Opportunities and Challenges of China's Low-Carbon Economic Development in the New Era

Zhang Chen1,*, Tong Yixuan2
1,2 Lanzhou University of Technology School of Economics and Management, Lanzhou, Gansu, China

Abstract. In the context of the increasingly severe global greenhouse effect, the "14th Five-Year Plan" proposes to "promote green development and promote harmonious coexistence between man and nature", which provides a new platform for the faster and better development of low-carbon countries. The low-carbon economy has entered a high-quality stage of China's economic development in the new era, which is of great significance to the overall green transformation of China's economic and social development. In order to assess the development level of China's low-carbon economy, this paper estimates the carbon emissions and carbon emission intensity of energy consumption from 2008 to 2017 and applies the LMDI model to decompose the influencing factors of carbon emissions, analyzes the contribution rate of driving factors, and proposes energy saving, emission reduction and low carbon. Developmental countermeasures. The results show that economic growth and energy intensity are the biggest driving factors for promoting and suppressing carbon emissions, respectively. Measures are taken to improve energy structure, increase utilization efficiency, develop low-carbon industries, and promote low-carbon life.

1 Introduction

The global greenhouse effect is becoming increasingly serious. Therefore, reducing the impact of greenhouse effect and promoting the transformation from high carbon to low carbon are not only the responsibilities of all countries, but also the important ways for governments to improve their international influence. Chinese President Xi Jinping delivered an important speech on September 22, 2020, in which he pointed out that China will increase its nationally determined contribution, strive to peak its carbon dioxide emissions by 2030, and strive to be carbon neutral by 2060. The "fourteenth five-year plan" period is an important strategic stage of China's economic development and ecological civilization construction. China should adhere to the concept of "green water and green mountains are golden mountains", accelerate green and low-carbon development, vigorously improve environmental quality, improve ecosystem quality and ensure ecosystem stability, vigorously build ecological civilization, and promote the transformation of economic and social development to comprehensive green development.

2 Research method

2.1 Data source

We selected 30 provinces, municipalities, and autonomous regions in my country as the research area (the data of Hong Kong, Tibet, Taiwan and Macau are defaulted). The energy consumption, GDP, population and other data required for the calculation come from the China Energy Statistical Yearbook 2009–2018 and the National Bureau of Statistics Statistical Yearbook.

2.2 Methodology

Based on the basic model of factor decomposition method, the factors affecting carbon intensity and decoupling state are decomposed into factors of energy structure, economic development, and population scale [1]. The calculation model is constructed as:

$$C_i = E_i \times \frac{E}{GDP} \times \frac{GDP}{P} \times \sum_{i} (F_i \times S_i \times I \times G \times P) (1)$$

In formula (1), C represents the total carbon emissions; Ci represents the carbon emissions of energy i; Ei represents the consumption of energy i; E represents the total energy consumption; P represents the number of people; Fi represents the carbon emission coefficient of i energy; Si represents the ratio of i energy to the total energy consumption, that is, the energy structure; I represents energy intensity, which reflects the effective utilization of energy; G represents per capita GDP, which reflects the level of economic development.

Using multiplication and integration solution, addition and decomposition, the carbon emission changes from the "0" period to the "T" period are decomposed, the formula is:
\[
\Delta C = C^T - C^0 = \sum_{0}^{T} (F^T \times S^T \times G^T \times P^T) - \sum_{0}^{T} (F^T \times S^T \times P^T = \Delta F \times \Delta S + \Delta I + \Delta G + \Delta P \quad (2)
\]

Assuming that the energy carbon emission coefficient remains unchanged from period “0” to period “T”, the model can be decomposed into:

\[
\Delta S = \sum (\ln c_i^T - \ln c_i^0) \times \ln \frac{s_i^T}{s_i^0},
\]

\[
\Delta I = \sum (\ln c_i^T - \ln c_i^0) \times \ln \frac{i_i^T}{i_i^0},
\]

\[
\Delta G = \sum (\ln c_i^T - \ln c_i^0) \times \ln \frac{g_i^T}{g_i^0},
\]

\[
\Delta P = \sum (\ln c_i^T - \ln c_i^0) \times \ln \frac{p_i^T}{p_i^0} \quad (3)
\]

The calculation formula of the contribution rate of each factor is:

\[
m_1 = \frac{\Delta S}{C^0} \times 100 \%,
m_2 = \frac{\Delta I}{C^0} \times 100 \%,
m_3 = \frac{\Delta G}{C^0} \times 100 \%,
m_4 = \frac{\Delta P}{C^0} \times 100 \% \quad (4)
\]

In formula (4), m1 is the contribution rate of energy structure, m2 is the contribution rate of energy intensity, m3 is the contribution rate of economic growth, and m4 is the contribution rate of population size.

