Research on the Cause Analysis and Improvement Measures of Measurement Error Based on Model Forecast

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Abstract: The accuracy of power measurement affects the economic benefits and operating costs of power supply companies, and even affects corporate decision-making. Analyzing the causes of errors in measurement data and making improvements to reduce errors is of great significance to both power companies and users. The article analyzes the causes of power measurement errors, and proposes improvement measures to reduce the errors.

1. Preface
In recent years, with the rapid development of my country's electric power industry, the demand for electric power resources has become greater and greater in both enterprise production and people's lives. With the guarantee of the latest scientific and technological devices, the quality of electricity metering has been improved. As the link between power resources and society, power companies must improve their work quality and provide more efficient services in their daily operations. When companies provide services and charge fees, they need to provide accounting units and basis. In power companies, this "accounting unit and basis" is power measurement. Therefore, it can be said that the ultimate income of power companies depends on efficient and accurate power measurement. Especially when the distribution of my country's electric power industry is extremely broad, even a very small loophole will cause a lot of losses. Therefore, it is necessary and imperative to regulate electric power measurement. Especially during the annual equipment survey of the power system, a large amount of power loss will be found, which greatly restricts the economic benefits of enterprises. Therefore, through power metering, power companies can have a more detailed understanding of their own operating conditions, and provide the necessary reference for the power companies to make final decisions on future development [1], all of which require the help of power metering. Not only that, efficient and accurate power metering also has a direct relationship with power resource consuming enterprises and thousands of households. However, in actual measurement, due to the interference of various factors, there are varying degrees of error in "electricity measurement", which threatens the rights of power companies as well as users of power companies [2]. In view of this, it is particularly important to study the causes of errors in power measurement and improvement measures.
2. Reasons for power measurement errors

2.1. There are problems with the power plant equipment itself
One of the reasons for the power metering error is the metering dysfunction of the power metering device itself. There are many types of power metering devices used in the market today, and there are obvious differences in metering accuracy between different devices. Compared with smart metering meters, active power metering errors are easily affected by line load imbalance, etc. The influence of the situation will eventually increase the power measurement error [3]. In addition, some power metering equipment itself has certain metering functional obstacles, and it is also likely to cause power metering errors. For example, the measurement equipment has high sensitivity and flexibility to the system during use, and it is impossible to accurately judge the abnormal situation in the measurement in time.; the daily operation of electricity metering and decoration is not standardized enough, etc.

2.2. Unreasonable equipment

2.2.1. Estimate without table
The meter less estimation is a relatively initial measurement method. The basic principle is to estimate the power consumed by the user according to the power size of the user's electrical facilities and the timeliness of use [4]. However, because ordinary people do not use electricity regularly like factory operations, and the load power is small, the error in the estimation without meter will be great, and the measurement of user electricity consumption will be interfered by some artificial factors.

2.2.2. One table by three
One meter multiplied by three is to use an electric energy meter to count the electric energy between the three-phase circuits. Because the three-phase circuit is mostly symmetrical, the initial estimate of the user's three-phase electricity value is based on three times the information of an electric energy meter [5]. This method is more accurate than non-metered estimation. In some areas, the three-phase load is uneven for a long time. Therefore, the one-meter-by-three method can only approximate the simple situation of the user's power consumption, and cannot be accurately calculated.

2.3. Incorrect installation of metering device
Whether the power metering device is installed properly will also cause errors, and it is also one of the main factors for the metering equipment to perform its functions. During the installation process of the power metering device, it is generally necessary to install it in accordance with the relevant technical specifications and installation standards. It is not only necessary to carry out accurate positioning, but also to ensure that the connection between the device and the wiring and other equipment does not deviate. Once in the installation process If there is a wiring deviation, it is very likely that there will be a wiring failure, which will cause the device resistance to increase and the later CT change to increase [6]. Therefore, the installation error of the power metering device is also likely to cause errors.

