

Research on the Development of Carbon-Neutral Circular Economy based on an Environmental Protection Strategy

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Abstract. The carbon circular economy is a new idea to achieve a circular economy that is green and low-carbon and respond to global climate change. It is a more sustainable, carbon-neutral, and zero-emission energy system solution. China can create a cutting-edge economic system of low-carbon circular development, improve the capacity of sustainable development, reach the carbon peak on time, and subsequently achieve carbon neutrality by developing a circular carbon economy. According to the analysis of the connotation of carbon cycle economy, this paper discusses the influencing factors, difficulties, and challenges of carbon cycle economy in the current era, puts forward the principles of reduction, reuse, and recycling of carbon cycle economy, explains the importance and necessity of the background and development of carbon cycle economy, and constructs the development model of carbon cycle economy based on the "3R" principle. Finally, this study put forward countermeasures and suggestions to promote the creation of a carbon-cycle economy.

1 Introduction

1.1 Research background

In the current world, the types and quantities of material resources produced and used by human society have rapidly increased. According to past statistics, the use of global material resources increased by three times from 1970 to 2015, especially fossil fuels, which increased by 45%. Suppose it is predicted according to this trend. In that case, the global use of material resources may double again by 2060, the time node for achieving the goal of carbon neutrality, which will inevitably bring a series of environmental impacts, especially the emissions of greenhouse gases, which are expected to increase by 43% [1]. Based on the United Nations Intergovernmental Panel on Climate Change (IPCC) assessment, to achieve the 2°C targets, the world should achieve carbon neutrality around 2070. To achieve the 1.5 °C target, carbon neutrality should be achieved by 2050. According to the current emission trend and countries' existing actions, the Paris Agreement's objectives cannot be achieved. This will bring a series of irreversible ecological disasters to countries worldwide and even lead to public health events, systemic financial risks, economic recession, and regional conflicts [2]. In terms of government planning around the world, as of December 31, 2020, 37 countries, as shown in Table 1, including China, have formally put forward carbon-neutral commitments by incorporating national laws and submitting agreements or policy announcements. As shown in Table 2, fifty-two countries only proposed

carbon-neutral targets through verbal commitments but did not give detailed information about the targets [3]. Under the circular economy principle, manufacturing industries such as machinery and industrial equipment can add advanced products with less energy consumption and longer service life to better realize their commercial value. By implementing the circular economy model and fulfilling the economic and social objectives of environmental protection and low carbon emissions, some industries that are closer to average consumers can also save money.

The circular economy follows the laws of ecology and economics. It aims to construct the production and consumption mode of "resource product renewable resources" by implementing the "3R" principle of reduction, reuse, and recycling, which is a crucial step toward being carbon neutral [4]. As opposed to the "acquisition, manufacture, and waste" linear economic model, the circular economy eliminates the concept of waste, decouples growth from the consumption of scarce resources, and prolongs the time that goods and materials are used in the production process; When these products and materials reach the service limit, they will be effectively circulated or turned into the system. Realizing a true cycle means rethinking and transforming the entire value chain to create a system that supports the cycle. The circular economy emphasizes the intensive, cost-effective, and recycling use of resources to minimize carbon dioxide emissions by improving resource consumption, aids in improving resource and energy utilization, and dissociates industrial prosperity from carbon emissions and pollutant emissions from the source, which is crucial to China's "carbon peak, carbon neutral," and "1+N" policy systems

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[5]. The "circular economy to help reduce carbon" will be one of the ten actions in the recently released Action Plan China must continuously promote the entrepreneurship of circular economy mechanisms, policies, models, technologies, and products oriented to the target of decarbonisation from the aspects of building a circular economy governance system in the interest of accomplishing the objective of carbon neutrality. China must concentrate on solving many problems and challenges that still exist in the development of a circular economy, establishing a circular industry and scientific and technological innovation system, and providing assistance and assurance for reaching the objective of carbon neutrality while constructing an ecofriendly and low-carbon cyclical community [4]. At the same time, this paper should further improve our political standing, accelerate transformation and innovation, and from a strategic height and long-term perspective of attaining high-quality growth, advancing the emergence of organic architecture, and safeguarding of energy and resources, encourage the implementation of a circular economy, and responding

for Carbon Peak before 2030.

to global climate change. Xie talked about how to promote development through innovation from four aspects: first, strengthen the innovation of mechanisms, regulations, and policies; Second, encourage business model innovation; Third, strengthen scientific and technological innovation; Fourth, promote international cooperation and innovation [5].

