Enlightenment and experience of foreign power retail market on China's electricity retail market construction

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Abstract. The power retail market is the key link of the power market system. It plays a fundamental role in supporting the opening, competition and orderly operation of the power market. It is also the key to coordinate market transactions and system security. In this paper, the United Kingdom, Singapore, Japan and other mature countries in the development of electricity retail market research, extract these countries in the construction of electricity retail market problems and achievements, and combined with the development of China's electricity retail market, put forward the enlightenment and suggestions for the construction of China's electricity retail market, hoping to be able to provide help for the builders of electricity retail market.

1. Introduction

In March 2003, the CPC Central Committee and the State Council issued the "several opinions on further deepening the reform of the electric power system", also known as the "No.9 document"), that is to promote a new round of power system reform. Subsequently, the national development and Reform Commission and the State Energy Administration jointly issued six supporting documents for the new round of electricity reform, emphasizing the need to continuously open the power distribution and sales business, cultivate the power sales competition subjects through multiple channels, so that more power users have the right of independent choice, and further improve the service quality of power sales and the level of energy consumption of users.

With the continuous reform and development of China's electricity retail market, the way of electricity purchase and sale in the past has gradually changed, and the electricity retail market has taken shape. Many distribution companies and social capital enter the market and set up power sales companies to provide electricity sales services for customers. The increase of power selling entities gives users more choices, which helps to increase competition, reduces the intermediate cost and improves the quality of power supply service. However, in the case of imperfect and opaque rules in the electricity sales market, various stakeholders may take advantage of the rule loopholes, malicious competition and even cheat users, affecting the stable operation of the power sales market.

Compared with the relatively mature electricity retail markets in Europe, Singapore and Japan, China's electricity retail market is at the initial stage, so we need to learn from the experience and lessons of foreign power retail market in the initial stage and the whole process. Reviewing the reform process of foreign power retail market, analyzing the successful experience of the development of foreign power sales companies and the design of electricity price system under the deregulation of sales side is of great benefit to the construction of domestic power retail market.
2. UK electricity retail market

Since 1989, based on the gradually improved laws and policies, the four-stage power market reform implemented in the UK has gradually expanded from the power grid in England and Wales to the power grid in Scotland and Northern Ireland. Privatization and competition have been introduced in all aspects in the four links of power generation, transmission, distribution and sales, and a fair, transparent and open electricity trading market has been established.

As the focus of the four power market reforms, the UK electricity retail market has experienced the formation, improvement and nationwide coverage of the trading mechanism. In recent years, with the large-scale access of new energy and low-carbon market, the British electricity retail market has entered the transition period.

As shown in Table 1, in the process of the four electricity market reforms in the UK, the formation of power suppliers has laid the tone of liberalization and competition in the retail market today, and its behavior in the market has explained the mechanism of electricity retail trading in the UK. Secondly, the decomposition of electricity sales price and consumer electricity bill is an important indicator to evaluate the health of the retail market, which can help to understand the motivation of consumers to change their power suppliers and the motivation of new power suppliers to join the retail market. In other words, the electricity price and electricity bill reflect the competition intensity and diversification of the retail market to a large extent. For example, the on grid pricing mechanism for renewable energy access is the direct encouragement to small new energy users and the indirect incentive for power suppliers to improve their charging mechanism under the background of the fourth low-carbon reform.

National grid transmission PLC is the only system operator (so). Three transmission operators (TOS) are responsible for the regional transmission network in the UK. The National Grid Corporation is responsible for England and Wales, Scottish Power Transmission Limited is responsible for southern Scotland, and Scottish hydro electric transmission PLC is responsible for northern Scotland and the Islands of Scotland. It is divided into 6 distribution networks in the UK. As an intermediary independent of power transmission and sales, distribution companies distribute the power transmitted by the transmission network to civil and industrial and commercial users through the operation of their own distribution network. But distribution companies are not involved in the sale of electricity.

| Reform stage      | Reform period | Characteristics of retail market | Reform evaluation                                                                 |
|-------------------|---------------|----------------------------------|-----------------------------------------------------------------------------------|
| Power bank mode   | 1990-2001year | Formation of electricity retail market | Break the monopoly of electricity selling, but the mechanism of electricity price contract is not perfect |
| Net a mode        | 2001-2005year | Formation of power suppliers     | Market segmentation and the establishment of a new market system, but not extended to the whole country |
| Betta model       | 2005-2013year | Power retail market covers the whole country | The competition and liberalization of electricity retail market have been extended to the whole country, but the development degree tends to be gentle |
3. Singapore power retail market

Singapore electricity market (NEMS) is mainly composed of wholesale electricity market, retail market and futures market. Among them, the retail market was opened to the public gradually from 1998 when it was only open to users with power exceeding 5MW. By 2001, it will be open to users with power consumption of more than 2MW, gradually to monthly electricity consumption of 20000 kW·h, 10000 kW·h, 4000 kW·h, and 2000 kW·h, until 2018, the retail market will be fully opened.

