

Management of Chinese Energy Sector for the Transition to a Low-Carbon Economy: Legislative Gaps and Emerging Judicial Trends

Zarządzanie chińskim sektorem energetycznym w procesie przejścia do gospodarki niskoemisyjnej: luki legislacyjne i kształtujące się trendy orzecznicze

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Abstract

The study aims to review the legislative regulation of the Chinese energy sector to identify gaps in the legal framework and new trends in judicial practice that affect the country's transition to a low-carbon economy. A comprehensive analysis of key regulatory acts such as Forest Code, Law on Renewable Energy Sources, Law on Electricity, and National Strategy for Adaptation to Climate Change until 2035 was carried out. International standards were evaluated and compared with the approaches of other countries. The study determined that despite the progress in creating a legal framework to support renewable energy and reduce greenhouse gas emissions, significant legislative gaps exist. For instance, the legislation does not fully cover emerging technologies, such as hydrogen and carbon capture and storage, which are key to achieving low-carbon goals. Legal mechanisms for the integration of decentralised energy systems are also underdeveloped, which limits the use of renewable energy sources. The study noted that China has set ambitious targets, including peaking CO₂ emissions by 2030 and achieving carbon neutrality by 2060. China, as the largest producer of CO₂ emissions in the world, faces a serious challenge related to emissions from fossil fuel combustion. This problem is becoming especially urgent given the country's large-scale industrial development and its dependence on coal as the main source of energy. Findings highlight the importance of further development and harmonisation of legislation to support China's sustainable energy development. This study can be used as a basis for improving legislative and regulatory approaches to achieving low-carbon development goals, by addressing identified legislative gaps and introducing new legal mechanisms.

Key words: renewable sources, innovative approaches, environmental law, climate strategy, green transformation

Streszczenie

Celem artykułu jest przegląd regulacji legislacyjnych chińskiego sektora energetycznego w celu zidentyfikowania luk w ramach prawnych oraz nowych trendów w praktyce orzeczniczej, które wpływają na transformację kraju w kierunku gospodarki niskoemisyjnej. Przeprowadzono kompleksową analizę kluczowych aktów normatywnych, takich jak Kodeks leśny, Ustawa o odnawialnych źródłach energii, Prawo energetyczne oraz Krajowa strategia adaptacji do zmian klimatu do 2035 roku. Oceniono standardy międzynarodowe i porównano je z podejściami stosowanymi w innych państwach. Badanie wykazało, że mimo postępów w tworzeniu ram prawnych wspierających rozwój odnawialnych źródeł energii oraz redukcję emisji gazów cieplarnianych, nadal istnieją istotne luki legislacyjne. Przykładowo, ustawodawstwo nie obejmuje w pełni nowych technologii, takich jak wodór oraz wychwytywanie i składowanie dwutlenku węgla, które są kluczowe dla realizacji celów niskoemisyjnych. Niedostatecznie rozwinięte są również mechanizmy prawne integracji zdecentralizowanych systemów energetycznych, co ogranicza wykorzystanie odnawialnych źródeł energii. W badaniu wskazano, że Chiny wyznaczyły ambitne cele, w tym osiągnięcie szczytu emisji CO₂ do 2030 r. oraz neutralności klimatycznej do 2060 r. Chiny, jako największy

na świecie emitent CO₂, stoją przed poważnym wyzwaniem związanym z emisjami pochodzącymi ze spalania paliw kopalnych. Problem ten staje się szczególnie pilny w kontekście wielkoskalowego rozwoju przemysłowego kraju oraz jego zależności od węgla jako głównego źródła energii. Wyniki podkreślają znaczenie dalszego rozwoju i harmonizacji przepisów prawa w celu wsparcia zrównoważonego rozwoju energetycznego Chin. Niniejsza praca może stanowić podstawę do doskonalenia podejść legislacyjnych i regulacyjnych w realizacji celów rozwoju niskoemisyjnego poprzez eliminację zidentyfikowanych luk prawnych oraz wprowadzanie nowych mechanizmów prawnych.

Słowa kluczowe: odnawialne źródła energii, innowacyjne podejścia, prawo ochrony środowiska, strategia klimatyczna, zielona transformacja

1. Introduction

The transition to a low-carbon economy has become one of the main objectives of global politics, and China, as the largest energy producer and consumer, plays a key role in these processes. Given the country's rapid economic development and high level of greenhouse gas emissions, the Chinese government has set a goal of achieving carbon neutrality by 2060. However, the implementation of this goal faces several challenges related to economic and social factors, as well as legislative and legal barriers.

The transition is increasingly assessed through the lens of sustainable development, where decarbonisation is not an end in itself but a governance pathway that simultaneously advances environmental integrity, social welfare, and economic resilience. In this regard, China's *dual carbon* agenda intersects directly with Sustainable Development Goal (SDG) 7, which prioritises access to affordable, reliable and modern energy services and a higher share of renewables, and SDG 13, which calls for urgent action to mitigate climate change and strengthen climate governance capacities. Consequently, the effectiveness of China's low-carbon transition depends not only on technological deployment and market incentives but also on whether the legal system can provide stable rules, accountability mechanisms, and enforceable rights and obligations aligned with SDG targets.

This research examines China's energy governance as an institutional condition for sustainable development. The study aims to identify legislative gaps and enforcement constraints that reduce the coherence between climate commitments, energy regulation, and SDG implementation – particularly SDG 7 (affordable and clean energy) and SDG 13 (climate action) (United Nations, 2025). Current regulations may lack explicit implementation mechanisms, compliance incentives, and monitoring arrangements, generating legal uncertainty and weakening the measurability of progress towards SDG-consistent outcomes (e.g., renewable integration, emissions reductions, and energy-system efficiency). Moreover, uneven subnational implementation and the incomplete maturation of carbon market institutions can reduce policy credibility and complicate verification of obligations. These factors warrant a systematic legal-institutional analysis that links statutory design and judicial practice to sustainable development performance.

The issues of energy management in the context of China's environmental policy have already been considered in several studies. For instance, Huang et al. (2023) emphasise that the problem of achieving carbon neutrality in China is closely related to energy governance. The authors analysed the current state of research, regulations and implementation in China. They identified problems such as a lack of a legal framework and a gap between energy laws and policies. A similar study was conducted by Lu et al. (2024), which addressed ways of promoting synchronised green and low-carbon development on both the demand and supply sides of energy through policy measures. The main conclusions of the study show that for a successful transition, it is not enough to rely on clean energy supplies alone, the government should encourage cooperation between parties in the construction of renewable energy facilities. Xiao et al. (2024) analysed the impact of the transition to a low-carbon economy on energy poverty in developing countries, with a focus on China. The study reveals the importance of energy infrastructure and costs in shaping the link between policy and energy poverty. The team of authors draws conclusions that help developing countries protect the energy well-being of their citizens in the transition to a low-carbon economy.

