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Research on Methodology of Carbon Neutrality from the Perspective of Philosophy

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Abstract

The goal of carbon neutrality is a major issue for the development of human society today, and it is also an important topic closely related to all countries and nations in the world. The smooth realization of the carbon neutrality goal is an important goal that all human beings look forward to, and it is also an important issue related to the fate and development of all human beings. This article studies and analyzes the methodology of carbon neutrality from the perspective of philosophy, and tries to study the methodology in the process of carbon neutrality with philosophical methods. Through the philosophical refinement and summary of the carbon neutrality methodology, it points out the development direction of the thinking methods and practical methods used in the process of achieving the carbon neutrality goal on schedule.This article summarizes the methodology of carbon neutrality through six parts and perspectives. This includes: accelerating the green transformation of traditional industries; Vigorously developing green and environmentally friendly industries and production methods; Accelerate the construction of carbon neutrality legal system; Promote the transformation of green living concepts and lifestyles; Grasp the future development trend of carbon neutrality; Promote international carbon neutrality exchange and operation. By summarizing and combing the above contents, we can summarize the methodology in the process of carbon neutrality, and further guide our practice in the process of carbon neutrality through this methodology, so as to ensure the smooth realization of the carbon neutrality goal on schedule.

Keywords: Carbon neutrality; philosophy; methodology.

1. Research on methodology of carbon neutrality from the perspective of philosophy

Carbon neutrality is the need of human social development, and carbon neutrality is also the inevitable result of human social development. As one of the important themes of today's era, carbon neutrality is gradually becoming an important problem that needs to be solved all over the world. Refining and summarizing carbon neutrality from a

philosophical perspective will help us to use the correct thinking mode and realization path in the process of achieving carbon neutrality, so as to promote the realization of carbon neutrality development goals on schedule.

Carbon neutrality is a term for energy conservation and emission reduction. Carbon neutrality refers to the total amount of carbon dioxide or greenhouse gas emissions directly or indirectly generated by a country, enterprise, product, activity or individual within a certain period of time. Through afforestation, energy conservation and emission reduction, it can offset its own carbon dioxide or greenhouse gas emissions, achieve positive and negative offset, and achieve relative "zero emissions".

According to the AR6 Synthesis Report: ClimateChange 2023, although there has been some progress in global policies and legislation to mitigate climate change since the previous report was released in 2014, "in the 21st century, global warming may exceed 1.5 °C. According to the assessment of National Independent Contributions (NDCs) in October 2021, the expected level of global greenhouse gas (GHG) emissions will lead to a warming of over 1.5 ℃.The climate target set by the Paris Agreement, which limits global warming to "well below 2 ℃" by 2030, will be difficult to achieve, but it is still possible to limit it to below 1.5 ℃.

Human activities have caused an average global warming of 1.1 ℃, leading to unprecedented climate change on Earth.The global temperature has risen by 1.1 ℃, and various regions of the world are facing unprecedented climate system changes, from sea level rise, frequent extreme weather events, to rapid melting of sea ice. Further increases in temperature will further exacerbate these changes. For example, for every 0.5 ℃ increase in global temperature, extreme high temperatures, heavy rainfall, and regional droughts will become more frequent and severe. In the absence of human activity, heatwaves only occur once every 10 years on average. When the average temperature increases by 1.5 ℃, 2 ℃, and 4 ℃, the frequency of high-temperature heat waves may increase by 4.1 times, 5.6 times, and 9.4 times, respectively, and their intensity may also increase by 1.9 ℃, 2.6 ℃, and 5.1 ℃, respectively.

The impact of climate on humans and ecosystems far exceeds expectations, and risks will rapidly escalate as climate warming intensifies.One of the most worrying conclusions of the report is that the adverse climate impacts have become more profound and extreme than expected. Currently, about half of the global population faces severe water shortages for at least one month each year, and rising temperatures have exacerbated the spread of vector borne diseases such as malaria, West Nile virus, and Lyme disease. Climate change has also hindered the growth of agricultural productivity in mid to low latitude regions. Since 1961, the growth rate of crop productivity in Africa has decreased by one-third. Since 2008, extreme floods and storms have forced over 20 million people to leave their homes every year.

