

Research on the Green Financial System and the Development of the Energy Industry under the Background of Carbon Peaking and Carbon Neutrality

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Abstract

Against the background of the "carbon peaking and carbon neutrality" goals, the development of the green financial system and the energy industry has become an important driving force for achieving the low - carbon economic transformation and sustainable development. By analyzing the green financial policy system, market status quo, and the trend of energy industry transformation, this paper studies the problems currently encountered by green finance in the transformation of the energy industry. On this basis, it explores how green finance can promote the energy industry to transform and upgrade towards environmental protection and low - carbon, aiming to provide references for policymakers and enterprises. The research shows that green finance has played a positive role in supporting the development of the new energy industry, optimizing the energy structure, and promoting technological innovation. However, it still faces many challenges. It is necessary to further optimize the policy system, expand the capital - gathering effect of green finance, optimize the investment - guiding effect, and promote the scientific and technological innovation effect of green finance.

Keywords

Background of Carbon Peaking and Carbon Neutrality; Green Finance; Energy Industry

1. Introduction

In recent years, the Chinese government has paid more and more attention to the development of the green financial policy system in the context of energy transformation. Energy is a powerful driving force for economic growth and social development, and it is also an important component of the coordinated development of the green economy. While the development of the energy industry has brought economic growth, the energy consumption mainly based on coal, oil, and natural gas has led to the excessive emission of CO₂. The large - scale carbon emissions have

caused great harm to the environment, and the low - carbon transformation has become an urgent issue. Therefore, in September 2020, President Xi Jinping put forward the goals of "achieving carbon peaking by 2030 and carbon neutrality by 2060" at the 75th session of the United Nations General Assembly. Against this background, the development of green finance and the energy industry has become a key issue. On the one hand, the development of green finance is conducive to adjusting the economic structure and improving the energy utilization efficiency. On the other hand, it can reduce the harm to the environment. By guiding funds to flow into environmental - protection and low - carbon fields, green finance supports the transformation and upgrading of the energy industry, which is of great significance for achieving the "carbon peaking and carbon neutrality" goals. However, in the process of supporting the development of the energy industry, green finance still faces problems such as an imperfect policy system, an immature market mechanism, and low capital - use efficiency. Therefore, this paper aims to conduct an in - depth study on the current situation, problems, and countermeasures of the development of green finance and the energy industry, so as to provide theoretical support and practical guidance for promoting the low - carbon economic transformation in China.

2. Literature Review

Against the background of "carbon peaking and carbon neutrality", the development of green finance and the energy industry has become an important issue for achieving these goals. The 2021 Government Work Report proposed to implement special policies on financial support for green and low - carbon development. The investment scale required to achieve the "carbon peaking and carbon neutrality" goals is at least over one million billion yuan. At present, there is a large capital gap. It is necessary to establish a sound green financial policy system to obtain market funds to make up for the gap (Huang Zhuo, Wang Pingping, 2022)[1]. In recent years, the Chinese government has issued a series of policies to promote the development of green finance. These policies include, but are not limited to, the "carbon peaking and carbon neutrality" action plan, green loans, green equity, and green bonds (Fan Limin, 2024)[2]. These measures aim to promote the green and low - carbon development of the energy industry through financial means. China has initially formed a policy system and market environment to support the development of green finance. Green financial products have developed significantly in the fields of credit, bonds, and funds (Huang Xinrui, 2022)[3]. At the same time, the central bank and other institutions have continuously improved the ESG evaluation index system and investment decision - making mechanism. With the proposal of the "carbon peaking and carbon neutrality" goals, the new energy industry will have broad development prospects (Chen Xingxing, Tian Yixuan, 2023)[4]. This not only involves optimizing the energy structure but also promoting the transformation and upgrading of ener-

gy.

Green finance has played a key role in supporting the green transformation of the energy industry. The innovation of financial tools and products has provided financial support for the new energy industry. Although there are some challenges, the development of green finance and the new energy industry in China has achieved initial results. In the future, strengthening policy support, improving the market mechanism, and international cooperation are the keys to promoting the further development of green finance and the energy industry.

