Research on Sustainable Energy Development From the Perspective of Focusing on Carbon Peaking and Neutrality

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Abstract

The promulgation of the carbon peaking and neutrality policy indicates the importance the state attaches to sustainable energy transformation. The policy will have a significant impact on the future development of the energy industry and will. In order to achieve "zero emission" of carbon dioxide, save energy consumption and reduce carbon emissions and help ecological balance, China is playing a positive role in contributing Chinese wisdom and strength to achieve carbon peak and carbon neutrality. While advocating for green lifestyles and production, we need to further restructure services for enterprises, promote innovative and sustainable energy development in raw material production, business models, technical functionalities, product design, etc., and expedite sustainable design. The implementation of the "dual-carbon" work guided by the sustainable design concept can not only actively respond to global climate change, but also improve the global green environment, further achieve a win-win global ecology and economy, and restore the best state of the ecosystem as much as possible. From the

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perspective of the carbon peak and neutrality goal and also with a focus on achieving the carbon peak and carbon neutrality as the main goal to study the development of sustainable energy, in a bid to make sustainable design better serve mankind.

Keywords: Carbon peaking, carbon neutrality, sustainable energy.

1 Introduction

With society constantly changing and developing, we must not only achieve sustainable development in economic, political, and cultural terms but also ensure environment-friendly, long-term development. Particularly in recent decades, the excess emissions of greenhouse gases have led to the frequent occurrences of extreme climates, causing huge and irreversible losses to the natural environment and human society. To maintain the natural space and environmental security for human survival, we need to comprehensively strengthen the general awareness of environmental protection. Therefore, the promulgation of the carbon peaking and neutrality policy has been an inevitable outcome in alignment to the development of the times. In October 2021, CPC General Secretary Xi Jinping attended the COP15 Convention on Biodiversity, where he delivered a speech, about the realization of carbon peaking and carbon neutrality, in which he pointed out that "China will publish its carbon peaking implementation plan in key fields and industries and a series of support and assurance measures [1]." It is more imperative for us to develop and provide a series of policy support measures for reaching this goal of carbon peaking and neutrality and to offer basic assurance. Therefore, to promote carbon peaking and neutrality and attain our goal, we need to carry out reforms in energy development; developing sustainable energy means less use of conventional fossil energy and providing assurance for energy development through sustainable design, look for new development opportunities and impetus from the ecological and economic rebalancing [2].

2 Content Overview of the Carbon Peaking and Neutrality Policy

2.1 Background for Promulgation of the Carbon Peaking and Neutrality Policy

The past 40 years have seen global climate change getting increasingly serious – global warming has given rise to various extreme weathers. According

to data on global climate change, as published by global meteoric organizations, it is quite clear that global temperatures in the most recent ten-to-twenty years have been higher than before and still keep rising, with 2020 being probably the hottest year in the past ten years. As climate change expedites the spread of viruses such as dengue fever, it will seriously impact the normal life of human beings all over the world. If we allow it to continue this way without taking any measures, global weather will be thrown into chaos, the global climate will gradually be chaotic. Since 1850–1900, the global average surface temperature has risen by about 1°C [3]. As revealed by the data about the melting of the Thwaites Glacier published by the researchers at the AGU (American Geophysical Union), the melting speed of this glacier will lead the ice shelf to collapse; if the glacier melts completely, the global sea level will rise by 65 cm or more [4]. The continuous rise of global temperatures on the surface of Earth speeds up the melting of glaciers, therefore leading to the rise of sea levels; this will cause irreparable losses in the coastal areas and bring an irreversible catastrophe to Earth.

Various countries place top priority on environmental protection while perfecting their laws and regulations; promoting green economic development and reducing CO_2 emissions has become imperative for the time being. Carbon is indispensable. Without it and the greenhouse effect, there would be no life and modern civilization. Fossil energy is the foundation for the global energy and economy today. However, the excess use of fossil energy causes CO_2 to keep increasing and brings about the risk of global climate deterioration [5]. The reduction of fossil energy consumption and CO_2 emissions is thus imperative and critical to the survival of human beings. As currently the world's second largest economy, China, sees a drastic increase in its conventional fossil energy and CO_2 emissions while the country is rapidly developing. Besides, at present, China is the country producing the largest amount of emissions. In the trends of CO_2 emissions in recent years, the total amount of CO_2 emissions showed a downward trend in 2020 all over the world due to the pandemic; but we should be aware that this downward trend was only temporary due to the pandemic. To achieve our carbon peaking and neutrality goal, we cannot just pay attention to the temporary decrease and get complacent in our efforts to reduce CO_2 emissions. In other words, while seeking to develop, we must make consistent, long-term efforts to reduce our consumption of conventional fossil energy and cut down on CO_2 emissions.

