Energy Saving Analysis in Plant Power Supply and Distribution Design

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Abstract: the Power Supply and Distribution System Plays a Very Important Role in Industrial Production. in Production, the Power Supply and Distribution System Has a Large Consumption, and It Faces High Energy Consumption in the Process of Industrial Development. Therefore, the Factory Needs Energy-Saving Transformation and Reduces Electricity Cost to Guarantee the Overall Economic Benefits of the Factory. the Use of Energy-Saving Measures in the Power Supply and Distribution System Can Also Reduce Pollution and Protect the Economic and Social Benefits of the Factory. Enterprises Should Adopt Energy-Saving Technologies to Further Achieve Sustainable Development and Reduce Costs. Enterprises Should Make Targeted Energy-Saving Design of Power Supply and Distribution Systems Making Full Use of Electrical Energy to Improve Their Economic Benefits. This Paper Mainly Analyzes the Significance of Energy Saving in Power Supply and Distribution Systems, and Proposes Specific Methods of Energy Saving.

1. Introduction

Nowadays, China's Society is Constantly Progressing, But the Energy Problem is Becoming Increasingly Prominent, Which Has an Adverse Impact on China's Economic Development. At the Same Time as China's Economic Development, the Consumption of Electrical Energy is Increasing, Which Has a Certain Negative Impact on the Development of Factories. Therefore, for the Problem of Power Consumption, Factories Should Adopt Energy-Saving Solutions to Reduce Power Consumption and Promote Sustainable Development of Enterprises.

2. Significance of Energy Saving in Factory Power Supply and Distribution

Energy Saving is the Use of Certain Technical Means to Reduce the Consumption of Electrical Energy. Energy Saving Measures Must Be Feasible and Reasonable. the Energy-Saving Design of the Factory Power Supply and Distribution System Can Greatly Improve the Efficiency of Electric Energy Use and Enhance the Economic Benefits of the Enterprise [1]. Currently, Coal-Fired Power Supply is Generally Used in the Operation of Factories in China. This Type of Energy-Saving Design Can Improve the Efficiency of Electricity Use to a Certain Extent, Reduce Indirect Consumption of Coal and Waste Emissions to Protect the Environment. the Energy-Saving Design of the Factory Power Supply and Distribution System is Also an Effective Way to Save Energy, Reduce the Incidence of Various Accidents, and Ensure the Safe Production of the Factory. the Use of Energy-Saving Technologies Can Promote Environmental Protection. the Significance of Power Supply and Distribution Energy Saving in Factories is as Follows:

(1) Make Up for the Contradiction between Supply and Demand.

China's Economy is Developing At a High Speed and the Demand for Electricity Continues to Increase, But China's Power Generation Infrastructure is Not Perfect Enough to Meet the Rapidly Growing Demand for Electricity. There is a Huge Contradiction between Industry Demand and Electricity Supply. the Use of Energy-Saving Measures in the Power Supply and Distribution System of the Factory Can Reduce a Certain Amount of Power Consumption, Reduce the Contradiction of Power Consumption in the Industry, the Demand for Electricity, and Pressure on Power Banks [2].

(2) Increase social wealth.

Utilizing energy-saving measures in the plant's power supply and distribution system can save

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China's social resources. Inspection of the factory power distribution system will not detract from the original production scale and production efficiency of the factory. By simplifying the process and improving factory production, the power efficiency of the factory will continue to increase, and it will also protect the economic benefits of the factory and increase China's social wealth.

(3) Promote scientific and technological progress.

The use of energy-saving measures in the power supply and distribution system of the factory must first raise the awareness of managers and producers. Both of them should know the significance of energy-saving measures in the power supply and distribution system of the factory before they can implement related work [3]. The energy saving measures in the power supply and distribution system of the factory are technical issues. To ensure the energy saving effect, the factory needs to optimize the original technology and production processes, increase capital investment, and use various scientific and technological methods and concepts, which is conducive to the development of science and technology in China.

3. Principles for Energy-Saving Measures Design in Factory Power Supply and Distribution Systems

(1) The principle of economic applicability.

In the process of designing the power distribution system of the factory, in order to achieve the energy saving effect, it is necessary to abide by the principle of applicability and design the energy saving measures in the power supply and distribution system of the factory. Energy-saving measures in distribution systems need to meet the principle of economic applicability. It can use artificial reactive power compensation to make the operation process more flexible, reduce artificial losses, save the power cost of the factory, and protect the economic and social benefits of the factory.

(2) Seeking truth from facts.