Tang and Zhang (2023) analysed the impact of low-carbon governance on energy and environmental efficiency in Chinese cities, which is an important aspect in the context of global climate change and sustainable development. The study also noted that low-carbon governance contributes to improving energy and environmental efficiency in both resource-oriented and non-resource-oriented cities, although the level of success differs. The same problem was studied by Lin and Li (2022). The authors analysed the role of cities in the fight against climate change and the reasons why the results of urban climate management have not met expectations. The researchers conducted a comparative analysis of two low-carbon projects in Shenzhen and Huizhou and examined national administrative and legal disputes related to decarbonisation. The study finds that the success of cities' climate initiatives depends on their ability to manage four key rationales: carbon re-regulation, carbon formalisation, carbon rationalisation, and carbon exclusivity.

Another issue was considered by Liu et al. (2024), namely, the effectiveness of the Chinese emissions trading scheme as a way of reducing carbon dioxide emissions and transitioning to a low-carbon economy. The authors concluded that to maximise the effectiveness of the emissions trading scheme, it is necessary to expand its coverage to other emitters, which will allow the scheme to fully unlock its carbon reduction potential. Liu et al. (2024) analysed the role of the digital economy and public administration in supporting the transition of Chinese cities to a low-carbon economy in the context of the double carbon goal, finding that the digital economy contributes to this transition both directly and indirectly through improved productivity. In addition, Huang et al. (2024) reviewed the history of energy transitions in China, concluding on the complexity of the current transition and its radicality, and highlighting key challenges such as the lack of scientific and technological base and innovation. Based on their analysis, the authors developed recommendations for policymakers to successfully implement the energy transition.

Although prior studies have extensively addressed energy transitions, policy instruments, and sectoral pathways in China, less attention has been devoted to how legal enforceability and judicial practice shape SDG-relevant outcomes over time – namely, the stability of renewable energy rights and obligations and the operationalisation of climate mitigation commitments through enforceable legal mechanisms.

The study aims to identify and address the legislative gaps in Chinese energy governance, as well as to explore new judicial trends related to the implementation of low-carbon policy. The study aims to answer the following key questions: Which legislative gaps and normative inconsistencies reduce the capacity of China's energy governance framework to deliver SDG-aligned outcomes? How does judicial practice – through legal interpretation, remedies, and dispute resolution – affect compliance, accountability, and investment certainty in low-carbon transitions? Which targeted legal reforms and enforcement mechanisms could strengthen the contribution of energy governance to sustainable development, while maintaining system reliability and policy coherence?

2. Materials and methods

The methodology of the study of Chinese energy governance in the context of the transition to a low-carbon economy was based on a content analysis of legislative and scientific sources to identify legal gaps and judicial trends. First, an analysis of Chinese regulatory acts on the energy sector and climate change was carried out. Such documents as Forest Law of the People's Republic of China (Ministry of Ecology and Environment of the People's Republic of China, 2019a), Law No. 57 of the People's Republic of China *On the Prevention and Control of Atmospheric Pollution* (1987), Renewable Energy Law of the People's Republic of China (Ministry of Commerce People's Republic of China, 2013), and Electric Power Law of the People's Republic of China (Food and Agriculture Organization of the United Nations, 2015) were studied. The following strategies were also analysed: Climate investment and financing pilot work plan (Climate Change Laws of the World, 2021), National Climate Change Adaptation Strategy 2035 (Center for Security and Emerging Technology, 2022), China's mid-century long-term low greenhouse gas emission development strategy (United Nations Climate Change, 2021), which aims to achieve peak emissions by 2030 and carbon neutrality by 2060, and Circular of the State Council on the Issuance of *Made in China 2025* (Central People's Government of the People's Republic of China, 2015). The legal framework and directions for the development of the energy sector, climate change adaptation and carbon neutrality were studied using the above documents. The focus was on the following strategies, Action plan for carbon dioxide peaking before 2030 (National Development and Reform Commission People's Republic of China, 2021a) and 14th five-year plan (Climate Change Laws of the World, 2022).

Action plan for carbon dioxide peaking before 2030 addressed the specific measures and targets that China plans to implement to limit the growth of carbon dioxide emissions and gradually move towards carbon neutrality. This document was used to analyse the strategic directions of energy development. 14th five-year plan was used to study the long-term strategy for the development of the Chinese energy sector for the period up to 2025. The document analysed how China plans to balance economic growth with the need to reduce emissions, as well as identify key areas where the legal framework and institutional support need to be improved. International regulations and standards governing the low-carbon economy were analysed to identify legislative gaps and their impact on energy sector governance. Such documents as Paris Agreement (United Nations, 2015a) were studied.

In addition, specific court decisions related to energy and environmental issues issued by Chinese courts in recent years were analysed. This analysis included a study of the legal interpretations applied by judges, as well as their impact on precedent-setting and the development of new case law. Particular attention was devoted to the analysis of court cases related to the abandonment of traditional energy sources and the introduction of new technologies in the energy sector. Data from National Bureau of Statistics (2024), International Renewable Energy Agency (2022), and National Energy Administration (2023) were analysed to assess the impact of government policy on the development of the energy sector and the dynamics of CO₂ emissions. The analysis of these data provided details on trends in the Chinese energy sector and the effectiveness of measures taken to achieve a low-carbon economy.

To embed a sustainable development perspective, the analysis operationalised SDG 7 and SDG 13 as evaluative lenses for legal design and enforcement. For SDG 7, the assessment focused on norms and institutional mechanisms that enable renewable energy deployment, grid integration and priority dispatch, energy-system efficiency, and affordability/market stability (e.g., legal duties of grid operators, pricing principles, subsidy adjustment rules, market access and dispute resolution). For SDG 13, the assessment examined statutory and quasi-statutory instruments that translate mitigation goals into measurable obligations, compliance incentives, monitoring and verification arrangements, and judicially enforceable remedies in climate- and carbon-related disputes. Legislative and policy documents were coded against these SDG-related dimensions, and judicial decisions were analysed to identify how courts interpret duties, allocate liability, and select remedies that influence mitigation and clean-energy outcomes.

3. Results

Chinese energy sector is the foundation of national security and macroeconomic regulation, which explains why administrative measures dominate legal ones in this area. While Chinese energy policy is broad and responsive, allowing for a quick response to national objectives, the laws governing the sector remain few and far between. The policy is subject to change and volatility, which underscores the importance of establishing clear and stable energy legislation to reduce market volatility.

