

Reasons, Economic Instruments and Suggestions for China to Achieve Carbon Neutrality

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ABSTRACT: China's declaration to the international community that it will reach a carbon peak by 2030 and a carbon neutral by 2060 is of great significance to the global promotion of the objectives of the Paris Agreement and the improvement of climate issues, and has a positive and far-reaching impact on China's high-quality development. This paper explains the origin, reason and solutions of carbon neutralization, and analyzes the high-quality development opportunity of carbon peak towards carbon neutralization and the net zero carbon transformation and development in the new era of ecological civilization. To achieve carbon neutrality, we need to control greenhouse gas emissions from the source. Economic instrument is one of the important means, such as carbon pricing and carbon tax. Finally, it puts forward policy suggestions on carbon neutralization, such as the zero carbon technology, green finance and building circular economy.

1. Introduction

In recent years, with the rapid development of China's economy and the acceleration of urbanization, the demand for fossil energy represented by coal and oil has increased rigidly. The climate problem caused by carbon emission is one of the bottlenecks restricting China's economic and social development, and the task of developing low-carbon economy is arduous. As the international community pays more and more attention to the issue of global warming, the issue of climate change has gradually evolved into an issue of international politics and relations and social development, which is related to the future of the country, the status of the international community and the happiness of the people.

Therefore, China pays more and more attention to climate issues. In particular, in September 2020, President Xi Jinping delivered an important speech at the general debate of the seventy-fifth UN General Assembly. He said that "China will increase its national independent contribution, adopt more effective policies and measures, strive to reach the peak of carbon dioxide emissions by 2030 and strive to achieve carbon neutrality by 2060"[5].

In 2021, the State Council took carbon neutralization as one of the eight major economic tasks and issued a series of "green" measures, including increasing the proportion of new energy vehicles, starting the green development fund, promoting the development of green finance, strengthening the mandatory disclosure of environmental information of listed companies and bond issuing enterprises, etc.

At a difficult time when the global climate problem is becoming increasingly prominent and the climate negotiations are tugging at each other, the launch of the carbon neutral and long-term goal shows China's determination to play a big role, adhere to the concept of sustainable development and develop a low-carbon economy, points out the direction for China's future low-carbon transformation, and helps to boost the confidence of all countries, especially developing countries, in coping with climate change, Inject new political vitality into the solution of the international climate problem[15].

However, as the largest developing country in the world, China is still in the stage of deepening industrialization and urbanization. The demand for fossil energy maintains a rigid growth. The time window for achieving carbon peak and carbon neutralization is tight and the work task is heavy.

2. Literature Review

A large number of scholars and teams in the world have predicted the effects of carbon neutralization. The special report on global temperature control of 1.5 °C issued by the Intergovernmental Panel on climate change (IPCC) points out that achieving a global temperature rise of less than 1.5 degrees is expected to avoid the irreversible negative impact of climate change on human society and natural ecosystem, This requires the efforts of countries around the world to reduce the global net anthropogenic CO₂ emissions by about 45% in 2030 compared with 2010, and to reach net zero around 2050[18]. The Institute of climate change and sustainable development of Tsinghua University has demonstrated that China's carbon neutralization target in 2060 meets the requirements of the 1.5 °C temperature rise control target[15]. The achievement of this target will effectively alleviate the global temperature rise trend and reduce the global temperature by about 0.2 ~ 0.3 °C than expected[19].

Achieving carbon neutrality requires close cooperation and coordination between the government and the market, and balances the relationship between the “double carbon” goal and multiple goals such as stable economic development, energy conservation and emission reduction technology innovation. Gao Yang (2021) believes that under the requirements of the “double carbon” goal, the annual growth rate of carbon emission quota will gradually slow down or even reduce the quota, which means that the amount of quota available for transfer will be tightened. If other conditions remain unchanged, the price of carbon emission right will show an upward trend. However, the unilateral rise of carbon emission rights is expected to contain large market risks, and the cost of enterprise emission reduction is too high, which is unfavorable to steady economic growth and price stability[1]. The development of carbon derivatives market can promote the activity of carbon trading. However, scholars such as Gao Yang (2021) believe that the forward price signal provided by the carbon emission right futures market can avoid the defects of spot signal and guide the effective allocation of resources. However, the expectation of unilateral market is easy to be amplified by the highly leveraged futures market, and there may even be the risk of “more short pressure”[2].

