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# Achieving carbon neutrality in China: Legal and policy perspectives

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China has committed to achieve carbon neutrality by 2060. However, this task is considerably difficult. To meet its carbon neutrality commitments, China will rely on a range of policies and laws. By analyzing policies and laws issued at the central and local levels in China from 2019 to the present, we assessed how the Chinese government will achieve its carbon neutrality targets by breaking them down. The results of this study showed that: 1) Carbon neutrality targets are translated into indicators such as energy consumption per unit of GDP, carbon dioxide emissions per unit of GDP, non-fossil energy consumption ratio, forest cover, and forest stock; 2) The focus of policy and law-making is on the role of the government rather than the carbon market; 3) The central government tends to promote and guide low-carbon development through specific actions; 4) Local policy and law-making is less proactive and is influenced by localism; 5) Overall, China's carbon neutrality policies and laws are characterized by comprehensive coverage, with emphasis on the rational use of executive power and the development of low-carbon-related technologies; and 6) The existing policies and laws remain unclear, with low levels of legislation and insufficient public participation. This paper puts forward some suggestions on the introduction of the climate change law, the promotion of citizen participation in policy-making and implementation, and the establishment of a public interest litigation system on climate change.

## KEYWORDS

carbon neutralization, carbon peak, policy and law, implementation path, climate change law

## 1 Introduction

Climate change is a global issue increasingly affecting human health, socio-economic development, population migration, food security, and terrestrial and marine ecosystems. Due to the increasing number of extreme climate disasters reported by the media in recent years, countries have started to set specific targets to decrease carbon emissions. The European Union (EU)'s Green Deal, launched in 2020, aims to make the EU climate-neutral by 2050<sup>1</sup>. As the world's largest emitter of greenhouse gases, China has taken

1 European Commission (2019), The European Green Deal. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52019DC0640&qid=1660118669836>.

action against climate change, aiming to peak carbon emissions by 2030 and become carbon neutral by 2060 (Mallapaty, 2020). This is a key step for China to address global climate change and contribute to the global environmental governance system. In September 2021, the Chinese government put forward the basic approach to achieve this goal, based on the aim to extend the principle of overall planning to the whole country, the strengthening of top-level design based on a national strategy, giving full play to institutional advantages, and improving existing laws and regulations. Therefore, the formulation of appropriate laws and policies to give full play to institutional advantages is an important means for China to achieve carbon neutrality.

Since the reform and opening up, China's economy has experienced a rapid development, accompanied by an increase in environmental pollution. To protect the environment, more than 30 laws have been enacted and implemented, including the "Environmental Protection Law," the "Air Pollution Prevention Law," the "Clean Promotion Law," the "Coal Law," and the "Mineral Resources Law". However, China's environmental legislation still faces a series of challenges and problems, including the lack of full implementation of the concept of sustainable development, as well as gaps and inconsistencies between laws and regulations, unclear responsibilities, an imperfect system design, unbalanced rights and obligations, an implementation being significantly affected by the GDP, the lack of applicability of legal content, and difficulties in public participation (Mu et al., 2014). These problems also apply to the issue of carbon peaking and carbon neutrality, in addition to a whole series of other legal problems in relation to China's carbon emissions. In fact, at the macro level, there is a lack of a master plan for scientific, low-carbon development, and the existing market-oriented management tools are still immature, which makes it difficult to coordinate with the administrative management tools. At the micro level, the legislation regulating each specific production sector is still insufficient (Han, 2014). This reflects the fact that the supply of public goods in China depends on the institutional inertia of administrative power, which limits the role of market-based tools in carbon emission reduction, and that the relevant administrative system has not been established. Faced with the arduous task of carbon emissions reduction, legislation is bound to continue to strengthen the executive power. Therefore, if China wants to achieve its carbon peak and carbon neutrality as soon as possible, it must have a complete legal framework for carbon management. On the one hand, the efficiency of emissions per unit of carbon through the carbon market should be improved. On the other hand, a rational management system should be established including energy transformation, energy-saving technology, carbon capture and utilization technology, and carbon sequestration technology, among others (Wang et al., 2021).

