

# The Market Mechanism and Issues of China's Clean Energy Consumption Policies

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DOI: [10.36347/sjebm.2023.v10i11.003](https://doi.org/10.36347/sjebm.2023.v10i11.003)

| Received: 07.11.2023 | Accepted: 16.12.2023 | Published: 20.12.2023

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## Abstract

## Review Article

Under the dual-carbon goals, since the 18th National Congress of the Communist Party of China, various regions and relevant departments have, based on the new development stage and the implementation of the new development concept, formulated a series of policies and measures related to energy, green, and low-carbon development. These policies include carbon trading, mechanisms to ensure the absorption of renewable energy, and mechanisms for trading green electricity. The focus has been on establishing a clean and low-carbon new power system. Against this backdrop, this article, starting from the national context, meticulously reviews the policy development process and current status of carbon trading, the absorption of renewable energy (green certificates), and green power trading. It also analyzes and introduces the operational mechanisms of clean energy absorption policies from the perspectives of market entities, transaction methods, and supporting measures. The study identifies issues in the development of carbon trading, green certificate trading, and green power trading, as well as the challenges arising from the integration of different clean energy policies. Based on these findings, specific development recommendations are proposed to clarify the operational mechanisms of typical clean energy absorption policies. This is aimed at assisting various entities involved in energy consumption to better fulfill their carbon reduction tasks.

**Keywords:** National Carbon Market; Renewable Energy Consumption Guarantee Mechanism; Green Power Trading; Green Certificate Trading; Clean Policy Coupling.

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## 1. INTRODUCTION

In 2020, China set forth goals for peak carbon emissions and carbon neutrality. However, the predominant share of electricity traded in the country's power market still comes from coal, and clean energy generation has not been fully absorbed. **Error! Reference source not found.** In response, China has introduced various incentives for clean energy absorption to achieve carbon reduction objectives. However, the specific implementation details of these policies are intricate, and the coupling effects between different policies are not sufficiently clear. This complexity makes it challenging for entities involved in energy consumption to understand the specific operational mechanisms of various clean energy absorption policies, thereby causing their ability to meet carbon reduction requirements. Therefore, there is an urgent need to conduct research on the market operation mechanisms and issues of typical clean energy absorption policies in China.

In this context, this paper first integrates and organizes the existing typical clean energy absorption policies, clarifying the current development status of these policies. Building upon this foundation, the paper further provides a detailed analysis of the operational mechanisms of each clean energy absorption policy. Through this analysis, the paper identifies current issues in the policy implementation and proposes relevant recommendations to theoretically support the further application and implementation of clean energy absorption policies in China.

## 2. Typical clean energy absorption policy development status

### 2.1 Carbon emission trading policy

Since 2013, China has gradually initiated eight carbon trading pilots, and by the end of 2017, the overall design of the national carbon market was completed. The construction of the carbon market has focused on the power generation industry and steadily progressed. In July 2021, the national carbon market officially started trading online. Currently, it is expected that the pilot

carbon markets will continue to operate concurrently with the national carbon market for some time and gradually transition smoothly to the national carbon market.

In general, since the launch of the national carbon market, China has issued numerous supportive policies. Key policy highlights are summarized in Figure 1:

