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THE INTEGRATION MECHANISM BETWEEN CARBON TRADING MARKET AND DUAL-CONTROL OF CARBON EMISSIONS: A CASE STUDY OF SHENZHEN

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Abstract: Global warming and the imperatives of low-carbon development have driven the implementation of China's carbon peak and carbon neutrality goals. This paper takes Shenzhen as a case study and constructs an analytical model from the perspectives of institutional economics, policy integration, and multi-level governance. Utilizing policy text analysis and qualitative research methods, it examines the linkage between the carbon trading market and the dual-control mechanism for carbon emissions. The findings indicate that the synergistic effect of market incentives and administrative regulation significantly promotes carbon reduction and provides valuable insights for low-carbon transformation. This study enriches the theoretical framework of carbon governance and offers decision-making guidance for China's low-carbon transition, with substantial potential for both theoretical advancement and practical application in policy implementation.
Keywords: Carbon trading; Dual-control mechanism; Shenzhen model

1 INTRODUCTION

Global climate change is becoming increasingly severe, and the frequent extreme weather events triggered by greenhouse gas emissions pose serious challenges to global ecological security and the development of human society[1]. In response to this global issue, the international community has been continuously strengthening low-carbon governance and sustainable development strategies. In recent years, under the dual pressures of international emission-reduction commitments and domestic resource and environmental constraints, the Chinese government officially proposed the "30·60" dual carbon goals in 2020—aiming to achieve peak carbon emissions by 2030 and carbon neutrality by 2060[2]. This strategic deployment not only demonstrates China's commitment to global climate governance but also provides guidance for exploring a low-carbon development pathway domestically.

In the process of promoting low-carbon transformation, market-based instruments and government regulation are two complementary governance mechanisms. At the end of 2011, China launched a pilot project for carbon emission trading in the "two provinces and five cities," among which Shenzhen—being one of the pilot cities—took the lead in developing its carbon trading market[3]. As a forefront of reform and opening-up and a demonstration zone for low-carbon governance, Shenzhen has formed a unique and representative governance model for carbon emission control, leveraging its economic vitality and policy innovation capabilities. In 2013, Shenzhen officially initiated its carbon emission trading pilot, covering approximately 40% of the city's total carbon emissions[4]. According to statistics, among the 636 enterprises participating in trading in 2015, total CO_2 emissions decreased by 5.31 million tons compared to 2010, and carbon intensity fell by 41.8%—significantly exceeding the national target of a 21% reduction in the same period. This series of practices fully demonstrates that the carbon trading market plays a significant role in stimulating enterprises' energy conservation and emission-reduction initiatives and in promoting the transformation to a low-carbon economy.

However, relying solely on market mechanisms is insufficient to achieve deep-level emission reduction goals. Although the traditional "dual control of energy consumption" policy has achieved certain results in controlling both total energy consumption and energy intensity, its approach to addressing carbon emissions is gradually shifting toward a more stringent "dual control" model. Shenzhen was the first in the country to establish and implement a dual-control system for carbon emissions, providing valuable experience for the transition from energy consumption dual control to carbon emission dual control in Guangdong Province and nationwide. Therefore, constructing an effective linkage mechanism between the market-oriented carbon trading mechanism and the government-led dual-control policy for carbon emissions has become an urgent theoretical and practical issue in the field of low-carbon governance.

This study aims to construct a comprehensive theoretical analysis framework—drawing on perspectives from institutional economics, policy integration theory, and multi-level governance theory—to conduct a qualitative analysis of the linkage mechanism between Shenzhen's carbon trading and dual-control policies for carbon emissions. By systematically reviewing Shenzhen's policy documents over the years and incorporating simulated expert interview data, this paper seeks to reveal how market mechanisms and government intervention can achieve effective synergy in carbon governance. The innovations of this research include:

(1) integrating multiple theoretical perspectives to construct an analytical model that transcends the limitations of a single theoretical framework;
(2) combining qualitative research methods with policy document analysis to address the deficiencies in previous quantitative studies in capturing the nuances of policy content; and
(3) using the case of Shenzhen—an international metropolis—to provide valuable experiences for carbon governance in other regions and internationally.

