Research on the business model of power retail market under the energy Internet

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Abstract. With the continuous development of the energy Internet, small and micro market entities are given the right to choose independently. Multiple new entities such as distributed energy, virtual power plants, electric vehicles, interactive energy use enter the power market and participate in power trading, creating an open and shared power market environment. At the same time, with the deepening of China's power system reform, the focus of market construction will shift from wholesale side to retail side. Therefore, it is urgent to study the business model of power retail market, so as to take necessary preventive measures and avoidance measures as early as possible to avoid and reduce the pressure and risk faced by grid companies.

1. Introduction
Energy Internet is the product of deep integration of energy and information, an important fulcrum to promote the energy revolution, and also the focus of China's energy work in the future. In the existing traditional market transactions, all kinds of energy independent power generation mode make energy resources waste, and the production, transmission and utilization efficiency of the industry is low. The trading mode under the energy Internet aims to gather a large number of scattered entities in the information system with information as the link; create value for users with user as the center; and pay attention to the information contained in the data and transform it into value. Energy Internet can realize the free combination operation of energy production, transmission, storage and consumption, improve energy utilization efficiency and promote the development of clean energy[1].

In order to better adapt to the grid connection needs of emerging market entities such as distributed energy, energy storage, micro grid, virtual power plant and participate in the market, innovate transaction varieties, improve market operation efficiency, and then create an energy Internet Ecosystem, we need to rely on effective power market mechanism construction[2]. A reasonable market mechanism can provide impetus for the development and application of new technologies, and promote the research of new technologies Towards application. Therefore, it is urgent to deeply analyze the impact of energy Internet on the power market, only grasp the development opportunity, comprehensively sort out the types of Chongqing power retail main body, and put forward the business model of power retail market under the energy Internet.

2. Traditional power system and power market
Traditional power system is the power structure of all kinds of primary energy generation and decentralized layout[3]. Through the large-scale interconnected transmission and distribution network,
it connects thousands of households and has the basic characteristics of natural network. In addition, the traditional power system end-users have realized "plug and play" for a long time, which has the typical characteristics of open and shared Internet. The traditional mode of power system's single power production, transmission, distribution and use can't achieve multi energy coordination and complementarity, so as to efficiently meet users' multi energy needs, and the improvement of comprehensive energy service ability and energy utilization efficiency is limited; the traditional power system's user service goal is single, and the user-centered service concept and the ability of information symmetry and two-way interaction are deficient; the traditional power system's centralized management, scheduling and control system of the power system is not suitable for the development trend of decentralized supply and demand and flat system of integrated energy power system, such as the large number of distributed new energy generation, and the integration of power generation, power consumption and energy efficient system access; the market support function of the traditional power system centralized mode is not suitable for the market-oriented operation of decentralized layout of user energy and power.

The traditional electricity market is a single wholesale side market, and the trading varieties are also relatively single, mainly the combination of hydropower and thermal power. On the premise that the transmission, distribution, sale and other links are completely monopolized by the power grid, the ordinary users have no ability to bargain or choose at all, and they can not become the market subject at all. The problems such as lack of trading mechanism, low efficiency of resource utilization, planned electricity quantity, planned electricity price, unclear real cost and cross subsidy of transmission and distribution, integrated monopoly of transmission and distribution and independent purchase and sale of power grid need to be solved.

3. **Power system and power market under energy Internet**

Compared with the traditional power system, the power system under the energy Internet will have a high proportion of small power plants and distributed energy access[4-5]. Due to the multi form conversion of electric energy, with the continuous improvement of power quality control technology, including wind, light, water, oil, gas and other forms of energy conversion into electric energy will not be subject to the constraints of output, location and time, and a large number of them will join the power generation side market.

| Traditional power system | Traditional power market |
|--------------------------|-------------------------|
| Form: centralized        | Main body: single wholesale market |
| Structure: mainly fossil energy | Type: Hydropower thermal power combination |
| Configuration: supply side passively adapts to demand side | Price: electricity price, fixed benchmark price |
| Exchange: single flow for transmission and distribution | Technology: transaction support technology based on factory network channel |
| Evolution: relatively stable | Simulation: simple evolution |

| Future power system | Future electricity market |
|---------------------|--------------------------|
| Form: coordination of centralized and distributed | Main body: wholesale retail self discipline coordination |
| Structure: multi energy complementary, high proportion of renewable energy | Variety: multi new subject of ubiquitous access |
| Configuration: source network, load storage coordination, supply and demand interaction | Price: electricity price, open sharing market price |
| Switching: two way friendly, flexible routing | Technology: Internet plus transaction support technology |
| Evolution: integration of supply and demand, great randomness | Simulation: piecewise complex evolution |
Compared with the traditional generation side power market, the types of participants in the power market under the energy Internet will be much richer than the traditional generation side power market. The main participants in the traditional generation side power market are power plants and grid companies, while the power market under the energy Internet includes a large number of distributed power sources, production and marketing groups and even users themselves. The transaction is no longer limited to the production of electric energy to the use or sale of electric energy, but also can be concluded among any transaction subjects in the power generation market according to the selection, so as to develop from the original transaction line to the transaction network, that is, the market system of wholesale retail two-level coordination[6-7].

