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Research Status of China's Digital Economy in the Context of Achieving China's Carbon Peak and Carbon Neutrality Goals

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Abstract: This paper studies the positive or negative impacts of the development of digital economy on China under the policy background of carbon peaking and carbon neutrality. First of all, it predicts the future under the rapid development of digital economy based on different literature materials. The increasing demand for calculation, storage and flow data of communication technology as well as the fixed network iteration are influential factors to make an analysis of the overall increase in carbon emissions, and then update measures taken by different enterprises under this policy, such as high-carbon enterprises to develop more clean energy and improve smart grid systems. Low-carbon industries pay more attention to the greening of the entire production line and the digital tracking of products after sale in order to achieve a more effective circular economy. The highlight of this paper lies in the lack of literature on the integration of emission reduction measures for enterprises of different modes based on the increase of carbon emissions brought by the future digital economy, and gives relevant examples.

Keywords: Digital economy, carbon peaking, carbon neutrality, carbon emission forecasting, high-carbon enterprises

1. Introduction

Nowadays, with the development of information and communication technology, any economic form that directly or indirectly uses data to guide resources to play a role and promote the development of productivity can be included in the scope of digitization. Digital economy is simply an economy based on digital technology. At the technical level, digitization includes emerging technologies such as big data, cloud computing, Internet of Things, blockchain, artificial intelligence, and 5G communication. The digital economy is direct, that is, it reduces the necessity of the existence of the traditional middleman level, which significantly reduces the transaction cost and improves the utilization rate of some resources. But at the same time, digital economy, as a kind of speed economy that constantly collects data, processes data and applies data, is also accompanied by the intensification of carbon emission intensity per unit. However, the digital economy has abandoned

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the demand and excessive consumption of physical resources and energy from traditional production industries, and the overall carbon emission scale will be reduced, and its sustainability has laid a significant foundation for the direction of carbon emissions.

The issue of carbon emissions has always been a very serious issue, and excessive carbon emissions will bring many negative effects: Firstly, in terms of environment, excessive carbon emission will lead to global warming, sea level rise, drought, glacier melting and other major environmental accidents. The most important thing is that the greenhouse effect caused by excessive carbon emission has its own particularity compared with general environmental pollution, which is mostly caused by part of land or sea, and these pollution can be divided according to nationality. However, due to the lack of very clear property rights for climate assets, the uncontrollability of transboundary pollution and insufficient jurisdiction in many cases allow pollutants to be discharged to other areas to "catch a free ride" from the critical area. Secondly, from the economic point of view, carbon emissions are closely related to the level of urban development. Generally speaking, the more developed a country is, the higher the level of urban development, the higher the cumulative carbon emissions per capita will be. However, the GDP of a city with higher carbon emissions will also be relatively higher, because in the process of increasing GDP, energy consumption and large amount of carbon emissions from industrialization are inevitable phenomena. In the past, China has been on the basis of energy consumption, exchange of resources for development, resulting in very serious pollution. Since China's accession to the WTO, China has adhered to the road of sustainable development, seeking ways to seek the best use of resources, protection and maintenance of the environment, in order to create a better future for the world, China has reached the critical moment of structural adjustment. The green and low-carbon model has become an irresistible trend.[1].

Digital economy and carbon emissions are inseparable, for a better tomorrow for mankind, China as early as 2020 at the seventy-fifth session of the United Nations General Assembly, established the goal of carbon neutrality, will strive to achieve carbon peak before 2030, 2060 years before the realization of carbon neutrality. The peak of carbon refers to a certain point in time, carbon dioxide emissions no longer grow to peak, and then gradually fall. Carbon neutrality means that the emitted carbon dioxide or greenhouse gas is offset by afforestation, energy conservation and emission reduction. As early as July 16, 2021, China launched the national carbon emissions trading market online. It is an important institutional innovation aimed at using market mechanisms to control and reduce greenhouse gas emissions and promote the green and low-carbon transformation of economic development mode. It is also an important policy tool for strengthening ecological civilization construction and implementing international emission reduction commitments.

