

Research on Consumption Behavior of Power Users based on Full Liberalization of Power Selling Side

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Abstract: Since reform and opening up, China has carried out many electric power reforms. At present, the marketization reform of electricity selling side has been effective, which has injected new vitality into the development of electricity market, and the consumption behavior of electricity users has also changed. This paper analyzes the development of electricity market and electricity trading mode under the background of full liberalization of electricity sales side, constructs the research model framework of electricity user consumption behavior through AISAS model, and designs the questionnaire of electricity user consumption behavior. The basic information of power users and the variables that attract consumers' attention, stimulate consumers' interest, the variables of consumers' information search, the variables of consumers' purchasing, and the variables of consumers' information sharing are measured. Finally, the consumption characteristics of power users are analyzed, and suggestions are put forward for the electric power trading platform.

1 INTRODUCTION

Electric power is the driving force of national economic development and an important basis for supporting modern production and life. At present, there are some problems in the power market, such as low efficiency of resource utilization, lack of relevant management mechanism, lack of effective competition mechanism for electricity selling side, insufficient market transaction between users and power generation enterprises, and the decisive role of market allocation of resources is difficult to play. In August 2017, China selected the south (starting from Guangdong), Mengxi, Zhejiang, Shanxi, Shandong, Fujian, Sichuan, Gansu and other eight regions as the first batch of pilot, to accelerate the organization and promotion of power spot market construction. With the full liberalization of electricity sales side, power users' participation in power purchase and consumption behavior will also have an impact. This paper studies the consumption behavior of power users under the background of full liberalization of electricity sales side, analyzes the characteristics of consumption behavior of power users, and provides a theoretical basis for the power trading platform to better meet the needs of power users and enhance competitiveness.

For the research on the power trading platform, Wang (Wang, 2016) and others summarized the achievements since the power system reform and the problems existing in the market construction, such as the opaque transmission and distribution price verification mechanism and the incomplete transformation of enterprise role, and analyzed the corresponding reasons. Zeng (Zeng, 2016) et al. analyzed the reform of electricity selling side and electricity selling companies and held that the key to the market-oriented reform of electric power is the reform of electricity price, in which the liberalization of electricity selling market is closely related to the construction of energy Internet. Yang (Yang, 2017) et al. designed a strategic platform for electricity sales of power grid enterprises from the perspective of power grid platform strategy from five aspects, including electricity sales business positioning, target market segmentation and user filtering mechanism.

As for the research on power users, based on the market-oriented environment, the basic power supply can no longer meet the needs of power users, and customized and personalized energy services will be more desirable. In addition, users can independently choose electricity sales companies with better power consumption mode and high power consumption efficiency, and these companies are allowed to charge reasonable fees for providing corresponding services.

Sun et al. (Sun, 2018) analyzed the main factors influencing users' selection of electricity selling companies in the electricity market, divided users into three categories: large industrial users, general industrial and commercial users and residential users, and then modeled according to the load characteristics of different users to analyze users' behavior of choosing electricity selling companies.

2 THE POWER MARKET

2.1 Definition of Electricity Market

Broad electricity market. Power market in the broad sense refers to the economic system including the relationship between power production, transmission, use and sales.

Narrow electricity market. In the narrow sense, the electricity market refers to the competitive electricity market, which refers to the electricity producers and users through negotiation, bidding and other ways of electricity and related products related to the transaction, and through market competition to determine the behavior, product price and quantity. The market is characterized by openness, competition, planning and coordination.

2.2 Impact of Power Selling Side Liberalization

2.2.1 Promote the Transformation of the Role of the Original Market Players

Before the release of the power sales side, the participants in the power market were power generation enterprises, power grid enterprises and power users. Because users have little influence on the market, a pattern of power generation and power grid is formed. After the official issuance of Document No. 9, power generation enterprises actively participate in the market and competition, and are allowed to sell electricity directly to large users. Due to the impact of various power sales entities, power grid enterprises take the initiative to join the competition and provide users with various power sales services.

2.2.2 Promote More Diversified Markets and Businesses

In order to win the market, various power sales companies have launched various power sales packages to meet the needs of different users, and the

competition is extremely fierce. Moreover, all kinds of emerging power selling companies have the characteristics of small individuals, rapid transformation and strong adaptability, which has a great impact on the original market subjects and their interests.

3 DESIGN OF QUESTIONNAIRE ON CONSUMPTION BEHAVIOR OF POWER USERS

3.1 AISAS Model Overview

AISAS model divides consumer behavior into five stages: A: Attention; I: Interest; S: Search; A: Action; S: Share. The core of the AISAS model is search and sharing.

AI stage is the customer gathering stage, gathering target users to the enterprise Internet platform is the most important step of Internet platform marketing. In this link, enterprises can provide targeted information and related services, gradually establish and enhance the brand image of enterprises through the Internet platform, and gather more and more target users.

SAS stage is the customer interaction and sharing stage. In the three links of information search, generation and purchase and information sharing, enterprise Internet platform interacts with customers and customers interact with their own customers at multiple levels.

3.2 Construction of Power Consumption Mode System based

Table 1: construction of power consumption mode system.