As revealed in the data survey on global CO_2 emissions in 2020, for all countries, it can be clearly seen that the European Union and the United States

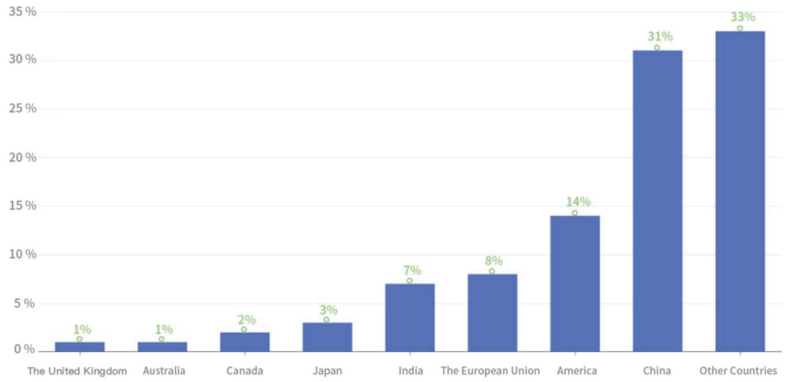

Figure 1 The proportion of global carbon emissions in 2020.

Photo data source: Discover the data platform, The "Wind" data Web site, Zheshang Securities Research Institute.

account for 8% and 14% of their global emissions, while other countries account for 33% of their global CO_2 emissions. China accounted for 31% of the total global carbon emissions (As shown in Figure 1). A general analysis of this data and information shows that the impact of continuous conventional fossil energy consumption on the environment is unimaginable; and that, in transitioning from a conventional fossil energy business to a sustainable energy business, that a large conventional fossil energy enterprise is like a large ship in the sea – it cannot quickly turn around due to its huge size and it should be allowed some time to do so on the condition that its safety is guaranteed. As such, the achievement of the carbon peaking and neutrality goal should depend on the actual conditions in various fields; the transformation of the traditional production means must be based on the production mode of various enterprises and we must make a reform plan suitable for their long-term business operations and carry out a continuous optimization of their configuration and end energy use mechanism; we must allow conventional fossil energy enterprises enough time to reform and restructure and we must provide policy support and a reform plan correspondingly.

The core of climate change mitigation is to reduce the excessive emission of greenhouse gases. Traditional means of governance cannot fundamentally solve the emission of greenhouse gases, because greenhouse gases have the natural attributes of liquidity and spillover [6]. In essence, we can solve the issue of global warming only by reducing the emissions of greenhouse gases such as CO_2, methane, and ozone and achieve zero greenhouse gas emissions. To reach this major historic goal, various countries have formulated relevant

laws and regulations in response to this. At the 75th UN General Assembly, General Secretary Xi Jinping put forth the goal "to try and attain carbon peaking before 2030 and carbon neutrality before 2060 [7]". We must protect environmental ecology as we do our lives and we must formulate rigorous laws and regulations for environmental protection. The promulgation of the carbon peaking and neutrality policy will provide strong support for the Beautiful China initiative and have a profound influence on the economic development in China and other countries; meanwhile, it is a significant contribution to the Community of Common Destiny for Mankind as advocated by China.

2.2 Meeting Carbon Peaking and Neutrality Requirements and Helping to Reach the Carbon Peaking and Neutrality Goal

Carbon peak carbon neutrality is both a scientific and policy issue [8]. To effectively implement carbon peaking and neutrality, the Central Committee of the CPC and the State Council have given important opinions regarding carbon peaking and neutrality – this is a task that must be delivered strictly in accordance with the important decision by the Central Committee of the CPC under the leadership of General Secretary Xi Jinping. To realize carbon peaking and neutrality, we must promote green economic development; we must be consistent in low-carbon development; we must stick to the principle of participation of the general public, coordinated reform, internal and external interconnection, and risk assessment. While making full use of our advantageous system, we must depend on resource efficiency as the key and, on this basis, reduce CO_2 emissions and the continuous conventional fossil energy consumption; and we must take good care of all safety issues in work and energy consumption.