2.4. Unreasonable use of transformer

2.4.1. CT ratio is large
The small load rate of the distribution transformer and the improper CT change rate are important reasons for the measurement error. The CT selection method is to calculate the first current once according to the rated second current on the distribution side. In the specific working conditions, the secondary operating current of CT is less than the rated operating current, so the CT selected according to the high accuracy runs for a long time with low accuracy, and the corresponding error occurs in the measurement [7]. When the load rate is relatively small, the error of the meter is also large, which will cause the overall error value to be too large. Choosing a suitable CT transformation ratio, the improved facility will maintain proper measurement accuracy, which can reduce
measurement errors.

2.4.2. CT external load is heavy

The error calculation when using the current transformer shows that reducing the external load of the CT and increasing the magnetic permeability of the core can improve the error. Measurement facilities and monitoring facilities are connected by lead wires, but many measurement points have long wiring, small cross-sections, and high contact resistance. They operate under low load conditions for a long time, resulting in high external load of CT and high measurement error [8]. Therefore, reducing the wiring, increasing the wiring section, reducing the contact resistance, reasonably reducing the CT ratio, and increasing the operating point can all improve the error. The error of the transformer and then the distortion of the power metering facility basically manifests the following two aspects: First, the accuracy of the transformer during assembly operation is low [9]. The operating accuracy level of the substation and power plant designed in the early stage is a class of 0.05 transformer, but it is stated in the testing standards that the accuracy of the class 1 and class 2-meter facility transformers cannot be lower than class 0.2. Second, there is no special secondary winding of the transformer in the metering facility. In the energy calculation standard, the type 1 and type 2 metering facilities used for trade records need to be equipped with special secondary windings for transformers according to the metering point. Because the primary current passes through the primary winding of the current transformer, it may cause the secondary winding generates induced electricity, which is no-load consumption. No-load consumption leads to loss and waste.

Since the accuracy of the current transformer has a greater impact on the overall error of the electric energy metering device, you should be particularly cautious when choosing the accuracy level of the current transformer, and try to choose a wide-load (S-level) current transformer. In daily work, the staff often ignore this point, treat the S-class transformer as an ordinary transformer, and cannot choose to use it correctly. As a result, the measurement device has a large measurement error. Take 0.5S class and 0.5 class current transformer as an example, see Table 1 for the comparative analysis of the error limit value.

| Current / rated current (%) | 1 | 5 | 20 | 100 | 120 |
|-----------------------------|---|---|----|-----|-----|
| Ratio difference | 0.5s | 1.5 | 0.75 | 0.5 | 0.5 | 0.5 |
| 0.5 | 1.5 | 0.75 | 0.5 | 0.5 | 0.5 |
| Phase difference | 0.5s | 90 | 45 | 30 | 30 | 30 |
| 0.5 | 90 | 45 | 30 | 30 |

It can be seen from Table 1 that under low load conditions, the ratio difference and phase difference of the 0.5S class current transformer are far smaller than the 0.5 class current transformer. In other words, although they are all 0.5-level current transformers, under low load conditions, the accuracy of 0.5S-level current transformers is much higher than that of 0.5-level current transformers.

2.5. Interference from external environmental factors

In addition to the above points, the causes of power measurement errors also include the interference and destruction of the external environment, and this is mainly manifested in the following two aspects: on the one hand, environmental factors such as weather, and the power meter summarizes it during use. Once impacted by the external environment, the safety and measurement performance of power measurement will be directly affected, and measurement errors will also occur; on the other hand, power measurement devices will also be damaged by some people during use, such as The generation of acts such as theft of electricity is to add some other devices to the power system to change the reading of the electric meter, thereby directly causing errors in power measurement.
3. Measures to improve power measurement errors

