Journal of World Architecture

Research Article

Technology and Strategy of Low-carbon Building Design

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Abstract: After the reform and opening up, China's economy has developed rapidly. But in the process of economic development, the ecological environment has also paid a huge price. The destruction of the ecological environment directly affects survival and development of people. Therefore, it is necessary to strengthen environmental governance. Everyone has also begun to focus on low-carbon development. The construction industry is a serious waste of building materials with large energy dissipation. Therefore it is also a key industry for low-carbon transformation. This article mainly analyzes low-carbon building design technology and studies specific development strategies.

Keywords: Low-carbon; Architectural design technology; Strategy

Publication date: April, 2020

Publication online: 30 April, 2020

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1 Introduction

With the intensification of global warming and the destruction of the ecological environment, all countries have begun to pay attention to the development of low-carbon economy and actively explore effective ways to develop low-carbon economy. In urban development, the building industry dissipates relatively larger amount of energy. Compared with other industries, the building industry has a lot of room for low-carbon development. Therefore, the building industry must pay attention to energy conservation and emission reduction, so as to reduce greenhouse gas emissions, and to improve the quality of energy-saving technology. As a result, it has led to the introduction of low-carbon buildings in the development of the modern building industry. This type of construction not only needs to reduce environmental pollution, but also needs to improve the ecological environment.

2 Concept of low-carbon building

Low carbon in architecture refers to the design concept of avoiding material waste and reducing energy dissipation as much as possible during the design and construction of the building, while ensuring the performance of the building. For example, carbon dioxide emissions can be reduced by increasing energy rate of utility. In the design process of low-carbon buildings, a series of technologies such as mass, space organization, construction, design of maintenance, illumination, daylighting, and ventilation are used to reduce energy dissipation of building and achieve the comprehensive low-carbon effects[1]. At the same time, the mild air circulation and microclimate circulation are formed in the building to reduce carbon dioxide emissions.

At present, many low-carbon type buildings mainly adopt a method of glass curtain walls in terms of energy saving to improve efficiency of daylighting. But there is not much study on floor slabs and exterior walls. At the same time, in the research of low-carbon buildings, too much attention was paid to the study of cold areas, because these areas require heating in winter and air conditioning in summer, which dissipates relatively large energy. In order to reduce energy dissipation, it is necessary to use thermal insulation design on the periphery of the building, so as to act as thermal

insulation and heat isolation. But thermal insulation and heat isolation are a pair of contradictions, and more problems need to be solved in order to achieve this goal[2]. Through research on the current situation of carbon dioxide emissions from buildings, it is found that carbon dioxide emissions in buildings are mainly caused by energy dissipation. Meanwhile, carbon dioxide emissions will also increase during the production and transportation of building materials. Therefore, to reserve the energy and reduce the emission of building needs the reduction of daily energy dissipation, which should be implemented in terms of the production and transportation of building materials.

3 Advantages of low-carbon buildings

3.1 Contribute to reducing energy dissipation

According to the analysis of building energy dissipation, it can be known that the energy dissipation of building mainly are caused by the construction and utilization of the building, and the building not only dissipate energy but also emits pollutants. And through the application of energy-saving technology of low-carbon building, it is conducive to greatly reducing the energy dissipation and pollutant emissions of buildings. According to the analysis of relevant data, it is suggested that compared with ordinary buildings, low-carbon energy-saving buildings have reduced energy dissipation by about 70%, which plays an important role in environment protection[3].

3.2 Conducive to the improvement of new buildings

From the analysis of the current form of general building, the commercialization characteristics of the building design, building process and applied technology of production are obvious. The low-carbon building emphasizes low energy dissipation in terms of design, choosing of raw materials based on local materials as much as possible, as well as reflecting the culture of local characteristic. This form of building reflects a new type of architectural aesthetics and artistic style[4].

