

# *Industrial Structure Optimization under the Background of Low-carbon Economy*

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**Abstract:** With the global greenhouse effect intensifying, it is urgent to promote the development of low-carbon economy. The optimization and upgrading of industrial structure plays a significant role in promoting the development of low-carbon economy. Based on the reality of China, this paper studies the relevant representative works and summarizes the contents of four aspects: first, the era background of low-carbon economy, describes the question of why to develop low-carbon economy; second, the analysis of the factors affecting the development of low-carbon economy, answers the question of what affects low-carbon economy; Third, the industrial structure is low-carbon, describing why we should promote the optimization of industrial structure; Fourth, the countermeasures and suggestions for the optimization of industrial structure in the context of low-carbon economy, put forward some suggestions and countermeasures on how to promote the optimization of industrial structure, hoping to be beneficial to the optimization of industrial structure in the context of low-carbon economy.

## **1. The Era Background of Low-Carbon Economy**

In the global context of a low-carbon economy, deployed the active and steady promotion of carbon peaking and carbon neutrality, emphasizing the importance of planning development from the perspective of harmony between humans and nature, and insisting on the concept that green mountains and clear waters are as valuable as mountains of gold and silver. Promoting the development of a low-carbon economy is an inevitable choice [1]. With a vast territory, each province in China has different resource advantages, resulting in significantly different industrial structures. Different energy structures and carbon emission methods lead to differences in the industrial structures of different regions, and each region has its own way of developing a low-carbon economy. Therefore, optimizing different industrial structures in each region is of great significance to the development of a low-carbon economy.

In a significant speech at the 75th United Nations General Assembly, China announced that it will increase its independent efforts, adopt more effective policies and measures, and strive to achieve a peak in carbon dioxide emissions before 2030 and achieve carbon neutrality before 2060. With the increasingly serious problem of climate change, more and more Chinese scholars are conducting in-depth and extensive research on the low-carbon economy.

In China, both the central and provincial governments have a “decentralized governance”

institutional characteristic in policy formulation and implementation. The central government coordinates the overall situation and develops macro directions and goals based on the national situation. Local governments make independent adjustments based on regional resource endowments and practical situations while implementing government policies [2]. When comparing the carbon emissions of industries supported by the central and local governments, it is found that industries supported by the central government have lower carbon emissions, while industries supported by local governments tend to be high-value-added industries, which may be considered for the sake of balancing GDP growth, but also reflect the determination of the central government to promote low-carbon economic development.

From an economic perspective, climate change is a common property of the world, and in the face of global warming, it requires collective action from all countries. In recent years, countries have reached international agreements on energy conservation and emissions reduction, and have clearly defined the responsibility for reducing carbon emissions between developed and developing countries [3]. As the world's largest developing country, China has always assumed the responsibility that a great nation should bear, actively promoting a low-carbon economy, optimizing industrial structure both domestically and internationally, demonstrating China's sense of responsibility and great power diplomacy.

## **2. Analysis of the Factors Influencing the Development of the Low-Carbon Economy**

The low-carbon economy represents a necessary measure in response to the issue of climate change. Therefore, it is vital to conduct a further analysis of the factors influencing the development of the low-carbon economy. Many scholars have provided definitions of the basic connotations of the low-carbon economy. Zhang Kunmin et al. noted that a low-carbon economy is based on the principles of low energy consumption, low emissions, and low pollution. He Jiankun further indicated that the essence of a low-carbon economy lies in enhancing carbon productivity. This means that for each unit of carbon dioxide emitted, a higher GDP production should be achieved, thereby reducing carbon emission intensity. Additionally, Lin Boqiang defined the low-carbon economy as a sustainable economic growth model that considers both development and sustainability. Indeed, as stated by Lin, the low-carbon economy seeks to balance sustainable economic growth while optimizing environmental sustainability. Finally, some scholars have focused on the analysis of carbon dioxide emission intensity as an object of study.

Based on the findings of numerous studies, the decline in China's carbon emission intensity is mainly attributed to a decrease in energy intensity. Given that China's energy structure is primarily focused on coal, recent adjustments to the energy structure have had limited effects on reducing carbon emissions. Nevertheless, in the long term, the development of new and clean energy sources is expected to have a more significant impact on reducing carbon emissions.

Optimization and upgrading of various production factors, including production technology, capital, and labor, within the Chinese industrial system will also impact the development of the low-carbon economy. Additionally, factors such as trade openness and urbanization levels can impact carbon emissions. Although the aforementioned factors all influence carbon emissions, the upgrading of the industrial structure is the core factor in promoting the development of a low-carbon economy from an industrial system perspective [4]. China's industrial system is a complex and integrated collection that is not only affected by the national level but also disparate by the provinces and cities. Therefore, the development of a low-carbon economy must focus on optimizing and upgrading the industrial structure. This optimization and upgrading must be considered at both the national and provincial/city levels.

Per capita GDP is an important factor that impacts carbon emissions, and the steady growth of

China's per capita GDP also suggests that carbon emissions might continue to rise. Although China's GDP carbon intensity reduction target is the same as that of developed countries, the nature of this target is entirely different. Developed countries have approached the limit of economic growth and, thus, aim to achieve an absolute reduction in carbon emissions [5]. In contrast, China's carbon emission intensity target is closely related to GDP, and carbon emissions can be directly controlled by improving GDP or reducing carbon emissions.

### **3. Low Carbon Industrial Structure**

The study by Sheinbaum et al. showed that countries such as Argentina, Mexico, Brazil, and Colombia successfully reduced industrial energy use intensity and carbon emissions by utilizing relevant strategies and increasing the use of clean energy after the Kyoto Protocol conference. Under the background of a low-carbon economy, the optimization and adjustment of the industrial structure were promoted. This success effectively demonstrated that industrial structure adjustment is a key factor in developing a low-carbon economy. By utilizing technological progress to optimize and upgrade the industrial structure, carbon emissions in the region were successfully reduced.