3.1. Improve the configuration of power metering devices
In power metering, if the old method is adopted, the accuracy of the metering will be affected. Therefore, it is necessary to introduce scientific and effective measures to make up for the shortcomings of traditional metering methods, effectively reduce power metering errors, and reform metering point work. Specifically, in order to optimize the structure and configuration of the power metering device, the device can be reasonably modified and combined with the standardized device: ① It seems that the metering can be increased by improving the actual accuracy of the electric energy meter, TA, and TV. Accuracy, especially for users with large load changes, choosing S-class TA and S-class electric energy meters [10] can greatly improve the measurement accuracy. ② When optimizing the structure of the device, the staff needs to replace the interface of the wire to reduce the actual length of the secondary wire, thereby reducing the impact on the measurement results. ③ Use appropriate TA to ensure stable operation of the metering device and improve the accuracy of metering. ④ The TA variable ratio can be selected as a double type, so that the variable ratio file can be selected scientifically according to the customer's electricity consumption change rule, so that the measurement work is more accurate. ⑤ According to the characteristics of the neutral point, it is necessary to upgrade the non-insulated grounding device at the user end: that is, the three-element measurement method is used to replace the traditional two-element measurement method to improve the accuracy of time measurement. ⑥ In accordance with work needs, reasonably select devices such as electric energy meters to minimize the error after combining them.

3.2. Make a reasonable choice for changes in current transformers
In the power metering device, the current transformer is affected by the location of the metering device, and its own load is constantly changing. Therefore, when the power company is performing power metering work, it must select the location of the power metering device according to the change of the current transformer to ensure accurate electricity metering. Practice has proved that a power metering device at a reasonable location can reduce the connecting wires of the current transformer and reduce the resistance of the power meter, thereby achieving reasonable control of power metering errors. In addition, a reasonable selection of current transformer changes also needs to be based on changes in the external environment where the power metering device is located, and reasonable arrangements can be made by understanding the actual season and temperature changes to ensure the accuracy of power measurement. In specific applications, it is necessary to adjust the current transformer in real time to adapt its changes to changes in the actual environment to improve overall efficiency. In this way, not only can the power measurement error caused by the current transformer be effectively solved, it is also of great significance for reducing the loss of power enterprises.

3.3. Scientific measurement of user electricity and factory electricity
We use reasonable layout settings to separately record residents’ daily electricity consumption and factory high-voltage electricity consumption. Basically, we use the meter gate alone, and the lighting and factory electricity use are recorded separately. The metering point is based on a concrete metering point on the surface, but inside it is separated, with a metering area and a control part. One area is equipped with its own meters and transformers, and the rest are equipped with safety devices such as switch switches and fuses. The keys of the metering room and the control area are given to the power section and users respectively. A well-sealed metering point can reduce interference caused by external temperature differences.

3.4. Introduce anti-theft technology to strengthen container protection
One of the causes of power metering errors also includes the theft of electricity. When it is improved, anti-theft technology can be introduced into the power metering system, which can effectively prevent
users from illegal use of electricity. Effectively improve the economic benefits of power enterprises. For the introduction of anti-electricity stealing technology, it is necessary to combine the types of frequent electric theft behaviors to make reasonable references, so as to further improve the overall anti-electricity theft effect. For example, most electricity theft behaviors are only installed in inherent power devices. Other devices such as voltage divider or shunt, and for this operation, we can standardize the installation and wiring of the electric energy meter, and do the lead sealing and paint sealing of the electric energy meter, so as to reduce the occurrence of anti-electric theft.

4. In conclusion
In summary, the reasons for power measurement errors are, on the one hand, related to the lack of rationality of device assembly; on the other hand, it is related to unscientific specific operations; in addition, it is also related to the unreasonable use of transformers. Therefore, in order to effectively improve the accuracy of power measurement, it is necessary to start from this, fully control the error situation, and take relevant measures to effectively control the power measurement in terms of device assembly, power calculation methods and current transformer changes, and reduce errors. To ensure the sustainable development of the power system.

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