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Exploring the Development Path of China's Carbon Trading and Carbon Finance Market

-- Based on the Experience of the European Union

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ABSTRACT

Based on the research of domestic and foreign scholars on the carbon finance market, this article summarizes the development history and model innovation of domestic and EU carbon markets, and compares similarities and differences. Finally, based on the case of the EU carbon finance market, this paper summarizes experience from several aspects such as market mechanisms and supporting measures, and proposes an innovative model for promoting the development of carbon trading markets through carbon finance markets. By organically combining the two, countermeasures are proposed to promote the sustained and high-quality development of China's carbon trading market, and to fully play a role in realizing China's carbon neutrality vision.

KEYWORDS

Carbon Finance; Carbon Trading; Low-carbon Economy.

1. DEFINITION OF CARBON FINANCE MARKET

In the context of economic development in the 21st century, environmental issues such as global climate change have become one of the most challenging challenges facing the world. In today's society, the issues of sustainable development and the development of low-carbon economy have received high attention from people. Internationally, countries have signed agreements such as the United Nations Framework Treaty on Climate Change and the Kyoto Protocol, and have subsequently formulated a series of important documents such as the Bonn Agreement, Marrakech Agreement, and Copenhagen Agreement, which have enabled countries around the world to establish a unified political framework and legal system in addressing climate change issues.

Since the reform and opening up, China's economic development has achieved remarkable results, but it has also formed a high carbon, high pollution, and high energy consumption economic growth model. China, as the world's largest emitter of greenhouse gases, faces severe challenges, but has even greater potential for emission reduction. In July 2021, China's national carbon trading market officially launched trading. The carbon emission trading market, as an important market emission reduction tool, will play an important role in achieving China's "dual carbon" goals. At present, the construction of China's carbon trading market is still in its early stages, with problems such as imperfect systems, insufficient participants, and low degree of financialization in the carbon trading market. Especially in the financialization of the carbon trading market, there are few types of carbon

finance products in China, with a relatively small overall scale and low participation of financial institutions. Sorting out the development context and experience of market mechanisms, supporting measures, and other aspects plays an important role in exploring China's low-carbon economic development mode in depth. In addition, the carbon finance market has various functions, including price discovery and stability, risk management and risk transfer, which can better reduce costs for social emissions reduction and serve the development of low-carbon economy.

To clarify the research direction and the development context and mechanism of carbon finance market, this article divides carbon finance market into narrow carbon finance market and broad carbon finance market. The narrow definition of carbon finance market refers to a carbon trading market that uses carbon emission rights as the trading subject and is not included in financial attributes, that is, a primary market based on carbon quota trading for market participants -- the carbon emission rights trading market. The broad carbon finance market not only includes carbon emission trading markets, but also refers to the use of carbon emission rights as carbon assets and the trading activities and financial institutional arrangements of various related financial products. This article focuses on the carbon finance market, which plays a constructive role in establishing a more extensive and mature carbon trading market driven by its financial product trading and mechanism.

The narrow definition of carbon finance market mainly refers to the carbon emission trading market. The main participants and ways of participation are primary trading markets where enterprises and individuals obtain quotas and achieve emission reduction targets by buying and selling carbon emission rights. The trading mechanism in which emission entities with lower emission reduction costs sell their emission rights at an appropriate cost to emission entities with higher emission reduction costs not only enhances the enthusiasm of enterprises to assume social responsibility and fulfill emission reduction targets, but also increases market activity. The carbon trading market releases price signals to achieve emission reduction targets, provides effective market incentives, assists in the low-carbon transformation of social production, and also provides financing channels for green and low-carbon development in industries and regions.

Carbon finance refers to the low-carbon economic investment and financing activities that emerged from the Kyoto Protocol, also known as carbon financing and the buying and selling of carbon materials. This refers to financial activities such as direct investment and financing, carbon rights trading, and bank loans that serve to limit greenhouse gas emissions and other technologies and projects. Financial capital is used to drive the improvement of carbon emissions trading markets, and financial means and methods are used on market-oriented platforms to enable the trading of related carbon financial products and their derivatives, ultimately achieving the goal of sustainable development. Under the framework of broad carbon finance, carbon assets, as a special and scarce valuable economic resource, are endowed with deeper "financial attributes" and gradually evolve into financial products with investment value, transaction demand, and liquidity. For example, in 2000, the World Bank established its first carbon fund, followed by the establishment of carbon emission trading centers such as the Chicago Climate Exchange and the European Climate Exchange. Major financial institutions also timely launched carbon trading based forward and futures products.

