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China's Carbon Market in the Context of Carbon Neutrality: Legal and Policy Perspectives

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Abstract: China's carbon market covers a huge amount of emissions, but the effects of emission reduction in the early stages are limited. This study explores the regulation of policies and laws on the carbon market through doctrinal and empirical research in the field of law. The study reveals that although the national carbon market witnessed a considerable quota trading volume, the peak of trading is concentrated and accompanied by a high compliance rate. The total amount of quotas in the first compliance cycle is too large, coupled with a single trading product, and participants in the early stage fail to activate the carbon market, making it difficult to form the carbon pricing mechanism in the market. The legal factors behind this phenomenon are related to the total amount setting mode and the construction route from simple to complex. Based on the above analysis, this study concludes with the following path to improve China's legislation. To comply with cap and trade, China must improve the setting mechanism of total quotas to form an investment field that participates in multiple entities; effectively play the role of carbon trading in market regulation; and guarantee smooth operation through penalty and reward coordination and a unified MRV mechanism.

Keywords: carbon neutrality; China; carbon market; carbon emissions trading; policy; legislation

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1. Introduction

Achieving carbon neutrality has become a global consensus. It is a complex and wide-ranging socio-economic issue involving energy, economy, environment, technology and many other fields [1]. Since 2021, more than 130 countries and territories have made carbon neutrality commitments. China announced its aim to achieve peak carbon emissions before 2030 and carbon neutrality before 2060. As a market-based policy tool for reducing greenhouse gas (GHG) emissions, the carbon market has become an indispensable part of overall emissions reduction. How can countries with significant emissions use the tool to play their market-regulating role for overall emission reductions? This study analyses this issue from policy and legal perspectives.

The study is focusing on policies and legislation in China's carbon market. The main relevant literature is as follows: (1) Feasibility analysis of the carbon market as an emission reduction tool. Carbon emissions trading has far-reaching implications for China's environmental problems, such as haze pollution. Scholars used a pilot of Hubei as a quasi-natural experiment to examine the effect of the carbon market in reducing PM2.5 [2]. Some scholars have calculated the total emissions required to achieve carbon peaking and introduced the carbon emissions trading market to simulate the development trend of China [3]. Other scholars have assessed the emission reduction effect of carbon emissions trading based on a continuous difference-in-difference model [4], and others have constructed a compliance-regulatory evolutionary game model to study the carbon pricing and compliance supervision mechanism [5]. These studies are all dedicated to building scientific models to analyze carbon trading policies and operating mechanisms. (2) The literature combined with other fields. In the context of climate change mitigation, there is an increasing number of studies on the integration of sustainable development with

science and technology [6,7]; for example, the empirical study of urban big data analytics and sustainable governance networks [8], environmentally sustainable urban development and Internet of Things-connected sensors in cognitive smart cities [9], and the economic and climate benefits of new-type vehicles [10]. Similarly, carbon trading as a market tool for achieving sustainable development has also been studied in feasibility analysis combined with trade [11], transportation [12], energy markets, and stock markets [13]. (3) The literature on the improvement of carbon market policies. Carbon trading policies have obvious policy effects on carbon reduction efficiency in pilot areas [14]. Some scholars have analysed the improvement of carbon market construction [15] by drawing on carbon market policies in pilot regions and foreign experiences and actively exploring transnational carbon trading [16]. Based on the above research, the study of China's carbon emissions trading legislation also extends to the field of blue carbon [17]. The related literature shows that the current research involves less of the latest analysis about the operational characteristics and legal regulations of China's carbon market after the national carbon market opened online.

This research will contribute to the studies of the policies and legislation on the carbon market. Currently, the general landscape of China's carbon market shows a transitionary condition from the pilot markets to the national carbon market. The pilot carbon markets operate in parallel with the national carbon market in the short term [18]. In the era of COVID-19, balancing epidemic prevention and control and sustainable economic development has become a serious challenge [19]. China's carbon market has entered a new stage of rapid development. Therefore, it is not enough to study the carbon market policies and legislations from the practice of the pilot carbon market. This empirical research identifies the problems in the current stage of China's carbon market by focusing on the latest carbon market operation data and doctrinal research on the legal framework. It also examines the current policies and legislations of the carbon market, conducts a comparative study of the core legislations, and examines the development trend in combination with the existing problems. The findings of this study may provide some references for carbon market legislation in other countries.

This article is organized as follows. Section 2 introduces the research methodology while Section 3 summarizes carbon market development in tabular form to reveal the lessons learned from the pilot work. Section 4 presents data analysis and the operational characteristics of the pilot markets and the national carbon market. Section 5 analyses the policies and legislation for the national carbon market, comparatively analyses the existing regulations and the new legislation, and summarizes the innovations of the new legislation to propose the problems and solutions. Section 6 concludes.

2. Methodology

2.1. Empirical Research

The operational characteristics and development status of China's national and regional carbon markets are reflected in the empirical analysis. First, the study conducts data analysis on the operation of the national carbon market by visually describing the monthly trading volume and turnover of quotas and carbon prices. The national carbon market has operated for nearly a year, and the current data represent the situation of this major emitter in the early stage of carbon trading. The figures are made in units of monthly data. Because the trading products of the current national carbon market only involve quota trading, this article selects factors that reflect market activity, quota trading volume and turnover, as well as the factor reflecting the market operation mechanism and carbon prices to evaluate the operation of the carbon market. Second, empirical analysis of the performance of the regional carbon markets in different aspects can intuitively present the development trend of different regions in covered industries, cumulative volume and turnover of allowances, the cumulative volume of CCER, and so on. Covered industries of regional carbon markets can illustrate the characteristics of industrial structures in different regions and the industry sizes of carbon markets. Cumulative volume and turnover of allowances are the most

intuitive manifestation of carbon market activity. As a major trading product and offset mechanism, CCER's cumulative volume can also explain whether the regional carbon market is well constructed or not. Compliance conditions can reflect the enthusiasm of the enterprises.

This article also introduces a relevant case for empirical analysis by expounding the basic facts and pointing out the disputes in the case. This article points out that the issue of this judgment is whether the defendant, the trading platform, should undertake the corresponding responsibility. The legal analysis of this case shows that the responsibilities of relevant entities in the trading process are unclear, which is an important problem in the current carbon market legal system.

