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Legal regulation of China's carbon emissions trading market

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The legal regulation of China's carbon emissions trading market is crucial in the country's efforts to combat climate change and transition to a low-carbon economy. As the world's largest emitter of greenhouse gases, China launched its national carbon market in 2021, building on years of regional pilot programs. This paper analyzes the legal framework governing China's carbon trading system, examining key legislation, policy developments, and regulatory mechanisms. The paper highlights the central role of the Ministry of Ecology and Environment in overseeing the market, as well as the legal principles guiding carbon allowance allocation and compliance requirements for businesses. Additionally, it addresses challenges such as the need for enhanced market transparency, stronger enforcement of non-compliance penalties, and the integration of China's carbon market with international trading platforms. While China's carbon trading market has made notable progress, the paper argues that further legal reforms are needed to improve its effectiveness in achieving carbon neutrality goals. It concludes with recommendations to strengthen the legal and regulatory framework, enhancing the market's efficiency, transparency, and global integration.

KEYWORDS

China carbon emission trading market, legal regulation, climate change policy market mechanism, carbon neutrality target, carbon neutrality

1 Introduction

1.1 Overview of China's carbon emission trading market

The rise of China as the world's largest emitter of greenhouse gases marks a pivotal moment in the global fight against climate change. As of recent years, China accounts for nearly 30% of global carbon dioxide emissions, a reflection of its rapid industrialization, vast population, and the continued reliance on coal and other fossil fuels for energy. However, alongside its position as the largest emitter, China has also emerged as a leader in climate change mitigation strategies. A cornerstone of this effort is the country's ambitious commitment to achieving carbon neutrality by 2060. This pledge was made by President Xi Jinping in 2020 and has since become a guiding policy for China's environmental and economic strategies. Achieving carbon neutrality involves balancing the amount of greenhouse gases emitted with the amount removed from the atmosphere, requiring a fundamental transformation of China's industrial processes, energy systems, and governance frameworks.

China's commitment to carbon neutrality by 2060 has catalyzed the development of various policy tools, one of the most significant being the carbon emissions trading market (ETS). The concept of carbon trading is based on the principle of "cap and trade," which sets a cap on total emissions and allows companies to buy and sell allowances within that cap

(Liu and Zhang, 2023). This market-based mechanism is designed to provide economic incentives for businesses to reduce their emissions, thus fostering innovation in low-carbon technologies and practices. As the world's most populous country and second-largest economy, China's transition to a low-carbon economy through the establishment of a national ETS holds immense implications, both domestically and globally.

The carbon emissions trading market in China was officially launched in 2021, but its origins date back to several years earlier, with the initiation of pilot programs in different regions of China. These pilot programs were experimental phases designed to test the feasibility and efficiency of carbon trading mechanisms before rolling them out on a national scale (Wang and Sun, 2023). Cities such as Beijing, Shanghai, Shenzhen, and Guangdong were among the first to establish regional carbon markets in 2013. These local markets provided valuable insights into how carbon trading could function in China's unique political, economic, and industrial context. The national carbon market, which initially focused on the power sector, is expected to expand gradually to cover other industries, such as steel, cement, and chemicals, as part of China's broader plan to achieve peak carbon emissions before 2030.

The development of carbon markets globally has provided important lessons for China's approach. The European Union Emissions Trading System (EU ETS), established in 2005, is the world's largest and most established carbon market, providing a benchmark for other countries and regions (European Commission, 2022). In addition, countries like the United States (under its Regional Greenhouse Gas Initiative) and South Korea have launched their own emissions trading systems, each offering different models of implementation and governance. China has studied these international experiences closely, adapting elements of their design to fit its own political and economic system. However, the Chinese carbon market also faces unique challenges, particularly related to its scale, regulatory capacity, and the central role of state-owned enterprises (SOEs) in the economy (Zhao and Li, 2022).

China's participation in the international climate change framework is closely tied to its carbon market, which plays a crucial role in the country's commitments under the Paris Agreement. As a signatory, China pledged to peak its carbon emissions before 2030 and achieve carbon neutrality by 2060. The carbon market is integral to meeting these targets, offering a mechanism through which industries can reduce emissions and comply with national climate goals.

Beyond its domestic impact, China's carbon market is also positioned as a potential model for other developing countries, showcasing how carbon trading can be effectively integrated into rapidly industrializing economies. Moreover, the future integration of China's Emissions Trading System (ETS) with international markets, such as the EU ETS, is seen as a significant opportunity to promote global carbon pricing and enhance international climate cooperation.

As part of its strategy to transition to a low-carbon economy, China has been working to establish a robust legal and regulatory framework for its carbon market. The creation of a comprehensive set of laws, policies, and guidelines to govern carbon trading is crucial to ensure that the market functions effectively and achieves its environmental and economic goals. This framework includes national laws such as the Environmental Protection Law and the Air

Pollution Control Law, as well as specific regulations related to carbon emissions trading. The legal framework also encompasses the roles and responsibilities of various government agencies, including the Ministry of Ecology and Environment (MEE) and the National Development and Reform Commission (NDRC) (National Development and Reform Commission NDRC, 2021), which oversee carbon market operations and compliance.

