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Application Analysis of Green Building Energy Saving and Emission Reduction Technology Under the General Trend of Low-carbon Energy Saving

Yixin Peng*

Hainan Vocational University of Science and Technology, Haikou 570203, China

Corresponding author: Yixin Peng, pennypeng0531@hotmail.com

Abstract: The White Paper on China's Green Development in the New Era has systematically shared the valuable experience of China's green development practice since the new era. Thus, low-carbon energy saving and green environmental protection have become the leading concepts of China's social and economic development. This concept has posed a lot of challenges to the construction industry. In traditional building construction, a lot of energy consumption and pollutant discharge can often be seen, which has caused serious damage to the ecological environment. Therefore, under the trend of low carbon energy saving, the introduction of energy saving and emission reduction technology into the green building industry can not only effectively reduce the energy consumption and pollution emissions in the building construction process, but also promote the green transformation and development of the traditional building industry, achieving the sustainable development goal.

Keywords: Low carbon energy saving; Green building; Energy saving and emission reduction technology

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1. Introduction

Green building emphasizes the benign interaction between people and buildings, that is, people should take protecting the ecological environment as the goal, actively use energy-saving, environmentally friendly and efficient building construction materials, as well as advanced and sustainable processes and equipment in the process of construction and application of buildings to achieve the green development goal of low carbon energy saving and resource-saving. Based on this, this paper analyzes the relationship between green building and energy saving and emission reduction technology, sorts out the problems existing in the application of energy saving and emission reduction technology in the green building industry, and expounds the path and method of its practical application, to promote the sustainable development of the green building industry and

create a stable and green development space for the application and promotion of energy saving and emission reduction technology.

1.1. Overview of the relationship between green building and energy saving and emission reduction technology

Green building is an active attempt made by the construction industry to adapt to the development mode of a low-carbon economy and achieve the goals of sustainable development. It refers to the application of renewable energy and energy-saving technology and equipment in the construction process under the premise of protecting the ecological environment, to create buildings that are in harmony with the surrounding ecological environment and have transparent lighting. To promote the construction industry to achieve energy saving, water saving, material saving and environmental protection [1]. The energy saving and emission reduction technology provides important technical support and means for green buildings to achieve the core goal of energy saving and carbon emission reduction, which covers efficient energy utilization, intelligent control systems, and so on. For example, the green transformation and development of the building industry requires scientific and technological innovation and the empowerment of science and technology, along with the rapid development of modern science and technology, energy-saving and emission-reduction technology is widely used in the green building industry in the continuous renewal and upgrading, which not only improves the energy utilization efficiency of green buildings, but also integrates intelligent technologies such as ground source heat pump and photovoltaic power generation into green building design. Effectively improve the comfort of people's living environment. In addition, the deep integration of green buildings and energy saving and emission-reduction technologies has spawned new economic growth points [2]. For example, led by the development of green buildings, energy-saving equipment manufacturing, intelligent control systems, and other fields show huge market development potential. This provides core momentum for the high-quality and sustainable development of a low-carbon economy. It can be seen from this those green buildings and energy-saving and emission-reduction technologies are mutually reinforcing and complementary.

2. The problems of green building energy saving and emission reduction technology under the general trend of low carbon energy saving

2.1. Energy consumption in construction

On the one hand, analyzing the relevant data of the International Energy Agency can find that the carbon emissions and energy consumption of the construction industry account for about 40% of the world. Despite the general trend of low-carbon and energy-saving development, the application of energy-saving and emission-reduction technologies in the green building industry has made certain progress, but the energy consumption and carbon emissions in the construction of green buildings are still a major challenge restricting the green transformation of the building industry. The EU Environment Agency survey report pointed out that most of the construction waste is usually incinerated, landfill way to deal with up to 900 million tons of construction waste production, causing a heavy burden on the ecological environment, which further aggravated environmental pollution and waste of resources [3]. At the same time, high-carbon materials such as cement and lime used in the construction of buildings are important sources of increasing global greenhouse gas emissions, and they are also relatively large raw materials for energy consumption. On the other hand, from the perspective of the development status of energy saving and emission reduction technology, the

related construction process system needs to be further improved and supplemented. In this context, operators have not mastered the construction process and technical indicators of energy-saving emission reduction technology, and then in specific operations improper technical operations led to energy consumption and carbon emission, affecting the construction effect of green buildings.