The aim of this study was to answer the following three questions: 1) What is the level of implementation of different carbon neutrality policy tools (especially market and government policy tools) in China's legislation? 2) What are the administrative tools that China has adopted to achieve carbon neutrality, and what are their characteristics? and 3) What are the characteristics of China's carbon neutrality policies and laws, and how should they be further improved? In order to answer these three questions reliably, this study divided carbon neutrality policies into two types: market-based incentives and government regulation, which represent different paths to achieve carbon emission reduction. Then, an assessment was conducted of the policies and laws issued after the carbon peak and carbon neutrality targets were put forward in China. More in detail, this study explored the path of China's carbon neutrality goal by analyzing the text of China's national and local legislation issued from 2019 to 2022, allowing to investigate the existing problems across different paths, and to identify feasible ways to improve the role of the government.

The theoretical and practical contributions of this study are as follows: 1) At a theoretical level, this study analyzed the differences between central and local governments in implementing carbon neutrality requirements, as well as the development of policies and laws; 2) It shed light on the perspective and mechanisms of action of carbon neutrality-related laws and policies, while at the same time it further analyzed the possible defects of such laws and policies; 3) It put forward suggestions to establish a more effective policy and legal system for carbon neutrality. This study provided a valuable literature review and research ideas to rationalize the role of the government in the achievement of carbon neutrality. At the same time, it also provided a reference to establish a more effective policy and legal system for carbon neutrality.

## 2 Literature review

Traditional environmental laws deter enterprises and individuals from harming the environment by employing fines, closure and rectification, and treatment of pollution (Li and Wu, 2017). However, carbon-neutral environmental governance, which aims to provide a public good, i.e., to stabilize the level of greenhouse gases in the atmosphere, limits the effectiveness of deterrent legislation. Therefore, taxation and subsidies have become widely used tools to curb the emissions of high carbon-emitting industries through taxation, and to encourage the development of low-carbon industries. However, these two tools do not necessarily work as intended. In the 1990s, the carbon tax was the first choice for European countries to reduce emissions. Although it was promoted in several countries and regions, its shortcomings have also been evident. In fact, as the carbon tax entails an increase in the price of fossil fuels, including gasoline, diesel, and

natural gas, social and public opposition to the tax emerged in the early days. In addition, the definition of carbon tax categories and tax rates is complicated. While a low-level tax rate will not reduce carbon emissions, a high-level tax rate will increase the burden on businesses, and then affect the international competitiveness of domestic industries (Hoel, 1996). On the contrary, a carbon tax on goods would force other countries to take steps to reduce emissions. The EU's Green Deal specifies the EU's Carbon Border Adjustment Mechanism, and the EU levy on the carbon emissions of some imported goods covers most EU countries (Ortega-Gil et al., 2021). Subsidy systems are widely used in the field of environmental protection, especially in the fields of research and development of environmental protection technology, energy conservation, and promotion of new energy products. However, as a financial means for the government to intervene in the market, the breadth and depth of implementation of a subsidy policy are constrained by the government's financial capacity and rigid budget. Therefore, the implementation of a subsidy system is often only applicable to a specific scope, and there are time constraints (Wang and Tao, 2018).

In order to achieve emission reduction targets, the EU has imposed relatively strict emission standards on some industries such as the automotive industry (Krämer 2020). Although existing climate policy measures will likely reduce emissions by more than 40% by 2030 in the wake of the COVID-19 pandemic, this will not be enough to meet the targets set by the Paris agreement (Meles et al., 2020). Therefore, in December 2020 the leaders of the 27 EU Member States reached a consensus on a revised emission reduction plan, agreeing to reduce the EU's greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels. On 14 July 2021, the European Commission announced a package plan called "Fit for 55" ("Carbon Reduction 55"), which covers climate, energy, transportation, and societal aspects. This plan proposes to expand the EU carbon trading market, stop the sale of fossil fuel-based vehicles, expand the share of renewable energy, and establish a carbon border tax and other new laws, thereby providing a substantive set of actions to achieve the set goal.

Using carbon markets to reduce carbon emissions is a common practice in countries around the world. Drawing on the foreign experience of carbon trading, in 2013 China officially launched a pilot project on carbon trading in seven provinces and cities; also, other provinces and municipalities launched their own carbon trading schemes, and in December 2017 the establishment of a unified national carbon trading market was announced. However, the carbon trading market is currently in its infancy, and the price of carbon trading is volatile. In several areas, the allocation of carbon trading quotas, business models, carbon emission reduction statistics, and other mechanisms need to be further explored and depend on the effective formulation of policies and laws (Zou et al., 2021). Recently, the price of carbon allowances under the EU's Emissions Trading System (ETS) has

