Research on fault analysis and positioning technology of distribution network based on big data

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Abstract: With the rapid development of big data technology, more and more data are gradually applied to power distribution systems. Based on the fault analysis and positioning technology of distribution network based on big data, the fault is analyzed through the data collection analysis and state detection of distribution network, and the relevant positioning technology is optimized, so as to shorten the fault location time of distribution network, improve the fault analysis efficiency of distribution network and the accuracy of fault location.

1. Introduction

With the rapid development of all aspects of society, the demand for electricity in social production and life is constantly increasing, so the construction of power supply system in China keeps a very rapid growth. Although China's power system laying mileage and power supply system technical level have been greatly improved, but at the same time the distribution network management has caused a greater challenge. At present, big data technology is widely used in China. In the field of distribution network, it started late and is still in the groping and trial stage. Power system is a key work of China's development, and China's power technology is also relatively high. However, due to the traditional power supply and management mode, not enough data is stored, which is unfavorable for the application of big data technology. However, in recent years, with the further development of China's science and technology and state of distribution network, data acquisition work of the distribution network is becoming more and more mature, our country also on this basis, have established by big data technology for traction power distribution network management system, effectively improve the management level of the distribution network. In distribution network, big data timely the most effective one aspect is in distribution network fault analysis and positioning technology, can according to the vast amounts of data analysis, reduce the power distribution equipment malfunction, shortening the time of failure, so in modern electric power enterprises to strengthen the research of distribution network fault location technology is very necessary.

2. Analysis of network fault

In the fault analysis and positioning of distribution network, the following problems mainly exist:
2.1. passive state of failure in emergency repair
In the traditional troubleshooting work of distribution network, it is often necessary to listen to two departments to obtain relevant fault information, and then analyze according to the actual situation of equipment operation, and finally determine the location of fault occurrence, and then determine the focus of this emergency repair work. During this period, in fact, many departments and emergency repair workers have been in a state of standby, and often delay the emergency repair time due to incomplete user information. In the repair process, there will often be inadequate preparation materials, maintenance errors and other phenomena.

2.2. long time to find fault in distribution network
In the case of failure of actual distribution network, it often takes a long time to locate the fault. Because when the network faults location, often use manual search and fault address to find. When manual search is adopted, it is generally conducted by the staff to pull the switch in order to check different line segments and finally find the fault line. This way of working is bound to be very time consuming. The fault of distribution network is searched by using the address recorder, and the fault line segment is determined by looking for the flip card. Such distribution network fault search is also time-consuming, not to allow staff to achieve timely repair.

2.3. high emergency repair cost
It not only takes a long time to find the network fault using the address recorder, but also causes a large amount of resource waste in the process. Once in a real network fault repair process, more people and cars, which is enough to reflect its serious waste of resources?

3. Research and application of fault location technology of distribution network

3.1. comparison and selection of detection methods
In order to reduce the time spent in finding fault in distribution network, through in-depth research on the traditional fault location technology of distribution network, it is found that there are defects such as high error rate, long control line and time-consuming manual search. In view of these problems, the author proposes to use the asymmetric current source method to locate the network fault, which avoids some shortcomings of the traditional fault location technology.

3.2. fault location technology of distribution network
The asymmetric current source method is realized through various measures when locating the network fault, which is a relatively complete fault positioning system, including fault addressing device, data forwarding station, fault positioning master station software and asymmetric current source equipment. The schematic diagram of asymmetric current source method is shown in Fig.1. The device consists of three vacuum switches, high voltage diodes and current limiting resistors. Its main working principle is that when a ground fault occurs in a transmission line, the switch will be tested in sequence, and when a fault is found in a line segment, the entire detection system will form a loop, thus causing the addressing device to turn over. This measure can effectively locate the network fault. Moreover, it can guarantee the accurate location of the distribution fault, which greatly shortens the time of the distribution fault location. The work efficiency of the emergency repair personnel of distribution network is improved.
There are certain principles to follow when installing these devices: first, the maximum spacing in the main line when installing a fault addressing device is one device per 3km. Second, the fault addressing must be installed on the side where the switch meets. Third, in the section prone to failure, we can properly install more such devices to ensure more accurate positioning.

