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THE EMPOWERMENT OF NEW-QUALITY PRODUCTIVE FORCES IN CHINA'S GREEN, LOW-CARBON, AND CIRCULAR ECONOMIC SYSTEM UNDER GLOBAL CLIMATE CHANGE

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Abstract

In the process of globalization, sustainable development is related to the future of human society. Building an effective model to promote the development of green economy is an urgent issue to be solved. Developing countries are undoubtedly an important part of global ecological governance. As the backbone of developing countries, China has always taken the global governance principal of "extensive consultation, joint contribution, and shared benefits" as the basic concept, implemented the "Community with a Shared Future for Mankind" initiative, and promoted the construction of the "Belt and Road Initiative" ecological community. In recent years, China is unswervingly following the Sustainable development path. In terms of energy, it continues to increase investment and development in clean energy such as solar and wind energy, and reduce dependence on non-renewable energy such as coal. In urban construction, emphasis is placed on the development of green transportation and the creation of an ecological and livable environment. This paper focuses on the excellent cases of China's ecological governance construction, analyzes the experience and inspiration contained in them, and uses the strategic deployment of "green development is the base color of high-quality development, and new quality productivity itself is green productivity" put forward by Chinese President Xi Jinping to explore in the new era, the new type of harmonious coexistence between man and nature relations of production, firmly establish the concept that green waters and green mountains are golden mountains and silver mountains, and contribute China's experience to the rapid development of the world's green economy.

Keywords: China's new-quality productive forces, Sustainable development path, Ecological construction, Green economy

Introduction

1. Research Background

The impact of climate change on humans is increasingly affecting socio-economic development and human settlements. According to one of the most recent studies published by the World Weather Attribution Consortium, an international scientific research organization, the 10 worst meteorological disasters in the world since 2004 are all linked to global warming.

On the 30th local time, *the **2024 Report of The Lancet Countdown on Health and Climate Change*** (van Daalen, K.R. et al, 2024) was released, Threats to human health from climate change have reached "record levels", the report said. In addition, the report estimates that extreme weather events will cost the global economy an average of $227 billion per year between 2019 and 2023. The report calls for an accelerated global energy transition, noting that fossil fuel investment will account for more than one-third of global energy-related spending in 2023, while clean energy investment is severely underfunded. In order to address climate change and adapt to the international demand and purpose of the new energy transition, governments around the world have made sustainable development and green and low-carbon development goals.

2. Research Objectives

In the context of the global response to climate change, many countries have taken the development of green economy and sustainable development as their main strategic goals, and are actively seeking effective methods. As a key force in developing countries, China has fully realized the importance of green economy for the long-term development of the country and the sustainable development of the world. In recent years, it has promulgated a series of laws and regulations to promote energy transformation. At the same time, it has promoted the low-carbonization of the energy system, the modernization of urban construction, and the intelligent living environment through independent innovation practices. Under the multiple benefits of policy support and win-win cooperation, it has firmly adhered to the United Nations Framework Convention on Climate Change, the goals, principles, and institutional arrangements of the Paris Agreement, China will always contribute Chinese wisdom to the development of the world's green economy as a responsible major country.

This paper starts with a case study of China's high-level modernization construction, attempts to analyze, and summarize the experience and wisdom contained in it, focuses on the important discussions of Chinese President Xi Jinping's "New-quality Productive Forces", explores the context of China's construction of the "Belt and Road Initiative" ecological community, and uses data visualization to show the achievements of China's ecological governance in recent years. The purpose of this paper is to provide a new paradigm for global ecological governance, strive to remove the factors that have led to the "failure" of current climate action, respond to the spirit of COP 29, and from the perspective of ambitious developing countries, provide the world with an effective methodology that can be learned, and emulated.

China's sustainable development path and the new quality productive forces

1. Global Sustainable Development Theory and China's Path to Sustainable Development

1.1 Global Sustainable Development Theory

The ongoing process of climate change has shown that sustainable development of humankind is a necessity. Existing resources need to be used in a form of a circular economy, and no more in a linear economy as has been the case until now. Resources need to be better managed to meet the needs of future generations. Therefore, energy, water and environment systems need to be integrated in order to slow down their overexploitation. (Mikulčić, et al, 2022)