1.2 Research aim and scope

The purpose of this paper is to critically analyze the legal and regulatory framework surrounding the carbon market in China, providing a comprehensive examination of its development, current state, and future prospects. This research will explore the historical context in which China's carbon market has evolved, including the early pilot projects, the legal foundation for the market's establishment, and the broader policy landscape that supports its development. In addition, the paper will provide an in-depth discussion of the current policies that govern the carbon market, focusing on key regulations such as carbon cap-setting, the allocation of allowances, and market mechanisms like emissions trading.

A central focus of this paper is to examine the key challenges facing China's carbon market, particularly in areas of legal enforcement, market liquidity, and governance. While the market holds significant potential to reduce emissions, it faces several obstacles, including weak regulatory enforcement at the local level, transparency concerns, and challenges in setting ambitious yet enforceable carbon caps. Additionally, the paper explores the implications of China's carbon market for global carbon pricing and the potential for future linkages with other international systems.

Finally, the paper will provide recommendations for strengthening China's carbon market, suggesting legal reforms and policy adjustments that could improve market performance, enhance regulatory oversight, and promote deeper integration with international carbon markets. By examining the development and operation of the Chinese carbon market, this research aims to provide a comprehensive understanding of both the opportunities and challenges facing China in its pursuit of carbon neutrality.

2 The history and development of China's carbon emissions trading market introduction

The history of China's Carbon Emissions Trading Market (CETM) can be divided into two primary phases: the early stage involving participation in global carbon markets, and the more recent transition to a nationwide carbon trading system. The development of the CETM reflects China's increasing commitment to address its climate change, transitioning to a low-carbon economy, and aligning with global climate governance mechanisms. This paper examines the key historical milestones and legal developments of carbon market, highlighting the progression from experimental pilot projects to the nationwide system launched in 2021.

2.1 Early phase: China's initial engagement with global carbon markets tables

China's journey toward establishing its own carbon market began with its involvement in international climate change frameworks, particularly under the Kyoto Protocol. The Kyoto Protocol, adopted in 1997 and entering into force in 2005, required industrialized countries to reduce their greenhouse gas emissions and introduced flexible market mechanisms, including emissions trading (Zhao and Zhang, 2020). As a developing country, China was not subjected to binding emission reduction targets under the Protocol. However, China participated actively in the global carbon market in other ways, notably by engaging in the Clean Development Mechanism (CDM). The CDM allowed China and other developing countries to host emission-reduction projects in exchange for carbon credits, which could then be traded in international markets.

From the early 2000s, China emerged as one of the world's largest producers of Certified Emission Reductions (CERs) under the CDM, positioning itself as a major player in the global carbon trading market. This involvement not only allowed China to accumulate significant financial resources but also provided valuable experience in managing emissions reduction projects. These projects laid the groundwork for China's eventual transition to a national carbon trading system.

In parallel with its involvement in the CDM, China began to explore domestic mechanisms for carbon pricing and emissions reduction. The need for a domestic emissions trading system became increasingly apparent as the country's industrial base continued to grow, and it became clear that China would need to develop its own mechanisms to address its rising emissions.

2.2 Pilot projects: a step toward national carbon market

China's first concrete step toward implementing a nationwide carbon market came in 2011, when the National Development and Reform Commission (NDRC) launched pilot carbon trading programs in several key cities and regions. These pilot projects were designed to test the viability of carbon trading mechanisms in the context of China's specific economic and political conditions, and to provide lessons for the development of a national market.

Cities like Beijing, Shanghai, Shenzhen, Guangdong, and Tianjin were selected to pilot carbon trading systems, each with its own set of local rules and carbon reduction goals. These pilots were aimed at introducing carbon emissions trading on a small scale, creating the necessary infrastructure, and gathering data to inform the creation of a broader national market. The carbon markets in these cities focused on sectors like energy, manufacturing, and heavy industry, with each region tailoring its system to local economic conditions (Li and Wu, 2019).

The Shenzhen Carbon Market, for instance, was one of the most successful pilots, and served as a model for the national market. Shenzhen's market began in 2013 and was notable for its relatively sophisticated structure. The city implemented an emissions cap, allocated carbon allowances to participating companies, and allowed the buying and selling of allowances. It was a testing ground for key elements that would later be adopted on a national level, including

carbon allowances allocation, carbon pricing, and the rules for monitoring emissions (Shen and Hu, 2021).

Similarly, Beijing and Shanghai implemented carbon markets with a focus on establishing a reliable monitoring and verification system for emissions. These early experiments provided China with valuable insights into the strengths and weaknesses of carbon trading, and the lessons learned from the pilot projects contributed significantly to the design of the national carbon market.