been rising from \$30 a tonne in 2021 to more than \$90 a tonne in 2022. However, in a moment when the price of carbon hit record highs and nearly broke the threshold of \$100, the conflict between Russia and Ukraine broke out, triggering financial market turmoil and risk aversion. Investors began to sell carbon assets in order to cut their losses; the price of carbon halved in a few days and plunged to a low of 55 Euros on 2 March 2022. This suggests that even the more regulated EU carbon market suffers from excessive price volatility. At present, the "Carbon emissions trading management measures (trial implementation)" is the only national law in place for specific carbon emissions management in China. Although it includes detailed provisions, the scope of action is small, the subject of regulation is single, the legal status is low, and its role in the achievement of the national "double carbon" target is limited (Hao and Yang, 2022). Unstable carbon prices will undoubtedly hinder the role of the carbon market, and the incomplete regulatory system for carbon financial products will magnify the shortcomings of the rules of the carbon market. Carbon financial products should be able to transfer environmental risks through the market and maximize the efficiency of resource allocation (Labatt and White, 2006). However, the development of green finance in China still faces multiple difficulties; in fact, the policies and standards are unclear, product innovation is not timely, and the international cooperation is not extensive (Zhou, 2022).

China's energy structure is highly dependent on coal, which is used to produce more than half of all electricity; more than 70% of China's power plants are coal-fired, generating 44% of the country's carbon emissions. Therefore, in addition to the market-based reform of the electricity sector, there is a need to adopt a series of policies such as the diversification of power sources, the clean and efficient transformation of coal-fired power plants, the setting of ultra-low emission standards, and the introduction of subsidy policies to support electricity prices in order to promote low-carbon energy production (Zhang et al., 2020). In addition, China's current efforts to reduce emissions have much in common with those of other countries in terms of energy efficiency, development of electric vehicles, and increased afforestation; however, limited by the current level of economic development and resource endowments, China faces huge professional challenges in reducing industrial carbon emissions and the supply of coal and coal power (Zhang et al., 2022). These factors demonstrate that legislation emphasizing the full use of market-based tools is not enough, and that total energy consumption control and industrial structure optimization are the main ways to reduce carbon emissions (Wang et al., 2021). In addition to continuing to improve the carbon market-related legal system, the improvement of other relevant administrative legal systems should also become another focus of research.

Scientific and technological innovation plays an important role in carbon emission reduction. It is generally believed that the

development and popularization of long-term, high-cost new technologies rely heavily on public policy support (Geels et al., 2020). In relation to technological innovation, the Porter hypothesis argues that proper environmental regulation can stimulate innovation, increase productivity, and ultimately offset the costs of environmental regulation (Porter and Linde 1995). This hypothesis, however, has not been proven (Wei et al., 2021). Therefore, in addition to regulation, China has adopted a centralized and locally implemented approach for the allocation of environmental subsidies in terms of economic mechanisms that provide incentives for environmental protection. Previous research showed that such subsidies encourage companies to innovate in environmental protection to a certain extent (Klette et al., 2000). In addition, government procurement can stimulate, create, and expand the market demand for environmentally friendly products and services, which is conducive to the improvement of environmental issues and to the achievement of the overall goal of sustainable development (Georghiou et al., 2014). Legal and institutional government action can make an important contribution to carbon neutrality; however, there is still insufficient research on how to systematically promote emissions reduction through improved policies and laws.

### 3 Materials and methods

In order to further improve the market rules, the Chinese Ministry of Ecology and Environment has issued the “Management Measures for Carbon Emissions Trading (trial implementation)”, the “Rules for the Management of Carbon Emissions Registration (trial implementation)”, the “Rules for the Management of Carbon Emissions Trading (trial implementation)”, and the “Rules for the Management of Carbon Emissions Settlement (trial implementation)”, establishing a legal and policy system for the effective operation of the national carbon emission trading market. However, improving the trading rules and the regulatory system will be a long and complex process, requiring patient trial and error. In addition to improving the rules of the carbon market, China has enacted several policies and laws to achieve carbon neutrality, laying the foundation for a specific climate change law in the future. By searching the keywords “carbon neutrality” in the title, we collected all the central and local laws and policies that have been issued; the content of these documents are listed in Table or Appendix. As of October 2022, there are 14 central regulations and regulations of national organizations that are subject to substantive restrictions. Inside the framework provided by the central legislation, local governments can choose their priorities according to the development needs of their regions and formulate corresponding local ordinances and policies. The same keyword search yielded 79 local regulations and policy documents (as shown in [Supplementary Material](#)); further

analysis of these policies and legal texts revealed the priorities of local governments in implementing carbon neutrality. In September 2020, the President of the People’s Republic of China announced at the 75th United Nations General Assembly that “China’s carbon dioxide emissions will strive to reach the peak by 2030 and strive to achieve carbon neutrality by 2060”. The goal of low-carbon development in China has, thus, become clear. Before that, in May 2019 the Chinese Ministry of Ecology and Environment issued the “Carbon Neutralization Implementation Guide for Large Scale Activities (trial implementation)” to standardize large-scale activities. Therefore, this study analyzed the main central and local policies and laws on carbon neutrality issued in China after 2019 through the literature analysis method.

