Research on Energy Internet Market Trading System

Zhu Li¹, Bo Pang¹, Jing Zhao¹, Dunnan Liu² and Genzhu Li²*

¹ Beijing Power Exchange Center, Beijing, 102206, China
² North China Electric Power University, Beijing, Beijing, 102206, China
*Corresponding author’s e-mail: lgz6869532@163.com

Abstract. At present, the level of energy development and utilization continues to increase, but it is still difficult to meet the growing energy demand. Because different types of energy consume a lot, and there are some barriers between different energy markets. The construction of energy Internet market can strengthen the incentive role of market competition mechanism, make the market regulation ability play a greater role, and make the energy distribution more reasonable and efficient. Therefore, this paper constructs the energy Internet market trading system from the aspects of energy Internet market subject, market object, market structure and trading mode. It aims to provide a theoretical basis for the construction of the energy Internet market.

1. Introduction
The future development direction of the energy industry is to vigorously develop clean energy, promote the consumption revolution of renewable energy production and demand side, and build a clean, low-carbon, safe and efficient energy system. Promote the energy production and consumption revolution by establishing a multi-supply system for energy systems, including not only macro-level domestic and international energy resource supply systems, but also energy-efficient, clean, low-carbon, safe and reliable supply systems that meet the diversified needs of end-use consumption.

Under the conditions of the new round of industrial revolution, the energy Internet can meet the requirements of the multi-supply system, so the construction of the energy Internet has become one of the key developments in the energy revolution in the world.

With China's existing energy infrastructure, the need to adapt to the integration of traditional energy and new energy, as well as the diversification of demand side and the complex use of energy, still need to complete huge challenges, mainly in the traditional energy and energy infrastructure. The service facilities transformed into the energy Internet are not only a question of the cost of energy use, but also a problem that is closely related to the new development of the future. At the same time, we should also fully realize that it is also a very complex problem that spans different fields and is related to the whole system. Therefore, top-level design and comprehensive macro research are the most urgent needs for energy reform.

2. Energy Internet market subject
Due to the particularity of energy commodities, the market players of energy include energy producers, energy carriers and energy users. Therefore, the main structure of the energy Internet market should be divided into five parts: “supply-transport-sale-use-management”. “Supply” refers to the energy supplier, i.e., the energy producer. It generally includes power suppliers, heat suppliers, gas suppliers and integrated energy suppliers. “Transmission” refers to energy carriers, transmission and distribution
grid operators, natural gas pipeline operators and heating network operators are currently in the oligopoly stage. “Sale” refers to sellers in the energy Internet market, in addition to sellers, natural gas distributors and heating system vendors, there are more integrated energy vendors. In addition, due to the widespread use of distributed energy, energy service providers have also emerged. “Use” refers to energy consumers. In the energy Internet, energy consumers are no longer just middlemen of large-scale users or sellers, but cover consumers of all sizes and types. “Management” refers to market regulators, mainly by relevant government departments.

3. Formatting the text
In the energy Internet market, according to the particularity of energy commodities, the main market objects are various energy sources, in addition to a series of energy-assisted services and energy financial products. Among them, energy commodities include all kinds of basic energy materials, including electricity, heat and natural gas in the current energy Internet market. Energy-assisted service is a necessary service generated by the special nature of energy commodities. It mainly focuses on electric energy. Its auxiliary services are mainly transmission and distribution and maintaining the real-time balance of the power grid to ensure the smooth output of electricity. Energy financial commodities are all kinds of energy futures commodities, analogous to the mature energy market, financial commodities include power futures options commodities and natural gas futures options commodities. It can be imagined that when the energy Internet market matures, there will be various kinds of energy futures options financial commodities. In addition, the trading of carbon emission rights also belongs to the trading range of financial commodities.

4. Energy internet market time structure
The energy market is generally divided into the spot market and the medium and long-term market according to the delivery time of the goods. In the energy Internet market, due to the different characteristics of different energy sources, the delivery time of the goods varies.

![Energy Internet market commodity types under different time structures](image)

Figure 1. Energy Internet market commodity types under different time structures
The situation of commodities in the energy Internet market under different time structures is shown in Figure 1. The power system requires real-time balance of the power grid. The power goods are transported and used at the same time of production. Therefore, the spot market of the power market is divided into daily, intraday and real-time markets. The natural gas market is different. Since the existing technology can already store natural gas for a long time on a large scale, the trading of natural gas is more similar to the trading of ordinary commodities. Its spot market generally refers to transactions completed within 30 days, with a maximum of no more than three months. Therefore, the division of spot transactions in the energy Internet market should take into account different types of energy. In terms of imaginary, the spot market can be roughly divided into real-time transactions, day-to-day transactions and short-term transactions, where short-term transactions refer to transactions within a few days or more. The medium and long-term transactions are common in the energy
commodity market, and the classification of different energy sources in the medium and long-term transactions is not so clear. The medium and long-term market plays a regulatory role in regulating the price of the energy market, which can effectively reduce the spot market. The risk of price fluctuations that exist.