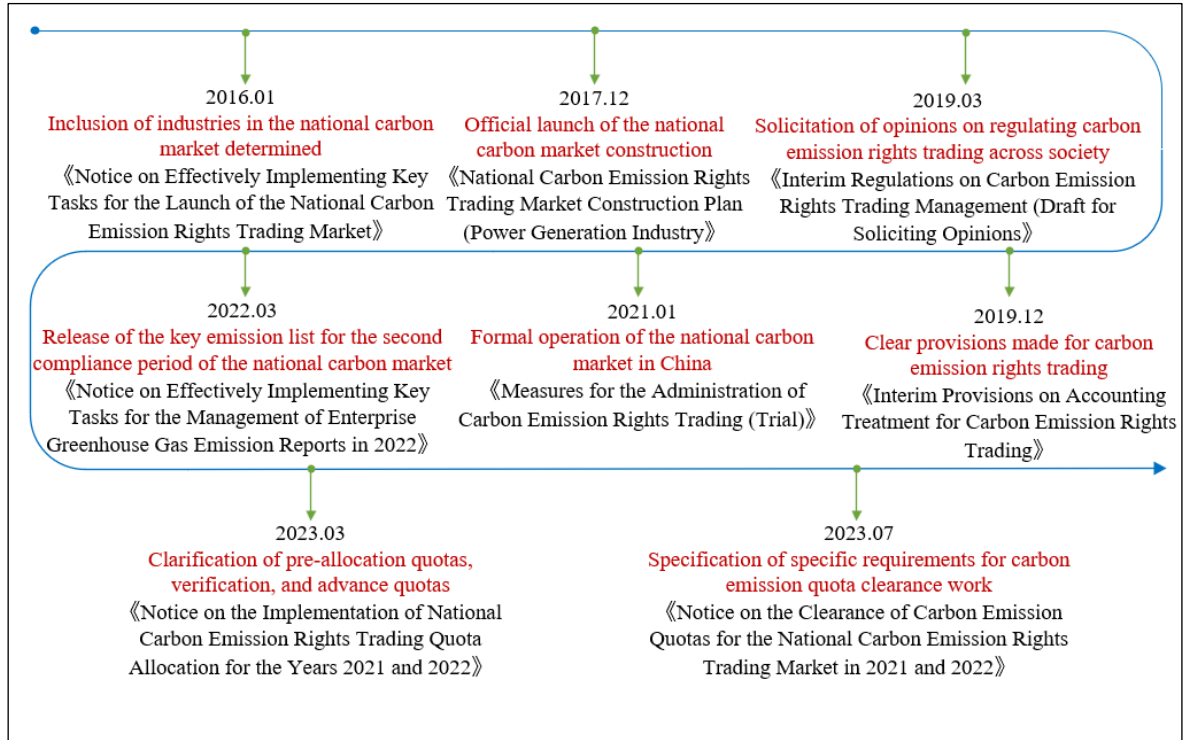
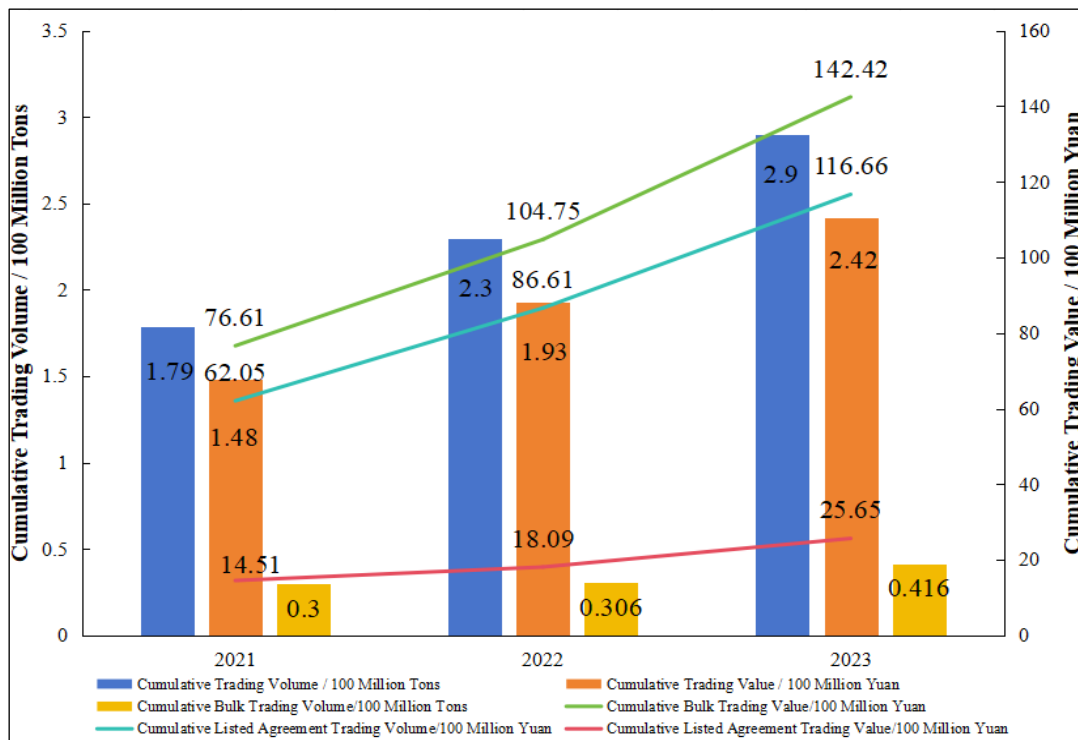


Figure 1: Key policy highlights of the national carbon market

Specifically, the trade situation of the national carbon market since its launch in 2021 until September 30, 2023, is illustrated in Figure 2.