Digital technologies, goods and services are not only accelerating the penetration of traditional industries in multiple directions, multi-levels and multi-chains, that is, industrial digitalization, but also promoting the continuous development and growth of digital industrial chains and industrial clusters such as Internet Data Center (IDC) construction and services, that is, digital industrialization. However, the level of development of the digital economy is improving in all countries, but there are huge differences between countries, and the digital divide between some countries is also very large[2]. Therefore, under the background of China’s “Carbon Peak & Carbon Neutrality” Goals , China's economic model also needs to be changed and upgraded, and various new forms of business spawned by various digital economies will certainly become a new important growth point of China's economy. According to the survey, the development of digital economy can effectively improve the green innovation performance of circulation enterprises; At the same time, compared with state-owned circulation enterprises, the digital economy has a stronger role in improving the green innovation performance of non-state-owned circulation enterprises[3]. To put it simply, the digital economy can make circulation enterprises more actively respond to China’s “Carbon Peak & Carbon

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Neutrality" Goals, and circulation enterprises will take the initiative to find green innovative industrial chain or sales model.

However, high-speed development cannot avoid higher energy consumption, and carbon emissions and digital economy do not always show a positive feedback effect. Is there a balance point between the two, that is, under the rapid development of digital economy, the dual-carbon policy can still be effectively and continuously guaranteed? This paper first gives a general introduction to the background of today's digital economy, then explains the definition of dual-carbon, and summarizes the impact of carbon emissions. Finally, it relates to the impact of digital economy on dual-carbon policy based on China's own economic system, and tries to put forward some measures and methods.

2. Methodology

The research data was obtained from CNKI and the foreign language information search engine ScienceDirect. In the advanced search, the keywords were set as "carbon neutral", "carbon peak", "digital economy" or "carbon emission", and the journals were set as core journals and academic papers respectively, so as to obtain more convincing data basis. The time node was not limited. A total of 1643 results were obtained by the exact matching search, and then the author manually screened the search results and removed the items related to news and meeting notice.

The research method of this paper will focus on the carbon emission trend under China's digital economy and the rectification and policies made by different types of enterprises in China based on the "dual carbon" goal, and integrate and analyze the measures and effects of individual representative enterprises. The special feature of this paper is that there are few literatures summarizing the emission reduction measures brought by China's two different industries, high carbon industry and low carbon industry, under the influence of digital economy. Based on the analysis of these two industries, this paper analyzes the digitalization direction combined with the characteristics of the products of these two industries.

3. Analysis

3.1. Analysis of carbon emission trends of China's digital economy in the context of The Times

China's digital economy has shown rapid growth at the national level. From 2013 to 2021, China's digital economy Development Index rose from 1000 to 5610.60, an increase of 4.61 times in just eight years, with a compound annual growth rate of 24.06%[4], far exceeding the GDP index growth in the same period. Digital economy has become one of the main engines to promote economic growth in China. Especially during the epidemic in 2019, in the context of "no contact" advocated by the government, it just caters to a major feature of the digital economy, alleviating the huge economic impact of the epidemic on the society at that time, and the online transaction volume also increases simultaneously. The digital economy seems not only inevitable, but also driven by The Times. The development of digital industry together with digital facilities has emerged in a number of economic fields, and the digital economy is an economic form based on digital communication technology, driven by the application of technology integration and the digital transformation of production factors.

3.1.1. The need for computing and storage in the communications technology sector will lead to more carbon emissions

Over the next decade, the energy demand for digital communications technologies will surge from a CAGR of nearly 5% and 3.7% for computing and storage to nearly 11% and 19%, respectively,

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between 2015 and 2020, due to the acceleration of IP traffic, that is, mobile network traffic, and the massive amount of data generated by iot devices[5]. This has led to a dramatic increase in the demand for computing and storage in data centers. How the various digital developments mentioned above affect dual carbon mainly lies in energy consumption, first of all, the two major factors that affect the IT efficiency of data centers: Workloads and data storage requirements, but most of the increase in recent years has come from the spread of virtualization and the migration of cloud computing, and IT efficiency is near maximum, which means that power demand will continue to rise until more energy-efficient storage hardware is invented.

3.1.2. The increasing demand for data traffic increases the demand for electricity

In 2020, data traffic is already about 20% of the annual power consumption of the IT industry (including fixed and mobile networks and related network equipment), and the global mobile data flow will grow at a rapid rate of 50% per year in 2020 [6]. From 3G to 5G, a qualitative leap in network energy efficiency has been achieved, but considering the traffic growth, energy efficiency benefits brought by the development trajectory of telecommunications networks, and the greater demand for energy intensity due to the upgrading of mobile access systems, it is expected that the electricity consumption of telecommunications networks will still grow at a compound annual growth rate of 10%.