Zhang Yichi, Mou Xiaoyi (2020) the path of low-carbon energy transformation is not unique. Energy policies should be formulated in full combination with domestic resources and industrial characteristics; policy support combined with market competition can accelerate the development of new energy industry and reduce transformation costs[3].

Liu Yong, Zhu Yu (2019), Yang xubiao, Zhu Liping (2015) studied the methods of carbon emission reduction or carbon neutralization in aviation industry [11] [16].

Cao Shuyan, Huo Tingting et al. (2014) sampled 63 villages and found that 90% of them have carbon neutralization potential, but need policy support and incentive[8].

3. The Development of Carbon Neutralization in the World

3.1 Origin of Carbon Neutralization

The UK put forward the concept of carbon neutralization in PAS 2060 specification on carbon neutralization commitments issued in 2010[12]. Legal entities and individuals measure their own direct or indirect greenhouse gas emissions within a certain period of time, which mainly refer to carbon containing gases, such as carbon monoxide and carbon dioxide, and then offset them by means of afforestation, production and living emission reduction and the development of zero carbon technology, so as to achieve the goal of zero emission, that is, the goal of carbon neutralization. To achieve this goal, there are generally two methods: carbon emission compensation method, which removes greenhouse gases such as carbon dioxide and carbon monoxide by afforestation and adsorption, such as afforestation in some cities in China; Second, use carbon free energy. For example, use solar energy, hydrogen energy and other energy to reduce carbon emissions.

3.2 The Development of Carbon Neutralization in the World

Since the industrial revolution, the human impact on the global ecosystem has reached a degree that can not be ignored. With the continuous upgrading of environmental constraints and climate warming, it has become a world consensus to balance the increasing contradiction and pressure of ecosystem.

In December 2015, the Paris climate agreement was officially signed. Its core goal is to control the global temperature rise within 2 degrees Celsius and strive to control it within 1.5 degrees Celsius. To achieve this temperature control goal, countries around the world need to make efforts to reduce emissions. Among them, global greenhouse gas emissions will be halved by the 1930s and reach net zero emissions by the middle of this century, that is, carbon neutralization.

By the end of 2020, the European Union, Japan and South Korea have announced to achieve carbon neutralization in the middle of the 21st world, and more than 100 other countries have also made carbon neutralization commitments. In December 2020, US President elect Joe Biden said that the United States would return to the Paris climate agreement and appoint a special envoy for climate change to take charge of this matter, so as to promote the process of dealing with global climate problems[17]. In December 2019, the EU launched the European Green agreement, proposing to achieve the goal of zero net emissions by 2050 and a set of climate and environmental policies[9]. In March 2020, the European Commission issued the draft of the European climate law, launched a new green deal, and promoted the gradual legalization of European carbon neutrality, so as to support Europe to become the first “climate neutral” continent in 2050[10].

In order to achieve the goal of carbon neutralization, western countries have taken great efforts to develop clean energy, such as wind energy, solar energy, hydrogen energy and other renewable energy, build a recycling society in Japan, and realize recycling by waste classification. Develop green finance, finance green industries and reduce financing for coal. Carbon pricing and carbon tax are used to control carbon emissions. By the end of 2019, more than 60 national and regional governments have priced or taxed carbon emissions through the emission trading system, covering more than one fifth of global greenhouse gas emissions, involving a total amount of about US \$45 billion[7].

4. Carbon Neutralization in China

4.1 Reasons of Carbon Neutrality for China

A large number of observation results and theoretical studies have shown that the climate is indeed changing, causing floods, melting of the Arctic Ocean and gradual rise of sea level, which affect people's life and living environment. China has a very long low-altitude coastline. Many developed cities are located in low-lying coastal areas with dense population and rising sea level, which have a great impact on the survival and development of these developed cities and can not be ignored. At the same time, climate problems will affect crop production. As a populous country, this impact is also great. In terms of energy, China has long relied on carbon resources such as coal and oil, which are non renewable resources and will be exhausted sooner or later. However, China is rich in hydraulic, solar and wind resources, so it is necessary to replace carbon energy. From the perspective of international relations, China's rise needs to play a leading role in some aspects. It has launched an unprecedented global green revolution to drive countries to achieve their emission reduction targets ahead of schedule. This is consistent with the goal of modernization in the middle of this century. The world is a community, and China's interests are highly consistent with the interests of all mankind. It has been pointed out that the achievement of China's carbon neutralization goal in 2060 will effectively alleviate the global temperature rise trend and reduce the global temperature by about 0.2 ~ 0.3 °C than expected . In terms of changing the mode of economic growth, the long-term extensive growth mode, low efficiency, environmental pollution and the development of carbon neutralization are conducive to improving the utilization efficiency of energy and resources, promoting the improvement of total factor productivity and supporting the long-term growth momentum. Green energy can replace oil and gas imports and save foreign exchange. Improving the electrification of industry, construction and transportation driven by green electricity can get rid of environmental constraints, reduce carbon emissions, alleviate the pressure on energy import security, save foreign exchange, and can be more used to introduce talents, technologies and purchase services. Increasing trade competitiveness and developing carbon neutral mark products can reduce the strategic risk of future trade and investment conflict, reduce trade barriers and provide a stabilizer to hedge geopolitical tensions. The EU has repeatedly raised the issue of “carbon boundary”. In the future, carbon emission intensive products of various countries are likely to be subject to carbon tariffs in international trade, which directly leads more and more countries and even enterprises to consider measures to control carbon to reduce tariff risk.