A proper view of the critical relationship between long-term economic development and green development is the crucial part of achieving the carbon peaking and neutrality goal. In his speech at the 2022 World Economic Forum, General Secretary Xi Jinping mentioned the relationship between economic development and the ecological environment: To develop economically we must not keep taking resources from nature and we must not stop economic development just to protect the environment; the two are complementary to each other. We should expedite the development of renewable and sustainable energy and speed up the development of sustainable energy while going all out to achieve the carbon peaking and neutrality policy goal; we should reduce the scope and amount of conventional fossil

energy use in end production in a gradual and orderly manner, promote green transformation socioeconomically.

In addition, the implementation of the carbon peaking and neutrality policy will further drive socioeconomic development. Economically, while it brings about massive new investments, the policy will provide new opportunities for the development of heavy industry. In the case of the iron industry, the policy will be an opportunity for new development. In the process of production and operation, there will be a shift from traditional blast-furnaces and converters to electric furnaces, which have the advantage of polluting the environment less, improving product quality, significantly reducing the use of material resources, and improving productivity. Other than the steel industry, a lot of new processes will be put in place. Take hydrogen energy for example. With such merits as safety, efficiency and environment-friendliness, hydrogen energy helps to reduce the consumption of conventional energy, this reduction represents an industrial upgrade for a traditionally heavy industry. Socially, the policy will create a large number of new jobs and provide more employment opportunities in environment science, new energy, and new materials, among others. Environmentally, the policy will make Earth a better living environment and result in a higher standards of living.

3 Development of Sustainable Energy Guided by the Carbon Peaking and Neutrality Goal

3.1 Overview of Sustainable Energy

In effect, global energy consumption exacerbates the scarcity of energy, and it is unknown how long the current energy supply can last. The key to achieving the goal of carbon peaking and neutrality lies in the structural transformation of energy, that is, one from conventional fossil fuel energy to new energy or the development of sustainable energy. The State Council recently issued regulations on energy conservation and emission reduction, synergistic efficiency in energy conservation, carbon and pollution reduction, and continuous improvement of ecological and environmental quality [9], only by vigorously developing solar and wind energy, wind energy and other renewable energy sources can we properly solve the current problem. This type of energy is characterized by relying on natural circulation and self generation, relatively speaking this type of energy is infinite and inexhaustible. In addition to their merit of being renewable, these kinds of energy do not generate CO_2 in their use, thus reducing the emissions of greenhouse gases to some extent; and they can be used without human

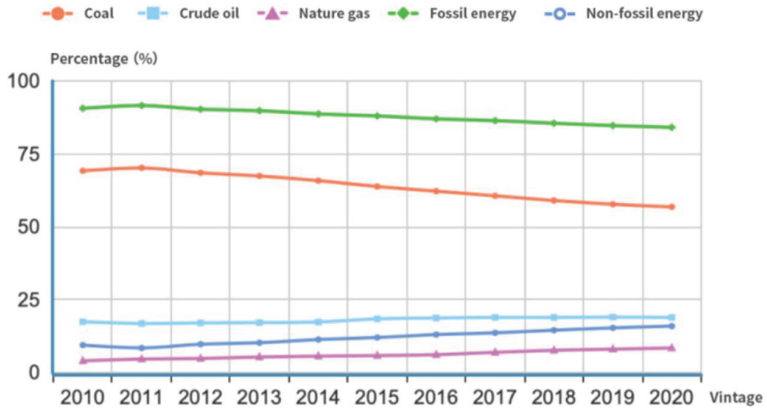

Figure 2 China's energy structure in the past 10 years.

Photo data source: Discover the data platform, The "Wind" data Web site, Zheshang Securities Research Institute.

intervention, thus considerably reducing the burden on the environment. This is also a reason behind the transformation and upgrade of conventional fossil energy. But at present, China's energy infrastructure is still mainly coal and traditional fossil energy (As shown in Figure 2). The green line stands for the proportion of fossil energy use in China from 2010 to 2020. Also the figure indicates that the proportion of fossil energy use is still at its peak. This means that, whether at present or in the future, it is still necessary to upgrade the energy that meets the sustainability standard and technology that improves energy efficiency.