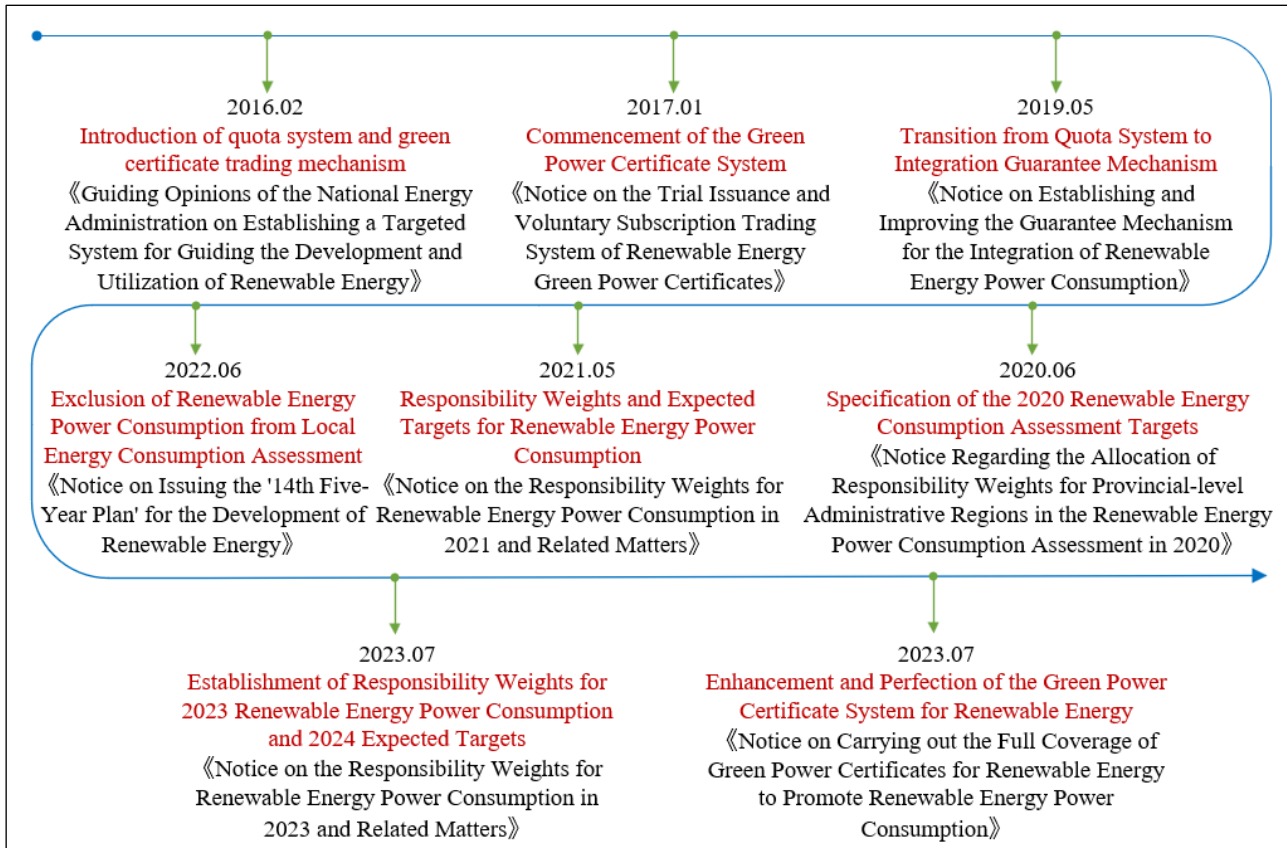


**Figure 2: Data for various types of transactions from 2021 to 2023 (statistics until September 30, 2023)**

**2.2 Renewable energy power consumption policy (including green certificates)**

In 2017, China officially implemented the green certificate trading mechanism. The core of the "grid parity + green certificate" system is to replace the renewable energy electricity price surcharge with green certificates 2]. In 2019, the mechanism for ensuring the

consumption of renewable energy electricity was officially implemented. It serves as a crucial institutional guarantee for achieving "grid parity + green certificate". The summary of important policies related to the mechanism for ensuring the consumption of renewable energy electricity and the green certificate system since its implementation is shown in Figure 3.

