Analysis on Zero Energy Consumption Strategy for Office Buildings Lighting in Lianyungang Area

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Abstract. In recent years, the energy-saving environmental protection has aroused the people's high concern, and set off a new application practice in China. By analyzing the advantages of the illumination condition in Lianyungang area and combining the content and form of office space, the author puts forward a series of ways and means of energy saving in office building lighting, in order to provide a way for reference to the goal of building Zero energy consumption in the office space environment under the background of green architecture.

1. Lianyungang Area Lighting Conditions Advantage
Lianyungang natural illumination resources are abundant, according to gb/t5ZeroZero33-2ZeroZero1 "Architectural Lighting Design Standards", it is known that the area belongs to the IV area of light climate zone, and the average illuminance of other districts is 22klx≤eq<24klx, which can be illuminated by the annual average illumination of 23klx. The area's natural lighting can replace daytime electric lighting, averaging at least 1Zero hours of daylight (6:ZeroZero-18:ZeroZero) in winter (8:ZeroZero-16:ZeroZero), natural lighting does not require electricity, and all parts of the lighting system can be recycled.

2. Method Strategy of Zero Energy Consumption in Space day Lighting Illumination of Office Building under Green Building Background in Lianyungang Area

2.1. Reasonable Layout of Office Space--Natural Lighting
Design first consider the layout of the building space, arrange office space with high frequency use in the south and east of construction, while arrange office space that not often used, such as conference rooms, toilets, staircases in the north of the building, which can effectively improve the space utilization of natural resources and reduce the power consumption of artificial lighting.

2.2. Coordinated Configuration of Natural Lighting and Artificial Illumination-Complementary Dynamic Illumination
For example, most of the office space lighting is by the side window light, the average lighting coefficient required is usually 2%-3%, when the window area occupies the external wall area about 1/3, and the area near window that is the range about 1.5 times higher than the depth of the window can be used in natural light lighting. However, the natural illumination below the prescribed standard of the area must be artificial illumination auxiliary, in the light coefficient of less than Zero.5% of the area, it mainly relies on artificial illumination, this will form three different lighting areas: natural lighting area, mixed lighting area and artificial lighting area.

The overall lighting of the work area is the rational disposition of the natural light and indoor artificial lights injected into the window, in order to create a comfortable and harmonious office
environment, the whole illumination of the space is coordinated by dynamic adjustment. The coordination method is divided into two kinds: illuminance balance and brightness balance, illumination balance refers to daytime indoor natural light exposure window, for the deep space of office space, in order to make the depth of illumination and near window illumination balance, the artificial illumination near the window can be reduced to make the whole space illumination uniformity; Brightness balance refers to the daytime interior window brightness is very high, for the people in room, the window near ceiling and walls appear dark, which will make people feel the entire space dark, so it must make indoor artificial lighting and natural light window brightness balance. When the brightness of the window decreases, the indoor artificial illumination is correspondingly reduced to meet the sensory needs of the office scene, and the illumination design adopts the dynamic control of the photosensitive device to reduce the light energy consumption and save energy.

Figure.1 One day of different moments of dynamic lighting program model

Figure.2 Solar windmill lamps daytime power generation and night lighting

2.3. Rational Configuration of Dimming Control System-Adjusting Type Dynamic Illumination

Some office space parts are equipped with photoelectric sensor to control dimming system, such as: manager's office, conference room and so on, the privacy of the building interior semi-private office space can be based on natural light changes in a timely manner to continuously adjust the light and shade, so that the office area of natural lighting and artificial lighting can maintain the total illuminance, to save lighting power consumption reduction.

In addition, the study found that long time in the same artificial lighting environment of the work will lead to a decline in sensory sensitivity, especially the modern computer automation office and traditional office make it more easy to produce visual fatigue and affect the quality and efficiency of the work, so the overall artificial light environment of office space can simulate the dynamic
regulation of the movement of natural daylight, according to the need of human visual senses, adjust the intensity of illumination and the change of color temperature dynamically, use intelligent control to carry on dynamic illumination. As shown in picture, this is a dynamic illumination scheme model at different times in one day.

2.4. Refraction Lighting—Using Prism-Type Crystal Glass Windows to Improve the Uniform Distribution of Indoor Illumination

As shown in picture, the building uses a crystal prism window, one side is the crystal glass plane and the other side is the serrated prism surface, the saw-tooth mirror angle is 90°, as shown in picture, the middle gap between two sides of saw-tooth interlock is small, and glass materials can be derived from crystal, because of the crystal hardness, high melting point, good temperature resistance, light transmittance, chemical stability, and Lianyungang has a wealth of crystal, quartz and other resources, which is named as China's crystal capital, the crystal is used for exterior lighting decoration of buildings can highlight the regional characteristics. As shown in picture, mosaic crystal wall, crystal partition indicates that the domestic crystal has been gradually developed by handicraft jewelry for architectural decoration, all the physical properties of crystal are stronger than glass, especially the piezoelectric effect, so it is more suitable for solar modules, in the Rainbow Church, designed by Japanese designer Tokujin Yoshioka, there exists a glass window with 5×5×5 crystal prisms, There is also a crystal prism inverted cone in the building of the Reichstag of Berlin. Foreign designers have widely used crystal prism glass windows extensively for architectural decoration.
building spacing is very small, more light can be obtained. Because of the constant variation of the sun's altitude angle, the angle direction of the crystal prism is flexibly set by the photoelectric sensor, keeping track of the changes of the sun's orbit, and in different seasons and time, the prism angle direction is also different. Crystal prism window is generally installed in the upper part of the window, in the position above the people's view, which can avoid the view of the scene to produce blurred landscape deformation.