During this period, China faced several challenges in scaling up these regional markets. Issues such as market liquidity, enforcement of regulations, and accurate emissions measurement were key obstacles. Despite these challenges, the pilot projects proved valuable in demonstrating that carbon trading could be implemented in China, and they provided a platform for broader experimentation that would influence national policies.

2.3 Transition to a national carbon market: 2021 and beyond

Building on the successes and challenges of these pilot projects, China officially launched its national carbon emissions trading market (CETM) in July 2021. This marked the culmination of years of policy experimentation and set the stage for the country's broader climate goals (Yuan and Wang, 2020). The transition from pilot projects to a national market represented a significant shift in China's approach to climate governance and emissions reduction.

The CETM's formation was underpinned by key political and legal events. In 2014, the State Council, China's highest executive body, included the establishment of a national carbon market in its 13th Five-Year Plan for Ecological and Environmental Protection. This set the legal and political framework for the development of the carbon market. The plan identified the need for a carbon trading system to support China's emission reduction goals, which were aligned with the country's commitments under the Paris Agreement.

A further milestone was the 2017 release of the national carbon market regulations by the NDRC, which outlined the legal structure for the market's operations, including rules on emissions monitoring, carbon allowance allocation, and the enforcement of penalties for non-compliance (China National Development and Reform Commission NDRC, 2017). The NDRC's regulations laid the groundwork for the formalization of a carbon market that could eventually include multiple sectors and industries.

In 2021, the Chinese government officially launched the national carbon market, starting with the power sector, which accounts for the majority of China's carbon emissions. The market's initial phase was relatively narrow, with around 2,000 power plants being required to participate. The government has plans to gradually expand the scope of the market, eventually including industries such as steel, cement, and petrochemicals. The market is intended to be one of the largest carbon trading systems in the world, and it is an integral part of China's efforts to meet its carbon peak by 2030 and carbon neutrality by 2060 targets.

The legal framework for the national carbon market was designed to address many of the challenges encountered during the pilot phase. The regulations now include more robust monitoring and reporting systems, as well as stricter penalties for non-compliance (Zhou and Li, 2021). China also plans to introduce an auction mechanism for carbon

allowances, which will help determine a market-driven carbon price and increase the market's efficiency.

In conclusion, the development of China's Carbon Emissions Trading Market has been a process of gradual experimentation, adaptation, and scaling up. From its initial involvement in the Kyoto Protocol and CDM, through the success and lessons learned from pilot carbon markets in key cities, to the formal establishment of the national carbon market in 2021, China has demonstrated a commitment to implementing a market-based approach to climate change. The CETM represents an essential tool for China in achieving its ambitious climate goals, and it serves as a model for other developing countries seeking to implement similar systems. The future of the CETM will depend on how effectively it expands, integrates, and enforces regulations, but it is clear that this market will be central to China's role in global climate governance in the coming decades.

3 Legal framework of China's carbon emissions trading market

China's commitment to reducing carbon emissions and transitioning towards a green economy has led to the establishment of a national Carbon Emissions Trading Market (CETM). This system aims to create a market-driven mechanism for regulating carbon emissions and achieving the country's ambitious goal of carbon neutrality by 2060. The legal framework that governs China's CETM is multifaceted and involves a variety of laws, regulations, and institutional actors. This paper outlines the key legal instruments and the role of state-owned enterprises (SOEs) in shaping the market structure.

3.1 Key laws and regulations

The legal foundation for China's CETM is provided by several key documents and laws, which serve as both the structural and operational basis for the market.

13th Five-Year Plan for Ecological and Environmental Protection: One of the most significant policy documents, the 13th Five-Year Plan, emphasizes ecological and environmental protection, which includes the development of market-based instruments for carbon management. This plan sets out the goals for reducing emissions and outlines the establishment of a national carbon market. The policy framework provided by the 13th Five-Year Plan has been crucial in guiding the operationalization of the CETM (State Council of the People's Republic of China, 2016).

Environmental Protection Law: China's Environmental Protection Law, enacted in 1989 and revised in 2014, is one of the cornerstones of environmental regulation in the country. While the law does not directly govern carbon emissions trading, it provides the foundation for broader environmental governance. Its influence is seen in the broader regulatory landscape that oversees environmental quality and emissions control, creating the legal space for the development of the CETM. This law obligates various actors to comply with environmental standards, including those related to air quality, which is a major concern for carbon emissions (National People's Congress of the People's Republic of China, 2014).

Air Pollution Prevention and Control Law: The Air Pollution Prevention and Control Law (2015) plays a critical role in emissions regulation, especially for the industries and regions most responsible for carbon emissions. This law serves as an essential tool for addressing air pollution while also complementing the broader goals of carbon market regulation. It is interconnected with carbon trading systems as it sets the legal framework for emissions limits, monitoring, and reporting, which directly influences how carbon allowances are allocated and traded (Standing Committee of the National People's Congress, 2015).

