Proceedings of Business and Economic Studies, 2022, Volume 5, Issue 5
http://ojs.bbwpublisher.com/index.php/PBES
ISSN Online: 2209-265X
ISSN Print: 2209-2641

Research on Carbon Reduction Strategy of China's Industrial Chain with the Goal of Carbon Emission Peak and Carbon Neutrality

Xiaorong Wang*

School of Business, Jianghan University, Wuhan 430056, Hubei Province, China

***Corresponding author:** Xiaorong Wang, wangxr1234@126.com

Abstract: In order to achieve the development goals of emission peak in 2030 and carbon neutrality in 2060, carbon reduction measures should be implemented in the whole industrial chain. Based on the existing research, the basic logic of carbon reduction in the industrial chain is analyzed, and then the specific strategies for carbon reduction in the industrial chain are proposed, including: reducing the use of fossil energy and vigorously developing the new energy industry; reducing carbon through energy conservation, industrial upgrading, development of circular economy, and application of carbon capture technology; reducing carbon through low-carbon transformation of logistics industry, innovation of trading methods, and promotion of low-carbon green consumption. The external guarantee system for carbon reduction includes the introduction of relevant policies, laws and regulations, and the use of carbon emission trading mechanism.

Keywords: Carbon emission peak and carbon neutrality; Industrial chain; Carbon emission reduction; Carbon emission rights

Online publication: October 21, 2022

1. Introduction

The goal of carbon emission peak and carbon neutrality was proposed to overcome global climate change. Research shows that greenhouse gases are the cause of average temperature rise and climate change. The greenhouse gas that has the greatest impact on climate change is CO_2, which accounts for about 75% of greenhouse gases. CO_2 is mainly produced in the production and consumption of fossil energy. Since the industrial revolution, global CO_2 generated by the combustion of fossil fuels has accumulated to 2.2 trillion tons, and global average surface temperature has increased by 1.1°C, which caused problems such as the increase of pests and diseases, drought, and rise of sea level.

In order to address the climate problem, the relevant parties signed the Kyoto Protocol in 1997, which specified the types and amounts of emission reduction gases. In December 2015, the Paris agreement was signed. One of its main objectives was to "control the global average temperature rise below 2 °C higher than the pre-industrial level, and strive to limit the temperature rise below 1.5 °C higher than the pre-industrial level." The research of the Intergovernmental Panel on climate change (IPCC) shows that to achieve this goal, the global greenhouse gas emissions need to be reduced by half before 2030 and reach net zero emissions around 2050, that is, carbon neutrality [1-2].

Carbon neutralization has become an important goal for global climate governance [3]. In 2021, about 130 countries and regions have established carbon neutralization time. Since the reforming and opening up, China's GDP has grown at an average annual rate of 10%, and has become the world's second largest

economy. Due to the high energy consumption and carbon emissions of leading industries, China is also the country with the largest carbon emissions in the world and also suffers the greatest impact due to global climate change. It is manifested by the rise of average temperature, the increase of extreme heat waves, floods in the south, droughts in the north, and so on. In order to promote sustainable development, reduce carbon emissions must be reduced [4]. This paper will discuss China's carbon reduction strategy from the perspective of the industrial chain.

2. Literature review

In October 2021, the State Council of China issued "The Guide on Fully, Accurately, and Comprehensively Implementing the New Development Concept to Achieve Carbon Emission Peak and Carbon Neutrality" and "The Action Plan for Carbon Emission Peak Before 2030", which established the top-level design of policies to reduce carbon emissions [5-7]. Since then, other ministries and local governments have introduced carbon reduction policies for key industries.

China's carbon emissions are still in the rising stage since fossil energy accounts for more than 85% of China's energy consumption, and the industry still dominates economic development. Hu Angang et al. believes that coping with global climate change is not only the biggest challenge for China to realize socialist modernization, but also the biggest opportunity for realizing green industrialization, urbanization and agricultural and rural modernization [8-9]. The goal of carbon emission peak will help promote China's high-quality development and comprehensive green transformation. Zhang Yaxin et al. proposed to strengthen the research and analysis of carbon neutralization strategies in European Union countries and learn from the advanced technologies of foreign countries, policy measures, and social transformation [10].

