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# Research and analysis on optimization design of building electrical energy saving

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***ABSTRACT.*** *The electrical electrical energy saving design, designers should pay full attention to the goal of building electrical energy saving in building electrical design to reflect in the various sectors, from safety, reliability, economy and energy saving effects synthetically considered, necessary use scheme comparison, select a reasonable power supply and lighting solutions, choose the advanced high efficiency and energy saving equipment, scientific selection of control and management, maximum limit to save energy.*

***KEYWORDS:*** *building electrical, energy-saving design, electrical design*

## 1. Introduction

From a large number of literature data show that the high-rise building construction electrical system energy consumption is much higher than the foreign advanced building electric energy consumption in developed countries, the domestic construction is common electrical wiring is not reasonable, for the distribution network loss, serious harmonic, indoor lighting and comfortable position, problems such as poor system energy consumption is quite large, caused a huge waste of energy resources, increase the comprehensive use cost of users.Electrical designers should pay full attention to electrical energy saving design[1]. The goal of building electrical energy saving should be reflected in every link of building electrical design. Reasonable power supply, distribution and lighting schemes, advanced high-efficiency energy-saving equipment and scientific control and management methods should be selected to maximize energy saving[2].

## 2. Optimization Design Of Building Electrical Power Supply And Distribution System

In the design of power supply and distribution system, according to the relevant standards of residential areas, analysis of the requirements of different households, according to the reasonable planning of the load level of power equipment, to the optimal, the most economical distribution system design and distribution power generation. According to the requirements of civil building electrical design code

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(JGJ/t16-1992), the power supply and distribution load levels of buildings are mainly divided into three levels. High-rise residential communities have a lot of electrical equipment, according to the function of electrical equipment, can be roughly divided into three categories, namely superior electrical equipment, secondary electrical equipment, three electrical equipment[3].

The digitalization of high-rise residential communities is characterized by a large number of electrification equipment and a large amount of work. Therefore, two sets of power supplies are generally adopted, namely the dedicated power supply and the standby power supply. When the power supply fails, the main line needs the low-voltage output circuit of two different power transformers. Normal working order can not be disturbed, and the other power supply can meet the needs of power supply and distribution. The urban power supply and monitoring system monitors the power supply status and related data of power distribution equipment in real time, and mainly monitors the high-voltage main switch and the transformer main switch. In order to prevent the impact caused by DDC debugging or problem display, the intelligent data parameter transmission power voltage value is used.

The low-voltage main wiring of high-rise residential area is operated by single bus section and busbar switch is set. Manual and automatic operation of the contact switch, while monitoring the low-voltage distribution system mainly USES two independent transformers standby each other, independent form a group of 0.4/0.23kv power supply, the main distribution line using the single-bus segmentation method. These two power sources work well. In the event of a power failure, the contact switch can be operated manually or automatically, requiring that the other power supply can be fully loaded to meet the needs of the first and second load power supply. The monitoring and metering of the distribution monitoring system in the power supply and distribution system of a residential area is only for the related devices in the power supply equipment and distribution equipment. But the high voltage main switch, the transformer switch off situation, mainly carries on the supervisory control by the spot supervisory control function. To prevent the influence of DDC field fault or debugging, the power factor, current value, voltage value and other parameters are transmitted through intelligent power parameters, and transmitted to the power monitoring station through the field bus.

Transformer device has evolved from transmission and distribution to become an indispensable equipment in the current power system. In the power system, the total power of transformer accounts for about 10% of the total power consumption due to the large capacity of the system. For high-rise building communities, the total energy consumption of transformers is very large, the transformer loss accounts for about 50% of the line loss of the power system, and the power system loss accounts for 60% to 70% of the total power grid consumption of the substation loss. The selection of transformer should be considered from the following two aspects: first, energy saving; when selecting the capacity of new transformer, the low loss power transformer should be reasonably considered; second, the economic operation of power transformer should be considered and the light load operation of transformer should be prevented to the greatest extent. Calculation formula of active power loss of transformer:

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$$\Delta P = Po + \beta 2PK \qquad (1\text{-}1)$$

Transformer energy saving mainly adopts economic operation mode, that is, the total system loss of active power loss to the minimum, to achieve the maximum economic benefits of equipment operation. According to the power supply situation of all kinds of users in a certain community and the power supply and distribution system, time should be reasonably arranged to encourage low energy consumption and low peak power, so as to minimize the energy loss of the transformer, and save the loss of the line and the whole power grid. The final purpose is to realize energy saving.