2.5. Reflective Lighting-Using Reflective Material to Guide the Light into the Interior
In order to give full play to the effect of natural lighting illumination, the design must study the device which will lead to the deep space of natural light, and avoid glare when the device is used. By brushing or installing reflective materials on the walls of the building's office area, or setting up a reflector in the window inside and outside the line of light, the brightness distribution of indoor lighting can be improved at the same time, it also can prevent the vicinity of the area by direct sunlight to produce glare interference work, as well as to avoid the anti-light plate shielding people's view. As shown in the picture, several design schemes using reflective materials for day lighting.

2.6. Direct Scattering and Transmission Lighting-High Efficiency and Energy-Saving Environmental Protection of Solar Cell Module Wall
The Zero energy-consuming building of the outer wall of the whole solar cell module is itself a large solar radiation receiver, which is made up of a series of monocrystalline silicon solar cells, with high current density and smaller size. The solar panel is formed by the aluminum alloy frame, the front plate and the bottom plate lamination. The metal frame of the assembly has a mounting hole that is easy to use and has a solid structure. The 3mm thick tempered glass front plate can provide efficient protection against environmental and mechanical effects, with high transmittance to direct and scattering light, and can make indoor light with diffuse effect and direct effect, in addition, seal floor can effectively prevent moisture intrusion and seawater infiltration corrosion.

Figure.10 Solar cell components Appearance effect of artificial freshwater island

3. Analysis of Zero Energy Consumption Strategy of Day Lighting Illumination in Office Space under Green Building Background
In terms of the lighting of office buildings in Lianyungang area, it is required to distribute the natural light evenly, to prevent direct sunlight, and to avoid the glare of specular reflection from glass wall. Therefore, the overall illumination of the building is mainly skylight refractive window lighting, partial illumination in some areas is supplemented by one side lighting, when the depth of the office space is 6m-8m, and the window area is about 1/4 to 1/5 of the floor, the minimum day lighting coefficient of the working area is 1.5% to meet the requirement of the light environment of the employees ' office work. The space illumination uniformity of the one side day lighting is poorer, the illumination of area near the window is more than 1Zero times higher than that of the inner wall, therefore, the design should set up windows on the inner wall to supplement the natural illumination. For the south-facing space, the windows should be arranged in the middle of the side window, and set
up a parallel window visor on the high side to prevent direct sunlight, the daily illumination of the office area in the window can also be lowered appropriately, as a part of the natural lights being reflected to indoors, the minimum value of day lighting coefficient in the office area can be slightly improved, thus improving the overall space office lighting level. When the high brightness of the side window in the space wall forms specular reflection and produce glare, at this time, at the distance of 1.5M to the wall, the windows in the local work area within the scope of the external wall should not be opened, the area can be supplemented by appropriate artificial lighting to assist in order to improve the brightness of the wall, also, by making the wall decorated with matte diffuse reflective material, the glare reflected by the light and shadow can also be weaken.

Simulated daylight illumination test on Zero energy-efficient building office space, this paper analyzes and discusses the organic combination of solar lighting and sunshade system deflection system: In summer, the sun's height is larger than the winter, the sunrise and sunset rays of office space of eastern-western wall are incident angle, relative to the southern wall, it is more likely to produce light heat. While for the western window, the height angle of the solar incident in summer is lower than that of the south, and the incident sunlight is easier to reach the working area, resulting in glare effect work. Therefore, for the west wall, in addition to the internal shading, it is mainly in the block plate shading, if the use of horizontal sun visor panels, it needs to be parallel with windows, and low incidence angle of solar irradiation can be controlled by combining with active sun shading.

4. Concluding Remarks
As shown in the picture, the application research of lighting design can take a dynamic form, and imagine the architecture as a transitional space filled with various scales in the city—the transitional space in which light and shadow converge. This paper studies the model experiment of Zero energy-consuming buildings based on the green building background, interprets the changes of the content and form of the new office space and the standard requirements of the new office lighting. The paper also studies and explores more natural forms of space and natural light resources. In the study of Zero energy-efficient building office space lighting program, in the exploration and practice of lighting design, the paper has always been committed to the local style perfect integration into the design. Nowadays, many local factors influence people's deep thinking on design, such as architectural form, material selection, geographical environment and climatic conditions, especially the corresponding lighting and ventilation. With the development of building technology, no matter whether daylight illumination or artificial lighting design, they all will have a broader stage.

5. References
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