Many scholars have discussed the development mode and strategy under the background of carbon neutrality. Zou Caineng et al. proposed that carbon substitution, carbon emission reduction, carbon storage, and carbon recycling are the four main ways to achieve carbon neutralization [11], with carbon substitution as the backbone of carbon neutralization. Zou Caineng and He Dong studied the path of world energy transformation, and pointed out that "new energy" + "smart energy" energy system is the development trend and direction of world energy transformation [12]. Zhou Shuhui suggested that oil and gas enterprises accelerate business transformation and upgrading, as well as promote the coordinated development of the upstream and downstream of the new energy industry chain [13]. Wang Can et al. have pointed out that the technologies supporting carbon neutralization can be divided into high energy efficiency recycling technology, zero carbon energy technology, and negative emission technology. Technological development needs policy support [14,15].

To sum up, the carbon emission peak and carbon neutrality goal provides a direction for China's high-quality economic and social development, and will push China's economic and social development to make a comprehensive low-carbon transition. Under the background of coexistence of opportunities and challenges, the path of carbon reduction has become the focus of discussions.

3. Study on the path of carbon emission peak and carbon neutrality in China

Due to the organic nature of the economic system and the close relationship between the upstream and downstream of the industrial chain, carbon emission reduction needs systematic linkage.

3.1. Carbon emission reduction logic from the perspective of industrial chain

An important source of carbon emissions is the combustion of fossil fuels. As the production and utilization of clean energy still face technical challenges [16], fossil energy will still be the main source of energy supply in China for a period of time [17]. In order to reduce carbon emissions while economic development, on one hand, the fossil energy industry needs low-carbon transformation; on the other hand, it is necessary to

accelerate the development of new energy industry, including the production, storage, transmission, and utilization of new energy, so as to form a new production and service chain.

The production and manufacturing industry produces carbon emissions during its operation. Therefore, it is necessary to pay attention to the key industries of carbon emission such as steel and cement, and reduce carbon emissions by adopting measures such as clean energy, energy conservation, and emission reduction, and developing circular economy. The above measures can promote the low-carbon transformation of process flow, facilities and equipment in relevant industries and the low-carbon innovation of technology. In addition, low-carbon high-tech industries and digital economy have also become development hotspots.

Carbon circulation and consumption also need to be reduced, and digital technology have become effective support conditions for carbon reduction. The logistics industry can use green energy-saving facilities and equipment, and adopt modern information technology to reduce emissions. E-commerce and new retail mode can improve transaction efficiency and reduce carbon emissions through centralized distribution. The development of smart home and other products can reduce the carbon emissions of different living scenarios. The industrial chain carbon reduction logic is shown in **Figure 1**.