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Electric motors are devices that convert electrical energy into mechanical energy. In a certain community, electric motors are all equipped with other devices, all provided by equipment manufacturers. Because the motor usually has a large capacity, it consumes a lot of power. According to statistics, the power of the motor accounts for 40%-60% of the total power. At the same time, due to lax management and backward technology, most of the motors have low efficiency, high energy consumption and serious energy waste in light load operation.

$$n0 = \frac{60f}{P} \qquad (1\text{-}2)$$

$$S = (n_0 - n)/n_0 \qquad (1\text{-}3)$$

$$n = (60f\ /\ p)(1-2) \qquad (1\text{-}4)$$

For motor stator winding, belongs to the connection of the three-phase squirrel-cage asynchronous motor, in order to reduce the current, at startup can transform in the connection mode and connection mode, this method is simple, and the cost is low, can effectively save electricity, from the analysis on energy saving effect, active power saving 20%, reactive power saving 50% in the case of other parameters constant, by changing the power frequency of the motor, can be done to change the speed of the motor, as the change of rotating speed, the actual motor speed will be relatively should change, through the change of power frequency to change the speed of the motor, That is, frequency control. In the actual construction engineering, the squirrel cage type electric motor in the electric motor type occupies

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the majority, this kind of electric motor can realize to the electric motor better speed regulation control, simultaneously in the computer network technology rapid development foundation, can realize to the electric motor frequency conversion speed regulation, may play the better energy conservation effect.

## 3. Reasonable Light Distribution To Achieve Energy-Saving Design.

The illuminative pattern of the village is decided according to the requirement to the light of indoor layout and environment, what need illuminance value according to different area is different will choose appropriate illuminant. Lighting design can not only illuminate the community, but also decorate and beautify the community, and provide people with a comfortable and efficient lighting environment. The calculation formula is as follows:

$$E_{av} = \frac{N\phi K_L K_{J\eta D}}{S} \tag{2-1}$$

Use coefficient method to calculate the number of room lighting arrangement:

$$N = \frac{E_{av} \times S}{N\phi K_L K_J} \tag{2-2}$$

Form according to the lighting situation, designers generally choose lamps and lanterns, by using the coefficient method to calculate the number of lamps and lanterns, the first step: according to the lighting situation, S the room area is calculated, and preliminary selected lamps and lighting, to find the manufacturer manual, power for lamps and lanterns, luminous flux Φ, lamps and lanterns of eta D efficiency. Step 2: according to the lighting occasions, check chapter 5 of architectural lighting design standards (gb50034-2004), and find the standard value of illumination Eav for different buildings or rooms. Step 3: calculate the coefficient KL.

The formula shows that, in order to improve the light distribution effect, KL can be increased. By using coefficient KL and ceiling reflection ratio, metope reflection ratio, ground reflection ratio, chamber coefficient equivalent, because the room cannot change the spatial position, so by improving the reflective ability of indoor walls, can improve the lighting effect, improve the lighting. Secondly, it can reduce the luminous efficiency and achieve the ideal light distribution effect.

## 4. Design Of Ef-Acs For Electrical Fire Monitoring Control System.

Ef-acs electrical fire monitoring system is a kind of advanced warning system for leakage monitoring. Different from the traditional automatic fire alarm system, the early alarm of the electrical fire monitoring system is to avoid losses, while the traditional automatic fire alarm system is to reduce losses. The electrical fire monitoring system can accurately monitor the fault and abnormal state of the

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electrical circuit, find the hidden danger of the electrical fire, timely alarm to remind the relevant personnel to eliminate these hidden danger, to prevent the occurrence of electrical fire.

The ef-acs host and the control cabinet of the electrical fire monitoring system are installed in the fire control room. UPS equipment is used for the system's special uninterrupted power supply. Monitoring modules are installed in each area according to the nature and purpose of the distribution system. The monitoring module ACS is installed in the distribution cabinet, and rs-485 special communication network connection is adopted between the monitoring modules! When the shunt tripping circuit breaker and the ACS module can be connected, it is convenient for manual/automatic control. The incoming circuit of all secondary normal lighting and emergency lighting distribution boxes shall be provided with residual current detection protection, and the residual current detection unit in the emergency lighting cabinet shall be connected with the ACS module in the general lighting cabinet.

## 5. Conclusion

Through the air of high-rise residential intelligent buildings energy-saving design of power supply and distribution system, lighting system, electric fire monitoring system design module separately carried on the detailed analysis and design, will be the goal of energy saving in every link in the design of the electrical, better realize the integrity of electric and electric energy saving, thus saving a lot of cost, make the area of economic, safe and comfortable.

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