The goal of the factory development is to improve economic efficiency. To improve the market competitiveness of the factory, it is necessary to make use of certain reasonable development opportunities. At present, China attaches more and more importance to environmental protection, and factories are large consumers of energy. They need to follow the principle of seeking truth from facts to reduce environmental pollution, reduce the pressure on power supply in China, and use energy-saving measures in the power supply and distribution system of factories to achieve sustainable development of factories [4].

(3)Optimization principles.

China continues to promote the concept of green development. Many factories have begun to pay attention to energy conservation and consumption reduction. They have used various scientific technologies and construction techniques to make extensive use of environmentally friendly materials. For example, permanent magnet contactors use permanent magnet force to achieve closing and maintaining. In the brake state, the current can be reduced to zero, so that the power consumption is continuously reduced.

4. Energy-Saving Analysis and Measures in the Design of Factory Power Supply and Distribution System

(1) Evaluation and analysis of power supply system and selection of electrical equipment

The power system can transmit the power required by the user. Since the distance between the power plant and the user is long, it is easy to trigger power consumption in the power transmission link. Therefore, in the substation design, the substation is set at the load center, and the higher distribution voltage is used to reduce the loss of the intermediate transformer; the length of the power supply and distribution lines is reduced, thereby reducing the power supply and distribution lines and achieve the purpose of energy saving. In the energy-saving design of power supply and distribution systems, the reasonable selection of electrical equipment is very important. There are many types and quantities of electrical equipment, so the power consumption of different electrical

equipment is very different. In the power supply and distribution system, electrical equipment such as motors and transformers have inductive characteristics. After passing through high-voltage and low-voltage lines, current will be transmitted to different electrical equipment, which will cause great consumption in the transmission of electrical energy. Therefore, the rationality should be improved and the energy consumption should be reduced in the line design. When the power conditions can be met, the capacity of the transformer should be combined to reduce the transmission distance of the line [5]. In the power transmission link, the consumption of electrical equipment should be reduced as much as possible, and its power factor should be improved. In the operation of the power system, the power factor is a important factor, which can measure the use efficiency of electrical equipment. If the power factor is too small, the reactive power will be very large, which will affect the efficiency of the use of electrical equipment. Therefore, in the process of energy-saving design, the power factor should be reasonably adjusted. In the selection of the motor, factors such as the start and load of the motor should be fully considered, the capacity of the motor and transformer should be properly selected, and the energy-efficient motor should be used to improve the natural power factor of the load. Energy-saving design and transformation can use the design of protection devices to improve the energy-saving transformation. The power parameters and parameter pools of the power supply and distribution system change with the fluctuation of the power load. In order to effectively prevent the system from malfunctioning during the change of the power load, a protection device should be designed to use high and low voltage power measurement equipment to load the electrical circuit and analyze with the rated value to improve the thermal stability test [6]. Some power supply and distribution systems need to have high reliability and perfect DC screen protection effects. On the other hand, companies should design high- and low-voltage power distribution systems. In the energy-saving transformation of the power supply and distribution of the factory, the energy-saving measures should be ensured to be feasible. Also, Costs should be analyzed, the selection of transformers should be improved, and the appropriate transformer should be chosen by combining the overall planning of the plant and the operation of the substation. Combined with the use of low-voltage cabinets and permit condition, the use of fixed switchgear can be applied.

(2) Reactive power compensation technology.

Reactive power compensation technology is often used in power supply and distribution systems in factories, but many factories do not implement reactive power compensation in substations and users of various workshops. This centralized compensation method cannot guarantee the effectiveness of compensation power. In order to meet national standards, the factory can only increase the power factor by setting more high-voltage compensation devices, but these circulating currents can continuously increase the current of transmission lines and transformers, reduce the power supply quality of the factory, and increase the energy consumption of the factory. To avoid this problem, effective measures need to be taken to increase the effective power of the plant's power supply and distribution system. Utilizing the compensation effect of phase-shifting capacitors and motor transformers to compensate for reactive power loss at the source, phase-shifting capacitors can be used as compensation equipment, and phase-shifting capacitors can be installed at the low-voltage bus sections of transformer stations in various workshops. If the operation of the capacitor is relatively stable, the reactive power compensation device can be directly placed on the site, and the power at the power supply inlet can be adjusted to ensure that the workshop transformer meets the working standards. In addition, the phase-shifting capacitors in the substation of the workshop can be appropriately grouped, and the adaptability of the phase-shifting capacitor is continuously improved by using switching methods. Under different working conditions, the power factor of the factory is within the range of national standards [7]. For large-scale machinery of the factory, if speed regulation is not required, reactive power compensation can be achieved using synchronous motors.

(3) Use economical transformer energy-saving technology.

Factories usually use high-performance transformers and run transformers in parallel. Through the combined use, the economic applicability of transformers can be continuously improved.

