Research on Data Acquisition and Sharing Methods Under Power Demand Side Management Based on Big Data Mining Analysis

Zhaoguang Yang¹, Mingjun Jiang², Linxin Wang², Xiaolong Wang³, Juan Shao³,*

¹Gansu Electric Power Company of State Grid, China
²State Grid Gansu Comprehensive Energy Service Co., Ltd., China
³State Grid Gansu Electric Power Company Marketing Center, China

*Corresponding author e-mail: shaojuan@gs.sgcc.com.cn

Abstract. Nowadays, China's power demand system reform has gone through many stages. With the rapid growth of China's population, China's power demand is also increasing rapidly. After experiencing the heavy pressure growth period, the power system really provides us with great convenience. However, it will also bring a lot of bad problems. In order to solve these problems, we must innovate the electric power industry [1]. Data acquisition and sharing in side management mode is the basic part of power demand management. Nowadays, the development of big data has gradually become prosperous. Many experts believe that data mining can be used to support data acquisition and sharing of power side management. This paper briefly summarizes the theory of power big data and power side management. On this basis, this paper proposes a data source and data sharing model based on data mining.

Keywords: Big Data, Power Side Management, Data Acquisition, Sharing

1. Introduction

In the early stage of power grid establishment, China's power supply and demand is unbalanced. The scale of power grid expansion speed and population growth is not proportional. This has led to the crazy growth of China's electricity demand. This situation provides greater pressure on the grid. Our country imitates the foreign electric power management system [2]. We introduce the theory of DSM from abroad. In the trial period, the theory provides a balanced theoretical system for power supply and demand. Therefore, it is concerned by the power resources department of the country. DSM makes use of the technology of data acquisition and sharing to formulate reasonable electricity consumption guidance for users. In recent years, the power grid has brought a lot of convenience to our life. However, it also brings a lot of problems. Data acquisition and sharing based on side management is an inevitable requirement of power grid work.

Today's power demand data acquisition and sharing mechanism is unable to meet people's electricity demand. Experts believe that the main innovation direction of side management of electricity demand is data mining of intelligent algorithm (see Figure 1). This theory has aroused great repercussions from many scholars. However, the quality of data collection today is volatile. There are...
still many risks in data sharing. These problems have been perplexing grid researchers. Facing the innovative direction of data mining, they put their energy into the research of big data. After a large number of experiments, it has been proved that big data mining and analysis technology that can effectively support and optimize the data acquisition and sharing of power side management.

2. Overview of comprehensive theory of DSM and big data

2.1. Theoretical overview of demand side management
In recent years, the concept of DSM has been introduced into China. However, there are subtle differences between Chinese and international theories. In fact, there are different views on power demand management in the world. It does not have a completely unified theoretical concept. In China, the concept of power demand management is to change the way of using electricity to meet people's electricity demand by using appropriate operation mode. On the other hand, it won't waste too much cost.

2.2. Three stages of side management mode
At the end of last century, the concept of demand side management was introduced in China. Mainly carry out the theoretical propaganda and training of demand side management. In the early 21st century, the state power resources department found that the learning of side management was successful. They have gradually formulated some policies applicable to the grid and demand side management. In recent ten years, China has begun to build more side management system organizations. Many enterprises have also carried out research on side management of power demand.

Figure 1. Data sharing of DSM.

2.3. Theoretical overview of big data
In the 1990s, foreign scholars found that a lot of data could not be processed by traditional methods. They call this data big data. It's similar to side management. There is no unified concept of big data. Some scholars in China define it as a collection of data that cannot be processed by traditional database software. Big data is characterized by many types of data, large data capacity and low value density of data.

2.4. Theoretical overview of power big data
Big data is actually another way to express big data in power industry. Experts believe that power big data is not only an extension of the application of big data, but also represents an important change of power system in the era of big data [3]. In fact, the disadvantages of power big data and big data technology are similar. It has many kinds of data, but the information it can mine is very few. According to the characteristics of power big data, we find that the biggest challenge for power grid
enterprises is to strengthen data mining.

3. Analysis of the source of data acquisition in DSM based on big data mining analysis

3.1. System operation data of various power systems
In fact, the system data refers to the data detected by the monitoring system during the operation of the power system. These data mainly include two categories. The first is the production data of the power system. The second is the life data of power equipment. The scope of the two types of data includes power consumption, power transmission, power configuration and power use. In addition, they also include the data of voltage, current and system related parameters of power equipment.

3.2. Power system operation data of some enterprises
Power related enterprises include power generation enterprises and power sales enterprises. The revenue and power parameters of these two enterprises should be included in the operation data of power system. In addition, the operation data should also include the interaction data of intelligent devices between enterprises and users. These devices include smart meters, power monitoring equipment and other intelligent terminal devices. As the number of electric power enterprises continues to increase, the types of system operation data become more and more.

3.3. Data based power management system
Many enterprises express their power management level in the form of tables and pictures. Every quarter and every year produces many kinds of data. These data are constantly updated. Unfortunately, these data need to be analyzed across industry gaps. It has caused a lot of work pressure to the power workers. The realization of the function of this kind of data also puts forward more acute requirements for data sharing.

3.4. Non-electric data of state of interest
The generation of non power data is based on the interests of the power system. Its source is the power system. However, in the industry standards, such data does not belong to the scope of the power industry. In the normal operation of the power system, we can not find this kind of non power data. However, it does exist objectively. In addition, data acquisition of power system has also extended to many fields. Including meteorology, architecture and transportation. These belong to the category of non electric data.