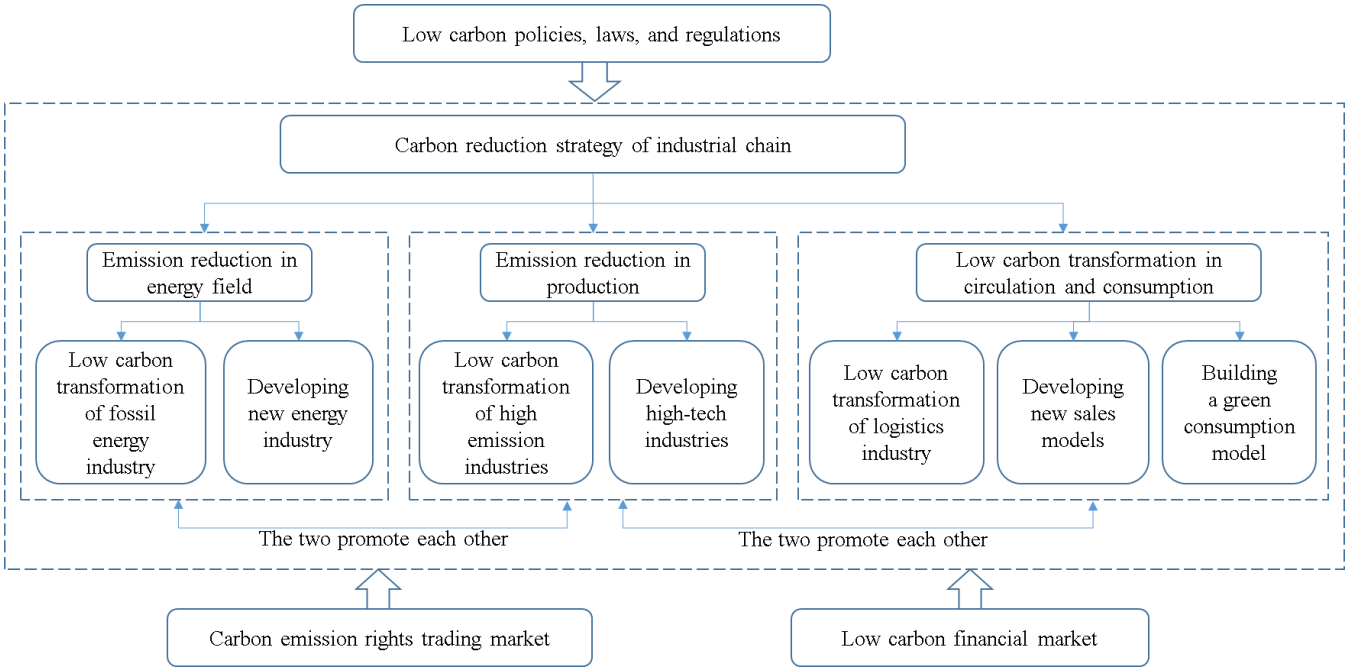

Figure 1. Carbon reduction strategy and logic diagram of the industrial chain

It should be noted that the carbon reduction measures in all links of the industrial chain cannot be separated from policy guarantees, legal constraints and financial support, and also need the help of market.

3.2. Carbon emission reduction strategy based on industrial chain

Based on the analysis above, actions of the entire industrial chain are neeed to reduce carbon emissions, from adjusting the energy structure to reducing carbon emissions in production, circulation, and consumption.

3.2.1. Low carbon reform in energy supply

China’s energy Low-carbon reform should start with the coal industry. Coal accounts for more than 60% of China's energy consumption. Technological innovation can promote low-carbon reform of traditional energy industries and the development of new energy industries. The goal of energy sector reform is to completely replace fossil energy with clean energy. The carbon reduction strategy of China’s energy

industry is shown in **Figure 2**.

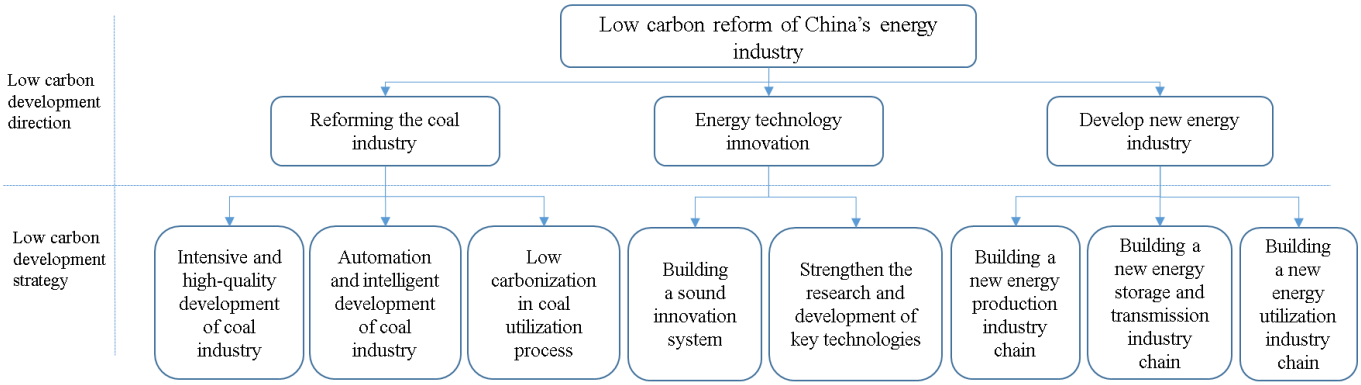

Figure 2. Carbon emission reduction strategy map of China's energy industry

The use of coal energy in the whole society must be reduced, and the production capacity must be increased. The mechanization, automation, informatization, intelligence, and green level of coal mines need to be improved. Large modern coal mines need to become the main body of coal production to build an intensive, safe, and efficient coal industry system. The efficiency of coal utilization should be improved, such as promoting the industrialization of coal deep processing, increasing the proportion of large capacity, high parameter and low pollution coal-fired power generation units in the installed capacity of thermal power, and strictly controlling the planning and construction of coal-fired power generation.