2. DEVELOPMENT HISTORY OF DOMESTIC AND INTERNATIONAL CARBON FINANCE MARKETS

2.1. Development History of the EU Carbon Finance Market

2.1.1. Development History of Carbon Trading Market

The Kyoto Protocol was signed in 1997, and the global carbon trading market developed rapidly. The Kyoto Protocol has designed three flexible market mechanisms for compliance, namely the Joint Implementation Mechanism (JI), the Clean Development Mechanism (CDM), and the Emissions

Trading Mechanism (ET), which form the foundation of the international carbon market, especially cross-border carbon emissions trading. Subsequently, in order to promote the achievement of emission reduction targets, various regions and countries have also established their own emission trading systems (ETS). Among them, the European Union Carbon Market (EUETS) was established the earliest and has the most mature mechanism. Compared with other major international carbon markets such as New Zealand and South Korea, the EU's carbon market participants are more diverse, and the market transaction scale is far larger than other countries internationally, which can provide reference for the development of China's carbon market. EU ETS participants in the industry include almost all heavy industries such as electricity and heat production, oil, steel, non-ferrous metals, and chemical industry. Financial institutions also include various types and service institutions such as intercontinental exchanges and consulting firms. The trading value of the EU carbon market in 2023 is approximately 770 billion euros, an increase of 2% from the previous year and accounting for 87% of the global total. As of the end of 2023, the average price is approximately 85.32 euros per ton.

The international carbon market is constantly developing, and in recent years, some regions and countries have effectively increased the activity of the carbon market by introducing auction mechanisms, setting stricter emission reduction caps, and gradually canceling free carbon quotas in the industrial sector. Since its launch in 2005, the EU carbon market has undergone four stages of continuous optimization and improvement, and has become the oldest, most mature, and most active carbon market globally. One is the expansion of coverage, at the industry level, the main body of emission reduction is gradually expanding from a single energy industry to ships, etc; The covered countries also include countries outside of the European Union such as Iceland, Liechtenstein, and Norway. The second is the continuous improvement of emission reduction targets, gradually improving the level of environmental governance and green production in heavy industry within the EU. The third is the gradual tightening of quota supply, including the acceleration of the rate of total quota decline, the reduction of free allocation ratio until all auctions, the transition from grandfather's law to baseline law, the tightening of carbon credit offset restrictions, and the increase in penalties for non-compliance. The improvement of these three aspects has gradually solved the supply-demand imbalance in the EU carbon trading market, curbed the unstable and continuous downward trend of carbon prices. In 2022, in the situation where the consumer price index, especially the price index of energy related commodities, has risen to varying degrees, the ETS quota prices have changed relatively small and far higher than the quota prices in other carbon trading markets, demonstrating its strong flexibility, resilience, and resilience in responding to external shocks.

At present, the EU carbon market has achieved the following results: the ETS pricing mechanism is basically mature, implementing a unified carbon price, promoting the efficient operation of the carbon trading system, avoiding carbon price distortion, balancing carbon emission reduction efficiency and fairness, and reducing carbon leakage issues. Carbon emissions and other greenhouse gas emissions have significantly decreased. In 2019, the EU's carbon emissions decreased by 23% compared to 1990, exceeding the third stage emission reduction target. A rigorous regulatory system has been established. From a vertical perspective, the European Commission, as the government regulatory body for carbon trading in the entire EU, has its own regulatory systems in each member state. Each member state has further subdivided areas and blocks in their respective fields to manage environmental quality; From a horizontal perspective, the European Commission, the European Council, and the Parliament jointly form the decision-making level, with the three institutions assisting and balancing each other; Looking at the EU's regulatory system from outside the EU, it refers to the EU's social supervision system.

2.1.2. Development History of Carbon Finance Market

Carbon finance products derived from carbon assets are an important component of the development of the broad carbon finance market. At the beginning of the establishment of the EU carbon market, the construction of carbon spot and futures markets also began simultaneously.