The issue of loss and damage is becoming increasingly severe and urgent as climate change intensifies. For example, if the global temperature rises by more than 1.5 °C, regions that rely on ice and snow melting water may face unadaptable water resource shortages; If the temperature increases by 2 ℃, the risk of corn yield reduction in important planting areas will sharply increase; If the temperature rises by more than 3 ℃, the high summer temperatures will threaten the lives of residents in some parts of southern Europe.

Global greenhouse gas emissions need to peak before 2025 to ensure the achievement of the 1.5 °C temperature control target.The various research scenarios in the report show that between 2021 and 2040, the likelihood of global temperature rise reaching or exceeding 1.5 ℃ is more than 50%. Especially under high emission paths, global temperatures may reach this critical point faster (between 2018 and 2037); By 2100, global temperatures may rise by 3.3 °C to 5.7 °C, while the last time global temperatures exceeded pre industrial levels by 2.5 °C was more than 3 million years ago.To limit global temperature rise to within 1.5 °C and not exceed or only slightly exceed this range, greenhouse gas emissions need to peak before 2025 at the latest, then rapidly decline, with a 43% decrease from 2019 levels by 2030 and a 60% decrease by 2035.

This article explores the realization path of carbon neutrality from the perspective of philosophy, respectively from accelerating the green transformation of traditional industries; Vigorously developing green and environmentally friendly industries and production methods; Accelerate the construction of carbon neutrality legal system; Promote the transformation of green living concepts and lifestyles; Grasp the future development trend of carbon neutrality; Promote international carbon neutrality exchange and cooperation, and analyze the realization path of carbon neutrality from these six aspects.

2. Method

This paper studies the methodology used in the carbon neutrality process from a philosophical perspective, summarizes and refines the basic methods that should be adopted by people in all countries in the carbon neutrality process, so as to play a beneficial role in promoting the development of carbon neutrality. Through the method of collecting information, this paper extensively collects the carbon emission data and literature related to carbon neutrality published by the world's major well-known institutions, so as to have a clearer understanding of the problems faced by carbon neutrality development. The article also uses the method of comparative analysis to compare and analyze the development status and goals of carbon neutrality in different countries and regions, and summarizes the differences and links among them from the perspective of philosophy to study the driving force behind carbon neutrality. This article summarizes the trends and problems that need to be faced and solved in the process of carbon neutrality through the philosophical method, so as to make a beneficial contribution to the formation of carbon neutrality methodology.

3. Results

This paper summarizes the methodological principles that should be adhered to in carbon neutrality through refining the methodology of carbon neutrality from the philosophical level. This includes: accelerating the green transformation of traditional industries; Vigorously developing green and environmentally friendly industries and production methods; Accelerate the construction of carbon neutrality legal system; Promote the transformation of green living concepts and lifestyles; Grasp the future development trend of carbon neutrality; Promote international carbon neutrality exchange and cooperation. These methodological principles are the core principles in the process of promoting carbon neutrality, and also the methodological principles that must be adhered to in order to successfully achieve the goal of carbon neutrality on schedule.

4. Discussion

Through philosophical refinement, we have summarized six methodological principles on carbon neutrality.

4.1. Accelerate the green transformation of traditional industries

Traditional industries, due to their high carbon emissions, pose serious environmental pollution. The main problems faced by traditional industries are low environmental protection and incomplete green facilities. This has led to traditional industries causing more severe environmental damage and more serious environmental pollution than emerging industries. Especially in heavy industry, steel industry, traditional energy industry, etc., they continue to transform towards environmentally friendly enterprises.

Natural pollution sources refer to places or areas where pollutants are released into the environment due to natural causes, such as volcanic eruptions, forest fires, hurricanes, tsunamis, weathering of soil and rocks, and biological decay. Artificial pollution sources refer to pollution sources formed by human activities.

(1) Domestic pollution sources refer to air pollution caused by burning fossil fuels and emitting soot into the air due to people's daily needs such as cooking, heating, and bathing. Such pollution sources are referred to as domestic pollution sources, such as stoves, boilers, etc.