3.3. application of network fault location system

By adopting the above measures, the problem of time consuming in finding fault of distribution network is effectively solved. However, in recent years, problems often occur in distribution transformer, which finally affects the quality of power supply. In the face of such problems, some of the electric power enterprise caused a distribution transformer fault location system, the system can through to the operation condition of transformer, vibration intensity and variable pressure tilt and related data, the distribution transformer to conduct a comprehensive inspection, so as to analyze the fault type and fault, and such as time, and can make a synchronous alarm, etc. When the enterprise installs such equipment, various faults of the electric power enterprise are effectively controlled, which greatly improves the service quality of the electric power enterprise.

When to find distribution network fault, the staff can install a phone card in the fault location system, once the distribution network occurs after ground fault or short circuit fault, fault detection system can automatically in the first time the fault information through mobile phone network in information sent to the relevant working personnel or personnel on duty on mobile phones, so convenient in and operations staff on duty to timely inspection and repair line, greatly increase the operational efficiency.

With the development of modern fault location technology of distribution network, in order to give full play to its advantages, power enterprises need to effectively integrate their information systems to ensure that fault location and emergency measures can be taken as a whole in the whole process of work. In addition, a customer service dispatch center is set up to optimize the allocation of relevant resources by effectively dividing the staff and vehicles, so as to truly meet people's electricity demand.

4. Application in big data fault analysis and positioning distribution network

With the development of big data application technology, it is possible to make equipment failure prediction by using existing power grid operation data and meteorological environment data. By integrating the decentralized system information, the standard data types, forming rich and homogeneity of large data samples, for different types, different types and different state of equipment failure probability prediction, a must for the grid support the corresponding protective measures are taken, for the safe operation of the power grid, the self-healing smart grid.

Big data plays a very important guiding role in the maintenance of distribution networks. First of all, it is necessary to master the operation state of distribution networks in a macro way. Then, use the collected equipment data information to comprehensively diagnose the equipment operation status and determine the maintenance mode. The equipment operation state evaluation based on big data is more
comprehensive, the basic data of input evaluation is richer, and the evaluation results are more reasonable and reliable. Big data technology can comprehensively affect the ontological and non-ontological factors of equipment operation state, and obtain more reasonable equipment state and network operation state, so as to develop more reasonable maintenance schemes.

5. Conclusion

To sum up, in the era of rapid development of modern information technology and power enterprises, modern information technology will be widely used in the analysis and positioning of power distribution faults, so as to improve the analysis efficiency of network fault and the accuracy of fault location. Through the technical improvement in this aspect, the maintenance efficiency of the distribution network fault can be greatly improved to ensure the power supply quality of power enterprises and meet the requirements of more aspects of power supply quality.

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References

[1] X.G.Meng,“Research and development application of distribution network fault positioning system,”Electrical engineering, vol.5, no.2, 2015, pp.33-36.
[2] Y.F.Huang,“Discussion on automatic fault location technology of distribution network,” Electromechanical information, vol.21, no.5, 2015, pp.79-80.
[3] K.Y.Liu, W.X.Sheng, D.X.Zhang,“Application demand and scenario analysis of intelligent distribution network big data,”Chinese journal of electrical engineering, vol.35, no.2, 2015, pp.287-293.
[4] J.Y.Pan, H.Zhao, J.Shi,“Application of multi-system monitoring and big data analysis in power supply emergency repair service,”Zhejiang electric power, vol.34, no.8, 2015, pp.59-61.
[5] X.Y.Liu, F.Zhang, Y.F.Lu,“Load prediction technology of distribution network based on decision theory,”East China power, vol.41, no.10, 2013, pp.2084-2085.
[6] D.W.Wang, Z.W.Sun,“Big data analysis and parallel load prediction of power user side,” Chinese journal of electrical engineering, vol.35, no.3, 2015, pp.527-537.