For a long time in the past, China has been a major energy consumer but its energy efficiency has remained at about 30%. By this level of energy efficiency, China is 20 years behind developed countries, but its energy consumption level is far higher than that in developed countries. It is currently imperative to solve the problem of improving energy efficiency.

3.2 Necessity to Develop Sustainable Energy

First, ecological and environmental protection. Traditional fossil energy will produce a large number of toxic substances and also emit a large amount of carbon dioxide, which makes the earth surface temperature rise lead to the emergence of harsh climate and cause great pressure on the natural environment. Around the world since the summer of 2021, high temperatures and heat waves hit the northwest of the United States of America and the

south of Canada. The highest temperature in Seattle reached 42°C and even 46.1°C; in Vancouver, the temperature went up to 40°C at one point, significantly higher than the historic record [10]. Especially at the end of 2021, the La Nina phenomenon has appeared continuously, which is expected to aggravate the rainfall and drought around the world. The extreme weather not only causes great damage to the ecological environment, but also seriously affects crop growth and agricultural production, threatens food security, and leads to human casualties. Therefore, accelerating the process of sustainable energy development is an important way to protect the ecological environment.

Second, energy and resource utilization. China is short of oil, natural gas and other high-quality energy sources, with a high external dependence of. Although there are more coal resources than high-quality energy resources such as petroleum and natural gas, we have a large demand for coal resources and coal reserves cannot be used for a long time. Therefore, we should actively cope with the challenges from long-term use of energy sources, strengthen scientific development and governance of sustainable energy sources and strive to make breakthroughs in solar energy, wind energy, hydroenergy and biomass energy to improve people's living standard and reduce energy consumption.

Third, social and economic development. Due to the frequent occurrence of extreme weather, natural disasters and weather variations may affect trade via different channels [11], will lead to global economic market disorders, which is not conducive to upward economic development. In 2021, China's economic growth rate decreased by 0.1–0.15% in the third and fourth quarters due to various influence factors such as substantial appreciation of prices of coal and natural gas, power demand rise and power shortage [12], and a constant rise of prices of coal and natural gas will directly affect China's power supply system. Realizing low-carbon economic mode and developing sustainable energy sources will reduce our reliance on coal and natural gas to some extent and maintain stable social and economic development.

4 Promoting Development of Sustainable Energy

4.1 The Status and Challenges of Energy Development in China

Currently, the consumption of fossil energy accounts for more than 80% of the total energy consumption globally. By the end of 2020, 2.969 billion tce of primary energy was produced in China, and 3.249 billion tce was consumed [13]. China's huge population and its fast, massive consumption

of energy have a serious impact on the environment; these problems are the reason for further development of sustainable energy. At present, the challenges faced in promoting sustainable energy include but are not limited to: sustainable supplies of energy; capability and cost-effectiveness of energy in market competition; energy production, transportation, consumption, etc., with environmental protection as the precondition. These are the premises for better development of sustainable energy.

In a general view of the challenges faced in China, the main reasons are as follows. First, though China is a developing country, it is doubling its pressure on the environment due to its huge population, needs, and energy consumption; energy professionals and talents are in short supply, which makes it considerably more difficult to develop sustainable energy. Second, the energy industry is huge and has a large scope and is known for its high level of resistance against reform. Given the current socioeconomic conditions, this will not change easily, and we need a lot of time for optimization. Third, the costs are high in the energy industry, leading to high economic pressure. When the user turns on the switch of the light, they hope to see the light turn on immediately. However, China consumes a massive amount of electricity due to its huge population. This is a kind of pressure in terms of electricity costs – the satisfaction of user requirements necessitates higher costs to improve operational efficiency. Fourth, China's energy production and needs are far higher than those in other countries, so energy transportation is an issue across the whole process. As some areas are geographically remote, transportation technologies need to improve continuously; support through technology reduces some of the fuel consumption during transportation, support through technology reduces some of the fuel consumption during transportation. Energy transportation is a precondition for the development of sustainable energy. For the time being, global sustainable energy development is in a process of being explored and researched. Therefore the author suggests that further exploration and research should be conducted in the direction of sustainable energy transformation and upgrades should be driven by predictable scientific and technological advances.