4 The application strategy of design technology of low-carbon building

Low-carbon building plays an important role in the development and protection of the ecological environment and is also the main trend of the development of building in the future. Therefore, it is necessary to reasonably design the internal and external environment of buildings and integrated management systems in combination with low-carbon requirements and characteristics in the design of low-carbon buildings. Through the application of new energy and new materials, it provides more references for low-carbon building design work, and promotes the smooth development of low-carbon building work. Meanwhile, it provides strong support for the protection of the ecological environment, and also acts as the basement to increase the international competitiveness of China's building industry. Next, the specific application of the design technology of low-carbon building will be analyzed[5].

4.1 Design of the internal environment of low-carbon buildings

First, it is the design of the internal light environment and acoustic environment(Table 1). In the design process of the building, a wave-shaped or arc-shaped building can be used as the main structure. The design of this building is conducive to the natural lighting of the building and prolong the time of it. It is beneficial to shorten the time of artificial illumination and reduce electricity dissipation. At the same time, some equipment of natural light such as reflective light panels and light pipes can be introduced into the architectural design. The decoration mainly use light tones to enhance the secondary reflection effect and intensity of light. Through these means and methods, the light inside the building can be enhanced, while ensuring the uniformity of the light, and enhancing the natural brightness in the building. At the same time, for the design of the windows of the building, it is necessary to reasonably set the orientation and area of the windows in combination with the characteristics of lighting to ensure the lighting effect [6]. In order to prevent solar radiation and reasonably control indoor sunlight as needed, a sunshade can be designed for the building and retracted as needed. Natural ventilation needs to be taken into consideration to improve the indoor air through natural ventilation and take away excessive heat in the design of the doors and windows of the building.

In the design of the acoustic environment, the location of the bedroom and the location for rest should be chosen as far as possible from the location of the noise source so as to effectively reduce the noise in the building. This design form has an important role in reducing noise. However, it is also easy to conflict

with daylighting. Therefore, during the design process, designers need to consider both noise reduction and daylighting, which means it should not affect the indoor daylighting of the building, but also reduce the noise impact. There are many ways to reduce noise in buildings. For example, sound-proofed curtain can be used for noise reduction or green plants can be placed around the building to reduce the transmission rate of noise into the room[7]. In addition, noise can be reduced by using sound absorption materials. For example, the porous sound-absorbing materials can effectively absorb sound.

Table 1. Design of sound and light in the building

Project of design	Form of design
Light design	Wave or arc shape, reflecting light board or light pipe equipment, reasonable design of door and window position, light reflection secondary reflection
Acoustic design	Backward noise source design, sound insulation curtain, porous sound absorbing material

Second, it is the design of the water and thermal environment in the building(Table 2). The design of the up and down of water in the design process of low-carbon buildings is one of the basic designs. In the design process, not only the water quantity and water quality issues need to be considered, but also water conservation must be paid attention to. In low-carbon buildings, rainwater collection devices can be designed to collect rainwater. Or a special sewage treatment system can be set up so that sewage can be disposed on-site. And the choice of water supply settings requires should emphasize the type of water conservation. If tons of water is also needed in the architectural landscape, then it needs to be taken into consideration in the water design[8]. In addition to the water environment, the thermal environment is also a major consideration in building design. It includes operations in thermal environments such as heating and cooling. Building heating in winter should be as energy efficient as possible while ensuring the comfort of the owners. If air conditioning needs to be used in summer, the indoor temperature needs to be set between 22 and 27 degrees Celsius, which is beneficial for reducing energy dissipation.

Table 2. Design table of water and heat environment in the building

Project of design	Form of design
Design of water environment	Reorganization of water supply, enhanced quality of water, water reservation, rainwater collection device
Design of thermal environment	Heating, cooling and energy saving. Air-conditioning should be controlled between 22-27 degrees Celsius

4.2 External environment design of low-carbon buildings

4.2.1 Green environment design

At present, there is a close relationship between architectural design and greening. The two can be unified, and resources need to be integrated in specific operations. At the same time, the job of compounding construction and greening should be nicely done, so as to expand the benefits of both in maximum and improve greening coverage. Therefore, it is necessary to highlight the human characteristics in the design of building greening, and to focus on solving the problems of building and urban ecological environment[9]. The building with the green environment and the natural environment should be integrated to ensure the continuity of the space and improve the ductility of the building. In the process of entering and leaving the building for the people, residents can easily pass the external green environment. And at the same time, a good green environment can create a sense of physical and mental enjoyment as well as enhance the visual enjoyment of the residents.

