

Research on the improvement of the legal system for the photovoltaic power generation industry under the "dual carbon" goals

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Abstract. In recent years, China has vigorously implemented renewable energy substitution initiatives in order to achieve its "dual carbon" goals. As a key component in the development of renewable energy, Photovoltaic (PV) power generation is characterized by its strong low-carbon attributes, making it a crucial force in the adjustment of the energy structure. Therefore, it is necessary to improve the relevant legal framework to promote the development of photovoltaic power generation and provide essential institutional safeguards for the realization of the "dual carbon" objectives. At present, China's legal system governing the photovoltaic industry suffers from a relatively low legislative hierarchy and lagging supporting mechanisms. In the future, consideration should be given to enacting a specialized law tailored specifically to the photovoltaic sector, while improving supporting institutional arrangements such as the renewable energy consumption guarantee mechanism and the green electricity certificate trading system.

Keywords: "Dual Carbon" Goals, photovoltaic power generation industry, legal system

1. Introduction

In September 2020, the Chinese government put forward at the 75th session of the United Nations General Assembly the goals of peaking carbon emissions by 2030 and achieving carbon neutrality by 2060. Subsequently, the Chinese government has formulated a series of policy documents to operationalize these objectives and has incorporated them into its national development strategy. According to the *Action Plan for Carbon Dioxide Peaking Before 2030*, energy not only plays a fundamental role in economic development but is also a major source of carbon emissions. Therefore, under the premise of ensuring secure and orderly carbon reduction, China should promote the substitution of renewable energy and optimize its energy structure and energy system.

As a key sector in the development of renewable energy, the photovoltaic power generation industry can provide essential institutional support for achieving the "dual carbon" goals through the improvement of its legal framework, thereby facilitating the advancement of PV power development.

2. Promoting photovoltaic power generation as an essential safeguard for achieving the "dual carbon" goals

2.1. The connotation and development path of the "dual carbon" goals

According to relevant materials of the Intergovernmental Panel on Climate Change (IPCC), the two core concepts of "carbon peaking" and "carbon neutrality" can be understood as follows: "carbon peaking" refers to the point at which a country or region's carbon dioxide emissions reach their historical maximum and subsequently begin to decline, signifying that economic development is no longer dependent on continuous growth in carbon emissions. "Carbon neutrality," by contrast, refers to a state in which, over a specific period of time, carbon dioxide generated by human activities is offset through measures such as afforestation and energy conservation, thereby achieving net-zero carbon emissions for society as a whole.

To achieve the "dual carbon" goals, China should adhere to a development path centered on carbon reduction. Given the inherent limitations of natural forest carbon sinks and other ecological conservation measures in achieving carbon neutrality, as well as the high costs associated with Carbon Capture, Utilization, and Storage (CCUS) technologies, the primary task at present remains the reduction of greenhouse gas emissions [1]. According to the *14th Five-Year Plan for a Modern Energy System*, during the "13th Five-Year Plan" period, coal accounted for 56.8% of total energy consumption, while non-fossil energy accounted for 15.9%. Although the energy structure has been continuously optimized and is undergoing a low-carbon transition, China's energy consumption pattern remains fundamentally "coal-dominated," exhibiting a pronounced high-carbon characteristic.

2.2. The superior value of photovoltaic power generation under the "dual carbon" goals

According to the *14th Five-Year Plan for a Modern Energy System*, China should not only implement renewable energy substitution initiatives and build a new-type power system, but also promote the optimized integration of coal and renewable energy as a key development direction.

Photovoltaic (PV) power generation refers to a technology that converts solar energy into electrical energy through the photovoltaic effect, representing a clean and non-polluting method of electricity generation [2]. Due to its high output efficiency, energy-saving characteristics, environmental friendliness, and technological advancement, PV power generation has become a major driving force in the reform of the power system. Compared with traditional thermal power and hydropower, solar energy used in PV generation is widely distributed and abundant, offering high energy output with relatively low resource consumption. Moreover, PV power generation is clean and pollution-free, aligning closely with environmental protection objectives. As an industry developed based on the photoelectric effect of semiconductor interfaces, technological innovation inevitably plays a decisive role in the advancement of the photovoltaic sector [3].

