

Research on Low Energy Consumption Building Design

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Abstract: *With the continuous and rapid development of the national economy and the continuous improvement of residents' material and property living standards, the number of urban and rural public buildings has rapidly increased, promoting the high-speed and healthy development of China's construction industry. Organization, the pace of China's new urbanization has accelerated, and various large-scale construction projects have also increased, highlighting the problem of insufficient energy consumption in construction projects, according to relevant data statistics, building energy consumption in various industries accounts for 40% -50% of the total social energy consumption for the entire year. Energy efficiency and low energy consumption concepts in building design have become the most important issues for architectural designers. This article will conduct relevant research around the characteristics and necessity of designing low energy buildings.*

Keywords: *new materials; design; low energy buildings*

1. Introduction

For a long time, the large-scale construction and building materials industry in China has generally tended to follow the extensive and non-traditional business management models of manufacturers of construction and building materials. They prioritize the comprehensive utilization and development of natural resources over the protection of ecological and environmental resources, and prioritize utilization over improvement. In order to continuously accelerate the construction of a healthy, energy-saving, and environmentally friendly society, it is imperative to design and build low energy consumption buildings.

2. The importance and necessity of designing and constructing low energy buildings

China is currently the country with the largest annual increase in various types of new buildings in the world, with an additional construction area of 2 billion square meters, equivalent to 40% of the world's cement and steel consumption. At the same time, billions of construction material waste are generated every year, posing a huge threat to the construction environment in China and even the world. At present, various types of construction industries in China have been in a monotonous and technologically backward development state for a long time. The main indicator factor is that these small solid clay and sintered bricks still account for 95% of the market share in various wall materials in China. Due to the large population and relatively small arable land area in our country, protecting arable land directly affects future generations. Moreover, there is a serious shortage of energy, land, water, raw materials and other resources in China, but the actual utilization rate is very low. Building materials cause serious environmental pollution and continue to worsen. With the continuous strengthening of national awareness of energy conservation and environmental protection strategies, and the dual pressure of energy shortage, "energy-saving buildings" and "green buildings" have become very popular topics of concern, and the design and construction of low energy buildings is very important[1-3].

Emphasizing energy conservation in architectural design is beneficial for fundamentally promoting energy resource conservation and rational utilization, alleviating the contradiction between China's energy resource supply and economic and social development, ensuring long-term national energy security, protecting the environment, improving people's quality of life, implementing the scientific development concept, accelerating the development of circular economy, and achieving sustainable economic and social development.

3. Design characteristics of low energy buildings

The main technological advantage of low energy modern architectural design lies in its ability to reduce cost risks and effectively utilize and control energy consumption in buildings. At the same time, it has the following basic and significant characteristics: firstly, a set of relatively scientific quality indicators for evaluating energy consumption costs in current building design are set up, which are sequentially presented as the direction of China's current energy conservation needs in building design, Mobilize the subjective initiative of current architectural design and construction professionals in China to continuously reduce the cost of energy management in architectural design. Secondly, the energy-saving application of architectural design is in its early stages, and it is relatively convenient to control the quality of form, structure, size, and the setting and adjustment of energy-saving parameters in current buildings.

This minimizes the energy demand and cost risks in the early stages of architectural design in China, taking into account passive factors such as the surrounding environment and climate change that affect energy, Excavate the potential energy consumption of building design and construction sites in China, integrate the comprehensive utilization and recycling of energy around buildings with relevant technologies for building energy conservation and reuse energy management, and achieve a perfect mutual utilization and fit between the surrounding environment of buildings and natural resources. Finally, low energy consumption building energy management, as an important means of energy-saving utilization in current building design, effectively utilizes and saves some of the main energy consumption factors that were not originally sustainable and deterministic in China's construction industry, and optimizes their utilization as its ultimate goal, Upgrade and transform into the current energy-saving application technology for building design and construction enterprises, as well as the energy-saving resource management application technology for building engineers.

