The Frontiers of Society, Science and Technology

ISSN 2616-7433 Vol. 1, Issue 2: 103-109, DOI: 10.25236/FSST.20190215

Energy-saving Design and Analysis of Building Electrical Lighting System

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Absrtact: *In the process of modern social development, all walks of life are increasingly demanding energy-saving. In order to meet this demand, China's construction industry in the design of electrical lighting system also needs to achieve energy-saving design, improve the efficiency of energy use, and promote the sustainable and stable development of energy use. In this paper, the energy-saving design of building electrical lighting system is discussed.*

KEYWORDS: *Building engineering; Electrical lighting system; Energy-saving design*

0. Introduction

Electric energy belongs to the main energy source of social development and plays an important role. With the development of electric energy characteristics and use functions, electric energy can be summed up as the main secondary energy for urban construction planning, agricultural production development and daily life of residents. Building energy consumption is mainly for building central air conditioning, electrical lighting equipment, water pumps and water supply equipment, other auxiliary electrical equipment. Central air-conditioning consumes most of the electricity, followed by lighting system. Central air conditioning and lighting system occupy the main position in the building, or the main body of energy consumption. In this way, in order to build an environment-friendly and resource-saving society, reduce the energy consumption in the process of building operation as the main work, realize the optimization of energy-saving scheme of

ISSN 2616-7433 Vol. 1, Issue 2: 103-109, DOI: 10.25236/FSST.20190215

lighting system, and improve the economic benefits of energy-saving development.

1. Basic Principles of Energy-saving Design for Building Electrical Lighting

1.1 Perfect function

In the actual use of buildings, their uses are different, so the functional requirements are also quite different. Therefore, in the process of lighting system layout, scientific analysis should be carried out according to the functional requirements of different buildings. For example, in the lighting design of entertainment venues, not only give full play to the function, but also have eye-catching performance[1].

1.2 Overall layout of economic development

At present, the functions, quality and safety of different electrical equipment in lighting market are also different. In the selection of electrical lighting, economic, suitable and efficient lighting devices should be selected according to the actual needs of users, so as to improve the efficiency and overall benefit of lighting, so as to advance the overall layout of the development of building electrical economy[2].

1.3 Green lighting

Based on guaranteeing the life, work and study of users, the unnecessary power loss in buildings can be reduced or avoided from the perspective of building electrical energy saving. In this process design, avoid excessive pursuit of energy-saving effect, neglect the use of demand, to achieve the scientific energy-saving design of building electrical lighting[3].

2. Energy-saving Design Strategy of Building Electrical Lighting System

2.1 Analysis of Design Scheme

In the process of realizing energy-saving design of building electrical lighting, it

ISSN 2616-7433 Vol. 1, Issue 2: 103-109, DOI: 10.25236/FSST.20190215

is necessary to rationally select the design scheme and optimize the design scheme. In order to achieve this goal, designers are required to: 1) Lighting equipment design has the use performance, can not be energy-saving because of energy saving, ignoring the actual needs of users. For example, in the process of realizing the design of lighting equipment in air-conditioned rooms, the general lighting, mixed lighting and local lighting methods should be combined to achieve energy saving. In the process of room design which needs good lighting effect or light color, natural light should be used without destroying the overall design goal of the room. (2) In the process of actual design, the structure, function and cost of Chinese-style buildings should be considered so as to make the design scheme efficient, energy-saving and green. For example, in the design process of power start-up equipment such as fluorescence, electronic ballast and gas discharge power can be combined to reduce energy consumption. (3) In the process of building electrical lighting design, the corresponding industry standards and national laws and regulations should be taken as the basis, regardless of which kind of construction lighting design, to meet the design standards[4].

2.2 Selection of high quality lamps and accessories

At present, energy-saving fluorescent lamps are mainly used in indoor lighting, which have high light efficiency, low thermal radiation, long service life, and can choose light color. In the process of continuous development of technology, the structure of straight tube fluorescent lamp is gradually reduced, which can improve the light efficiency, save production cost, play an important role in reducing the use of metal mercury and phosphor, and meet the energy-saving planning requirements of green building lighting. Reasonable selection of lamps can improve the lighting effect of light source, and combine with the theoretical basis of conversion of lighting effect. The reflection surface of lamps has a higher reflection ratio, and the lighting effect will be better. Therefore, lighting designers should reasonably choose the radiation surface of lamps and lanterns, so as to improve the reflection ratio, so as to improve the lighting effect. Generally, in order to meet the basic lighting needs of building rooms, open lighting lamps should be selected to give full play to 75% of the energy conversion advantage. Based on the analysis of actual lighting usage in construction projects, the gas discharge lamp is relatively high, and it is widely used

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in building lighting system. When using gas discharge lamp and matching lamps, using appropriate ballast and high-quality and high-performance electronic ballast can realize energy-saving optimization of building lighting system[5].