Interim Measures for Carbon Emissions Trading Management: The Interim Measures for Carbon Emissions Trading Management are pivotal regulations that define how carbon emissions trading operates in China. These regulations lay out the mechanisms for carbon credit allocation, the establishment of carbon trading markets, and the roles of different entities in managing the carbon market. These interim measures provide the initial regulatory framework, which later evolved into the national carbon market framework established in 2021 (National Development and Reform Commission NDRC, 2017).

National Carbon Market Construction Plan: The National Carbon Market Construction Plan, issued by the government, lays out the roadmap for developing the CETM and establishing its institutional, legal, and operational structures. This document details the implementation process, specifying the scope of the carbon market, the sectors included, and the mechanisms for trading carbon allowances. It provides a clear vision of how the market is to operate, alongside ongoing regulatory adjustments as the market matures (Ministry of Ecology and Environment MEE, 2021).

3.2 Role of state-owned enterprises (SOEs) and market structure

In China, State-Owned Enterprises (SOEs) play a significant role in the country's carbon trading market. These enterprises are key emitters and dominate the industries that contribute heavily to carbon emissions, such as energy, steel, cement, and manufacturing. As such, they are pivotal participants in the CETM, both as regulated entities and as market actors (Liu and Zhang, 2020).

SOEs are crucial to the success of the carbon market because they represent the major sources of carbon emissions in China. Their active participation and compliance with carbon trading rules are essential for the market's effectiveness in reducing emissions. Moreover, SOEs have close ties with government bodies, giving them a unique position in terms of market access and influence on the regulatory framework.

The market governance structure is primarily overseen by two key institutions:

Ministry of Ecology and Environment (MEE): The MEE is responsible for the overall governance and supervision of environmental protection laws, including the management of carbon emissions trading. This ministry is tasked with enforcing environmental regulations and ensuring that companies adhere to carbon emission standards. The MEE also plays a critical role in

monitoring and reporting emissions data, an essential component for the functioning of the CETM.

National Development and Reform Commission (NDRC): The NDRC has historically played a central role in China's climate policy, particularly in developing the mechanisms for carbon pricing and emissions reduction. In the context of the CETM, the NDRC is involved in setting national carbon trading policies and frameworks, as well as overseeing the broader economic implications of carbon pricing.

Together, these institutions form the backbone of China's carbon market governance. The MEE ensures environmental compliance, while the NDRC shapes economic policy around carbon trading. Additionally, the regulatory framework for the CETM has been designed to promote collaboration between these institutions, ensuring a balanced approach to emissions management and market governance.

3.3 Conclusion

The legal and regulatory framework of China's Carbon Emissions Trading Market is integral to the country's broader efforts to mitigate climate change and transition to a low-carbon economy. The interaction between key laws, such as the Environmental Protection Law, the Air Pollution Prevention and Control Law, and the Interim Measures for Carbon Emissions Trading Management, establishes a comprehensive structure for emissions management (Wang and Li, 2021). The role of SOEs, combined with the regulatory oversight of the MEE and NDRC, ensures that the carbon market operates efficiently. As China continues to develop its CETM, legal and regulatory refinements will be essential to addressing emerging challenges and ensuring the market's success in achieving carbon neutrality by 2060.

4 Challenges facing China's carbon emissions trading market

The development of China's Carbon Emissions Trading Market (CETM) represents a significant milestone in the country's efforts to combat climate change and reduce greenhouse gas emissions. However, despite the establishment of a national carbon market and the implementation of several policies to drive emissions reductions, the CETM faces various challenges that could undermine its effectiveness. These challenges include issues related to enforcement and compliance, market liquidity and volatility, as well as gaps in the legal and regulatory framework. This paper examines these key challenges and their potential impact on the success of China's carbon market.

4.1 Enforcement and compliance issues

One of the most critical challenges facing the CETM is related to enforcement and compliance, which largely rests on the ability of local governments to ensure that carbon regulations are followed. There are significant enforcement gaps in the existing system, particularly in terms of monitoring emissions and ensuring that

companies comply with their carbon allowances (Zhao and Tang, 2019). In many regions, local governments have been found to be less strict in enforcing emissions targets due to concerns about economic growth. This problem is especially prevalent in regions that rely heavily on carbon-intensive industries, where there may be resistance to stringent carbon reduction measures.

There are also concerns regarding the accuracy and transparency of emissions data, which are vital for the proper functioning of the carbon market. Inaccurate emissions reporting—whether due to mistakes or intentional manipulation—undermines the market's credibility and disrupts the fair allocation of carbon allowances. Ensuring the integrity of emissions data is crucial, as it directly affects the allocation of credits, market pricing, and the achievement of emissions reduction targets.