## 4 Results

### 4.1 Carbon neutrality targets and paths in China’s policies and laws

#### 4.1.1 Carbon neutrality targets in China’s policies and laws

The “Central Committee of the Communist Party of China and the State Council’s Opinions on Fully, Accurately, and Comprehensively Implementing the New Development Concept and Achieving Peak Carbon and Carbon Neutrality”, issued in 2021, concretizes the targets for carbon neutrality into several indicators, such as energy consumption per unit of GDP, carbon dioxide emissions per unit of GDP, non-fossil energy consumption ratio, forest coverage, and forest volume, and sets the specific objectives for the various stages of implementation. It can be found that the current carbon intensity reduction target cannot be replaced by total carbon emission control until a complete carbon emission market system is established. Internationally, the more authoritative and widely recognized definition of greenhouse gases was proposed by the United Nations Framework Convention on Climate Change (UNFCCC). Article 1, paragraph 5 of the UNFCCC defines greenhouse gases as “natural and man-made gaseous substances in the atmosphere that absorb and reemit infrared radiation”<sup>2</sup>. Specifically, the emissions of six greenhouse gases, namely carbon dioxide, methane, nitrous oxide, sulfur hexafluoride, hydrofluorocarbons, and tetrafluoromethane, should be controlled and limited<sup>3</sup>. On the eve of the

2 United Nations. (1992) United Nations Framework Convention on Climate Change. Available at: <https://unfccc.int/resource/docs/convkp/conveng.pdf>.

3 Specifically, emissions of the following six greenhouse gases shall be controlled and restricted: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), sulfur hexafluoride (SF<sub>6</sub>), hydrofluorocarbons (HFC), and perfluorocarbon (PFC).

TABLE 1 Differences between the carbon peak legislation of China and the EU.

	China's carbon peak action plan by 2030	European union climate law
Subject matter and scope	Establish the guiding ideology and action principle	Building a legal framework
Climate-neutrality objective by 2030	Flexible multiple objectives	Rigid single objective
Provisions on science and technology	Strengthen the layout and promotion of basic research	Set up of the European Scientific Advisory Board
Adaptation to climate change	Promoting green and low-carbon development in the region from a practical perspective	Special concern towards the most vulnerable and impacted populations and sectors
Assessment of Union progress and measures	Strict supervision and assessment	Review and evaluation every 5 years and adoption of necessary measures
Public participation	No rules	Rules have been established

Copenhagen Climate Change Conference in 2009, to achieve a constructive outcome in international climate negotiations, the State Council of China formally announced the country's greenhouse gas emission control target of reducing carbon dioxide emissions per unit GDP by 2020 by 40%–45% compared to 2005 levels. This is the first time that China has committed itself in front of the international community with a relatively clear quantified emission reduction target. To fulfill the international commitments on greenhouse gas control, the carbon dioxide emission intensity per unit of GDP was set as a binding index in the 12th and 13th Five-year plans. However, in the policy documents, after the setting of the carbon neutrality target, it can be found that the energy structure transition, forest cover, and forest stock have also been included in the broad emission reduction targets.

#### 4.1.2 The path to carbon neutrality in China's policies and laws

Unlike the EU, which relies more on framework laws to achieve emissions reduction, China relies on achieving its emissions reduction goals through bureaucracy under the guidance of some principles (shown in Table 1). These principles are flexible to some extent; however, once the indicators are determined, their implementation is rigid. After 2019, regulations and policy documents with the names “peak carbon” or “carbon neutrality” broke down these overall goals to articulate how China will achieve carbon neutrality (as shown in Table 2). To achieve this objective, China attaches great importance to the use of financial instruments, preferring subsidies rather than taxes, thereby stimulating companies to reduce their emissions through innovative technologies. Due to the strong government guidance, China is trying to set up a low-carbon standard system to guide enterprises and society to achieve green and low-carbon development; moreover, it has also imposed stricter requirements on key sectors such as energy, state-owned enterprises, new infrastructure, eco-industrial parks zones, and transportation. In these areas, relevant standard systems are also

beginning to be formulated at the level of the central government. To ensure the reorganization of human resources, the Ministry of Education of China issued a special document to provide scientific and technological support and personnel security for the achievement of carbon peak and carbon neutrality targets. In general, these policies and laws have a common feature of promoting and guiding the whole society to achieve low-carbon development through government actions.