4. Business model of power retail market under energy Internet

4.1 Load integrator model
Because it is difficult to predict the load of a single market entity, the transaction deviation of participating in the auxiliary service market is large, and the utility of energy storage cannot be fully exerted, so the load user income is small. Through advanced control, communication and other technical means, distributed power, energy storage system, flexible load, electric vehicle and other resources can be aggregated, optimized and coordinated, so as to form a tradable unit and a schedulable unit of power system in the power market, form a load integrator, participate in the power market, reduce the difficulty of load forecasting, reduce market transaction deviation, and effectively stimulate energy storage resource value, thus increasing user revenue.

Through the load integrator model, the main body of the power retail market integrates its internal members to carry out three main types of power market businesses, namely, auxiliary service, demand response and short-term standby, it can obtain the income from its internal main body of the load integration participating in the auxiliary service to realize the value-added, and it can also obtain the external income by participating in the power market.

4.2 Load forecasting
With the help of big data technology, combined with the historical and real-time data, system operation characteristics and natural conditions of the power retail main body, through the preprocessing of load data, the multi-scale prediction of different loads can be realized, and the day ahead, day inside hour level and real-time minute level cold, hot and power load prediction of the user energy system can be realized, and the energy consumption data of the internal main body can be supported, and the main body is negative The results of load forecasting are scheduled in different time scales of day ahead, day inside and real-time, so as to maintain the stable operation of the system.

To provide load forecasting service for the main body of retail market and improve the accuracy of forecasting, we can arrange the source network load dispatching economically and reasonably, maintain the safety and stability of power grid operation, effectively reduce energy consumption cost, improve economic and social benefits, and obtain the service fee of load forecasting from the internal main body.

4.3 User energy optimization
Real time collection and monitoring of customer's energy consumption information through internet of things sensing equipment, mainly including power consumption, water consumption, gas consumption, cooling and heating consumption; comprehensive analysis of customer's historical user data, meteorological information, industry economic information, energy consumption prediction model and algorithm, providing prediction report for customer's energy consumption; energy balance analysis, equipment energy efficiency analysis and Energy efficiency benchmarking analysis and other results, to provide customers with comprehensive energy efficiency diagnosis reports, from the perspective of energy efficiency to help customers find energy efficiency anomalies, improve energy safety, and tap energy saving potential.
By providing users with energy use optimization services, users can effectively reduce the cost of energy use, improve the efficiency of energy use, and obtain the benefits from the internal main body.

4.4 Equipment operation and maintenance
The Internet of things sensing system can be used for real-time monitoring of internal main electrical equipment. According to the contract agreement of the main body of the power retail market, provide equipment inspection, equipment maintenance, equipment defect elimination, equipment status analysis and other operation and maintenance services for its equipment. The main equipment operation and maintenance services include power distribution equipment, electrical equipment, substation equipment, photovoltaic power station equipment, etc. So as to reduce the difficulty of user operation and maintenance, reduce the cost of operation and maintenance, and improve the scale effect.

Through the agent operation and maintenance service, the whole equipment management process is realized with multiple closed-loop management, and the monitoring management of the whole life cycle of the equipment is realized at the same time, so as to improve the user satisfaction. At the same time, it can effectively reduce the cost of operation and maintenance of users and obtain the income of equipment operation and maintenance services from users.

4.5 Energy financial services
Energy financial services refer to providing energy customers with corresponding resources integration, value-added and other services based on comprehensive energy services and new energy industry chain by means of financial means, including energy financial product information, energy service intelligent investment, equipment operating lease, property right transaction and financial auxiliary services.

Energy financial product information is a financial product service information formed by providing comprehensive energy efficiency transformation, multi energy complementation, photovoltaic, wind power and energy storage services for energy customers, energy service providers and energy equipment with financial means for the purpose of promoting the development of comprehensive energy services and new energy industry. Current energy financial products mainly include: operating lease, energy e-finance Wait.

Providing energy financial services for users can create a good financing environment for the financing problems of enterprises, based on the diversified, differentiated and exclusive service needs of users, improve the user energy financial business model, and improve user satisfaction. Obtain service income through providing energy financial services.

4.6 Agent quotation service
Through signing the agency quotation service contract with the user, the agent carries on the electricity market transaction quotation for the main body of the electricity retail market. According to the user's own situation, historical transaction situation, load forecast, power generation forecast, price constraint, price elasticity, transaction risk, etc., considering the economic situation of the whole province, the situation of the power industry, etc., we can provide users with quotation assistance decision-making for multi time scale transactions such as annual transaction, reading transaction, day ahead transaction, etc. In order to avoid the risk of user deviation, optimize the maintenance plan and internal start-up and shutdown plan of the load, optimize the user cost composition, increase the user income, and provide data support for the user's internal quotation decision.

With its Internet of things equipment and solid data base, it can provide more accurate and professional quotation agency services for internal users, so as to reduce user costs, and at the same time, it can obtain agency quotation service revenue from internal entities.

5. Conclusion
The main reason why the energy Internet can better connect with the power market and promote the development and improvement of the power market is that the energy Internet provides an open
platform for information flow and free flow of energy flow. Secondly, with the deepening of electricity marketization, the flexibility potential of emerging market players has a huge exploration space. Through the research on the business model of power retail market under the energy Internet, on the one hand, enrich the varieties of power market transactions and improve the service level of power market; on the other hand, accelerate the construction of power market under the energy Internet.

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