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ANALYSIS AND REDUCTION OF ENERGY LOSS IN POWER GRID OF INDUSTRIAL ENTERPRISE

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With the rapid development of global economy and the continuous progress of science and technology, people's demand for electricity and the requirements of power supply quality are also increasing, and the problem of power energy is becoming increasingly prominent. Under the concept of energy conservation and emission reduction, scientists continue to optimize the use of energy, and try to create the maximum value with the lowest consumption of energy.

There is a lot of energy waste in the traditional power system [1]. The loss of power grid lines, including the loss of electrical equipment and power supply system, has become a problem that can not be ignored. It not only causes the waste of resources, but also affects the economic benefits of individuals, families, enterprises and even the country, so it is particularly important to find scientific methods to reduce the power and energy loss in the power grid.

In this paper, through the analysis of the traditional 10 kV power grid diagram of industrial enterprises, the physical quantities such as cable length, conductor section and cable rated current are measured, and the total operation time (hours) of the power network every year is counted to calculate the total cable cost. After analyzing the causes of power and energy loss in the power grid, the ways and methods to reduce the power and voltage loss of the power system are found, and then the improved cable cost was calculated according to the required physical quantities. So as to judge whether the method can really reduce the loss of power and energy in the power grid, achieve the purpose of saving resources and improving economic benefits.

Power economy is a huge and complex hierarchical system, including power supply, power and automation, electrical lighting, operation and maintenance of electrical equipment. In all aspects of the industrial power supply system, with complex electrical equipment, the related power loss also occurs [2].

Causes and solutions of power and energy loss in power grid.

1. Unreasonable wiring structure of power grid. In the power grid, the distribution lines are messy and lengthy, which often leads to the phenomenon of near power supply, far power supply and circuitous power supply. With the increase of wire length, the resistance value of wire also increases, resulting in the loss of active power of unnecessary lines. By improving the power supply mode of the circuit, the load center power supply or trunk power supply mode can be reasonably adopted to shorten the power supply radius and reduce the loss of reactive power in the line. In addition, the aging of the line, the humidity of the environment, reduce the insulation level of the wire, resulting in the loss of active power leakage. Therefore, we should regularly check and update the wire, and do a good job in 6S management, to avoid external subjective factors leading to power loss.

2. Improper conductor section. In the traditional power supply lines, due to the relatively small number of high-power equipment, for the consideration of production level and economic cost, the conductor with small cross-section and safe current carrying capacity is generally selected. The most direct impact of improper cross-section of wire is to increase the wire resistance, increase the Joule loss of wire, and there are fire safety hazards. Increasing the wire cross section can reduce the wire resistance, Joule loss and voltage loss. But increasing the cross section of conductor will increase the economic cost. When increasing the cross section of conductor, the optimal scheme between investment cost and line loss reduction should be determined by calculation, and the economic payback period should be determined by using the method of repayment period.

3. High loss of substation equipment. Loss of transformer, loss of current metering transformer and voltage transformer (including ammeter), and power consumption of substation itself. In the lower transformer, the actual total loss can reach 5-8% of the network energy consumption. Transformer loss is divided into iron loss and copper loss. Iron loss, also known as no-load loss, is its fixed loss. In fact, it is the loss caused by iron core. The loss of transformer winding is copper loss, which is also called load loss. It is mainly the loss of resistance when load current passes through winding. The copper loss is generally 0.5% of the variable loss, and the iron loss is generally 5 ~ 7% of the variable loss. The load loss is also affected by the temperature of the transformer. At the same time, the leakage flux caused by the load current will produce eddy current loss in the winding and stray loss in the metal part outside the winding. For the loss of transformer, the main solution is to choose the capacity of transformer reasonably and realize the economic operation of transformer. For a single operating transformer, the efficiency is the highest and the loss is the smallest when the iron loss is basically equal to the copper loss. Generally, two or more transformers with parallel operation and load in the distribution transformer capacity should be put into operation more when the load is large and less when the load is small, so that the transformer can always operate in the high efficiency area. Generally, the load should be operated between 40% - 65% of the distribution transformer capacity. For two or more transformers in parallel operation, more input when the load is large, less input when the load is small, so that the transformer always operates in the high efficiency area.

4. Receiver power consumption. Receiver power consumption refers to the consumption of electrical equipment. The main methods are as follows: selecting the motor according to the power and model correctly; replacing the under load asynchronous motor with the low power engine; the winding voltage of the asynchronous motor is low, and the asynchronous motor works under the low load systematically; limiting the idling movement of the asynchronous engine;

Improve the quality of motor maintenance and other factors to reduce the loss of power and energy in the grid.

5. Asymmetry of voltage and current. The asymmetry of voltage and current will lead to extra power and energy loss in power grid, shorten the life of electrical equipment, conductor and transformer, and lead to overload of each phase. It is mainly reflected in the increase of neutral line current, which leads to the increase of line loss. It can balance three-phase load and adjust three-phase voltage to reduce line loss.

Calculation of power and energy loss in power grid before and after improvement

1. After changing the wiring structure of power grid, the saved line loss is calculated by shortening the total length of wires. Further, calculation of the reduced economic cost was made.

2. The next step is selecting the appropriate wire section, calculating the reduced Joule loss, and counting the economic benefit recovery period.

3. The following steps include selecting the appropriate substation equipment and appropriate electrical equipment, calculating the economic cost rate consumed and calculating the economic benefit of recovery period.

4. Finally, the three-phase load is balanced, the three-phase voltage is adjusted, and the saved line loss is calculated.

The economic cost and economic benefit recovery period after the improvement are calculated.

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