In summary, against the background of "carbon peaking and carbon neutrality", the integrated development of green finance and the energy industry is an important path to achieve China's low - carbon goals. Through policy guidance and market mechanisms, China is expected to make greater breakthroughs in the fields of green finance and new energy.

3. Development Status of Green Finance and the Energy Industry

3.1 Development Status of Green Finance

Green finance refers to considering environmental protection in the process of financial development and promoting environmental protection and the sustainable development of the social economy through financial innovation, financial tools, and financial management strategies, while achieving the sustainable development of the financial industry itself. In the Guiding Opinions on Building a Green Financial System released in 2016, green finance is defined as financial services provided to support economic activities related to environmental improvement, climate change response, and efficient use of resources. That is, financial services such as project investment and financing, project operation, and risk management in the fields of environmental protection, energy conservation, clean energy, green transportation, and green buildings. It is clearly stated that green financial tools mainly include green credit, green bonds, green funds, carbon finance, and other related financial products. Therefore, this paper summarizes the current development status of green finance from the perspectives of the above - mentioned financial tools.

3.1.1 Green Credit

Green credit refers to the environmental assessment of loan projects by financial institutions. When approving funds, they give preferential treatment to environmentally - friendly projects, enabling enterprises that consider both profitability and the environment to obtain loans at lower interest rates to ensure the implementation of enterprises' green projects. In recent years, the balance of green credit in China has shown an upward trend. By the end of 2022, the balance of green credit in China reached 22 trillion yuan, ranking first in the world, with a non - performing asset ratio of less than 1%, much lower than the world average. The balances of green loans for clean energy, green infrastructure, and energy - saving and environmental - pro-

tection were 5.68 trillion yuan, 9.82 trillion yuan, and 3.08 trillion yuan respectively, with average annual growth rates of 35%, 33%, and 59%. At the same time, against the background of "carbon peaking and carbon neutrality", the investment of green credit funds has also flowed more into the low - carbon transformation of traditional industries[5]. The green credit system is also being gradually constructed under the promotion of relevant departments, accelerating the expansion and diversification of the green credit scale in China.

3.1.2 Green Bonds

Green bonds refer to bond tools that specifically use the funds raised to finance green projects that meet the specified conditions or refinance these projects. The development of green bonds in China started relatively late. The first green bond was issued in 2015. However, the scale of green bonds has expanded very rapidly. Since 2016, the green bond market in China has shown a gradually increasing trend. From 2016 to 2019, the number of domestic green bonds issued continued to increase, from 80 to 340. In 2020, the epidemic led to a slump in the issuance of green bonds. The number of green bonds issued in China decreased to 278, a year - on - year decrease of 18.24%. However, it has continued to grow since then. In 2022, the issuance of green bonds in China increased by 874.6 billion yuan, an increase of 44.04% compared with the previous year, accounting for 89% of the issuance scale of green bonds at home and abroad. And the number of issuances was 521, an increase of 7.5% compared with the previous year. By the end of 2022, the scale of green bonds in China had reached approximately 2.78 trillion yuan. The rapid development of green bonds in China benefits from the introduction of a series of relevant policies and measures. The green bond market system has been gradually improved, attracting more issuers and investors with green bond demand in the market. By the end of 2020, the issuance volume of green bonds in China had ranked second in the world.

3.1.3 Green Insurance

Green insurance is of great significance in China's 14th Five - Year Plan and the realization of the "carbon peaking and carbon neutrality" goals. The China Banking and Insurance Regulatory Commission clearly defines green insurance in the Notice for the first time as "Green insurance refers to the general term for the economic behaviors of the insurance industry in providing risk protection and financial support in environmental resource protection and social governance, green industry operation, and green life consumption." Green insurance not only provides financial support for environmental protection but also guarantees enterprises' green investment, making enterprises' green financing channels more diversified. Under the support and guidance of relevant policies, green insurance has gradually developed. Since 2013, China has begun to implement the pilot of compulsory environmental