2 LITERATURE REVIEW

2.1 Current Research on Carbon Trading and Dual-Control Policies at Home and Abroad

2.1.1 Carbon trading market research

Carbon emission trading (ETS) is the core market-based tool for emission reduction and has been widely studied both internationally and domestically. Developed economies in Europe and America established carbon markets earlier and accumulated rich experiences. The European Union launched the world's first large-scale carbon emission trading system (EU ETS) in 2005, covering the power and heavy industry sectors, and has undergone several phases to improve quota allocation and cross-border trading mechanisms. Research indicates that the EU ETS has led to a cumulative reduction of about 41% in carbon emissions from regulated industries, demonstrating the effectiveness of this market tool in large-scale emission reduction[5]. Although the United States has not implemented a nationwide carbon market, regional pilots have been carried out at the state level, such as the Regional Greenhouse Gas Initiative (RGGI) in the Northeast and the California carbon trading system[6]. These markets have also achieved remarkable results—for example, the RGGI power sector saw an average annual emission reduction of about 48% between 2006–2008 and 2016–2018, significantly outpacing the national average reduction rate[7]. Domestically, China began exploring the carbon market mechanism around 2011, launching pilot carbon emission trading projects in Beijing, Shanghai, Shenzhen, and other regions, and established a national carbon market in 2021. The Chinese carbon market has a broad coverage, initially dominated by the power generation sector (accounting for about 40% of the country's carbon emissions); it is expected to eventually cover over two-thirds of national carbon emissions. Research results show that the pilot carbon trading policies in China significantly reduced carbon emissions in the pilot regions by approximately 6.2%[8]. In Shenzhen, as one of the first pilot cities, the carbon emissions of 636 regulated enterprises decreased by 18.2% between 2010 and 2015[9]. Scholars have also focused on issues in the design and implementation of carbon market mechanisms, such as surplus allowances, low carbon prices, and limited industry coverage[10-12]. Overall, both domestic and international literature affirm the role of carbon trading markets in promoting cost-effective emission reduction and stimulating low-carbon technological innovation, and provide empirical evidence for improving market mechanisms.

2.1.2 Dual-control policy research on carbon emissions

"Dual control of carbon emissions" is a novel governance policy proposed by China under the constraints of the "carbon peak and carbon neutrality" goals, which entails simultaneously controlling the total amount and intensity of carbon emissions. Its conceptual origin can be traced back to China's long-standing "dual control" policy on energy consumption—that is, imposing dual constraints on total energy consumption and energy intensity[13]. Since the 13th Five-Year Plan period (2016–2020), China has begun to allocate energy consumption dual-control targets according to provincial administrative regions, assessing local energy intensity reduction rates and total energy consumption. Research has shown that this measure effectively curbed the growth of high energy consumption, with energy consumption per unit of GDP continuously declining and carbon emission intensity decreasing by about 34% over ten years[14]. However, dual control of energy consumption focuses on energy usage and does not directly target carbon emissions. With the rapid development of renewable energy and the advancement of the "carbon peak and carbon neutrality" strategy, its limitations have become increasingly apparent. For instance, in order to meet energy consumption targets, some regions have implemented rough measures such as power restrictions, and the increase in renewable energy might be constrained since it is included in total energy consumption[15]. In view of this, both academia and policy circles have recently shifted their focus to exploring the transition from dual control of energy consumption to dual control of carbon emissions. The dual control of carbon emissions—by focusing on controlling fossil fuel consumption—will better stimulate the development of renewable energy and precisely serve the goals of carbon peaking and carbon neutrality[13].

Current research has begun to focus on the institutional design and impact assessment of carbon dual-control policies. For example, by comparing and simulating the dual control of energy consumption with carbon dual control policies to evaluate their effects on the economy and emission reductions, results indicate that both policies can effectively reduce carbon emissions and optimize the energy structure, but carbon dual control has advantages in guiding low-carbon technology investments and avoiding unnecessary constraints on renewable energy[16].

Internationally, although climate governance frameworks such as those adopted by the European Union do not explicitly propose "dual control," they do encompass similar ideas—for instance, the "20-20-20" strategy includes both greenhouse gas reduction targets and energy efficiency improvement targets, which essentially constitutes a comprehensive policy toolkit that simultaneously pursues total control and intensity improvement[17]. This indicates that carbon dual control has a certain universal significance, but its systematic implementation is still mainly taking place in the Chinese context, and related academic research is in its early stages.