In 1987, the WCED released a report entitled "Our Common Future." (Visser, et al, 2017) For the first time, the concept of "sustainable development" was proposed: human beings should enjoy the right to live healthy and productive lives in harmony with nature, meeting the needs of the present without compromising or diminishing the ability of future generations to meet their own needs Sustainable development (SD) means, "Development that meets the needs of current generations without compromising the ability of future generations to meet their needs and aspirations", and can be implemented in many different ways (Yu, et al, 1483). Therefore, sustainable development requires the coordination of economy, society, resources and environment, so as to achieve the purpose of economic development while protecting natural resources and their environment, and to maintain the population within the carrying limits of the geographical environment, so that human beings and their future generations can survive and develop sustainably. In September 2015, the United Nations adopted *the 2030 Agenda for Sustainable Development* (Cf, et al, 2015), with 17 Sustainable Development Goals at its core, committing to eradicating poverty, promoting equality, and addressing climate change by 2030.

1.2 The path of China's sustainable development path and its achievements

In the process of promoting economic and social development, we are facing a triple contradiction between man and nature: the contradiction between the limited carrying capacity of natural resources and the ecological environment and the people's growing material and cultural needs; the contradiction between respecting the value of nature and respecting human rights to development; the contradiction between technological development and nature protection. Based on the above three points, it is inevitable for China, as a developing country, to take the path of sustainable development. In September 2021, Chinese President Xi Jinping first proposed the Global Development Initiative (GDI) in his speech at the General Debate of the 76th Session of the United Nations General Assembly, the initiative advocates that all countries adhere to development priorities, people-centered, inclusive, innovation-driven, harmonious coexistence between man and nature, and action-oriented, so as to promote stronger, greener, and healthier global development.

The global development initiative is aligned with the United Nations 2030 Agenda for Sustainable Development, and cooperation in the eight areas of poverty reduction, food security, climate change, and green development that countries are most concerned about in the Sustainable Development Goals has injected new impetus into the implementation of the United Nations 2030 Agenda for Sustainable Development, reflecting China's wisdom and strength in addressing global challenges.

According to the *2024 Sustainable Development Goals Report* released by the United Nations in June 2024, The world faces

serious challenges in achieving the Sustainable Development Goals on schedule. Only 17% of the 169 Sustainable Development Goals are on track, nearly half are "making little or no progress," and more than a third are "stagnant or regressing." On current trends, nearly 600 million people will continue to live in extreme poverty by 2030. Faced with the huge obstacles to the implementation of the global sustainable development goals, China's "Global Development Initiative" is forward-looking and positive, and aims to bring sustainable development back to the center of the international cooperation agenda.

As a major developing country, China has steadily carried out cooperation in new fields such as health, green, and digital in the process of sustainable development, continued to provide assistance to jointly build countries, supported green and low-carbon energy development in developing countries, promoted information sharing and capacity building for green and low-carbon development, and deepened cooperation on ecological environment and climate governance, which has yielded outstanding results in recent years.

The Report on Big Earth Data in Support of the Sustainable Development Goals (2024) written by the International Research Center for Big Data for Sustainable Development was officially released on the United Nations website recently. The report shows that China has achieved remarkable results in promoting sustainable development, with more than half of the targets meeting the goals of the United Nations 2030 Agenda for Sustainable Development ahead of schedule.

The Earth Big Data Supporting Sustainable Development Goals Report (2024) uses multi-source satellite remote sensing data and artificial intelligence algorithms to quantitatively evaluate seven global sustainable development goals and 227 sustainable development indicators in China. The report points out that, despite the slow progress in some global indicators, China has made significant contributions to industrial energy conservation, emission reduction, and renewable energy development. From 2017 to 2021, China contributed 33.61% of the global decline in industrial heat sources; by the end of 2023, China's offshore wind power cumulative installed capacity accounted for about 50% of the global total.

Figure 1: Changes in China's green energy transition in recent years (the data in the figure is from the Earth Big Data Supporting Sustainable Development Goals Report (2024))

In addition, China has also made positive progress in agricultural water resources management and drinking water safety, public transportation convenience, energy conservation and emission reduction, and marine pollution reduction.

2. The new-quality productive forces and the green productive forces

2.1 The new-quality productive forces and the green productive forces

New quality productivity is an advanced productive force that plays a leading role in innovation and conforms to the new development concept. It has the characteristics of high technology, high efficiency, and high quality. New quality productivity, as a specific manifestation of advanced productive forces, is the innovation and practice of Marxist productivity theory in China.