Technology is an important support to promote the low-carbon transformation and upgrading of the energy industry. An energy technology innovation system should be built. Scientific and technological innovation investment in important energy fields and emerging energy industries needs to be increased, and relevant talent teams need to be cultivated. Breakthrough technologies will be needed for safe and green mining of coal, storage and utilization of new energy, and construction of distributed energy system.

To achieve China's carbon emission peak and carbon neutrality goal, it is necessary to accelerate the development of non-fossil energy industries such as solar energy, wind energy, hydropower, nuclear energy, biomass energy, geothermal energy, and marine energy. The development of the industries mentioned involves many links such as energy production, storage, transmission, and utilization. In short, the production and application of new energy need to plan and build a complete industrial chain. The development of new energy industry will not only change the energy structure, but also optimize the industrial and employment structure as the number of relevant employees in China has reached about 4.5 million from 2010 to 2019.

3.2.2. Carbon emission reduction in production

Carbon reduction of the manufacturing industry needs to be accelerated through energy conservation and emission reduction, industrial upgrading, recycling, and other ways [18].

According to various calculations, energy conservation and energy efficiency improvement will contribute more than 70% to China's goal of achieving the peak carbon emission in 2030. China's energy-saving and emission reduction strategy includes the modernization of equipment and management in key industries, the innovation of energy-saving technologies, and the improvement of energy utilization efficiency in key industries. Industrial upgrading and industrial structure adjustment is another important measure to reduce carbon in the manufacturing industry. Suitable carbon reduction strategies need to be formulated for different regions and industries based on development characteristics and plans to realize low-carbon transformation of manufacturing industry. The carbon reduction strategy should also be reflected in the new fixed asset investment. The circular economy strategy adopted by many countries is

also conducive to energy saving and emission reduction of manufacturing industry. In addition, it is necessary to use technical means to implement carbon capture for carbon emissions that are difficult to reduce. Some specific measures are shown in **Table 1**.

Table 1. Main strategies for carbon emission reduction in production

Main strategy	Concrete measure
Energy saving	Modernization of equipment and management in key industries
	Energy-saving technological innovation
	Promoting new energy-saving models
Industrial upgrading and industrial structure adjustment	Implementing specific optimization strategies to reduce carbon according to the characteristics of the industry
	Matching the new fixed asset investment with the goal of reducing energy consumption intensity, promote the development of new energy, new energy vehicles, digital economy
Developing circular economy	Using the concept of circular economy to guide regional development
	Developing and applying the technology of "zero" emission technology and the recycling technology
	Developing environmental protection industry and renewable resources industry
Carbon removal and carbon utilization technology	Adopting point source CCUs Technology
	Adopting biomass energy carbon capture and storage technology
	Adopting air carbon capture and storage technology

3.2.3. Carbon emission reduction in commodity circulation and consumption

The strategies for reducing carbon emissions in the field of commodity circulation and consumption mainly include three aspects: low-carbon logistics, electronic transactions and green consumption.

The main path of low-carbon development of the logistics industry is to promote the integration of digital technology and logistics industry. Specific carbon reduction strategies includes: Firstly, the logistics industry can use information technology support to realize the optimization of logistics schemes, transportation modes and routes, and strengthen cooperation to promote the development of multimodal transport; Second, the logistics industry can information technology to improve the level and efficiency of warehousing management, and promotes warehousing and procurement management modes such as just in time and zero inventory; thirdly, the logistics industry should build an information platform, improve the efficiency of matching logistics supply and demand, and promote centralized distribution, joint distribution and other modes to reduce costs and carbon emissions; fourthly, the logistics industry will strengthen the R & D and application of intelligent transportation related software, hardware and technology, promote driverless and unmanned distribution business, and reduce carbon emissions.