1.2 Research framework

Based on the "3R" principle of circular economy of reduction, reuse, and recycling, this paper explains the critical role of resource efficiency in achieving the goal of decarbonisation, analyzes the internal relationships between the development of the circular economy and the realization of zero carbon, and offers guidelines for championing China to achieve the goal of carbon neutrality through the low - carbon economy, as shown in Table 1 and Table 2.

Table 1. 37 Countries making an official commitment to carbon neutralization

Year to achieve carbon neutrality	Implemented	2030	2035	2040	2045	2050	2060	The second half of the 20 th century
Country	The kingdom of Bhutan, Surinam	Uruguay, Maldives	Finland	Austria, Iceland	Sweden	Ireland, Denmark, Germany, France, Fiji, Costa Rica, Korea, Canada, Marshall Islands, South Africa, Norway, Portugal, Japan, Switzerland, Slovakia, Spain, New Zealand, Hungary, England, Chile, Argentina, Andorra, Slovenia, Vatican, Nepal	China, Brazil, Kazakhstan	Singapore

Table 2. 52 Countries making a verbal commitment to realize carbon neutralization

Classification	EU countries	Non-EU countries
Country	Belgium, Bulgaria, Cyprus, Croatia, Czech, Estonia, Greece, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Romania	Antigua and Barbuda, Bahamas, Barbados, Belize, Benin, Cape Verde, Comoros, Cook islands, Dominica, Dominican, Ethiopia, Federated States of Micronesia, Guyana, Kiribati, Lebanon, Mauritius, Mexico, Monaco, Namibia, Nauru, Nicaragua, Niue, Palau, Papua New Guinea, Samoa, Seychelles, Solomon Islands, South Sudan, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and Granadines, Timor-Leste, Tonga, Trinidad and Tobago, Tuvalu, Vanuatu

2 Methods

The primary components of the literature research approach are gathering, categorizing, and organizing

materials as well as developing scientific understanding of information through documentation study. In this paper, by analyzing the literature on the carbon-neutral circular economy, this paper will explain the necessity and importance of developing a carbon-neutral circular

economy and put forward relevant measures to maximize the economic benefits.

3 Result

3.1 Development status

The laws of ecology and economics are upheld by the low carbon economy. By applying the "3R" principle of reduction, reuse, and recycling into practice, it seeks to build the production and consumption mode of "resource products renewable resources," which is a crucial step toward reaching net zero emissions [4]. Unlike the conventional "acquisition, manufacture, and disposal" economic framework, the circular economy completely eliminates the concept of waste, decouples growth from the consumption of scarce resources, and prolongs the time that goods and materials are used in the production process; When these products and materials reach the service limit, they will be effectively circulated or turned into the system. Realizing a true cycle means rethinking and transforming the entire value chain to create a system that supports the cycle. The circular economy emphasizes the intensive economy. Recycling resources reduces carbon emissions by increasing resource utilization efficiency, contributes to increasing resource and energy utilization efficiency, and dissociates economic growth from pollutant emissions and greenhouse gas emissions at the source, which is crucial to China's "carbon peak, carbon neutral," and "1+N" policy management system [5]. In addition, in order to achieve a multiplier impact of "1+1>2," the circular economy should be seen as a crucial part of sustainable solid waste management. It pays attention to both the resource cycle and the indirect carbon emissions of solid waste throughout its life cycle [6]. The "circular economy to help reduce carbon" will be one of the ten actions in the recently released Action Plan for Carbon Peak before 2030.

Nowadays, countries worldwide have established relatively mature regional carbon trading markets mechanisms such as EU ETS, CCX, NSW, and GGAS. By 2030, China is set to reach a carbon peak, and by 2060, it aims to be carbon neutral. One of the goals is to change the high-carbon economic development model fundamentally. For a long time, China has consistently carried out its national plan for combating climate change, taken part in and taken the lead in global climate governance, and successfully fostered the development of an ecological society. Breaking the energy, resource, and environmental bottlenecks, advancing science and technology, and fostering a new phase of economic growth are all dependent on China actively examining and developing the carbon emissions trading system in a low-carbon economy. As China enters a new developmental level and prepares to build a socialist modern power, achieving the "dual carbon" goal will be a new challenge. Regarding creative technology, industrial assistance, and governmental support, promoting the cyclical economy's inventive development and assisting with the achievement of the "dual carbon" target face new hurdles [7]. Although the pilot work of carbon emission trading in China has