The term "new-quality productive forces" was first coined by Chinese President Xi Jinping during his inspection tour in Heilongjiang in September 2023. On January 31, 2024, Xi Jinping emphasized at the 11th collective study of the Political Bureau of the CPC Central Committee that we should accelerate the development of new quality productivity and solidly promote high-quality development. Adhere to green development, get rid of the traditional production and consumption mode of "mass production, mass consumption, and large amount of emissions", realize the coordination and unity of economic and social development and ecological environmental protection, and realize the harmonious coexistence of man and nature. Present Xi Jinping pointed out: "Green development is the base color of high-quality development, and new quality productivity itself is green productivity." This important assertion points out the intrinsic connection between new quality productivity and green development, and provides theoretical guidance for promoting the comprehensive green transformation of China's economic and social development.

In short, the new quality productivity is the new driving force for China's high-quality development and the new driving force for the world's sustainable development. Sustainable development is an inevitable product of the development of social productive forces and scientific and technological progress, and is the golden key to solving current global problems.

2.2 Specific cases and analysis of China's green productive forces

2.2.1 The cases of China's energy transformation

From the perspective of green and low-carbon field, green and low-carbon technology is one of the important driving forces for new quality productivity. Technological breakthroughs in power batteries, photovoltaic cells, wind turbines and other fields are a significant symbol of China's green productivity development. The green and low-carbon transformation and upgrading of the energy industry is one of the important carriers for the formation of China's green productivity. The following is an excellent practical case of China's energy transformation and development.

2.2.1.1 The "super power bank" of the power industry – Hebei Fengning Pumped Storage Power Station, China

Fengning Pumped Storage Power Station is located in Fengning County, Hebei Province, China, and supplies power to the Beijing-Tianjin-Tang power grid. The power station is planned to have an installed capacity of 3600MW and will be built in two phases, each with an installed capacity of 1800MW, with weekly adjustment performance.Its completion, with other existing pumped storage power stations and peaking power supply to solve the Beijing-Tianjin-Tang power grid peaking capacity shortage and other problems. At the same time, the power station can also undertake system frequency regulation, load standby and other tasks to maintain power grid security. (Wang Jianhua, 2020.)

Fengning Pumped Storage Power Station is a highlight project of China's rational utilization of ecological resources and green key technology breakthroughs. The geographical location of the power station has natural advantages, with good topographic conditions of upper and lower reservoirs and large adjustable storage capacity. Pumped storage power stations are an efficient way to store energy, providing reliable power supply during peak power demand periods and storing energy during low power demand periods. This will not only improve the reliability of the power grid, but also reduce emissions from coal-fired power plants and protect the environment. After the project is completed, it will exert huge economic, social and environmental benefits. It will strongly support the implementation of the "foreign power into Hebei" strategy, alleviate the dilemma of abandoning wind and light in the "Three North" (Northeast, North and Northwest China) region, and better absorb cross-regional clean energy. (Yan Xudong and Wang Jianhua, 2012) Taking 1.80 million kilowatt-scale pumped storage as an example, it can be converted from full-load pumping to full-load power generation within 5 minutes, providing 3.60 million kilowatts of accident support capacity. At the same time, the pumped storage power station has good regulation performance, which can effectively improve the peak shaving capacity of the system, meet the part of the peak shaving demand increased by the rapid growth of wind power in Hebei, ensure the efficient consumption of local new energy, and provide favorable conditions for the large-scale development of new energy in the local area. It can greatly promote energy conservation and emission reduction and air pollution prevention. It can save 480,000 tons of raw coal consumption and 1.14 million tons of carbon dioxide emission reduction every year.

Figure 2: Multiple working faces in the underground plant of Fengning Power Station operate simultaneously (Image source: State Grid Xinyuan Group Co., Ltd.)

Figure 3: Upper Reservoir of Fengning Power Station (Image source: State Grid Xinyuan Group Co., Ltd.)

After the completion of the power station, it will effectively support the "foreign power into Hebei" strategy, alleviate the dilemma of abandoning wind and light in the "Three North" region, better absorb cross-regional clean energy, and undertake peak regulation, frequency regulation, phase modulation, energy storage, system backup and black start tasks in the Beijing-Tianjin-Hebei power grid, generating important economic, social and environmental benefits.

After all 12 units are put into operation, the excess electricity can be consumed 8.80 billion kWh per year, and the annual power generation 6.612 billion kWh, which can meet the electricity consumption of 2.60 million households for one year, save 480,800 tons of standard coal per year, and reduce carbon emissions 1.20 million tons, equivalent to more than 240,000 acres of afforestation.