(2) Industrial pollution sources refer to air pollution caused by soot, dust, and inorganic or organic compounds emitted into the air during industrial production. Such pollution sources are referred to as industrial pollution sources, such as waste gases emitted during production and fuel combustion by industrial and mining enter prises such as thermal power plants, steel plants, chemical plants, and cement plants.

(3) Transportation. Cars, trains, planes, and ships are the main means of transportation in modern times, and the exhaust gases generated by burning coal or oil are also the main pollutants. The pollutants emitted from automobile exhaust can directly attack people's respiratory organs, causing serious air pollution in cities. The main exhaust gases emitted by automobiles include carbon monoxide, sulfur dioxide, nitrogen oxides, and hydrocarbons.

The impact of air pollution on health is divided into acute hazards and chronic hazards.Acute hazards are mainly caused by the sharp increase in the concentration of atmospheric (especially outdoor ambient air) pollutants in a short period of time (such as severe haze), and the acute hazards caused by large amounts of inhalation of pollutants by the population, mainly manifested in respiratory and eye irritation symptoms, cough, chest pain, dyspnea, sore throat, headache, vomiting, cardiac dysfunction, pulmonary failure, and acute episodes of chronic cardiovascular and cerebrovascular diseases.

Chronic hazards mainly include:

(1) Chronic inflammation of the eye and respiratory system caused by long-term irritation, such as conjunctivitis, pharyngitis, and tracheitis, can seriously cause chronic obstructive pulmonary disease (COPD), which can lead to cor pulmonale.

(2) The immune function of the body has decreased. In areas with severe air pollution, the contents of lysozyme and secretory IgA in saliva of residents have significantly decreased, and other immune indicators have also decreased.

(3) Aggravate chronic cardiovascular and cerebrovascular diseases.

(4) It can exacerbate allergic reactions or allergic diseases. Certain pollutants in the atmosphere, if they have sensitization effects, can exacerbate diseases such as asthma and allergic rhinitis.

(5) To increase the risk of lung cancer, the International Institute for Cancer Research (IARC) has classified air pollutants, including particulate matter, as category A carcinogens. According to a review article published internationally, although the overall risk of cancer from air pollution is relatively low, for lung cancer, air pollutants, especially particulate matter, often contain carcinogens such as benzo (a) pyrene (BaP) and arsenic, which pose a high risk.

In addition, international studies have found that long-term air pollution is also associated with adverse birth outcomes such as low birth weight, premature birth, and birth defects. Air pollution can not only directly affect health, but also affect our health through long-term indirect effects, such as affecting solar radiation and the microclimate, generating a greenhouse effect, destroying the ozone layer, and forming acid rain.

Facing the goal of carbon neutrality, the traditional industry must realize its green transformation as soon as possible, further save energy and reduce emissions, improve equipment use efficiency, reduce equipment emissions, eliminate old equipment and facilities that cause heavy environmental pollution, and explore new ways for the green transformation of traditional industries. As one of the main sources of environmental pollution, the green transformation of traditional industries will greatly reduce greenhouse gas emissions, thus eliminating the main obstacles of carbon neutrality.

4.2. Develop green and environmentally friendly industries and production methods

Environmental friendly industries and undertakings are an important way to achieve the goal of carbon neutrality. Green and environment-friendly industry is an inevitable requirement and approach for the development of carbon neutrality. Environmental friendly industry can not only save energy and reduce emissions and further reduce emissions, but also promote the development of the whole industry chain towards low-carbon and environmental protection. Green production methods are diverse, and through the application of new energy and materials, industrial upgrading and transformation can be achieved, further reducing carbon emissions.

According to the data of the United Nations Environment Programme, the carbon dioxide emissions from construction and construction in 2021 will account for 37% of the global total emissions, which is much higher than the 23% of the transportation system. It is one of the main sources of greenhouse gases.

At present, many countries around the world have begun to implement the zero-carbonization transformation of buildings in order to achieve the goal of reaching the carbon peak. At the beginning of July, Paris, France announced that it would carry out energy transformation of 47000 apartment buildings in the city by 2050. The International

Energy Agency suggested that if the goal of the Paris Climate Agreement is to be achieved, the construction industry will be generally zero carbonized by 2050. From 2017, the annual building renovation rate in all regions should be at least about 3%.