Renewable energy sources are substantial in ensuring national energy security, despite the continued use of fossil fuels. In 2022, the total installed capacity of renewable energy sources exceeded 1150 GW. According to the International Renewable Energy Agency (2022), by the end of 202, global renewable energy capacity will reach 3372 GW. 14th five-year plan (Climate Change Laws of the World, 2022) envisages an increase in the share of non-fossil fuels to 20% in total primary energy consumption and to 39% in electricity production in the year, with 33% of them coming from renewables. The plan also includes measures to remove barriers to market trading in distributed energy, create spot markets between provinces, and encourage green energy trading in the private sector. In addition, 14th five-year plan plans to develop onshore and offshore wind power, increase local consumption of renewable energy and expand inter-provincial transmission. By 2030, it is planned to increase the installed capacity of wind and solar energy to 1200 GW and increase the share of non-fossil resources in primary energy consumption to 25%. In 2021, the country adopted a China's mid-century long-term low greenhouse gas emission development strategy (United Nations Climate Change, 2021), which aims to reach peak emissions by 2030 and carbon neutrality by 2060. Among the sectoral goals of this strategy are to ensure a 25% share of non-fossil energy in total energy consumption by 2030 and to reach a total installed capacity of wind and solar energy of more than 1.2 billion kW.

According to the National Energy Administration (2023), the installed capacity of China's power system reached 2,920 GW. For the first time, the total capacity of solar and wind power plants exceeded 1000 GW, accounting for 36% of the total installed capacity of the power system in 2023, while the share of thermal power plants decreased to less than 50%. These figures are confirmed in the Statistical bulletin of the People's Republic of China on national economic and social development (National Bureau of Statistics, 2024). Figure 1 shows the dynamics of capacity growth by year (rounded values).

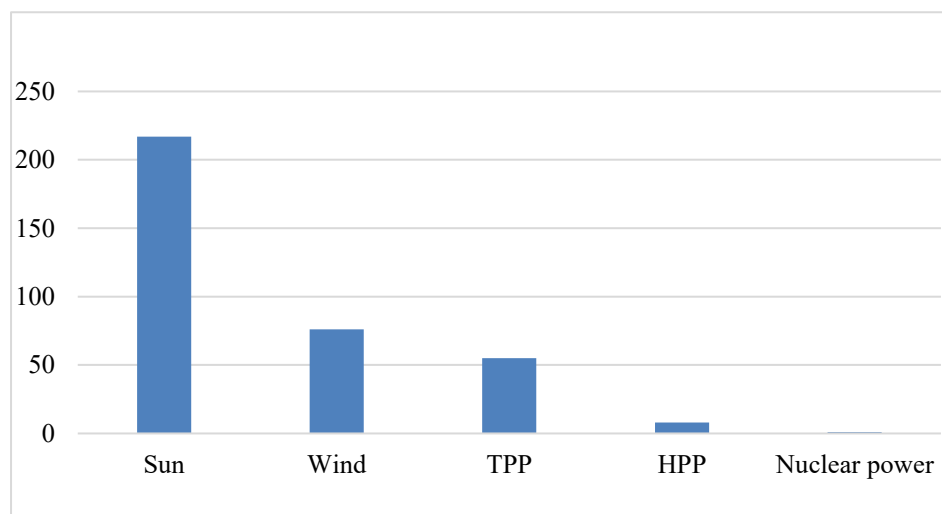


Figure 1. Increase in electricity generation in China in 2023 (GW), source: compiled by the authors based on Statistical bulletin of the People's Republic of China on national economic and social development (National Bureau of Statistics, 2024)

According to the Statistical bulletin, Chinese electricity generation in 2023 totalled 9456.4 TWh, up 6.9% compared to 2022 (National Bureau of Statistics, 2024). China remains the global leader in this metric by a significant margin. Solar power plants in China have been generating more electricity than nuclear power plants for the second year in a row, and wind power plants have been surpassing nuclear power plants in terms of generation since 2012 (Figure 2).

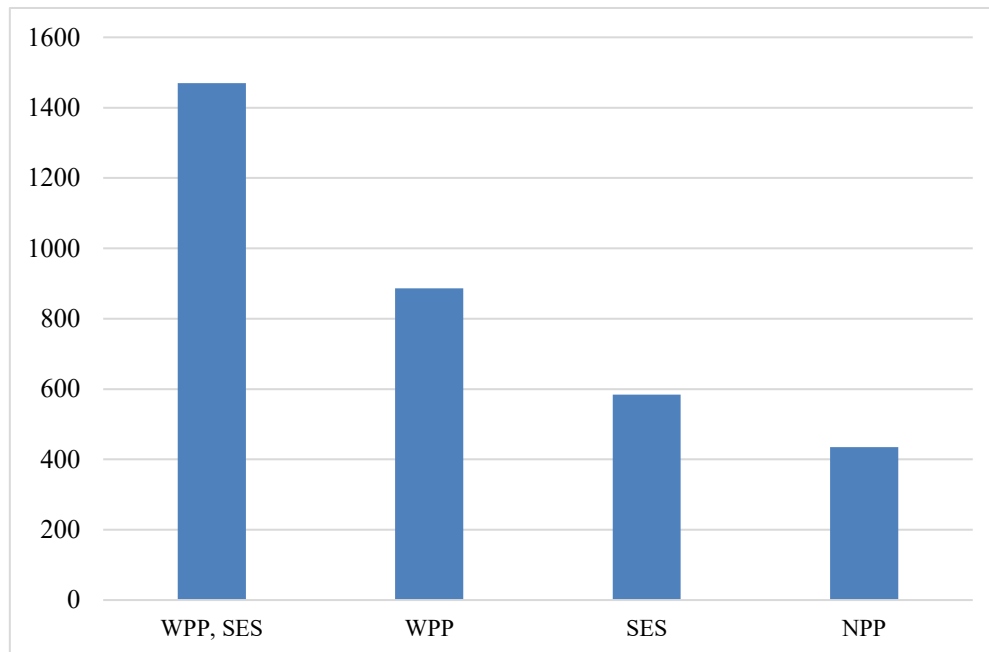


Figure 2. Electricity generation in China in 2023 by source: solar, wind and nuclear energy, TWh, source: compiled by the authors based on Statistical bulletin of the People's Republic of China on national economic and social development (National Bureau of Statistics, 2024)

According to the National Bureau of Statistics (2024), China's per capita electricity consumption was 6,539 kWh, which follows the consumption level of industrialised countries such as Germany and Denmark. For comparison, in India, this figure is approximately 1200 kWh. In 2023, there will be a rapid increase in the capacity of energy storage systems in China, with 22.6 GW of new energy storage facilities commissioned, excluding pumped storage.