2.2. Doctrine Research

The operation and development of China's carbon market are reflected in the empirical research on available data. The impact of policy and legislation on the carbon market requires doctrine research on the rules of the carbon market. First, since 2011, authorities have continuously issued policies and legislation to adjust carbon market operations. All policies and legislations jointly stipulate the carbon trading legal structure. The interpretation of policy and legislation requires the study of the elements of carbon market construction. This article comprehensively reviews the overall legal framework regulating carbon market operation, focusing on several perspectives. This study analyses the selection of market participants, the setting mode of total quotas, the allocation method of quotas, trading products, registration, trading, and settlements to derive the legal motivation behind the development of the carbon market. Second, the core legislations of China's carbon market, *Administrative Measures for the Trading of Carbon Emissions Permits (for Trial Implementation) (Administrative Measures)* and the *Interim Regulations on the Administration of Carbon Emissions Trading (Revised Draft) (Interim Regulations)*, reflect the legal regulation of China's carbon market at different stages, so comparing the legislations is conducive to concluding the development trends of the carbon market in this study. Based on the above, it is possible to summarize the existing problems in China's carbon market and the path to improvement.

3. Development of China's Carbon Market

The pilot carbon markets advanced low carbon development in key industries, such as energy, industry, building, and transportation to form a series of good practices to be copied and promoted. After the maturation of the pilot markets, China began to work on its national carbon market in the following three development stages. The following tables will present the development of the regional carbon market and the national carbon market.

3.1. Regional Pilot Carbon Markets

The general design of the pilot markets can be gleaned from the following aspects presented in Table 1. In 2011, the regional carbon markets officially began pilot work. China implemented the development route from regional pilot work to national market preparation. It has gained practical experience mainly from the following five aspects. These experiences serve as a guide for the construction of the national carbon market.

Table 1. The practical experience of regional carbon markets.

Element	Practical Experience
Covered industries	The coverage of major emitters and exclusion of the smaller emitters; The coverage of industrial sectors with large emissions in the early stage
Allowance allocation	The gradual transition from free-paid allocation; The unified criteria for key emitters
Trading products	The introduction of other appropriate trading products based on quotas; The exploration of carbon financial products for the coordinated development of carbon finance and the carbon market

Table 1. *Cont.*

Element	Practical Experience
Regulatory model	The prompt disclosure of enterprises' surrender conditions and the risky circumstances in the market; The emphasis on risk prevention in the carbon market to clarify the responsibilities of market participants
Penalty type	The adoption of a punishment mechanism combining economic and credit penalties for enterprises that failed to fulfill their compliance

3.2. The National Carbon Trading Market

The development of China's national carbon market has been a long process, and the basis of the construction has required many mechanisms, platforms, and policies. Technology preparation is essential because data collection and MRV capacity building can be conducted for many years to improve the availability and quality of databases and minimize data differences among enterprises [20]. As listed in the Table 2, at different stages, the national carbon market has witnessed phased achievements, and more mature policies have been gradually promulgated.

Table 2. The development stages of the national carbon market.

Phase	Period	Event
Preparation Phase	2013–2016	The *Interim Measures for the Administration of Carbon Emissions Permit Trading*; The plan to launch a national emissions trading scheme (ETS) in 2017 [21]; The *Notice on the Key Tasks of launching the National Carbon Emissions Trading Market.*
Infrastructure Completion Phase, Simulation Operation Stage, and Deeping and Expanding Phase	2017–2020	The *National Carbon Emissions Trading Construction Plan (Power Generation Industry) (Construction Plan)*
Accelerated Phase	2021–2025	*Administrative Measures for the Trading of Carbon Emissions Permits (for Trial Implementation);* the launch of first compliance period; the *Interim Regulations on the Administration of Carbon Emissions Trading (Revised Draft)*

4. Status of China's National Carbon Market

At present, China's national carbon market has been running for nearly a year. The first compliance cycle has ended, and many operational characteristics of the national carbon market have emerged. According to the operational characteristics, the legal regulation behind these characteristics can be analysed, and the existing problems and solutions will be pointed out. After years of development in the regional carbon markets, different regions have shown their own development trends. The study of these regional carbon markets will also contribute to studying the regulatory effects of laws and policies.

4.1. Status of the National Carbon Market

On 16 July 2021, China's national ETS officially began trading on the Shanghai Environment and Energy Exchange (SEEE). China's ETS will be a key policy instrument to realize green development in both the short and long term.

4.1.1. Nationwide Transaction

The opening price on 16 July 2021 was CNY 48 per ton; the closing price was CNY 51.23 per ton [22]. The prices were generally stable. The first batch of 2162 power plants covered approximately 4.5 billion tons of CO_2, which exceeded the volume of the EU, making itself the world's largest carbon market by emissions volume [23].

The fundamental logic of the carbon market's role in reducing emissions is reflected in the transfer and balance of quotas owned by key emitters. Both the trading volume and

turnover of quotas are important variables that reflect the operation of quota transactions. By May 2022, the total amount of quota traded in the national carbon market reached 192 million tons [24]. Figures 1 and 2 show that the trading volume and turnover peak occur in December 2021, reaching 70% of the total amount in the first 11 months. In the remaining months, the cumulative volume and turnover began to slow. Especially after November and December of 2021, the trading volume and turnover rapidly declined. Therefore, China's national carbon market shows a phenomenon of concentrated surrender at the end of 2021. This may be due to the current single trading product and the requirements for the surrender work.

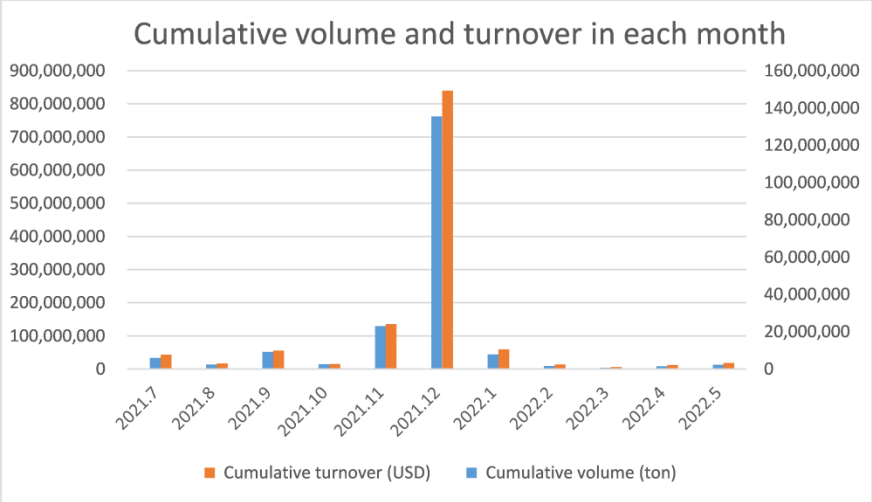

Figure 1. The national carbon market's trading volume and turnover condition.