made positive progress, it started relatively late. Carbon emission trading involves adjusting energy structure in key domestic industries and fields and the complex international situation, which has brought great uncertainty to the economic, trade, and low-carbon technological progress. At the same time, there are still problems such as weak legal basis, unclear regulatory targets, decentralized trading market, and insufficient participation of financial institutions. In the context of realizing the carbon neutrality objective, the development of China's circular economy still faces many prominent contradictions and problems. For the purpose of achieving carbon climax and carbon neutrality, there are still some key problems in China's circle economical growth, such as the imperfect governance system of circular economy, which restricts the implementation of carbon reduction measures, the immature system of circular industry and scientific and technological innovation, which leads to the lack of strong support for the accomplishment of carbon neutrality targets, the lack of social co-governance system, and the difficulty in popularizing the concept of low carbon in all aspects. The unreasonable energy structure is the main source of China's large total carbon emissions and rapid growth. The continuous increase in carbon emissions has brought great pressure to the realization of China's dual-carbon goal. Coal use makes up a significant amount of China's total energy consumption, and it is the largest source of the country's carbon emissions, along with oil and other fossil fuels. Thus, it is essential to advance the use of non-fossil energy, encourage the transition to clean, low-carbon energy sources, and progressively create a cleaner energy consumption structure. China faces huge pressure to reduce emissions as the world's largest greenhouse gas emission country. Despite the fact that China does not currently comply with the Kyoto Protocol's legally required emission reduction obligations, European and American nations have asked several times China, India, and other emerging economies to ratify the legally binding international agreement on emission reduction as soon as possible and to take immediate action. Therefore, future acceptance of the required emission reduction metrics by China is very likely. In addition, China's urbanization is causing previously unheard-of environmental issues, and the model of vast industrial expansion has not changed. A robust and complete carbon emission trading market must be established in order to quickly leave the conventional development path of high levels of air pollution, high energy consumption, and high emissions, establish a mature and full carbon emission trading platform and enhance the quality of productivity expansion [8]. Therefore, it is urgent for China to learn from the sound legal system of the international carbon trading market, reasonable carbon rights allocation, a good trading model, complete financial products, and other measures to promote the healthy development of the domestic carbon emissions trading market.

3.2 Influence factors

In general, once the Chinese economy moved into the new

baseline level, the rate of economic growth slowed from high to medium-high. Scale-speed extensive expansion gave way to quality-efficiency intensive growth as the dominant style of economic growth. The circular economy is also important in solving the contradiction between consumption growth and carbon emissions [9]. The realization of the dual-carbon goal will inevitably profoundly impact China's industrial reform [10].

In order to reach the objective of double carbon, the proportion of clean energy and the new chain of the energy industry in China's energy structure will be significantly increased in the future, and the consumption structure will also be more inclined to the popularization of new energy vehicles and intelligent green buildings. From the perspective of industrial layout, as the application of fossil energy such as coal, oil, and natural gas gradually decreases, new and renewable energy sources such as photovoltaics, wind, hydroelectric, nuclear and hydrogen energy will increase. The energy center will also spread from the central region to the western region with good resource endowment and mining conditions, forming a new regional development pattern.

At the same time, the two-carbon objective contributes to the development of the economy. First, it is conducive to the transformation of the economic development mode of low resource consumption, achieving sustained economic growth as fossil energy consumption and carbon dioxide emissions continue to decrease, speeding up the low-carbon energy structure. and meeting the growth of total demand by increasing the supply of new and renewable energy; The second is the formation of an economic development model conducive to environmental protection, the implementation of coordinated treatment of reducing pollution, carbon and greenhouse gas emissions, and the better promotion of environmental governance focus on late-stage treatment to focus more on prevention and treatment at source.