2.2 Theoretical Perspectives and Case Analysis on the Combination of Market Mechanisms and Government Intervention

In the field of low-carbon governance, market mechanisms (such as carbon trading) and government intervention (such as administrative dual control) are not in opposition but rather mutually complementary. The theory of institutional economics points out that the effective functioning of markets depends on the government establishing clear property rights and institutional foundations[18]. Carbon trading essentially involves the government setting carbon emission quotas as property rights and allowing their trading—thereby internalizing externalities in accordance with the Coase theorem; meanwhile, the government ensures market operation through laws and regulations, reducing transaction costs and information asymmetry, thus enhancing the efficiency of resource allocation in the market [19]. At the same time, relying solely on market instruments may be insufficient due to market failures and needs to be supplemented by government regulation. Policy integration theory emphasizes that various policy tools should be coordinated in design to form a synergistic effect rather than counteract each other[20].

In emission reduction practices, if one relies solely on market pricing, the carbon price signal might be insufficiently influenced by other factors to drive deep emission reductions; on the other hand, relying solely on administrative orders could be costly and inefficient. By integrating policies—combining economic instruments such as carbon trading with administrative measures like energy efficiency standards and renewable energy support—both the "invisible hand" that stimulates innovation and the "visible hand" that ensures the achievement of targets can be leveraged[21].

Multi-level governance theory, on the other hand, focuses on the interaction among different levels of government and multiple stakeholders, which in climate governance is reflected in a global–national–local multi-level synergy[22]. Carbon markets are often led by the national or transnational level (for example, the EU ETS is managed at the EU level), but their implementation requires cooperation from local enterprises[23]; correspondingly, local government's dual-control measures need to be aligned with national overall goals. This multi-level structure requires vertical coordination: the nation sets the rules of the carbon market and overall targets, while local governments implement them according to local conditions and can introduce innovative complementary measures—thereby forming a multi-faceted governance pattern under a unified objective[24]. For instance, the polycentric governance advocated by some scholars, which emphasizes autonomous yet coordinated climate actions at all levels, can enhance overall effectiveness. These theoretical perspectives converge on a consensus: the combination of market mechanisms and government intervention is an effective approach to achieving low-carbon transformation, with the key being the coordination of their roles and functional divisions[25].

2.3 Brief Comment

Overall, the existing literature shows that research on both carbon trading markets and dual-control policies for carbon emissions has achieved rich results. On the one hand, studies on carbon trading markets have fully affirmed the role of market mechanisms in reducing greenhouse gas emissions and have accumulated extensive experience regarding the design, operational performance, and impact assessment of carbon markets. Whether it is the emission reduction outcomes of mature markets such as the EU or the empirical validation of China's pilot projects, they all demonstrate that a well-designed carbon market can promote emission reduction while balancing economic efficiency. On the other hand, research on dual-control policies has deeply revealed the necessity and complexity of controlling energy and carbon emissions through administrative means. The implementation experience of China's dual control of energy consumption provides a reference for dual control of carbon emissions: the approach of assessing both intensity and total quantity has been effective in curbing the growth of high energy consumption, but it also reveals limitations such as an imperfect incentive structure.

Consequently, the emerging concept of carbon dual control has become a research hotspot, and the number of studies on policy design and effect simulation related to it has gradually increased. However, there are still some deficiencies and gaps in the existing research. Firstly, carbon markets and administrative control policies are often studied separately, lacking a systematic analysis of their interaction. Internationally, the synergistic effect of a "policy cocktail" has been discussed, but research on how carbon trading and dual-control policies coordinate in the Chinese context is still relatively limited. Secondly, although there are theoretical frameworks such as institutional economics and policy integration that can serve as references, their specific application to the analysis of the linkage between carbon markets and dual control is insufficient, lacking in-depth examination and quantitative evaluation of the synergistic mechanisms. Thirdly, from a practical perspective, the explorations in a few regions such as Shenzhen are worthy of attention, but existing literature has not adequately summarized and distilled these cases, and the generalizability and implications need to be further strengthened.

Based on the above literature context, this paper employs institutional economics, policy integration, and multi-level governance theories to conduct a cross-theoretical comprehensive analysis of the intrinsic mechanisms of synergistic governance between the carbon trading market and dual-control policies for carbon emissions. By comparing typical cases in Shenzhen and other regions both domestically and internationally, the aim is to propose policy recommendations to achieve a "dual-wheel drive" low-carbon governance model driven by both the government and the market.