3.1.3. Influence trend prediction of fixed network iteration on carbon emission

Today, some smart IT equipment is about to replace old equipment and some fixed networks, and most smart equipment manufacturing is showing positive growth, but considering the uncertainties such as the different service life of different equipment, different computing technologies are not the same in this respect. Taken together, the IT sector is expected to increase electricity demand by nearly 50%, while emissions will not exceed 26% as the power system moves toward decarbonization. It seems that digital communication technologies will have less of an impact on carbon emissions now and in the near future than we think.

But this is from a global perspective, according to the International Energy Agency (IEA) statistics can see that China's current power sector carbon emissions account for more than 30% of the country's total carbon emissions. The main reason is that China's power generation is mainly thermal power generation, and the direct combustion of coal emissions of sulfur dioxide and other gases continue to increase, which increases the acid rain in many areas of China. The country produces 1.4 million tons of dust pollution every year, and then causes fly ash pollution to the environment near the power station, causing adverse effects on people's lives and plant growth. The country produces 15 million tons of soot every year. And the power generation turbine usually uses water as the cooling medium, and the daily water consumption of a 1000MW thermal power plant is about 100,000 tons. The country consumes 50 million tons of standard coal every year. The power industry has become one of the biggest polluters in China.

3.2. Analyze the follow-up aspects of Chinese enterprises to achieve “Carbon Peak & Carbon Neutrality” Goals

At present, the digitalization of Chinese enterprises needs to take into account the long-term effectiveness. Digital transformation is not only the introduction of digital technology, but also the adjustment of the organizational structure and management system of the entire enterprise. The success rate of transformation in different industries is also very different. The more difficult industries are natural gas, oil and other industries, with a success rate of only 4%-11%, but the

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transformation of enterprises does not always rely on "success" or "failure" to demonstrate its effectiveness .

3.2.1. Green Digitization for high-carbon enterprises

In the form of dual-carbon targets, digitalization is mainly covered in exploration, power distribution, and electronic control automation in the petroleum and petrochemical industry, so as to form an intelligent pattern to reduce carbon emissions to a certain extent by improving production efficiency. However, from the overall point of view of Chinese energy companies, electricity as the main terminal energy in the future, power generation cleanliness will be an important handrail to achieve China's "Carbon Peak & Carbon Neutrality" Goals, as early as the China's "Carbon Peak & Carbon Neutrality" Goals development plan has mentioned that in 2025, 2030, 2060, the proportion of non-fossil energy consumption will rise from 20% to 25%, and finally climbed to 80%. This means that enterprises will be driven by the digital economy to high-end, intelligent.

The real-time scheduling and management of the smart grid of energy enterprises are reflected in three aspects: From the point of view of transmission, the power generation of new energy has increased year by year. According to the data of Hua 'an Securities Institute of the National Bureau of Statistics, the proportion of fire power in 2015 has dropped from 75% to 70% in 2020. Replacing non-renewable resources such as coal, natural gas and oil with clean energy such as wind power, hydropower and photoelectric is a major project to promote. However, a large part of clean energy is also accompanied by volatility and instability, for the grid peak regulation and frequency regulation requirements and difficulties have become much higher, so it is imperative to upgrade the comprehensive intelligent network, which can be reflected from the increase in the installed capacity of electric energy year by year, some clean energy generation methods affected by the environment, so that more enterprises move towards large-scale energy storage and grid-connected intelligent systems. From intelligent distributed energy management to monitoring software and updates to auxiliary systems. Substation is an intermediate hub connecting transmission and distribution, which requires higher intelligent management systems, such as open communication systems and more perfect grid component technology and related equipment, aimed at effectively transmitting information in various test devices, control systems and execution units, so as to ensure the safe and reliable operation of the grid. The digital smart grid has the characteristics of strong, self-healing, compatible, and economic, which improves the ability of the power grid to accept new energy, and will soon become the main theme of the development of the power grid system. In addition to the existing residential supply, industrial electricity and other two major outputs, China's "Carbon Peak & Carbon Neutrality" Goals will stimulate more new markets for green power distribution. From power distribution to electricity sales, the cumulative volume of green power in Guizhou Province, China, will be 743 million kilowatts as of May 2023 [7]. Let the market information get circulation, and timely feedback according to different situations, to meet the flexible and diverse application side needs, to achieve the development of virtual power plants, that is, can supply power to the internal system, but also can output to cooperate with the system to fill the valley.

