Environment, Social and Governance; Vol.3, No.4; 2026
E-ISSN: 3006-3973 P-ISSN：3006-3965
DOI: https://doi.org/10.70267/ esg2026.v3n4.0105
Published by: Zeus Press

The Efficient Empowerment Mechanism for Energy Conservation and Emission Reduction in the Digital Economy Has Been Analyzed and Explored Its Path

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Abstract

Digital economy has become the main sectors in the development of the digital economy. Based on the close relationship between the digital economy and energy conservation and emission reduction, this article will focus on the empowering mechanism of the digital economy for energy conservation and emission reduction, regional differences and concrete approaches. The method used in this study was the literature review method which was used to determine the relationship between the two. The results indicate that the digital economy has indirect positive effects to reduce energy and carbon emission intensity with an inverted "N" - shaped path, and the effects can be spatially transferred. It is also highly regionally disparate, with the developing east, and energy-poor, high innovation cities in the north, having larger impacts on reducing emissions. The Digital Economy has a carbon emission increasing effect at an early stage which is followed by an emission reduction and efficiency improvement effect in the mid-stage and a marginal effect reduction in the late stage. Research indicates the need to speed up digital transformation, develop green and smart cities, combine regional cooperation and use digital technology to effectively facilitate the dual carbon target goal.

Keywords

digital economy, energy conservation and emission reduction, carbon neutrality, regional disparities

1. Introduction

With the continuous expansion of the scale and status of the core industries of the digital economy in recent years. Today, digitalization has become a key attribute of the global economy and has ushered human society into an all-new era focused on digital development. Today, China is in a digital transformation and the digital economy is the main driving force of economic development in China. Meanwhile, the environmental damage inflicted by the traditional industries' development in the past has become a big hindrance to the economic development. As a key force in promoting global green development, China has always been firmly at the forefront of green and low-carbon development. Energy conservation and emission reduction policies have been adopted and China strives to achieve carbon peaking by 2030 and carbon neutrality by 2060. By the start of the 15th Five-Year Plan, the total output value of energy-saving services has reached 528.03 billion yuan, and the cumulative volume of carbon emission quotas trading in the national carbon market is 46.784 billion yuan, with the aim of comprehensive transformation towards carbon emission control. In the present stage,

digital economy is well integrated with energy saving and emission reduction, and a new stage of system integration and scale promotion has arrived from the initial exploratory phase.

As they both become popular, scholars have been interested in the research of how to efficiently reduce energy consumption and emissions through the digital economy, which is rapidly developing. After reaching a certain stage of development, the digital economy can realize the mutual benefits between energy conservation and carbon emission reduction, which is a non-linear relationship between them and regional location differences, Wang Xiangyan et al. believe [1,2].

This will be analyzed in this article and further explained the role of digital economy in the current era in energy conservation and pollution reduction in an effective manner. The majority of the literature currently available relates to its effects in a disjointed way, without a full appreciation. This article integrates and summarizes the practice conclusions and policy implications of the research today, summarizes energy conservation and emission reduction impact mechanism and regional differences of the digital economy and puts forward new constructive ideas for later practice.

2. The Current Situation and Development of the Digital Economy and Energy Conservation and Emission Reduction

The digital economy is a new form of economy where data resources are key production factors and digital technology is the key production enabler. It supports industrial restructuring and economic structure optimization, in a profound way integrated with real economy. It is a rising means of technology, and a thinking approach.[3] However, the existing literature has summarized Three-dimensional measurement of the digital economy: region, industry, and enterprise [4]and highlighted that the digital economy is a transformation of the economic system with the support of the digital infrastructure at the regional level. At the industry level, it is about traditional industries using digital technologies to optimise their production processes, improve their supply chain management efficiency and capabilities of interaction. Enterprise level use of digital technology to change the way they produce, and increase production efficiency. However, while the digital economy brings convenience to human life, it is evident that it is rapidly becoming the main source of carbon emissions in China, with the total emissions and their weight still on the rise. Currently, Kong Lingzhang and others have also indicated that the development of the Chinese digital economy is generally on the rise, and the regional differences in the development of digital economy continue to narrow[5].The digital divide between the urban and rural areas is gradually reduced and the issues of uneven development and lack of ecological coordination are increasing.