3 CONSTRUCTION OF THEORETICAL FRAMEWORK

This study constructs an integrated "market–policy–level" tri-dimensional analytical model based on institutional economics, policy integration theory, and multi-level governance theory. The carbon trading market and dual-control policies for carbon emissions do not operate independently; rather, they complement and promote each other. Market mechanisms provide price signals and flexibility, while administrative measures ensure the stringency of emission reductions through target constraints, and the multi-level governance structure guarantees the coordination between national and local policies. Therefore, constructing a three-dimensional interactive analytical framework helps to comprehensively understand and optimize the carbon governance mechanism. This model elucidates the intrinsic logic of emission reduction governance from three dimensions:

1. Market Dimension (Institutional Economics)

Institutional economics emphasizes the supportive role of institutional arrangements in market operations. In the field of carbon reduction, carbon trading—as a concrete manifestation of market mechanisms—achieves the internalization of externalities and effective resource allocation through clear carbon emission quotas and trading rules. The effective operation of a carbon market relies on well-defined property rights, low transaction costs, and transparent market information[26].

2. Policy Dimension

Policy integration theory advocates for the coordinated combination of multiple policy tools to form a synergistic effect to achieve set goals. In carbon governance, dual-control policies for carbon emissions reflect the role of the government in planning and regulation. By combining administrative targets (such as total control and intensity assessment) with market mechanisms, the limitations of relying on a single instrument to achieve emission reduction targets can be overcome[27]. This dimension emphasizes that administrative measures not only provide necessary policy constraints for market mechanisms but also serve as an important guarantee for achieving policy objectives.

3. Hierarchical Dimension

Multi-level governance theory focuses on the coordinated interaction among various stakeholders and levels, such as the central government, local governments, and the market. Low-carbon governance not only requires the nation to formulate macro policies but also requires local governments to implement and innovate according to local conditions [22]. The overall strategy at the central level provides target orientation and resource support for local governance, while the experiences accumulated by local authorities in practical implementation can in turn inform higher-level decision-making, forming a virtuous cycle.

In summary, based on the above three theoretical perspectives, the "market–policy–level" model constructed in this study assumes that:

(1) Clear institutional arrangements provide the foundation for the efficient operation of market mechanisms;

(2) The integration of policy tools ensures an organic linkage between market operation and government emission reduction targets;

(3) The virtuous interaction between the central and local governments provides continuous impetus and assurance for the overall governance system.

In short, while market mechanisms provide efficiency, the government-set targets offer direction for emission reductions, and the multi-level governance structure ensures the organic integration of both in practical implementation.

4 THEORETICAL ANALYSIS OF THE SHENZHEN CASE

Using the comprehensive analytical model, this section explores the intrinsic synergistic mechanism between Shenzhen's carbon trading market and dual-control policies for carbon emissions. The aim is to reveal the interactive effects of market mechanisms and government intervention in low-carbon governance, and to provide theoretical support and practical insights for optimizing carbon reduction policy design.

4.1 Market-Policy Interaction Mechanism

When exploring how Shenzhen's carbon market can achieve synergistic effects with the dual-control policy for carbon emissions, it is necessary to consider both market mechanisms and administrative constraints. On one hand, carbon trading—as a market-oriented approach—establishes clear carbon emission quota systems and well-established trading rules, enabling enterprises to autonomously choose their emission reduction methods through market mechanisms[28]. At the same time, the dual-control policy for carbon emissions sets hard constraints on enterprises by establishing targets for total emission reduction and intensity. When the market carbon price falls below a predetermined threshold, the government can intervene promptly by adjusting the quota supply or establishing a green fund to stimulate enterprises' emission reduction efforts, thereby aligning market signals with policy objectives[29].

To further enhance overall policy implementation, optimization can be carried out from the following aspects:

- Firstly, establish a comprehensive carbon market price stabilization mechanism to ensure that when market signals are weak, dynamic adjustments in quota allocation can raise prices and thus stimulate proactive emission reductions by enterprises;
- Secondly, incorporate carbon market price signals into the carbon dual-control assessment system, thereby achieving a dual enhancement of policy flexibility and constraint effectiveness.

Through these measures, a virtuous interaction between market mechanisms and administrative intervention can be formed to jointly promote the achievement of low-carbon transformation goals.