4.2 Developing Sustainable Design to Promote Energy Development

The concept of sustainable design was set forth by in a 1987 report by the World Commission on Environment and Development. It is mainly about an environment that can maintain the quality of life and the survival of not

only the contemporary people but also the future generations; it upholds the people-centric design philosophy and compliance with ergonomics. At its core is the proper balance of relations between socioeconomic development and environmental protection; it requires us to provide support for core user needs in order to attain the ultimate goal of environment-friendliness and efficiency. Sustainable design differs from other design approaches, in that it takes into account various aspects during design, as well as the natural attributes, social attributes, economic attributes, and scientific and technological attributes [14]. The four attributes include natural resources, social development, economic environment, and technological innovation. As design is people-centric and serves people, during the design we need to consider comprehensive factors in order to ensure the feasibility of the scheme. The applicable fields of sustainable design include but are not limited to life, science and technology, medicine, enterprise, and nature. In life, we can, by optimizing and upgrading living equipment, improve the quality of life and product practicality and alleviate the pressure on humans, society, and the environment from some factors in life. In the aspect of science and technology, we can study sustainable structure upgrading of technology to reduce consumption and use of energy sources and improve the utilization efficiency of energy sources through technological innovation and upgrading. In medicine, we can re-engineer medical resources and materials and design ergonomic medical apparatuses to reduce the occurrences of medical accidents. Meanwhile, we can, by re-upgrading the materials for medical apparatuses, reduce medical costs and the production of primary medical waste. As for the enterprise, we can, based on the philosophy of sustainable development, reshuffle its structure, functions, production, and others in order to improve corporate operational efficiency and reduce unnecessary consumption of energy and human resources. In nature, the sustainable utilization and management of natural resources, the change law of natural environment, environmental capacity and its self-purification ability are studied [15]. Through sustainable design we can make a reasonable plan for the entire ecology to enhance nature's capability of regeneration and self-purification.

Sustainable design has the advantage of unlimited possibilities, which can in turn promote energy development and help us explore more reliable and more sustainable supplies of energy, for the sake of energy sustainability. We must improve the competitiveness of energy in the market and effectively reduce energy use costs to maximize profits. We must effectively protect the environment and make its beauty sustainable in order to boost energy productivity, transportation technology, and energy tradability.

4.3 Reducing Energy Consumption Through Sustainable Design

Sustainable design aims to create harmony between mankind and nature; and to find a development way to solve the living environment and conditions on the basis of environmental protection [16]. Through design, to reduce massive fossil fuel energy consumed in industrial production, daily life, technological research, and so forth, and to alleviate the pressure on the natural cycle. The designer's insight can be combined with the use of resources and the sustainable design concept to effectively reduce energy consumption. For example, the design of environmentally friendly toothbrush adopts high-quality reusable body, which enhances the service life and greatly reduces the use of plastic and batteries in the production of ordinary toothbrushes and electric toothbrushes on the market. The design of environmentally-friendly takeout tableware mainly involves the use of recycled plastics as the material, and such plastics have merit in reducing the use of single use tableware and alleviate the pressure on the environment from traditional plastics at the same time. Through the design of comprehensive waste materials, its core design feature is the use of mycelium and other sustainable materials to reproduce black bees, this design is to reduce the production of other harmful waste, and a wide range of applications.

When the concept of sustainability is applied to sustainable design, it can effectively reduce energy use and reduce environmental pressure. Future sustainable development is no longer specialized in a certain field, but multidisciplinary research should analyze sustainable design [17]. Therefore, under the guidance of the carbon peaking and neutrality policy, we can, through this philosophy, innovate and upgrade traditional materials. During design we should give top priority to the reduction of energy consumption and the improvement of energy efficiency. Through the sustainable design mindset, we will be able to make products that are suitable socioeconomically and environmentally, thus effectively alleviating energy pressure.