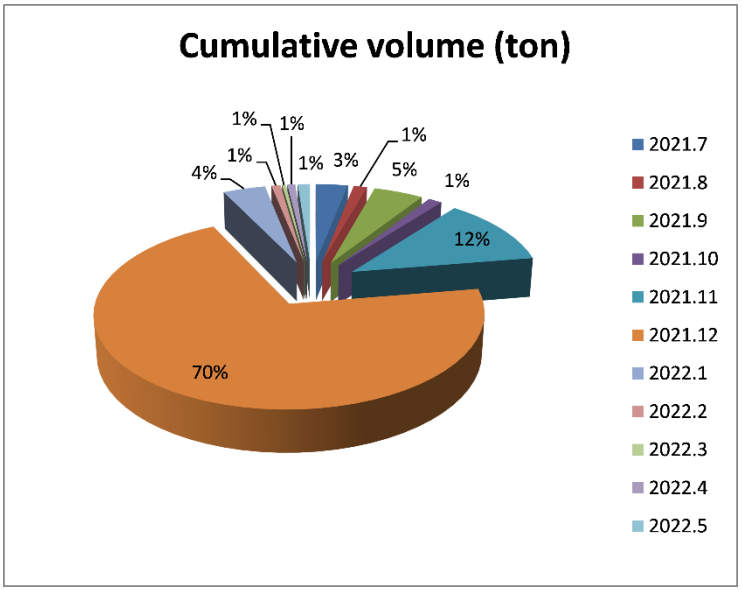

Figure 2. The percentage of trading volume per month.

This cyclical fluctuation in data shows that in the early stages, at least during the first compliance cycle, there was little pressure on companies to reduce emissions. At the end of 2021, the end of the first compliance cycle, the compliance rate of the national carbon market reached 99.5%. Quota transactions are concentrated at the end of the year, with December 2021 witnessing the largest trading volume of quotas. Even in the last month, most companies can fulfill their compliance on time. This phenomenon shows that there are too many tradable quotas in the national carbon market, which is not conducive to achieving China's overall emission reduction targets.

Meanwhile, in Figure 3, the lowest and highest carbon prices in the last 11 months show that the Chinese Emission Allowances (CEA) price remains stable and comparatively low. The monthly carbon price fluctuation is relatively gentle. During the first compliance period, due to the excessive number of quotas, there was no significant increase in carbon prices even in November and December, when trading volume and demand were greatest. Generally, the allowance is priced between CNY 40–60. If appropriately designed, carbon pricing can play a role by sending a price signal to incentivize low carbon action and avoid locking in more fossil fuel-intensive investments [25]. The carbon pricing mechanism and its formation are related to multiple factors. Carbon pricing is a market mechanism; thus, the total volume of allowances is a decisive factor. The offsetting mechanism is also an important factor, so the offsetting CCER ratio should be set at 5%. With the introduction of more trade products, cap and trade, and CCER transactions, the carbon price will improve in the future.

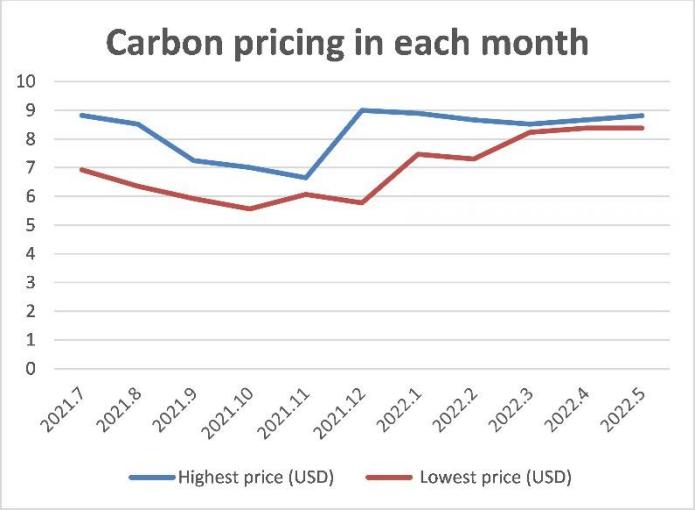

Figure 3. The condition of carbon pricing.

4.1.2. Single Diversification

Regarding trading entities, Article 4 of the *Rules for the Administration of Trading of Carbon Emissions (for Trial Implementation)* (*Trading Rules*) states that the national carbon trading market's trading entities include covered companies as well as institutions and individuals who meet the regulations [26]. Individual investors are active players in carbon emissions trading who have been involved in pilot market transactions. The Shenzhen, Chongqing, Guangzhou, and Hubei pilot markets, among others, have successively issued relevant regulations to allow individuals to open accounts for transactions. However, at present, the trading entities of the national carbon market only involve key emitters in the power sector, and individual investors cannot participate in the trading. At the same time, limited to the current single trading product, the quotas traded by enterprises are only for compliance. It is not yet possible to introduce carbon financial products based on basic trading products.

