Research on US Green Certificate Trading Mechanism Experience and Domestic Implementation Prospects

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Abstract. The green certificate represents the non-energy benefits of green power, namely, the social marginal benefits of green energy such as fossil energy substitution and environmental protection. Starting from the study of the US green certificate trading mechanism, this paper sorts out the types of green certificate market and transactions, the regulatory system and policy benefits, and compares the situations in China, aiming to propose three major issues needed to be clarified as well as summarizing the experience and problems of of building a green certificate trading market in the United States.

1. Introduction

Under the general trend of global energy structure transformation, many countries have embarked on the road of 'renewable energy quota & green certificate system'. In 2017, the National Development and Reform Commission issued the 'Notice on the Trial Implementation of the Green Power Certificate for Voluntary Energy and the Voluntary Subscription System'. The 'Notice' stipulates that the green certificate will be used for voluntary subscription, and its price shall be determined by the buyer and the seller either by self-negotiation or through bidding. Once the green certificate is sold, the related electricity will no longer be subsidized [1].

For the research on the green certificate trading market, the focus of domestic and foreign scholars are different. In view of the fact that foreign countries have begun to implement the renewable energy quota system for many years, foreign scholars have paid more attention to the details encountered in the implementation of the green certificate trading system, such as transaction costs, cost effectiveness and risks[2-4]. The construction of renewable energy quota system in domestic is still in infancy. Therefore, compared with foreign research, domestic scholars focus more on the design and construction of the system, the main factors that should be considered in the implementation process, and certificate pricing mechanism,etc[5-8]. In addition, it is a simulation study of the green card trading system. As described in the literature [9] on the basis of analyzing the tradable green certificate system and the carbon emission trading system, a system dynamics model is constructed to explain the mechanism of the two systems, and how they act on the domestic electricity market as well as simulating the policy effect. The research shows that the tradable green certificate system and carbon emission trading system can not only affect the electricity, but also promote the development of power generation industry by setting a reasonable planning targets.

There are still many problems in the development of the domestic green certificate trading mechanism. How to clarify and solve these problems makes senses. First of all, we should understand

the concept and working principle of the mechanism. Next, we will sort out foreign successful experiences and compare the status in domestic. Based on the actual situation of domestic industry development and economic regulation, we will clearly identify the problems to be solved and the solutions. This article elaborates on the above issues with the process experience and lessons learned from the green certificate trading market in US.

2. The Overview of Green Certificate Trading Mechanism

Green certificates represent the environmental value of certified, a specific amount of renewable energy generation [10]. Its trading mechanism mainly includes the following five steps.

(1) Registrar. Renewable energy power generation enterprises are registered with the operation management organization.

(2) Issue. The operation management agency issues a green certificate.

(3) Book-keep. The power generation company will record the certificate in the green certificate account.

(4) Merchandise. The responsible entity purchases a green certificate from the power generation enterprise or the entity with the surplus green certificate to complete the quota target.

(5) Transfer. After the transaction is confirmed, the ownership of the certificate will be transferred from the seller's account to the buyer's account.

The verification and measurement of the responsibility of the quota system (usually the electricity sales company) is realized in the form of a renewable energy certificate. A certain amount of renewable energy is generated correspondingly to generate a certificate and trade between the power generation company and the power sales company. Renewable energy power is consumed by end users, while certificates are retained at the power sales company for verification. Excess certificates that meet the quota requirements can be traded through the grid between the electricity sales companies. Subjects who fail to perform on time are usually fined far above the cost of performance, which provides a strong guarantee for the implementation of the Green Card system. The general green certificate trading system is shown in Figure 1.