pollution liability insurance in various places. With the continuous pilot and system improvement of the insurance industry in serving green development, the insurance scope and various clauses of environmental pollution liability insurance have basically taken shape and have begun to be promoted across the country. In 2017, the Reform Plan for the Ecological Environment Damage Compensation System was put forward, and then the ecological environment damage compensation system was piloted nationwide. In 2018, the Ministry of Ecology and Environment compulsorily levied environmental pollution liability insurance on enterprises that cause environmental pollution in the management measures of such insurance, providing options for dispersing environmental risks and internalizing external costs, which has an enlightening effect on the legislative work of other green insurances. By 2020, the amount of environmental pollution liability insurance in China reached 18.3 trillion yuan, an increase of about 6 trillion yuan compared with the previous year, with an average annual growth rate of 14%[7]. The compensation amount has shown an upward trend in recent years. In 2020, the compensation amount was 21.35 billion yuan, with an average annual growth rate of 28.8%. The trend of the joint growth of the current and cumulative insured amounts of green insurance indicates that the guarantee function of green insurance is continuously enhanced. In addition to environmental pollution liability insurance, green insurance also promotes the development of green finance by investing in other green insurance products. In the energy field, the cumulative insured amount of Taiping Property Insurance's green insurance exceeds 2 billion yuan, and that of Ping An Property Insurance exceeds 400 billion yuan[8].

3.1.4 Carbon Finance

Carbon finance aims to promote the reduction and management of carbon emissions by means of the market and covers the fields of financial activities and mechanisms. These activities and mechanisms generally include carbon funds, carbon quotas, carbon emission trading, financing, investment, insurance, etc. In 2010, China first proposed the construction of a carbon trading market. With the continuous exploration of the carbon trading market and the introduction of a series of policies to build and improve the carbon market, its market scale has become larger and larger. From 2013 to 2021, the trading volume of the carbon trading market generally showed an upward trend. In 2022, the annual trading volume of the national carbon emission quota was 50.88 million tons, the amount was 2.814 billion yuan, and the average price was 45.61 yuan/ton[9]. The development and continuous improvement of the carbon finance market are conducive to promoting the realization of the "carbon peaking and carbon neutrality" goals. Carbon finance can optimize the allocation of resources, direct more funds to low - carbon industries, and promote the use efficiency of green resources.

3.2 Current Situation of Energy Structure Consumption

Energy is an important material force supporting the sustainable development of society. China is the largest energy - consuming country in the world. With the rapid growth of China's economy, the consumption of energy is also increasing, which also brings pollution to the environment. Especially after the proposal of the "carbon peaking and carbon neutrality" goals, China's energy consumption is facing transformation and upgrading and urgently needs to develop towards new energy that is resource - saving and environment - friendly. In the short term, the dominant position of coal consumption will not change. However, in recent years, the proportion of coal and oil consumption has shown a downward trend. In 2018, it was first reduced to less than 60%, and in 2021, it dropped to 55.9%. The proportion of oil showed an upward trend before 2000 due to the lack of coal resources. After 2000, the decrease was mainly due to the change in international oil prices and the shortage of oil supply and demand. In recent years, clean energy such as natural gas, wind energy, and water energy has continued to develop. The proportion of natural gas and other clean energy such as primary electricity has continued to rise. In 2021, natural gas rose to 8.8%, more than four times that in 1990, and other clean energy such as primary electricity rose to 16.7% in 2021, more than three times that in 1990[10]. Since the "13th Five - Year Plan" period, China has accelerated the adjustment of the energy consumption structure, reduced coal consumption, and vigorously promoted the use of clean energy, successfully achieving the goals of the "13th Five - Year Plan". In 2023, the proportion of coal consumption in China's total energy consumption was 55.3%, a decrease of 0.7 percentage points compared with 2022. The proportion of clean energy consumption such as natural gas, hydropower, nuclear power, wind power, and solar power was 26.4%, an increase of 0.4 percentage points. Although so, China's energy consumption structure still needs to be improved. After entering the "14th Five - Year Plan" period, this period is particularly important for achieving the "carbon peaking" goal. China will continue to optimize the energy structure dominated by coal consumption, increase the utilization rate of clean energy, develop new energy, increase the proportion of natural gas consumption, and promote the transformation of the traditional fossil energy consumption structure towards clean and low - carbon energy. The above data are from the China Statistical Yearbook.