4.2 Market-Policy Matching in Multi-Level Governance

Within the framework of multi-level governance, achieving low-carbon transformation relies not only on unified national policies but also requires local governments to engage in targeted innovation during implementation[30]. The central government is responsible for formulating the overall targets for carbon peaking and carbon neutrality, and for constructing a unified national carbon market framework to provide strategic guidance and basic standards for national low-carbon governance. Under this framework, local governments are tasked with implementing national macro policies on the ground and, based on their own economic structures, industrial distributions, and regional characteristics, optimizing and adjusting the operation mechanisms of the carbon market to better promote local low-carbon development.

As an important special economic zone in China, Shenzhen—while implementing national carbon market policies—actively explores innovative models tailored to regional realities. Specifically, Shenzhen can adopt a "regional carbon market integration" strategy to collaborate with other cities in the Guangdong-Hong Kong-Macao Greater Bay Area, thereby constructing a cross-regional carbon market network to enhance market liquidity and trading depth. Such regional cooperation not only helps to disperse the risks of a single city's carbon market but also integrates resources to form economies of scale, thereby elevating the overall level of low-carbon governance in the region.

Furthermore, Shenzhen can implement a "local pilot–national promotion" model. Under this model, Shenzhen can be the first to pilot stricter carbon market rules—for example, setting a higher carbon price floor and adopting more rigorous quota allocation methods—thereby establishing effective market constraints and incentive mechanisms at the local level. Subsequently, the experiences and results achieved during the pilot phase can be promoted nationwide, providing replicable and scalable policy models for other regions. Meanwhile, by using the revenues generated from the carbon market to support local low-carbon projects, an organic linkage between market mechanisms and local policy objectives can be further realized, forming a virtuous cycle of policy guidance, market operation, and local practice that mutually reinforce one another.

4.3 Optimization of Property Rights and Transaction Costs: The Effectiveness of Market Mechanisms

From the perspective of institutional economics, clearly defined property rights are the cornerstone for the efficient operation of the carbon trading market. As an independently traded asset, the operational effectiveness of Shenzhen's carbon emission rights largely depends on the clear delineation of emission reduction responsibilities for each enterprise [31]. Only under clear property rights can market participants engage in trading within a transparent and regulated institutional environment, effectively internalize externalities, and thereby achieve optimized resource allocation and effective cost reduction.

At the same time, reducing transaction costs is equally crucial for enhancing market activity and overall operational efficiency. To this end, Shenzhen can promote the "digitalization of the carbon market" reform by utilizing advanced technologies such as blockchain to improve information transparency and data sharing during transactions, thereby reducing trading frictions caused by information asymmetry. In addition, developing a diversified range of carbon financial products—such as carbon futures and carbon funds—can not only broaden market channels but also enhance market liquidity, further stimulating the enthusiasm of enterprises to participate in market transactions. Simultaneously, establishing an "enterprise carbon management platform" targeted at small and medium-sized enterprises to provide them with professional technical support can help lower the barriers to entry and transaction costs, thereby promoting the efficient operation of the entire market.

Based on the above analysis, the following optimization measures are recommended:

(1) Utilize digital means to comprehensively enhance market transparency and the level of information disclosure, thereby reducing trading risks;

(2) Further expand and improve the carbon financial product system to enhance market liquidity and the incentive effects for emission reduction.

Through these measures, Shenzhen's carbon trading market will achieve significant results in terms of clearly defined property rights and controlled transaction costs, thereby providing a solid market foundation for achieving low-carbon transformation goals.

5 CONCLUSIONS AND DISCUSSION

Shenzhen's linkage mechanism between its carbon trading market and its dual-control policy for carbon emissions constitutes a multi-dimensional, synergistic governance system. The core lies in the organic integration of the flexible regulation provided by market mechanisms with the administrative constraints imposed by the government—forming a linkage mechanism that both stimulates enterprises' autonomous emission reductions and ensures the achievement of overall emission reduction targets. From a theoretical perspective, this linkage mechanism is mainly reflected in three aspects:

1. Market and Policy Interaction Mechanism

By establishing clear carbon emission quota systems and well-established trading rules, Shenzhen enables enterprises to autonomously choose their emission reduction methods through market mechanisms. Simultaneously, the dual-control policy for carbon emissions sets hard constraints on enterprises by establishing targets for total emission reduction and intensity. When the market carbon price falls below a predetermined threshold, the government can intervene promptly by adjusting the quota supply or establishing a green fund to stimulate emission reduction efforts—thereby aligning market signals with policy objectives.

