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# Design Ideas of Green Energy Market Trading Mechanism Based on Charging Network and Vehicle Network

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**Abstract.** The integration and continuous development of vehicle network technology and charging network will provide new ideas for power dispatching and trading, and will also promote the participation of green energy in market transactions. First, this paper combed the development of the charging network and the vehicle network platform, and analyzed the situation of the participation of green energy in the current electricity market. On this basis, combined with the technical characteristics of the charging network and the vehicle network platform, the opportunities and challenges that green energy would face when participating in the market were analyzed. After that, in order to give full play to the technical advantages of the charging network and the network platform of the car, this article put forward two kinds of transaction mechanisms, the direct green energy transaction and the green certificate trading, further evade the market risk, and provide reference for the development of electric vehicles and the development of green energy trading mechanism in China.

## 1. Introduction

At present, the Internet and communication technology have been applied to various fields of economy and society. The integration of the two and the energy system has led to the emergence of the new concept of "energy Internet". Energy Internet is a development model based on the traditional fossil energy, which is likely to change the existing fossil energy, and it is also a cleaner, efficient, safe and sustainable energy use model to solve the problems of traditional fossil energy exhaustion, global environmental pollution, climate warming and so on. Internet that has characteristics of innovative vitality and flexibility led to the development of information technology, which has brought a subversive revolution for the global economic and social life. In recent years, the characteristics of energy Internet, key technical equipment, basic concepts and organizational structure have been extensively studied, which have promoted the development of the energy Internet.

As a new means of transportation, electric vehicle is also a kind of distributed power load with energy storage function. It can not only respond to the policy requirements of energy saving and emission reduction, but also reduce the dependence on traditional fossil energy. It is an important part of the energy Internet, which is directly related to the real realization of the energy Internet.

Foreign direct trade in green energy has been carried out for many years and is more perfect in the trading market and policy system. In the research and practice of green certificates, foreigners actively explore to protect renewable energy enterprises and promote the development of renewable energy industry.

The domestic renewable energy direct transaction and the green license subscription have been highly valued by the government and research institutions, and are beginning to explore the renewable energy transaction field by combining the actual situation in China and drawing on the foreign experience for the supplement. Therefore, based on the vigorous development of electric vehicles and renewable energy, it is of great significance to study the green energy transaction mode of energy Internet through the platform of the vehicle network.

## **2. The development status of charging network and vehicle networking platform and green energy trading**

### *2.1. The current situation of the development of the charging network and the vehicle network platform*

With regard to the charging network, the national Power Grid Corp has vigorously carried out the construction of the urban public and expressway charging network. By the end of August 2017, the national Power Grid Corp has built up a total of 5526 recharge stations and more than 45 thousand charging piles, 273 cities throughout 26 provinces, and six longitudinal sections of Beijing, Shanghai, and Beijing and Macao, six cross sections of Qingyin, Shanghai and Hong Kong, ring Beijing, and Hangzhou and Hangzhou. State bay two ring "six longitudinal six horizontal two ring" expressway fast charging network, a total of 1350 high-speed fast charging station, 5518 charging pile, covering the highway 16 thousand kilometres, the city 121, powerfully led the new energy car sales and social investment construction of the charging facilities [1,2].

In the vehicle network platform, the national grid has developed the online third generation network platform. According to the idea of "large platform + micro service", relying on the public service cloud of the national grid, the Internet technology framework is used in an all-round way, using China Mobile, China Telecom, China Unicom as the Internet entrance, and the security special "Internet of things" As an entrance facility, it builds multiple sharing capability centres for application agile development, and constructs a number of business applications, such as charging service, automobile service, grid service, value-added service, which meet the multi-tenant application mode[3,4].

### *2.2. current situation of green energy transaction*

In the direct trading model of green energy, the National Energy Bureau drafted the notice on the pilot of the distributed generation market transaction, and put forward 3 kinds of distributed generation trading modes, including the direct transaction of the distributed generation project and the power users, and paid the net fee to the power grid enterprises. In the literature research, many scholars have put forward the solution to the intermittence of wind power, including the establishment of a scheme to adjust the market of the trans province to realize the treatment of power balance deviation [5], and introduce a new bilateral reserve market. The wind power suppliers can purchase the reserve from the traditional power supply and minimize the loss of the uncertainty of the power supply [6]. In the market model, a new market mechanism for the power users to participate in wind power consumption is designed in the market model, and the participation market model of the green energy producer is put forward [7,8].