Changes in trading patterns can also reduce carbon emissions. Developing e-commerce can improve transaction efficiency and reduce carbon emissions through nearby transportation and distribution. The information provided by the e-commerce platform can also help consumers judge the carbon emission level. The Ministry of Ecology and Environment reported that online platforms can raise the awareness of the transformation of green and low-carbon and promote certain behaviors under certain conditions, which helps enterprises in reduce carbon emissions in terms of consumer demands.

Some studies show that the consumption oriented economic model reduces carbon emissions by about 35% compared with the export-oriented economic model. Reducing carbon emissions from the consumption side requires consumers to establish a low-carbon consumption concept and develop low-carbon consumption and living habits, such as buying green low-carbon products and services,

strengthening the recycling of waste materials, etc.

3.3. Build an external guarantee system conducive to carbon reduction

Carbon reduction in the industrial chain needs policy support and legal norms, as well as market guidance.

In terms of energy supply, fiscal and tax policies in the energy field need to be improved; energy prices need to be reformed to reflect energy shortages and carbon emission intensity; the government needs to increase research and development support for key technologies in the new energy industry, and accelerate the revision and formulation of energy and environment related laws and regulations to meet the strategic requirements of carbon emission peak and carbon neutrality. In terms of energy consumption, local governments need to formulate differentiated "double carbon" plans. The government will also introduce relevant policies to support energy conservation and emission reduction, industrial transformation and upgrading, circular economy development, etc., and promote and guide a low-carbon lifestyle. In order to obtain financial support, the government needs to guide and encourage financial institutions to participate in carbon emission reduction in the industrial chain [19], such as encouraging financial enterprises to carry out green financial business through fiscal and monetary policies, credit guarantees, risk supervision, and performance assessment. In addition, domestic and foreign experience shows that carbon emission trading is an effective tool to control carbon emissions [20], and the market mechanism can promote enterprise carbon reduction and drive industrial upgrading. Relevant safeguard measures are shown in **Table 2.**

Table 2. External guarantee system for carbon emission reduction in industrial chain

External guarantee system	Domain division	Examples of specific measures
Policies, laws and regulations	Energy policies and regulations	Subsidies related to new energy industry chain
		Supporting policies for transformation of traditional fossil energy industry
		Government energy price reform
		Financial fund for energy technology R & D
	Manufacturing policies and regulations	Regional and industrial carbon peak and carbon neutrality planning
		Circular Economy Promotion Law
		Regulations on comprehensive utilization of resources
		Low carbon industry promotion law
		Government performance appraisal system for energy conservation and emission reduction, circular economy development, new energy utilization
	Circulation and consumption policies and regulations	E-commerce low carbon development law
		Green logistics Promotion Law
		Low carbon consumption regulations
	Investment and financing policies and regulations	National Green Development Fund
		Government green bond
		Fiscal and tax policies for green development
		Green development monetary policy
		Green development risk sharing policy
		Green finance supervision and assessment system
Carbon market	Carbon emission trading system	Accounting and reporting of total carbon emissions
		Allocation and payment of carbon emission quotas
		Regulations on punishment of illegal discharge
		Administrative measures for carbon emission trading

4. Conclusion

The carbon emission peak and carbon neutrality targets are of great significance to China's development in the new stage, which can promote economic transformation and upgrading and form a greener, more efficient and sustainable development model. In order to achieve this goal, carbon reduction strategies need to be implemented in energy production, circulation, consumption, and other fields from the perspective of the entire industrial chain. The main way to reduce carbon emissions is to reduce the use of fossil energy, reform energy supply, and vigorously develop the new energy industry. At the same time, we also need to reduce carbon emissions in energy consumption which can be achieved in the following ways: firstly, implement a carbon reduction strategy in the production field, including energy conservation and emission reduction, industrial upgrading, developing a circular economy, and applying carbon capture technology; Secondly, reduce carbon emissions from the circulation sector, including low-carbon transformation of the logistics industry, innovation of trade methods and promotion of low-carbon green consumption; thirdly, build an external guarantee system for carbon emission reduction in the industrial chain, including the introduction of policies and regulations to encourage and restrict carbon emission reduction in relevant industries, enterprises and individuals, and the improvement and application of the carbon emission trading mechanism.