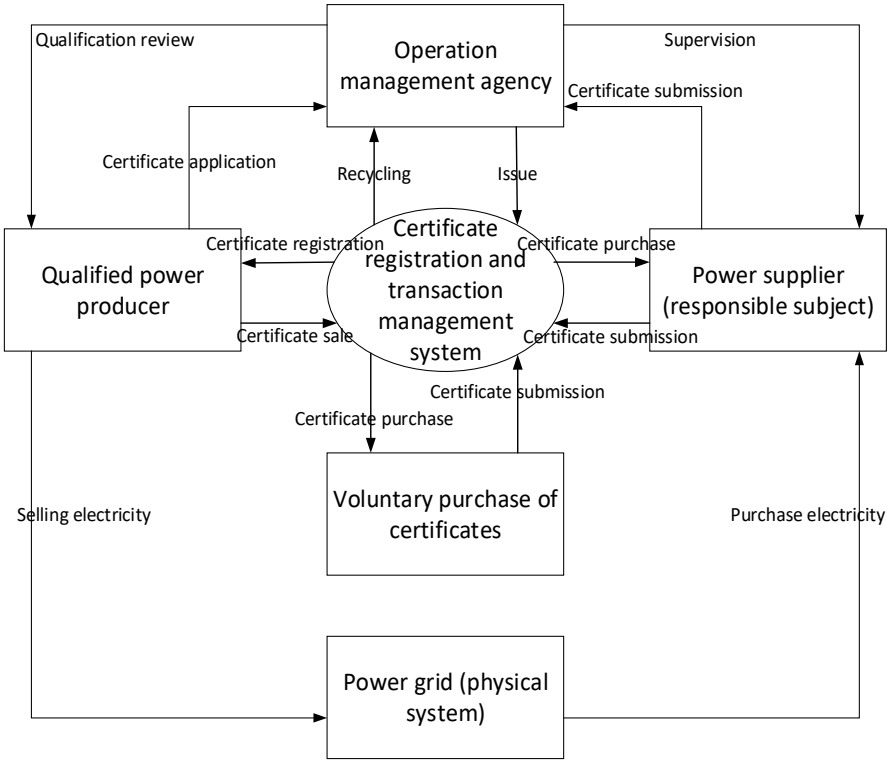

Figure 1.The general green certificate trading system

3. Green Certificate Trading Mechanism in US

3.1. Green certificate market

US renewable energy generation has three parts of revenue: electricity sales, green certificate sales and subsidies. The original intention of designing a green certificate is to help power producers and users connect. Even if power generation and green certificates are not produced at the same time, it can help the two achieve a win-win situation. In the United States, Green Certificates have two distinct markets - compliance markets and voluntary markets. The compliance market was created in accordance with the relevant laws and regulations on renewable energy quota standards, also known as the quota system, which exists in more than 30 states. The voluntary market is a market for consumer users to purchase renewable energy for their own willingness to support renewable energy development.

3.2. Transaction forms

There are two transaction forms in the United States: bundled and boundless. The former is bundled with the renewable energy physical power, which is sold separately from the renewable energy physical power. The advantage of the bundled sale is that the end user also purchases the green certificate while purchasing the power, and the certificate is an invisible product. The retailer does not have to explain its concept to the user. The advantage of boundless sales is that end users can freely purchase green certificates to support the development of renewable energy without having to replace existing retailers. And it can avoid the difficulty of purchasing power in the physical power spot market or the bilateral contract market to eliminate power dispatching. At the same time, the cost of delivering renewable energy power to end users and the risk of purchasing physical power related prices in the spot market can be reduced.

3.3. Regulatory system

If the additional cost of renewable energy generation exceeds the specified threshold, there will be certain penalties. Due to the different resource bases or energy development preferences of different regions, the United States has adopted a certificate multiple method in order to encourage the development and utilization of certain energy sources or to solve the problem of large difference in power generation cost of different resource types. For example, for every 1MWh of electricity purchased, wind power can only be equivalent to one certificate, and solar energy can serve as five certificates. The Green Card will be assigned a unique ID number to ensure that it will not be purchased and sold, and will be tracked by the Regional Tracking System. Most states in the United States that have compliant markets are required to use this third-party tracking system, which is gradually being used by the voluntary market because of its curability.

3.4. Policy benefit

There are 30 states in the United States that implement quota systems. Renewable energy quota standards require power suppliers to have a minimum renewable energy ratio in their retail load. The states have accumulated experience through practice, but the policy design varies widely, and the overall implementation effect is relatively good. After the implementation of the quota system, about 50% of the projects benefited. Most of the electricity suppliers fulfilled their obligations without fines, and the retail electricity price increased by about 2%. In recent years, as the cost of solar energy has continued to decline, the proportion of solar green power that meets the green quota system has also increased significantly. Since 2000, 60% of the green electricity generated in the United States has come from the quota system.