In 2015, the strategy *Made in China 2025* presented by the Central People's Government of the People's Republic of China (2015), which aims to reduce the carbon intensity of value added in the industrial sector by 40% by 2025 compared to 2015 levels. In 2022, an action plan was developed to reduce greenhouse gas emissions in the industry, which includes targets to reach the peak of industrial emissions by 2030 and reduce the energy intensity of value added by 13.5% by 2025 compared to 2020 (Ministry of Industry and Information Technology of the People's Republic of China, 2022). Separate targets have been set for carbon-intensive industries: by 2025, it is planned to reduce the energy intensity of cement production by 2% and steel by 3.7% (Sandalow et al., 2022). It is also planned to reduce CO₂ emissions from electrolytic aluminium production by 5% and increase the use of recycled steel from 260 to 320 million tonnes between 2020 and 2025. In non-ferrous metallurgy, the emphasis is on recycling to increase the share of recycled non-ferrous metals to 24% of the total use by 2025. China, being the largest source of CO₂ emissions in the world, faces a major problem – emissions from fuel combustion (Figure 3). Chinese climate policy is determined by the Working guidance for carbon dioxide peaking and carbon neutrality in full and faithful implementation of the new development philosophy (National Development and Reform Commission People's Republic of China, 2021b). The key documents governing Chinese climate policy are the Action plan for carbon dioxide peaking by 2030 (National Development and Reform Commission People's Republic of China, 2021a) and 14th five-year plan (Climate Change Laws of the World, 2022), which includes targets to reduce carbon intensity, especially in the energy and end-use sectors. In the context of Chinese energy management for the transition to a low-carbon economy, the following laws and policies are central. Forest Law of the People's Republic of China (Ministry of Ecology and Environment of the People's Republic of China, 2019a) is the main law aimed at protecting and managing forests. They contribute to carbon sequestration, which is important for reducing the overall national carbon emissions. Law No. 57 of the People's Republic of China *On the Prevention and Control of Atmospheric Pollution* (1987) regulates emissions of air pollutants and promotes air quality, which is also an important aspect of the transition to a low-carbon economy.

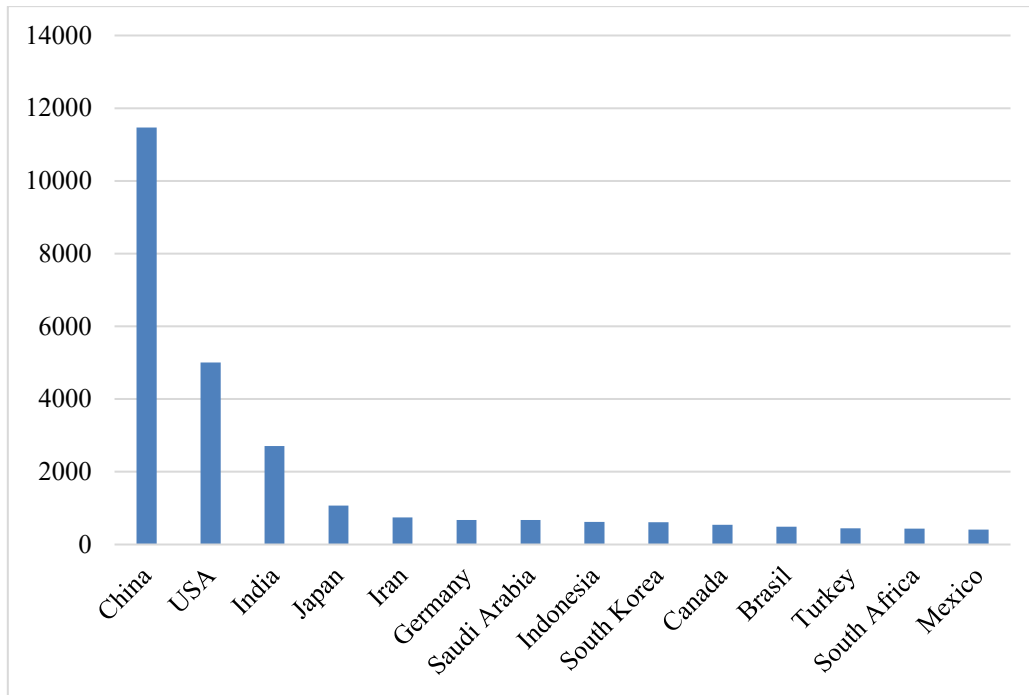


Figure 3. Countries with high carbon dioxide emissions in 2021, source: compiled by the authors based on Blokhin (2024)

Renewable Energy Law of the People's Republic of China (Ministry of Commerce People's Republic of China, 2013) promotes the active development and use of renewable energy sources such as solar, wind and hydroelectric power, which is critical to reducing dependence on hydrocarbon sources. Electric Power Law (Food and Agriculture Organization of the United Nations, 2015) regulates the production and distribution of electricity, including incentives for the use of clean and renewable energy sources in the energy sector. Law of the People's Republic of China on Prevention and Control of Soil Contamination (Ministry of Ecology and Environment of the People's Republic of China, 2019b) aims to control and reduce soil pollution, which affects the sustainability of agricultural land and land use management, which plays an indirect role in the energy strategy. Climate investment and financing pilot work plan (Climate Change Laws of the World, 2021) supports climate-resilient projects through financial instruments, stimulating the transition to a low-carbon economy by investing in green technologies and infrastructure. National Climate Change Adaptation Strategy 2035 (Center for Security and Emerging Technology, 2022) provides a long-term roadmap for the country's adaptation to climate change, including measures to reduce emissions and develop sustainable energy. The above laws and strategies form a comprehensive approach to China's energy management and transition to a low-carbon economy, aimed at reducing carbon emissions and increasing the resilience of the economy to climate change.

China has repeatedly attempted to pass Energy Law through the National People's Congress, but none of them have been successful, reflecting the complexity of the energy transformation process. The main obstacles are related to the division of responsibilities between the state, private companies and other actors, which requires the development of a detailed legal framework. In the face of these difficulties, the Chinese government actively engages the judicial system to resolve issues related to energy transformation. Although Chinese courts, operating under civil law, are usually limited by existing regulations, they take a more active role in promoting energy transformation by applying legal interpretations and conducting litigation. Judges, despite the limitations of their powers, use flexible approaches to facilitate the implementation of the state energy policy, which can be seen as a manifestation of *judicial Chinese activism*. For the successful development of the Chinese energy sector, it is necessary to frequently review and improve legislation, as well as strengthen international cooperation to share experiences and adapt to new challenges.

In the last ten years, low-carbon development priorities have been increasingly discussed in scientific research, international documents and national programmes. This concept was supported by all countries of the world, which is confirmed by the final documents of the UN global conferences, such as Paris Agreement on Climate Change (United Nations, 2015a) and 2030 Agenda for sustainable development (United Nations, 2015b). An analysis of these documents identifies the key aspects of the transition to low-carbon trends: reduction of greenhouse gas emissions, reduction of consumption of traditional fossil fuels (coal, oil, gas) in the energy balance, as well as transition to low-carbon and carbon-free energy sources, with priority given to the development of renewable energy sources (such as wind, solar, geothermal, biofuels, hydropower, tidal and wave energy). These processes are often referred to as *decarbonisation* and are based on the creation of a low-carbon economic model (Hepburn et al., 2019). China is actively pursuing an energy policy that seeks to address domestic energy supply and demand

issues and consider global trends (Bradshaw, 2010). The main task is to reduce dependence on fossil fuels, effectively combat climate change and meet new environmental requirements at the national and international levels. This policy envisages a transition from the traditional fossil fuel-based, low-efficiency system to a low-carbon, high-efficiency energy system. This transition plays a key role in achieving carbon emission reduction targets.