In terms of green certificate, after the release of green electricity certificate and voluntary subscription system in February 2017, China has attracted wide attention from the vast number of new energy generation enterprises and power users. At present, China's green card is still in the stage of voluntary subscription, and the mandatory renewable energy quota system has not yet been implemented.

## **3. impact of charging network and vehicle networking platform on green energy transactions**

### *3.1 the transaction subjects enrich*

With the continuous development of charging network and vehicle networking platform, the main categories and number of participants in green energy trading are constantly enriched.

From the subject category, under the intervention of the charging network and the platform of the car network, the green energy transaction has also increased the new main body, such as the charging pile operator and the electric vehicle, in addition to the traditional market main body, such as the original generator, the user and so on.

In terms of the number of subjects, as shown in Figure 1 and Figure 2, the new energy auto industry in China has entered the golden period of five years. With the rapid development of electric vehicles in China, the charging pile has also experienced the barbarous growth. At the beginning of 2012, the number of charging piles in China was about 17000. By the end of 2016, the charging pile of electric vehicles in China had exceeded 1 million 400 thousand. However, compared with the new energy vehicle production and sales data, the number of charging piles is far from enough. According to the statistics of China's electric vehicle charging infrastructure Promotion Alliance (charging alliance), by September 2017, the number of public charge pile construction and operation is 190599, which is 44253 more than at the end of 2016.

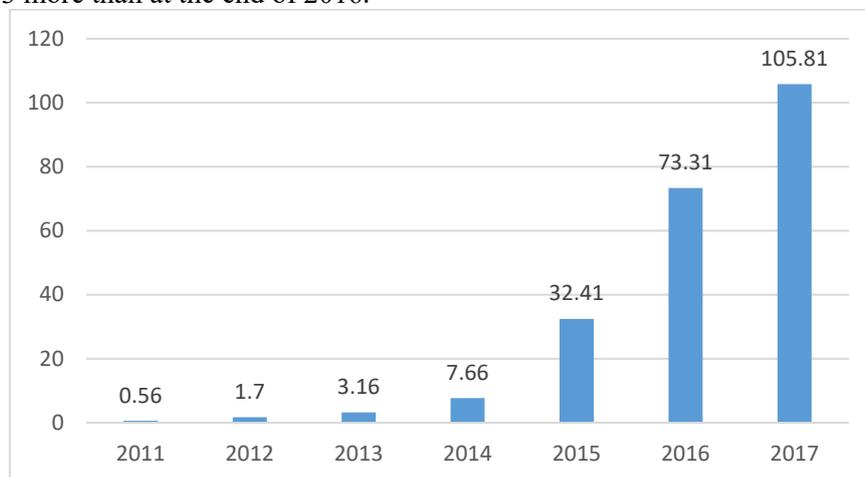


Figure 1 2011-2017 China electric vehicle Holdings (10000 vehicles)

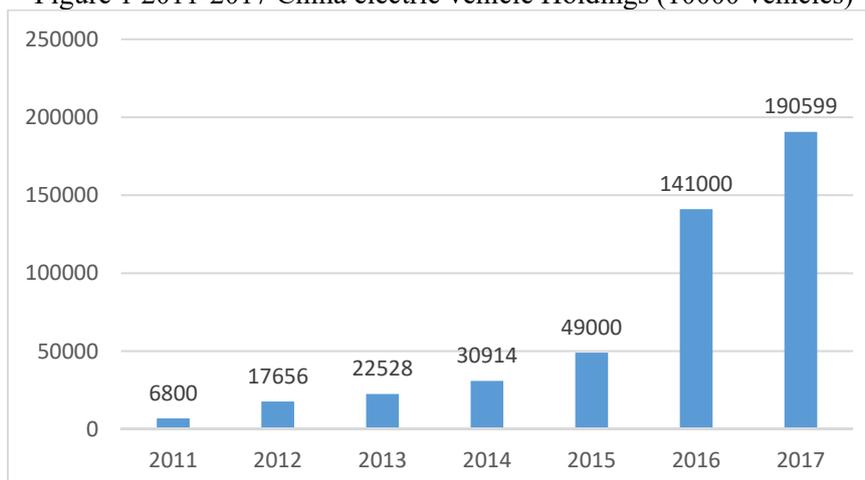


Figure 2 2011-2017 China electric vehicle charging pile construction scale (pile)

### 3.2 increasing frequency of green energy transactions

By integrating technology, information and data, the charging network and the vehicle network platform make use of the electric vehicles, energy storage and charging piles in order to achieve a flexible green energy transaction and promote green energy consumption.