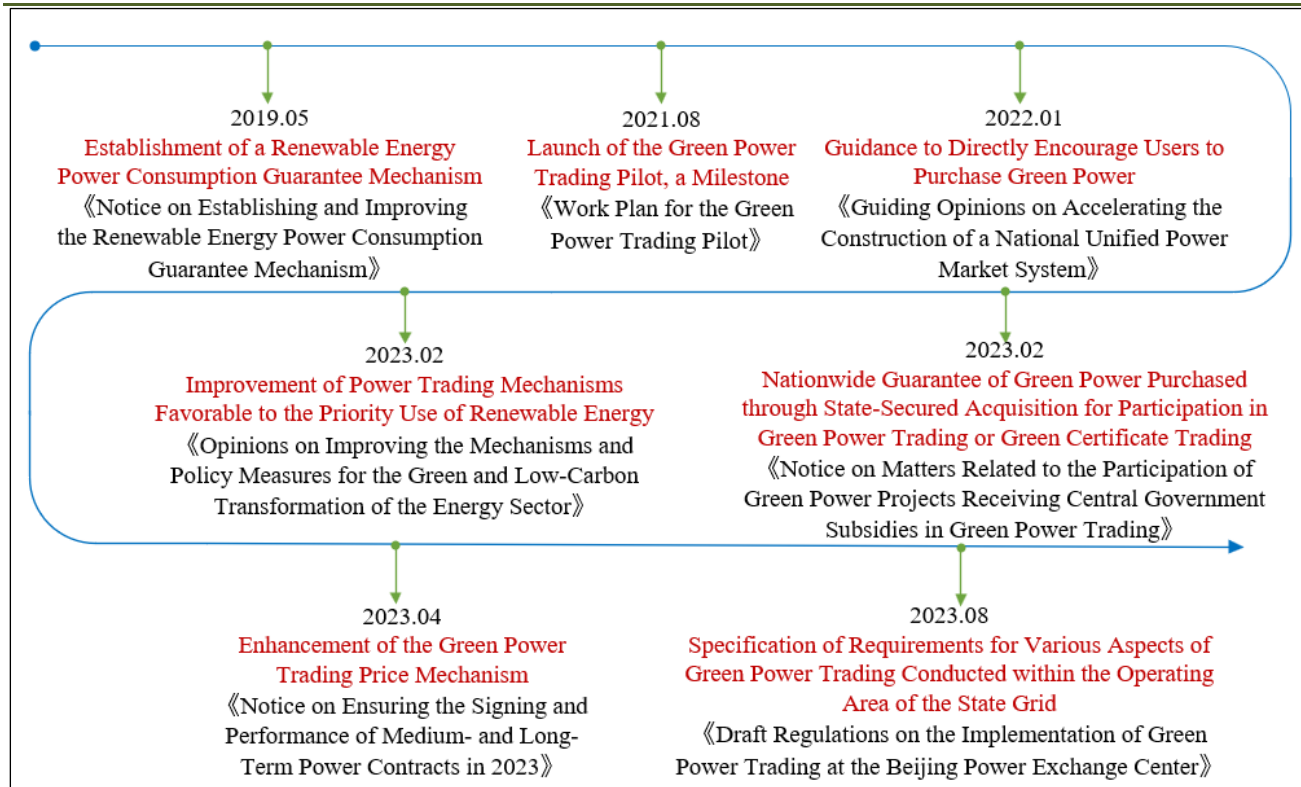


**Figure 3: Summary of important policies for the consumption of renewable energy electricity**

According to the renewable energy consumption data released by the National Energy Administration since 2019, it can be concluded that provinces with relatively high consumption of renewable energy are mainly located in coastal areas, such as Shandong, Jiangsu, Zhejiang, Guangdong, as well as in provinces like Sichuan and Yunnan.

**2.3 Green power trading policy**

In September 2021, China officially implemented green power trading, which plays a crucial role in further guiding society towards green consumption, accelerating the low-carbon development of the power industry, promoting significant tasks such as China's energy transition, and contributing importantly to the further promotion of renewable energy power consumption. The key policies implemented since the initiation of green power trading in 2021 is summarized in Figure 4.



**Figure 4: Summary of key policies in green power trading**

From the start of the trading pilot in 2021 to the end of 2022, the cumulative traded green power reached 518.66 billion kilowatt-hours nationwide. The trading mainly occurred through bilateral negotiations, and the regional transaction prices of State Grid Corporation were at a premium of 3-5 cents per kilowatt-hour compared to the medium to long-term transaction prices. The Beijing Power Exchange Center has indicated that the green power and certificate trading mechanism will be further improved in 2023, and the scale of transactions is expected to achieve a new breakthrough. It is anticipated that the national green power trading will exceed 500 billion kilowatt-hours in 2023 [3].

### 3. Analysis of market operation mechanisms of typical clean energy consumption policies

#### 3.1 Operation mechanism of carbon trading policy

The essence of carbon trading is to treat carbon emission rights as a commodity, and control and reduce greenhouse gas emissions through market mechanisms. Carbon trading can promote the realization of emission reduction targets, stimulate technological innovation, optimize resource allocation, and increase government tax revenue [4].