The reduction of the demand load rate of buildings corresponds to the reduction of carbon emissions, that is, the use of building space layout planning, window layout, etc., to reduce the electricity use of building operation. In terms of supply, adjusting the energy structure corresponds to carbon compensation and increasing the supply of renewable energy. For example, building a "light storage, direct and flexible" building is actually to convert solar energy into electrical energy by installing photovoltaic panels, and solve some flexible electricity needed for building operation, such as charging piles and some electrical appliances, and then DC.

Example 1: Present carbon neutral building construction (Commercial headquarters for Gazprom Neft).

As of spring 2020, MVRDV designed the largest timber building in the world for Saint Petersburg's historic Okhta Cape. Once thick with trees and marshland, the site has been home to fortresses, a tree nursery, shipyards, and factories. After many years lying dormant, this design inspires its fruition as the commercial headquarters for Gazprom Neft.

A celebration of the embankment landscape context, its rich and storied history, the carbon-neutral building stands 28 meters high, and is supported by a forest of 119 wood columns. This "forest floor" is free and open to the public with a park and plaza that highlight the history of the site, while the office space lies above in the columns' "tree" canopy. A roof-scape with native vegetation crowns this commercial complex, helping to rehabilitate the cape's biodiversity, as in the landscaping of the park below. This way, building is landscape and landscape is building; a clear embodiment of the 'green shift' MVRDV strives for in all designs.

Example 2: Future carbon neutral building planning (Carbon Neutral Tower in Hong Kong).

Arup recently announced the design of a zero-carbon commercial tower in Hong Kong, with a height of 230 meters. The tower is called "Taikoo Green Ribbon" It aims to embrace and promote Hong Kong's goal of achieving carbon neutrality by 2050. The integration of technology and nature has created a new intergenerational sustainable working space and established a complete urban ecosystem. The facade of the tower is made of curved PV material, equipped with aerial garden, algal wall and various renewable energies. The project is a high-performance building. It is planned to achieve the goal of carbon neutrality within ten years after completion. Through this project, Arup demonstrated its commitment to decarbonization design, and made full use of the company's professionalism in sustainability, technology and cycle design, setting up a beacon for the development of environmental protection in Hong Kong.

The shape design of the tower is intended to respond to the conditions of the base site with the optimal solution, including a series of green cooperation spaces, forming a penetrating ascending path inside. This path network also has water-cooled gardens and squares on the lower floors, and includes a landscape airstrip equipped with kinetic energy pads, a naturally ventilated garden with edible plants, and a rooftop theater that can accommodate 500 people. The office floor of the tower is cut by the eccentric core tube and the atrium, while the cooperation space connects the working areas with different heights. The tower is almost completely naturally ventilated, providing a healthy office environment. The automatic air sensing device will also assist the indoor air circulation, and the intelligent facade system controlled by AI can filter the air and adapt to the microclimate environment of the tower. The east and west facades of the tower are self-operated windows equipped with PV panels, and 3D printing shading elements with raw materials from recycled plastic bottles. The south facade contains a series of tubular modular units wrapped in curved PV, which can accommodate conference space, coffee shop and other related facilities.

The project is an exploration of advanced technologies and materials, including more than 40 different energy systems, sufficient to generate a large amount of excess energy. In addition, the project's extensive green space network system has created a greening rate of 350% on the site area. The project is the winning plan to promote the net zero creative competition.

The development of green industry is an inevitable trend for the smooth realization of the goal of carbon neutrality. Accelerating the construction of green industry, constantly developing green production mode, and actively exploring new forms of green industry are strong guarantees for the smooth realization of the carbon neutrality goal.

4.3. Accelerate the construction of carbon neutrality legal system and regulations

An important factor to ensure that the carbon neutrality goal can be achieved on schedule is to establish relevant legal systems and regulations as soon as possible. While accelerating the transformation of traditional industries and the development of green industries, it is necessary to formulate corresponding laws and regulations to constrain and guide the green development of society. As the legal guarantee for the realization of the carbon neutrality goal, the legal system and laws and regulations play a vital role in regulating and guiding the development of green economy.