Green energy generation has the characteristics of large fluctuation and strong instability, and the network platform can realize green energy near cancellation, valley charge and peak time discharge through data analysis and control of charging pile and energy storage device. On the one hand, it can achieve flexible trading of green energy by increasing the green energy transaction frequency. On the one hand, it can be flexible. Sex trade reduces the load fluctuation of green energy grid, realizes the peak filling and grain filling, guarantees the security of the power grid. On the other hand, it can reduce the cost, improve the reliability and increase the extra income by trading the idle electricity.

From the above analysis, we know that the quantity of electric vehicles and the number of charging piles in our country are in the period of rapid growth, and the number of the electric vehicles trading through the network platform is also increased significantly. This makes the platform for the vehicle network to further strengthen the capacity of green energy, and improve the security of the power grid. Power producers and consumers of green energy can reduce costs, form a virtuous circle, and achieve large-scale consumption of green energy.

### *3.3 green energy market trading mechanism needs to be improving*

The ratio of non-fossil energy consumption to primary energy consumption in 2020 and 2030 is 15% and 20% respectively, which sets a strategic target for the implementation of the renewable energy generation quota system. In order to ensure the realization of non-fossil energy consumption and renewable energy development planning goals, it is necessary to develop and absorb renewable energy on a large scale.

However, because of the imperfect green energy trading mechanism in China, there is no consideration of the green energy trading mechanism, such as electric vehicles, charging piles and energy storage operators. Therefore, it is urgent to design the green energy market transaction mechanism involving the market participants such as electric vehicles. On the one hand, the green energy producers are mainly dependent on the government subsidies. There are many problems such as serious subsidy arrears and inadequate competitiveness, such as reducing the intensity of financial subsidies, improving and implementing the direct green energy transaction, implementing the mandatory quota and the green certificate binding trading mechanism. On the other hand, we should cooperate with the charging and discharging conditions of electric vehicles, charging piles and energy storage, and design the green energy direct transaction and green license trading system suitable for the charging network and the platform of the vehicle network, so as to guarantee the green energy dissipation.

## **4. framework of green energy market trading mechanism based on charging network and vehicle networking platform**

### *4.1. direct green energy transaction*

In 2016, the State Energy Bureau issued the guidance of "promoting the development of the" Internet + "smart energy". In the future, a number of pilot demonstration projects will be started, and the new business model and new industry development of the energy industry will be promoted, which will become a new economic growth point in China. Green energy direct transaction is an important measure for the development of China's energy industry, and is also an important guarantee for the new normal economy. The charging network and the vehicle network platform can integrate the multi-level resources such as physics, information, finance and so on. It can join the energy trading market participants such as electric vehicles, wind power generators, photovoltaic power producers, thermal power producers, energy storage equipment and charging pile operators and so on, which is beneficial to the construction and promotion of green. Energy trading market.

With the support of the charging network and the platform of the Internet, distributed energy producers (distributed PV, small wind power plants, etc.) will play an important role in the green energy direct trading market. As shown in Figure 3, by using the information technology of the vehicle network platform, the related information of the distributed energy generator and electric vehicle is

collected. After the information integration and optimization matching, the charging pile is used as the node to form the power and electricity balance of the local electric power, which lays the foundation for the realization of the power transaction. Therefore, distributed energy generators will mainly sign long-term bilateral contracts with electric vehicles online, and negotiate to determine the transaction price. More ideally, the distributed energy generation integrator signed the contract with the charging pile operator or the electric vehicle agent, which not only helps to ensure the security and stability of the power grid through the virtual power plant technology, but also improves the bargaining power of the electric vehicle, and is more conducive to the benign development of the market.