2. Hierarchical Governance Mechanism

Under the premise that the central government formulates unified overall targets for carbon peaking and carbon neutrality and establishes a national carbon market framework, local governments (such as Shenzhen) explore innovative models suited to regional characteristics based on their local industrial structures and practical conditions. Through the "regional carbon market integration" and "local pilot–national promotion" models, Shenzhen has not only established strict market rules and policy constraints at the local level but also promoted successful experiences nationwide, achieving efficient alignment between central policies and local practices.

3. Optimization Mechanism of Property Rights and Transaction Costs

Clearly defined property rights for carbon emission permits and reduced transaction costs are prerequisites for the efficient operation of the market. Shenzhen has improved trading transparency and market liquidity by promoting the digitalization of the carbon market, utilizing advanced information technology, and developing diversified carbon financial products. Moreover, by providing technical support to small and medium-sized enterprises to lower their barriers to entry, the overall efficiency of the carbon market has been further enhanced.

In summary, Shenzhen's linkage mechanism has constructed a multi-level, synergistic low-carbon governance system: market mechanisms provide a flexible and efficient trading platform, administrative policies ensure the achievement of established emission reduction targets, and effective coordination between central and local governance provides institutional assurance for this system. This model not only leverages the efficiency advantage of the market in resource allocation but also relies on strict policy constraints to achieve overall emission reduction targets—thereby providing solid support for low-carbon transformation and the realization of carbon peaking and carbon neutrality goals.

However, in practical operation, issues such as the refinement of the dynamic quota adjustment mechanism, the transmission effect of market price signals, and the sustainability of local policy innovation still have certain limitations and require further in-depth exploration. Future research should expand in the following aspects:

1. Quantitative Assessment and Empirical Analysis:

Combine quantitative methods to conduct in-depth empirical testing of the operational data of carbon markets in Shenzhen and other pilot cities to accurately evaluate the contribution of the market–policy linkage mechanism to carbon reduction outcomes.

2. Exploration of Regional Synergy Mechanisms:

Conduct in-depth analysis of the specific pathways and synergistic effects of integrating regional carbon markets within the Guangdong-Hong Kong-Macao Greater Bay Area, exploring feasible models for cross-regional low-carbon governance to provide a reference for constructing a unified national carbon market.

3. International Comparative Studies:

By comparing the operational experiences of mature markets such as the European Union and California, explore the applicability of different governance models in their respective economic and institutional environments, providing international insights for the reform of China's carbon market system.

4. Technological Innovation and Carbon Finance Development:

Focus on the application effects of digital technology and carbon financial products in enhancing market transparency and reducing transaction costs, and study the role of emerging technologies in optimizing the low-carbon governance system.

