

Research And Enlightenment of China's Environmental Protection Policy on The Development of Carbon Finance: A Case Study of The New Energy Vehicle Industry

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Abstract. In recent decades, environmental problems continuously interfering with people's daily lives, and the new energy automobile industry has thus risen among big countries. Despite the rapid development of China's new energy vehicle industry, there are still many problems that need to be solved. By reading and collecting a large number of literatures, this paper comprehensively studies and summarizes a number of papers using the TRIZ theoretical research model, based on the research and analysis of the development status of BYD, a well-known industry in the field of new energy vehicles in China, discusses the methods and shortcomings of China's environmental protection policies to promote the development of carbon finance market in the context of the development of new energy vehicles in China in recent decades. The paper puts forward some feasible solutions to these problems, as well as some inspirations for the future development of China's new energy automobile industry in the carbon financial market.

Keywords: New energy, green innovative technology, carbon finance market, green finance.

1. Introduction

With the intensification of global climate change, climate warming has posed a severe challenge to the survival and development of human society. Against this backdrop, reducing greenhouse gas emissions and promoting low-carbon development have become the common mission of all governments and the international community. Carbon finance, as an emerging financial model, has become a keyway to achieve the goal of green economy with its innovation and effectiveness. As a major country with important influence in the world, China has shown a positive attitude and remarkable results in the formulation of environmental protection policies and the development of carbon finance.

As a pivotal pillar of the environmental protection industry, the new energy vehicle sector, characterized by its low emissions, high efficiency, green nature, and sustainable development, has emerged as a vital instrument in the fight against climate change. The Chinese government is deeply aware of the dual significance of new energy vehicles for environmental protection and economic development, so it has introduced a series of strong environmental protection policies, including car purchase subsidies, tax relief, charging infrastructure construction, etc., aiming to promote the popularization and application of new energy vehicles. The implementation of these policies has not only greatly stimulated the vitality of the new energy vehicle market and provided a huge space for the development of new energy vehicle enterprises, but also provided a broad stage and a deep soil for the development of carbon finance in China.

In China, the development of carbon finance shows vigorous vitality and vitality. The gradual establishment and improvement of carbon emission trading market provides a market-oriented incentive mechanism for carbon emission reduction. The continuous innovation and enrichment of carbon financial products meet the diversified needs of different market players. And the continuous optimization and improvement of carbon financial services provide more convenient and efficient financial support for carbon emission reduction projects. As one of the important application fields

of carbon finance, the new energy vehicle industry has an increasingly strong financial demand in the upstream and downstream of the industry chain. The application prospect of carbon finance in the new energy vehicle industry is broad.

However, despite the remarkable achievements made in China's environmental policy and carbon finance development, it still faces many challenges and problems. How to further improve the environmental protection policy system, improve the efficiency of policy implementation, and ensure the smooth realization of the policy objectives? How to deepen the reform of the carbon finance market, promote the innovation of the carbon finance products, and meet the diversified needs of the market? How to strengthen the deep integration of the new energy vehicle industry and carbon finance, realize the benign interaction between industry and finance, and jointly promote green and low-carbon development? These problems urgently need our in-depth study and discussion.

Therefore, this paper aims to analyze the impact of China's environmental protection policy on the development of carbon finance and explore the important role and great potential of the development of carbon finance in the new energy vehicle industry as an example. At the same time, this paper will combine domestic and foreign the experience and lessons of carbon finance development, and put forward targeted strategies and suggestions, in order to provide useful reference and enlightenment for the further improvement of China's environmental protection policy and the sustainable and healthy development of carbon finance.