Fengning Pumped Storage Power Station absorbs electricity like a super "power bank", allowing the stable utilization of "scenery" resources. The construction of Fengning Pumped Storage Power Station is of great significance to the development of China's power industry.

2.2.2 Green productivity in urban construction

2.2.2.1 "Garden City" - to create a high-quality development demonstration area to promote green urban development in Beijing

A few days ago, the *Beijing Garden City special project plan (2023-2035)* was officially released, and Beijing will create a green barrier of great green and beauty. By 2035, the city's forest coverage rate will reach more than 45%. This also marks the "Garden City" as an important part of the capital's planning system. Beijing is striving to realize the expectation that "ordinary people can walk into gardens when they go out of their homes".

At present, Beijing has deepened the spatial construction pattern, and constructed an urban spatial pattern of "one screen, five belts, two axes, three rings, and nine wedges and fifteen pieces". Optimize the management and control strategy of natural elements, take the forest as the base, and create a green barrier. By 2035, the forest coverage rate in the city will be

increased to more than 45%, effectively ensuring the protection space of 1.66 million mu of cultivated land. Build a water-green interconnection ecological network, and the landscape waterline in the central urban area will reach 500 kilometers by 2035. Improve the leisure tour routes, and by 2035, the coverage rate of the 500-meter service radius of the park green space will be increased to more than 95%, and the per capita park green space area in the built-up area will reach more than 17 square meters. Strengthen the management of ecological protection red lines, and by 2035, the ecological control area will reach more than 75% of the municipal area.

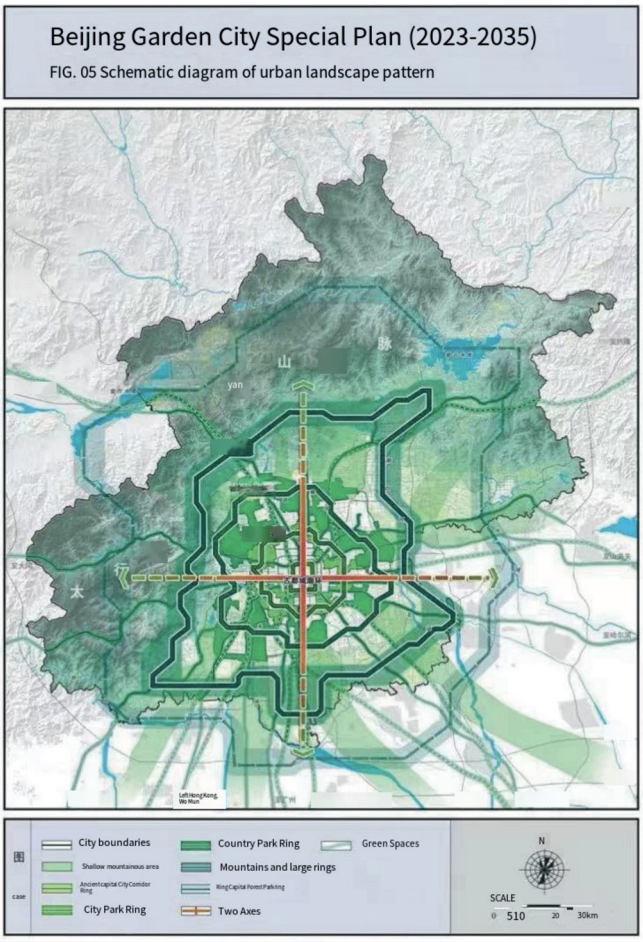

Figure 4: Beijing Garden City special project planning map (2023-2035) (picture source: "Beijing Garden City special project planning (2023-2035) "

At present, China has achieved remarkable results in green consumption and domestic energy consumption, and all provinces and cities have achieved excellent results in energy transformation and urban environmental construction. All localities actively promote energy-saving and low-carbon products such as new energy vehicles and energy-efficient household appliances. The government encourages citizens to trade in household appliances and consumer electronics. The scale of government procurement of green products has reached more than 85%.The green transformation of the energy system is developing rapidly. The installed scale of renewable energy exceeds that of non-renewable energy such as coal and power, and the newly installed capacity accounts for more than 50% of the world's new renewable energy capacity. At the same time, the national urban sewage treatment rate exceeds 98%, the harmless treatment rate of urban solid waste reaches 99.9%, and the proportion of rural solid waste collection and treatment administrative villages exceeds 98%. At present, the Chinese government is actively building green highways, green railways, green waterways, green ports and green airports. Vigorously develop green buildings in various cities, accelerate the energy-saving renovation of existing buildings, more than 27,000 projects have obtained green building labels, and the proportion of new green building area has reached 94%.