2.2. Energy consumption problem in operation

Energy saving and emission reduction technology can help green buildings reduce energy consumption and environmental pollution, but some advanced energy-saving equipment and systems need additional energy consumption to support their operation, such as ventilation equipment, intelligent control systems, etc., and need continuous uninterrupted power support. This virtually offsets the energy consumption reduced by green buildings, resulting in a waste of resources. In addition, not all green building users are clear about the operation principle and use of energy saving and emission reduction technology, because of inappropriate management methods and behavior habits, they may abuse, use, and other behaviors in daily life. These bad behaviors not only affect the running state of these energy-saving equipment but also produce some unnecessary energy consumption [4]. At the same time, improper management behavior will lead to the failure and instability of energy saving and emission reduction technology in actual operation. This requires professional and technical personnel to carry out frequent maintenance and debugging, which further increases the consumption of energy resources. In addition, skilled equipment and systems need professionals to carry out regular maintenance and maintenance, otherwise, there will be problems of aging and damage, which will affect the safety performance and operation efficiency of green buildings.

2.3. Technical standards are not uniform

Energy saving and emission reduction technology is a new technology based on scientific and technological innovation, which has not yet formed a unified certification system and technical standards in production and application. Low-quality and low-efficiency energy saving and emission-reduction technology and products flow to the green building market, which not only leads to market chaos but also seriously affects the realization of green building energy saving and emission-reduction goals. Limiting the sustainable development and green transformation of the building industry [5].

3. The application measures of green building energy saving and emission reduction technology under the general trend of low-carbon energy saving

3.1. BIM energy-saving technology

By applying BIM technology to the design of green buildings, technicians can build an energy consumption simulation model based on specific engineering data to predict the relevant energy consumption data in advance, and then provide data reference for the subsequent specific construction. For example, in the simulation experiment, by setting parameters such as room temperature in different seasons, intelligent control system load time length, and artificial characteristics of enclosure structure materials, technicians can effectively calculate the energy consumption, carbon emission and other data generated by facilities and equipment such as air conditioning, ventilation, lighting and so on during the experiment simulation. This provides data support for technical personnel to determine whether the energy-saving coefficient of green buildings meets the design requirements. If the model does not meet the relevant design requirements,

technicians need to optimize and improve the parts with high energy consumption again [6]. If the lighting system exceeds the standard, technicians can try to replace the light source of the experimental model, or further improve the natural lighting conditions by optimizing the spatial layout of the green building. If there is a large amount of heat loss in the envelope structure, technicians can find the most suitable low-energy consumption and environmental protection materials by replacing different materials. When optimizing and improving the relevant design problems, the technical personnel should conduct simulation tests again to further check whether there is still a problem of high energy consumption.

At the same time, technical personnel and green building design personnel can also use BIM technology to check the energy-saving effect of a certain aspect of the building, and deeply determine whether the building can also tap the energy saving potential of other aspects. Specifically, relevant personnel can rely on BIM technology to carry out sunshine simulation experiments. The sunshine simulation experiment refers to the relevant personnel will introduce the data of the natural geographical environment of the green building into the model, and analyze the natural lighting conditions of the building and the indoor temperature changes of the green building under different weather conditions by setting real sunshine data and solar energy reception data. This helps to explore the influence of the external natural environment on the construction of green buildings and enables the relevant personnel to optimize and improve the design scheme of the building again under the influence of the natural environment [7]. For example, adjusting the layout of the building can effectively improve the natural lighting conditions. This can help shorten the operating time of the lighting system and effectively reduce the energy consumption generated during operation. At the same time, the setting of shading facilities around the green building and the adjustment of insulation materials of the envelope can effectively reduce the indoor high-temperature problem caused by the sun to ensure the comfort of the living environment.

3.2. Energy-saving technology of envelope structure

3.2.1. The application of energy-saving technology in the external wall

The application of energy saving and emission reduction technology in the enclosure structure of the external wall is mainly reflected in two technical measures, that is, the air interval layer reserved by the wall insulation box. Enhancing the insulation function of the external wall can not only reduce the overall heat loss of the building, keep the indoor temperature appropriate, eliminate the energy consumption and carbon emission of the air conditioning and HVAC system in operation, but also improve the utilization rate of renewable energy and realize the green environmental protection of the building. Under normal circumstances, the operators in the construction of the building will be in the outer wall of the outer wall, the inside, or the middle part of the inner and outer wall laying insulation layer, placing temperature core board and so on. The use of a thermal insulation layer, and thermal insulation core board to reduce the indoor and outdoor heat exchange, can make the indoor temperature in a more stable state for a long time [8]. Moreover, the use of external thermal insulation can avoid the occupation of space in the form of indoor thermal insulation, and effectively ensure the availability of indoor space. The reserved air layer mainly refers to the traditional construction form of innovative buildings, embedding a double-layer skin structure in the external wall, so that it can reserve the air layer. This can make the building maintain good ventilation conditions, for example, building users can open the vent, to improve the indoor air quality, and let fresh air into the room, to effectively reduce the energy consumption and carbon emissions of intelligent ventilation systems. In addition, by closing the vents in winter, the thermal performance of the air layer can be leveraged, further enhancing the insulation performance

of the external walls [9].