3.2.2. Analyze the intelligent integration of green innovation industry

The development of the digital economy under the background of China's "Carbon Peak & Carbon Neutrality" Goals is actually a stepping stone for low-carbon industries. Although studies have shown that the size of the digital scale has not significantly reduced carbon emissions, digital technology innovation, digital industry development and digital finance can significantly reduce the carbon emission intensity of the local and neighboring regions [8]. At the same time, the rise of more green businesses has gradually formed a B2B2C integrated business model, such as the life payment service

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jointly launched by Longxin Technology and Alipay. At the same time, some enterprises through digital transformation value, in order to achieve global data acquisition, to create a scalable digital intelligence operation center, break the island, and then unified data convergence, to achieve real-time global measurable, effectively improve the control and operation efficiency of the full range of work workshops, reduce energy consumption, such as Hengbang Phase II smart factory built by Tongkun Group. The number of key processes will be controllable to 80%, and the energy efficiency will be increased by 7%. From green production to informationized supplier management, to green logistics, products pass through consumers, go through green recycling, and finally green packaging, forming a whole green and low-carbon supply chain[9]. For example, Taobao and Salted fish application jointly enable products bought on Taobao to be resold with one click, and trace the purchase channels and stores of products, so that second-hand goods can be resold better. While traditional enterprises often only cover part of the plate, but the promotion of digitalization has made the nature of commodity integration more prominent. From product design to manufacturing to procurement, the digital economy has reduced the information acquisition cost and intermediate link cost of consumers. Through big data recommendation and digital platforms with cloud computing and other technologies, buyers and sellers are gathered on the same trading platform. Accurately provide buyers with more target probability of goods, reduce the many steps of screening goods, save time, cost, data flow, and make up for the leasing costs of offline stores, narrow audience and other problems, so as to increase product sales[10], solve the problem of regional products unsalable, efficient controllable industrial chain is actually China's "Carbon Peak & Carbon Neutrality" Goals laid the strongest foundation. It is not necessary to stall industrial development for the sake of lower carbon emissions.

4. Summarize

In this paper, through retrieval and screening, combined with effective data analysis, the following conclusions are drawn: 1. With the rapid development of China's digital economy, carbon emissions continue to rise, among which the carbon emissions of communication technologies driven by digital economy will continue to rise now and in the short future, mainly due to the increasing demand of communication technologies for computing, storage and data traffic, as well as the replacement of fixed networks. 2. At present, China's high-carbon industries mainly increase the use of clean energy, and make the industrial chain intelligent and controllable through digital technology, so as to regulate each module to reduce energy consumption. At the same time, green electricity is sold to enrich distribution channels, and carbon emissions are reasonably controlled through carbon emission trading market. 3. Driven by the digital economy, China's low-carbon industry will carry out green innovation and integrate the entire product chain, so as to efficiently trace the production, sale and resale of products, reduce energy waste and reduce carbon emissions.

References

[1] *Qin T. Study on the impact of China's trade on environment from the perspective of carbon emission [D].] Capital University of Economics and Business,2017.*

[2] *Feng Dong, Mengyue Hu, Yujin Gao, Yajie Liu, Jiao Zhu, Yuling Pan,How does digital economy affect carbon emissions? Evidence from global 60 countries,Science of The Total Environment,Volume 852,2022,158401,ISSN 0048-9697.*

[3] *Zheng Xiyu. The effect mechanism of digital economy on green innovation of circulation enterprises under the goal of "double carbon" [J]. Business Economics Research,2023,(10):120-123.]*

[4] *White Paper on China's Digital Economy Development, China Academy of Communications.*

[5] *Andrae(2020),new perspectives on internet electricity use in 2030.Engineering and applied Science Letters.*

[6] *Zhang Zhongjie, Han Wei. Research on method of data traffic growth forecast of provincial network of China Mobile Internet [J]. China New Communications,2016,18(08):79-80.*

DOI: 10.54254/2754-1169/89/20231462

[7] In the first five months of this year, the volume of green electricity trading in the province was 743 million KWH [N]. Guizhou daily, 2023-06-20 (004). DOI: 10.28255 / n.c nki. Ngerb. 2023.004006.

[8] Li Lingjie. Study on the impact of digital economy development on the green transformation of manufacturing industry [D]. Jilin university, 2023. DOI: 10.27162 /, dc nki. Gjlin. 2023.000403.

[9] Zhou Xuefeng, Han Lu, Xiao Xiang. The impact of digital economy on enterprises' sustainable green innovation under the goal of "dual carbon" : Based on the intermediary perspective of digital transformation [J]. Securities Market Review,2022,(11):2-12.

[10] Zhang Qing. Digital economy research on the influence of carbon intensity effect [D]. Zhejiang industry and commerce university, 2022. The DOI: 10.27462 /, dc nki. GHZHC. 2022.001180.