4.1.3. Data Transparency

The carbon emissions data determine whether companies can enter the carbon market and how much allowance they can be assigned. In December 2021, the Ministry of Ecology and Environment (MEE) and eight other ministries jointly issued a notice proposing to strengthen the supervision, management, and information disclosure of carbon emissions; explore the enterprise carbon accounting system; and regularly conduct enterprise carbon audits to strictly prevent carbon data fraud [27]. On 31 December 2021, the MEE issued the *Format Guidelines for Legal Disclosure of Enterprise Environmental Information*, which stipulates that when enterprises prepare annual and interim reports the expression of

relevant environmental issues should be true, accurate, and objective, with no misleading judgments and no exaggerated, fraudulent, misleading, inaccurate, or objective words. The information that the covered companies shall disclose includes their carbon emissions for the previous and current years, information about quota settlements, and annual GHG emissions reports [28]. During the 14th Five-Year Plan period, as the eight high-emissions industries (i.e., petrochemical, chemical, building materials, and steel) become gradually regulated by the national emissions trading market, more enterprises will report their annual carbon emissions data to the relevant authorities. During this time, the extent to which China's emitters must disclose their carbon emissions data will be further expanded.

Although China's ETS remains in its early stage, it already contains a relatively complete MRV system. Since 2013, China has continuously increased the requirements for the MRV system. To establish a sound MRV system, between 2013 and 2015, the National Development and Reform Commission (NDRC) issued the *Greenhouse Gas Emissions Accounting Methods and Reporting Guidelines* for 24 industries, which covered almost all the important industries in China. On 15 March 2022, the MEE updated the *Guidelines for Enterprise Greenhouse Gas Emissions Accounting and Reporting-Power Generation Facilities (2022 Revision)* in the form of annexes. The provincial-level Department of Ecology and Environment shall organize the covered power plants to submit a 2021 annual GHG emissions report. Those companies that meet the requirements (GHG emissions in 2020 or 2021 that exceed 26,000 tons of CO_{2e}) shall publish the relevant emissions information on the appointed platform before 31 March 2022. Each provincial-level Department of Ecology and Environment shall complete verification of the 2021 annual report by 30 June 2022 and shall submit a written verification report to the Department of Climate Change (DCC) of the MEE [29].

4.2. Status of Regional Carbon Markets

As of December 2020, there were nine regional carbon markets in China. Apart from pilot markets, Sichuan and Fujian have successively established nonpilot regional carbon trading markets. The continuous improvement of the carbon market system in various provinces and municipalities has also progressed the operation of China's national ETS.

The list of covered industries in the various provinces and cities is not completely consistent as they relate to the regional industrial structure. The eight highest polluting industries (i.e., power, chemicals, building materials, steel, nonferrous metals, paper, and aviation) are all covered as they are the main contributors to carbon reduction. As listed in Table 3, all carbon markets cover the power and industrial sectors. Most markets, such as Tianjin, Shanghai, Hubei, and Fujian, cover chemicals and steel. Beijing and Shenzhen cover the transportation sector. Shanghai and Fujian incorporate the aviation sector into their emissions management. In addition to the eight highest polluting industries, some areas also cover nonindustrial industries; Beijing brings manufacturing, public institutions, and universities under its emissions control, while Shanghai and Guangdong cover the textile sector.

Figure 4 shows the total amount and turnover of allowances traded in each pilot market as of June 2022. Regarding the total amount of allowance, Guangdong shows almost twice that of Hubei and is four times that of Beijing and Shanghai. Except for Guangdong and Hubei, the total allowance traded in other regions is average, and Tianjin and Chongqing trade the least allowance. In terms of turnover, Guangdong leads the way. Its cumulative turnover is approximately twice that of Beijing and Hubei. Tianjin and Chongqing have the lowest total turnover.

Table 3. Covered industries in the regional carbon markets [30].

	Platform	Opening Date	Coverage
Beijing	China Beijing Green Exchange (CBGEX)	28 November 2013	Power, heat, manufacturing, transportation, construction, public institutions, and universities.
Tianjin	Tianjin Climate Exchange (TCE)	26 December 2013	Power, heat, steel, chemicals, petrochemicals, oil and gas exploitation, and other key emissions industries.
Shanghai	Shanghai Environment and Energy Exchange (SHEEEX)	26 December 2013	Industries involving steel, petrochemicals, chemicals, nonferrous metals, power, building materials, textiles, paper, rubber, chemical fiber, and so on. Nonindustrial sectors involve aviation, ports, airports, railways, commerce, hotels, finance, and so on.
Guangdong	Guangzhou Emissions Exchange	19 December 2013	Sectors include cement, steel, power, and petrochemicals. Gradually expanded to more than 10 industrial sectors, such as ceramics, textiles, nonferrous metals, plastics, and paper during the second phase.
Shenzhen	China Emissions Exchange (Shenzhen)	18 June 2013	The industrial sector, building sector, and transportation sector.
Hubei	China Hubei Emissions Exchange	12 April 2014	Steel, chemicals, cement, automobile manufacturing, power, nonferrous metals, glass, paper, and other high-energy-consuming and high-emissions industries.
Chongqing	Chongqing Carbon Emissions Trading Center	19 June 2014	Six high-energy-consuming industries: electrolytic aluminum, ferroalloys, calcium carbide, caustic, cement, and steel.
Fujian	Haixia Equity Exchange	22 December 2016	Power, steel, chemicals, petrochemicals, nonferrous metals, aviation, building materials, paper, ceramics, and so on.

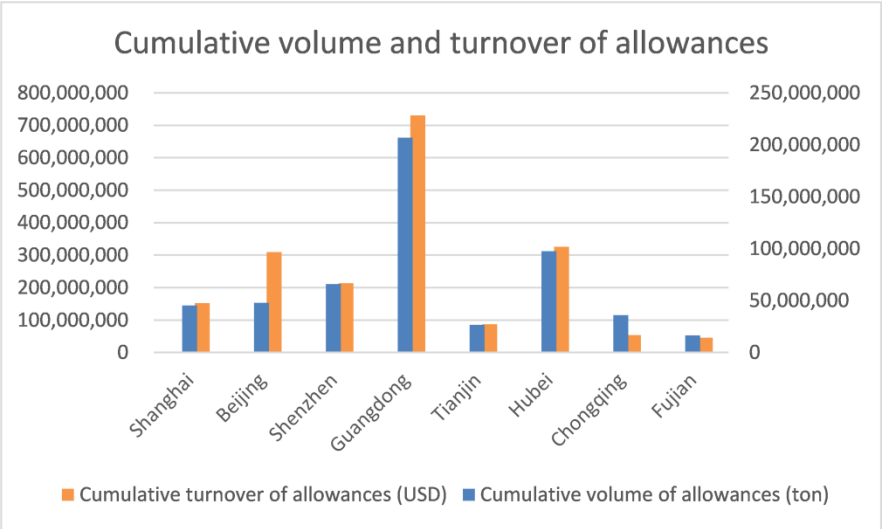

Figure 4. Cumulative volume and turnover of allowance in the pilot markets as of 22 June 2022.