4. Main data sharing methods of DSM based on big data mining analysis

4.1. Document or file data sharing
In the management mechanism of some electric power enterprises, the way of file or copy resource sharing is very common. The purpose of this data sharing model is clear. And the transmission process is very simple. However, this way of data sharing has great defects. These shortcomings include the loss of files, overdue files and delayed updating of file contents. Therefore, people rarely use this form of data sharing to share key data (see Table 1).

| Sharing mode      | Feature               | Enterprise application |
|-------------------|-----------------------|------------------------|
| File sharing      | Easy and Convenient   | 95.69%                 |
| Memory sharing    | Hidden danger         | 71.85%                 |
| Communication network | Programming is difficult | 82.41%         |
| Database          | High cost             | 68.15%                 |

4.2. Data sharing based on memory access
The security of this way of data sharing has been questioned by the public. It is generally set as the
information transmission form of LAN by some enterprises. Compared with the external network, the security of LAN can be more guaranteed. However, in recent years, the threat of network virus is growing. Moreover, the data sharing of memory access is related to the security of computer internal system [4]. Experts believe that this form of data sharing security risks are very big.

4.3. Data sharing of communication network
The information transmission of communication network includes four parts. They are generating information, transmitting information, exchanging information and receiving terminal. The internal structure of different communication networks is also different. It is a special channel for enterprises to complete information exchange. It has high transmission efficiency. However, it needs a lot of programming information to make it. Programming is difficult. Therefore, the establishment of communication network needs a lot of manpower and financial resources.

4.4. Data sharing based on commercial database
Generally speaking, a large electric power enterprise must have a commercial database with complete functions. It can store all kinds of data information. It has perfect data acquisition function. The collected information will be stored in the database. The structure of data sharing in database is very complex. The timeliness and accuracy of its data are very high. According to the current situation of data sharing in the power industry, it is a reasonable way of information transmission that is worth using.

5. Problems to be solved in data sharing of DSM based on big data mining and analysis

5.1. It is necessary to strengthen the collation of various documents or resources
There are many kinds of data for a large power enterprise. It mainly comes from different departments within the company. Therefore, data sharing is a cross business work. The traditional way of data sharing is obsolete. In the process of data integration, there may be many data loss problems. Strengthen the collation of various documents or resources to protect the integrity of resources. This can enhance the stability of data sharing.

5.2. Strengthen the data development of public resources
In fact, the data of public resources mainly refers to the behavior information of users. A lot of people think it includes user's personal information. In fact, this statement is wrong. Various behaviors of users will also produce a variety of data information. Strengthen the data development of public resources, power enterprises can better complete the interaction with users. In the process of data sharing within the company, the company's managers can more intuitively see the user's feedback.

5.3. Strengthen and improve the data entry standard
The capacity of commercial database is limited. It should not receive useless information. Useless information will increase the working pressure of the internal staff of the enterprise. Moreover, some malicious hackers may put the network virus in this useless information. Therefore, enterprises need to strengthen and improve the data entry standard. Eliminate useless information as much as possible. This can not only ensure the work efficiency of staff, but also improve the security of the system.

5.4. Strengthen the security of data system
Data information of electric power enterprise is an important part of enterprise wealth. Its contents are of great value. We must ensure the security of the data system [5]. Security macro-control measures can also be used in the database. Staff can use some independent anti-virus software or computer manager to protect the computer from external virus. In addition, the establishment of a secure local area network is also an excellent way.
6. Analysis of key technologies of power side management based on data type

6.1. Distributed measurement of side management
Facing many kinds of data, the staff are at a loss. Their workload is increasing. In order to reduce the cost of human resources distributed computing technology is introduced. This technology can classify the data according to different processing methods. According to the classification, the distributed system can process these data at the same time. Therefore, it can process different kinds of data quickly.

6.2. Data mining of side management
Data mining technology is also the data processing technology mentioned in this paper. It mainly includes data preparation, rule searching and rule representation. The combination of these three parts can analyze a large amount of data. Power enterprises usually use data mining technology in human-computer interaction platform. It can analyze the consumption habits and power demand of users from the behavior data of users. According to these data, enterprises can choose their own revenue direction.

6.3. Descriptive and inferential statistical techniques
These two technologies are generally used in the process of data management. Descriptive statistics can divide a lot of data into different categories. Statistics of different types of data. Enterprise managers can more intuitively see the power revenue [6]. The technology of inferential statistics generally uses probability method to find the unified connection of different data. It includes parameter estimation and hypothesis detection. However, compared with distributed measurement, the data processing speed of these two technologies is not fast.

7. Conclusion
At present, the global economic system is slowly improving. Big data technology is in a golden age. Using power big data mining technology to improve the income of power enterprises has become the common goal of the power industry. As the basis of power data operation, it is necessary to study the data acquisition and sharing mode of DSM.

References
[1] Weijun, Lei. Analysis of Supply Chain Information Sharing Mode Based on Big Data[C]// . 2018.
[2] Xin L I, Yue-Xian G , Wei-Lei H , et al. Research on Warehouse Sharing Mode Based on Big Data[J]. Value Engineering, 2019.
[3] Wenyan Z. Research on the big data based engineering cost information sharing mode[J]. Computer Era, 2018.
[4] Jie Gao. Research on Data Resource Construction in Digital Library under Big Data Environment—Investigation and Analysis Based on NSTL[J].2018, 020(003):53-57.
[5] Wang, Mei. Research on Big Data Analysis and Mining Technology of Smart Grid Based on Privacy Protection[C]// 0.
[6] Alexandra Amado."Research trends on Big Data in Marketing: A text mining and topic modeling based literature analysis." European Research on Management and Business Economics 24. 1(2018):1-7.