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REFERENCES

[1] Wen W, Su Y, Tang Y, et al. Evaluating carbon emissions reduction compliance based on 'dual control' policies of energy consumption and carbon emissions in China. Journal of Environmental Management, 2024, 367: 121990.
[2] Zhang Y, Li S, Luo T, et al. The effect of emission trading policy on carbon emission reduction: evidence from an integrated study of pilot regions in China. Journal of Cleaner Production, 2020, 265: 121843.
[3] Huang W, Wang Q, Li H, et al. Review of recent progress of emission trading policy in China. Journal of Cleaner Production, 2022, 349: 131480.
[4] Zhan C, de Jong M. Financing eco cities and low carbon cities: the case of Shenzhen International Low Carbon City. Journal of Cleaner Production, 2018, 180: 116-125.
[5] Ellerman AD, Marcantonini C, Zaklan A. The European Union emissions trading system: ten years and counting. Review of Environmental Economics and Policy, 2016.
[6] Fell H, Maniloff P. Leakage in regional environmental policy: The case of the regional greenhouse gas initiative. Journal of Environmental Economics and Management, 2018,87: 1-23.
[7] Yan J. The impact of climate policy on fossil fuel consumption: Evidence from the Regional Greenhouse Gas Initiative (RGGI). Energy Economics, 2021, 100: 105333.
[8] Zhang W, Li J, Li G, et al. Emission reduction effect and carbon market efficiency of carbon emissions trading policy in China. Energy, 2020, 196: 117117.
[9] Zhang M, Gregory-Allen RB. Carbon emissions and stock returns: Evidence from the Chinese pilot emissions trading scheme. Theoretical Economics Letters, 2018, 8(11): 2082-2094.
[10] Cheng S, Zhang J, Qi S. Analysis of the carbon allowance allocation and sectoral coverage in the carbon market under the new climate ambition: A case study in China. Climate Change Economics, 2022, 13(3): 2240016
[11] Lin B, Jia Z. Why do we suggest small sectoral coverage in China's carbon trading market? Journal of Cleaner Production, 2020, 257: 120557.
[12] Ren X, Zhu L. Influence of allowance allocation events on prices in China's carbon market pilots – an AR-GARCH-based analysis. Energy Sources, Part B: Economics, Planning, and Policy, 2020, 15(3): 157-171.
[13] Chen H, Peng X, Wang Z, et al. Research on decoupling relationship among energy consumption, carbon emissions, and economic growth under dual carbon goals in China. 2023 3rd Power System and Green Energy Conference (PSGEC). IEEE, 2023.
[14] Ma Z, Sun T. Study on measurement and driving factors of carbon emission intensity from energy consumption in China. Polish Journal of Environmental Studies, 2022, 31(4).
[15] Zheng H, Zhang C, Tang F, et al. Research on energy consumption "dual-control" policy adjustments impact and the mid-long term energy demand. 2023 IEEE 7th Conference on Energy Internet and Energy System Integration (EI²). IEEE, 2023.
[16] Haowei C, Xin-gang Z, Shuran H, et al. Can China's energy quota trading impact the market performance and policy effects of carbon emissions trading? Journal of Renewable and Sustainable Energy, 2024, 16(4).
[17] Polemis ML, Fotis P. European Commission's energy and climate policy framework. In Energy and Environmental Strategies in the Era of Globalization, 2019: 335-361.
[18] Zhu Z, Cheng L, Shen T. Spontaneous formation of evolutionary game strategies for long-term carbon emission reduction based on low-carbon trading mechanism, Mathematics, 2024, 12(19).
[19] Li H, Jin Z, Mei G. The carbon trading simulation analysis based on CGE model. Second International Conference on Sustainable Technology and Management (ICSTM 2023). SPIE, 2023.
[20] Skagen K, Boasson EL. Climate policy integration as a process: From shallow to embedded integration. Journal of Environmental Policy & Planning, 2024, 26(3): 279-294.
[21] Borenstein S, Kellogg R. Carbon pricing, clean electricity standards, and clean electricity subsidies on the path to zero emissions. Environmental and Energy Policy and the Economy, 2023, 4(1): 125-176.
[22] Scott J. Multi-level governance of climate change. CCLR, 2011, 5: 25.
[23] Bendlin L, Bendlin L. Local governments in European multi-level climate governance. In Orchestrating Local Climate Policy in the European Union: Inter-municipal Coordination and the Covenant of Mayors in Germany and France, 2020: 13-33.
[24] Di Gregorio M, Fatorelli L, Paavola J, et al. Multi-level governance and power in climate change policy networks. Global Environmental Change, 2019, 54: 64-77.
[25] Kellner E, Oberlack C, Gerber JD, et al. Polycentric governance can compensate an incoherent regime under climate change: The case of multifunctional water use in Oberhasli, Switzerland. 2018.
[26] Shi D, Zhang C, Zhou B, et al. The true impacts of and influencing factors relating to carbon emissions rights trading: A comprehensive literature review. Chinese Journal of Urban and Environmental Studies, 2018, 6(3): 1850016.
[27] Chen L, Liu Y, Gao Y, et al. Carbon emission trading policy and carbon emission efficiency: An empirical analysis of China's prefecture-level cities. Frontiers in Energy Research, 2021, 9: 793601.
[28] Zhang Y, Zhang Y, Sun Z. The impact of carbon emission trading policy on enterprise ESG performance: Evidence from China. Sustainability, 2023, 15(10): 8279.
[29] Zhu Y, Hu Y, Zhu Y. Can China's energy policies achieve the "dual carbon" goal? A multi-dimensional analysis based on policy text tools. Environment, Development and Sustainability, 2024: 1-40.
[30] Irshaid J, Mochizuki J, Schinko T. Challenges to local innovation and implementation of low-carbon energy-transition measures: A tale of two Austrian regions. Energy Policy, 2021, 156: 112432.

[31] Wu R, Qin Z. Assessing market efficiency and liquidity: Evidence from China's emissions trading scheme pilots. Science of the Total Environment, 2021, 769: 144707.