5. Energy internet market space structure
According to market scope and participation, the energy Internet market can be divided into a centralized trading market and a regional trading market. The centralized trading market is large in scale and has a wide market range, similar to the wholesale market in the commodity market. Due to the large scale of transactions, the threshold for entering the market has increased, some small and medium-sized traders are unable to enter the market for trading, and the regional regional trading market is the trading platform for small and medium-sized traders. In the regional regional trading market, market participants are free to trade and dock, without scale restrictions, similar to the retail market in the general commodity market.

Due to the fact that thermal energy cannot be transmitted over long distances, the heating market only exists in the regional trading market, and the electricity market and the natural gas market can enter the centralized trading market due to the mature transportation network. Figure 2 shows the market components of each market and regional market.

6. Energy Internet market trading model
6.1. Bilateral transaction
The bilateral trading mode means that the buyer and the seller reach a transaction through negotiation and negotiation, and agree on the trading time, trading method, number of transactions and transaction price. Since bilateral transactions require both parties to spend a lot of time negotiating terms of the transaction, bilateral transactions are a common trading model for the medium and long-term trading market, and can also be used for non-instant spot markets, not for real-time markets and day-to-day markets.

Bilateral transactions can be divided into intra-exchange transactions and over-the-counter transactions. Trading within the exchange refers to the negotiation and negotiation between the two parties in the exchange organized by the government to conclude the transaction. In the bilateral negotiation transactions conducted on the exchange, there are standard contract terms that can be used for reference, and the process is more standardized and transparent, which can avoid some traps in the transaction process. However, due to the venue and management costs provided by the organization, the exchange transactions need to pay a certain amount of intermediate fees, and the exchange transactions are subject to government control. Therefore, exchange trading is more suitable for traders who have entered the market and have less trading experience. The over-the-counter transaction can be divided into direct negotiation and negotiation through the intermediary. The direct negotiation between the two parties is generally a transaction method between the transaction objects that have had a history of cooperation. It requires a certain level of trust between the two parties. This
transaction method has no intermediary fees, and direct communication between the two parties is more convenient and faster. However, since the average trader has no trading history and there is no basis of trust between the two parties, this trading mode cannot be adopted. The intermediary transaction is similar to the broker transaction in the natural gas transaction mentioned above. This transaction method has less intermediate fee than the exchange transaction, and there is also a standard contract as a reference, but the participation of the third party may lead to the competition of the transaction. The intensity has increased.

6.2 Centralized transaction
Since bilateral transactions are not suitable for real-time transactions in the energy market, the particularity of energy commodities determines that energy cannot be transported in full accordance with the plan, and the energy system must ensure that the load is always balanced, so the existence of centralized transactions is indispensable. Centralized trading means that market participants gather together to conduct real-time bidding transactions on energy commodities within a certain period of time to ensure that energy commodities can be delivered quickly. Centralized transactions can be divided into three trading modes: listing, bidding and bidding. The detailed process of these three trading modes has been introduced in the previous section and will not be repeated here. Since the characteristics of energy commodities in the energy Internet market are different, the three trading modes are applicable to different trading situations.

Figure 3. Market participants participate in market transaction types

7. Conclusion
Energy commercialization is the necessary trend of energy market development in the future. Because most of the energy used today is non-renewable energy, it is imperative to improve energy efficiency for sustainable development. Therefore, we should speed up the construction process of energy Internet market. The existing energy market trading model is a feasible and appropriate model after long-term practice testing. Therefore, for the establishment of the energy Internet market, it is more important to integrate different energy markets so that they can convert each other.

References
[1] Jiang Guoqi. Research on China's comprehensive energy market system construction [D]. CPC Central Party School, 2013.
[2] Zhang Zi, He Yongjian, Fan Pengfei, et al. Target Framework and Path Model of China's Energy Market System Construction[J]. Price Theory and Practice, 2011(7): 33-35.
[3] Sun Hongbin, Guo Qinglai, Pan Zhaoguang. Energy Internet: Idea, Architecture and Frontier Outlook[J]. Automation of Electric Power Systems, 2015(19): 1-8.
[4] Li Bingsen, Wu Fan. Research on the Status Quo and Trend of Energy Internet Development[J]. Journal of Intelligent Computer and Application, 2017(2).
[5] Feng Hongli. Research on the development status and business model of comprehensive energy services at home and abroad[J]. Electrical Apparatus, 2017(06): 39-47.
[6] Zhou K, Yang S, Zhen S. Energy Internet: The business perspective [J]. Applied Energy, 2016, 178:212-222.
[7] Xue Y. Energy internet or comprehensive energy network?[J]. Journal of Modern Power Systems & Clean Energy, 2015, 3(3): 297-301.

[8] Cai Jinqi, Li Shuxian, Fan Bing, et al. Energy Chaining Based on Blockchain in Energy Internet[J]. Electric Power Construction, 2017(9).

[9] Liu Fan, Bie Chaohong, Liu Shiyu, et al. Design, trading mechanism and key issues of energy Internet market system [J]. Power System Automation, 2018, v.42; No.635(13):114-123.