Because the interests of the central government and the local government are different, central environmental policies are not fully implemented in some places. As a result, the environment has continued to deteriorate, affecting people's life, especially after 2010. By emphasizing the importance of the central authority and strengthening the implementation of the central environmental policy, the implementation of these policies can be significantly improved. However, strict environmental protection will hinder local development. When the “Legislative Law” was amended in 2015, the local government was given the power to formulate regulations in the field of environmental protection. Thus, a relatively ideal governance relationship initially formed, and the central government and the local governments should realize a cooperative environmental governance mechanism through the division of labor and cooperation, whereby the central government will not be responsible for all legislation.

From the 79 local policies and laws analyzed, we can see that the role of local governments in the process of achieving carbon neutrality is still relatively limited. In fact, 26.58% of these policies and laws emphasize the comprehensive legislation of the central government, while 35.44% emphasize the development of science and technology for emission reduction in the region (as shown in Table 3). Moreover, the majority of the comprehensive policies and laws are not clear enough. Only a few provinces, such as Shanghai, Jiangxi, and Qinghai, have defined their development indicators as e.g., non-fossil energy consumption ratio, forest coverage rate, and forest volume, while most provinces have not set specific development goals. There is little appetite for specific policies in areas with high carbon emissions, such as construction, energy,

TABLE 2 Objectives of central policies and laws.

Legislator	Law and regulation	Date of promulgation	Objective
Ministry of Ecology and Environment	Carbon Neutralization Implementation Guide for Large-scale Activities (Trial)	29 May 2019	To standardize the implementation of carbon neutrality for large-scale activities
Ministry of Education	Carbon Neutral Science and Technology Innovation Action Plan for colleges and universities	12 July 2021	To provide scientific and technological support and personnel guarantee for achieving carbon peak and carbon neutrality
Ministry of Ecology and Environment	Notice of the office of the National eco-industry Demonstration Zone Coordination Leading Group on promoting carbon peak and carbon neutrality of the national eco-industry demonstration zone	27 August 2021	Fully reflect the leading role of the national eco-industrial demonstration park in promoting the reduction of pollution and carbon synergy, promoting a regional green development model
The CPC Central Committee and the State Council	The CPC Central Committee and the State Council on the complete, accurate and comprehensive implementation of the new development concept to achieve peak carbon neutrality	22 September 2021	Bring carbon peak and carbon neutrality into the overall context of economic and social development, and ensure that carbon peak and carbon neutrality are achieved on schedule
The State Council	Carbon Peak Action Plan by 2030	22 September 2021	Bring carbon peak and carbon neutrality into the overall economic and social development, and ensure that these goals are achieved on schedule
State-owned Assets Supervision and Administration Commission	Guidelines on promoting high-quality development of central enterprises and achieving carbon peak and carbon neutrality	27 November 2021	Optimize the industrial structure and energy structure of central enterprises, and improve the energy utilization efficiency of key industries
National Development and Reform Commission, Cyberspace Administration of China, Ministry of Industry and Information Technology of China, National Energy Administration	Implement carbon peak and carbon neutrality targets, and promote green and high-quality development of new infrastructures such as data centers and 5G	30 November 2021	Promote the green and high-quality development of new infrastructure, represented by data centers and 5G
All-China Federation of Industry and commerce	Guidelines by the China Federation of Industry and Commerce on guiding private enterprises to achieve carbon peak and carbon neutrality	27 January 2022	Guide and serve private enterprises to achieve carbon peak and carbon neutrality
Ministry of Transport of China, National Railway Administration, Civil Aviation Administration of China, State Post Bureau	Guidelines by the Ministry of Transport, National Railway Administration, Civil Aviation Administration of China, and State Post Bureau on implementing the guidelines of the Central Committee of the Communist Party and State Council on implementing the new development concept in a complete, accurate and comprehensive manner to achieve peak carbon and carbon neutrality	18 April 2022	Achieve carbon peak in the transportation sector
Ministry of Education	work program to strengthen the carbon peak and carbon neutrality and personnel training system construction of higher education	19 April 2022	Improve the training quality of carbon peak and carbon neutral professionals
Treasury Department	Guidelines on Financial support for carbon peak and carbon neutrality	25 May 2022	Establish and develop a fiscal and tax policy framework conducive to green and low-carbon development
Standardization Administration of China	Circular on Standard and the plan for the National Carbon Peak and Carbon Neutrality and for the foreign language version of the relevant standards by Standardization Administration of China in 2022	21 July 2022	improve the standard system for carbon peak and carbon neutrality
National Energy Administration	Notice by the National Energy Administration of Issuing the Action Plan to Standardize Carbon Peaking and Carbon Neutrality in Energy	20 September 2022	Implement carbon peaking in the energy sector
The State Administration of Market Supervision, the National Development and Reform Commission, the Ministry of Industry and Information Technology, the Ministry of Natural Resources, the Ministry of Ecological	Establish and improve the implementation plan of carbon peak carbon neutralization standard measurement system	18 October 2022	Promote the construction of a carbon peak and carbon neutralization standard measurement system