To achieve this goal, China has adopted several national strategies, among which the most significant are Action plan for carbon dioxide peak by 2030 (National Development and Reform Commission People's Republic of China, 2021a) and 14th five-year plan (Climate Change Laws of the World, 2022). These documents define the main directions of the country's energy transformation, providing for the gradual replacement of traditional energy sources with new ones, and specify the tasks for creating a modern energy system within 14th five-year plan. According to these plans, the process of Chinese energy transformation is divided into reforms related to energy supply and demand. On the supply side, the focus is on reducing carbon emissions in the electricity and fuel sectors (Meidan, 2023). This requires changing the structure of the electricity supply and increasing the share of renewable energy sources in total electricity production. This involves not only increasing wind and solar power capacity, but also developing infrastructure such as transmission, storage, and demand-side management systems to ensure efficient consumption of renewable energy.

To implement Action plan (National Development and Reform Commission People's Republic of China, 2021a) and 14th five-year plan (Climate Change Laws of the World, 2022), various government agencies developed additional regulations that provide a comprehensive policy framework for China's ongoing energy transformation. These national policies have allocated responsibility for implementing energy transformation to various sectors and organisations. For power plants, the main priority has been to increase the share of renewable energy sources and improve the efficiency of electricity production, which helps not only to reduce carbon emissions but also to improve the national energy grid (Newell et al., 2022). Concerning State Grid, which holds a monopoly in electricity transmission and distribution, the policy aims to prioritise the procurement, planning and billing of clean energy, which should accelerate the commercialisation of clean energy and contribute to the green transformation of the energy system.

In the fossil energy sector, the transition involves increasing the efficiency of resource use, rather than completely abandoning fossil fuels. To ensure energy security, the development of the oil and gas industry is supported, and the coal industry must ensure stable supplies while reducing the carbon footprint of all stages of production (Lipfert & Sareen, 2023). Environmental management and restoration of mining areas, as well as full utilisation of by-products such as coal seams, are emphasized. For industrial consumers, especially in the transport and construction sectors, the policy aims to accelerate the introduction of new and clean energy, which not only reduces energy consumption and carbon emissions but also supports the green development of related sectors.

Notably, on 11 July 2023, the Central Committee for Comprehensive Deepening of Reforms approved the *Conclusions on Promoting the Dual Control of Energy Consumption and Gradual Transition to Dual Control of Carbon Emissions*, which calls for a shift from controlling energy consumption to controlling carbon emissions (Central People's Government of the People's Republic of China, 2023). In the new approach, the focus is on controlling carbon intensity, with total emissions control as an additional element. This transformation underscores the national emphasis on reducing carbon emissions and strengthens the role of non-fossil fuels such as nuclear and renewable energy in achieving peak emissions and carbon neutrality targets.

For ordinary consumers, the policy aims to encourage residents to adopt a green consumption lifestyle by improving ancillary facilities. According to the Action plan for carbon dioxide emissions peak by 2030 (National Development and Reform Commission People's Republic of China, 2021a), Chapter 3, Article 3, Part (e), encouraging residents to use more energy-efficient appliances by improving environmental labelling; increasing the level of electrification in the area of end-use energy consumption, especially by building infrastructure (such as charging stations) to encourage consumers to purchase new energy vehicles to replace petrol vehicles. In addition, the document for 14th five-year plan (Climate Change Laws of the World, 2022) also contains encouragement, namely, Chapter 3, Part 12, encouraging residents to use green transport, such as public transport and bicycles, by improving public transport.

Notably, Chinese national courts inevitably follow government policies and guidelines when considering energy-related cases (Kabeyi & Olanrewaju, 2022). These policies are central in shaping case law and contributing to the transformation of the energy market. In the absence of specialised legislation, these policy initiatives are binding through court decisions. This means that various aspects, such as the development of renewable energy, increasing the efficiency of power plants, the clean energy priorities of the State Energy System or requirements to reduce the carbon footprint of fossil fuels, receive the necessary legal support. The interplay between government policy and the legal system provides a solid foundation for the green transformation of the Chinese energy sector, ensuring the stability of policy decisions and maintaining fair competition in the market. In addition, disputes between market participants can be effectively resolved through fair judicial proceedings, contributing to the healthy development of the energy market.

In recent years, the Supreme People's Court of China has emphasised the need to support the energy revolution and promote green transformation. In 2021 and 2023, judicial policies aimed at achieving carbon targets were

adopted, which are being actively implemented in court decisions on climate cases and carbon disputes, supporting the development of a low-carbon economy and clean energy in the country (Setzer & Vanhala, 2019). In 2023-2024, China saw several key court decisions that had a significant impact on energy sector governance and the promotion of a low-carbon economy. For example, in a case involving the construction of a wind farm in Hebei province, the court upheld the local authorities' refusal to build on the grounds of environmental risks, emphasising the importance of environmental standards in the national strategy for the transition to a low-carbon economy. In another case involving subsidies for solar power plants, the court found the government's actions to reduce subsidies to be justified, demonstrating the flexibility of the judiciary in supporting government reforms while protecting investors' rights. These court decisions demonstrate that Chinese courts are playing an active role in supporting the government's policy of transitioning to a low-carbon economy. Increased enforcement of environmental regulations and support for innovation and new technologies are contributing to the creation of legal precedents that, in turn, are driving the development of a green economy.

At the same time, the development of new energy in China receives significant government support, including financial subsidies, tax benefits, and easier market access. This direction has become a key element of economic modernisation and the transition to green development (State Council the People's Republic of China, 2019). Chinese courts are also actively promoting this policy by addressing cases related to new energy and facilitating the resolution of disputes within the framework of the law. The government has also strengthened control and management of the sector to ensure its sustainable and orderly development. Especially in the automotive industry, the development of vehicles powered by new energy sources is deemed a substantial step towards achieving energy-saving and emission-reduction targets. The energy efficiency of electric vehicles is 46% higher than that of conventional cars, which can reduce CO₂ emissions by 13% to 68% (National Development and Reform Commission People's Republic of China, 2021a). To support this initiative, national policies and industry standards have been introduced to transform and modernise the automotive industry. In turn, the Chinese courts actively support the spirit of the *transformation and modernisation* policy by considering cases related to new energy in the transport sector and facilitating the resolution of disputes within the framework of legislation that promotes the healthy development of this industry.

