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Indoor Environment Design and Energy Saving Analysis of Sustainable Development Integrated with Green Building

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Abstract. Modern architectural design has gradually distanced itself from the actual living needs of urban residents in the process of pursuing the integration of architecture and nature. To achieve the perfect combination of sustainable ecological concepts and effective energy utilization, green buildings have become an actively pursued design concept. Unlike relying solely on high-tech means, the core goal of green buildings is to build an environmentally friendly building environment by achieving sustainable and efficient utilization of energy and resources. In the design phase, green buildings should focus on functionality and economy, and be tailored to the local economic conditions, regional characteristics, natural resources, and climate conditions of the building's location to create green buildings with unique architectural and regional characteristics. This article endeavors to furnish both theoretical underpinnings and practical directives for the indoor environment design and energy conservation efforts of green buildings. By delving into the pivotal role of indoor environments as an essential architectural component, it integrates sustainable development principles with green building practices and delves into the intricate relationship between indoor environment design and energy efficiency, thus offering valuable insights and guidance for achieving sustainable and energy-efficient indoor spaces. In this process, this article examines the energy and resource utilization benefits that green building design can achieve, as well as the specific impact of indoor environment improvement on the quality of life of residents. Through an in-depth analysis of these aspects, this article aims to provide substantial contributions to achieving the sustainable development goals of green buildings. The experimental comparison results show that in terms of natural ventilation design, compared to mechanical ventilation, the proposed scheme can achieve an annual energy cost savings of 20%.

Key words. Architectural Interior Environment Design, Environmental Protection, Green Design.

1. Introduction

With the deepening of human cognition of the natural environment and the increasingly serious problem of global climate change, sustainable development has become the focus of global attention. As one of the main sources of global energy consumption and carbon emissions, the construction industry is in urgent need of transforming into green buildings and sustainable development. Interior environment design, as an important part of architectural design, directly affects the quality of life, health and psychological feelings of building users, and its close combination with sustainable development is an inevitable trend in the future. Therefore, the research on "indoor environment design and energy saving analysis of sustainable development integrated with green buildings" has important theoretical and practical significance. With the development of human society and the progress of science and technology, we gradually realize the importance of harmonious coexistence with nature. Green building, renowned for its characteristics of environmental friendliness, energy efficiency, and health benefits, has garnered increasing attention and favor. As a crucial aspect of green building, the interior environment design holds significant importance in enhancing the quality of life and well-being of occupants. Green buildings prioritize not only the harmonious coexistence between the structure and its surroundings, but also the efficient utilization of resources, minimal environmental impact, and the enhancement of human health and quality of life throughout their entire lifecycle [1]. As a bridge connecting buildings and human activities, indoor environmental design can significantly improve the energy-saving performance of buildings, indoor environmental quality and comfort of users through scientific design strategies. For example, reasonable lighting and shading design, efficient ventilation and air conditioning system design, and the selection of environmental protection and healthy building and decoration materials are the key means to optimize the indoor environment of green buildings.

The goal of the indoor environment is to emphasize the application of natural colors and materials in the design, so that residents can relax their tense working conditions and perceive and return to nature in a safe, healthy, efficient and comfortable indoor environment [2]. There should be a balanced and benign interaction between sustainable design, a good environment and beneficial users to achieve the optimal effect. Green building is based on this point of view to balance and coordinate the internal and external environment and different needs and different energy dependence between users, and achieve the natural integration of architecture and environment.

Firstly, the importance of indoor environmental design in green building is expounded, including improving indoor environmental quality, reducing energy consumption and so on [3]. Subsequently, this paper summarizes the energy-saving technologies of green buildings, including natural lighting, solar energy utilization, energy-saving air conditioning systems and other technical means. Through case analysis, the influence of these energy-saving technologies on indoor environment design is discussed, such as improving indoor comfort and reducing energy consumption. Finally, this paper puts forward the optimization strategies of indoor environment design and energy saving, including rational use of natural light, adoption of high-efficiency energy-saving equipment, optimization of ventilation systems and other measures. The effectiveness of these strategies in improving indoor environmental quality and reducing energy consumption is evaluated through empirical research.

With the development of social science and technology [4], people's aesthetic consciousness gradually changed from liking complicated decoration in the early stage to appreciating concise and lively style. Under the condition that the existing natural resources are gradually scarce, we should strive for the optimal utilization and restrained development and utilization of natural resources in the design, minimize environmental pollution and protect the balance and harmony of natural ecology [5]. Through this study, we hope to create a healthier, more comfortable and sustainable living environment for human beings [6].

2. Overview of Green Building and Sustainable Development

Green building takes the harmony between man and environment as the premise and pursues the unity of ecological, economic and social benefits [7].

In the realm of architecture, sustainable development necessitates the optimal utilization of renewable resources, minimization of reliance on non-renewable resources, environmental preservation, and mitigation of harm to natural ecosystems. Green building serves as the embodiment of this philosophy, lessening the environmental impact of edifices and enhancing their sustainability through the adoption of energy-efficient measures, environmentally friendly practices, and the utilization of renewable building materials and technologies. Figure 1 shows the flow chart of green building and sustainable development.

