

Analysis of Electricity Consumption Behavior of Electricity Customers Based on Big Data

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Abstract: As the overall development of our society shows an upward trend year by year, the development of all walks of life has been changing with each passing day. Especially in the environment of science and technology occupying the market, the informatization mode of every industry becomes more and more obvious. Electric power companies are related to people's livelihood development. In the big data era, they are constantly improving their own development mode, so as to ensure that they are not eliminated by the rapid development of the big data era. The development of China's electric power industry, on the basis of constantly improving its own digitalization and informatization and in combination of the advantages of big data, integrates and extracts the diversified resources reasonably, and brings more perfect feelings for the national electricity consumption experience. This paper takes the big data era as the background of development, carries out a detailed analysis of the national electricity consumption behavior, and provides the necessary basis for future professional research in this area.

1. Introduction

Under the background of big data era, China's electric power industry combines the information technology and digital technology to form a new business mode, which further strengthens the competitiveness of electric power enterprises in the market. The actual needs of direct consumers of power supply enterprises are detailed analyzed, understood and properly solved. Providing safer, more convenient and faster service experience, and improving customer satisfaction are the root causes of the long-term development of China's power enterprises. It is one of the effective ways for electric power enterprises to achieve sustainable development to analyze customer information through big data technology, formulate targeted business activities and make customers enjoy high-end services, so that regular customers are retained to the maximum extent and new customers are constantly developed.

2. Behavior Analysis System of Electric Consumption Customer

2.1 Analysis of Customer Contribution Degree

The basis of value analysis for customers by power supply enterprises in China is mainly lying in two aspects: the quantity of electricity used by customers and the amount of electricity charges paid by customers. As the main source of profit for power supply enterprises, in the premise of no arrears, the amount of electricity used by customers corresponds to the amount of actual fees paid directly, determining whether the power supply enterprises can survive in the fierce market competition or not. Every power supply enterprise has a detailed record of all the behaviors of its customers, such as the amount of electricity used, the amount of electricity charges paid, etc. By multiplying the price of each kilowatt hour by the specific amount of electricity used by customers, the calculated result is the amount of electricity charges that customers should pay. Through the actual payment of electricity fees, the economic status of customers will be accurately judged, and the future development of power supply enterprises will be predicted in advance. At the same time, the power supply enterprise conduces detailed analysis of the proportion of electricity customers through big

data technology, pointing out the direction for the next development. The number of electricity customers continues to increase on the basis of the original, which can ensure power supply enterprises achieve the goal of sustainable development to the largest extent.

2.2 Analysis of Customer Appeal Behavior

In view of the composition mode of power supply enterprises in China nowadays, it is mainly composed of several systems, such as business consultation, business development, equipment installation, customer complaints, failure warranty and so on. Power supply enterprises make a detailed analysis of the actual needs of customers through big data technology, and formulate diversified business for different customer groups according to their different needs. They properly solve their own imperfections, formulate development policies and application modes, make appropriate adjustments in combination with social development, and further enhance the service experience of power supply enterprises for customers, thereby improving the operating efficiency. Because the power supply enterprises are based on different needs of various customer groups, through the analysis of large data, the conclusions are also different. For example, for large customer groups, they have strong economic strength, so they do not pay much attention to the cost of electricity, but stress the experience of electricity, the security of the power grid, the speed of the network, the stability of the network, etc.. For the business customers, they have a higher utilization rate of time, so they pay more attention to the convenience and speed of the related business processes of power supply enterprises. Therefore, power supply enterprises are required to set up multi-channel consultation windows according to different needs of different customer groups. After fully understanding the needs of power customers, power supply enterprises should formulate scientific and perfect business activities to meet the needs of customers, minimize the probability of complaints from customers, further enhance the service experience for customers, and then improve the operation efficiency of power supply enterprises.

2.3 Analysis of Electricity Consumption and Electricity Theft

It is a commonly used method for power supply enterprises in China to collect the actual electricity consumption situation of power customers through the energy collection mode. The electricity consumption situation of customers mainly includes the time point of power consumption, the voltage situation of power consumption, the current stability situation of power consumption, the load curve Table and many other information. According to the actual environment at that time, such as seasonal climate and temperature, degree of humidity, geographical environment and so on, the electricity consumption behavior of power customers will be analyzed and sorted out in detail. The characteristics of electricity consumption behavior of customers will be clearly understood by power supply enterprises, so as to ensure to the greatest extent that power supply enterprises can formulate a specific power supply mode according to the different actual needs of different customers. On this basis, for customers who can not use electricity normally, power supply enterprises are required to make use of various advanced technologies, such as energy-saving, reactive power compensation and capacity expansion, to ensure the normal power supply of the power system and lay a good foundation for customers' electricity consumption experience. Moreover, some activities should be often carried out to analyze and discuss the specific behavior of customers. Violation of national laws and regulations to conduct electricity theft, stealing behavior needs to be properly solved at the very first time for minimizing the risk and loss of power supply enterprises. Therefore, the necessary analysis of the electricity consumption behavior of customers is a means that most power supply enterprises in China are implementing. It not only maximizes the efficiency of power supply enterprises and ensures customers' electricity consumption feeling, but also further improves the overall economic profits of power supply enterprises and promote the steady development of the power industry in China.

