Analysis of the Use of Smart Meter Data by Energy Companies in Various Countries

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Abstract. Under the current trend of power reform, traditional power grid operators are seeking to transform themselves, and various types of integrated energy service companies have emerged. Competition for customer resources is bound to become increasingly fierce. However, with the deepening of the concept of green development and the gradual promotion of low-carbon life, the needs of customers are also changing. Simple and convenient services have become the basic requirements of customers rather than the advantages of suppliers. As a connection port between suppliers and customers, smart meters are able to obtain a large amount of customer power data. It makes good use of and strengthens the breadth and depth of data mining, and will not only be able to understand customer needs through data analysis, thus providing value-added services for customers. The mastery of a large amount of data resources will further enhance the ability of market participants to control the market.

1. Instruction

In the face of the new pattern of energy transformation in the world, governments in various countries have begun to promote smart grid construction in order to improve energy consumption structure and reduce energy consumption. As one of the smart grid data acquisition devices, the smart meter has many functions such as data acquisition, two-way data communication, and multiple rate metering, in addition to undertaking traditional electricity consumption measurement tasks. It is used by both parties to obtain and exchange electricity power data platform. This article summarizes the application of smart energy meter data from foreign energy companies and provides a reference.

2. Application of smart meter data on the supply side

2.1. Improve troubleshooting efficiency

Through the information such as the voltage and current that the smart meter periodically transmits to the power supply enterprise, the power supply company can discover the customers' power failure situation and master the fault information in time, effectively shortening the response time of the customers and improving the troubleshooting speed. For example, Jemna Electrical Network used smart meter systems and power outage management systems to comprehensively analyze and judge the power outage information returned by smart meters, and screens appropriate dispatching and dispatching work orders based on the location, nature, and scope of faults to improve the efficiency of fault handling; PC&G Corporation used the smart meter data reception situation to determine the

cause of the fault, and checks the data communication of the smart meter after the inspection is completed to ensure that the power supply is fully restored.

2.2. Prevention of power equipment failure

The smart meter can also reflect abnormal data of the power grid and its equipment while feeding back abnormal data. It can not only provide reference for fault early warning and troubleshooting, but also improve power supply reliability. For example, Florida Power & Light used the retrospective analysis of the smart meter measurement to find out the secondary voltage variation rule of the faulty transformer and implemented the fault early warning monitoring of the whole system transformer. The average cost of transformer replacement savings is 25%, and the users' power outage time is reduced by an average of 93 minutes. Southern California Edison Company judged the use of distribution transformers through smart meter data, determined whether the transformer's actual voltage exceeded the rating plate rating to determine its remaining life, which also could provide reference for the installation of capacitor banks to ensure the safe and stable.

2.3. Predict grid load

Smart meter data has the characteristics of high collection frequency, variety, and large scale, which can more accurately reflect the load situation of the power grid and lay a good foundation for power network load forecasting. For example, the Swiss BKW Group processed the smart meter data and sent it back to the power generation company. It provided a reference for optimizing the power generation plan, and promoted the power generation companies to reduce the cost of power generation, reduce energy consumption, and effectively mitigate the impact of large-scale new energy generation on the stability of the power grid.

3. Application of smart meter data on the demand side

The real-time metering function of the smart meter can accurately reflect the changing trend of the electricity load. Through the analysis of the data, customers' electricity habits and demands can be grasped. Some large energy service providers use this as an opportunity to expand the comprehensive energy service-related business. However, since the acquisition and use of data are mostly limited by meter metering and communication functions, only smart meter customers can usually enjoy related services. Therefore, suppliers with better smart meter promotion and application tend to occupy a dominant position in market competition.

3.1. Based on electricity prices

For countries with a high degree of openness on the side of power sale, energy companies usually provide multiple tariff schemes to attract customers at different levels of demand. The real-time data gathered by the smart meter not only provides the basis for the supplier to determine the time-division electricity rates, but also allows them to design more attractive charging schemes according to the customers' power characteristics, thereby expanding the scope of services and increasing the total number of customers. For example, Commonwealth Edison's "hourly pricing" plan uses electricity at an hourly market rate to pay electricity bills; Lakeland Electric supplies electricity at peak-to-peak hours outside standard rates. The electricity demand billing plan for quantity and peak hours; Hong Kong China Light & Power Co., Ltd. launched the "Intelligent Power Consumption Plan" to provide customers with two types of charging modes: "pay-by-hour" and "rewards in summer".

3.2. Based on electricity prices

3.2.1. Energy saving service

Energy saving services are one of the mainstream services of integrated energy services. Service providers can obtain customer energy consumption data through smart meters, understand customer

energy consumption, and provide customers with feasible energy saving suggestions through comparative analysis.

One model is to make a vertical comparison of customers' own energy consumption changes and propose energy-saving suggestions. For example, users of Pacific Gas and Electric Company can check the hourly electricity consumption through mobile phones, and understand the impact of external temperature and humidity on home appliances; US Southern California Edison Company through the customers' comprehensive analysis of the results of the online survey of historical electricity consumption and electricity usage, providing customized power-saving suggestions.

Another model is to make horizontal comparisons of a range of customers or similar customers with similar characteristics and summarize advanced experiences for reference. For example, EDF Group provides customers with energy consumption of other similar households, which is convenient for customers to refer to the energy-saving skills of low-energy-consumption families; Tokyo Electric Power Co., Ltd. and Opower Company provide "Competitive User" services, and customers can not only learn similar households. The energy saving experience also enables us to understand the number of users and the user experience of various energy saving methods, so that customers can accurately know the actual use of various energy saving methods and be more targeted when selecting them.