4.2 Market liquidity and volatility

Another significant challenge for China's carbon market is the issue of market liquidity and volatility. The carbon trading market has struggled with low liquidity, particularly in its early stages. The relatively small number of participants, including both buyers and sellers, limits the market's capacity to facilitate efficient trading and price discovery. This lack of liquidity can result in market inefficiencies, where carbon credits may be priced too low or too high, which can lead to ineffective emissions reductions.

Moreover, the carbon credit prices in the CETM have been characterized by significant volatility. Price fluctuations can create uncertainty for companies participating in the market and may discourage them from investing in carbon-reducing technologies or strategies. Price volatility also poses risks to the broader economy, as sudden price changes may disrupt industries that are heavily dependent on carbon emissions allowances (Chen and Li, 2022). For industries like power generation, cement, and steel, which are major contributors to emissions in China, the volatility in carbon credit prices could lead to unpredictable costs, complicating long-term planning and investment decisions.

4.3 Legal and regulatory gaps

China's carbon emissions trading market also faces challenges related to gaps in the legal and regulatory framework. The current legal structure lacks clear definitions and provisions, particularly in relation to key industries like heavy industry and the power sector, which are the largest emitters of carbon. The absence of specific, detailed regulations for these industries complicates the enforcement of emissions reductions and the implementation of carbon trading. While the government has implemented regulations to guide the market, these are often seen as insufficiently detailed or poorly enforced.

Additionally, there is a tension between national emissions reduction targets and the enforcement capabilities of local governments. China's national carbon reduction goals are ambitious, yet there is often a discrepancy between the central government's objectives and the actions taken by local authorities, particularly in regions where industries that

contribute to high emissions are concentrated. Local governments, under pressure to maintain economic growth and stability, may prioritize short-term economic goals over long-term environmental objectives. This divergence creates a significant barrier to achieving the country's climate commitments and undermines the effectiveness of the carbon market.

4.4 Conclusion

China's carbon emissions trading market is facing several challenges that could hinder its ability to effectively reduce carbon emissions and contribute to the country's climate goals. Issues related to enforcement and compliance, such as weak enforcement mechanisms and concerns over the accuracy of emissions data, threaten the integrity of the market. Additionally, the lack of market liquidity and the volatility of carbon credit prices create uncertainty and undermine the long-term sustainability of the market. Finally, gaps in the legal and regulatory framework, particularly in key industries like heavy industry and power generation, prevent the effective implementation of carbon trading mechanisms. To address these challenges, China will need to strengthen its enforcement mechanisms, improve data transparency, enhance market liquidity, and ensure better alignment between national goals and local implementation. Only through these reforms can China's carbon emissions trading market become a reliable and effective tool in the country's fight against climate change.

5 Current policies and market mechanisms in China's carbon emissions trading market

China's Carbon Emissions Trading Market (CETM) is a central part of the country's strategy to meet its climate goals, including achieving carbon neutrality by 2060. The market has developed over time through a series of policies and mechanisms designed to regulate and reduce carbon emissions. This paper explores the current policies and market mechanisms in China's carbon market, focusing on the carbon cap and allocation system, the structure of the carbon emissions trading system (ETS), the monitoring, reporting, and verification (MRV) system, and the carbon pricing and trading mechanisms.

5.1 Carbon cap and allocation system

A fundamental feature of China's carbon emissions trading market is the carbon cap and the distribution of emission allowances. The government sets an overall cap on the total allowable carbon emissions for the covered sectors, which is a critical component of the market's design. This cap is intended to gradually decline over time, reflecting China's long-term commitment to reducing emissions. The total carbon cap is distributed among companies and industries based on their historical emissions and future reduction potentials (Hong and Zhang, 2021). These allowances are then traded on the carbon

market, giving companies the flexibility to buy and sell emissions permits based on their individual needs.

The allocation of carbon allowances is a critical issue, as it directly affects the market's ability to drive emissions reductions. China has employed a mix of free allocation and auctioning in its carbon market. The free allocation method is mainly used for industries facing intense international competition, such as heavy industries like steel and cement, which are crucial to the national economy. The auctioning of allowances, however, is being gradually introduced to encourage greater market participation and ensure that emissions reductions are achieved at the lowest possible cost (Chen and Li, 2022).

Different sectors have distinct emissions reduction targets. For example, the power generation sector, which is one of the largest contributors to emissions in China, has specific targets and is heavily regulated within the market. In contrast, other sectors like transportation and construction are either less regulated or excluded from the market. The inclusion of these sectors in the future, however, is part of China's long-term strategy to expand the market's coverage and make it more effective in reducing emissions across the economy.

5.2 Structure of the carbon emissions trading system (ETS)

The carbon market is closely integrated with other environmental policies. For example, renewable energy subsidies and efficiency improvement programs are often linked with the carbon market to enhance overall environmental performance. These policies are designed to work in tandem with the carbon market to create a more comprehensive approach to addressing climate change. The interaction between these different policies ensures that emissions reductions are not only driven by the market but also supported by a broader regulatory framework.