The futures market plays an important role in price discovery, risk management, and promoting effective allocation of carbon resources. According to a report from the China International Capital Corporation (CICC) Research Institute, in the second phase of the EU carbon market construction, the trading volume of the carbon futures market accounts for 90% of the total carbon quota trading volume. In terms of participants in the futures market, the current trading volume is mainly between commercial enterprises (such as power companies) and financial intermediaries (such as investment banks, commercial banks). Generally speaking, commercial enterprises hold long positions in carbon futures, while financial intermediaries hold short positions in carbon futures. The composition of the investor structure in the carbon futures market indicates that the futures market is still dominated by the risk management needs of commercial enterprises, and the pricing of carbon futures can fully reflect the demand of the real economy for carbon futures. The rise and fall of carbon prices are closely related to global energy prices. In 2023, due to the "Fit for 55" resolution passed by the European Union in December 2022 and the need for the carbon market to digest the demand squeeze during the period after the peak of the energy crisis in 2022, the EU carbon price showed a strong and then weak trend, with the spot carbon price dropping from 100.23 euros/ton to 55.34 euros/ton. For market entities, risk avoidance can be achieved through carbon futures prices, further highlighting the importance of using carbon futures for risk management.

Compared to carbon futures, carbon options can help market participants manage carbon risks at a lower cost. According to data, the opening volume of carbon options in November 2021 was 188 million EUAs, while the opening volume in November 2021 increased to 351 million EUAs, an increase of 86.7%. The development of the carbon options market has also made information transmission and price discovery more effective, enhancing the completeness of the carbon finance market.

There is also controversy in the operation of the European carbon futures market. The most typical issue is whether there is excessive speculative trading in the carbon futures market, and whether it is necessary to impose position restrictions on individual market entities in futures.

Overall, the European carbon financial derivatives market attracts different market entities (including commercial enterprises, financial intermediaries, investment funds, etc.) to participate in the pricing of the carbon market. Investors with different trading purposes engage in a thorough game to generate clear price targets, thereby successfully helping commercial enterprises better manage carbon risks.

The international carbon market not only strengthens the financial attributes of carbon assets in policy and institutional design, but also keeps pace with the times in legal systems. Taking EUETS as an example, the establishment of a secondary market provides possibilities for the development of carbon finance markets. In 2003, the European Parliament and the Council of the European Union issued the EU Greenhouse Gas Emissions Trading Directive, followed by the 2004/101/EC Directive the following year, along with relevant laws, regulations, and policy arrangements. The combined effect led to the establishment of a carbon finance market almost simultaneously after the establishment of the EU ETS. As of now, the broad carbon finance products under the EU ETS mechanism can carry out diversified innovation based on spot, futures, options, and forward contracts. On the other hand, the EU has effectively enhanced the scarcity and specificity of carbon emissions as an asset, enhanced its financial attributes, optimized market pricing functions, and promoted the rise of carbon prices through the expansion of participating entities and industry scope, quota allocation methods, and increased emission reduction targets in four development stages.

2.2. Development History of Domestic Carbon Trading and Carbon Finance Market

Compared to developed countries in Europe and America, China's carbon market developed relatively late and follows a trend of development from point to surface. In 2008, the establishment of Shanghai Environmental Energy Exchange, Beijing Environmental Exchange, and Tianjin Emission Rights Exchange marked the beginning of China's carbon trading marketization. In 2011, the State Council

issued the Comprehensive Work Plan for Energy Conservation and Emission Reduction during the 12th Five Year Plan period, proposing the pilot of carbon emission trading. In the same year, the General Office of the National Development and Reform Commission issued a notice on the pilot work of carbon emission trading, establishing a total of seven pilot areas for carbon emission trading in Beijing, Tianjin, Shanghai, Chongqing, Hubei Province, Guangdong Province, and Shenzhen. In 2020, the Ministry of Ecology and Environment announced the "Management Measures for Carbon Emission Trading (Trial)", which provided legal support for the construction of the national carbon emission trading market. In 2021, the national carbon emissions trading market officially launched online trading, marking the bid farewell to the pilot program and the full launch of China's national carbon emissions trading market. However, at present, China's carbon finance market is still in its early stages of development, mainly focused on carbon spot trading, with the main types of trading including carbon emission rights trading and voluntary emission reduction trading. When the national carbon trading market was launched in 2021, it was only included in the power generation industry. On February 4, 2024, the State Council announced that the Provisional Regulations on the Management of Carbon Emission Trading (hereinafter referred to as the "Regulations") will officially come into effect on May 1, 2024. Industry insiders believe that the Regulation provides a clearer definition of the legal attributes of carbon emission rights, which is not only conducive to the expansion of the national carbon emission trading market, but also to the extension of financial business in the green and low-carbon field. This has opened up a new legal situation for carbon emission trading in China, and is an important measure to implement the "sound carbon emission market trading system" in the report of the 20th National Congress of the Communist Party of China, laying an important foundation for the operation and development of the market.