Coping with climate change is an inherent requirement of China's sustainable social development and an international obligation of a responsible big country. The goal of carbon neutrality is also set by ourselves, not imposed by other countries. By assuming the responsibility of a big country, China should force the transformation of domestic energy and development mode.

4.2 Development of Carbon Neutralization in China

According to the requirements of China's economic and social development and the carbon neutralization commitment made at the United Nations General Assembly, China's carbon neutralization path can be divided into four stages, namely, the carbon peak period from 2020 to 2030, the platform period from 2030 to 2035, the decline period from 2035 to 2050 and the neutralization period from 2050 to 2060[17].

China has a large population, large consumption of carbon resources and high greenhouse gas emissions. Zero carbon technology is still in its infancy[9].

The implementation guide for “carbon neutralization” of large-scale activities (Trial) issued by the Ministry of ecology and environment in June 2019 standardizes the Standard Guide for carbon neutralization of large-scale activities. The implementation guide stipulates that greenhouse gas emissions from large-scale activities can be offset by purchasing carbon quotas, carbon credits or carbon sinks generated by new forestry projects[12].

In October 2020, the Ministry of ecological environment, the development and Reform Commission, the people's Bank of China, the China Banking and Insurance Regulatory Commission and the China Securities Regulatory Commission jointly issued the guiding opinions on promoting investment and financing in response to climate change, and put forward the development goals for 2022 and 2025[13]. From a financial perspective, Promote low-carbon transformation. We should improve the climate investment and financing system as soon as possible, establish Climate Investment and financing standards in line with international standards, and strengthen the disclosure of green investment and financing information[13].

One belt, one road, is to help foreign investment, such as South China cooperation and the “one belt road” process, regardless of the aid behavior of the development fund or the overseas investment behavior of the enterprises, integrate the green investment concept, provide norms and guidelines for foreign aid and overseas investment, so as to reduce the risk of Climate Investment and help developing countries achieve green development and green prosperity.

4.3 Difficulties Faced

China faces more difficulties and challenges in achieving carbon neutrality than developed countries. Developed countries in Europe and the United States spend 40-60 years from the peak of carbon emissions to the promised carbon neutralization, while China takes about 30 years to complete this process, so it is facing greater challenges. In terms of resource endowments, fossil fuels account for a high proportion in China's energy structure, and carbon emissions will naturally be carried out, so the transformation is not easy. China's per capita GDP has just reached about \$10,000. It is a developing country. The development of industrialization and urbanization will continue. In the future, economic development will continue to grow, and energy consumption will continue to grow. Advanced technologies in carbon neutralization, such as carbon capture, collection and storage, have not been popularized. To achieve carbon neutralization and negative emission, biomass energy plus carbon capture, collection and storage (beccs) technology is needed, which involves population, land and other constraints. Regional economic development and resource endowments are also different, and some regions are facing great difficulties. In addition, China also faces the challenge of international pressure. After China put forward the goal of carbon peak and carbon neutralization, the international community first cheered, but then there was public opinion questioning the time point of China's carbon peak and carbon neutralization. All these need to strengthen interpretation, cooperation and mutual trust.

5. Economic Instruments to Achieve Carbon Neutrality

5.1 Carbon Price

To achieve carbon neutrality, we need to control greenhouse gas emissions from the source. Therefore, countries have formulated relevant policies, which are generally divided into three categories: command control, economic stimulus and persuasion and encouragement. Among them, economic stimulus means are favored by all countries because of their good flexibility and continuous improvement. Among the means of economic stimulus, the most important is the carbon pricing mechanism. Based on the principle of “polluter pays”, if you want to emit CO₂ and other greenhouse gases, you should first obtain the right to carbon emission, and then pay for this right. This process is called carbon pricing.