2.4 Analysis of the Behavior of Payment and Arrears

Through the marketing business application system, power supply enterprises can carry out

detailed inquiries about the detailed payment of electricity fees, such as the time of payment of electricity fees by customers, the specific amount of electricity fees, the number of arrears in payment of electricity fees, the amount of arrears in payment of electricity fees and a series of other issues. In view of these statistics, power supply enterprises must classify strictly their customers into low-risk customers, medium-risk customers and high-risk customers according to the payment situation. For each category of customers, power supply enterprises apply different business modes to provide electricity services. For example, for high-risk customers with high risk coefficient, it is necessary for power supply enterprises to carry out risk assessment. In the light of the actual payment of electricity tariffs of power users, the means to reduce risk will be provided to power users, and their defense awareness will be further enhanced. At the same time, according to different customer groups, different ways of paying electricity bills should be carried out. Through large data analysis, suggestions and opinions of power customers need to be actively adopted. The service efficiency of power supply enterprises should be further improved by updating and reforming the payment methods in light of actual conditions.

3. The Application of Electric Power Consumption Behavior Analysis

3.1 Data Integration and Cleaning

Analysis of customers' electricity consumption behavior needs to extract relevant data from the database of relevant business systems, including the electricity consumption module of marketing business application system, such as customers issue electricity consumption data, electricity consumption data, payment data in payment module, payment mode, arrears data, 95598 business module report data, failure report data, and complaint report data. The specific method is to collect real-time data, current and voltage load data in power user information acquisition system, then conduct matching according to customer number, remove invalid data, blank data and unmatched data, and finally form subject database. Specific business application system extracts fields. Demand Analysis of Customer's Electricity Consumption Behavior is shown in table 1.

Table 1 Demand Analysis of Customer's Electricity consumption Behavior

Demand Analysis of Customer's Electricity Consumption Behavior								
Data Classification	Field							
Customer Information	Customer Number	Region	Industry Category	Voltage Grade	Electricity Price Category	Electricity Price Code	Meter Number	Customer Address
Customer Service Data	Number of Customer Complaints	Number of Responsible Complaints	Satisfaction Rate of Return Visit	Number of Unreal and Irresponsible Complaints	Distribution of True Complaints by Causes of Complaints	Region Distribution of Truth Complaints	Causes of Complaints	Type of Complaints
Customer's Electricity Data	Total Electricity Consumption in the Previous Year	Change Rate of Electricity Consumption Growth in the Past Year	Total Active Power Volume in the Current Month	Voltage	Electricity Consumption Time	Electric Current	Issuing Month	Total Reactive Power Volume in the Current Month
Customer Payment Data	Number of Arrears	Electric Charges Issued	Number of Consecutive Arrears in the Current Month	Amount of Arrears	Arrears Time	Payment Method	Month of Electric Charges	Total Arrears in the Year
Power Quality Data	Average Power Outage Time of Customers	Reliability of Power Supply for Urban Network Users	Voltage Eligibility Rate	Power Supply Reliability of Power Grid Users	Voltage Grade	Names of Two or More Power Outages in a Month	Power Failure Time	Number of Outage Users
Production Data	Transmission Line Length	Substation Capacity	Distribution Line Length	Line Loss Rate	Fault Rate of Equipment	Equipment Model	Equipment Type	Date of Handling
Regulatory Data	Number of Rush Repair Orders	Cash Rate of Arrival Time of Failure Report	Average Time of Emergency Repair Arrival in Urban Area	Average Time of Rush Repair Arrival in Rural Areas	Emergent and Non-rush Repair Work Order out of 7x 8 Hours	User Address	Name of Power Station Area	Cause of Failure
External Data	Regional Map	Weather Condition	Natural Disaster	Temperature Condition	Date	Time	GNP	Economic Value Added

3.2 Data Storage and Calculation

With the development of business, database read-write separation needs to be supported by distributed database and distributed file system. The data warehouse Hive based on Hadoop is established. Now Hadoop has developed into a complete ecosystem, including Hadoop distributed file system, HDFS, distributed database HBase Cassandra and MapReduce, etc, which is the most popular large data processing platform. According to the different needs of business scenarios, different data analysis models are selected, including clustering analysis, correlation analysis, regression analysis, time classification analysis and classification prediction. According to model evaluator, the most suitable model is selected. Power customer behavior analysis classifies user groups, so this paper chooses the clustering analysis model, uses the most commonly used K-means algorithm to classify customers and mark out the classification characteristics of users.

3.3 Data Analysis and Visualization

Visualization is one of the most direct and effective means of displaying the results of large data mining. It uses scientific operations to display the Abstract data analysis results, and is widely used in many industries. Data visualization is a kind of technology, method or theory that uses modern computer graphics and image processing technology to convert data into graphics or images, then display them on display, and realize interactive processing. In the aspect of communicating with objects, and transferring the Abstract data to visible graphics or images, graphical interaction mode is more direct than the traditional text, which is conducive to helping people find the inherent rules hidden in the data. On the basis of subject database, Hive is taken as the data source and R as data mining and interface display tool.

According to the results of calculation and display, abnormal customers will be found, which is conducive to judging high-quality potential customers and potential risk customers. It ultimately realizes the in-depth analysis of consumer' electricity consumption behavior, formulates corresponding marketing strategies for different user groups, and provides basic data for the commercial use of power information.

4. Conclusion

In short, due to the impact of China's specific national conditions, a large number of electricity consumer have brought a large amount of electricity data to power supply enterprises. Therefore, making full use of the advantages of big data technology in the operation and management of power supply enterprises will improve the value of these huge amounts of data, further increase the operating profit of power supply enterprises, and minimize the operational risk, which can realize the first as well as the second control. Moreover, it improves the enthusiasm of power supply enterprises to participate in market competition, and further enhances the comprehensive service capacity of the power market. For the concept of big data, power supply enterprises should not stay in the traditional sense, but train their ability to analyze and solve problems from big data, and make full use of this ability in the development and reform of power supply enterprises to further promote the steady development of China's power industry.

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