At present, China's carbon finance market is still in the initial stage of partial diversified innovation, but it has not yet been fully launched. On the one hand, China's carbon finance has initially formed a diversified product system led by carbon asset collateral loans., The diversified product system is taking shape. The main body of the carbon finance market includes legal or natural persons participating in carbon related investment and financing activities, as well as relevant carbon related intermediary service institutions, mainly specialized financial institutions such as commercial banks, securities companies, insurance companies, fund companies, etc. With the increasing attention of the country to the development of green finance, advocating for the active participation of the financial system in green and low-carbon development, and promoting the achievement of the "dual carbon" goals, commercial banks, trust companies, and fund companies have also begun to enter the field of carbon finance. On the other hand, the construction of the national carbon market is still in its early stages and faces multiple problems, especially in the financialization development of the carbon market. Although some pilot carbon markets and financial institutions have developed carbon finance products, the overall scale is small and lacks sustainability, and the participation of financial institutions is not very active. At the same time, the market liquidity is poor, the development is uneven in various regions, and there is still a lack of systematic carbon finance markets. The methodology and monitoring system related to carbon emission measurement still need to be improved, which makes the relevant participants in the carbon finance market cautious about purchasing related financial products or financing. Overall, the national carbon market is still positioned as an emission reduction market.

Although the market is still in its early stages, the establishment of a national carbon trading market has driven industry progress. Taking the power generation industry as an example, the establishment of a carbon trading market drives enterprises to innovate technology and improve management levels, gradually establish a carbon asset management system, and actively participate in the trading of emission rights and financial derivatives. On the other hand, the establishment of a national market has greatly improved the liquidity of the carbon market. As the carbon market becomes increasingly mature, carbon finance will play an increasingly important role in it. At present, the national carbon market can roughly benchmark the transition from the second stage to the third stage of the European Union. Therefore, the experience of the EU carbon market has important reference significance for

the development of China's carbon market. At the same time, China's carbon finance market also urgently needs development.

3. SUMMARY OF EXPERIENCE IN INTERNATIONAL MATURE CARBON FINANCE MARKETS - TAKING THE EU CARBON FINANCE MARKET AS AN EXAMPLE

3.1. Market Mechanism

The carbon quota allocation mechanism has a direct impact on the determination of market prices, and to improve the construction of carbon markets, it is necessary to explore appropriate carbon quota allocation mechanisms. The market price refers to the greenhouse gas emission cost of economic entities. Excessive allocation of quotas will reduce the carbon emission cost of enterprise entities and weaken their willingness to reduce emissions; If the total quota is too small, the increase in carbon prices will directly exacerbate the emission costs of enterprises and squeeze their profit margins; The price fluctuation of quotas is too large, which will directly exacerbate the operational risks of enterprise entities; The uneven distribution of quotas in regions or industries will exacerbate structural imbalances and unfairness in development. If the government approves quotas as the primary market for carbon trading, how to allocate quotas appropriately according to local conditions will play a decisive role in guiding secondary market prices, promoting carbon market construction, and balancing the development needs of enterprises and emissions reduction.

3.1.1. Experience of EU Carbon Quota Allocation System: Free Allocation to Paid Auction

The allocation of EU carbon quotas in the first and second stages is roughly the same, based on the total amount to determine further emission reduction targets. The "grandfather method" is used to determine its own NAPs (National Allocation Plans) plan, which is reported to the European Commission from bottom to top, and the remaining portion is ultimately allocated free of charge to emission reducing entities. Although free allocation was adopted at this time, a paid auction mechanism was also explored, but it only accounted for a very small part of the total quota. In the first stage, 5% of the quota was used for auction, and in the second stage, it was slightly increased to 10%. However, due to sufficient quota supply in the early stage, there were fewer participants in the paid auction. In addition, the first stage mainly involves the power and manufacturing industries, and in the final year of the second stage (2012), it was included in the aviation sector, which used EUAAs as emission deduction quotas. At this point, two types of quotas, EUAs and EUAAs, have emerged for the distribution of quotas in the EU ETS primary market. Due to the greater impact of EUAs on EU emissions reduction, this article mainly discusses the allocation system related to EUAs.

Due to the imperfect carbon emission detection system and monitoring at that time, the European Union adopted the "grandfather law" based on historical emissions to determine the next period's share. However, it ignored the particularity of each country and industry and the objectivity of statistical emissions. The unreasonable allocation of shares caused a serious oversupply in the market, and carbon prices fluctuated and fell. Moreover, the "Grandfather Law" adheres to the concept of "using more, dividing more, and using less, dividing less". Therefore, under this mechanism, enterprises are encouraged to emission in order to strive for more quotas in the next phase.