A fundamental component of the carbon trading market's integrity is the monitoring, reporting, and verification (MRV) system. Designed to ensure the accuracy, transparency, and verifiability of emissions data, this system plays a crucial role in the effective operation of the carbon market. The allocation of carbon credits and the determination of compliance are directly dependent on the reliability of the reported emissions data.

The MRV system requires companies to regularly report their emissions and submit them for third-party verification. Independent audits confirm that reported data aligns with actual emissions, helping to prevent fraud and ensuring transparency in the market. This third-party verification is vital for maintaining the credibility of the carbon market and ensuring that emissions reductions are genuinely achieved.

5.3 Carbon pricing and trading mechanism

The pricing and trading mechanism of carbon credits in China's carbon market is still in its early stages but plays a crucial role in incentivizing emissions reductions. Carbon prices are determined by market forces, and companies that can reduce their emissions at lower costs can sell their excess allowances to those who face higher

reduction costs (California Air Resources Board CARB, 2019). The price of carbon credits is typically influenced by factors such as supply and demand for allowances, market liquidity, and the overall stringency of emissions reduction targets.

China's carbon pricing mechanism is gradually evolving towards a more market-driven approach, with an increasing proportion of allowances being auctioned. In comparison to established markets like the European Union Emissions Trading Scheme (EU ETS), China's carbon market still has a relatively low level of price discovery (Ministry of Environment of the Republic of Korea, 2021). The EU ETS has a long history and a well-established carbon price, whereas China's market is still developing, and carbon prices have been relatively volatile. However, China is working to establish a more stable pricing system by introducing stricter emissions caps and expanding the market to cover additional sectors.

5.4 Conclusion

China's carbon emissions trading market is still in its early stages but has shown significant promise as a tool to reduce carbon emissions. The carbon cap and allocation system, along with the carbon trading mechanism, are designed to provide market-based incentives for emissions reductions. However, the market faces challenges related to transparency, regulatory oversight, and price stability. As the market continues to evolve, China will need to address these challenges and ensure that the carbon pricing system is robust and effective in driving emissions reductions across all sectors of the economy.

6 International comparison and best practices in carbon emissions trading markets

As China continues to expand and develop its Carbon Emissions Trading Market (CETM), it faces both challenges and opportunities for growth. One of the critical ways China can enhance its market's efficiency is by learning from the experiences of other countries with established carbon trading systems. Notably, the European Union Emissions Trading System (EU ETS) has been operational since 2005 and remains one of the most prominent and successful carbon markets globally. By comparing China's emerging carbon market to the EU ETS and exploring global best practices, valuable lessons can be drawn to improve China's approach to carbon emissions reduction.

6.1 Comparison with the EU ETS and other international carbon markets

The EU ETS serves as one of the most advanced and comprehensive emissions trading systems in the world, and it provides a model for other nations and regions seeking to implement similar systems. One key feature of the EU ETS is its strong regulatory framework, which has evolved through various phases, gradually expanding its coverage and tightening emissions

caps (Harris and Wong, 2021). This approach provides a stable environment for businesses while progressively increasing the pressure on industries to reduce their emissions.

One of the significant lessons China can learn from the EU ETS is the implementation of a robust carbon pricing mechanism. In the EU ETS, carbon prices are determined through the interaction of supply and demand for allowances. The price is influenced by factors such as the stringency of the emissions cap and the availability of low-carbon technologies. China can benefit from further developing a transparent carbon pricing system that allows for better price discovery, which would help market participants plan and invest in long-term emissions reductions. Furthermore, China could implement a phased approach similar to the EU ETS, gradually expanding its coverage to include more sectors, such as transportation, construction, and chemicals, to increase market liquidity and comprehensiveness.

Additionally, international cooperation and linking carbon markets play a crucial role in the effectiveness of global climate policies. The EU has explored linking its ETS with other countries' systems, such as Switzerland's carbon market, to enhance market liquidity and create a more integrated global carbon pricing system. China's carbon market could benefit from similar international cooperation. By collaborating with other major carbon markets, such as those in California and South Korea, China can increase the market's efficiency and help harmonize global efforts to meet climate goals.

6.2 Global best practices in carbon market regulation

In addition to the EU ETS, there are other successful carbon markets that have developed effective regulatory frameworks. For example, California's cap-and-trade program, established in 2013, is one of the largest carbon markets in North America (Zhao and Zhang, 2022). California's market is characterized by its clear regulatory framework, which includes strict emissions caps, transparent data reporting, and a sophisticated monitoring and verification system. These features help to ensure compliance and transparency, which is essential for building trust among market participants and ensuring the integrity of emissions reductions.