China has established a national ETS to mitigate its emissions. For sustainable development in the long term, a series of supplementary mechanisms will be necessary [31]. In China, CCER transactions are used to offset part of the carbon emissions and can appropriately reduce enterprises' compliance costs. Figure 5 shows that in the regional carbon

markets, Shanghai trades the largest amount of CCER, which far exceeds the other carbon markets. The market share of Shanghai's carbon market has always been high. In 2021, its cumulative CCER transaction volume was 170 million tons, accounting for 39% of the total transaction volume of CCER in China and ranking it first out of several carbon markets [32]. Chongqing has the lowest total volume of CCER, accounting for 1% as shown in Figure 6. The volume is comparatively large in Beijing, Tianjin, and Guangdong.

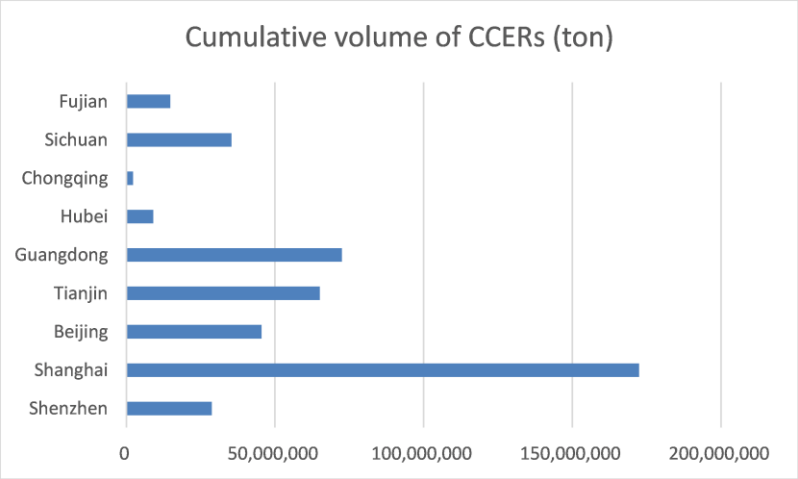

Figure 5. The cumulative volume of CCER in the regional carbon markets as of 22 June 2022.

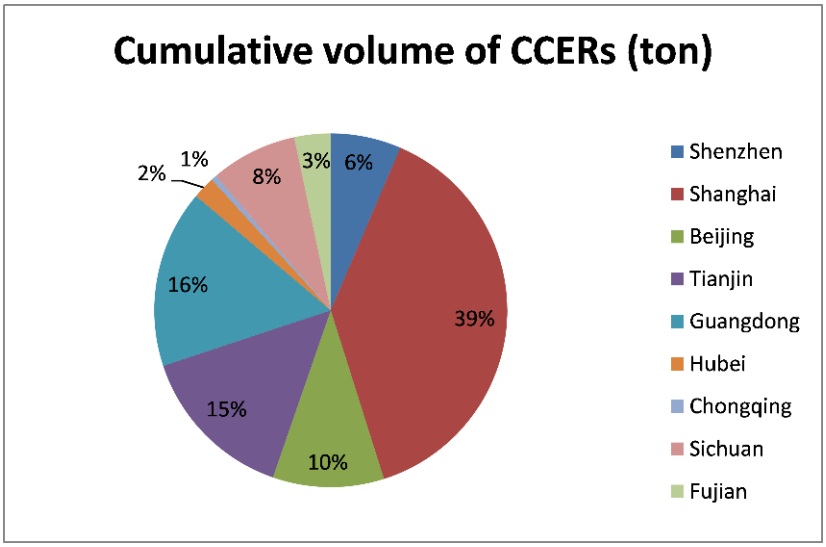

Figure 6. The percentage of CCERs in each regional carbon market as of 22 June 2022.

Table 4 shows the regional carbon markets' compliance rates; various regions show an upwards trend. The compliance rate in many carbon markets has been as high as 100% for several years. Shanghai performs perfectly. It completed the surrender work for eight years and has achieved a 100% compliance rate for eight consecutive years. Since 2015, Tianjin has maintained a 100% compliance rate for six consecutive years. Compared with other markets, Chongqing has a lower rate of compliance and inadequate information disclosure.

Regional fragmentation is relatively obvious in China. It will take time to progress from a national carbon market in the power sector to all sectors, and the role of the pilot markets should be fully utilized during this transition period [4].

Table 4. The compliance condition from 2013–2020 (a blank field means no information disclosure).

	2013	2014	2015	2016	2017	2018	2019	2020
Beijing	97%	100%	100%	100%	99%		100%	100%
Tianjin	96%	99%	100%	100%	100%	100%	100%	100%
Shanghai	100%	100%	100%	100%	100%	100%	100%	100 %
Chongqing		70%						
Hubei		100%	100%	100%	100%			100%
Guangdong	99%	99%	100%	100%	100%	99%	100%	100%
Shenzhen	99%	99%	100%	99%	99%	99%	99%	100%
Fujian				99%	100%		100%	100%

5. Policies and Legislations of China's ETS

The ETS can play a role in reducing emissions and achieving the goal of sustainable development only by bringing carbon emissions trading onto the legal track. Through laws and regulations, the government makes mandatory provisions for trading purposes, participants, rules, and objects, as well as incentives and punishments [33].

5.1. Current Status of Policies and Legislations

China adopts a top-down collaborative legislative model. The central government formulates management regulations and implementation rules, and local governments refine them according to actual conditions. This model is suited to the regionalized characteristics of the carbon market [34]. Under the guidance of the Administrative Measures, the MEE established the basic legal framework of the national ETS by releasing the Registration Rules, Trading Rules, Settlement Rules, and many other regulations listed in Table 5 in chronological order. The different phases of policy and legislation reflect the development strategies of the carbon market and different considerations in formulating these rules. This study will focus on the main elements of policy and legislation to examine the current legal regulation deficiencies and prospects of the carbon market. By issuing various policies and legislations, the MEE has achieved a grasp of the overall process of the carbon market, which is reflected in the following aspects.