5 Beijing Winter Olympic Games as Example of China's Execution of Energy Savings and Emissions Reduction

5.1 Green "Point of Entry" – Science and Technology

Promoting scientific and technological advance is an important "point of entry" for reducing carbon emissions and developing sustainable energy. On the evening of February 4, 2022, the opening ceremony for the Winter Olympic Games took place at the National Stadium in Beijing; it was the

first Winter Olympic Games that had realized zero carbon emissions from the torches. According to calculation, more than 30 low-carbon technologies and measures were implemented in the Beijing Winter Olympic Games and thus used about 1 million tons less of CO_2 than a traditional Winter Olympic Games [18]. The existing venues such as the Bird's Nest, the Water Cube, and other existing venues were remodeled for use in the Games. Many technologies were applied in the preliminary preparations for the Games; the CO_2 trans-critical direct cooling ice-making technology was applied for venues such as the National Speed Skating Oval [18]. In the past Winter Olympic Games, the venues had mainly used synthetic refrigeration technology and ammonia refrigeration technology. This new technology, first used in the Beijing Winter Olympic Games, greatly helped to reduce CO_2 emissions; at present it is an ice-making technology with nearly zero pressure on the environment. It was used in multiple venues such as the National Speed Skating Oval during the Beijing Winter Olympic Games and reduced CO_2 emissions by 6,400 tons. It set an excellent example of environmental protection and sustainability to the world. The use of this CO_2 trans-critical direct cooling ice-making technology will inspire more creativity in venue designs for the Winter Olympic Games for various hosting countries.

Promoting innovation in green technology not only helps reduce costs for clean energy by solving the issue of carbon emissions at lower cost; it also provides a new driving force for economic growth [19]. The transformation and upgrade of energy depends on the advance of science and technology; scientific and technological power drives innovation in the energy industry, further speeding up development of sustainable energy.

5.2 Green "Oxygen" – Hydrogen

There are three kinds of hydrogen, namely gray hydrogen, blue hydrogen, and green hydrogen. Blue hydrogen and green hydrogen have been chosen as key energies by many countries. Meanwhile, hydrogen is a new direction in the research on zero carbon emissions. Hydrogen energy is characteristically clean and efficient. In the torches used for the Beijing Winter Olympic Games, the traditional fuel was all replaced by hydrogen energy, according to hydrogen's flammability feature ($2H_2+O_2 = \text{lit} = 2H_2O$), which made the torches green, environmentally-friendly, and pollutant-free.

In addition, the cities supplying hydrogen for the Games included Beijing and the neighboring cities. In total, 11 hydrogen-producing plants from these cities supplied hydrogen energy for the Games. In this Winter Olympics,

hydrogen fuel cell vehicles, hydrogen fuel cell vehicles have superior low temperature resistance, do not have to worry about the range attenuation caused by the low temperature, unlike lithium battery electric vehicles to charge too long. Hydrogen fuel cell vehicles also have the effect of emission reduction in colleges and universities. Compared with the fuel consumption of about 35 L per 100 kilometers, the carbon dioxide emission of buses per 100 kilometers is 94.8 kg. Using fuel cell buses, the reduced carbon dioxide emissions per 100 kilometers per car is 94.8 kg [20]. Those 212 vehicles were estimated to have saved a total of 9.6 t of fuel; with each of them managing to reduce carbon emissions by 0.75 kg/km, they reduced 30 t of CO_2 emissions in total. Obviously, China's hydrogen-producing technology has reached a high level. Through the use of hydrogen energy, we can effectively reduce carbon emissions, alleviate pressure on the environment, improve our competitiveness in the market, and promote long-term socioeconomic development.

5.3 Green "Resource" – Electricity

The achievement of 100% green electricity for the Beijing Winter Olympic Games was attributed to Zhangjiakou, a city in Hebei. While it was one of the three major competition areas in the Games, the city is the first demonstration area for renewable energy in China. It is rich in wind and solar energy resources. As revealed in statistics, by the end of 2021, the installed capacity of renewable energy in Zhangjiakou had exceeded 23.47 million kW [21]. An event in the Games took place in the city; specifically the Shougang Ski Jump, huge amounts of materials and human resources were required in the preliminary construction of this venue. Here it took four to six days to make artificial snow; the snow amounted to a total of 11,500 cubic meters, which was equivalent to 28 meters high of snow in a standard basketball court. The process needed to consume about 20,000 kWh of electricity [22]. After the snow had been made, the venue needed to be maintained according to the actual conditions there in real time. As one can imagine, the amount of electricity consumed in the subsequent use of the venue was vast.

Though Zhangjiakou is rich in wind and solar energy resources, electricity supplies can become unstable due to the indirect nature of wind energy. Flexible direct current grid engineering happens to be able to solve this problem effectively. Flexible direct current transmission, which is known for its excellent stability and reliability, better helped the Games to attain the goal of 100% green electricity use.