Primary Index	Secondary Index	Tertiary Index
Attention	The degree of concern about electricity trading patterns	Level of interest in trading items
		Level of interest in the transaction method
	The degree of concern on the generator side	Degree of preference for renewable energy
	The degree of concern on the selling side	Degree of preference for electricity suppliers
Interest	Power trading platform to communicate with consumers	The extent to which the platform disseminates electricity trading information
		The degree to which platforms build relationships with consumers

		The degree to which the platform maintains a relationship with consumers
	Expectations for power trading platforms	Customers' ideal expectations for the service quality of the platform The customer's minimum expectation of the service quality of the platform
Search	The convenience of consumer information search	Through which channels to search for power trading platform selection
		Through which channels to search for trading patterns to choose
Action	Reliability of power trading platform	Grade the performance of commitments
		Evaluate whether the platform personnel are professional
		Whether the grid load is properly planned
	Convenience of electricity trading platform	Convenience of telephone and Internet consulting services
		The convenience of door-to-door service
	Timeliness of electricity trading platform	Score information release, electricity price settlement, contract signing, complaints and feedback
Fairness of electricity trading platform	Score the fairness of resource allocation, power purchase plan and transaction results	
Share	Consumers like and are willing to share	Score the e-commerce providers who are willing to share and promote sales
		Score your willingness to share and promote transaction patterns
		Rating generators willing to share promotions

3.3 Questionnaire Distribution and Data Collection

Formal questionnaires are mainly electronic questionnaires issued on the network as the carrier, and the survey objects are people related to electricity trading. Questionnaires were issued to electricity consumers in different industries and regions. 350 formal questionnaires were issued and 332 were recovered, with a recovery rate of 94.9%. 32 invalid questionnaires were deleted, and 300 valid questionnaires remained, with a valid questionnaire recovery rate of 90.3%.

4 STATISTICAL ANALYSIS

4.1 Basic Statistical Analysis of Consumers

4.1.1 Power Consumption Attribute

In the 300-point questionnaire, there are 170 commercial users, accounting for 56.67% of the total number of respondents, 95 industrial users, accounting for 31.67% of the total number of respondents, and 89.34% of industrial and commercial users, which is similar to the power consumption proportion of industrial and commercial users in the Analysis Report on The Status of China's Electricity Consumption Demand in 2019. Indicates that this data is representative in the proportion of users.

4.1.2 Electricity Consumption Market

There were 232 consumers in the retail market, accounting for 77.33%; 68 users, accounting for 22.67%, consume electricity in the wholesale market, which involves the sale of electricity between power companies and power traders, and ultimately sells it to consumers; In the retail market, electricity sales companies are the main agents to purchase electricity. Due to the low bargaining power of small and medium-sized enterprises, they are more inclined to purchase electricity on behalf of electricity sales companies. This is consistent with the conclusion that electricity users tend to be medium and small in the electricity Trade Report 2020, indicating that the survey results are representative in the electricity consumption market structure.

4.1.3 Electricity Trading Category

Among the 300 surveyed users, 82 and 101 users used spot trading frequently and secondary users respectively, accounting for 61% in total; There are 43 frequent users and 81 secondary users of futures trading respectively. Frequent users and secondary users account for 41.33% of futures trading. If the frequent users or secondary users are classified as the main users, it can be found that the total proportion of main spot trading and main futures trading is close to 100%. It shows that the results of this investigation are true in terms of electricity trading varieties.

4.1.4 Option of Electricity Seller

From the 300 valid questionnaires, it can be

concluded that there are 224 users who often use and secondary use the power sales of power grid companies, ranking first in all power sales industries, and the selection of power users for the other six types of power sellers is similar. This shows that with the opening of China's power market, a new market pattern of "multiple buyers and multiple sellers" has gradually taken shape. Under this pattern, China's power users have the right to choose their own power sellers after comprehensive consideration of factors such as price, service and reputation of power selling companies. In the research, we can provide new ideas for the innovation of power trading mode by observing the differences of power users' choice of power suppliers.

4.1.5 Electricity Trading Cycle

Electricity consumers mainly choose the form of annual transaction and monthly transaction, among which the number of regular and minor annual transaction consumers account for 31.33% of the total number, the number of regular and minor monthly transaction consumers account for 55% of the total number, both more than 50%; Power consumers seldom choose the form of day-trading and day-trading, and the number of consumers who never use day-trading and never use day-trading exceeds one third of the total number. It can be seen that medium and long term electricity transaction is still the most common form of electricity market transaction at present, and electricity consumers rarely participate in electricity spot transaction. China to speed up the pace of reform of electricity market, promote the construction of electric power spot market, but the current electricity spot market also is not very perfect, also has the very big development space, along with the advancement of electric power spot market, the future to participate in electricity will gradually increase the proportion of the spot transactions.

4.1.6 Mode of Electricity Transaction

The vast majority of electricity consumers are inclined to participate in bilateral negotiated transactions, and the number of consumers who often use bilateral negotiated transactions and those who use bilateral negotiated transactions is 67.33%. In terms of economics, bilateral electricity transaction maximizes the interests of both sides of supply and demand, and reflects the fairness of the electricity market. The transaction is simple, flexible and practical, with low technical requirements and low transaction costs. It is the most important form of electricity transaction. Centralized bidding

transaction and listing transaction solve the real-time problem and the imbalance of power supply and demand respectively, complement and perfect the deficiency of bilateral negotiation transaction, and are also widely used by power consumers.