In recent years, China's energy saving and emission reduction efforts have been realized step by step. From a macro perspective, the energy use per unit GDP is still on a downward trajectory, the carbon emission intensity is also on a downward trend and the energy-saving renovation work in various industries is orderly. In the industry, high energy consuming enterprises are gradually eliminating the old production equipment and advocating energy saving equipment and clean production technology. In terms of architecture, the ratio of green buildings and prefabricated buildings is gradually increasing; In the field of transportation, new energy vehicles are becoming popular in the market and smart transportation systems are also supporting the low carbon emission in transportation. All in all, China is still on the path of Industrialization and urbanization.

Many factors have an impact on the success of energy conservation and emission reduction. First, the traditional production mode has a low efficiency of energy use, and the transformation cost is high; Second, there is a lack of incentive for enterprises to transform. Second, the policy implementation must be improved and the division of energy-saving and emission reduction task in some areas is not scientific enough, and the assessment mechanism still needs to be perfected. Thirdly, energy structure of China is still dominated by fossil fuels. The proportion of clean energy needs to be further improved. As can be seen from this, the continual propagation of energy saving and emission reduction work still needs the concerted efforts of various parties.

3. Energy Saving and Emission Reduction by the Digital Economy

The digital economy and energy saving and emission cutting are important driving forces for China's economic transformation and development. Digital economy has an 'N' shape effect on energy intensity and

carbon intensity and is accompanied by strong spatial spillover effects. And this spatial spillover effect is more pronounced during the focused growth stage [6]. Labor productivity is bolstered and resources allocated optimally in the digital economy, which helps to mitigate carbon emissions in resource-based cities, as per a study by Luo Xing et al. In the meantime, it lowers the carbon emission intensity in its contribution to economic growth [7].

The digital economy doesn't directly impact the energy conservation and emission reduction but in many cases it contributes to energy conservation and emission reduction in other ways. There is literature that expands the lines of action with regard to production and everyday life. Regarding production, the building of the digital economy can be a good assistant to the upgrading of the urban industrial structure, optimize the regulation, and realize the energy-saving and emission reduction of urban industry. Regarding daily life, the digital economy helps to diminish the carbon footprint through less mobility in cities, increased awareness among citizens on environmental issues and promotion of modernization of social services. According to the research of Sun Wenyuan et al., the influence of the digital economy's development on carbon emission can be manifested in optimizing the energy structure and altering residents' consumption concepts. The results indicate that the digital economy has an inverted U-shaped impact on carbon emissions – first increasing, then decreasing. [9].

There are different ways of regulating energy conservation and emission reduction in the digital economy at different times. The short-term effect of the digital economy is to generate more carbon emissions due to the greater use of energy and higher use of high-carbon technologies. Digital technology development and the negative role of industrial structure upgrading are the main factors impacting carbon emissions in the digital economy in the long run. As can be seen from this, during the evolution of energy efficiency improvement and carbon mitigation, industrial transformation and technological improvement have a role to play.

At some point, there is also a win-win scenario between the digital economy and energy saving / emission reduction. Kou Jiali et al. said that the development of the digital economy can show the energy-saving and emission-cutting effect in the process of establishing theoretical models, and can greatly promote the energy-saving and emission-cutting of cities through green technology research and development, industrial transformation, capital factors, and optimized allocation [11]. Of these, the quantile regression results reveal that the coupling and coordination degree between the digital economy and unexpected emissions has the lowest coupling intensity at the 15th percentile, while the total energy consumption intensity is the lowest under the impact of the digital economy. The effect of the digital economy on the improvement of energy conservation and emission cutting efficiency is quite large at the 75th percentile, and is relatively low at other percentiles at the same time. To sum up, technology has an impact on our life and in the digital economy, energy saving and emission cutting are encouraged by different aspects and technologies.

To explore the regional differences in energy conservation and emission reduction effectiveness of digital economy, a GIS-based index was created based on 2017 data and compared with that of 2018.

The comprehensive development of China's digital economy is tending to be more and more inclined to regionalization, and the regional digital economy development gap is narrowing from day to day. But the variation in regional energy resources, the mobility of population and the economic level is a fact, the influence of the digital economy on energy conservation and emission reduction varies from region to region.