Table 5. The policies and legislations (the interim regulations have not yet gone into effect.) on the carbon market construction.

Policy	Issuing Authority	Date Issued	Effective Date
The Notice on Carrying Out the Work of Carbon Emissions Trading Pilot Program	NDRC	29 October 2011	29 October 2011
National Carbon Emissions Trading Market Construction Plan (Power Generation Industry)	NDRC	20 December 2017	20 December 2017
2019–2020 National Carbon Emissions Trading Cap Setting and Allowance Allocation Implementation Plan (Power Generation Industry) (*Implementation Plan*)	MEE	30 December 2020	30 December 2020
Name List of 2019–2020 Major Emitting Entities in Power Generation Sector (*Name List*)	MEE	30 December 2020	30 December 2020
Guidelines for Enterprise Greenhouse Gas Verification (for Trial Implementation)	MEE	29 March 2021	29 March 2021
Notice on the Key Tasks of the Management of Enterprises' Greenhouse Gas Emissions Reporting in 2022	MEE	15 March 2022	15 March 2022
Guidelines for Enterprise Greenhouse Gas Emissions Accounting and Reporting-Power Generation Facilities (2022 Revision)	MEE	15 March 2022	15 March 2022

Table 5. *Cont.*

Legislation	Issuing authority	Date issued	Effective date	Level of authority
Interim Measures for the Administration of Voluntary Greenhouse Gas Emissions Reduction Transactions	NDRC	13 June 2012	13 June 2012	Departmental Rules
Interim Measures for the Administration of Carbon Emissions Permit Trading	NDRC	10 December 2014	10 January 2015	Departmental Rules
Interim Regulations on the Administration of Carbon Emissions Trading (Draft for Solicitation of Comments)	MEE	3 April 2019		Administrative Regulations
Administrative Measures for the Trading of Carbon Emissions Permits (for Trial Implementation)	MEE	5 January 2021	1 February 2021	Departmental Rules
Interim Regulations on the Administration of Carbon Emissions Trading (Revised Draft)	MEE	30 March 2021		Administrative Regulations
Rules for the Administration of Registration of Carbon Emissions (for Trial Implementation) (*Registration Rules*)	MEE	17 May 2021	17 May 2021	Departmental Rules
Rules for the Administration of Trading of Carbon Emissions (for Trial Implementation)	MEE	17 May 2021	17 May 2021	Departmental Rules
Rules for the Administration of Settlement of Carbon Emissions (for Trial Implementation) (*Settlement Rules*)	MEE	17 May 2021	17 May 2021	Departmental Rules

5.1.1. The Choice of Carbon Market Participant

It can be seen from different policies, documents, and legislations that the overall idea of reducing emissions in China's carbon market is to 'control the major emitter and exclude the small one'. At present, to achieve carbon peaking, the national carbon market not only considers the total GHG emission control and phased target requirements in the allocation of quotas but also requires the necessary criteria of emissions of key emitters in the selection of covered enterprises. According to the *Construction Plan* in 2017, only enterprises with annual emissions of 26,000 tons of carbon dioxide equivalent (CO_{2e}) and above can be considered key emitters. There are only 2162 enterprises in the first batch of the power industry in the national carbon market. Although the carbon market covers a huge amount of emissions, the number of trading entities is not large, so the carbon market is not prosperous. In 2020, the MEE issued the *Implementation Plan*, which also stipulates the incorporation criteria for enterprises under emission control, that is, annual emissions of 26,000 tons of CO_{2e} in any year between 2013 and 2019. From 2019 to 2020, there were 2225 key emitters that met this condition [35]. The selection of this number harmonizes the coverage criteria for participants in the national carbon market.

5.1.2. Setting Mode of Total Amount of Quotas

The Implementation Plan sets a down-top model for setting the total number of quotas. The provincial-level ecological and environmental authorities approve the number of quotas for each key emitter and add up the quotas for each key emitter in their administrative region to form the total amount of the provincial-level administrative region. The total quota of each provincial-level administrative region is summed to finally determine the total amount of quotas nationwide. This setting method is flexible, and the total amount of the quotas can be set according to different situations in administrative regions, but it will also give local authorities greater power for decision-making, which is not conducive to the realization of the overall emissions control target. However, considering the difficulty of enterprises under emissions control to adapt in the early implementation stage of carbon market policy as well as the uncertainty in the market, this method can improve the enthusiasm of enterprises while ensuring the compliance rate. It is also for this consideration that the *Implementation Plan* established a limit on quota surrender; that is, in 2019 and 2020,

regardless of the emission amounts generated by the key emitters, the maximum that the key emitters must surrender was their free quotas plus 20% of their verified emissions [35].

5.1.3. Allowance Allocation Method

The allocation method of quotas is the responsibility of the central authority, the MEE, which formulates the allocation plan, and the provincial ecological and environmental departments, which allocate quotas to key emitters in their administrative regions in accordance with the central authority's plan. At the same time, *Administrative Measures* stipulate the opportunity for key emitters to object to the issue of quota allocation. According to the quota accounting formula given by the *Implementation Plan*, if the key emitters object to the allocation of quotas, they can apply to the department of ecology and environment for review. In terms of emissions quotas, both *Administrative Measures* and *Interim Regulations* have set rules for substantive dispute resolution. As more enterprises are covered by the national carbon market in the future, detailed provisions on remedies for key emitters, such as applications for review, will effectively increase the enthusiasm of enterprises.

5.1.4. Trading Product

Owing to the small volume of CCER transactions as well as some unregulated projects and other problems the NDRC issued an announcement suspending the application of CCER projects and emissions reduction in March 2017. At present, the second compliance cycle of the national ETS has begun. The cost of CCERs is lower than that of quotas, making it a cheaper choice for enterprises to surrender. Reducing the total amount of quotas will improve the price of quotas. To balance carbon pricing, China's carbon market needs to be supplemented by CCERs. The maximum proportion of CCERs used for settlement and offset is 5% of the allowances to surrender [36].