2. Take the New Energy Vehicle Industry as an Example to Analyze the Impact of Environmental Protection Policy on the Development of Carbon Finance

2.1. Industry Background

On September 22, 2021, the State Council issued the "Work Opinions of the State Council and the CPC Central Committee on the Comprehensive and Accurate Implementation of the New Development Concept of Carbon Peak and Carbon Neutrality," emphasizing that achieving carbon peak and neutrality is an inevitable choice for addressing resource and environmental constraints, realizing sustainable development for the Chinese nation, and fulfilling the solemn commitment to building a shared community for all mankind [1]. Internationally, the carbon neutrality stipulated in the Paris Agreement mainly focuses on the targets and mechanisms of global greenhouse gas emission reduction. Specifically, it calls for countries to work together to reduce greenhouse gas emissions low enough to keep global warming within 2 or even 1.5 degrees Celsius. Carbon neutrality is considered one of the key tools. In addition, the Paris Agreement emphasizes the importance of international cooperation mechanisms in the process of promoting carbon neutrality. Developed countries are required to provide financial, technological and capacity building support to assist developing countries in implementing emission reduction and carbon neutrality measures. Such cooperation will not only help to promote the global energy transition and carbon markets, but also to ensure equitable and sustainable development among countries in tackling climate change.

As one of the largest developing countries, China's contribution to carbon neutrality is significant and gradually increasing. As one of the world's largest carbon emitters, China has taken a series of positive measures to achieve its carbon-neutral goals and has made an important contribution to global climate governance. First, China has made a clear commitment at the policy level. The government has proposed the goal of achieving carbon peak by 2030 and carbon neutrality by 2060 and has defined this strategic direction in several government documents. These policies provide clear guidance and support for China's carbon emission reduction efforts. In addition, China is also promoting the optimization of its industrial structure and energy mix. By developing green and low-carbon industries, promoting industrial transformation and upgrading, and strengthening energy consumption management, China is gradually reducing the proportion of high-carbon industries, improving energy efficiency, and reducing carbon emission intensity.

2.2. Enterprise Background

In order to study the impact of government policies on the development of new energy vehicles in the carbon financial market, this paper selected the new energy vehicles of BYD company as a case study. Build Your Dreams new energy vehicle enterprise background is quite deep and rich. Byd is a Chinese high-tech private company founded in 1995, headquartered in Shenzhen, Guangdong province. This company integrates IT, automobile and new energy industries, and has made remarkable achievements especially in the field of new energy vehicles. In the automotive business, BYD has gradually grown into the world's leading new energy vehicle manufacturer through continuous technological innovation and market expansion. Byd's new energy automobile product line, covers from private cars to buses, taxis and other types, and application scope has covered multiple areas, including private cars, buses, taxis, sanitation car, road passenger transport, urban commodity logistics, urban buildings in areas such as conventional flow, as well as warehousing, mines, ports and airports. Byd has made a number of major breakthroughs in new energy vehicle technology, such as blade battery, Yunbian system, e platform 3.0 and Yisifang core technologies. The application of these technologies not only improves the performance and quality of BYD's new energy vehicles, but also further strengthens its leading position in the industry. In addition, BYD also actively promotes the construction of multi-brand matrix and the process of going overseas, committed to its own new energy vehicle technology and products to the global market, in order to achieve a wider market coverage and brand influence. With the growing global demand for new energy vehicles, BYD is expected to continue to maintain its leading position in the future and promote the sustainable development of the new energy vehicle industry.

2.2.1 Case Specific Circumstances

Under the background of the global carbon peak and the ban of fuel vehicles in many regions, the new energy vehicle industry continues to maintain a trend of rapid development. The driving force of the development of new energy vehicles is gradually shifting from the To Business market with policy subsidies to the high-end and intelligent To Customer market. In October 2020, The State Office of the State Council issued the New Energy Vehicle Industry Development Plan (2021-2035) (referred to as "New Energy Vehicle 2035 Plan"), which is the top-level design for the development of China's automobile industry. At the present stage, the internationalization process of China's new energy vehicles presents a state of a hundred flowers blossoming. In addition to traditional car companies such as SAIC, Jili and BYD, new power car companies such as Weilai and Lixiang are also speeding up their overseas layout.