2.3 Lighting distribution

Lighting distribution system should meet the following requirements in the design process: Lighting distribution box should be installed in the lighting load center, and close to the power side, so as to reduce line losses. When the installation power of lighting is relatively large, special transformer for lighting should be set up; compensating capacitance should be set for gas discharge lamp, and the power factor after compensation is above 0.9; rated voltage of high-intensity gas discharge lamp with power over 1500W is 380V. The power supply voltage of general lighting source is 220 V. If the voltage deviation is large, then an automatic voltage stabilization device should be set up. The current of each single-phase branch circuit should be less than 16A, and the number of connected power sources should be less than 60. The power socket can not be connected to the same branch circuit with the lamp. When using type I lamps, the leakage conductive part of the lamps should be grounded reliably. Isolation transformer should be used for safe ultra-low voltage power supply. The selection of conductors should meet the following requirements: copper conductors should be used for lighting distribution trunk and branch lines, and copper core insulated conductors should be used for lighting branch circuits, whose cross section is more than 2.5 mm 2. The section of lighting distribution line should calculate current according to load, and the voltage loss from distribution transformer to lamp head should be above 5% of rated voltage. The main power supply to the three-phase distribution line of gas discharge lamp should meet the needs of unbalanced current and harmonic current[6].

2.4 Intelligent control system

Because of the continuous development of building electrical lighting system, intelligent control system has emerged. Using intelligent control system in lighting relation system can improve the normal operation ability of lamps and give full play to the functional requirements of lamps and lanterns. In addition, the intelligent

ISSN 2616-7433 Vol. 1, Issue 2: 103-109, DOI: 10.25236/FSST.20190215

control system can achieve no illumination dazzling, the light emitted by lighting lamps is more gentle, evenly distributed in the lighting system, the overall energy-saving effect. For example, the designer can make the smart home system as an intelligent control system, which can control the lighting and monitor it remotely. With the application of intelligent control system, the lighting lamps in building electrical can be managed. In the process of energy-saving design of building electrical lighting, automatic adjustment of lighting equipment does not waste a lot of human resources, so as to reduce the consumption of labor costs. So this system can use computer network to control lighting, so that the defects caused by manual control can be reduced[7].

Taking an office building project as an example, the construction of its electrical lighting system should make full use of natural light, that is to say, under the condition of defining the effect of natural light, the lighting range of indoor environment should be controlled to meet the energy-saving and environmental protection needs of building users for the operation and control of lighting system. Natural light is divided into sunlight and sky astigmatism. Electrical lighting system mainly uses the former to reduce the energy consumption of building lighting. For example, a row of illumination near the window of the office should be controlled independently. In this way, under the premise that the natural light can meet the illumination requirements, the row of illumination lamps should be closed, so as to achieve the purpose of energy saving. For example, there are many rows of lamps in an office, corresponding to different jobs, each lamp should also be controlled independently. People are lighting up, people are walking out of the lights, saving energy, and will not affect the normal work of other staff[8].

3. Concluding remarks

China's population base is relatively large, so its corresponding proportion of energy consumption is also relatively large. However, in the process of energy-saving design, it will be constrained by the national conditions in the primary stage, and there are few research and development fields. Compared with developed countries, their energy-saving technology is relatively backward. In the process of the continuous development of society and economy, society is also making constant progress, and the effective use of energy has attracted the attention

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of all sectors of society. In this way, China should attach importance to environmental protection propaganda, so as to improve the energy utilization rate and achieve sustained and stable economic development. In the process of building construction, how to improve the efficiency of electric energy use is the main work of modern designers. In order to make our country's energy-saving design level of building electrical lighting in line with the world, it is necessary to promote the healthy development of energy-saving of building electrical lighting and effectively promote the sustainable development of social economy. In this way, we should reasonably determine the optimization scheme, scientifically select lighting fixtures, make full use of natural light sources, realize the optimization of lighting control, and use multi-pronged approach to achieve the purpose of saving energy consumption.

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