The Application of Information Technology in Condition-Based Maintenance of Power Transmission and Transformation Equipment

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Abstract. Power transmission and transformation equipment plays a very important role in the normal and stable operation of China’s power system. To ensure the safety and reliability of the operation of power transmission and transformation equipment, it is necessary to do a good job in the maintenance of equipment status. In recent years, with the further development of science and technology in China, the maintenance technology of power transmission and transformation equipment has become more and more advanced, and the information technology has been gradually applied to it, which has effectively improved the efficiency and accuracy of condition-based maintenance of power transmission and transformation equipment. In this paper, the application of information technology in condition-based maintenance of power transmission and transformation equipment is analyzed and studied.

1. Introduction

To better adapt to the development trend of modernization and standardization of power enterprises, the new mode of condition-based maintenance has gradually appeared in the maintenance process of power transmission and transformation equipment. As a new maintenance mode and method, it not only effectively remedies the drawbacks of the traditional maintenance mode, but also reduces the cost of equipment maintenance and further prolongs the service life of equipment. At present, how to better apply information technology to condition-based maintenance of power transmission and transformation equipment has become one of the key issues that most power enterprises pay attention to.

2. The Current Application of Information Technology in China’s Power Industry

In the context of the continuous updating and improvement of modern science and technology, many power enterprises have gradually raised their attention to information technology, and applied information technology to the condition-based maintenance and management process of equipment. Information technology has already appeared at the end of the 20th century. Although China started relatively late in information technology, it has achieved remarkable results. The popularization and application of information technology in the field of power has greatly reduced the amount of manual labor, effectively reduced the hidden dangers of safety production faced by power enterprises, made the service life of power equipment longer and longer, and increased the speed and reliability of operation. One of the main manifestations of equipment condition-based maintenance informatization is to carry on standardization processing to all kinds of data. However, at present, most of the power enterprises in China are still at the initial stage in the application of information technology, the application level is still not mature enough,
and many applications remain superficial and formal, so the deep and high-level information processing effect can not be achieved.

The main reason is that there is still a big gap between the development level of China’s power industry and foreign countries, and the overall level of economy and technology needs to be improved. Power enterprises often encounter various data loopholes and problems when carrying out condition-based maintenance of transmission and transformation equipment, which results in great differences in the defective representation of data state quantity and deduction criteria. Computer can not automatically and intelligently detect and deal with this problem at all, which eventually leads to the failure of equipment maintenance personnel in locating the fault.

3. The Significance of the Application of Information Technology in Condition-Based Maintenance of Power Transmission and Transformation Equipment

Condition-based maintenance is a brand-new maintenance mode and method different from traditional schedule maintenance and break maintenance. It mainly takes the safety, comprehensive benefits and environmental conditions of enterprises as its basic standpoint, carries out all-round analysis and evaluation of the risks facing equipment, and adopts targeted ways to carry out maintenance, so as to ensure the safe and stable operation of power transmission and transformation equipment. Compared with the traditional maintenance, condition-based maintenance has many outstanding advantages, such as low cost, paying attention to prevention beforehand and prolonging the service life of equipment. Taking the Pushan Power Plant in China as an example, the total maintenance cost of the unit in 2010 was 2.8 million yuan, while the maintenance cost of the unit in 2019 was 4.2 million yuan under the premise of maintenance of the same C-level and D-level projects and contents three times, which was 1.4 million yuan lower than that in 2010, which was the cost saving effect brought by the introduction of condition-based maintenance mode. Moreover, in 2010, the supplementary expenses for the maintenance equipment of the unit also decreased by about 120,000 yuan compared with the same period last year.

At present, the major power enterprises in China are in the transformation stage from traditional schedule maintenance to condition-based maintenance. How to realize the effective development of condition-based maintenance has become one of the most important problems faced by many enterprises. In the contemporary society of networking, informatization and digitization, the condition-based maintenance of power transmission and transformation equipment must be based on a comprehensive and in-depth analysis of all kinds of data. To achieve this, it is necessary to rely on modern information technology and take informatization technology as the basic support. Only in this way can the condition-based maintenance of power transmission and transformation equipment be carried out smoothly and effectively. Otherwise, no matter how to improve the management concept or maintenance mode, the maintenance can not completely get rid of the influence of traditional maintenance forms, and can not achieve a fundamental change.