Therefore, accelerating the formulation of climate change response law has become the only way to achieve the goal of carbon neutrality. At the same time, key systems such as carbon emissions trading, green bonds, publicity and education should be included, and the legal system should be connected and coordinated. The legal and regulatory system should not only involve the entire industry chain, but also penetrate into every individual in society, guiding and influencing people towards the direction of energy conservation and environmental protection.

In the process of achieving the goal of carbon neutrality, on the one hand, laws and regulations should be used to regulate and punish enterprises and individuals who violate the principles of energy conservation and environmental protection. On the other hand, it is also necessary to effectively establish and apply reward mechanisms, and provide certain rewards and compensation to enterprises and individuals who comply with regulations. This form can come in many ways, such as reducing taxes or issuing consumption vouchers. The effective application of the reward and punishment mechanism is an effective guarantee to ensure the smooth progress of the carbon neutrality goal.

4.4. Promote the transformation of green living concepts and lifestyles

Green life philosophy and lifestyle are another important factor to achieve the goal of carbon neutrality. The development of human society cannot be separated from the existence of humans. The total carbon emissions of each individual in their daily lives cannot be ignored. While promoting the upgrading and transformation of the manufacturing industry, the production and lifestyle of everyone is also very important.

Household greenhouse gas emissions come from burning fuel in buildings for heating or cooking and using electricity in homes. In 2020, global household direct carbon emissions accounted for 6% of global total emissions, and indirect carbon emissions accounted for 11%. Direct emissions include fossil fuels used for heating or cooking, waste and wastewater treatment, and leakage of refrigerant from air conditioners. The use of natural gas and oil products for heating and cooking can emit a certain amount of carbon dioxide, methane, and nitrous oxide. Domestic waste generated in household daily life will emit a certain amount of methane when sent to a garbage disposal site for treatment and disposal. Wastewater treatment also emits a certain amount of methane and nitrous oxide. Global waste and wastewater disposal accounts for 1.9% and 1.3% of global greenhouse gas emissions. Fluorinated greenhouse gases (mainly hydrofluorocarbons or HFC) used in air conditioning and refrigeration systems may be released during maintenance or from leaking equipment. The way people travel can also generate carbon emissions. For example, taking a car or airplane can lead to an increase in emissions, while using a bicycle to travel can reduce a lot of carbon emissions.

Saving water and electricity in daily life can effectively reduce carbon emissions. Choosing more ways to travel, such as cycling or walking, can also reduce carbon emissions. Reduce the use of non recyclable items and use more recyclable items. When selecting products, purchase as many green and environmentally friendly products as possible. These methods can effectively reduce carbon emissions.

Mass- production will inevitably cause conflicts with environmental protection, and consumerism will make people ignore the importance of environmental protection. This has caused environmental pollution and destruction in the process of development, and further led to a global crisis. In recent years, various natural disasters such as global warming and water resources crisis are exacerbating the global ecological crisis. The living environment of mankind is deteriorating further. If the pollution and damage to the environment cannot be effectively controlled, the damage to the environment will become more serious and ultimately affect the development of the whole human being.

In the process of protecting the environment, the role of individuals is also very important. As we all know, industrial manufacturing and human needs are inseparable. And enterprises manufacture products around consumer needs. That is to say, enterprises manufacture products according to the needs of consumers for the use of products. This also means that if individual consumers change their consumption habits and form a trend, enterprises will change their manufacturing products accordingly, and the manufacturing mode will also change accordingly.

Individual consumers can also take corresponding measures to transform enterprise manufacturing into an en-

vironment-friendly direction. For example, consumers can buy more green goods and reduce the purchase of goods with more serious pollution. Consumers can also buy more degradable goods or degradable packaging. Consumers can also recycle the used products. Through these ways, enterprises can pay more attention to energy conservation and environmental protection and protect the ecological environment.