With regard to the main participants, the main subjects of national carbon emissions trading include key emission units as well as institutions and individuals that comply with the relevant national trading rules. Among them, the electric power industry is the main carbon

emission sector, and it is stipulated that 26,000 tons of carbon dioxide equivalent, i.e., about 10,000 tons of standard coal in comprehensive energy consumption, shall be taken as the specific standard, and carbon emission verification and list management shall be carried out for the power generation industry (including self-provisioned power plants of other industries) that meets or exceeds this standard in any one year from 2013 to 2019 [5].

In terms of trading types and methods, the carbon trading market is divided into the voluntary emission reduction market and the mandatory emission reduction market. The specific carbon trading mechanism is shown in Figure 5. The mandatory emission reduction market, also known as the quota (CEA) market, is a market in which the government sets a target for the total amount of carbon emissions in a certain space and time and allocates the quotas to market players (the figure takes the power generation industry as an example). In the voluntary emission reduction market, all kinds of market players can trade carbon allowances. If an enterprise is rich in carbon allowances, it can choose to sell its excess allowances. On the contrary, enterprises can choose to reduce emissions on their own, purchase allowances in the market, or offset a certain amount of voluntary emission reductions against the clearance of carbon emission allowances, but it should be noted that the offset ratio shall not exceed 5% of the carbon emission allowances to be cleared.