According to Kuznets' theory, the economy can be divided into three sectors: the primary sector, represented by agriculture; the secondary sector, represented by industry; and the tertiary sector, represented by services. As the economy develops, the composition of the labor force transitions from the primary to the secondary sector, and eventually to the tertiary sector. China's industrialization has made significant progress, and urbanization levels continue to rise. As a result, the share of GDP attributed to the primary sector has continuously declined, while the share of the secondary sector increased and then decreased during certain periods [6]. In recent years, the share of the tertiary sector has begun to rise, but the secondary sector still occupies the highest proportion of GDP.

Although China's industrialization is beginning to shift toward higher quality, the share and output of the tertiary sector still lags far behind developed countries. In the past, China's industrial structure optimization relied more on labor, energy and capital input, while there were obvious deficiencies in critical technology and knowledge. This is also related to China's resource advantages and stage of economic development.

Currently, China's consumption structure, compared with developed countries, is characterized by low per capita capital stock, which indicates that China's energy demand has not yet peaked and will continue to grow at a relatively high rate. As a result, China is still in the rising period of carbon emissions before reaching peak carbon. Without further industrial restructuring, GDP growth will continue to be accompanied by high carbon emissions, as the energy structure still relies heavily on coal. Moreover, adjusting the industrial structure can rapidly reduce energy demand, based on China's current energy consumption structure. Developed countries have maintained high GDP growth rates while significantly reducing industrial energy consumption and carbon emissions, mainly because their economies focus on high-tech industries. Statistical data reveals that there is still a significant gap between China and developed countries in terms of the proportion of high-tech manufacturing and the contribution of the tertiary sector to the economy. Therefore, increasing the proportion of high-tech manufacturing and the service industry, further restricting the energy demand of high energy-consuming industries, and ensuring the stable operation of the social economy while conserving energy and reducing emissions, are essential.

### **4. Countermeasures and Suggestions on Industrial Structure Optimization under the Background of Low-Carbon Economy**

The goals of achieving "peak carbon emissions" and "carbon neutrality" differ from those of the past because they are more specific and favorable to realization. The requirements of a low-carbon

economy will penetrate deeply into industrial development, energy structure, and even the daily lives of residents. In order to optimize China's industrial structure, reduce carbon emissions, and attain peak carbon, industrial restructuring must be implemented from four aspects: promoting high-tech advancement in industrial structure optimization, reducing energy consumption through high-tech, low-carbonization of industrial production processes, and promoting low-carbon consumption at the industrial demand level. These strategies will support the development of low-carbon economy.

#### **4.1. Promoting High-Tech Advancement in Industrial Structure Optimization**

The upgrading of industrial structure is reflected in the development of industries with high value-added and advanced technologies. Typically, lower-level industrial structures are dominated by labor-intensive and resource-intensive industries, which often result in high carbon emissions. In contrast, technology-intensive and knowledge-intensive industries are mainly characterized by low-carbon emissions [7]. High-tech industries can accelerate the replacement of high-carbon emission industries with low-carbon emission industries.

High technology can also promote products to achieve high added value. In the case of manufacturing industry products, high added value mainly consists of surplus value and profits. High technology can accurately obtain consumer demand and provide personalized services for consumers through user profiling. Precise data can enable manufacturers to produce goods that meet consumer needs, thus enabling manufacturers to obtain higher profits.

#### **4.2. Reducing Energy Consumption through High-Tech**

China still relies heavily on coal for its energy structure, making it difficult to develop a low-carbon economy, hence there is an urgent need to increase the proportion of clean energy sources.

High-tech can accurately calculate energy demand and real-time monitor carbon emissions, reduce energy consumption, and promote the rational use of energy. By employing high-tech, the supply and demand of energy can be reasonably allocated, and the energy output and consumption in the production process can be accurately matched [8]. In addition, high-tech can also be used to timely monitor and record energy consumption, making it easier to develop optimized production processes with higher energy utilization rates.

Through high-tech, carbon emissions can be monitored in real-time, and emitted carbon dioxide can be detected, allowing for negative carbon emissions through agricultural and forestry carbon sinks, carbon capture, utilization, and storage technologies to repair damaged ecosystems and reduce carbon emissions.

#### **4.3. Low-carbonization of Industrial Production Processes**

Integrating high-tech into the existing industrial structure enables greener and low-carbon research and development phases and production processes. By replacing traditional production factors with more green production factors, it is possible to promote further industrial low-carbonization [9]. Traditional production factors mainly include land, capital, labor, technology, resources, etc., with a focus on industrial technology and mainly targeting production processes, but not able to exert macro control over the entire production process. Emerging new technologies, such as big data, artificial intelligence, etc., have strong permeability and shaping power over capital and labor, which can play a revolutionary role in the production process by accurately calculating the production requirements and reducing the unnecessary input of traditional production factors.

## 5. Conclusion

Greenhouse gases have the basic attributes of global public goods, and the realization of low-carbon transformation and development of the global economy is inseparable from coping with climate change. The key to the international coordination mechanism is to build a global responsibility system based on the allocation of carbon emission quotas in various countries. International climate change agreements such as the United Nations Framework Convention on Climate Change, the Kyoto Protocol and the Paris Agreement advocate "a total of "The principle of common but differentiated responsibilities". Based on the reality of China's development, China scholars share the responsibility of international carbon emission reduction in response to global climate change. Actively voiced China's voice and put forward China's plan on the issue, which enriched and deepened the principle of "common but differentiated responsibilities".

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