Another example comes from South Korea's emissions trading system, which launched in 2015. South Korea's market is notable for its strong emphasis on transparency and accountability. The country's regulatory framework includes rigorous monitoring, reporting, and verification (MRV) protocols, which are essential for ensuring that the emissions reductions claimed by companies are legitimate. China can draw inspiration from these MRV systems and adapt them to its own context to improve the accuracy and transparency of its emissions reporting.

Moreover, China can benefit from the experience of other countries in terms of integrating renewable energy policies with carbon markets. For example, the EU ETS has gradually incorporated renewable energy subsidies and other environmental policies to create synergies between emissions reduction efforts. This integrated approach helps maximize the effectiveness of both the carbon market and renewable energy programs. By aligning its carbon market with its growing renewable energy initiatives, China can achieve greater emissions reductions while supporting its transition to a green economy.

6.3 Opportunities for improvement in China's carbon market

While China's carbon market has made significant strides since its inception in 2021, there are areas where improvements can be made. One key area is the development of a more sophisticated and transparent carbon pricing mechanism. Currently, the carbon price in China's market is relatively low and volatile, which can deter companies from investing in long-term emissions reductions. By implementing a more transparent pricing mechanism, similar to the EU ETS, China can provide stronger market signals that encourage investment in low-carbon technologies.

Additionally, China can improve the accuracy and reliability of its monitoring, reporting, and verification (MRV) system. As the market expands to include more sectors, the need for robust MRV protocols will become even more critical. Adopting the best practices from countries like California and South Korea (European Commission, 2020), which emphasize transparency and accountability, would enhance the integrity of China's carbon market and build trust among participants (Zhao and Zhang, 2022).

Another area for improvement is the inclusion of more sectors in the carbon market. While the national carbon market in China currently covers the power generation sector, the expansion to include industries like steel, cement, and transportation would improve market liquidity and lead to more comprehensive emissions reductions. By learning from the phased expansion strategies of the EU ETS and other markets, China can ensure a smooth and effective transition to a fully integrated carbon market.

6.4 Conclusion

China's carbon emissions trading market is still developing, and there is much to gain from international best practices. The experiences of systems like the EU ETS, California, and South Korea provide valuable insights into carbon pricing, market structure, regulatory frameworks, and transparency. By learning from these successful models, China can refine its market design and implementation, advancing its climate goals and strengthening its role in global climate efforts. However, to fully realize the market's potential, China must continue to refine its policies, enhance regulatory oversight, and expand market coverage to drive significant emissions reductions.

7 Future prospects and reform suggestions for China's carbon emissions trading market

As China moves towards its ambitious goal of carbon neutrality by 2060, the nation's Carbon Emissions Trading Market (CETM) is central to achieving this target. However, for the market to realize its full potential, several areas require improvement and reform. This essay discusses the potential expansion and enhancement of the carbon market, legal reforms needed to stabilize the market, and how the carbon market can contribute to China's long-term sustainability and environmental goals.

7.1 Expanding and strengthening the carbon market

One of the most critical steps toward achieving China's carbon neutrality goal is the expansion of the carbon market. Currently, the national carbon market primarily covers the power generation sector. However, significant potential lies in including more industries such as steel, cement, transportation, and other energy-intensive sectors. By expanding the market to cover these sectors, the government can enhance its emission reduction efforts across the economy and create a more comprehensive market for trading carbon allowances. The broader market would also provide businesses with more flexibility in reducing their carbon footprints and enable the discovery of more cost-effective solutions for carbon reduction (Zhao and Zhang, 2022).

In addition to sector expansion, the implementation of technological innovations such as blockchain can further improve the efficiency and transparency of the market. Blockchain technology can ensure that carbon credits are securely and transparently tracked, reducing the risks of fraud and double counting. It would also streamline the process of reporting and verification, providing stakeholders with real-time data on carbon credit transactions and emissions reductions. With greater transparency and accountability, blockchain technology can help build trust in the market, attracting more participants and investments in the long run.

7.2 Legal reforms for improved regulatory and market stability

While the CETM has made significant strides, legal reforms are necessary to address gaps in the existing regulatory framework. One of the primary challenges is the inconsistent enforcement of regulations across regions. Local governments often face difficulties in ensuring compliance with emission limits, partly due to varying levels of regulatory capacity (Liu and Li, 2021). To address this, the central government should strengthen its oversight of local authorities and ensure that they have the necessary resources and incentives to enforce carbon trading regulations effectively.

Additionally, the legal framework for carbon trading needs to be more comprehensive, particularly in industries such as heavy industry and power generation. Clearer rules regarding carbon allowance allocation, penalties for non-compliance, and the involvement of third-party verification bodies are essential for creating a stable and predictable market (Liu and Li, 2021). The government should also consider adopting more market-friendly regulations, such as allowing for the use of international carbon credits to meet national targets. This could facilitate the integration of China's carbon market with international systems, providing a more globalized approach to emissions reduction.