As the leader of China's new energy vehicle industry, BYD has strong research and development strength and industrial layout in the key technologies of "three power". It is expected that in the next few years, China's electric vehicle industry will achieve greater development in policy support, market demand, technological innovation and industrial chain improvement, making important contributions to the sustainable development and upgrading and transformation of China's automobile industry. Byd's current new energy vehicle products are mainly divided into dynasty and ocean two series. Dynasty series models are mainly SUVs and cars, to maintain pure electric, hybrid, fuel three power versions, belong to the mainstream products for the mainstream market at the present stage. The ocean series focuses on the pure electric power version, mainly for young consumer groups. In addition to private cars, it also involves public transport, logistics, passenger transport and new energy vehicles operating in airports and ports.

2.2.2 Problems Incomplete at Present

As a leading company in the new energy vehicle industry, BYD's products have been widely concerned in the market. However, any product cannot be perfect, byd new energy vehicles also have some problems. Here are some of the common questions:

The first problem is range and battery performance. Although BYD has made significant progress in battery technology, some users report that its range of new energy vehicles still cannot meet all its needs, especially during long trips or bad weather conditions. In addition, the problem of battery

performance attenuation is also the focus of users, and over time, the capacity and performance of the battery may gradually decline.

Secondly, charging facilities and charging speed are also an existing problem. Despite BYD's continuous efforts in the layout of charging facilities, there are still insufficient and uneven distribution of charging facilities. In addition, some users reflect that the charging speed of their new energy vehicles is slow, especially when using public charging piles, which need to spend a long time waiting for the charging to complete.

Finally, production capacity is also a thorny issue. Byd while relying on their own technology platform to build many hot models, sales orders continued hot, but because the previous years of new energy vehicles market demand is not so much now, so byd in automobile manufacturing base construction more conservative, before 2020, byd almost no passenger car base expansion, until the development of new energy automobile market in recent years, began to strengthen the construction of manufacturing base, but the part of its models still exist capacity problem [3].

2.3. Theoretical Analysis

2.3.1 Theoretical Basis

Based on the above solutions to solve problems of new energy vehicles, this research invoked the TRIZ Theory (Theory of the Solution of Inventive Problems) and summarized the law and method of solving issues of new energy vehicles based on the research of large amounts of literature reading [4]. As a solution, the following policies implemented by the Chinese government for the development of the new energy automobile industry can play an effective role in solving the problem: charging infrastructure construction, new energy automobile industry development support policy, financial subsidy policy and vehicle purchase tax reduction policy.

2.3.2 Instance Analysis

Through an analysis of these issues, this study identifies three crucial factors in government policies that facilitate the development of the new energy vehicle (NEV) industry in the carbon finance market. These factors are the efficacy of policies in supporting the construction of NEV infrastructure, their capacity to promote the optimization of the NEV industrial chain, and their ability to drive the optimization and upgrading of NEV enterprises.

(1) In view of the problem that how can government policies of carbon market help domestic new energy vehicle infrastructure construction, the "charging infrastructure construction" policy implemented by the state can support the construction of charging infrastructure such as charging piles with investment, provide convenient conditions for the popularization of new energy vehicles, and further release the consumption potential of new energy vehicles. Today, in response to the problem of insufficient charging facilities, uneven distribution and uneven charging quality, The General Office of the State Council issued the "Guiding Opinions on Further Building a high-quality Charging Infrastructure System" in June 2023 strengthened the layout of new energy vehicle charging infrastructure, in accordance with the basic principles of scientific layout: moderate advance, innovation and integration, safety and convenience. Further building a high-quality charging infrastructure system [5]. It strengthened the coverage of charging infrastructure network, built a well-structured urban charging network, focusing on residential areas, office areas, business centers, industrial centers, leisure centers, and actively build an information network platform for the sharing of charging infrastructure information and facts through various convenient channels such as map software. It is convenient for citizens to use charging piles and understand the real-time location of charging piles [6]. In pursuit of enhancing the charging rate and quality of electric vehicle charging stations, it is imperative to expand their scale while adhering to green development principles. This approach aims to strengthen the infrastructure for new energy vehicles, mitigate carbon emissions, and collectively advance towards the "dual carbon" goals.

