

THE IMPORTANCE OF REACTIVE POWER COMPENSATION EQUIPMENT IN IMPROVING POWER QUALITY

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Abstract: This article discusses one of the main factors affecting the quality of electric power - reactive power and the need for its compensation. Effective control of reactive power can reduce load, energy losses and voltage drops in power networks. The article analyzes reactive power compensation methods, types of equipment and their impact on the efficiency of the power system.

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Current on the day electricity energy savings and his/her to the quality big attention is being directed . Electricity quality only effort level with not , but vine and effort to the phase angle between , i.e. to the reactive power both depends Reactive power increase online download increases energy losses increase equipment efficiency reduces Therefore , reactive power cover equipment in the energy system important place It catches .

Compensation of reactive power is of great importance for the power system and is one of the main factors in increasing the efficiency of the power supply system, improving its economic and quality indicators. Given that the growth of reactive power consumption is currently much higher than the growth of active power consumption, it is mandatory for consumers with an installed capacity of more than 50 kW to compensate for reactive power. Given that the transmission of reactive power over long distances along lines leads to a deterioration in the technical and economic indicators of the power supply system, this issue is one of the most urgent issues of the present day.

If we look at the calculation results and statistics, we can be sure that the main part of reactive power in industrial enterprises is consumed by asynchronous drives (60-65% of the total reactive power consumed), transformers (20-25%), overhead power transmission lines, reactors, converters (about 10%).

what the power coefficient of the enterprise will be , because when the issue of reactive power compensation is solved correctly, the efficiency of the system work, which includes consumers, power transmission lines, power distribution devices, transformers, converters and generators, is ensured.

the power factor ($\cos \varphi = \frac{P}{S}$), the higher the efficiency of the power system. The transmission of reactive power through lines and transformers leads to additional energy losses, increased

voltage losses, and increased costs for the power supply system. The following examples show how the efficiency of consumers depends on the amount of voltage reaching them:

- 1) Electrothermal technological processes work to the regime of strength deflection very big impact shows. Of tension from the decline technological of the process duration it gets longer, some in cases and this process completely from work comes out Inductive and resistance in the ovens 8-10% reduction in voltage technological of the process to stop take comes.
- 2) Voltage fluctuations also have a significant impact on the operation of electric welding equipment. A decrease in voltage leads to poor quality welds. A 10% decrease in voltage increases welding time by 20%.
- 3) A change in the quality of voltage has a serious effect on the operation of lighting devices. Tension less than nominal by 20%, luminescent and gas-discharge lamps generally does not burn. Of these outside of strength deflection lighting of devices light of the currents to change take comes and of workers to see abilities It slows down.
- 4) Electric valve drive systems are also very sensitive to voltage fluctuations. The fluctuation of the alternating current voltage affects the amount of rectified voltage, which in turn causes the drive's speed to change.

It can be seen from these examples that the quality of the voltage has a significant impact on the technological process of the enterprise, the energy indicators of its consumers, and the operating modes of the devices.

Reactive power flowing through power lines also leads to increased power dissipation. If active (P) and reactive (Q) powers are transmitted through a power line with active resistance R and inductive resistance X , the power dissipation is found as follows:

$$\Delta U = \sqrt{3}IR \cos \varphi + \sqrt{3}IX \sin \varphi = \sqrt{3} \frac{UI \cos \varphi}{U} R + \sqrt{3} \frac{UI \sin \varphi}{U} X = \frac{P}{U} R + \frac{Q}{U} X = \Delta U_a + \Delta U_p$$

This on the ground:

- ΔU_a associated with active power transmission was effort loss;

ΔU_p related to the transmission of reactive power was effort loss.

So, reactive power transmission as a result electricity supply in system elements additional effort waste ($\Delta U_p = \frac{Q}{U} X$) happened is, and its amount of reactive power transmitted through the transmission line (Q) and the inductive resistance of the transmission line (X) right to. Considering that it is proportional, it leads to a decrease in the effective value of the voltage, that is, a decrease in the quality of electrical energy. Poor-quality electrical energy, in turn, leads to a reduction in the service life of consumers and poor quality of manufactured products.

From the examples discussed above, it is clear that it is necessary to develop measures to reduce reactive power in the power supply system. In turn, if we take into account the reduction of electricity bills of production enterprises, the increase in the quality of the manufactured product and the exemption from additional fines, the price of the produced product will decrease, the quality of the product will increase, which will create a basis for the increase of the

company's income.

Nowadays, the efficient and sustainable use of electricity is an important factor not only for economic efficiency, but also for the reliable operation of the entire power supply system. One of the main factors affecting the quality of electricity is reactive power. Reactive power does not perform useful work in the power system, but creates a magnetic field necessary for the operation of equipment. At the same time, its excess leads to voltage drops in the network, power losses in the lines, and inefficient operation of equipment.

To solve the problem of reactive power, special equipment is used - reactive power compensation equipment (compensation equipment). Through them, the amount of reactive power in the electrical system is reduced or completely compensated. The most commonly used equipment is capacitor banks. They compensate for reactive power caused by inductive loads. In addition, synchronous compensators, thyristor reactive power regulators, and modern intelligent equipment such as SVG (Statcom) are also widely used. Reactive power compensation not only improves the quality of electricity, but also eliminates adverse conditions in the electrical network. For example, it has such benefits as voltage stabilization, reducing energy losses, and reducing the load on lines and transformers. It also prevents penalties for reactive power at manufacturing enterprises, which is economically beneficial for them.

In practice, the correct selection and placement of compensation equipment is of great importance. For this, special analyses are carried out in electrical networks, taking into account temporary or permanent changes in reactive power. In particular, the introduction of intelligent automated systems allows for real-time control of reactive power.

Used literature.

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