5.4 Green "Clothing" – Plastics

During winter in Beijing and Zhangjiakou, the apparent temperature can get to −10°C or lower. So participating in winter sports in such freezing weather was a challenge to the athletes and the staff alike – it was a serious matter whether the clothes of the athletes were warm enough before the competition in such weather. The clothes were made of yarns recycled from waste plastic bottles and textiles. Overall, they consisted of three layers, namely the quick-drying layer, the insulation layer, and the windproof and waterproof layer. The middle or insulation layer was partially made of waste plastic bottles and textiles, and it could maximally improve the insulation effect while being environmentally-friendly. In addition to environmentally-friendly clothes, the tableware used in the Games was made of degradable materials, therefore having no pressure on the environment during their decomposition.

6 Trends of Sustainable Energy Development in the Future

For energy sustainability to develop in the green direction, we must ensure a whole, new low-carbon transformation, which includes but is not limited to the electric power industry, the petroleum and natural gas industry, and the chemicals industry. Only by solving problems thoroughly can we really address the challenges faced in current energy development. According to the report by the academic Shu Yinbiao at China Quality (Hangzhou) Conference, China has achieved continuous optimization of their energy structure and made innovative breakthroughs in electric power technology; we have pulled off significant success in energy transformation. In the past 10 years the consumption of non-fossil fuel energy in China has risen from 9.4% to 15.9%, at a speed 3.6 times higher than the average speed in the world across the same period of time; in the future, sustainable energy will develop mainly in the direction of hydrogen energy, electric energy, and biomass energy. The advantages of hydrogen energy and electric energy will not be repeated here. Biomass energy is a kind of renewable energy and it mostly comes from photosynthesis in plants; it is also the first energy ever explored by mankind. It works through the release of energy inside biomass, such as, directly burning fuel wood (thermal energy), biomass conversion and liquefaction (thermo-chemical conversion), and biogas fermentation (bio-chemical conversion) [23]. Besides its characteristic as renewable energy, it has advantages, such as low pollution, extensive availability of resources,

wide distribution, and extensive applicability; with the advance of science and technology, the scope of biomass energy application will continue to expand.

The promotion of sustainable energy development must revolve around the following measures. First, speed up the development of new onshore and offshore wind power, further expand the scope of renewable energy use, and reduce the use of conventional fossil fuel energy in a safe and orderly manner. Second, improve digital information technology and expedite the process of the carbon peaking and neutrality goal through such technology. Third, improve the overall level of electric energy and promote the development of the new electric power system. Fourth, keep improving energy efficiency, develop new industries to create more jobs, and develop green high-end manufacturing. Fifth, further innovate and upgrade low-carbon technology, drive development through innovation, and make breakthroughs in critical core technology through in-depth research.

7 Conclusion

At present is a critical period for global energy governance reform. Energy transformation and upgrading is the inevitable result of contemporary economic and social development. Promoting carbon peak and carbon neutrality will inject more vitality into global energy governance. Based on the research of sustainable energy development from the perspective of cohesion and double carbon goal, natural ecology and natural resources in the first place of development, and clarify the implementation path and actual development strategy. To expedite the process of carbon peaking and neutrality and seek a space for longer-term survival and development, comprehensive, multidimensional cooperation is needed between government, society, enterprise, and the general public. Support, in terms of policies, laws, and regulations, is also required to attain the ultimate goal. The concept of sustainability runs through the implementation of the "dual carbon" policy, guide the energy transformation and upgrading, and give full play to the auxiliary function of sustainable design. During the development of sustainable energy, we must uphold the philosophy of the new development and keep improving our technological innovation capability. Furthermore, we must get involved in energy savings and emissions reduction in a diversity of manners in a bid to provide strong support for the development of sustainable energy.

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Biographies

Yadong Guo, associate professor, graduate student instructor she has presided over 2 projects of Ministry of Education's industry-university cooperative education project. 2 projects of Humanities and social sciences of Liaoning Provincial Department of Education and 1 project of Municipal Federation of Social Sciences; Participated in one art project of the National Social Science Foundation of China. More than 10 papers (works) published in Chinese core journals and authoritative journals; Four textbooks were published. Guide students to participate in provincial and national competitions for many times.

Meina Zhao, a 21-level graduate student majoring in art design, has won the first-class admission scholarship, won the 2021 "Liaoning Story" Cup Agricultural Products Packaging Innovation and Competition, got first prize.