2.3 Analysis on the driving factors of low-carbon economic development

The LMDI model is used to analyze the influencing factors of my country's energy carbon emissions from 2008 to 2017, and the contribution values and contribution rates of energy structure, carbon emission intensity, economic growth, and population scale factors are respectively measured.

From the calculation of formula (3), it can be seen that the changes in carbon emissions caused by energy structure and energy intensity factors from 2008 to 2017 are negative growth, and economic growth and population scale factors are positive growth. In addition to energy intensity and economic growth, economic growth has the largest positive contribution rate to carbon emissions, followed by use, which is a negative driving factor; economic growth and population scale factors play a promoting role, which is a positive driving factor; energy intensity and Economic growth is the biggest driver of changes in carbon emissions.

3 Opportunities facing the development of China's low carbon economy

3.1 Green "One Belt And One Road" was vigorously developed

Whether from the Paris climate change agreement to the full implementation of the United Nations framework convention on climate change, or advocate green "area" to participate in global ecological and environmental governance, China has been trying to bear a big responsibility, especially for green "area" initiative is to guide the development of China's low - carbon economy in the new era [2].

The Green Belt and Road Initiative provides a platform for enhancing innovation capacity in low-carbon technologies. Promoting the construction of "area" the special planning of science and technology innovation cooperation, emphasis on scientific and technological innovation in the importance of "area", this will be closely along the world, to enhance communication technology innovation, make development idea is same, factors flow unimpeded, science and technology facilities unicom, innovation chain financing, the innovation of the personnel exchanges shun tong community, The ideas and key areas of technical cooperation have been clarified.

3.2 Steady progress was made in building a national carbon emission trading market

The carbon emission trading market guides the rapid development of the low-carbon industry. In order to achieve the carbon emission reduction target, China has carried out carbon trading on a pilot basis since 2013, and the carbon emission trading mechanism has been formally applied in China's carbon emission reduction work, accumulating experience for the establishment of a national carbon emission trading market in China.

Carbon emission trading market promotes market-oriented reform in the energy sector. In order to improve energy efficiency and enhance the international competitiveness of the energy industry, China carries out market-oriented reform in the energy sector. On the premise of ensuring energy security, China should give full play to the role of market mechanism in resource allocation and introduce effective competition mechanism to better meet the increasing demand for energy in China.

4 Challenges facing the development of China's low carbon economy

4.1 The COVID-19 outbreak impedes the development of a low-carbon economy

The outbreak of COVID-19 caused a global economic downturn. In October 2020, the International Monetary Fund predicted that the global economic growth rate would shrink by 4.4% in 2020. Globally, although CO2 emissions have been significantly reduced in the short term due to the COVID-19 epidemic, the economic downturn is bound to increase the risk of a return of high-carbon, high-pollution economic activities in the future. [3]

As economic growth slows sharply, the primary goal of all countries is to stimulate economic growth, and the low-carbon economic development plan will be put on hold. Therefore, coordinating the relationship between economic recovery and carbon emission reduction after the epidemic is a new challenge for the development of low-carbon economy in China.
4.2 The "high carbon" economy still dominates

Figure 1 shows China’s energy consumption structure in 2019. It can be seen from the figure that China’s energy structure is dominated by coal. Although China is rich in clean energy such as hydro power, wind power and solar power, the research and development of clean energy needs much money and the imported technology is very expensive, which makes the promotion of clean energy difficult. The lack of advanced technology makes the unit energy consumption of high-energy products in China higher than that of developed countries.

![Figure 1. China’s energy consumption structure in 2019](image)

4.3 The low carbon economic system needs to be improved

The "fourteenth five year plan" emphasizes that "green water and green mountains are golden mountains and silver mountains". Development should respect and conform to the natural environment, and more importantly, protect nature. This requires the rapid development of green economy, so as to promote the harmonious coexistence between man and nature. Accelerate green and low-carbon development, provide strong legal and policy guarantee for green development, promote the development of green finance industry, promote the innovation of green technology, promote clean production mode, develop environmental protection industry, and promote the green transformation of key industries and key fields. China need to change the energy structure, promote the development of energy utilization in the direction of cleaner, low-carbon, safe and efficient, reduce the intensity of carbon emissions, and gradually achieve the peak of carbon emissions in different regions. We should continue to improve environmental quality, raise public awareness of environmental protection, and resolutely fight against pollution prevention and control. We should attach great importance to the control of new pollutants, fully implement the emission permit system, and promote the market-oriented trading of emission rights and carbon emission rights. We will strengthen the management of environmental protection, energy conservation and emission reduction by binding objectives, and establish and improve the central regulatory system for ecological environmental protection. In the new era, the development of China’s low-carbon economy should protect the ecological environment, grasp the national policy dividend, and take the green development oriented high-quality development road.