4.1.7 Degree of Preference for Green Power

On the whole, most power consumers are interested in using renewable energy, which is consistent with the trend of expanding green and low-carbon energy supply and building a clean, low-carbon, safe and efficient energy system in China. Specifically, electricity consumers prefer hydropower in the use of green power. In practical use, hydropower generation has low cost, low price, high power generation efficiency and flexibility, while photovoltaic power generation and wind power generation have high cost. Photovoltaic power generation is not the first choice, which may be due to the high cost of photovoltaic power generation, low conversion efficiency, intermittent work, inconsistent with people's power demand and other reasons.

4.2 Statistical Analysis of Each Variable

4.2.1 Interest

Consumers are highly satisfied with the power trading platform's use of various channels to disseminate power trading information, establish relations with consumers, maintain relations with consumers and the service quality of the power trading platform. The number of "satisfied" and "very satisfied" with these services accounts for more than 80% of the investigated people. This shows that before the purchase behavior of power consumers, all power trading platforms pay great attention to mastering and meeting the interests of consumers, disseminate power information targeted, establish and maintain the relationship with consumers, shape a good corporate image and gather more loyal customers. Therefore, consumers are more satisfied with the service of the power trading platform before purchase.

Consumers have high ideal expectations for the service quality of the power trading platform, the number of people who choose "very expected" accounts for more than 50% of the total, indicating that power users have high requirements for power trading, there is much room to improve the service quality of the current power trading platform.

4.2.2. Search

For the search channel of electric power trading platform, 34.2% of the respondents chose power grid companies, 27.9% responded to power generation enterprises, 19.1% responded to customer relationship, and 18.8% responded to Internet. For the search channel of transaction mode, 36.3% of power grid companies, 25.7% of power generation enterprises, 18.8% of customer relationships and 19.2% of the Internet were selected. This shows that users prefer to obtain electricity transaction information from power grid companies.

4.2.3. Action

The survey results show that in the process of power purchase, power users are satisfied with the service of the power trading platform, electricity price and electricity settlement and the fairness and impartiality of the transaction. More than 70% of the respondents chose "satisfied" or "very satisfied", indicating that the current power trading platform can basically meet the needs of users when purchasing power. The satisfaction of electricity price and electricity settlement is slightly low, which needs to be further improved.

With regard to the relationship between power trading platform and power trading, more than 75% of respondents agree that power trading platform promotes the fairness of power trading and the degree of competition in power trading. This shows that the power trading platform enlivens the power trading market to a certain extent, reduces the information barrier, increases the competition of participants, and makes the power trading more transparent and fair.

4.2.4. Share

The survey results show that consumers are willing to recommend to other enterprises for information sharing when they are satisfied with the cooperative power sales market, power producers and the existing power trading mode.

5 CONCLUSIONS

Combined with the era background of the full liberalization of the power selling side, this paper analyzes the development of the power market and the development of the power trading mode, constructs the research model framework of the power user's consumption behavior through the

AISAS model, designs the power user's consumption behavior questionnaire, and analyzes the basic information of the power user, the variables that attract the attention of consumers, the variables that stimulate the interest of consumers. By measuring the variables of consumer information search, consumer generated purchase and consumer information sharing, the consumption characteristics of power users are as follows:

- Characteristics of consumption concept: power consumers tend to buy electricity in the retail market. Electricity consumers tend to use spot trading.
- Characteristics of consumption mode: the vast majority of power consumers tend to participate in bilateral negotiation transactions. Medium and long-term power trading is still the most common form of power market trading.
- Characteristics of consumption trend: electricity consumers prefer hydropower in the use of green electricity. The new market pattern of "multi buyer - Multi seller" has gradually taken shape.

Therefore, the following suggestions are put forward for the power trading platform:

First, market transaction organization and implementation. According to the transaction rules formulated by the government, the power trading center should build an open, transparent and fully functional trading platform for market members to carry out bilateral negotiation, centralized bidding, listing and other trading activities, and publish the trading results. In terms of transaction contracts, the rights and obligations of all parties to the transaction should be further detailed and clear; Straighten out the dispute resolution mechanism, establish timely and effective communication channels, and coordinate the settlement of contract disputes.

Second, statistical analysis and information release. The power trading platform shall regularly publish market analysis reports, evaluate the operation status of the power market through the analysis of key indicators of power trading operation, and provide market environment prediction and analysis for the next stage of trading. The power trading platform must follow the principles of openness, transparency, timeliness, accuracy, standardization and unity and high-quality service, treat all kinds of market subjects fairly.

Third, risk prevention and control. When formulating the business process, the power trading platform should fully consider the compliance risk, integrate the compliance management into the business process, and run through the whole process of market trading activity organization, so as to

effectively avoid the occurrence of compliance risk. At the same time, do a good job in compliance and self-discipline of their own operations.

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