At present, the international carbon pricing mechanism is generally divided into two types: one is the mandatory means of the government, that is, the imposition of carbon tax; The other is to establish a carbon emission trading system through market means. The two mechanisms have

essential differences in emission reduction mechanism: carbon tax refers to the carbon price specified by the government and the final emission level determined by the market, so the final emission is uncertain; Carbon emission trading system means that the government determines the final emission level and the market determines the carbon price, so the carbon price is uncertain. Based on the above differences and practical experience of various countries, the introduction of carbon tax is more suitable for controlling small and micro emissions, and the carbon emission trading system is suitable for controlling enterprises or industries with large emissions. Of course, these two policies can be combined. At present, China adopts a carbon pricing mechanism to realize carbon emission and carbon neutralization commitments. Of course, it does not rule out the imposition of carbon tax in the future as a supplementary way.

Internationally, as of April 2020, there are 31 parties to the international climate agreement with carbon emission trading policy in the world, and the rest include the European Union, South Korea, California, etc. There are 30 contracting countries implementing carbon tax policy, mainly located in northern Europe, Japan and Canada.

5.2 Carbon Market

Carbon emission trading market refers to a market in which carbon emission rights are publicly traded as the object of assets. In other words, the core of carbon trading is to “cost” carbon emissions, turn carbon emissions into a paid production cost element with the help of market forces, and circulate carbon emission rights as valuable assets in the market.

At the initial stage of establishing the carbon trading market, the government determined the overall emission reduction target and adopted the quota system. First, the initial carbon emission rights were allocated to the enterprises included in the trading system in the primary market. The enterprises can use them themselves or freely trade these carbon emission rights in the secondary market. Secondly, due to economic incentives and advanced emission reduction equipment, that is, enterprises with relatively low emission reduction costs will take the lead in emission reduction, sell the remaining carbon emission rights in the carbon trading market and sell them to enterprises with relatively high emission reduction costs, that is, they will obtain additional benefits. Enterprises with higher emission reduction costs also reduce the cost of carbon emission compliance. In the micro decision-making of enterprises, it is mainly to compare the cost of carbon emission reduction, the cost of excess carbon emission, the cost of purchasing carbon quotas with the benefits brought by excess emission production, and make corresponding decisions.

China's carbon exchange mainly has two trading varieties: carbon quota and CCER. Carbon quota is the hard currency of the market, and CCER is relatively a supplementary mechanism, which is more affected by policies. The goal of carbon exchange is to affect the cost of enterprises through market-oriented carbon price. The higher the carbon price, the less carbon emissions will be. In short, when the carbon price increases, it will increase the cost of enterprises. When the profits of enterprises are reduced or even lose money, they will take the initiative to reduce production, so as to reduce carbon emissions. In addition, it will also promote enterprises to upgrade equipment and reduce unit energy consumption.

6. Recommendations

6.1 Strengthen the Overall Planning and Coordination of Social Green Development

Focusing on the goals of “achieving carbon peak by 2030” and “achieving carbon neutrality by 2060”, government have coordinated economic and social development, energy and resources support and ecological environment protection, carried out top-level design, integrated the concept

of green development into environmental, industrial, construction, transportation and financial departments, deployed objectives, tasks and plan in various fields, and strengthened institutional and financial support, Form a joint force to promote the green transformation and development of economy and society. Encourage provinces that are active in reaching the peak or have the advantages of reaching the peak to take the lead in independently exploring carbon neutralization paths and developing carbon neutralization technologies.

6.2 Developing Zero Carbon Technology

In recent years, with the vigorous development of zero carbon energy technology, the cost has decreased significantly. Compared with traditional fossil energy, it has formed strong competitiveness in price and has the potential for large-scale economic development. However, the market space is still relatively small and needs reasonable and effective policy support. Referring to other countries, we can consider establishing a carbon emission tax to play a tax role, increase the use cost of fossil energy and enhance the low-cost advantage of zero carbon technology. Promote low-cost emission reduction of existing enterprises and enhance the social effect of zero carbon technology.

China's transportation industry used more oil, so need to develop new energy vehicles, popularizes the use of zero carbon energy technology in the transportation field, and completes the important transformation from fossil fuel to zero carbon energy. Develop renewable energy power, such as solar energy, wind energy, hydraulic energy, hydrogen energy and Sustainable Bioenergy, and complete zero carbonization of energy utilization.