(2) In view of the problem of how to use policies to promote the optimization of the new energy industry chain, the green development policy and financial subsidy policy of the new energy

automobile industry implemented by the state can provide deeper support to this problem. For example, the state actively strengthens the guaranteed conditions of the new energy automobile market and formulates a fine plan to promote the development and implementation of the carbon resource industry. The "New energy Vehicle power battery collection and utilization Management Measures" researched by experts are constantly building the green industry chain ecosystem of the new energy automobile industry. In addition, under the continuation and optimization of the new energy vehicle purchase tax reduction policy, the purchase tax policy for vehicles and passenger cars is extended for a longer period of time, and the outstanding car enterprises that have been evaluated by the Ministry of Industry and Information Technology according to the technological progress of new energy vehicles, the development of standard systems and model changes enjoy the vehicle purchase tax reduction policy, and promote enterprises to accelerate the research and development and upgrading of new energy vehicle technology to better respond to the "double carbon" goal to accelerate the development of green industries [6]. Based on this situation, if the country can strengthen the cooperation and communication between the leading new energy automobile enterprises in the industry through fiscal policies, as well as financial subsidies for scientific researchers who have made outstanding innovative contributions to the innovation field of new energy vehicles, people can more effectively make the domestic new energy field go hand in hand and continuously break through innovation.

(3) In view of how can policies promote the optimization and upgrading of new energy enterprises, the state can implement the incentive policy for the after-sales service of new energy vehicles under the policy of financial subsidies, aiming at providing economic subsidies to the after-sales service institutions that obtain a good reputation through quality certification and other ways, so as to optimize the after-sales service system and enhance the after-sales service experience of customers. In the process of vigorously promoting the development of the new energy automobile industry, Xiamen City, for example, has responded positively and continuously improved relevant policies by introducing many financial subsidies for the promotion and application of new energy vehicles, and achieved remarkable results [7], as shown in table 1. The government should encourage enterprises to carry out scientific research and technological transformation through preferential tax measures [8]. At the same time, people insist on carrying out the special action of "Upward development of Chinese automobile brands" guided by the Ministry of Industry and Information Technology of the People's Republic of China to help supervise enterprises strengthen quality management, optimize production capacity layout, promote the large-scale development of new energy vehicles, and create local brands that are more internationally competitive in the field of new energy vehicles [6].

Table 1. The number of new energy vehicles promoted and holdings in Xiamen City unit:10 thousands

year	Amount of promotion	holdings
2017	0.43	2.3
2018	1.08	3.9
2019	1.64	4.4
2020	1.55	5.1

2.4. Theoretical Influencing Factors

In addition, different factors that exist inside and outside the market can affect the successful implementation of theories and policies. Through the study of TRIZ model, this study summarized several key influencing factors: the level of scientific and technological progress, the level of market demand, economic and environmental factors and environmental protection factors.

Firstly, regarding the level of scientific and technological progress factors, the level of new energy science and technology in China plays a key role in whether it is infrastructure construction or increasing the performance of automobiles. Therefore, the country should vigorously promote its science and technology level while developing the economy to ensure more protection for the market. Secondly, to regard the factors of market demand level, China should increase the selling point of

performance comfort of new energy vehicles to better meet consumer demand, so as to stabilize market demand and supply relationship. Thirdly, regarding the economic environment factors, the unstable economic environment at home and abroad may play a role in obstructing the implementation of the policy theory. China should stabilize the domestic economic market and prepare to respond to various potential crises. Finally, to regard environmental protection factors, China should give consideration to environmental protection while vigorously developing the economy of new energy vehicle enterprises and cater to the main purpose of green economic development.