Therefore, the grandfather method in the third stage has been replaced by the benchmark method, which allocates reasonable free quotas within the industries of each member country based on accurate data. At the same time, the EU carbon market has begun to adopt top-down National Implementation Measures (NIMs). In addition to the significant change from the "bottom-up" process of quota determination to "top-down", we have also begun to vigorously promote paid auctions, implementing parallel paid auctions and free distribution, and gradually expanding the proportion of auctions. At this point, an average of over 57% of the EU ETS quota is allocated through auctions;

In the fourth stage, the auction ratio is increased to 90%. At the same time, the European Union stipulates that at least 50% of the income earned by countries through auctions needs to be reinvested in climate and energy related projects, using auction mechanisms to promote corporate emissions reduction and achieve a healthy cycle of carbon reduction systems.

Compared to free distribution, auction law has many benefits. One is to introduce auctions, allowing enterprises to determine the required quota quantity based on their own operating conditions. Auctions are conducted on demand, and transactions between the supply and demand sides in the market can help discover the price of carbon quotas in the primary market, improve the efficiency of the carbon market, and enhance the marketization level of carbon trading; The second requirement is to require the funds obtained from auctions to be reinvested in support of low-carbon projects, accelerate the efficiency of capital flow in emission reduction, and promote the development of the zero carbon industry.

3.1.2. Experience of EU Carbon Quota Allocation System: Market Stability Reserve Mechanism

In the first stage of the EU ETS and the transition from the second stage to the early stage of the third stage, due to the adoption of the "grandfather law", the EU carbon market experienced a serious quota surplus problem. The supply of about 2 billion carbon quotas significantly reduced carbon emission prices, which is not conducive to market guidance price formation and seriously weakened the guiding role of prices on corporate carbon emissions.

The European Commission has launched two mechanisms, "Back loading of Auction" and "Market Stability Reserve", to address the issue of excess quotas. Discount auction (also known as "delayed auction") is a short-term mechanism to address carbon quota excess, by transferring the total amount of recent auction quotas to the future, thereby reducing the supply of recent quotas, and gradually putting the reduced portion into the market during future regulation. The discount auction did not change the total amount of carbon quotas, but instead delayed the distribution of some recently excess quota supplies, which helps to adjust the supply structure in the short term. The European Commission has postponed auctions of 400 million tons in 2014, 300 million tons in 2015, and 200 million tons in 2016 until 2019-2020.

However, the 900 million tons quota that was previously held was not directly auctioned off, but instead deposited into market stability reserves. The Market Stability Reserve Mechanism was launched in January 2019 as a long-term mechanism to address the issue of quota excess. The market stability reserve mechanism adopts "pre-defined rules", which operate according to predetermined rules, and any committee or member state has no discretion in its implementation. Before May 15th each year, the European Union calculates the total amount of circulating quotas in the market, and based on this, formulates a reserve execution plan to determine how many quotas should be included in the reserve or how many quotas should be released from the reserve that year. According to regulations, if the threshold of 833 million shares is exceeded from 2019 to 2023, the percentage of circulating quotas in the stable reserve will temporarily double from 12% to 24%. In addition, starting from 2023, quotas in stable reserves higher than the previous year's auction volume will no longer be valid.

The market stability reserve mechanism plays a "reservoir" role, absorbing carbon quotas in excess of the market and releasing them in a timely manner. This not only alleviates the supply and demand relationship of quotas in the long-term market circulation process, but also helps to stabilize the huge fluctuations caused by external shocks in the market, stabilize carbon prices, and mitigate the risks brought by fluctuations in emission reduction costs in the operation of enterprises.