(Continued on following page)

TABLE 2 (Continued) Objectives of central policies and laws.

Legislator	Law and regulation	Date of promulgation	Objective
Environment, the Ministry of Housing and Urban Rural Development, the Ministry of Transport, the China Meteorological Administration, and the State Forestry and Grassland Administration			

TABLE 3 Topic, quantity, and percentage share of local legislation and policies.

Topic	Quantity	Share (%)
Development of science and technology	28	35.44
Comprehensive	21	26.58
Finance	8	10.12
Fiscal	6	7.59
Education, training	5	6.33
Post and telecommunications	3	3.80
Construction	2	2.53
Energy	2	2.53
Agriculture	2	2.53
State-owned enterprises	1	1.27
Transportation	1	1.27
Total	79	100.00

transportation, and agriculture. This may be because local governments are concerned that policies to reduce emissions will hamper the region's economic development. However, the promotion of carbon neutrality in a region by encouraging technological innovation and earmarking, also in the local interest, can enhance the competitiveness of local enterprises at the national level. Therefore, in addition to promoting the development of science and technology, there are few policies and laws in the fields of finance, education, training, post, and telecommunications that have a less beneficial impact. In general, local initiatives to implement low-carbon development are not strong, and there are few policies and laws that impose rigid constraints, except through financial subsidies and incentives for specific research and development projects.

## 4.2 Characteristics and problems of China's carbon neutrality path

### 4.2.1 Characteristics of China's carbon neutrality path

China's carbon neutral policy and law are very comprehensive. Ideally, China's approach to carbon neutrality

is based on the principles of national coordination, prioritizing of conservation, government-and market-driven coordination, coordination of domestic and international energy resources, and risk prevention. It is worth noting that, compared to other countries, China's carbon reduction efforts put more emphasis on strengthening the top-level design, giving full play to institutional advantages, and assigning equal responsibilities between the Communist Party and the government, encouraging some key areas, key industries, and places to take the lead in reaching the peak. From an economic standpoint, it is quite certain that what is right at the micro level is not always right at the macro level; on the contrary, what is right at the macro level may be very wrong at the micro level (Samuelson and Nordhaus, 2009). This fallacy of composition is, therefore, likely to trigger a crisis at the micro-governance level under more rigid emission reduction targets. China's emissions reduction policy clearly states that the relationship between pollution and carbon emission reduction, on the one side, and energy security, supply chain security of the industrial chain, food security, and people's normal lives, on the other side, should be well handled, effectively dealing with the possible economic, financial, and social risks associated with the green low-carbon transition, preventing overreaction and ensuring safe carbon emission reduction. China has integrated carbon peak into all aspects of its economic and social development. The "Carbon Peak Action Plan for 2030" sets out 10 key actions to be implemented, related to energy, industry, urban and rural construction, transportation, circular economy, scientific and technological innovation, carbon sequestration, and education for all. It can be seen that China's emission reduction framework not only is comprehensive, but also sets clear priorities to tackle key issues.