5.2. Comparison of Two Core Fundamental Legislations

The *Administrative Measures* and *Interim Regulations*, which have not yet taken effect, are the core regulations. *Interim Regulations* provide more comprehensive regulation of the development and operation of the national carbon market on the basis of *Administrative Measures*. By comparing the two legislations, this study can extrapolate the problems in the current legal structure and appropriate improvement for China's carbon market. Their provisions differ in the following aspects:

a. Regarding the division of responsibilities, the *Interim Regulations* place more emphasis on the cooperation between the MEE and other departments. It stipulates that for the supervision and management of carbon emissions trading activities, the trading entities, verification agencies, registration institutions, and trading institutions shall be completed via multidepartmental cooperation.
b. Regarding the key emitters, the *Interim Regulations* do not establish clear inclusion criteria. This indicates that in the future as emissions reduction targets change, the conditions for the key emitters will change accordingly.
c. Regarding the setting of total quotas, the *Interim Regulations* have changed to a top-down model. The MEE is responsible for determining the total amount of quotas.
d. Regarding the verification work, the *Interim Regulations* provide more detailed provisions based on the *Administrative Measures*.
e. Regarding illegal transactions, the *Interim Regulations* stipulate that the competent departments, registration and trading institutions, and verification service agencies shall not participate in quota trading.
f. Regarding the key emitters' responsibilities, the *Interim Regulations* increase the penalties for failure to report and surrender.
g. The *Interim Regulations* add provisions on multi-entity responsibility and credit punishment. They also add risk prevention provisions and propose government funds for carbon emissions.

5.3. Problems in China's Carbon Markets

Basic elements of the carbon market constitute the foundations for its construction and operation; therefore, the lack of the following framework elements will incur a series of influences that will result in problems and risks to the normal operation of the carbon market.

5.3.1. Deficient Carbon Pricing Mechanism

In the context of carbon emissions trading, allowances can be circulated and converted into cash in the market. The allowance has the attributes of the property and economic value [37]. In the future, with the introduction of paid allocation and its increase in the ratio, the total amount of quota will bring huge economic benefits. The looser total allowance amount will make quota allocation a tool for pursuing profit. Combined with the current down–top setting mode of total quotas, the imbalance in the allocation of regional quotas will lead to unfair quota transactions between enterprises under emissions control in different regions, which is not conducive to forming a solid carbon pricing mechanism. The trading volume and price should reflect factors such as the supply and demand relationship of the carbon market, the cost of carbon emissions reduction and the compliance status of key emitters and send the correct price signal to market entities so that market participants can make correct decisions [38]. Carbon trading is a market tool for emissions reduction, so the imbalance between supply and demand and oversupply will reduce carbon prices. In the current situation of a single trading product, lack of an offset mechanism, and few market participants, the two parties to the transaction are still in the exploration stage, and the carbon price mechanism cannot effectively play a role in stabilizing the market.

5.3.2. Light Penalties

At present, the allowance allocation in the national carbon market is comparatively loose, and there is less pressure on enterprises to fulfil their compliance. However, according to the MEE's statistical information, at the end of the first compliance period, the compliance rate of the national carbon market was 99.5% of the allowance volume for compliance [39]. Subsequently, the enterprises concerned were punished. One enterprise in Zhangjiagang, Suzhou did not complete their surrender work on time, bringing about the first case of failure to fulfill their compliance on time in the national market. The punishment is stipulated in the *Administrative Measures* that were issued on 1 January 2021. However, the *Administrative Measures* do not impose severe penalties on those who fail to fulfill their compliance, thus limiting its deterrent power [40]. It stipulates that key emitters who do not surrender their allowances on time shall be fined between CNY 20,000 and 30,000. Moreover, if an enterprise does not surrender in a timely manner, then the provincial-level Department of Ecology and Environment shall reduce its allowances for the next year. Since the cost for enterprises to purchase surplus allowances or CCERs from others and to explore emissions reduction technology is much higher than the fine, the CNY 30,000 fine makes it difficult to deter enterprises.

5.3.3. Regional Fragmentation in China's Regional Carbon Markets

Developments in regional carbon markets in terms of coverage, cumulative volume and turnover of allowances, and compliance conditions are mixed. Therefore, there is serious regional fragmentation in China's carbon markets. In the rules and regulations that have entered into force, the *Administrative Measures* mention a transition mechanism. Article 13 stipulates that the key emitters in the national carbon market shall not be subject to the control of local carbon markets. In the near future, with more emitters being regulated by the national market, new questions will emerge. For example, the coverage of all eight industries in the national carbon market would inevitably incur the shrinkage of local markets. Subsequently, stabilizing the carbon price would be a major challenge for the local carbon markets. Inconsistent carbon prices in regional carbon markets make it impossible to achieve cross-regional trading, exacerbating fragmentation. Furthermore, enterprises that

would soon be covered by the national carbon market would also face much uncertainty because the regulations for the pilot markets differ from those for the national market regarding allowance allocation, data accounting and reporting, regulatory mechanisms, and other aspects.

5.3.4. Insufficient Legal Basis for Dispute Resolution

The market regulatory mechanism is not perfect. Existing regulations make it difficult to effectively settle market disputes because the regulatory rules lack clarity, making them prone to disputes. For example, in the case of a contract dispute between Micro Carbon (Guangzhou) Low Carbon Technology Co., Ltd. and Guangzhou Carbon Emissions Trading Center Co., Ltd. the plaintiff, Micro Carbon, claimed that after it delivered more than 2.3 million tons of quota to the purchaser through the Guangzhou Carbon Emissions Trading Center, the center did not settle the corresponding price into its account. The plaintiff argued that the nature of the center determined that all parties in the transaction must settle through the center's account to improve transaction efficiency and trading credit. However, in this case, the behavior of the center seriously damaged its own credit; therefore, it was responsible for the corresponding legal responsibilities [41]. Because China's regulatory rules for trading platforms were vague, the plaintiff misunderstood the regulatory responsibilities of the trading platform. China had no clear rules stipulating that the platform should ensure that both parties involved in the transaction had the corresponding quotas and funds required, which was also the main reason why the plaintiff lost the case. This case further highlights that the legislation of the pilot markets' regulatory model needs meticulous operational norms. Moreover, the *Administrative Measures* state that the authorities and agencies are responsible for the supervision and management mechanism. There are omissions in the responsibilities of third-party institutions. In the process of emissions trading, some trading components require the direct participation of other professional institutions. For example, the trading process of carbon financial products will inevitably involve financial sectors. At present, dispute resolution in the legislation only stipulates the situation in which the covered enterprises are dissatisfied with the allowance allocation and can apply for review. The liability of other entities is mostly a principal clause.