4. Domestic prospects

4.1. The status of green certificate trading mechanism

The green certificate trading mechanism has completed the 'three-step' strategy from concept proposal to design planning to implementation in China, and its future direction has also caused heated discussion in the industry. On June 12, 2017, China's first batch of green power certificates was officially issued, laying the foundation for the implementation of the green card voluntary subscription transaction mechanism. According to the data released by the National Renewable Energy Information Management Center, 20 renewable energy power generation projects totally gained 230,135 green certificates. Although there are still uncertainties about when and how the green certificate system will be put into the next step, the policy is more likely to be officially introduced under the support of the national energy authority. Because it can play a role in reducing the huge gap in renewable energy subsidies and promoting cross-regional consumption of renewable energy.

4.2. Issues about future development

From the development experience of foreign countries domestic actual situation, at least the following two aspects need to be further explored and clarified.

(1) The occasion of the implementing the green certificate transactions. For China, the government's willingness to establish a market-oriented renewable energy development mechanism and introduce a green certificate system is strong. However, as market-oriented power reform is still in the initial stage, the planned electricity consumption will still occupy a large proportion for few years. Therefore, it is difficult to improve the market-based electricity price mechanism in a short term. How to rely on the 'transition period' price mechanism to guide the cost of green certificates faces a big test.

(2) Clearly defined the entity responsible for the compulsory purchase of the green certificate. If the power producer is the subject of the responsibility, it must be transmitted to the consumer through the power supplier or the electricity seller. This increases the transaction link and cost, which easily leads to market inefficiency and distortion. And there is no powerful means to transfer the responsibility of promoting the utilization of renewable energy to transmission, distribution, and electricity sales companies. Based on the above reasons, it is not appropriate for power generation enterprises to be the subject to pay for the green certificate.

5. Conclusion

The implementation of the US green certificate trading mechanism has greatly stimulated the development of domestic wind power, photo-voltaic power generation and other green power, enabling the United States to achieve a smooth transformation in the power supply structure. The mechanism design, implementation and improvement process have important reference for the implementation of China's green certificate trading mechanism, mainly reflected in the following points.

(1) The green certificate trading mechanism needs to be smooth and excessive. China's wind and photo-voltaic power generation were successful. If the government considers a new system to achieve transformation, it needs to consider the advantages and practices of historical accumulation and cannot be changed suddenly.

(2) The green certificate trading mechanism does not solve all problems. The green certificate mechanism is only one of the means to encourage green energy consumption and does not solve all problems. For example, the problem of abandoning wind and abandoning light and high cost of renewable energy still needs corresponding supporting systems to solve.

(3) The goals and design of policy development should be consistent. Clear policy objectives. For example, to determine whether to stimulate wind power and photostatic at the same time, or to encourage other renewable energy sources. If the target is to favor higher prices in the Southeast, it should be considered in the design.

(4) Specify a certain price. In the quota-based electricity market in the northeastern United States, the power sellers did not have the willingness to sign long-term contracts, and the power generation companies faced uncertainties, which led to fluctuations in the price of the green card, sometimes even

close to the fine price. Therefore, policy design needs to be price-deterministic and requires a relatively stable market to attract renewable energy investors to invest.

(5) Identify the assessment targets applicable to the green certificate mechanism. The appraisal object applicable to the green card mechanism must have the ability to perform relevant policies and be able to pay the relevant costs. In the design of the system, it is necessary to consider the allocation of the overall cost and determine which type of entity will ultimately pay.

(6) Pay attention to the coordination of green certificates and other policies. At present, there is a conflict of interest in the use of green certificate transactions and carbon emission trading, and the use of energy rights transactions, which imposes an administrative burden on enterprises. In the design of the system, it is necessary to coordinate the contradictions between various mechanisms to ensure an efficient connection between policies.

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