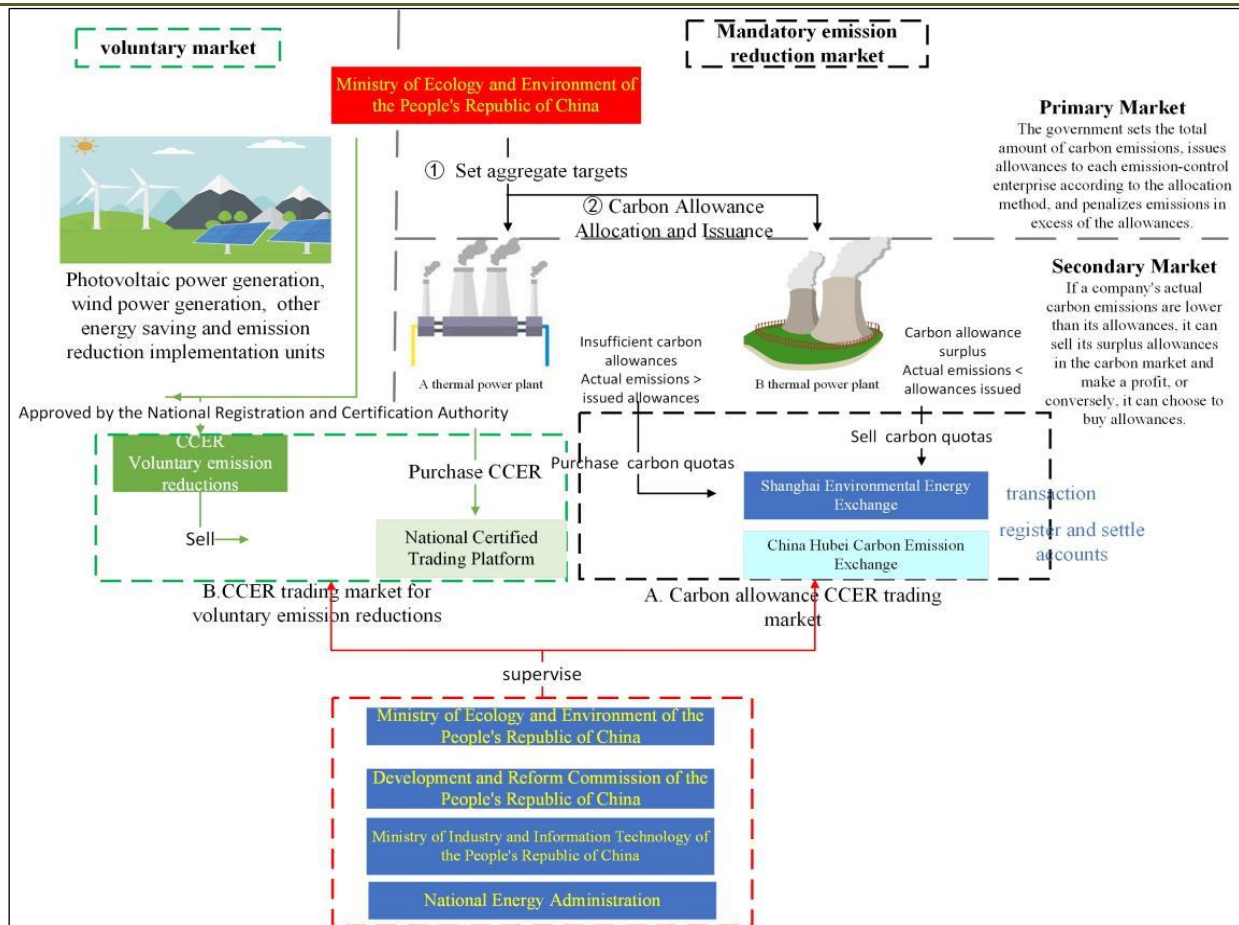


Figure 5: Carbon trading mechanism

With regard to quota management, the management of quotas involves the setting of the total amount and the allocation of quotas. The total amount of China's quotas is set using a bottom-up method of total quota sums for provincial administrative regions. In terms of allocation, the national carbon market currently implements free allocation and utilizes the baseline method on this basis. In the process of implementing the quota work, in order to promote the effective operation of all aspects of the work, China has formulated corresponding supervision and penalty measures, namely the MRV (Measurement, Reporting and Verification) mechanism [5].

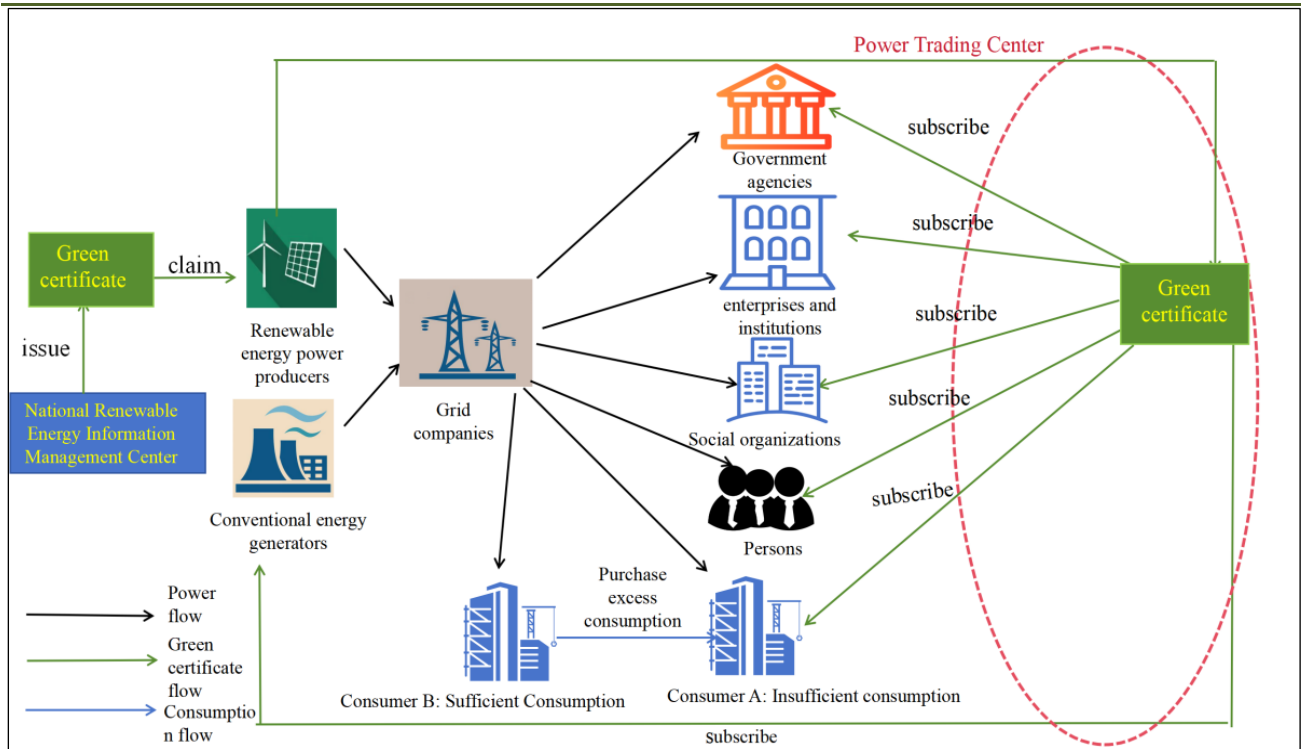
### 3.2 Operation mechanism of the guarantee mechanism for the consumption of renewable electricity

In the face of China's waste of renewable resources, the implementation of renewable energy power consumption guarantee mechanism can prompt the provincial regions to prioritize the consumption of renewable energy so as to reduce the waste of resources, at the same time, make all kinds of main body equitably assume the responsibility of consumption.

There are two main categories of entities that bear the responsibility for consumption in the market.