5.4. Prospects for the Legal System

China's ETS has been gradually established and improved and has developed from the local pilot markets to the national unified market and then to the global market [42]. In the 14th Five-Year Plan period, from the improvement of the legal framework and credit system of China's carbon market, the carbon financial market will rapidly develop and will gradually form a situation in which spot and forward products will be covered simultaneously, and the trading mode and trading products will be constantly enriched [43]. Accelerating the legislative process for the carbon market is a premise for achieving low-carbon development.

5.4.1. Top-Down Total Amount Setting Mode and Allowance Allocation

Under the goal of carbon neutrality, setting the total amount of allowances will transition to the method of overall emissions reduction and will maintain a moderately tightened principle for a long time. When comparing the effectiveness of the EU's emissions reduction in phase three with the first and second phases, the top-down cap and trade principle has played a crucial and decisive role in achieving emissions reduction targets. In the third phase, the EU abolished allocations by member countries, established a unified system of total emissions at the EU level, and changed to a top-down setting method [44]. In the *Interim Regulations,* the total allowance amount will be decided by the MEE and the provincial authorities will be assigned the allowance according to this amount. When the *Interim Regulations* come into effect, the top-down mode will be implemented. Consequently, the paid allocation method will be introduced in the future. After incorporating the eight major

industries, adapting the characteristics of each industry can allow the national carbon market to learn from Guangdong's carbon market experience, and different proportions of paid quotas in different industries can be implemented.

5.4.2. Expanding Industry Coverage, Trading Products, and Participants

To achieve the carbon peak and carbon neutrality targets on schedule, targeting the power sector's key emitters alone will be insufficient; only by covering the other seven high-emissions industries can green, low carbon transformation be achieved. China's pilot markets have covered the power, petrochemical, chemical, building materials, and steel industries, among others. Similarly, the coverage of China's national ETS also follows the path of 'from less to more'. The national carbon market is expected to incorporate the building materials and steel industries in 2022 and incorporate all key industries during the 14th Five-Year Plan period [18]. In the near future, because the coverage expansion depends on the emissions situation and monitoring capacity, the MEE will adjust this process by releasing regulations. At present, the development of carbon financial products in the regional carbon market is becoming increasingly diversified. When future conditions are appropriate, based on quotas and CCERs, more carbon financial products will be introduced into China's carbon market. Combining the carbon market and the financial sector will be a new investment area for individual investors and uncovered enterprises. Multiple types of participants will greatly increase the activity of the carbon market.

5.4.3. Penalty and Reward Coordination

For each country, the concept of sustainable development has no fixed and unified paradigm, which must be explored by different countries according to specific conditions [45]. Combined with China's specific conditions, the combination of reward and penalty will be effectively applied to the compliance mechanism in China's carbon market. In China, penalties will be revised after the *Interim Regulations* takes effect. Regarding the issue of the accountability system, the new law will impose tougher penalties on noncompliant enterprises by revising the fines from CNY 10,000–30,000 to CNY 50,000–200, 000 [46]. In addition to enterprise liability, the liability of other subjects will also be listed, such as the staff at the Department of Ecology and Environment at the county level or above, as well as other departments responsible for supervision and management. Furthermore, the illegal situations will be expanded, such as illegal verification, transactions, institutional trading, and resisting supervision and inspection. In addition to this negative punishment mechanism, the positive incentive mechanism will also be particularly important and the carbon market can be linked with financial services. For example, regarding pledge services with allowances as the subject matter, the SEEE's *Shanghai Carbon Emissions Quota Pledge Registration Business Rules* provide an emerging financial service for enterprises with surplus quotas [47]. Through this service, companies can cash out their carbon assets and simultaneously expand their access to financing. The exchange, as the registration agency, shall review the relevant applications; the relevant department shall supervise and manage the registration; and the safety of carbon assets shall be guaranteed.

5.4.4. Unified MRV Mechanism

On 14 March 2022, the MEE reported that four institutions had forged reports and that the conclusions of the reports were distorted. Only by truly improving the MRV mechanism can these problems be effectively alleviated in the future. China's pilot markets have successively formulated detailed MRV rules. For example, the Guangdong authority responsible for emissions trading has issued documents, such as the *Guangdong Implementation Rules of Enterprise Carbon Emissions Information Reporting and Verification (for Trial Implementation)* and the *Guangdong Enterprise Carbon Emissions Verification Regulations* on its official website, and has updated the guidelines, verification specifications, and quota allocation schemes according to the situation of its pilot market [48]. Similarly, China's national carbon market

requires unified MRV rules with high legislative levels. It is essential to develop a law of a more legally binding nature to regulate MRV activities in the national carbon market [49].

6. Conclusions

China's national carbon market was officially launched in July 2021. It is working well, but the number of quota transactions is large and the compliance rate is high. The transactions are concentrated in the month before the expiration of the compliance period. Too much quota will make it difficult for the carbon market to achieve the purpose of overall emissions reduction in the early stage. In addition, the trading product in the national carbon market is single, only involving quota trading, and market participants are only high-emission enterprises in the power industry. The above situation makes it impossible for the national carbon market to form an effective pricing mechanism. The cost of noncompliance stipulated by law is too low, which is not conducive to the compliance mechanism. The carbon markets in various regions are relatively independent, and the gap in coverage industry, trading volume, and compliance rate is too large. For the regional carbon markets, there is a lack of clear policy guidance in the future convergence with the national carbon market. The existing dispute resolution provisions tend to be principled allocations of responsibilities. There is a lack of an effective legal basis for dispute resolution. In the future, to play the market role of carbon trading, the top-down setting mode of total quotas can enable the government to grasp the progress of overall emissions reduction. Accompanied by a variety of trading products, participating entities, and covered industries that can activate market vitality, an effective pricing mechanism will be formed which will play a role in stabilizing the market and balancing the allocation of resources. Through stricter penalties for noncompliance, effective incentive mechanisms, and unified MRV legislation, enterprises can be supervised to fulfill compliance to ensure the smooth completion of compliance work.

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