The process of China's green, low-carbon and circular development economic system

1. Green low-carbon circular development economic system

On February 22, 2021, the Chinese government issued the Guiding Opinions of the State Council on Accelerating the Establishment and Improvement of a Green, Low-carbon and Circular Development Economic System. It is proposed to establish and improve a green, low-carbon and circular development economic system to promote a comprehensive green transformation of economic and social development. The core of "China's green, low-carbon and circular development economic system" is to implement green planning, green design, green investment, green construction, green production, green circulation, green life, and green consumption in an all-round and whole process, so that development is based on the efficient use of resources, strict protection of the ecological environment, and effective control of greenhouse gas emissions. On the basis of promoting high-quality development and high-level protection, establish and improve the economic system of green, low-carbon and circular development, ensure the realization of peak carbon dioxide emissions and carbon neutrality goals, and promote green development to a new level.

2. The green, low-carbon and circular development economic system has achieved positive results in many aspects

2.1 Industrial and agricultural production

By the end of 2023, China's industrial green manufacturing system has been continuously improved, and nearly 5,100 green factories, more than 370 green industrial parks and more than 600 green supply chain management enterprises have been cultivated. Actively develop a circular economy in agriculture, and use agricultural waste resources. A total of 300 national modern agricultural industrial parks, 180 advantageous and characteristic industrial clusters and 1,509 agricultural towns have been built. The number of green food and organic agricultural products in the country has reached more than 60,000.

2.2 Utilization of circular transportation resources

The use of green and low-carbon transportation tools is vigorously promoted nationwide. In 2023, the total freight volume of railways and waterways will account for 26.3%. As a major e-commerce freight country, China actively promotes the standardization of express packaging, reduces secondary packaging, and no longer has a secondary packaging rate of more than 95%. Recycling and utilization of renewable resources is nearly 40,000 tons.

2.3 Green technology innovation

Encourage enterprises to innovate independently, stimulate the innovation vitality of universities and scientific research institutes, and provide corresponding fund policy support for various green technology innovation and projects. At present, China's technologies in clean and efficient coal processing and utilization, remanufacturing, energy equipment, pollution control and other fields have reached the international leading level. China's National Green Technology Trading Center has completed more than 1,500 green technologies, with a transaction amount exceeding 3.60 billion yuan.

2.4. Promulgation of policies and regulations related to green, low-carbon and circular development

China has written "ecological civilization" into the national constitution, and basically established a legal system covering all key regions, various types of resources, and various environmental factors. Build a "1 + N" policy system for peak carbon dioxide emissions and carbon neutrality, increase national financial support for green and low-carbon development, and improve the green tax system. By the end of the first quarter of 2024, the balance of green loans reached 33.77 trillion yuan, an increase of 35.1% year-on-year.

3. The "Belt and Road Initiative" ecological community

China is now the world leader with green capital actually creating renewable energy technologies. (Schwartzman, et al, 2024). In the process of developing a green, low-carbon and circular development economic system, China is gradually becoming a global pioneer of climate security. As part of the "Belt and Road Initiative" initiative, China is implementing the "Community of Shared Future for Mankind" initiative based on the concept of global governance of "extensive consultation, joint contribution and shared benefits", and building a "Belt and Road Initiative" ecological community with countries along the route.

3.1 "Belt and Road Initiative" and "Azerbaijan Energy Corridor"

Promoting the green development of the "Belt and Road Initiative" is an extension of China's concept of ecological civilization, and it is also the value pursuit of high-quality development by the countries that jointly build the "Belt and Road Initiative". Most of the countries that jointly build the "Belt and Road Initiative" are developing countries and emerging economies. With the rapid advancement of industrialization and urbanization, complex and diverse sustainable development issues related to biodiversity, resources and environment, ecosystems, green energy, climate change and other fields have followed.