The first category consists of various types of power grid enterprises, independent power sales companies, and power distribution companies that can directly supply and sell electricity to power users. The second category includes power users who purchase power through the wholesale power market and enterprises with their own power plants, which can choose their own sources of power consumption and take the initiative to fulfill their consumption responsibilities.

In terms of the way in which the relevant entities accomplish the amount of renewable energy electricity consumption, there are two ways: direct consumption of electricity and indirect purchase of equivalents. Direct consumption of electricity as the main way refers to the direct purchase or self-generation and self-consumption of renewable energy electricity by users, and finally the amount of consumption is counted according to the actual purchase and self-generation and self-consumption. Indirect purchase of equivalents is mainly through the purchase of excess consumption and green certificates of other market players, and the electricity corresponding to the excess consumption or green certificates after the transaction is credited to the consumption of the purchaser [6]. The specific trading mechanism is shown in Figure 6.



**Figure 6: Excess consumption trading mechanism**

In terms of the reward and punishment mechanism, it is divided into two levels: national and provincial. The national level publishes an annual monitoring report as the basis for the assessment, and the provincial energy authorities carry out the assessment and supervise the rectification of non-compliant subjects [6].

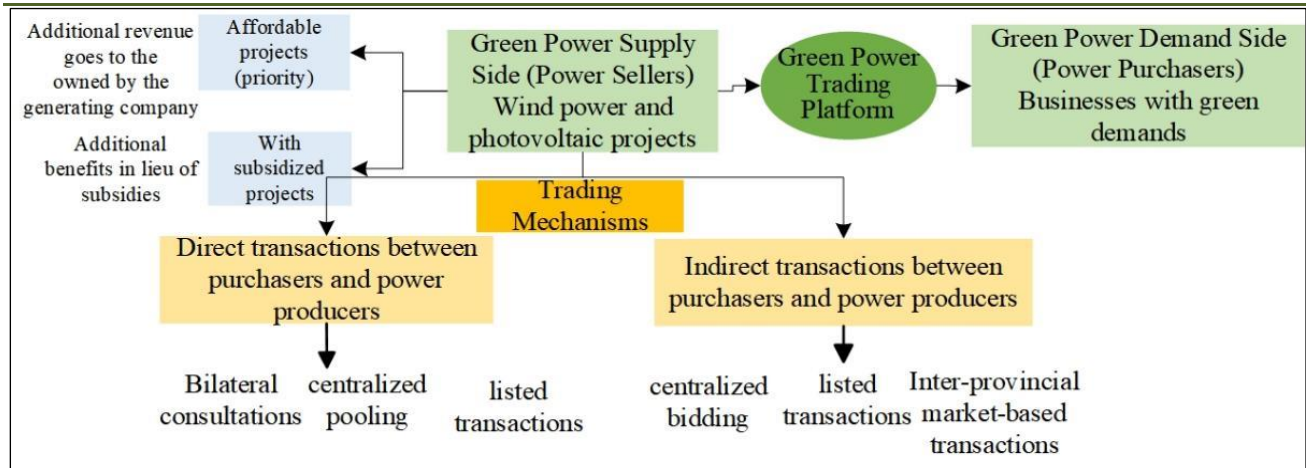
### 3.3 Operation mechanism of green power trading policy

Green power trading specifically refers to medium- and long-term trading of electricity with green power products as the underlying. The transaction is compatible with the needs of power users to purchase and consume green power, and promotes the development of green energy.

The forms of green power trading can be categorized into two. The first is the direct purchase of green power products from power generation enterprises by power users (including power-selling companies) through bilateral negotiation, centralized aggregation, listed trading and other means. The second is that provincial power grid enterprises and power users purchase the green power they guarantee to acquire from

power grid enterprises by means of centralized bidding and listed trading.

In terms of price formation, under the bilateral negotiation trading method, the buyer and seller determine the overall price of the green power transaction through negotiation, and specify the price of electric energy and the environmental value of green power respectively. Under the listed trading mode, the listed party determines the overall price of the green power transaction, and the delisted party delisting is equivalent to accepting the overall price of the green power transaction as well as its electric energy and green power environmental value components. Under the centralized bidding trading method, market participants declare the overall price of the green power transaction, and according to the overall price offer summary legal clearing, the average value of the offer of the purchasing and selling parties to form the overall transaction price of each trading pair, and then finally the overall transaction price will be decomposed to form the price of electric energy and the environmental value of green power [7]. The specific mechanism for market players to participate in green power trading is shown in Figure 7.