Supreme People's Court (2021) considered the *Industrial Transformation and Upgrading Policy for the Automobile Industry* in reaching its decision and applied innovative compensation methods to stimulate the development of the *new energy industry*. The case is as follows: a Jibo-based automotive company produced a diesel truck, model ZB1020ADC0F, whose emissions did not meet national standards. The Beijing-based environmental organisation Natural Friends filed a lawsuit, claiming that this caused long-term environmental damage. They demanded that the company cover the costs of pollution control and make a public apology. However, the court that heard the case did not limit itself to a direct demand for damages. Instead, it linked the company's liability to the national policy of new energy development. Instead of standard compensation, the court suggested that the company should be obliged to provide 108 electric vehicles to the relevant government agencies. These cars should compensate for excessive pollutant emissions, and the company should maintain them free of charge for 8 years, regularly reporting on the condition of the vehicles.

The introduction of alternative compensation demonstrates how court decisions can stimulate the transition to new energy sources (Olujobi et al., 2023). For businesses, this decision accelerates the process of phasing out traditional diesel trucks and facilitates their entry into the electric vehicle market. By providing new energy vehicles to public sector enterprises free of charge, companies offset losses while reducing their debt obligations and facilitating their transformation. This creates a situation with a positive outcome: carbon emissions are reduced, the market for new energy vehicles is developed, and air quality improves. In addition, companies can sell emission reduction certificates, which opens new revenue opportunities. This decision illustrates how courts can effectively support public policies in the field of industrial transformation and environmental justice. This case shows that courts can actively contribute to the fight against climate change and the development of new energy industries. An important element of this process is the development of infrastructure for new energy vehicles, including charging stations. Judicial decisions in this area have become the basis for the accelerated deployment of charging stations, establishing the obligation of real estate companies to facilitate their installation (Hofbauer et al., 2022; Ismayilov et al., 2021). Without this cooperation, the full functioning of electric vehicles would not be possible, which would slow down the development of the entire industry.

In addition, courts support the development of other new energy infrastructure, such as solar power plants, by ensuring the cooperation of all stakeholders. Such decisions contribute to the further development of a green economy and low-carbon society (Dall-Orsoletta et al., 2022). Thus, the judiciary is central in supporting the development of new energy technologies in China, and as the industry develops, the role of the courts will only increase, providing a legal framework for future environmental transformation.

In China, the state-owned State Grid Corporation holds a leading position in the energy sector, controlling the transmission, distribution and sale of electricity (Ministry of Commerce People's Republic of China, 2013). According to Renewable Energy Law of the People's Republic of China (Ministry of Commerce People's Republic

of China, 2013), grid companies are obliged to fully purchase electricity generated from renewable sources. However, in practice, due to technical difficulties with power backup, interregional transmission, and the unstable nature of renewable energy generation, priority is still given to more reliable thermal generation, which has slowed down the implementation of many renewable energy projects. The phenomenon of *wind and photovoltaic abandonment* not only leads to electricity losses but often requires increased electricity generation from coal-fired power plants to compensate, which in turn increases emissions of carbon dioxide and other pollutants such as sulphur dioxide and nitrogen oxides, harming the environment and human health (Long et al., 2022). Although Renewable Energy Law requires grid companies to purchase all electricity generated from renewable sources, the legal consequences of non-compliance are not clearly defined, which creates difficulties for courts in making decisions based on the law.

This situation served as the backdrop for cases of rejection of wind and solar energy in Gansu Province and other regions in 2017. On 6 June 2017, the environmental organisation Friends of Nature filed a lawsuit against the Gansu branch of State Grid, accusing it of failing to comply with Renewable Energy Law and refusing to fully procure wind and solar power, which led to an increase in the use of coal-fired generation and thus increased pollution (Chang, 2017). The organisation demanded that Gansu Power Grid Company stop violating environmental regulations, repay 1.718 billion CNY for environmental damage, and publicly apologise to the public (Climate Change Litigation Databases, 2018). The court of the first instance dismissed the claim because the defendant was not directly involved in environmental pollution, but the court of the second instance overturned this decision and remanded the case for reconsideration. In 2020, the plaintiff revised its claims, proposing that the defendant invest 0.5% of its annual income for five years in research and construction projects related to the development of renewable energy. This case has aroused great public interest, as it is the first lawsuit filed by an environmental organisation against State Grid for violations. If the court finds State Grid's actions illegal and holds the company liable, it will set an important precedent for supporting renewable energy and environmental initiatives.

However, the case faces certain difficulties. Firstly, proving the unlawfulness of State Grid Gansu Branch's actions is difficult. Secondly, even if the actions are found to be illegal, the calculation of compensation for the damage will require careful analysis. Moreover, if the final decision is in favour of the State Grid, it could undermine the credibility of environmental organisations and the public. In 2023, the court managed to conclude a mediation agreement between the parties, in which the defendant committed to investing heavily in the development of infrastructure for new energy sources, thereby supporting the goals of carbon neutrality and emission reduction. The case is recognised as one of the most important climate change cases in China and highlights the importance of reducing the country's carbon footprint for the judiciary.

The cases of wind and solar power abandonment in Gansu, Xinjiang and other regions have sent an important signal to grid companies to take into account their social responsibility to protect the environment, increase investment in infrastructure and increase grid capacity for renewable energy consumption. As a large state-owned enterprise, grid companies should follow the policy guidelines and actively include renewable energy development in their strategic plans. This case highlights the importance of addressing renewable energy and environmental issues. The wind and solar rejection litigation have had an impact on the Chinese energy mix and climate change measures. According to the National Energy Administration's 2023 report, the Chinese average wind energy curtailment rate has declined, indicating that the system's effectiveness depends on its practical implementation.

Chinese courts, using climate justice enforcement measures, have contributed to the achievement of the political goals of the energy transition (Sokołowski & Kurokawa, 2022; Valujeva et al., 2024). The implementation of climate justice contributes to the promotion of clean energy, reducing dependence on traditional fossil fuels, reducing carbon emissions and protecting the environment. Through litigation, violators can be held accountable, which supports social justice and the rule of law. Thus, Chinese courts play an important role in ensuring the implementation of government policies and achieving the goals of the energy transition. In China, the legal system in the energy sector has not yet reached the required level of sophistication. Specialised laws, such as Energy Law or the Oil and Gas Law, have not yet been adopted. This leads to conflicts between existing regulations (Slimane et al., 2022). For instance, the National Development and Reform Commission's Notice on Renewable Energy Production Management allows power-generating enterprises to apply for grid connection subject to administrative permits. However, Electricity Law requires power plants to have legal personality. Furthermore, although Electricity Law establishes equality of electricity prices, Renewable Energy Law provides for privileges and compensation for energy produced from renewable sources.