Collaboration between national and local governments, as well as between the government and industry players, is another critical aspect of strengthening the carbon market. It is essential to create a framework where industry participants can actively engage with policymakers to ensure that the market rules are practical and conducive to achieving long-term emissions reduction goals.

7.3 Sustainability and long-term goals

To align with China's long-term environmental and economic objectives, the carbon market must be integrated into broader national strategies for sustainable development. The carbon market should not only focus on reducing emissions but also encourage investment in low-carbon technologies and green innovation. Incentivizing industries to transition toward cleaner energy sources and technologies will be essential in meeting the 2060 carbon neutrality target. The carbon market, through its pricing mechanism, can act as a powerful tool to push industries towards adopting cleaner technologies by making carbon-intensive options more expensive.

Furthermore, the carbon market must be closely integrated with other environmental policies, such as renewable energy subsidies, energy efficiency standards, and green finance. These complementary policies can create a robust framework for achieving China's long-term goals, providing both regulatory and financial support for businesses as they transition toward a more sustainable future (Wang and Zhou, 2021).

In the context of carbon neutrality by 2060, the carbon market plays a pivotal role in meeting China's emission reduction commitments. However, to achieve this target, the market needs to be progressively enhanced and supported by strong legal frameworks and active collaboration between government, industry, and other stakeholders. By implementing the necessary reforms and expanding the market to include more sectors, China can leverage the carbon market as a vital tool for achieving its climate objectives while promoting sustainable economic development.

7.4 Conclusion

China's Carbon Emissions Trading Market has significant potential for supporting the country's carbon neutrality goals by 2060. Expanding the market, implementing technological innovations, and enacting legal reforms are essential steps to improve the market's effectiveness. The integration of the carbon market with broader environmental and economic policies will ensure that the market serves as a powerful instrument for sustainable development, enabling China to meet its long-term environmental and climate objectives.

8 Conclusion

This paper has provided a comprehensive analysis of China's Carbon Emissions Trading Market (CETM), focusing on its legal framework, current policies, challenges, and proposed reforms. The findings reveal that while China's carbon market has made significant strides in its development, there are still numerous areas that require attention to ensure its effectiveness in achieving the country's carbon neutrality target by 2060.

Firstly, the legal framework governing China's carbon market is a critical factor for its success. Key regulations, such as the "Interim Measures for Carbon Emissions Trading" and the "National Carbon Market Construction Plan," provide the necessary structure for the market's operations. However, there are still gaps in the clarity and consistency of

enforcement, particularly in certain high-emission sectors such as heavy industry and power generation. Legal reforms, including clearer allocation rules, stronger penalties for non-compliance, and more robust third-party verification systems, are essential to creating a more stable and predictable market.

In terms of policy, the expansion of the carbon market to include more industries and regions, as well as the integration of technological innovations like blockchain, holds great promise. Expanding the scope of the market can lead to more cost-effective emission reductions and create a more comprehensive system for emissions trading. Blockchain technology, in particular, could enhance the transparency and efficiency of the market, fostering greater trust among stakeholders. Additionally, the interaction of the carbon market with other environmental policies, such as renewable energy subsidies and energy efficiency measures, could provide a synergistic effect, driving China toward its environmental goals.

However, significant challenges remain in the execution of China's carbon market. These include issues such as enforcement gaps, regional disparities in regulatory capacity, and the volatility of carbon prices. Local governments often lack the necessary resources to enforce compliance effectively, which undermines the integrity of the market. Additionally, market liquidity and price volatility present risks for industry participants and may hinder the stability of the system. Addressing these issues requires a more coordinated approach between national and local governments, clearer regulations, and stronger market oversight.

Finally, this paper proposes several reform suggestions, including enhancing regulatory oversight, expanding the market to cover more industries, adopting blockchain technology, and fostering collaboration between the government and industry participants. These reforms would not only strengthen the carbon market in China but also contribute to global climate change mitigation efforts.

In conclusion, while China's Carbon Emissions Trading Market has made significant progress in its development, there are still substantial challenges and opportunities for improvement. With effective reforms, enhanced collaboration, and continued market expansion, the CETM has the potential to play a leading role in global climate change mitigation efforts. As China strives to meet its carbon neutrality goals by 2060, the successful implementation of the carbon market will be instrumental in reducing emissions, promoting green innovation, and fostering sustainable economic development. By addressing the current challenges and leveraging the opportunities for growth, China can continue to lead by example in the global effort to combat climate change.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

MY: Conceptualization, Methodology, Writing – original draft, Writing – review and editing, Project administration.

J-MB: Data curation, Formal analysis, Writing – review and editing. YQ: Writing – review and editing, Methodology, Formal Analysis, Visualization, Validation. YL: Writing – original draft, Writing – review and editing. SL: Writing – original draft.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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