Research on Renewable Energy Quota System and Power Coordination Transaction

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Abstract. On May 10, 2019, the National Development and Reform Commission and the State Energy Administration promulgated the Notice on Establishing and Perfecting the Guarantee Mechanism of Renewable Energy Power Consumption, which opened the prelude to the implementation of the renewable energy quota system in China. The emergence of renewable energy quota trading market will greatly affect the traditional electricity market trading mechanism which only considers electricity trading. In order to promote the optimal allocation of power resources, this paper aims at the coordinated transaction between renewable energy quota and electricity. Firstly, it analyses the relationship between renewable energy quota market and electricity market, and the impact of renewable energy quota on power trade is explored. Secondly, renewable energy quota execution and assessment are elaborated. The basic principle of quota and electricity coordinated trading; finally, according to China's national conditions, the paper puts forward countermeasures for the construction of the coordination mechanism of electricity trading and quota trading, and provides direction and suggestions for the implementation of renewable energy quota system in China.

1. Introduction
As an important driving force to promote social development, energy has always attracted the attention of human society. The contradiction and conflict between supply and demand of traditional energy is becoming more and more obvious. At the same time, the development and supply of conventional energy have been difficult to meet the needs of social and economic development. Therefore, the energy transformation characterized by clean and low carbon has become a common strategic choice for energy development in major countries. The core content of China's energy transformation will be to optimize the use of stored fossil energy projects and ensure the safety of energy supply. Under the premise of policy incentives, clean low-carbon renewable energy will become the main source of energy supply increment. Through gradual substitution, the main body of energy supply will be completely transformed.

In the process of promoting the development of renewable energy power generation industry, we need to rely on major institutional innovation, and renewable energy quota system is one of the market mechanisms which mainly reflects the environmental value of renewable energy. The renewable energy quota system in the United States, Britain, Australia and other foreign countries was implemented earlier and achieved good results. With the promulgation of "Notice on Establishing and Perfecting the Guarantee Mechanism of Renewable Energy Power Consumption", it indicates that China's renewable energy quota mechanism will soon be implemented, and each market entity will be assessed in the form...
of the weight of the responsibility to absorb, which will effectively improve the capacity of renewable energy absorption.

The main objective of this paper is to discuss the relationship between quota market and power market, analyse the impact of renewable energy quota system on power trading, and elaborate the basic principles of coordination between power trading and quota trading, so as to analyse the countermeasures for the construction of coordination mechanism between power trading and quota trading in China. The relationship is shown in Figure 1.

Figure 1. Relationship between quota market and power market

2. The Relation between Quota Market and Electricity Market

From the current construction and operation of renewable energy quota market and electricity market, there is a close relationship between the two markets, which is embodied in the following three points.

1) The ultimate goal of the two markets is the same. All of these are to improve the efficiency of power system, reduce costs, realize energy saving and emission reduction in power field, promote the development and efficient use of clean energy, guide the whole society to consume green energy, and promote the absorption and utilization of clean energy.

2) The two markets have common participants. The main bodies of electricity market transactions include all kinds of power generation enterprises, power grid (power sales) enterprises, power users and independent ancillary service providers. The implementation scope of the quota market is limited to the power industry;

3) coordinated trading between the two markets will help promote the development and efficient use of renewable energy. By coordinating transactions, on the one hand, it will lead to changes in the structure and scale of power consumption within and across provinces and regions, on the other hand, it will make the power transfer from high-energy-consuming thermal power units to low-energy thermal power units, coal-fired thermal power plants to renewable energy enterprises, thus contributing to energy conservation, all of these contribute to the goal of energy saving, emission reduction and efficient utilization of clean energy.
3. The Impact of Renewable Energy Quotas on Electricity Trading

The impact of renewable energy quotas on the electricity market is as follows:

1) Inter-provincial green power channels or transactions will be swiftly opened. In the inter-provincial electricity transaction, renewable energy power will have priority market demand, receiving provinces will buy renewable energy power with priority, which will change the power investment structure of power output provinces. Because of the high quota index, power output provinces will export surplus quota to other provinces when their quota is completed.

2) Electric power users will be able to choose their own power sources and renewable energy sources in power trading. Because the quota system also assesses the industrial enterprises with their own power plants and the direct purchasing power users who participate in electricity market transactions, these large power users will also give priority to renewable energy power in future purchasing. The customers are not satisfied with the situation that the power market in our country is purchased and sold by three major power grid enterprises. They hope to choose the type of power supply and have their own preferences.