3.2.2. The application of energy-saving technology in doors and windows

The thermal insulation performance of the door and window structure is relatively low, therefore, technicians and operators mainly control window wall ratio, sunshade and sun protection, heat preservation and insulation of these three measures to achieve green emission reduction of the building. The through-the-wall ratio refers to the ratio of the area of the form to the area of the wall where it is located. Operators should ensure the building's natural lighting, natural ventilation conditions, follow the relevant engineering specifications, and combine with the actual situation to calculate, to reduce the heat transfer area [10]. Because the heat resistance function of the window is small, the penetration ratio can be controlled within the appropriate range, which can effectively ensure the thermal performance of the envelope structure, and keep good lighting and ventilation conditions indoors. Specifically, operators should follow GB50352-2019 when constructing residential buildings [11]. The selection of appropriate glass in the doors and windows can reduce the influence of solar radiation on the indoor temperature and reduce the indoor and outdoor heat exchange. In this regard, the operator can choose the glass with an infrared blocking function, such as LOW-E double insulating glass. Finally, the installation of sunshades in the doors and Windows also helps to improve the thermal resistance of the envelope structure, so that the indoor lighting and ventilation are in good condition.

3.2.3. The application of energy-saving technology in the roof part

As an important roof structure, the roof part plays a unique role in ensuring energy conservation and emission reduction in buildings. Operators usually adopt greening, water storage, and heat preservation three energy-saving measures to achieve energy saving and emission reduction of the roof part. Among them, greening mainly refers to the planting of green plants on the roof [12]. As a natural temperature regulator, green plants can regulate the temperature around the building by blocking the range of sunlight. In addition, green plants also have an anti-noise function, which can reduce the interference of external noise to the building users, providing them with a good living environment. Water storage refers to the construction of a reservoir on the roof, in the way of water storage, so that the water body in the process of flow, evaporation plays a role in regulating the temperature. Thermal insulation measures refer to the laying of polyethylene foam and other thermal insulation materials so that the roof parts play the function of waterproof and heat insulation [13].

4. The development prospect of green building energy saving and emission reduction technology

4.1. Integrate into national characteristics

The proper integration of national characteristics into green building construction can not only highlight the spiritual core of the Chinese nation but also make China's green building industry shine in the world. In the past building construction, China's architectural style has typical European and American characteristics. This led to the extreme lack of national characteristics in the construction industry of our country. At the same time, the same European and American architectural styles are not in line with China's ecological and environmental protection concepts, and it is difficult to reflect our unique national aesthetic value. Therefore, under the general trend of low carbon energy saving, when the relevant personnel apply energy saving and emission reduction technology in the construction of green buildings, they can combine the

development characteristics of the local economy and culture, and deeply dig the excellent traditional culture with national characteristics, to create green architectural groups with national characteristics based on transforming architectural styles [14]. For example, relevant personnel can integrate the concept of "heaven and earth nature, landscape compatibility" into the construction scheme design of green buildings to highlight the concept of harmonious coexistence between man and nature.

4.2. Insist on putting people first

In the green development and transformation of the construction industry, the concept of "people-oriented, local conditions" should be upheld, and the humanized characteristics of the construction industry should be highlighted based on following laws and regulations. The introduction of humanistic care into green building construction is an important guarantee for sustainable development, and helps to reduce the impact of building construction on "people" and "environment." On the one hand, the construction unit of green buildings can start from the perspective of "people," paying attention to the initiative and creativity of "people" in the construction process. On the other hand, the construction unit should respect the differences between the geographical environment and cultural environment, that is, according to the actual situation and differences in local development, the use of energy-saving and emission-reduction technology according to local conditions [15]. At the same time, in various simulation experiments, relevant personnel should focus on the analysis of wind, light, water and other natural factors on the impact of green buildings, to effectively achieve the development goal of energy conservation and emission reduction. Choosing appropriate technical indicators according to the natural environment and cultural environment can effectively highlight the humanistic attributes of green buildings so that users can live with peace of mind and comfort.

Disclosure statement

The author declares no conflict of interest.

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