5 Suggestions for the development of low-carbon economy in the new period

5.1 Adhere to the concept of green development and pay close attention to policy benefits

With the promulgation of the "14th Five-Year Plan", all provincial and municipal plans will further release policy dividends. Emissions trading market, deepen the pilot work of low-carbon provinces and cities, and improve the local capacity to respond to climate change. This means that related industries in the field of environmental protection and clean energy will face new opportunities, and more companies need to continuously improve their technological innovation capabilities and actively undertake the obligation of energy conservation and emission reduction in order to better seize opportunities and usher in better development of. The Belt and Road Initiative should be implemented in all directions to make full use of policy advantages. We should turn challenges into opportunities, coordinate the prevention and control of epidemics, gradually resume normal work and production, initiate a sustainable low-carbon economic stimulus plan, and guide the development of green and low-carbon industries.

5.2 Improve the economic system and create an atmosphere for low-carbon economic development

China’s low-carbon economic system is still in the exploratory stage, and there are many areas to be improved. We should learn from advanced international experience and combine China's actual conditions to continuously improve the economic system. On the one hand, China will accelerate the development of a low-carbon economy, provide institutional guarantees for development, and improve the energy-saving target responsibility system and energy-saving evaluation system. On the other hand, fiscal investment in low-carbon economy should be increased, fiscal budgets should be formulated to promote the development of low-carbon economy, special budget funds should be increased, investment in green environmental protection industries and new developments should be increased. In addition, many developed countries such as the United States and the United Kingdom have implemented carbon taxes and mining taxes, and have introduced preferential policies for low-carbon taxes. China can consider reforming the environmental protection tax and formulate a plan to incorporate carbon tax into the environmental protection tax or a separate carbon tax system. Drawing on the advanced experience of foreign countries, China should speed up the establishment of a low-emission tax
carbon tax system, while continuously optimizing low-carbon tax preferential policies, and give full play to the role of the carbon emission tax system in guiding corporate technological innovation and regulating corporate carbon emission reduction behavior.

5.3 Promote the development of a green financial system with diversified investment and promote the development of low-carbon technologies

The green financial system plays an important role in the development of a low-carbon economy. The government should play a guiding role to help attract enterprises and the public to actively participate. It should also provide financial support to enter the field of green finance and ensure a good connection between green finance and the market. Establish a sound green financial investment return and supervision mechanism. China will accelerate the formation of a diversified investment green financial system with government investment as the mainstay and corporate and public investment as a supplement, accelerate the research and development of low-carbon technologies, and accelerate the innovation and development of China's low-carbon technologies.

5.4 Optimize the energy mix and increase energy efficiency

In the new era of high-quality economic development, China must optimize its energy structure and improve energy efficiency in a green and low-carbon economy. The focus of optimizing the energy structure is to strictly control coal consumption and pay attention to the complementarity of various energy sources. By improving energy efficiency to reduce carbon emissions, China will continue to reduce and prevent excess coal and petrochemical energy production capacity, and gradually form a new situation of various energy supply. Promote industrial development through technological innovation, and continuously improve resource utilization efficiency through the development of high-efficiency and low-energy products. Reduce the energy consumption of product production.

6 Conclusion

Energy intensity and economic growth are the biggest driving factors for changes in carbon emissions. Reducing energy intensity and improving energy structure can curb the growth of carbon emissions. Changing economic growth patterns and improving the cultural quality of the population can reduce the growth of carbon emissions. Therefore, improving energy structure, improving utilization efficiency, developing low-carbon industries, and promoting low-carbon life are effective countermeasures to promote the development of a low-carbon economy and accelerate the realization of sustainable strategies.

References

1. Li Xin, Shi Jianping, Wang Chengling. (2020) Study on the development level and driving factors of low carbon agriculture in Sichuan Province. Journal of Northeast Agricultural Science, 45:77-82.
2. Fan Jinlu. (2017) Research on clean coal technology system in China under the background of energy revolution. Coal Economics Research, 11:11-15.
3. Wang Ke, Lu Mei, Wang Qingqing. (2020) Impact of COVID-19 on carbon dioxide emissions in China. Journal of Beijing Institute of Technology: Social Science Edition, 4:11-16.
4. Du Xinjie. (2019) "One Belt And One Road" Science and Technology Innovation Cooperation: Current Situation, Impact and Prospects. Accounting Learning, J, 31: 6-7.
5. He Xiujia. (2020) The status quo, problems and strategies of China's environmental protection industry "going out" under the background of green "Belt and Road". Practice of Foreign Economic and Trade, J, 7: 20-24