3) Technological requirements such as flexible power supply and energy storage will obviously accelerate the layout. With the increase of renewable energy in the proportion of installed units and in the proportion of transmission power, the demand for supporting management will also increase significantly. At present, there is still no auxiliary management design such as capacity price in the power market, and the power grid can be maintained when the proportion of renewable and other fluctuating power sources is low. With the advent of the era of high proportion renewable energy, there will inevitably be a commercialized ancillary service market.

4. Basic Principle of Coordination between Electricity Transaction and Quota Transaction

4.1 At the implementation stage of renewable energy quotas

In the quota execution stage, because each quota subject is carrying out its own quota task, there will be no excess completion, so there will be no transfer of quota completion volume in this stage. For enterprises with large customers and self-owned power plants, green certificate transactions are carried out while renewable energy is being absorbed. In order to fulfill their quota targets, the main body of quota is more willing to accept renewable energy power, which may lead to a decline in the proportion of thermal power generation in the future. Therefore, thermal power enterprises will transform to renewable energy enterprises and invest more in renewable energy power generation. In the quota implementation stage, renewable energy power generation enterprises can not only sell renewable energy power to market participants, but also sell green certificates to market participants in exchange for certain subsidies.

4.2 In the Assessment Stage of Renewable Energy Quota

In the quota assessment stage, the main body that completes the quota index can trade thermal power to meet its own electricity demand. The subjects who have not completed the quota index will rank according to the price of thermal power-quota completion transfer-green certificate-renewable energy power, and choose the one with the highest interest to trade, so as to meet their own electricity demand and quota demand at the same time. In addition, the way that the quota subject completes its quota index will be added, that is, to purchase the excess completion part from the subject with excess quota completion, and the price will be determined by negotiation between the two parties. Therefore, renewable energy power generation transactions will be more, the market participants who have not completed the quota will buy renewable energy power in time.

To sum up, power trading institutions should organize different kinds of trading according to the implementation and assessment of renewable energy quotas at different stages, coordinate the resources of each province and meet the quota demands of each quota subject, so as to complete the quota indicators of the whole region.
5. Countermeasure Analysis on Coordination Mechanism Construction of Electricity Transaction and Quota Transaction

5.1. Establishment of relevant supporting policies
In order to realize the coordinated transaction between electricity market and quota market, it is necessary to clarify the relevant rules of quota issuance. Due to the different maturity of wind power and photovoltaic technology, the cost of construction is different (wind power is lower than photovoltaic), so the fixed price subsidies given by the government to these two types of projects are different. In the compulsory quota trading market, if a quota is approved according to the 1 MW/h power consumption of wind power and photovoltaic projects, the price of wind power projects will be lower than the quota price of photovoltaic projects because of their lower cost, which is obviously unfair to photovoltaic projects.

5.2. Publish relevant penalty measures
In the mandatory quota trading market, the market participants who fail to meet the assessment criteria of renewable energy power quota should be punished forcefully. For example: the way of fine. In the case of failing to fulfil the quota target of specified quantity and failing to perform the transaction, the third-party supervisory committee led by the government department shall punish the power generation enterprises that fail to fulfil the quota target assessment according to a certain number of fines per megawatt-hour. This method has been adopted by Australia, the Netherlands and other countries. In addition, in order to ensure the efficient operation of the quota market, when setting the penalty amount, we should try our best to make the fines paid by the market participants who do not complete the quota index much higher than the cost of completing the quota index evaluation by purchasing certificates in the quota market.

5.3. Realizing the Interconnection and Information Sharing of Electricity and Quota Trading System
Firstly, quota trading institutions should build a management information decision-making system for quota subscription transactions. On the one hand, it can automatically acquire the data information of electricity trading and electricity billing from power grid Trading Institutions and apply it to certificate trading; on the other hand, it is necessary to establish a decision-making system suitable for matching transactions in the national unified market. In addition, in order to coordinate the relationship between power trading institutions and quota trading institutions, it is even possible to consider incorporating quota trading into national power trading institutions. The power trading institutions are responsible for quota trading. Certificate certification is still under the responsibility of the National Renewable Energy Management Centre.

6. Conclusion
Starting from the relationship between renewable energy quota market and electricity market, this paper studies the impact of renewable energy quota on electricity trading, and analyses the basic principle of coordination between electricity trading and quota trading in the implementation and assessment stage of renewable energy quota. Then it puts forward the countermeasures to build the coordination mechanism of electricity trading and quota trading, which is suitable for China's national conditions, and provides reference for the implementation of renewable energy quota system and the coordination of electricity trading in China.

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