3. Existing problems in China's legal system for the photovoltaic power generation industry

3.1. Low hierarchy of legislation

In terms of Photovoltaic (PV) legislation in China, the leading law is the *Renewable Energy Law of the People's Republic of China* (hereinafter referred to as the "Renewable Energy Law"), revised on December 26, 2009. China's legal framework for the photovoltaic industry—composed of the *Renewable Energy Law*,

supporting administrative regulations, departmental rules, and other normative documents—constitutes the basic institutional structure governing the operation and development of the PV industry [4].

Within the *Renewable Energy Law*, which serves as the fundamental statute for the renewable energy sector, provisions specifically addressing the photovoltaic industry are relatively limited. The core provision is Article 17, which stipulates that "the State encourages units and individuals to install and use solar energy utilization systems such as solar water heating systems, solar space heating and cooling systems, and solar photovoltaic power generation systems," among other relevant provisions.

From the perspective of supporting regulatory rules governing the PV industry, the overall legislative hierarchy remains relatively low. These detailed rules are primarily formulated and issued by departments such as the National Energy Administration and the Ministry of Finance. Although they provide practical guidance for implementation, their legal authority is limited and their binding force remains relatively weak. In addition, local regulations formulated by subnational governments, due to the absence of higher-level legislative guidance, often struggle to effectively consolidate and systematize prior regulatory experience [5].

3.2. Lagging supporting institutional arrangements

Due to the absence of a unified statute covering the entire upstream, midstream, and downstream photovoltaic industrial chain, existing supporting institutions governing different stages of the PV power system lack both independence and adaptability, and are generally applicable to all forms of renewable energy rather than specifically tailored to photovoltaics. According to Articles 7, 14, 19, 20, and 24–26 of the *Renewable Energy Law*, China's core legal mechanisms for PV development include the total quantity target system, the full guaranteed purchase system, the feed-in tariff system, the cost-sharing mechanism, and economic incentive mechanisms.

However, at present, the *Renewable Energy Law* has become significantly misaligned with the requirements of the "dual carbon" goals and can no longer adequately meet the future development needs of China's renewable energy sector. Accordingly, the photovoltaic legal system constructed on this basis also requires substantial revision and improvement.

On the one hand, China's photovoltaic industry has achieved a significant increase in competitiveness and has entered a stage of large-scale supply. The subsidy-protection approach embedded in the *Renewable Energy Law*, which aims to shield the industry and avoid market competition, is no longer consistent with the logic of a market-oriented economy [6]. In 2023, China accounted for more than 80% of global photovoltaic module production [7]. Over the past decade, the unit cost of PV power generation projects has declined by as much as 70% per kilowatt installed capacity [8].

On the other hand, the PV legal framework built upon the *Renewable Energy Law* has lagged behind reforms in the electricity sector. According to the *Guiding Opinions on Improving the Management of Photovoltaic Power Generation Scale and Implementing Competitive Allocation of Projects* (Fa Gai Energy [2016] No. 1163) jointly issued by the National Development and Reform Commission and the National Energy Administration, China began implementing a competitive allocation mechanism for photovoltaic power generation projects in 2016. Furthermore, the *Notice on Relevant Matters Concerning the 2021 New Energy Feed-in Tariff Policy* (Fa Gai Price [2021] No. 833) explicitly provides that "for newly filed centralized photovoltaic power stations, commercial and industrial distributed photovoltaic projects, and newly approved onshore wind power projects in 2021, central government subsidies will no longer be granted, and grid parity will be implemented."

As photovoltaic feed-in tariffs are rapidly moving toward subsidy-free grid parity, corresponding institutional arrangements—such as the full guaranteed purchase system, the feed-in tariff mechanism, and the

cost-sharing system—must be revised accordingly.

4. Pathways for improving the legal system of the photovoltaic power generation industry under the "dual carbon" goals

4.1. Enacting specialized legislation

Although the Standing Committee of the 14th National People's Congress released its legislative plan in September 2023, listing the *Renewable Energy Law* (amendment) as a Category I priority project, and although the future basic law for the photovoltaic industry will become more aligned with the energy transition under the "dual carbon" goals, reliance solely on the *Renewable Energy Law* remains insufficient to provide precise and effective legal safeguards for the photovoltaic sector.