4. Building design principles under the premise of environmental protection and energy conservation

Nowadays, with the continuous enhancement of modern people's awareness of green energy conservation, environmental protection, and low-carbon buildings, and the dual economic pressure of increasing global clean energy supply, "energy-saving buildings" and "green buildings" have become the hottest academic discussion points and topics. The engineering design standards and technical requirements for energy-saving, low-carbon, and environmentally friendly green buildings should also be completely unified, What the energy-saving and environmentally-friendly green building industry should do in employment is to build environmentally friendly buildings, fully utilize renewable resources such as sunlight and rainwater that are close to nature, utilize clean energy, and maximize green and low-carbon energy, which can save electricity and water as well as low-carbon water. We will vigorously develop new types of green, energy-saving, low-carbon buildings, energy-saving, and environmentally-friendly green buildings. This is already an important strategic planning direction for the development of China's green and environmentally friendly construction industry in the next five years[4-5].

5. Design methods for energy-saving buildings

(1) The correct site selection for construction bases. Generally, the site selection for construction engineering bases should try to maintain the best location with a sunny and windward direction, creating necessary ventilation conditions for the entire construction base to achieve sufficient summer sunlight.

(2) The main factors that need to be considered when choosing a good oriented apartment include: whether there is an appropriate amount of outdoor sunlight in winter and whether high-quality outdoor sunlight can shine into the room regularly throughout the year; Try to minimize direct sunlight from the outdoor sun during hot and hot seasons on the outdoor walls of indoor and other living rooms; In summer, indoor ventilation is good, and in winter, try to avoid outdoor cold fans blowing; Fully utilize natural terrain and space in winter to save building land; Fully cater to the functional combinations of different groups in high-rise buildings where residents reside. Most high-rise residential buildings are oriented in a north-south direction or are relatively close to a north-south direction. The residential area and some east-west high-rise residential buildings have adopted measures such as shading and guiding fans, respectively.

(3) How to choose a building with a suitable temperature and a distance of one to two degrees of

sunlight on the roof is not only of great significance for each of us due to the basic research of human physiological hygiene and medicine, but also has a certain degree of hygiene and impact on our daily life psychology, physical health, and spiritual well-being.

(4) A good organization can arrange the entire main building through internal natural ventilation consistency - in winter, we can effectively reduce the rotational wind speed of the cooling fan inside the main building, effectively reduce the direct loss of relative heat between the entire main building and other living animals, as well as the overall building surface, and save energy consumption of the entire building; In summer, we can not only timely and well organized natural ventilation, but also form good internal ventilation through natural air between various main buildings and the entire interior of other buildings[6].

(5) Architectural form

The main form of the insulation structure of energy-saving residential buildings is not only due to the requirement of small size and thermal conductivity resistance coefficient (requiring the inner building area of the outer surface of the main building/indoor building volume) due to temperature loss, but also due to the requirement of less heat radiation from the sun in summer, and also due to the need for external insulation in winter to avoid the cold wind in winter, it is beneficial, However, due to the often inconsistent structural forms of various energy-saving residential buildings that can meet the needs of these three energy-saving design schemes, energy-saving design schemes should fully consider the direct impact and constraints of various major environmental factors.

There is a significant causal relationship between the comfort level of the actual household ecological environment utilization of construction production enterprises and their individual units and the actual ecological environment utilization conditions of these high-rise buildings. Today, with the prevalence of the collective economy model in high-rise residential areas in China, the problems that high-rise buildings may directly bring are the livability of the living environment, serious imbalance in the geographical structure of the ecosystem, high energy and low energy consumption, and other multifaceted issues. These problems can be effectively and thoroughly solved through the comprehensive utilization of these vertical greening elements and various means of landscaping.

6. The expression of energy-saving design concept in architecture

6.1 Power system design

The power system mainly refers to parts such as high-rise elevators, water pumps, and fans. In the design of energy-saving systems for high-rise elevators, it mainly refers to the mutual consumption of electrical energy between the staircase driving power system and the staircase electrical control management system. Design personnel can mainly manage and control the electrical energy consumption of these two major systems by focusing on advanced elevator energy-saving management technology, Control the electrical energy consumption control level of the entire high-rise elevator, and for the staircase drive control system, advanced elevator electrical drive control technology is mainly used to enhance the efficiency of staircase electrical energy conversion and achieve energy-saving effects. In the energy-saving engineering design of traditional water pumps and fans, due to the high working power of the water pump motor, the use of traditional water pumps and electric fans consumes a lot of energy. In the energy-saving engineering design of buildings, it is necessary to choose a new type of energy-saving motor, integrate PLC technology, achieve multi-stage speed regulation function, and achieve energy-saving goals.