The effective transformation of reason; Third, it is conducive to realizing the economic development vision of ecological protection. Carbon emissions cover social and economic sectors and fields such as energy, industry, construction, transportation, and agriculture. Carbon sinks, on the other hand, involve several ecosystems, such as forests, prairies, wetlands and oceans. The quantity of greenhouse gases and the potency of photosynthetic process together reveal the degree of regional economic and social development as well as the endowment of natural resources and the ecological environment, which is crucial for advancing the development of ecological civilization. The overall design of ecological civilization construction includes carbon apex and emission reduction, which means that carbon will be a crucial reference for the goals and metrics of ecological human culture construction and will significantly raise the standard of forests, grasslands, and other ecosystems [10]. In general, this paper can only solve the ecological problems of China's resources and environment This study aims to address the ecological issues of China's resources and environment and actually accomplish carbon climax and carbon neutrality by realizing the comprehensive green transformation of the social and economic growth and encouraging the economy to follow the path of green and

low-carbon circular development.

4 Discussion

4.1 The principle of reducing carbon emissions by controlling input from the source

The reduction principle is to meet the established production goals or consumer demands, reduce the input of natural resources, power, liquid, and other resources through engineering sustainability and clean manufacturing. This will result in resource conservation and a reduction in carbon emissions at the point of economic activity. A circular economy can significantly reduce the consumption of key mineral resources in terms of consumption reduction and material substitution through innovative manufacturing technologies, such as the development and application of environmentally friendly technologies like energy-efficient cars, renewable energy, and energy storage, as well as encourage the implementation and advancement of pertinent low-carbon technologies., and ensure the realization of the carbon neutralization path.

4.2 Reuse principle of extending product cycle and improving utilization efficiency

The principle of reuse is to extend the life cycle of products and materials, which will result in resource conservation and a decrease in carbon emissions. This will increase the efficiency of products and materials in manufacturing and use. Additionally, increasing material reprocessing rates and encouraging the growth of the remanufacturing sector are crucial for resource preservation and lowering carbon emissions. Remanufacturing machinery can replace new machinery and take measures aimed at modularization, reuse, and remanufacturing to increase the remanufacturing sector's usage effectiveness. Moreover, the cascade utilization of products can help solve the problems of low efficiency and high cost in the remanufacturing industry and effectively reduce carbon emissions.

4.3 Recycling principle of recycling resources and reducing solid waste

The principle of resource utilization is to save and replace the original resources and minimize the carbon pollution caused by the extraction of resources through fully utilizing refuse, smelting, processing, and other links of the original resources. To attain carbon neutrality, important mineral resources are recycled again. It is possible to lessen reliance on primary resources and effectively promote electric vehicles, renewable energy, and other low-carbon technologies by increasing the recycling rate and use effectiveness of important mineral resources. At the same time, the recycling of recycling economy can also effectively reduce the generation of waste, thereby reducing the carbon emissions in the process of storage, transportation, and treatment of solid

waste.

To sum up, the "3R" principle of circular economy is significant for achieving carbon neutrality. China needs to work to find solutions to numerous issues in order to reach its objective of carbon neutrality. The development of a circular economy is still facing challenges, which are continuously promoting the innovation of circular economy mechanisms, policies, models, technologies, and products oriented to the goal of carbon neutrality from the creation of a circular economy governance system oriented to the goal of carbon neutrality, the establishment of a circular industry and technological innovation system, and the development of a green low-carbon circular society. Support and ensure reaching the carbon neutrality objective.

5 Conclusion

5.1 Conclusion of key findings

Achieving carbon neutrality is greatly aided by the circular economy. In order to achieve carbon neutrality, China must work to address a number of issues and challenges that remain in the development of a circular economy. Additionally, China must actively encourage innovation in circular economy mechanisms, policies, regulations, models, technologies, and products from the perspectives of creating a circular economy and a legal governance system that is carbon neutrality-focused.

5.2 Research significance

On the one side, the upcycling may successfully increase the pace of resource output and lower carbon emissions by conserving resources, using them more efficiently, and altering the manner in which goods and materials are produced and used. The upcycling, on the other side, can assist in realizing the efficient recycling of waste resources, enhancing China's resource recycling effectiveness, reducing China's economic development's reliance on primary resources, ensuring national resource security, and easing resource constraints that may be encountered in achieving the goal of carbon neutrality.

5.3 Limitations

This research discusses the approach to achieving carbon neutrality under the circular economy according to the technique of literature analysis by consulting, collecting, and sorting out the existing literature. The main use is secondary data; primary data is not used. In the future, primary data can be obtained through survey, interviews,

and other methods.

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