At present, China's administrative regulations and departmental rules governing the photovoltaic industry remain relatively low in legislative hierarchy, while local legislation is fragmented, which is not conducive to the overall unified planning of the industry. Therefore, the formulation of specialized photovoltaic industry legislation and corresponding implementation rules would better reflect China's practical needs and help reduce the phenomenon of "curtailed solar power" (PV curtailment) [9]. In other words, from a long-term perspective, China should design a dedicated photovoltaic law that integrates relevant provisions from national economic and social development plans, aligns the "dual carbon" objectives with photovoltaic development strategies, clarifies the characteristics of solar energy resources, promotes sustained growth in solar power generation, and advances renewable energy substitution.

4.2. Improving supporting institutional arrangements

In the early stage of China's renewable energy development, the industry was relatively weak and the market conditions for implementing a quota system were not yet mature; accordingly, the *Renewable Energy Law* adopted a feed-in tariff system as its core institutional arrangement [10]. Under the advancement of the "dual carbon" goals, mechanisms such as the renewable energy consumption guarantee system and the green electricity certificate trading system should be incorporated as core components of the *Renewable Energy Law* as soon as possible.

The *Energy Law of the People's Republic of China* (effective January 1, 2025) provides a solid legal foundation for the development of photovoltaic and other new energy industries. Articles 23 and 34 establish China's renewable energy consumption guarantee mechanism and green electricity certificate system (hereinafter referred to as the "Green Certificate System"). According to Article 23, power supply enterprises, electricity sales companies, relevant electricity users, and enterprises using self-generation power plants are all obligated entities under the consumption guarantee mechanism. According to Article 3 of the *Rules for the Issuance and Trading of Renewable Energy Green Electricity Certificates* (Guo Neng Fa Xin Neng Gui [2024] No. 67), green electricity certificates constitute the sole proof of the environmental attributes of renewable energy electricity in China and serve as the exclusive certification for the production and consumption of renewable electricity.

Against the backdrop of advancing the "dual carbon" strategy, China should prioritize improving the quota system and the green certificate system. These two mechanisms not only generate dual benefits in promoting photovoltaic development and carbon reduction, but also help alleviate issues related to revenue insecurity in renewable energy generation caused by the increasing number of grid-parity renewable energy projects and delays in subsidy payments [11].

At present, China's green certificate trading system is still undergoing continuous development. Its foundational mechanism—the renewable energy quota system—faces challenges such as inconsistent regulatory frameworks and the absence of clearly defined legal liabilities. Meanwhile, the green certificate system itself also suffers from ambiguities in legal nature, limited functional realization, an underdeveloped regulatory framework, and the need for improved market trading rules. These issues collectively hinder the effective operation of the system [12].

In the future, China may further optimize and systematically construct the renewable energy consumption guarantee mechanism by continuously promoting a "quota system + green certificates" development model, and by clarifying in law the binding force of quotas so as to strengthen stakeholders' awareness of compliance responsibilities in the photovoltaic industry. At the same time, it is necessary to further explore the linkage between the green certificate system and other related mechanisms, ensuring more precise trading rules for green certificates, so as to facilitate their integration with carbon emission permit markets and other related systems, thereby providing institutional support for the realization of the "dual carbon" goals.

5. Conclusion

To achieve China's "dual carbon" goals, it is essential to adhere to a development pathway centered on carbon reduction. Photovoltaic (PV) power generation, with its outstanding low-carbon attributes, constitutes a necessary safeguard for the realization of these goals. Against the backdrop of ongoing reforms in energy pricing mechanisms and the power sector, the *Renewable Energy Law* has become increasingly misaligned with the requirements of these systemic transformations. Consequently, the legal framework governing the photovoltaic power generation industry—constructed on the basis of this law—urgently requires revision and improvement. Not only is it necessary at the macro level to enact a dedicated law tailored specifically to the photovoltaic industry, but at the level of concrete institutional design, China should also prioritize the establishment of a quota-based system as the core mechanism. On this basis, supporting arrangements such as the green electricity certificate system should be further refined, and the renewable energy consumption guarantee mechanism should be systematically developed and improved.

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