China attaches importance to the development of environmental protection, local governments will focus more on controlling economic growth. The local government has limited energy, at the same time, the green environmental protection supervision work is difficult, coupled with the imperfection of the supervision mechanism itself and other reasons, resulting in the government's supervision of the enterprise supervision is not in place [7, 8]. Local governments can designate corresponding milestones to lead the green transformation of enterprises according to the carbon emission characteristics of local industrial enterprises.

4.2. Weak Technological Innovation Capacity of Enterprises

Under the "dual-carbon" goal, China urgently needs enterprises and other enterprises to innovate in science and technology in order to complete the green transition as soon as possible. However,

China's green science and technology innovation capacity is relatively insufficient, and enterprise innovation funds are limited, especially after the three-year epidemic, more leaders of small and medium-sized enterprises (SMEs) tend to be conservative in their decision-making, and it is difficult for SMEs to invest huge costs in them. In addition, China's new green technology foundation is weak, and relevant talents are scarce, so there are difficulties in green transformation at the technical level.

4.3. Difficulties in Optimizing the Energy Mix

China's industrialization process has accelerated in recent years, and energy demand is still growing. Industrial development will inevitably bring increased carbon emissions, but current energy consumption is still dominated by coal, with low energy utilization efficiency and a heavy industrial structure. The existing technology of clean energy and renewable energy is not enough to change the energy structure dominated by fossil energy, in addition, under the condition of ensuring the integrity of the industrial chain, some countries in Europe and the United States of America on the treatment of high energy-consuming industries is not very meaningful for our country to learn from the need to solve the problem of energy for the national conditions of our country.

5. Industrial Green Transformation Path Classification under the "Dual Carbon" Goal

5.1. Government-led Green Transformation of Industry

5.1.1. Government improves the oversight and incentive system

The government has a considerable role to play in the green transformation of industry, and should take into account special circumstances such as the differences in industrial carbon emissions in different fields, and introduce relevant supervisory measures in response to their characteristics, so as to force enterprises to make a green transformation. At the same time as the establishment of the monitoring mechanism, corresponding preferential policies should also be introduced to incentivize enterprises to green transformation, such as lowering taxes or subsidies when certain conditions are met, and giving certain technical support to some enterprises, so as to provide institutional safeguards for enterprises.

5.1.2. Building financial markets for carbon trading

China's launch of the carbon emissions trading market in 2021 is of great significance. However, China's carbon trading market is still characterized by low market volume and imperfect mechanisms. Led by the goal of "double carbon", China should improve the market mechanism as soon as possible, optimize the allocation of corporate carbon quotas, promote the maturation of the carbon trading market, give full play to the positive role of the market, and strengthen the docking with the international market.

5.2. Accelerating Technological Innovation in Enterprises

Enterprises are the main position of technological innovation, enterprises need to increase investment in technological innovation, strengthen their independent innovation ability, master the front-end technology in this field, improve enterprise competitiveness, combined with the development of new energy technology, optimize the energy structure. Secondly, it can strengthen the cooperation between enterprises and universities and research institutions, strengthen the exchange of talents, and jointly innovate and develop carbon reduction technologies. In addition, the development of high-tech enterprises and green enterprises can be encouraged, and relevant protection mechanisms can be established to improve the enthusiasm of enterprise innovation [8].

5.3. Improve Energy Efficiency and Utilize Multiple Sources of Energy

China should carry out macro-control of energy issues, formulate relevant plans from the perspective of the overall situation, and carry out optimization of energy structure in stages [9]. In addition, it is necessary to continuously improve energy efficiency, rational balance of energy issues, so that less energy consumption to support greater social development. At the same time, to promote the development and utilization of new energy, as far as possible to increase the proportion of clean energy, renewable energy in the use of energy, take the road of energy diversification [10].

6. Conclusion

This paper mainly writes in the "double carbon" goal, China's industrial enterprises combined with the existing situation, analyze the constraints of green transformation, and analyze the green transformation path of industrial enterprises for its factors. In the international and domestic context, China's industrial development is characterized by "big but incomplete", different industries have different carbon emissions, but also has certain general characteristics, industrial enterprises urgently need green transformation. It is very important to change it. After analyzing the governmental system, enterprise technology and energy structure, there are aspects that can be improved. In view of the problems, we analyze the path of green transformation, such as perfecting the relevant mechanism of the government, developing the financial market of the carbon trading, accelerating the technological innovation of the enterprises, improving the energy efficiency, and making full use of a variety of energy sources. In the future, we can start from the green transition path, such as the government to strengthen the construction of carbon trading market, enterprise innovation and optimization of energy structure, etc., to help the "dual carbon" goal as soon as possible. This paper provides some thoughts and references for related personnel, and is eager to contribute to solving practical problems.

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