In short, the condition-based maintenance is an effective means to improve the overall efficiency of equipment operation under the guidance of scientific concept. It can provide necessary technical support and premise for the long-term stable operation of equipment. Introducing information technology into condition-based maintenance of power transmission and transformation equipment can not only reduce the risk of the whole maintenance process, but also maximize the service life of equipment and optimize product quality in an all-round way. It can be seen that it is very necessary and meaningful for China’s power enterprises to realize the informatization of condition-based maintenance for power transmission and transformation equipment.

4. The Application Countermeasure of Informatization in Condition-Based Maintenance of Transmission and Transformation Equipment

4.1 Creating a Scientific and Perfect Production Management System for Power Transmission and Transformation Equipment

In order to effectively carry out condition-based maintenance of power transmission and transformation equipment, it is necessary to build a scientific and perfect production management system of power transmission and transformation equipment, namely GPMS. Without the support of this system, condition-based maintenance can only become the passive water. The production management system of power transmission and transformation equipment is composed of many business departments, covering a wide range of areas, and the process is relatively complex. Each link needs to deal with a lot of data, which
requires real-time correlation of information.

In order to meet the requirement of real-time sharing and all-round integration of basic data information resources in production management, it is necessary to actively apply advanced technologies such as data mining and analysis technology and mass data storage technology, and constantly promote the development of specialization, systematization and intellectualization in the production process of power enterprises. The staff should take the daily work of power transmission and transformation as the breakthrough point and collect data and information for all teams. This can not only promote the effective completion of the daily work tasks, but also generate various detailed reports in a relatively short time, so as to improve the overall work efficiency and quality of management departments, maintenance departments and other departments, so that all departments can cooperate with each other, and the work can be carried out more coordinately and efficiently. The data mining process is shown in fig1.

4.2 Constructing the Auxiliary Decision-Making System for Condition-Based Maintenance

In fact, the application of information technology in condition-based maintenance of power transmission and transformation equipment is to build an auxiliary system of equipment maintenance with the help of the Internet platform, so as to achieve the goal of maintenance intellectualization and informatization. The introduction of information technology provides a professional and standardized monitoring platform for condition-based maintenance of equipment, which can realize assistant decision-making and automatic display of equipment status. Thus, the establishment of the decision-making system is a major manifestation of information technology.

Generally speaking, the auxiliary decision-making system has the following functions: The first is reporting, collecting and managing information. With the help of the data report management module of the auxiliary decision-making system, the timely approval and management of experimental reports and standing books of the system equipment can be realized. The information collection is the basis of state assessment, and it and online monitoring system belong to the central part of auxiliary decision-making system. The second is the online monitoring. The online monitoring function mainly involves three aspects: early warning, condition diagnosis and condition evaluation. The early warning mainly refers to early warning rules and early warning information. The so-called early warning rules refer to setting the test data range of power transmission and transformation equipment, so as to provide reference standards for the development of monitoring work. The early warning information refers to the mode of data information display, release and startup status detection.

In view of this, in the design of the system, it is necessary to ensure that the system has a strong information analysis and storage capacity. The state assessment is the process of analyzing and evaluating relevant data and information to determine the health status of equipment. It is the last function of online monitoring system, and it is also the most closely related link with condition-based maintenance of power transmission and transformation equipment.
4.3 Building Portable Computer System

When equipment maintenance personnel arrive at the site for equipment maintenance, they often need to take various data information as a reference point. For maintenance staff, it is very difficult to obtain such a large amount of data information in the first time after arriving at the fault equipment site. This requires the development of a portable computer system as the center of the power transmission and transformation production management system, so that the maintenance personnel can download the required data information in real time with the help of the server at the fault repair site, and make accurate analysis and judgment of the working conditions on the spot. In addition, after comparing the actual data with the historical data, they can more accurately judge the operation of the equipment, so that the equipment status evaluation report has higher authenticity and credibility.

5. Conclusions

In conclusion, the application of information technology in condition-based maintenance of power transmission and transformation equipment can effectively improve the efficiency and accuracy of condition-based maintenance of equipment. However, from the current situation, many power enterprises in China still have some problems in the information construction of condition-based maintenance for transmission and transformation equipment, which leads to the fact that the role of information technology is hard to bring into full play. Therefore, in the future practice, we must further enhance the emphasis on the application of information technology, so that it can play its due role in the condition-based maintenance of power transmission and transformation equipment.

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