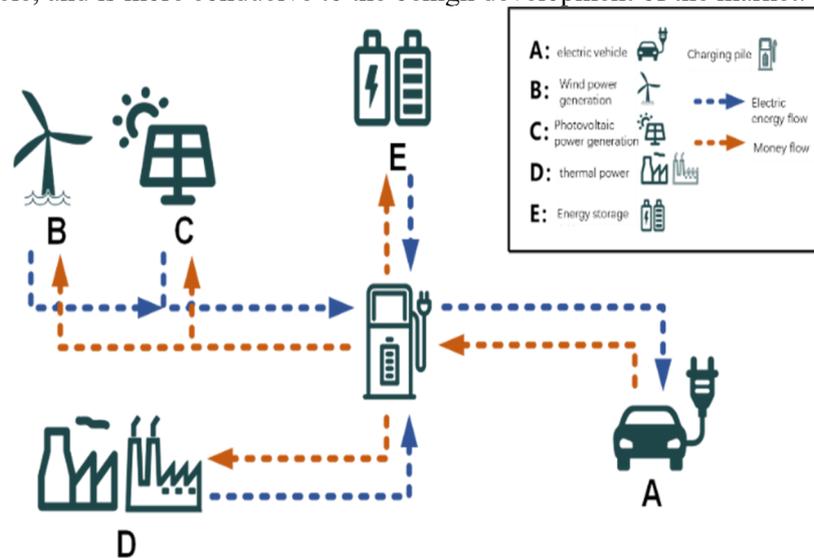


Figure 3 green energy direct transaction

#### 4.2. green certificate transaction

A green certificate is a tradable, currency-denominated certificate that is an indicator of how renewable energy generates electricity. In January 2017, the State Development and Reform Commission, the Ministry of Finance and the State Energy Administration jointly promulgated the "notice on the trial implementation of the certification and voluntary subscription of renewable energy green electricity certificates and voluntary subscription trading system", which proposed that the voluntary subscription system for renewable energy green electricity certificates will be gradually established and renewable energy electricity will be launched from 2018. Force quota assessment and green power certificate mandatory constraint transactions.

From the economic perspective, green certificates are financial derivatives of energy and electricity transactions. Green certificate transactions mainly exist between thermal power plants and renewable energy plants to optimize the allocation of resources through market transactions and reduce the expenditure of government subsidies. Therefore, the green certificate trading market under the charging network and the vehicle network platform needs to be combined with the direct green energy transaction, and the two trading markets interact with each other. The information collection characteristics of the vehicle network will be conducive to the certification and issuance of green certificates, which lays a foundation for the construction of green certificate trading market. As shown in Figure 4, the green certificate transaction further integrates the power side resources, which is also the necessity of market construction. In addition to the transaction participants will mainly include distributed generators and thermal power plants, the specific transaction process of green certificate transactions still adopts the rules of the present phase of green certificate transactions. Highly integrated charging network and vehicle network will improve the convenience and accuracy of green card accounting, but also from the side to ensure the reliability of the transaction.

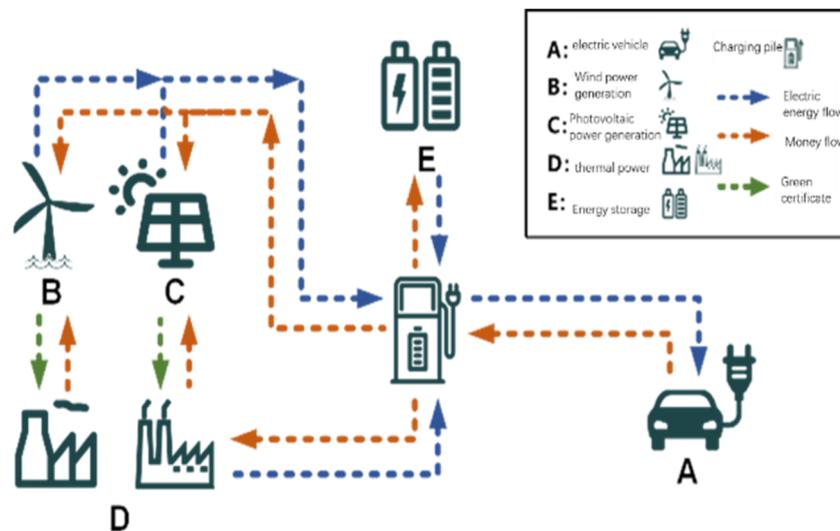


Figure 4 green certificate transaction

## 5. Conclusion

(1) The charging network and the vehicle network platform will have many effects on the green energy transaction, including the more abundant types of transaction subjects, the increase of the number of main bodies and the increase of the frequency of the transaction, which makes the existing green energy transaction mechanism face the challenge.

(2) The direct green energy transaction mainly occurs between the distributed energy generator and the electric vehicle. Considering the transaction cost, the transaction can be carried out between the two bilateral integrators, signed the contract through bilateral negotiation, and the thermal power plant and storage capacity as standby to guarantee the stability of the transaction and system.

(3) The green certificate will be transferred between the generators. The platform of the car network will provide technical support for the green license transaction, which is beneficial to the effective verification of green certificate and the convenience and accuracy of the green certificate transaction.

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