3.1.3. Experience of EU Carbon Quota Allocation System: Market Norms and Punishment Mechanisms

With the development of the carbon market, its participating entities will gradually expand with the increase of market maturity. At the same time, the industries and gas scope covered by the carbon market also determine the scope and quantity of participating entities in carbon trading. The diversification of market entities can fundamentally affect the size and liquidity of the market, as well as the economic and environmental benefits it generates. At present, the EU carbon finance market covers many high carbon emission industries such as electricity, heat, refining, steel, building materials, aerospace, chemical industry, and enterprises involved in the production of synthetic ammonia and electrolytic aluminum. The coverage gases include multiple greenhouse gases such as CO2 and N2O. However, the national carbon emissions trading market in China only covers the power industry and has entry barriers, with only CO2 as the gas covered. At the same time, in order to better regulate market order and ensure orderly entry of all participating entities, as the carbon trading market gradually matures, it is necessary to provide corresponding entry thresholds and quota allocation methods for participating entities from different industries and with different characteristics. Targeted measures not only enhance the effectiveness of the carbon market, but also reflect fair and objective policy considerations. For example, in the electricity industry of the European Union, the entry threshold for thermal power facilities is 25 megawatts, and the entry threshold for power generation enterprises is that the total input capacity is above 35 megawatts. Facilities or enterprises that do not meet this standard will enter other small-scale emission systems. In addition, the EU also has certain regulations on the quotas used for auctions in various industries. For example, from 2013 to 2020, industry specific quota allocation was implemented, with over 60% of the quota allocated for auctions. Among them, quotas for the electricity, carbon capture, transportation, and storage industries were all allocated in the form of auctions. For industries with serious carbon leakage risks in industrial and heating enterprises, 100% free allocation was implemented, while other industries received 80% of the quota for transitional free allocation and were gradually reduced year by year. However, China's national carbon market currently only covers power companies with facility annual carbon emissions exceeding 26000 tons of CO2. In the future, China's carbon market will definitely include more industries in its coverage, and the EU's shift in entry thresholds and allocation methods from coarse to fine has certain reference significance for the top-level design of China's future market.

3.2. Supporting Measures

3.2.1. Experience of EU Carbon Market Supporting Facilities Construction: Policies and Legal Regulations

Market policies have a significant impact on market flexibility, development potential, and other aspects. If not appropriate, they can constrain the optimization of market mechanisms. This effect has been particularly evident in recent years when the European carbon market has faced energy issues leading to price fluctuations. The relevant plans or goals launched at the top level can enhance the energy self-sufficiency capacity of the region or country, thereby restoring market confidence and leading to a rebound in carbon prices. In addition, improving relevant laws, regulations, and institutional systems can also contribute to the healthy operation of the market.

Secondly, in terms of regulation, the EU's carbon market has a clear division of labor, with targeted regulatory provisions set up to adapt to the characteristics of the primary and secondary markets, and the introduction of third-party institutions responsible for reviewing the effectiveness of emission reduction credits, increasing market participants while improving market efficiency.

However, China's carbon market is still in its early stages of development. In terms of carbon market legislation, the Ministry of Ecology and Environment issued the "Carbon Emission Trading Management Measures (Trial)" in December 2020, marking the official start of the first compliance

cycle of China's carbon market and laying the legal foundation for the establishment of China's carbon trading market. However, this management measure is still in the trial stage, with limited content and low level, So far, there is no unified law or administrative regulation in the field of carbon emissions in China, only documents from the National Development and Reform Commission and the Ministry of Ecology and Environment. This means that there is still significant room for improvement in the relevant laws and regulations of China's carbon market.

3.2.2. Experience of EU Carbon Market Supporting Facilities Construction: Infrastructure Construction

Effective infrastructure is the fundamental support tool for the carbon market. The carbon market infrastructure, represented by carbon emission monitoring, accounting, reporting, and verification systems, ensures the accurate measurement of emissions by emission entities. The carbon finance infrastructure, represented by trading platforms, market trading institutions, and third-party brokerage institutions, ensures the smooth operation of carbon finance market transactions, and these two will work together to support the efficient operation of the carbon finance market. In addition, the consulting and other service institutions included in the EU's market participants can provide detailed data analysis and market forecasts for the carbon market, including carbon price trends, supply and demand balance, policy impact, and other factors that may affect the market. This not only helps market participants better grasp market dynamics, but also provides a basis for formulating trading strategies and risk management plans. China needs to draw on the experience of mature international carbon markets in the formulation of accounting methods, infrastructure construction, and other aspects.

4. SUGGESTIONS FOR PROMOTING THE DEVELOPMENT OF CHINA'S CARBON FINANCE MARKET AND EMPOWERING THE CARBON TRADING MARKET

China's industrial development has experienced a period of high pollution, high emissions, and high energy consumption, gradually transitioning towards sustainable development. Under the "dual carbon" goal, China is facing enormous pressure to reduce emissions. The development of carbon finance market plays an important supporting role in the development of carbon trading market. The lagging development of China's carbon finance will also lead to China being in a passive state in international carbon trading, lacking leadership and discourse power. At present, China needs more than ever a fully functional, sound mechanism, and efficient carbon finance market. We need to accelerate the establishment and improvement of market-oriented operating mechanisms to improve carbon reduction effectiveness. While achieving green mountains and clear waters, we need to better address the impact of climate issues on the geopolitical situation and enhance the influence of international climate governance.