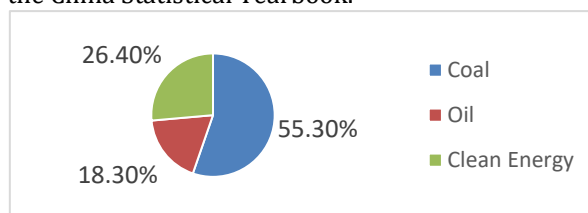


Figure 1. Proportion of Different Energy Consumption in 2023

4 . Challenges and Demands in Energy Transition

Against the backdrop of the "dual carbon" goals, the traditional energy consumption model is at a disadvantage in resource consumption and carbon emission control, making it urgent to change the energy consumption structure dominated by traditional fossil fuels. With the continuous development of clean energy technologies and their lower costs, renewable energy sources such as solar and wind power have become important alternatives to traditional energy. However, energy transition faces challenges including technological maturity, capital investment, and market access. These require the support of green finance to promote large-scale application of renewable energy and technological innovation through financial support and market guidance, thereby accelerating the low-carbon energy transition and driving the energy industry toward a more environmentally friendly and sustainable direction.

4.1 Single Financing Model Restricts the Capital Agglomeration Effect of Green Finance

Theoretically, green finance can provide long-term and stable funding sources and other support for the development of new energy enterprises. However, the current reality in China is less than ideal, with the capitalization process of green finance being slow and its role limited. The smaller number of new energy enterprises among the top 500 Chinese enterprises compared to other types of enterprises reflects that although investment in new energy by green finance in the capital market is increasing, new energy enterprises still have significant room for capitalization and require greater support for the new energy industry.

The development of new energy enterprises not only relies on natural conditions such as hydropower and wind energy but also requires technological innovation and R&D, which demand substantial funding. The capital agglomeration effect of green finance plays a crucial role. However, a green finance in China currently mainly operates through green credit, while other green financial instruments such as green insurance primarily target polluting enterprises. As new energy enterprises are clean and environmentally friendly, they fall outside the promotion scope of green insurance, significantly reducing the support of green finance for new energy enterprises. Moreover, green credit, supported by green finance policies, is heavily concentrated in the new energy sector. When macroeconomic fluctuations occur, the supply and demand of new energy enterprises will also fluctuate, threatening the safety and efficiency of funds and increasing risks in the financing environment. Therefore, it is necessary to expand the capital market financing scale for the new energy industry, further develop green financial activities, and involve more participants in green finance.

4.2 Chaotic Investment Guidance Effect of Green Finance on the New Energy Industry

The new energy industry, with its low-carbon and high-tech characteristics, has re-

ceived significant attention in China, and successive policies have been introduced to support its development. However, the lack of evaluation of policy effectiveness has led to imbalanced industrial development in practice. For example, China provided substantial policy support to the photovoltaic industry, quickly becoming the world's largest photovoltaic producer within a few years. This led to severe overcapacity after increased production. Meanwhile, reduced support for the photovoltaic industry in countries such as the EU caused profit declines and increased operational risks for Chinese enterprises. Loss-making enterprises were not eliminated due to policy support, leading to overall industrial imbalance. Therefore, although the new energy industry has developed rapidly under the guidance of green finance, it lacks autonomy, and more targeted green financial policies should be formulated to ensure sustainable industrial development.

4.3 Insufficient Innovation in Green Finance

The development of green finance in China's new energy industry currently faces issues such as insufficient innovation, unimproved services, high financing costs, and limited support for technological innovation. Compared with other strategic emerging industries, the technological innovation level of the new energy industry lags significantly behind sectors such as next-generation information technology, high-end equipment, and new materials. As shown in Table 1, the patent implementation rate, patent industrialization rate, patent licensing rate, and patent transfer rate in the new energy industry are only 56.1%, 41.1%, 6.8%, and 4.4% respectively, all below the average. This further indicates that the technological innovation effect of green finance has not been fully realized in the development of the new energy industry.