**Figure 7: Green electricity trading mechanism**

#### 4. Problem analysis and policy recommendations

Overall, the current implementation of various clean energy consumption policies still faces certain challenges, with a focus on the following four points. First, the nationwide carbon market lacks liquidity, and the carbon trading industry ecosystem is weak; the mechanism for carbon price formation and stability needs improvement. Second, there is significant pressure on the integration and consumption of new energy sources, and traditional power systems cannot meet the requirements for the large-scale and high-proportion development of new energy sources. Third, the consumption system of the green power market and the green power trading mechanism between provinces still need improvement. Fourth, the design of coupling mechanisms between various clean energy consumption policies needs further refinement, and the synergies of multiple policies require more detailed exploration.

To address these issues, the following four policy recommendations are proposed. First, emphasize top-level design; the total carbon quota should reflect both total carbon emissions and intensity dual-control targets. Gradually expand the coverage of the carbon market, optimize quota allocation methods, implement quota auction mechanisms, and enhance the liquidity of the carbon market. Second, improve the accuracy of renewable energy generation forecasts to optimize scheduling processes. Focus on the development of energy storage technologies to smooth load curves and reduce peak-to-valley differences, thereby enhancing the grid's capacity to consume renewable energy and ensuring flexible and stable grid operation. Third, focus on developing cross-provincial and cross-regional green power trading, facilitating transactions and power transmission between regions abundant in green energy resources and those with high power demand. Improve the construction of peak load and frequency regulation auxiliary service markets, gradually expand the scope of green power trading, and explore and establish a comprehensive cross-regional green power trading system to effectively coordinate the attraction of green

power from nearby sources to the market and the operation of cross-regional green power trading systems. Fourth, emphasize the driving effect of local governments on the gradual integration of green power, green certificates, and carbon trading. Actively explore innovative models and propose new solutions for market cooperation and development. Actively explore relevant aspects of electricity pricing composition, metering standards, etc., to prevent the electricity industry from duplicating environmental protection fees. Emphasize the coordinated and synergistic effects of different clean energy policies, jointly promoting the achievement of dual carbon goals.

#### 5. CONCLUSION AND OUTLOOK

Under the impetus of the "dual-carbon" goal, the promulgation of various clean energy policies has provided policy safeguards and guidance for the development and operation of carbon trading, renewable energy consumption (green certificates) and green power trading, and certain progress has been made. However, due to the late start of China's various markets, the current development also exists in the trading varieties and trading organization and other content to be improved, the lack of in-depth coupling synergies between the mechanisms and other issues. In the future, the power market, carbon market and the green certificate under the quota system, excess consumption market can be improved under the premise of their own market operation to strengthen synergistic operation and improve market efficiency. Each market can achieve the carbon emission reduction target through integrated optimization [8].

#### REFERENCE

1. Chuang, L., Fengting, L., Qin, C., & Xinghao, W. (2021). A new model of multilateral power generation rights trading considering clean energy consumption [J]. *Electric Power Automation Equipment*, 41(01), 92-98.
2. Dai, H. (2022). A Review of New Energy Power Generation Price Subsidy Policies and Suggestions for

- r Improving the Incentive Mechanism [J]. *Price Theory and Practice*, (03), 22-25.
3. Polaris Solar PV Network. Beijing Power Exchange : China's Green Power Market Construction Practice and Related Thoughts. [A/OL].(2021-09-03)[2023-10-19]. <https://huanbao.bjx.com.cn/news/20210903/1174562.shtml>.
  4. Wen, M. (2023). Current Situation and Development Trend of China's Carbon Trading Market [J]. *China Money Market*, (04), 71-75.
  5. PRC National Development and Reform Commission. Circular on the Issuance of the National Carbon Emission Trading Market Construction Program (Power Generation Sector) [R/OL]. (2019-05-10) [2023-10-19]. [https://www.gov.cn/zhengce/zhengceku/2019-09/25/content\\_5432993.htm](https://www.gov.cn/zhengce/zhengceku/2019-09/25/content_5432993.htm).
  6. PRC National Development and Reform Commission National Energy Administration. Global wind report 2017 Notice on the Establishment and Improvement of Renewable Energy Power Consumption Guarantee Mechanisms [R/OL]. (2019-05-10)[2023-10-19]. [https://www.gov.cn/zhengce/zhengceku/2019-09/25/content\\_5432993.htm](https://www.gov.cn/zhengce/zhengceku/2019-09/25/content_5432993.htm).
  7. Cheng, X., & Zhang, C. (2023). Problems, Challenges and Prospects of Green Power Trading in China [J]. *China Power Enterprise Management*, (16), 70-72.
  8. Ma, L. (2023). Synergistic Development of Electricity and Carbon Markets Helps Realize Carbon Emission "Double Control" Targets [J]. *China Power Enterprise Management*, (22), 50-53.