Determine the number of transformers to run based on the plant's electrical load. If the number of transformers used is relatively small, it can also meet the plant load, which can improve the economic efficiency of the plant. If the load is insufficient, joint adjustments need to be implemented. Factories need to choose energy-saving transformers. For example, non-crystalline iron core transformers have relatively low no-load losses and can be widely used in factories. Surrounding iron cores have higher working efficiency and stable working quality. Less wear and tear can also be promoted. When the factory upgrades the transformer, it needs to improve the economics of the combined application. According to the off-peak season of the factory, determine the different power needs. In order to maximize the power consumption of the factory, the factory needs to estimate its actual use. If the load is relatively large, two deformation systems can be used. Small power transformer system reduces power loss. In the peak production season, a more powerful transformer system can be used. The factory can open dual systems according to actual conditions to improve factory operation and production efficiency.

(4) Reduce transmission line losses.

First, the length of the wire can be reduced. In the process of designing the transmission line, the output lines of the low-voltage box and the distribution box should be straight, and the power supply radius of the low-voltage line should be controlled within 200m. The power supply radius of the line in the medium-density area should be controlled within 150m. The power supply radius should be controlled within 250m. In order to optimize the power transmission line, the actual length of the transmission line needs to be continuously adjusted according to the power supply radius, so that the length of the wire is minimized [8]. Secondly, the cross-sectional area of the wire needs to be increased. If the transmission line is relatively long and the load capacity is relatively stable, the cross-sectional area of the conductor can be increased during the grid design process. Although this may increase the economic investment of the factory, in the long run, by increasing the cross-sectional area of the wire, it is beneficial to save the factory's electrical energy. This power saving method is more scientific. Need to classify the electrical load. Water heaters and refrigerators are divided into ordinary loads, and one line is used to power these conventional devices. Use another line to power the larger machines in the factory. Based on the actual power consumption of the factory, the length of the wires and the cross-sectional area of the wires are determined to ensure the safety of power consumption in the factory [9]. At present, the power supply and distribution system of the factory consumes a lot of power in the transportation of power resources. In the output lines of low-voltage switch cabinets and distribution boxes, straight lines are generally used, and in accordance with local power consumption conditions, the power supply radius must be reasonably controlled, the long-distance transmission of power can be effectively reduced, and the losses incurred in power and transmission links can be reduced. In long-distance transportation, you can save power resources by increasing the area of the wire. Power cables use high-conductivity copper wires, and reasonable selection of cable insulation materials [10]. It is reported that the cable using the new insulation material has 30% to 40% lower inductive reactance than VV-type insulated cables, and has significant energy saving effects. It is recommended to use YJV-type insulated cables in the project.

(5) Popularize energy-saving lighting systems.

Factories need to vigorously promote energy-saving lighting systems to achieve energy savings. The factory lighting system needs to make full use of natural light, and use efficient energy-saving lighting levels and accessories in the factory office buildings, employee dormitories, and workshops. For example, LED lamps. The use of intelligent lighting can achieve unified management and complete the control plan [11]. For example, you can set up control schemes with a bypass scheme, all-night lights, and midnight lights for more work and rest time in the factory. It can play the role of intelligent control technology and strengthen maintenance and energy saving. For the operation near the lights, electronic ballasts are preferentially selected to improve the efficiency of power consumption in the factory and reduce power loss. The application of the lighting energy-saving system controls the illuminance value and power density value of the lighting system in accordance with the requirements of national regulations. Green energy-saving lamps are used to improve the

power factor of the lamp itself, make full use of natural light, and control the lighting time of the lamp to save energy effect.

(6) Complete process detection and control

Adopting the three-in-one computer control system and adopting mature control software to realize automatic control of the entire production process, which will help increase production and efficiency and reduce energy consumption. In addition, for large-scale equipment in the factory, a set of variable-frequency speed regulation system can be developed, which can timely adjust the operation rate of large fans and other equipment according to the user's production capacity requirements, and the energy saving effect is significant. Strengthening equipment inspections, improving equipment operating rates, and reducing idling time are all effective ways to increase enterprise output and quality and reduce energy consumption.

Conclusion: Energy-saving design of power supply and distribution plays a very important role in the operation of the plant and can promote the long-term development of the plant. In actual operation, the staff should attach great importance to energy-saving design. In combination with the operation of the plant, various technical means should be used to reduce power consumption, improve the economic efficiency of the plant, and achieve the effect of energy conservation and emission reduction. This paper analyzes the energy-saving measures used in the power supply and distribution system of the factory, promotes the factory to save power resources, alleviates the pressure on China's power, and can also improve the competitiveness of enterprises and achieve sustainable development. Therefore, in the future development process, the factory needs to give full play to the role of energy saving measures in the power supply and distribution system.

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