2.5. Workaround

In view of the challenges of BYD's new energy vehicles in terms of mileage, battery performance, charging facilities, charging speed and production capacity, the guidance and support of government and industry policies are particularly important. By formulating forward-looking and targeted policies and measures, the paper can effectively promote the solution of these problems and promote the healthy development of the new energy vehicle industry.

2.5.1 Improves Range and Battery Performance

It is necessary to increase scientific research funding support and tax incentives. The government should increase financial subsidies and tax exemptions for the research and development of core components of new energy vehicles, especially high-energy-density battery technology, to encourage enterprises to accelerate the pace of technological innovation and break through the bottleneck of mileage. At the same time, a special fund will be set up to support the research of battery recycling technology, extend the life cycle of batteries, and alleviate users' concerns about battery performance degradation.

It is necessary to further improve the standardized certification system.

establish and improve the performance and safety standard system of new energy vehicle batteries and ensure that the battery products circulating in the market meet the requirements of efficient and safe use through a strict standard certification mechanism and enhance consumer confidence.

2.5.2 Improve the Construction of Charging Facilities and Charging Efficiency

Guidance on infrastructure planning and construction is necessary. Introduce relevant policies to guide local governments to reserve land for charging facilities in urban planning and encourage public-private partnership (PPP) investment in the construction of charging stations, especially the coverage of charging networks in high-speed roads and remote areas, so as to solve the problem of uneven distribution of charging facilities.

The promotion and unification of standards for fast charging technology are needed. The government should promote the research and development and application of fast charging technology, provide corresponding R&D funding, and coordinate the unification of standards within the industry to ensure the compatibility between different brands of vehicles and charging facilities, and reduce the waiting time of users for charging.

2.5.3 Strengthen capacity expansion and market regulation

Industrial policy guidance is very necessary. the government can formulate corresponding industrial policies, give preferential policies such as land and financing for the expansion of new energy vehicle manufacturing bases, encourage enterprises to flexibly adjust the scale of production according to market demand, and at the same time, avoid overcapacity caused by blind expansion through industrial planning.

Market demand forecasting and policy incentives are a must. Establish a market demand forecasting model for new energy vehicles, adjust incentive policies such as purchase tax reduction and exemption and car purchase subsidies in a timely manner according to the forecast results, guide consumers to choose to buy cars, balance the relationship between supply and demand, and provide data support for enterprise capacity planning.

To sum up, through the effective combination of precise government policies and market mechanisms, BYD's new energy vehicles can effectively respond to the current challenges, promote industrial technology upgrading, optimize infrastructure layout, enhance production capacity adaptability, and ultimately promote the high-quality development of China's new energy vehicle industry.

3. Conclusion

China's new energy vehicle industry has undergone years of development. Drawing upon a comprehensive review of extant literature pertaining to the nexus between the new energy vehicle industry and carbon market financial policies, this paper delves into the current challenges faced by the NEV industry and the catalytic role of governmental financial policies. It further distills effective policies that can be implemented within the new energy vehicle industry against the backdrop of governmental insights in promoting green carbon finance development and green development within the new energy vehicle sector.

It is expected that in the next few years, China's electric vehicle industry will make greater progress in policy support, market demand, technological innovation and industrial chain improvement, and make important contributions to the sustainable development and upgrading and transformation of China's automobile industry. In the future research on new energy vehicles, green manufacturing and circular economy can be explored, and this research can focus on the development of green manufacturing processes and material recycling technologies and establish a circular economy model to reduce the impact of new energy vehicles on the environment in the production and waste treatment process, which also has a positive impact on the development of the carbon finance market.

To sum up, the future research on new energy vehicles will involve many fields and directions, which will not only help promote the progress and development of new energy vehicle technology and carbon finance market, but also bring more convenient, environmentally friendly and intelligent experience to people's travel.

Authors Contribution

All the authors contributed equally, and their names were listed in alphabetical order.

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