China's carbon neutrality is more emphasized on the rational use of administrative means. The implementation of China's carbon neutrality goal emphasizes both the government's and the market's efforts to build a new nationwide system. As a result, in addition to industrial policy and market instruments, China has adopted a more diversified approach to achieving carbon neutrality, reconciling its long-term, medium-term, and short-term goals. The executive branch approach has the following characteristics. First, it emphasizes the positive role of technological research and development and higher education. For example, the major initiatives set out in the Carbon Neutral

Science and Technology Innovation Action Plan of Colleges and Universities include training carbon-neutral talents, breakthroughs in basic research, tackling key technologies, enhancing innovation capacity, and promoting not only the transformation of scientific and technological achievements, but also international cooperation and exchange. Second, it establishes a variety of administrative guidance means. For example, the carbon neutrality implementation guidelines for large-scale events (pilot) encourage large-scale event organizers to develop a carbon neutrality implementation plan in the preparation phase of a large-scale event, to undertake mitigation actions in the implementation phase, and to account for greenhouse gas emissions and take offsetting measures to achieve carbon neutrality at the final stage. Third, it focuses on achieving carbon neutrality in development and on creating carbon reduction models. For example, the implementation of major regional strategies, such as the coordinated development of the Beijing-Tianjin-Hebei region, the development of the Yangtze River Economic Belt, the construction of the Guangdong-Hong Kong-Macao Bay Area, the integration of the Yangtze River Delta, and the ecological protection and high-quality development of the Yellow River Basin, focuses on strengthening the orientation and task requirements of green and low-carbon development. Fourth, it encourages key areas, key industries, and places with appropriate conditions to take the lead in reaching the carbon peak.

Local governments pay more attention to the effectiveness of discipline and technology iteration. Twenty-three of the local regulations and policies analyzed revolve around the promotion of science and technology. This shows the importance that local governments attach to facilitating the resolution of major technological bottlenecks and key scientific issues through policies, by combining the active layout of government departments with the demand-driven approach of market entities, to break through the neck of key core technology, improve the actual fulfilment of major scientific and technological achievements, and promote the upgrading of the industrial base and the modernization of the industrial chain.

#### 4.2.2 The problems of China's carbon neutrality path

China's carbon emission reduction tools do not emphasize the application of financial instruments. China is following an ambiguous and complicated route in relation to the financial market rules and specialized regime of the carbon market. There are still no clear financial market laws and rules for carbon emission allowances (Chen and Wu, Forthcoming 2022). The development of the carbon market is a long-term process; hence, the role of government regulation has been highlighted under the rigid emission reduction constraints. At the same time, government regulation also faces the following problems.

The first problem is a lack of clarity. The realization of the vision on carbon peak and carbon neutrality will touch on the

interests of multi-sector actors; therefore, the conflict and coordination of their interests need the strong intervention of the rule of law. However, to date, most of the laws and policies specifically focusing on emission reduction are advocacy-based, and the lack of clarity means that executive branches have room to abuse their power. These laws and policies do not include requirements on the production and management of enterprises as strict as those in the traditional environmental legislation. This creates some buffer space for enterprises to undertake emission reduction obligations; however, if the administrative power is abused, it will also cause the opposite effect. In China, the cost of breaking the law remains high due to the government's control of environmental pollution and related enterprises. Although some researchers believe that strict low-carbon enterprise responsibility is conducive to their green innovation, the opportunity cost of illegal investment in the process of green innovation is a more rational choice (Wang et al., 2022). However, in addition to the traditional environmental responsibility, in the short term, the imposition of excessive emission reduction costs will hinder the normal development of enterprises (Zhao et al., 2017). Clearer legislation would also impose more rigid constraints on local governments, and avoid the implementation difficulties that localism would create.

Second, the degree of public participation is low. A review of central and local regulations and policies revealed that, although the public is mentioned several times in various documents, it is only the target of knowledge and policy dissemination. Plenty of research showed that public participation can play an active role in addressing climate change, forming public opinion. In response to public demands, decision-makers will establish practical carbon allocation policies, which are based on the status quo of different subjects in social production and life. Thus, the realization of equity and efficiency values in the operation of the carbon market will be promoted (Peeters and Deketelaere, 2006). The EU's 2020 proposal for a European climate law, as well as the numerous revisions to the Carbon Market Directive, include public participation in addressing climate change and the carbon market and reinforce it as an important procedural rule. If China is to achieve higher emission reduction targets, it must increase public participation in emissions reduction to make legislation and policies more rational.