Individuals can use persuasive facts to spread climate action through friends, family, colleagues, and online social networks around them. You can do something within your power, such as driving less and flying less, choosing more "green" energy suppliers, changing your diet and consumption habits, and so on. Infect others and involve them in the camp of change. Everyone has the right to enjoy their rights as citizens and consumers, and pressure should be placed on governments and businesses to ensure that they make the necessary systemic changes. By promoting and implementing their own energy conservation and emission reduction initiatives, they will affect more people around them, ultimately driving changes in the entire industry and related policies.

4.5. Look forward to the future development trend of carbon neutrality

Looking forward to the future development trend of carbon neutrality, effectively using the development opportunities brought by the carbon neutrality goal, and constantly exploring the possibility of future carbon neutrality development are the development requirements of carbon neutrality goal.

Just like feedback loop is important when constructing climate models.Climate feedback refers to an interaction mechanism between various physical processes in the climate system. When an initial physical process triggers a change in another process, which in turn affects the initial process, such interaction is called climate feedback. Positive feedback enhances the initial physical process, while negative feedback weakens it. Positive climate feedback, such as the melting of arctic ice under high temperature, causes the reflection of solar radiation to weaken, thus causing temperature rise. Negative climate feedback, such as temperature rise, leads to cloud thickening, which will reduce solar radiation and limit climate warming.

The climate system is the whole of the interaction and interaction of the atmosphere, hydrosphere, ice and snow sphere, lithosphere and biosphere. The change of one factor in the climate system may cause a series of changes of other factors, leading to climate change. Climate change will also have an effect on the change of this factor. This is the interaction of various factors in the climate system. This effect is called feedback mechanism. The feedback mechanism in the climate system is of great significance to climate change.

The climate system feedback mechanism can not only enhance the final output (positive feedback), but also weaken the output (negative feedback).The feedback mechanism is an important climate process in the climate system. The result is to strengthen the positive feedback of the pilot process, which is an unstable factor in climate change, and in turn is called negative feedback. The existence of both positive and negative feedback is called multiple aftereffects.

Positive feedback example like water vapor-radiation feedback Under the condition that the relative humidity remains unchanged, the rising temperature increases the water vapor content, thus increasing the absorption of longwave radiation emitted from the surface, resulting in a further increase in the temperature of the bottom atmosphere.

Negative feedback example like Cloud cover - ground temperature feedback The ground temperature increases with the absorption of more solar radiation, which will promote the evaporation of the ground, resulting in the increase of water vapor content in the atmosphere, and promote the development of clouds. The increase of cloud cover will reduce the solar radiation incident to the surface, and the ground temperature will decrease.

The impact of green transformation on the world market is enormous. Green development means an important change in human industrial production mode. The development of industry is in the direction of green, low-carbon and environmental protection. This change is of epoch-making significance. The labor market will also change with the change of demand. The number of new jobs related to green development will increase further.

The green transformation of industry is full of challenges. The transformation of existing industries to green production needs a difficult process. For example, it is difficult to transform the traditional coal industry and other industries with serious pollution. At the same time, people's consumption needs also need a gradual change process. The adjustment of government policies also needs some time to be promoted and improved.

With the green transformation of industry, some emerging occupations have also followed. Especially in the recycling industry, with the deepening of the concept of low-carbon environmental protection, waste utilization is an

important means of energy conservation and environmental protection. Some new energy industries, such as wind energy and solar energy, will also demand more people. The demand for practitioners in the energy-saving service industry will also increase. The number of scientific researchers and educators studying the green development mode also needs to increase.

4.6. Promote international carbon neutrality exchange and cooperation

Addressing climate change is a global public issue. The Earth's atmospheric resources have the attribute of public goods, and the impact and governance of climate change are global. It is difficult to effectively address climate change relying on the efforts of a single country.

International cooperation plans goals and paths for the global response to climate change. On the one hand, international cooperation can promote climate awareness and technological innovation, enhance international community's understanding of climate issues and establish action goals through exchange and cooperation, and promote the development, popularization and application of climate friendly technologies; On the other hand, we should guide investment, market, and economic development through international cooperation, and promote the establishment of a climate and environmental friendly market system through financial support models, international trade rules, and other means, leading to the establishment of a low-carbon economy.

4.6.1. Challenges to effective climate action

(1) Countries have serious differences in their positions on climate governance.