Due to the reliance on politics, laws become abstract and vague. To reconcile the stability of the law with the flexibility of practice, Renewable Energy Law includes only general principles (Peyerl et al., 2022; Iskandarov & Novruzova, 2024). For instance, Article 13 of this law states that the state supports the use of renewable sources for electricity generation but does not contain specific obligations and liabilities for grid operators in case of violations. This gives the government the flexibility to regulate the renewable energy sector through policy documents but creates instability in the legal position of renewable energy developers and complicates court proceedings.

Existing legislation lags current practice in China. Although the central government has long recognised the need to improve energy legislation, no significant changes have been made so far (Calver et al., 2022; Szlag-Sikora et

al., 2025a). Energy legislation is still heavily focused on administrative regulation, which is related to the historical legacy of the planned economy and China's traditional emphasis on macroeconomic management. In addition, the current energy laws do not sufficiently address environmental and climate aspects. Law on Air Pollution Prevention and Control focuses on pollutant emissions but does not contain provisions on energy efficiency and greenhouse gas emissions control. Electricity Law also does not regulate pollutant emissions associated with the development of thermal power (Kullmann et al., 2022; Szélag-Sikora et al., 2025b). As a result, despite China's ambitious plans to transition to renewable energy sources, legislation has been slow to develop and does not provide a clear legal basis for judicial authorities in carbon-related disputes.

The findings indicate that China's progress on renewable deployment and system-scale integration supports SDG 7, yet the legal architecture remains more policy-driven than statute-driven, which reduces predictability for market actors and weakens enforceable obligations. In particular, the Renewable Energy Law establishes a general purchase obligation for grid companies but provides limited specificity on liabilities and remedies for non-compliance, which constrains judicial capacity to secure reliable renewable integration and thereby affects SDG 7 targets related to increased renewable share and modern energy systems. From the SDG 13 perspective, the *dual control* shift towards carbon emissions control strengthens mitigation orientation, but the legal system continues to rely heavily on administrative instruments and programme documents, leaving gaps in binding emissions governance, verification, and enforcement pathways. The emergence of judicially supported remedies (including policy-consistent compensation and infrastructure-orientated commitments) suggests a growing institutional role of courts in climate governance; however, the absence of a comprehensive Energy Law and the coexistence of partially inconsistent norms preserve uncertainty and limit the systemic contribution of litigation to SDG-consistent mitigation outcomes (United Nations, 2025).

Thus, strengthening energy legislation is an urgent task. Only by improving it can a balance between law and policy be achieved, providing a stable legal framework for the development of the energy market. At the same time, it is necessary to strengthen the interaction of legislative and judicial bodies to more effectively support the transformation and development of the energy sector.

4. Discussion

The study demonstrates that China's low-carbon transition is also a sustainable development governance problem: decarbonisation outcomes depend on whether legal norms, institutions, and enforcement pathways can deliver reliable clean-energy expansion (SDG 7) while strengthening mitigation capacity and accountability (SDG 13) (United Nations, 2025). The results indicate that, alongside rapid technology scale-up, legal uncertainty persists due to reliance on programme instruments and general statutory principles, which may be insufficient for stable market expectations, compliance incentives, and consistent adjudication. From a sustainable development standpoint, legal predictability is a mechanism of intertemporal justice: it reduces regulatory volatility, stabilises investment horizons for renewable infrastructure, and enables measurable progress reporting against SDG targets.

The results of the study are consistent with the findings of other researchers, who also emphasise the importance of structural reforms in the energy sector for achieving a low-carbon economy. Nguyen et al. (2024) emphasise that to achieve the sustainable development goals and transition to a zero- and low-carbon economy, energy systems need to be diversified through the introduction of renewable and clean energy sources. The study focuses on an in-depth analysis of the role of renewable energy sources such as bioenergy, geothermal, solar, hydropower, hydrogen, ocean, and wind (BIGSHOW) in the production of clean energy. The authors also analysed the barriers and bottlenecks to the deployment of BIGSHOW projects and proposed policy solutions to overcome them. The main conclusion of the paper is that BIGSHOW can contribute to the transition to a sustainable, low-carbon economy.

In contrast, this study focuses on the governance of the Chinese energy sector in the transition to a low-carbon economy. It examines the legislative gaps and emerging judicial trends affecting the country's energy policy. In contrast to the authors' global discussion of energy system diversification, this study focused on the national level, analysing specific Chinese regulations and court decisions, emphasising the importance of legislative and judicial support in the transition to a low-carbon economy. The study determined that Chinese courts are beginning to play a more active role in supporting government energy policy, despite the restrictions on civil rights. The study found that court decisions are becoming important means for achieving carbon emission reduction targets and supporting the transition to renewable energy sources. The study also identified significant legislative gaps that require further improvement of the legal framework for a successful transition to a low-carbon economy.

A similar opinion is shared by Leal-Arcas (2024). The author analysed new trends in international economic and environmental law in detail, emphasising that macroeconomic growth and environmental protection can now be compatible goals. The author emphasised that modern legal instruments make it possible to overcome the trade-off between economic development and environmental sustainability. The study contributes to the academic literature on the integration of economic growth with environmental sustainability and highlights the role of international law and multilateral economic institutions in promoting industrial decarbonisation and achieving the UN

sustainable development goals. The author also examines the impact of geopolitics on trade and the role of mega-regional agreements in the fight against climate change, concluding that it is important to develop green trade and sustainable supply chains. In contrast to the author's research, the relevant study focuses on the governance of the Chinese energy sector in the context of the transition to a low-carbon economy, with an emphasis on domestic legislative and judicial mechanisms. While the author addressed global legal instruments and their impact on macroeconomic growth and environmental protection, this study is more localised. The results of the study analyse the existing legislative gaps in China and identify key judicial trends that play a role in supporting environmental initiatives and the transition to renewable energy sources.

The results highlight the need to improve the legal framework and judicial mechanisms in China to effectively support national carbon emission reduction targets. While the author's research addressed broader international contexts, this study offers specific recommendations for strengthening institutional support for sustainable development at the national level. The study demonstrates that China's transition to a low-carbon economy requires not only international cooperation but also significant domestic efforts to create an effective and sustainable energy policy. Another side of the relevant issue was studied by Mittal and Kushwaha (2024). The authors noted that hydrogen, as an energy carrier with zero emissions, has several attractive qualities, including wide availability, environmental friendliness and high calorific value. The study provides a critical analysis of various aspects of low-carbon hydrogen, including the economic, environmental, technological and political aspects of its production and use. The authors examined the current policy outlook and forecast hydrogen demand to 2030 and conducted a thorough economic analysis of hydrogen production and storage technologies, critically evaluating current policies from the perspective of various stakeholders.

Furthermore, alongside Mittal and Kushwaha (2024), this aspect was studied by Sulek and Borowski (2024). The study by Sulek and Borowski emphasised that the modern energy market is undergoing significant changes due to the introduction of innovative business models focused on sustainable economic growth with zero emissions. Microgrids and hybrid energy models, which combine solar, wind and conventional energy, play an important role in this transformation, providing flexibility and stability of energy supply. Companies' transition to renewable energy sources, as well as their efforts to reduce their carbon footprint and decentralise the energy system, are opening new opportunities for a sustainable future.