4.2.2 Smart design

With the development of science and technology, more and more intelligent systems begin to be applied to the design of the building environment. However, the application of these intelligent devices often requires power support. In order to achieve the purpose of low-carbon environmental protection, it is necessary to reduce the operation of the device as much as possible. After meeting the needs of the occupants, reducing the number of applications of the equipment and achieving the purpose of reserving electrical energy, can also help reduce air pollution. The Internet of Things is

an important component of intelligent technology. It is a form of science and technology that promotes the connection of objects in buildings. At present, it is widely used in architectural design, such as radio frequency identification, infrared sensor lights. And actual objects can be connected be carrying out agreed protocols. The realization of the positioning, tracking, supervision and identification of objects is conducive to the monitoring of buildings. Through the application of intelligent technology, the energy-saving management system can be improved to realize the monitoring functions of energy dissipation of building, environmental monitoring, equipment operation and other aspects, which is beneficial to the supervision and management of the building environment.

4.3 The design of the overall management system of low-carbon buildings

The advancement of science and technology has led to the development of networking and digitalization in various industries, and the building industry has also shown this trend of development. In the digital development, we pay attention to the application of international advanced digital technology, and carry out scientific prediction, analysis, monitoring and feedback on the entire building, so that the carbon emissions of the building can meet the standard. First, through the application of digital technology software in building design, the carbon emissions of buildings are simulated and estimated. This high-tech method can obtain the carbon emissions of buildings in a short time, so the current calculated method is also a very common form of calculation in design of low-carbon building. Through the application of digital technology, the physical environment in the design can be digitized and parameterized, and it can be effectively applied in reality. In addition, environmental science and digital technology can be combined to reasonably calculate the carbon emissions and low-carbon energy reservation effects that buildings may generate after use. Secondly, in the design of low-carbon buildings, the advantages of use and management of building can also be brought into play through the application of digital technology. The water supply and drainage system, digital management system, illuminating system and power system in the building are integrated into the central computer system to form comprehensive system management and utilization to improve operating efficiency of the equipment. The main system among these will form a central processing module to respond reasonably to the control of equipment and then achieve reasonable control of building carbon emissions(Table 3).

Table 3. Overall management system design

Project of design	Form of design
Project 1	Digital technology software is used to simulate carbon emissions and form physical parameters
Project 2	Digital technology is used to strengthen management and integrate water supply, drainage, lighting, and power systems

4.4 Design and application of new energy and materials

The concept of energy conservation in design of low-carbon building needs to give full play to the advantages of new energy sources. This requires the use of new energy and new materials in the design process of low-carbon buildings, so as to reduce the use of chemical fuel in buildings and the environmental pollution. It needs to meet pollution-free conditions as much as possible in the process of selecting and using building energy by using some renewable resources such as wind, solar, and geothermal energy. Solar energy is mainly used for daylighting and heating in buildings[10]. At the same time, the selection of new materials is also an important way for applications of design of low-carbon building. The use of new materials can improve low-carbon efficiency. For example, nanomaterials will not cause environmental pollution during utilization and the subsequent processing. Furthermore, in the design of the wall surface, diatom mud is selected as possible, which is beneficial to eliminating indoor pollutants and achieving the effect of low carbon and environmental protection.

5 Conclusion

In summary, design of low-carbon building is an important concept in current architectural design. In the process of design of low-carbon building, comprehensive considerations must be given to the integrated characteristics of the building's living comfort, energy reservation, and environmental protection, so as to reduce the loss in the building design as much as possible. It will increase the utilization of building materials and energy, and make

full use of renewable resources and natural conditions to meet the needs of building.

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