Due to the impact of highly endogenous factors such as the geographical location and economic development strategies of various countries, there are complex differences in governance willingness and capacity in addressing climate risk issues among different countries and regions. Due to the different interests and demands of various countries, there are also significant differences in some policies and perspectives. In general, developed countries believe that climate change is a by-product of the rapid development of the global economy, and countries should bear common responsibility for reducing emissions, without discrimination; Developing countries emphasize the differentiated treatment of greenhouse gas emission reduction responsibilities, believing that developed countries not only bear historical responsibility for global climate change issues, but also provide economic and technological support to developing countries because their economic and social development has reached a relatively mature and stable state, and they have more sufficient funds and advanced technology to cope with climate risks compared to countries with lagging development, To improve the ability of developing countries to adapt to and mitigate climate change. Due to the different interests and demands of different subjects, the legal effectiveness of allocating greenhouse gas emission reduction responsibilities under the framework of international law has always been a focus issue in the United Nations climate change negotiations, and there are many disputes among countries on this issue.

(2) The uncertainty of climate risk has become a barrier for countries to make climate governance decisions.

Scientific uncertainty is a major feature of climate risk and a major challenge to global climate governance. The impact of climate risk involves natural, social, economic, political, and life fields, which increases the uncer tainty of climate risk as a whole, and puts forward corresponding requirements for countries to take climate governance measures.

(3) The synergy of climate risk response paths faces the test of global governance systems.

Climate risk is a systemic risk that endangers human society and ecosystems, and requires coordinated responses by countries.The synergy of climate risk response paths is mainly reflected in legal policies, sanctions measures, response timing, and other aspects. Climate governance is always based on specific policy and legal grounds. Although countries may have different legislative traditions, legislative techniques, and legal systems, due to the world wide characteristics of environmental law, it is easy for countries to form consensus on the content, policy framework, and institutional aspects of environmental law and coordinate their actions at the practical level based on this. However, due to differences in the ability of different countries to respond to risks, it is difficult for countries to reach a unified value position on climate governance issues, making it even more difficult to adopt coordinated response measures.

4.6.2. Countries' actions

(1) Early warning system

Research has shown that just providing a 24-hour warning of upcoming heat waves or storms can reduce subsequent losses by 30%. An early warning system that provides climate forecasting is one of the most cost-effective adaptation measures, with a total benefit of approximately $9 per dollar invested.

(2) Ecosystem restoration

The United Nations Environment Programme and its partners launched the "United Nations Decade for Ecosystem Restoration" in 2021, triggering a global campaign to restore the world's ecosystem. This global recovery effort will not only absorb carbon, but also increase "ecosystem services" to protect the world from its most destructive impacts.

(3) Infrastructure for adapting to climate change

Climate change adaptation infrastructure refers to assets and systems that can withstand extreme climate shocks, such as roads, bridges, and power lines. Infrastructure accounts for 88% of the estimated cost of adapting to climate change.

(4) Water supply and security

Investing in more efficient irrigation will be crucial, as agriculture accounts for 70% of global freshwater extraction. In urban centers, by 2030, by reducing leakage, approximately 100 to 120 billion cubic meters of water can be saved globally. Governments are being encouraged to develop comprehensive water resource manage ment plans that take into account the entire water cycle: from water sources to distribution, treatment, reuse, and return to the environment. Research has shown that investments in rainwater harvesting systems need to be sustainable in order to make them more widely available. The United Nations Environment Programme is working with government partners to build over 1000 rainwater collection systems around the world and provide expert guidance on the construction and use of solar wells, boreholes, micro-irrigation technologies, or water reuse systems.

(5) Long-range planning

It would be more effective to incorporate climate change adaptation solutions into long-term strategies and policies. National adaptation plans are important governance mechanisms for countries to plan for the future and give strategic priority to adaptation needs.

As the common goal of human society, carbon neutrality has a profound impact on the development and continuation of human civilization. The common development goals of humanity cannot be achieved without the participation and contribution of every country and individual in the world. Only by constantly strengthening international exchanges and cooperation can we ensure that the carbon neutrality goal is achieved on schedule and create a better future for mankind.

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