Unlike the study by Mittal and Kushwaha (2024), Sulek and Borowski (2024), this study focuses on the governance of China's energy sector in the context of the transition to a low-carbon economy. It focuses on the analysis of legislative gaps and emerging judicial trends affecting Chinese energy policy. While the authors explore the hydrogen economy with a focus on specific hydrogen types and their implementation within global policy frameworks, and business model analysis, this study focuses on the national specifics of China, where the judiciary is beginning to play an increasingly important role in supporting government policies to transition to renewable energy and reduce carbon emissions. The results of the study show that despite significant legislative gaps, Chinese courts are actively contributing to the implementation of state energy policy. The study also determined that a successful transition to a low-carbon economy requires further improvement of the legal framework and intensified international cooperation to ensure clearer and more effective mechanisms for energy sector governance.

Judicial practice functions as an institutional bridge between policy ambition and enforceable sustainability outcomes. In terms of SDG 7, disputes concerning grid access, renewable curtailment, and subsidy adjustment directly affect whether clean energy is not only installed but also integrated and monetised under stable rules. In terms of SDG 13, remedies that internalise environmental costs and incentivise low-carbon substitution contribute to mitigation governance by shaping behavioural incentives and compliance expectations. The analysed cases suggest that courts increasingly legitimise climate-orientated administrative priorities and may promote innovation through remedies that are not purely compensatory but also restorative and transition-enabling (e.g., infrastructure commitments). Nevertheless, reliance on flexible interpretation cannot fully substitute for statutory clarity on duties, liabilities, monitoring standards, and proportional remedies.

Wang et al. (2024) investigated the synergistic effect of low-carbon city pilot policies on reducing air pollution and CO₂ emissions in China. The authors found symbiotic agglomerations of carbon emissions and air pollution, which confirm the successful reduction of CO₂, SO₂ and PM_{2.5} concentrations in low-carbon cities. However, they also noted that the effectiveness of these policies varies across regions, with stronger impacts in central and western cities. The main policy transmission mechanisms included reductions in overall energy consumption, industrial restructuring, and improvements in urban transport. This study focuses on the governance of the Chinese energy sector in the context of the transition to a low-carbon economy, analysing the legislative and judicial mechanisms that can facilitate this transition. While the authors addressed the specific outcomes of pilot policies at the local level, this study emphasised national legislative reforms and their role in reducing emissions. The study found that while regional initiatives are effective, they need to be complemented by national legal changes that create a favourable environment for further deployment of low-carbon technologies. The need to strengthen the legal framework and institutional support to achieve emission reduction targets across the country was emphasised.

Public policy and market conditions in the deployment of low-carbon technologies have been considered by Shahzad and Cheema (2024). The authors concluded that although hybrid cars, battery electric vehicles, and fuel cell

electric vehicles have the potential to reduce carbon emissions, each of these technologies has its advantages and disadvantages. In addition, government support is critical to driving the adoption of low-carbon vehicles. This includes financial incentives, the development of the necessary infrastructure (e.g., charging stations for electric vehicles), and legislative initiatives that facilitate the transition to greener vehicles. Skidmore and Girling (2024) share a similar opinion. The authors emphasised that the decarbonisation of industrial sectors is critical to achieving net zero emissions. The authors also emphasised the importance of sustained political support and the development of innovative strategies to achieve the UK's net zero goals by 2050. This topic was also covered by Morganti et al. (2024).

The authors concluded that low-carbon fuels have significant potential to reduce greenhouse gas emissions in the transport sector, but their implementation depends on many factors, including the need to adapt infrastructure and vehicles. This study, in contrast to the work of the above-mentioned authors, addressed the management of the Chinese energy sector in the context of the transition to a low-carbon economy. While the authors focus on the technological and market aspects of decarbonisation in the automotive industry, this study focuses on the legislative and legal measures that stimulate the use of renewable energy in China. This study shows that some low-carbon fuels have minor barriers to widespread adoption, while others require more significant changes to achieve a significant level of decarbonisation.

In conclusion, the study highlights that a comprehensive approach, including infrastructure upgrades, vehicle adaptation and alignment with environmental standards, is required for the successful introduction of low-carbon fuels. Strengthening the legal framework and institutional arrangements is key to supporting long-term change in the energy sector and achieving climate goals. Accordingly, strengthening the legal framework is not only a sectoral reform but also an SDG implementation strategy. Clarifying enforceable grid obligations, defining proportional liability for renewable curtailment, and establishing transparent rules for subsidy adjustment would strengthen SDG 7 delivery by improving system reliability and investment certainty. In parallel, embedding climate mitigation duties into binding energy legislation, strengthening MRV (monitoring, reporting, verification) linkages for emissions governance, and formalising judicial standards for climate-related harm would reinforce SDG 13 implementation by improving accountability and measurability of mitigation action.

5. Conclusions

A study of China's energy sector governance in the context of a low-carbon transition indicates that sustainable development performance depends on the alignment between policy ambition, legislative clarity, and enforceable judicial practice. The analysis identified legislative gaps – most notably the absence of a comprehensive Energy Law and the coexistence of partially inconsistent norms – that reduce regulatory predictability and complicate adjudication in energy and climate disputes. At the same time, judicial practice is becoming more consequential for the operationalisation of the transition: courts increasingly interpret legal duties and craft remedies in ways that support renewable integration, industrial upgrading, and climate-orientated policy priorities.

From the perspective of SDG 7 (Affordable and Clean Energy), the findings suggest that rapid renewable capacity expansion and grid modernisation are necessary but not sufficient: statutory specificity is required to stabilise market expectations, secure priority access and purchase obligations, and ensure proportionate liabilities and remedies when renewable integration is constrained. From the perspective of SDG 13 (Climate Action), the results indicate that climate governance would benefit from more explicit binding mechanisms that translate mitigation goals into enforceable obligations, supported by clearer standards for monitoring, reporting, verification, and judicial remedies in carbon- and climate-related disputes.

The study therefore concludes that China's low-carbon transition requires coordinated action by the legislature, executive agencies, and judiciary to strengthen legal certainty while maintaining system reliability. A key limitation is that policy and regulatory instruments evolve rapidly, which may affect the stability of specific findings over time. In addition, the analysis was based on accessible precedents and policy documents; the available set of publicly documented cases remains limited, which constrains generalisations across the entire energy sector. Future research should broaden the empirical base of judicial decisions, track longitudinal changes in adjudicatory standards, and evaluate how specific legal reforms measurably affect SDG-linked indicators such as renewable curtailment, investment stability, and emissions intensity trajectories.

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