3.2.2. Home energy management

Energy companies can use the real-time data transmission function of smart meters to detect energy consumption on the user side. According to the overall supply and demand of the power grid, they can selectively access customers' distributed power or advise customers to use their own reserve power to maximize the use of household energy. If the Swiss BKW Group collects data through smart meters, it compares the cost of self-generated electricity generated by the customer with the real-time electricity price, and transmits the results of the data analysis to the client, so that customers can use the electricity to refer to them and maximize the use of various resources; Tokyo Electric Power Co., Ltd. encourages customers to install a home energy management system. This system can control the energy consumption of home appliances based on the monitoring data of smart meters, thereby realizing effective use of electric energy.

At present, the popularity of smart meters in China has been increasing year by year. First-tier cities such as Beijing and Shanghai have taken the lead in completing full coverage of smart meters, but data for smart meters has not yet been effectively used. Faced with new power reforms, power sales companies are springing up. If they want to maintain their competitive advantages, they must adapt to the development of the times and changes in market rules. Through the analysis of smart meter data, the energy suppliers can improve the reliability of power supply, optimize the allocation of power resources, and strengthen demand side management, while ensuring stable and reliable power supply, meets the diversified needs of customers for the use of electricity and other energy services.

4. The emergence of new business models

With the increasing development and maturity of technology, the development space for smart meters has become broader, and owners of large amounts of electricity data will also play a decisive role in the market. In Germany, smart metering systems can not only provide real-time feedback on customer's power consumption information, but also can implement power generation conditions that provide distributed power supply. These information and data are valuable and effective to all parties in the electricity market.

For power supply enterprises, through the analysis of the correlation between the massive power consumption data and related factors, the overall power consumption situation in the region can be understood, providing guidance and assistance for future power grid planning and construction. And through the mastering of real-time power, the control center can be used to optimize and adjust the grid load to provide basis for the development of peak-to-valley tariffs. In the future, these data can also be used in emerging technologies such as virtual power plants and distributed energy. In addition, the stability of power supply will also be improved. The reason is that through the analysis of

customer power consumption information and power generation information, power supply companies can grasp the customer's power consumption rules, so that load forecasting is more accurate, and early measures are taken to ensure the power grid. The overall operation is stable.

In the case of power sales companies, the real-time power supply information provided by smart metering systems can accurately reflect the customer's power consumption habits, and can be used as the basis for companies to provide energy supply packages. The E'On Group provides customers with personalized energy use solutions, is based on the above electricity information. The mastery of electricity information has truly fulfilled the demand-side response. The electricity sales company can classify customers according to their electricity usage habits and have targeted energy solutions to make customers' energy use more efficient and reasonable. Energy product services are also closer to customers' demand.

For customers, this is a good opportunity to improve the habit of using electricity. Customers can observe the details of power consumption that were previously ignored through real-time data feedback, such as the fact that some appliances still consume power when they are not completely powered off. In Germany, customers can also use the real-time floating tariff information delivered by the market to adjust the use of electrical appliances, improve the efficiency of electricity consumption, and effectively reduce energy consumption. Customers can also choose their own energy supply portfolio based on their own electricity habits.

At present, China's ownership of the data collected by the meter is not clearly defined, so the general data is also owned by the owner of the meter, which means who gets it, who owns it, and who uses it. Under the background of the new power reform, a large number of power sales companies will soon be flooding into the electricity market. The above new digital business model will enable some companies that are good at data analysis and use to stand out from the competition. At this time, the data owner's importance will then be highlighted. In the future, there may be disputes over the ownership of data, and even the competition for data among enterprises.

For Internet companies such as Alibaba and Tencent, which have a large amount of customer data and have strong data processing capabilities, the digital trend may become a stepping stone for them to enter the energy industry to develop new businesses. Whether through the model of data business services and cooperation with other power selling companies, or directly establishing an independent power sales company, this stock can't be underestimated. If we further take advantage of the Internet company's own sales platform, its future strengths and competitiveness in the field of power sales are self-evident.

5. Smart meters in China

According to the author's understanding, the current domestic use of smart meters and related data is more advanced: State Grid Shanghai Electric Power Co. (abbreviated as Shanghai Company) and State Grid Beijing Electric Power Company (referred to as Beijing Company). The two companies have different directions for the development and use of smart meters.

Shanghai company accesses the smart water meter and gas meter data in the power consumption information collection system, and realizes "multi-table copying". The power supply company will not only be able to obtain customer's power consumption information, but also to carry out the customer through the digging of multiple energy data for comprehensive analysis of energy use. However, there are two important preconditions for such a service approach. First, the cooperative relationship between several energy supply companies must be very stable and reliable, and clearly define the provision of services, the use of relevant data and information, and so on. Second, all Meters must be intelligently modified. Therefore, this "Shanghai mode" is relatively simple and easy to implement in a small area, but it may be quite difficult to achieve a wide range of promotion.

The Beijing company has effectively improved the accuracy of load forecasting through an innovative sales analysis method, narrowing the error to 0.6%-0.7%. They combined the customer's electricity consumption data with economic normal conditions, weather changes, and population growth, and used the big data analysis method to establish examples of electricity sales forecasting

models. Due to the data quality reasons, the current analysis is still at a relatively macro level, that is, it has certain guiding significance for power grid planning and construction, power dispatching, etc., but the relevant analysis results are not effectively applied to the customer service level.

6. Conclution
In the face of new electricity reforms, electricity sales companies are springing up. However, under such fierce market competition, the company's development prospects are not yet clear. Taking the smart meter as a breakthrough, it may be a good choice to carry out demand-side management by obtaining customer's electricity data.

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