4.1. Market Mechanism

4.1.1. Coverage

From the perspective of participants in the carbon trading market, a nationwide carbon trading market has been launched and a unified market has been officially launched. At present, China's carbon quota gas only covers carbon dioxide, but due to compliance with the certified emission reduction (CCER) of voluntary emission reduction projects, which also cover six types of greenhouse gases stipulated in the Kyoto Protocol, the possible warming caused by other greenhouse gases can be converted into carbon dioxide equivalent in actual accounting for emission reduction. Therefore, in practice, all types of greenhouse gases can participate in China's carbon trading market emission reduction projects. From an industry perspective, the current national carbon emission trading market only covers the power generation industry and has an entry threshold. But apart from electricity, China's traditional

industries such as heat, steel, petroleum, chemical, and manufacturing are all high energy consumption, high emissions, and high pollution industries. These industries have large greenhouse gas emissions, large-scale enterprises, and good data foundations. Under the call of the "dual carbon" background, they have the ability to carry out green transformation of their own enterprises, establish a carbon asset management system, and have good emission reduction potential. In the later stage of industrialization, the number of enterprises in the heavy industry sector remained stable, and the tertiary industry flourished. The participation of new industries will enhance the effectiveness of the carbon trading market, better reflect the demand for carbon emissions from various industries, and thus form an effective carbon price; It will also lubricate market trading, improve market trading activity and flexibility.

From the perspective of the carbon finance market, the EU's carbon trading and carbon finance markets have almost been established and developed simultaneously, while China's national carbon trading market has been officially launched and continuously optimized and improved. However, the development of the carbon finance market is relatively backward, with low market activity and diversification. Capital participation and activity are important factors affecting the efficiency of financial markets. To promote the timely development of the carbon finance market, it is necessary to appropriately relax institutional access and encourage commercial banks and other financial institutions, as well as consulting and other service institutions, to enter the carbon market. Financial institutions participating in the carbon market can launch carbon financial derivatives for carbon assets and place them in the market for trading. This can not only bring liquidity to the carbon trading market, strengthen the market's ability to discover prices, improve the effectiveness of carbon prices, cope with external factors and stabilize price fluctuations, but more importantly, financial institutions developing carbon financial derivatives can help deepen and diversify the carbon finance system. In May 2021, the two-year variety plan of Guangzhou Futures Exchange was approved by the China Securities Regulatory Commission, including carbon emission rights futures, which will be developed and listed by Guangzhou Futures Exchange. The establishment of the carbon futures market marks a new stage for China's carbon finance market. The futures market can convey clear carbon price targets, enabling market participants to effectively manage carbon risk exposure, thereby helping to achieve the dual carbon target. In the future, we can also explore ways for financial institutions to trade carbon assets on behalf of others, gradually opening up channels for individuals and attracting more social capital investment. At the same time as the threshold for loan access, regulatory agencies and government departments also need to formulate corresponding incentive policies, such as tax reductions for financial institutions to carry out carbon finance business, to make the market aware of the value of carbon finance.

4.1.2. Quota Allocation and Market Mechanism

Compared to the EU carbon market, domestic carbon quota allocation also follows the "baseline method" and "bottom-up" approach to set the total amount of carbon quotas. But the auction system is not yet mature and still mainly focuses on free distribution. According to the "Measures for the Administration of Carbon Emission Trading (Trial)", "the allocation of carbon emission quotas is mainly free of charge, and paid allocation can be introduced in a timely manner according to relevant national requirements." The quota allocation plan for 2019-2020 clearly states that "all free allocations will be implemented.". Compared to free allocation, a paid auction mechanism can improve price discovery efficiency and enhance the flexibility of enterprises in reducing emissions. Based on the experience of the European Union shifting from free allocation to paid auctions, it is necessary to anchor the establishment and implementation of a carbon quota total auction allocation mechanism. At present, only Beijing and Tianjin in China have implemented auction measures in the carbon market to maintain the stability of trading prices. The secondary market of national carbon emission trading has also adopted paid bidding methods such as performance bidding and non performance bidding for quota allocation. However, the total carbon quota auction allocation mechanism is still in its early stage, and enterprises currently do not have the ability to obtain carbon