Funding

Hubei Social Science Foundation Project "Research on the Relationship Between Rail Transit and Intensive and Sustainable Development of Large Cities" (Project number: 2020052)

Disclosure statement

The author declares no conflict of interest.

References

[1] Intergovernmental Panel on Climate Change, 2013, Climate Change 2013: The Physical Science Basis Summary for Policy Makers, viewed July 12, 2022, https://www.ipcc.ch/report/ar5/wg1/

[2] Intergovernmental Panel on Climate Change, 2020, Global Warming of 1.5°C, viewed July 15, 2022, https://www.ipcc.ch/sr15/

[3] Carbon Neutrality Coalition, 2017, Plan of Action: Carbon Neutrality Coalition, viewed July 15, 2022, https://www.carbon-neutrality.global/plan-of-action/

[4] He J, 2019, New Situation of Global Climate Governance and China's Countermeasures, Environmental and Economic Research, 3: 1–9

[5] Yang G, Chang X, (eds) 2020, An Important Speech at the General Debate of the 75th Session of the United Nations (UN) General Assembly, People's Daily Overseas Edition, September 23, 2020.

[6] The State Council, 2021, Opinions of the Central Committee of the Communist Party of China and the State Council on Fully, Accurately, and Comprehensively Implementing the New Development Concept and Doing a Good Job in Carbon Peak and Carbon Neutralization, viewed September 10., 2022, http://www.gov.cn/xinwen/2021-10/24/content_5644613.htm

[7] The State Council, 2021, Carbon Emissions Peak Action Plan Before 2030, viewed September 10, 2022, http://www.gov.cn/zhengce/content/2021-10/26/content_5644984.htm?skinTheme=0

[8] Hu A, 2021, China's Goal and Main Ways to Achieve Carbon Peak by 2030 Journal of Beijing University of Technology (Social Science Edition), 21(03): 1–15

[9] Li J, 2020, Carbon Neutrality, Opportunities and Challenges for China's Development and Transformation, Xinde Marine News, viewed September 15, 2022, https://www.xindemarinenews.com /topic/yazaishuiguanli/24908.html

[10] Zhang Y, Luo H, Wang C, 2021, International Trend Analysis of Carbon Neutrality Action. Research Progress on Climate Change, 17(01): 88–97

[11] Zou C, He D, Jia C, et al., 2021, The Connotation and Path of World Energy Transformation and its Significance for Carbon Neutrality. Journal of Petroleum, 42(02): 233–247.

[12] Zou C, Xiong B, Xue H, et al., 2021, the Position and Role of New Energy in Carbon Neutrality. Petrol Exploration and Development, 48(02): 480–491

[13] Zhou S, Wang J, Liang Y, 2021, The Development of China's Natural Gas Industry in the 14th Five Year Plan Against the Background of Carbon Neutrality. Natural Gas Industry, 41(02): 171–182

[14] Wang C, Zhang Y, 2020, Realization Path and Policy System of Carbon Neutrality Vision. China's Environmental Management,12(06): 58–64

[15] Zhang X, Guo S, Kong H, et al., 2021, Science and Technology Demand and Technology Path of Carbon Neutrality Vision. China's Environmental Management, 13(01): 65–70

[16] The State Council, 2020, White Paper on China's Energy Development in the New Era, viewed September 17, 2022, http://www.gov.cn/zhengce/2020-12/21/content_5571916.htm

[17] Gao J, Jiang K, Liu J, et al., 2017, Scenarios Analysis of the Coal Demand in China Based on LEAP Model. China Coal, 43(4): 23–27.

[18] Liu J, Xiahou QR, Wang K, et al., 2019, Research on the Medium and Long-term Low-Carbon Development Path of China's Industrial Sector. China Soft Science, 2019(11): 31–41 + 54

[19] Chai Q, Fu S, Wen XY, et al., 2019, Research on China's Funding Needs for Implementing the National Independent Contribution to Climate Change by 2030. China's Population, Resources and Environment, 29(4): 1–9

[20] Mackenzie D, 2009, Making Things the Same: Gases, Emission Rights and the Politics of Carbon Markets. Accounting, Organizations and Society, 34(3-4): 440–455. https://www.doi.org/10.1016/j.aos.2008.02.004