Table1. Patent Implementation, Industrialization, Licensing, and Transfer in Six Emerging Industries

Industry Category	Patent Implementation Rate (%)	Patent Industrialization Rate (%)	Patent Licensing Rate (%)	Patent Transfer Rate (%)
Next-Generation Information Technology	63.2	46.5	7.8	6.5
High-End Equipment	65.9	53.7	6.7	6.0
New Materials	64.7	47.9	7.9	6.3
Biotechnology	61.3	45.1	6.6	7.3
New Energy	56.1	41.1	6.8	4.4
Digital Creativity	43.7	32.4	7.5	6.7

Average	59.2	44.5	7.2	6.2
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5. Countermeasures and Suggestions for Green Finance to Support Energy Transition

Coordinating energy transition and vigorously developing new energy are crucial for achieving the "dual carbon" goals. As an important funding source for the green and low-carbon development of the real economy, green finance has invested substantial funds in the energy sector. However, China's green financial market is still in its infancy. Based on the above analysis, the following countermeasures are proposed to address the challenges in green finance's support for the new energy industry:

5.1 Expanding the Capital Agglomeration Effect of Green Finance

The capital agglomeration effect of green finance on the new energy industry can transform scarce and usable resources into profit-generating capital, thereby improving the financing efficiency of new energy enterprises. However, the current proportion of green credit in total credit is small, and the share of green bonds in the global market is also quite low, indirectly indicating insufficient support from green finance for the new energy industry. Therefore, the capital agglomeration effect should be leveraged to attract more social capital. First, establish a priority system for new energy enterprises to go public; second, encourage more institutions to actively participate in the listing and financing of new energy enterprises to increase the number of listed new energy companies, which can use the main board market to attract capital for efficiency improvement and accelerated development; finally, utilize the growth enterprise market and over-the-counter market to create more financing channels for the new energy industry [6].

5.2 Optimizing the Investment Guidance Effect

To leverage the investment guidance effect of green finance, first, increase the proportion of green credit in total credit and design green credit products suitable for new energy development; second, address the issues of maturity mismatch and risk exposure in green credit supporting the new energy industry by issuing asset securitization products such as green credit-backed securities to enhance the liquidity, profitability, and safety of financial institutions, better aligning indirect financing with the development characteristics of the new energy industry. Additionally, further optimize the transmission mechanisms and channels of the investment guidance effect, gradually eliminating external factors that hinder its effectiveness, thereby substantially improving the overall support level of green finance for new energy industry development.

5.3 Promoting the Technological Innovation Effect of Green Finance

In promoting the technological innovation effect, first, advance the establishment of a green information sharing platform to reduce risks caused by information asymmetry, strengthen corporate environmental awareness and responsibility, improve information disclosure systems, and strive to build a comprehensive green information sharing platform with diverse participants and wide coverage to enhance the financing efficiency of new energy enterprises; second, support financial product innovation, explore all areas supporting the new energy industry, continuously increase funding for infrastructure such as wind power, photovoltaic power, and hydropower, and expand the application scenarios of new energy projects. In line with the development characteristics and actual needs of the new energy industry, actively develop and promote new energy subsidy confirmation loans, and explore environmental rights mortgage products such as carbon emission rights mortgages to provide precise financial support for new energy enterprises. In terms of risk-sharing mechanisms, accelerate consumption subsidies and support measures for green power and new energy vehicles, provide loan interest rate discounts and guarantee fee subsidies for new energy technology R&D enterprises, and support guarantee institutions in providing credit enhancement services to lower corporate financing thresholds. Meanwhile, establish a risk compensation fund pool to cover losses from credit products of related enterprises supported by financial institutions, effectively mitigating corporate financing risks and promoting the technological innovation effect of green finance.

6. Conclusion

Under the "dual carbon" goals, China's economy is shifting toward green and sustainable development, and the energy industry urgently needs to transition from traditional energy to new energy. Green finance is of great significance for the development of new energy. This paper proposes suggestions to expand the capital agglomeration effect of green finance, optimize the investment guidance effect, and promote the technological innovation effect in response to the challenges faced by the new energy industry. These green financial support mechanisms can effectively promote the sustainable development of new energy in China, assist the long-term growth of green and low-carbon enterprises, and facilitate the smooth advancement of the dual carbon goals.

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