![Figure 1. Singapore Electricity Retail Market Reform](image)

The retail market in Singapore is operated and managed by the energy market authority (EMA). In the past 20 years of reform and development, Singapore’s retail market has gradually grown into a more perfect and mature market. In the past, the electricity used by small consumers such as residential buildings in Singapore was supplied and charged by the only electricity selling company, SP services. The electricity price changed every three months. At present, in addition to the retail sales of electricity, ordinary residential and individual users can also directly participate in the retail market.

On April 1, 2001, Singapore took the lead in implementing the small consumer electricity market in Jurong district. In the past half a year, nearly 30% of consumers have switched from SP services to retail. Compared with the past regulated tariff, the average monthly electricity charge in the pilot half a year is about 20% cheaper. Among them, consumers are most interested in the discount of fixed tariff and regulated tariff in the retailer purchase plan. Peak and non-peak hour fee packages are not popular, with only 1% of Jurong users choosing.

The Singapore government has fully liberalized the electricity retail market in different regions and stages, and has fully popularized the open electricity market (OEM) to all domestic electricity customers since November 1, 2018. After strict screening, a total of 13 power retailers can provide electricity purchase services for all users. According to their own conditions, customers can choose the right retailers to purchase electricity.

After that, the consumers can choose from the electricity supply department that the consumers can choose from. For those old customers who meet the optional conditions and do not want to purchase electricity from retailers, they can continue to purchase electricity from MSSLs according to the previous regulated tariff. By the end of 2018, about 60000 corporate accounts have shifted from purchasing electricity from MSSLs to purchasing electricity from retailers. At the same time, many small
and medium-sized power consumers choose to purchase electricity from small and medium-sized enterprises.

4. Electricity retail market in Japan

2016 Since April 1, 2001, Japan has fully liberalized the electricity retail market. Through this round of power market reform, the business license of power companies has changed greatly. According to the electric utilities law, the business licenses of General Electric Power Utilities Company, power company with specific scale and wholesale power utilities company will be revised and adjusted according to the option of fully liberalizing the electricity sales market, and will be divided into "power generation business" business license, "transmission and distribution business" business license and "power sales business" business license by function. For example, Japan’s top 10 general electric power companies, such as power generation, transmission and distribution and retail, will be divided into three major sectors after reform, namely, power generation, transmission and distribution, and power retail, which will obtain three business licenses. The power generation business license is a reporting system, the transmission and distribution business license is a licensing system, and the power sales license is a registration system. (power generation companies: they will obtain the power generation rights through market competition rules; transmission and distribution companies: power transmission and distribution areas are monopolized, and transmission / distribution lines are operated and maintained, and transmission and distribution prices are regulated and priced by the government; power retail companies: through market competition rules, they obtain the power to provide electricity to consumers and have the obligation to ensure power supply.)

After the reform, the number of Japanese electricity sales enterprises increased sharply. As of August 26, 2016, a total of 334 companies have passed the provincial examination and obtained electricity sales business licenses. There are four modes of power sales companies: one is the electricity sales business of general electric power company; the second is the company with independent power plants and carrying out electricity sales business; the third is the company that carries out the package sales business of electricity plus (communication and gas) in the non power industries such as communication and gas; the fourth is the company that carries out the electricity sales business independently. The number of small power companies accounts for 60%. Among the registered power selling companies, more than 60% of them belong to the small-scale companies, and the maximum demand for electricity purchase in the future is less than 10 MW, while only 26 companies, less than 10%, may purchase more than 100 MW.

5. Conclusion

Although there are many different starting points of electricity market reform in different countries, we can learn from them.

1. Make full preparations and legisate first. Before the reform, all countries have a series of policies, laws and regulations issued by government departments or relevant institutions as the code of conduct, which is determined by the important position of the power industry in the whole national economy.

2. Unified planning, multi-party coordination. Due to the complexity and particularity of electricity market-oriented reform, which involves the redistribution of many interest patterns, the prominent characteristics of this reform are that it needs to be comprehensively promoted from the aspects of system, laws and regulations, technology, etc., and it needs the participation of experts from many aspects, such as power industry, society, economy, law and so on, to steadily advance under the coordination and guidance of the government. At the same time, combined with China’s national conditions, detailed planning and solutions are proposed for all aspects.

3. Overall design, step by step implementation. The construction of power market can not be achieved overnight, but needs to be gradually promoted. Electric power reform is related to the overall reform of the power system, so it can be said that the reform is a macro overview and grasp, and then step-by-step promotion and implementation. From the competition of power generation enterprises to the opening of the electricity sales market, they are all gradual, and they must go through the process of
opening up step by step and enlarging the competition step by step. Every successful reform country is constantly finding new problems in the reform, and constantly further reform to solve problems.

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