Azerbaijan is at the heart of the Belt and Road Initiative, an important energy node linking Eurasia. It hopes to bring renewable energy to European markets by establishing a green energy corridor from the Caspian Sea to the Black Sea and then to Europe. Chinese companies see huge opportunities in Azerbaijan's renewable energy sector. Many companies, including China Datang Group, TBEA and Guangdong Electric Power Design Institute, have actively participated in negotiations and cooperation with the Azerbaijani government. China's extensive experience in global clean energy projects, particularly its leadership in solar, wind, and energy storage technologies, makes it an ideal partner for Azerbaijan to develop renewable energy. China's cooperation with Azerbaijan in renewable energy covers several technical fields. In terms of wind energy development, Azerbaijan has abundant offshore wind energy resources, especially in the Caspian Sea region. The Azerbaijani government expects to build large-scale wind farms with the help of offshore wind energy development technology from Chinese companies. In terms of solar power generation, Chinese companies are expected to vigorously promote the construction of solar power plants in Azerbaijan. It also includes the upgrade of the power grid that China is best at. In order to cooperate with the promotion of green energy, Azerbaijan needs to upgrade the existing power grid. Chinese companies are able to participate in Azerbaijan's power grid transformation by leveraging their power grid technology and HVDC power supply experience to improve power transmission efficiency and reduce energy consumption.

Sino-Arab cooperation in renewable energy projects is not limited to the commercial level, but also has important political and strategic implications. Through cooperation with Azerbaijan, China can further consolidate its energy influence in Central Asia and the South Caucasus, while strengthening its strategic position in the global energy market. Azerbaijan can make full use of China's superior technologies to empower the country's green development.

The global ecosystem is an organic whole, and energy flows and material cycles continue among ecosystems around the world, forming a community of mutual ecological destiny. That is to say, in the face of increasingly complex and severe global ecological and environmental problems, no one or any country can be immune, and the joint construction of the "Belt and Road Initiative" has found the greatest common divisor to solve the challenges and contradictions of global ecological and environmental problems, breaking the artificial barriers and barriers created by some countries, and building a high-quality "Belt and Road Initiative" with ecological base colors and green chapters.

To build a more open green, low-carbon and circular development economic system, we must adhere to mutual benefit and win-win results, and cannot do it behind closed doors. The construction of the "Belt and Road Initiative" ecological community can widely carry out green international cooperation, jointly build countries to deeply integrate with each other, and continuously expand green international cooperation "Friend zone".

Conclusion

In the process of sustainable development, green development is a key link. Accelerating the green and low-carbon transformation of the development mode and leapfrogging the traditional development path are major issues facing many countries around the world in carrying out high-quality development. In the past 40 years of rapid economic growth, China has accumulated more lessons and experiences in the urgency and difficulty of protecting and managing the environment brought about by extensive development. Green and low-carbon are being integrated into all aspects of China's economic and social development, continuously stimulating new momentum for high-quality development. The 10-year joint construction of the "Belt and Road Initiative" has formed an international circulation pattern of interconnection, which has greatly improved the connectivity and nesting of the global green economy. It provides a specific and feasible practical reference path for promoting the "Belt and Road Initiative" to jointly build a country to form a green, low-carbon, circular and sustainable development mode and lifestyle.

In general, facing the challenge of global ecological governance, countries need to build a more open green, low-carbon and circular development economic system to empower green productivity. Incorporating peak carbon dioxide emissions and carbon neutrality into the overall layout of ecological civilization construction, and comprehensively promoting the development of green, low-carbon circular economy. We can emulate the fruitful part of the Chinese model explained in this article, actively participate in the formulation of international rules in the fields of climate change, marine pollution control, biodiversity protection, plastic pollution control, etc., and promote the construction of a fair, reasonable, and win-win global environmental and climate governance system. Participate in leading global green development.

Discussion

The "green, low-carbon and circular development economic system" has a long way to go for domestic and international development, and countries around the world can strengthen policy exchanges around green and sustainable development. At the same time, governments and organizations of all countries should also respond to the spirit of the 29th Conference of the Parties to the United Nations Framework Convention on Climate Change, reduce greenhouse gas emissions, respond to global climate change, and jointly promote sustainable human development. Increase ambition and catalyze action, especially for developing countries, by agreeing on a fair and ambitious new climate finance target, completing Article 6 of the Paris Agreement, strengthening the Global Financial Institutions Group and securing private sector commitment to climate action. We will jointly enhance the international communication efficiency of ecological civilization, so that developing countries can fully respond to the goals and needs of ecological governance, and jointly build a cleaner and more beautiful world, with beauty and harmony.

Authors'notes:

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Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

The authors confirm being the sole contributor of this work and have approved it for publication.

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Externally peer-reviewed.

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Conflict of interest

No potential conflict of interest was reported by the author(s).

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