There is an objective difference in the effectiveness of the digital economy in energy saving and emission reduction in various regions. Kou Jiali et al. discovered that the role of the digital economy in energy saving and emission reduction has a non-linear pattern, and is inverted U-shaped, and emphasized that the impact is significantly different based on the regional differences, economic structure, and industrial characteristics. For instance, in the less developed areas like the central and western areas, the digital economy can only contribute to the carbon emission. Based on the results of the heterogeneity analysis, Du Xin discovered that the carbon emission reduction effect of the digital economy is significantly higher in the northern regions than in the southern regions, and its carbon emission reduction effect is only significant in urban agglomeration regions compared with urban agglomerations. Sun Wenyuan's study reveals that there are clear heterogeneities in the carbon emission effect of the digital economy – its effect is most pronounced in high-innovation investment energy-poor cities, developed region, and high innovation investment energy-poor cities. [8]. In addition, Luo Xing pointed out that the digital economy has more important effects on low-carbon transformation for declining and regenerating cities, but has no significant effects on growing and mature cities [7]. Hence, it is

necessary for the government to give the lead to developed areas and followed by underdeveloped areas, discover their own advantages, create links and gradually develop their digital economy in the country into a highly developed digital economy.

4. Conclusion

Both the digitalization of the economy and energy savings and emission reductions are progressing towards technology specialization, with a general improvement and reduction in regional disparities. But issues like regional disparities, technology constraints and indigenization costs remain. These issues will be addressed in future development, enabling the digital economy to better empower energy saving and emission cutting.

The impact of the digital economy on energy saving and emission cutting is inverted in an "N" shape, with significant spatial spillover effects, which are more significant in the growth stage and short term. The digital economy, as well as technological development and the growth of energy consumption, also in the early stage of development, causes increase in carbon emission and decline in energy efficiency, which hinders energy saving and carbon reduction. As the digital economy continues to develop, the empowerment of digital technology has been increasing, the industrial structure continues to optimized, the carbon emission gradually reduced, and the energy efficiency continues to improve, and energy saving and emission reduction is promoted. But, with the continuous development of the digital economy, the marginal effect decreases and the emission reduction effect weakens. During this process, regional linkage is quite easily established and spread to the neighbouring areas.

The digital economy is significantly effective in energy conservation and emission reduction, but the effectiveness of the digital economy differs from region to region. Digital industry foundation is strong and promotion effect of emission reduction is the strongest in the eastern region. The central region is the middle and the western region has weak inhibitory effect on emission reduction, and the short-term inhibitory effect is prominent. Different regions of the country have different levels of development, unequal distribution of energy and goal-based regional inequalities.

To sum up, in this article, the following suggestions are offered: Firstly, speed up the national digital transformation process and speed up the landing of the digital economy. To speed up the research and transformation of digital based green technologies. Guide the deep integration of digital technology and traditional industries, rely on big data, industrial Internet and other digital technologies, promote the intelligent and green transformation of traditional industries, and eliminate backward and inefficient production capacity; Vigorously support the development of low-energy and high value-added industries such as digital and green low-carbon industries, optimize industrial hierarchy and structure, and reduce the comprehensive level of energy consumption and carbon emission intensity of the industry.

Secondly, based on the digital economy to promote urban modernization construction and realize green, low carbon and smart cities. Through digital technology, optimize the allocation of urban resources, improve the operation efficiency of the city, reduce urban traffic congestion, energy waste, environmental pollution and other problems; Build an urban energy conservation and emission reduction digital monitoring platform, realize real-time monitoring, accurate control, intelligent scheduling of urban energy consumption and emission data, promote refined and green urban governance, and push the comprehensive level of energy conservation and emission reduction in urban modernization upgrading.

Thirdly, coordinate the regional coordinated development and optimise the spatial layout of energy saving and emission cutting in the digital economy. Adopt differentiated policies to reduce regional differences in the development of the digital economy, industrial foundations, energy saving and emission reduction levels.

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Funding

This research received no external funding.

Conflicts of Interest

The authors declare no conflict of interest.

Acknowledgment

This paper is an output of the science project.

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