quotas in a paid manner. The supply and demand regulation function of small-scale markets is also relatively limited. Therefore, China needs to gradually and scientifically formulate quota allocation methods for enterprises entering the market. On the basis of implementing free quota allocation, the proportion of auctions in quota allocation should be gradually increased, and the decisive role of quota auctions in determining carbon market prices, promoting market circulation, and serving market transactions should be played. And it is stipulated that the profits obtained by enterprises will be used for future energy-saving and emission reduction projects, encouraging small and medium-sized enterprises to participate in carbon investment. However, for different industries, businesses, and regions, when designing quota rules, it is necessary to fully consider the characteristics of industry development and the imbalance of local development, such as the allocation of EUAAs aviation carbon quotas by the European Union. In addition, due to the industrial advantages of different regions, when incorporating new industries into the national carbon market, the impact on the regional economy caused by the industry should be considered.

At the same time, accelerate the exploration of risk mitigation mechanisms in the carbon market and build a stable reserve mechanism for the carbon quota market. The unreasonable allocation of carbon quotas and external disturbances to the economic environment will seriously affect the efficiency of carbon market price discovery of carbon emission rights, leading to insufficient, volatile, and high-risk pricing of carbon emission rights, or impacting the normal production and manufacturing of enterprises. The market stability reserve mechanism is an important tool for regulating market risks and can help stabilize market volatility.

4.1.3. Punishment Mechanism

While optimizing the allocation of carbon quotas based on market coverage, the punishment mechanism should also keep pace with the times. For more diverse participants and industries involved in different businesses, while implementing refined management, the punishment mechanism is also given greater flexibility. For example, establishing differentiated and three-dimensional punishment systems, setting differentiated penalty amounts or deducting emissions based on the severity of exceeding standards or violations, recording and disclosing them, and even suspending operations for rectification, in order to better constrain the carbon market and ensure market fairness Transparent and effective.

4.2. Supporting Measures

4.2.1. Policies and Regulations

At present, China is in the early stage of carbon finance market development, and there are few laws and regulations related to carbon finance. The "Management Measures for Carbon Emission Rights Trading (Trial)" issued by the Ministry of Ecology and Environment and local legislation in pilot areas do not have universality and strong legal binding force, and the functional allocation of regulatory bodies in each pilot area is not unified, making the relevant measures less likely to be promoted and used. The Provisional Regulations on the Management of Carbon Emission Trading (hereinafter referred to as the "Regulations") will officially come into effect on May 1, 2024. However, the cross departmental and cross industry characteristics of carbon trading require financial regulatory authorities to continue to deepen and coordinate supervision, accelerate the issuance of unified and detailed regulatory documents and related rules, including total amount control, quota allocation, carbon price verification, certified emission reduction management, regulatory system and risk control, and further clarify the legal responsibilities of market entities; And regulate the financial activities involved in the carbon finance market at the legal level, providing a legal basis for its healthy development, promoting the overall standardization, scientificity, and efficiency of China's carbon finance market, thereby making carbon finance activities normalized. At the same time, it is necessary to continuously improve the regulatory system for carbon emissions, monitor the entire production cycle of enterprises, and ensure the objective and transparent information of the carbon market. To

establish an effective carbon market regulatory system, it is necessary to improve the monitoring, reporting, and verification (MRV) process of emission enterprises throughout the entire production cycle, and to improve the guarantee system including third-party institutions for monitoring, verification, verification, registration, issuance, and other carbon trading links, improve reporting and disclosure standards, and enhance the transparency and transparency of carbon finance trading information.

4.2.2. Infrastructure

One is the carbon emission data detection and management system. Effective monitoring facilities are important infrastructure for maintaining the stability and objectivity of the carbon trading market. At present, various power generation enterprises have established carbon emission management chains within their enterprises. With the opening of the market and the lowering of entry barriers, emission entities and relevant government departments should continue to maintain and optimize the carbon emission data monitoring and reporting system to ensure the accuracy and transparency of market data.

The second is to establish a carbon emission database and blockchain, which is not only of great significance for emission tracking and data security, but also enables emission reduction entities, governments, and society to continuously track and study their own emission reduction trajectory and target completion degree, thereby exploring more suitable emission reduction paths. At the same time, accelerate the digital construction of the carbon market, ensure the standardization, accuracy, and timeliness of key emission data for enterprises in various regions of the carbon market, and better serve the carbon trading market.

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