6.3 Green Finance

Strengthen the top-level design of the green financial system and promote the development and innovation of green financial business. The people's Bank of China also takes “implementing the major decision-making and deployment of carbon peak and carbon neutralization, and improving the green finance policy framework and incentive mechanism” as one of the top ten tasks in 2021. In the future, we will promote the gradual inclination of financial resources to the green field, and guide green finance to serve the all-round development of China's low-carbon economy era in the 21st century.

Encourage financial institutions to actively carry out climate investment and financing, lay out a net zero carbon economy in advance, develop green financial products and strengthen the disclosure of green financial information. In terms of credit, banking financial institutions can be encouraged to provide green loan support for zero carbon technology, improve the market-oriented green credit guarantee mechanism, and apply for financial discount support according to regulations. In terms of financial institution management, we will implement green rating for financial institutions and guide the green development of financial institutions. In terms of investment, promote the development of green bond and green fund market, and guide social capital to actively participate; Support qualified energy conservation and emission reduction projects to issue zero carbon project ABS through capital market financing. In terms of insurance, a carbon emission compulsory liability insurance system shall be established in the field of high-risk carbon emission. Promote the “going global” strategy of green finance investment and financing, and guide the flow of international capital to the zero carbon industry through the national green development fund and green bonds.

6.4 Circular Society

Improve the people's active participation and build a circular society with “diversified cooperation”. It is necessary to clarify the legal responsibilities and obligations of multiple subjects such as governments at all levels, enterprises, communities, social organizations and the people. The government should fulfill its obligations under international environmental conventions and China's environmental protection regulations, strengthen the construction of environmental protection system, and actively explore the mechanism of establishing a circular society, such as waste classification mechanism. A circular society joint meeting mechanism can be established to become a platform for communication between the government and the people. Regular meetings can be held to let the public know the local construction of circular society, absorb public suggestions and improve working methods. Responsible individuals and groups should be encouraged to set up environmental protection organizations to support and reward their activities. Enterprises are obliged to disclose energy conservation and emission reduction measures and accept socialized supervision. In addition, governments at all levels should also increase policy and financial support for the construction of circular society. Encourage enterprises to independently develop energy-saving and water-saving technologies and resource recycling technologies. Support universities and scientific research institutes to develop technologies and products needed by the circular society. At the same time, we should strengthen publicity and promote the concept of circular economy. For example, we can consider setting up a “circular society Publicity Week”. During the publicity week, the government, enterprises, schools and communities carry out various activities to publicize the concept of environmental protection and sustainable development, encourage people to consciously practice waste classification, waste recycling, promote degradable plastic products and use green and low-carbon products, Promote degradable packaging, etc[14].

7. Conclusions

Carbon peaking and carbon neutralization is one of the important ways for countries to deal with climate problems. As one of powers, to achieve carbon neutralization, and carbon emission should reach the peak as soon as possible, reduce steadily, reduce rapidly, and become stable and neutral. We should realize that to achieve zero carbon emission, we should reach the peak of carbon as soon as possible. The peak of carbon here is not to climb the peak. We should abandon the thought that the higher the peak is, the more it reflects the “political achievements” and “effects” of reducing carbon emissions in the future. From the experience of other countries, it takes a long way to go from carbon peak to carbon neutralization. The higher the peak, the more difficult it will be to achieve carbon neutralization. If we transform as soon as possible to realize peak shaving development, we can shorten the peak platform period, from a lower peak to zero emission, the difficulty of realization will be greatly reduced, and the realization time will be shortened accordingly[17].

To achieve the goal of carbon neutrality, we need multi-dimensional support and guarantee such as policy, system, market, technology and consciousness. From the perspective of ways to control carbon emissions, effective market pricing, green financial support, green policy guidance and the development of carbon neutralization technology are important guarantees to achieve the goal of carbon neutralization[17].

The government, society, enterprises and the public play their respective roles on the road to carbon neutrality. This needs to be based on the actual situation in China, fully investigate and demonstrate, form a scientific system, highly integrate with the tasks of each stage, establish a systematic and effective incentive mechanism, and promote the rapid assembly of various production factors in the direction of technological innovation and industrialization required for carbon neutralization. Organize experts from research institutions to plan the division of tasks at

various stages of China's medium and long-term green and low-carbon development, implement them to specific units and specific road maps, form a joint force, strengthen the guarantee of systems, policies, funds and talents, accelerate the high-quality development of a green and low-carbon society and build a beautiful China.

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