6.2 Design of enclosure structure

In architectural design, in accordance with the concept of low energy building design, emphasis is placed on the low energy design of the external enclosure structure of the building. According to relevant design standards, advanced energy-saving technology is used to increase the insulation effect of the building, control the energy consumption during the process, and ultimately achieve the goal of low energy building design. Specifically, it can be manifested in the following aspects: firstly, energy-saving exterior wall design. As an important subject in the external thermal insulation and enclosure structural engineering of high-rise buildings in China, external wall thermal insulation materials have two functions: external wall thermal insulation and wall thermal insulation and cooling protection of high-rise buildings. In order to achieve good energy conservation and consumption reduction and thermal insulation effects at the same time, designers and construction personnel must first fully consider the requirements of actual

building use environment, Reasonably plan, design, and select various insulation protection methods such as external insulation, sandwich insulation, and internal insulation on the inner side of high-rise building structural walls. Use other insulation materials at appropriate positions on the outer side of high-rise building structural walls to strengthen the external wall insulation and wall insulation function protection effect of high-rise building structural walls. Secondly, energy-saving door and window design. In addition to the function of ventilation and heat dissipation, external doors and windows will also have an impact on indoor lighting. In order to increase the utilization of sunlight, large windows can be designed, which will weaken the thermal insulation effect of the wall. For this, in actual design, designers should reasonably design the proportion of windows and walls, consider the heat transfer coefficient and shading coefficient, and ensure the comfort of indoor temperature. Thirdly, energy-saving roof design. Roofing is an important part of building structures. As it is located at the top of the enclosure structure and is exposed to solar radiation, it requires its thermal insulation performance. Designers can choose inverted or planted roofs according to the situation to reduce energy consumption and improve solar energy utilization.

In modern architectural design, commercial style is the most common, which is generally manifested in the architectural design into similar or even the same shape, in order to quickly complete the construction, or to achieve a more unified visual effect. However, such design style is generally limited to the architectural characteristics, making the building lack of certain new ideas and characteristics. The introduction of the concept of modern energy conservation has increased the selection of materials and shapes in the design of buildings, especially the design that conforms to the surrounding environment where the buildings are located, which will directly show a natural feeling of "harmony between nature and man", so that people can not only meet the needs of visual appreciation but also meet the requirements of spiritual understanding while enjoying the buildings.

7. Summary

In architectural design, a high degree of emphasis is placed on the issue of energy-saving, circular, emission reduction, and conservation in new buildings, which is conducive to firmly adhering to the fundamental principle of promoting the effective utilization, conservation, and rational resource allocation of natural production energy. This alleviates the contradiction between the balanced supply of natural production energy and the sustainable and healthy development of China's national economy and society; China has adopted many long-term policy measures that are conducive to ensuring the maintenance of energy security in the main fields of the country, protecting the environment, improving the quality of daily life and production work of cadres and masses at all levels of the people's government, and implementing the Scientific Outlook on Development; At the same time, it is also conducive to promoting the government's accelerated reform and development of a new type of green, energy-saving, and circular economy, and achieving the healthy, harmonious, and sustainable development of contemporary China's national economy and society.

All in all, the concept of building energy efficiency should be reasonably designed in combination with the characteristics of small and medium-sized buildings, which should not only retain the traditional concept, but also be rich in the sense of The Times. Its promotion and implementation will lead our economy towards a more harmonious, reliable and stable goal. Therefore, implementing the concept of energy conservation is conducive to fundamentally saving energy, accelerating the development of circular economy, achieving sustainable economic and social development, and reflecting the light of progress of human civilization.

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