Third, existing policies and laws have a low rank. China has issued a comprehensive emission standard for air pollutants, specifying the emission limits for 33 types of air pollutants and various requirements for implementation. The standards set by regulation also provide a basis for the government or the environmental authorities to punish enterprises or individuals emitting air pollutants that exceed the standards or emitting unauthorized air pollutants. However, although local governments tend to compete in the setting of ambitious goals for pollution emission reduction, in practice there is no corresponding



accountability system (Yang et al., 2020). The public or enterprises cannot sue carbon-emitting enterprises just as they sue pollution-discharging enterprises. If too many legislative matters are handed over to local governments, it will be difficult to implement them due to the lack of legal cooperation. Even though there are no technical barriers to monitoring greenhouse gases, it is difficult to sue the energy sector for excessive emissions, or the governments for failing to fulfil their duty (He, 2021). In China, decentralized and fragmented laws and regulations make it difficult for various systems to create systematic synergies for climate change mitigation, thereby reducing the benefits of law enforcement and increasing the cost of social governance. In 1998, Japan formulated the policy-oriented “Global Warming Countermeasures and Promotion Law”, which was the prelude of national legislation on climate change. At the end of 2009, around the Copenhagen Climate Conference, the international community saw a peak in climate legislation. In 2008, the United Kingdom passed the “Climate Change Act”, which was a pioneering step in including greenhouse gas emission reduction targets into law, setting for the first time a carbon budget system and a special authority. In 2009, the Philippines introduced a policy-based “Climate Change Act”. In 2010, the Republic of Korea issued the “Basic Law on Low-Carbon Green Growth”, a policy-oriented and framework legislation, while in 2012 Mexico adopted the “Basic Law on Climate Change”, which specified emission reduction targets and set up a management body. In the following years, France, Germany, Denmark, Norway, and Finland also introduced specific legislation aimed at reducing carbon emissions. Given the current legislative situation of China, with a decentralization that is not exerting the resultant force, the backward policy implementation, and the local legislation lacking the upper-level law to rely on, it is more suitable to make a special law to solve these problems.

## 5 Conclusion and policy recommendations

Carbon neutrality does not entail a simple emission reduction goal, but rather broad and profound economic and social systemic changes. China has developed a top-level guidance plan for carbon peak and carbon neutrality and needs to make appropriate use of a wide range of policy tools, including legal, economic, technological, market, and financial instruments. Strengthening the design of synergies among different policy objectives and instruments, and gradually establishing a complete and effective policy and legal system, will help promote the transformation and reshaping of the energy system and achieve an effective low-carbon transition. As the world’s factory and late developing

country, China has undertaken important emission reduction tasks. To achieve the goal of carbon neutrality while maintaining economic growth requires an effective cooperation between the central government and local governments. A clearer, higher-level, and enforceable legal system needs also to be established. If China can achieve the emission reduction targets as scheduled, its legislative model can also be a feasible example for other developing countries. Based on this analysis, the following suggestions are advanced:

- 1) Improve carbon finance rules. China has already created a specialized regime for the spot carbon market. To reduce the pressure of government regulation, carbon finance laws should be improved. Effective financial market rules can help build carbon neutral infrastructure. Therefore, a new approach to connect the carbon market rules and financial market rules should be developed.
- 2) Timely promulgation of the climate change law. Climate change is a complex global problem. The enactment of this law will support the development of low-carbon related fields such as ecological protection, energy sustainability, and circular economy. The regulation of low-carbon development in various fields in the form of legal principles could solve the problem of fragmentation of legislation. After clarifying the legal objectives, basic principles, management bodies, mitigation and adaptation system measures, and accountability mechanisms, other laws and regulations should also be amended to incorporate the concept of low-carbon development, including the “Electricity Law”, the “Air Pollution Prevention Law”, the “Circular Economy Promotion Law”, the “Forest Law”, and the “Grassland Law”.
- 3) Increase citizen participation in policy-making and implementation. It is necessary and feasible to integrate public participation mechanisms into the legislative processes of China’s carbon emissions trading legislation, especially the quota allocation. In the legislative path, we can choose the specific way to legalize the mechanism of public participation, and design a specific system aiming at the main content, scope, and mode of participation, so as to improve the rationality of policy-making.
- 4) Establish a public interest litigation system on climate change to restrain the executive power. As a branch of environmental public interest litigation, climate change public interest litigation has already been practiced across the world (Gerrard, 2007). In China, central and local policies have led to high coal prices, power cuts, and coal shortages in some places, highlighting the potential for abuse. Although the central government has made it clear that it wants to avoid the social risks associated with reducing emissions, the COVID-19 pandemic has pushed

local governments to make irrational decisions because of a fallacy of composition, which has a major impact on citizens' lives. The existence of a public interest litigation system on climate change can not only restrain the government from actively performing its duties to promote emission reduction, but also limit the government's abuse of power and excessive emission reduction.

## Data availability statement

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

## Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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## Conflict of interest

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

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## Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fenvs.2022.1043404/full#supplementary-material>

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