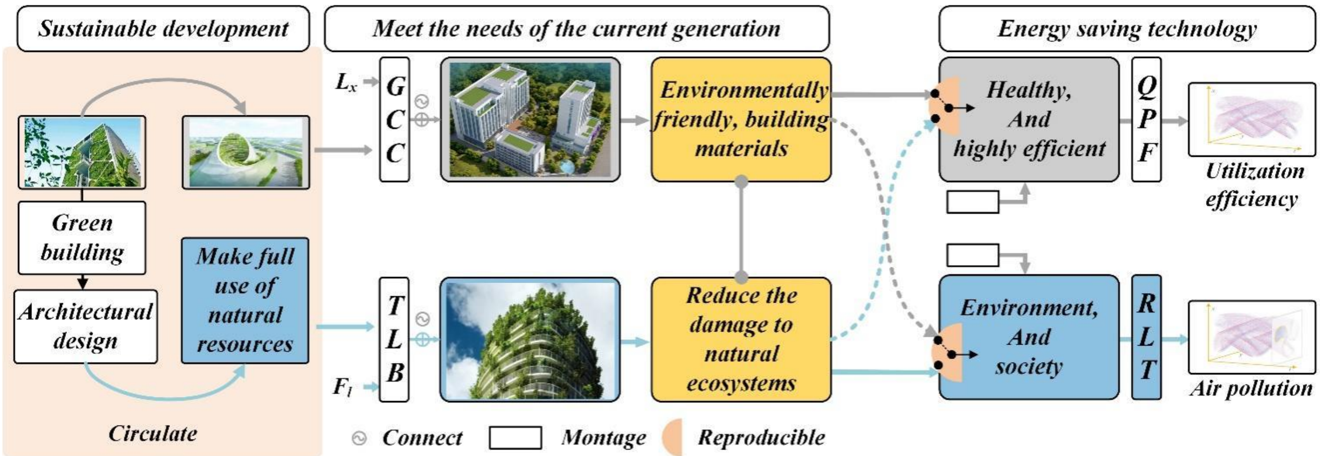

Figure 1. Green Building and Sustainable Development Flow Chart

A. Characteristics of Green Building

Green form refers to a kind of building that makes full use of natural resources and energy in the process of architectural design, construction and operation [8], [9]. It is a new architectural concept that comprehensively considers the needs of the environment, economy, society and human beings. Green building is not only a technology or a way of design, but also a brand-new way of life and thinking [10]. These characteristics will be described in detail next. Energy-saving means that green buildings pay attention to the effective use of energy, adopt energy-saving technologies, materials and equipment, reduce energy consumption and improve energy efficiency. For example, renewable energy sources such as solar energy and wind energy are used for heating and lighting to reduce dependence on traditional energy sources. Environmental protection means that green buildings emphasize reducing pollution and damage to the environment, adopting environmental protection materials and technologies, and reducing the impact of buildings on the environment. For example, use low Volatile Organic Compounds (VOC) coatings, floors and other materials to reduce indoor air pollution; Adopt a rainwater collection system and reclaimed water reuse system to reduce water waste. Renewability means that green buildings pay attention to the recycling and renewability of resources, adopt renewable energy and materials, and promote sustainable development [11]. For example, renewable wood, bamboo and other materials are used to support building structures; Use plants for indoor greening to increase indoor oxygen content. Sustainability means that green buildings pay attention to the long-term benefits and sustainability of buildings, not only considering the use function and life of buildings, but also considering their long-term impact on the environment and society. For example, a passive design strategy is adopted to reduce dependence on mechanical equipment; Adopt green building materials and construction methods to reduce the consumption of environment and resources. The green building evaluation index is shown in (1).

$$GBI = \frac{1}{n}\sum_{i=1}^{n}\left(w_i \cdot r_i\right) \quad (1)$$

Where, GBI represents indoor temperature, n is number, w_i is indoor humidity and r_i is natural illumination. Indoor Environmental Quality Index (IEQI) is an index used to evaluate and measure the indoor environmental quality of buildings [12]. It comprehensively considers many factors affecting the indoor environment, including but not limited to air quality, lighting, temperature, humidity, acoustics, air flow, etc. Its calculation formula is shown in (2).

$$IEQI = \frac{1}{m}\sum_{j=1}^{m}\left(v_j \cdot q_j\right) \quad (2)$$

Where, $IEQI$ represents the energy consumption of artificial lighting, m represents the mass, v_j represents the ventilation efficiency, and q_j represents the thermal resistance of building materials. Green building is a brand-new architectural concept and design method, which pays attention to the development of energy saving, environmental protection, renewability and sustainability [13].

B. Concept of Sustainable Development and Its Application in Field of Architecture

The inseparable system aimed not only at economic development, but also at protecting the natural resources and environment on which human survival depends, such as the atmosphere, fresh water, oceans, land and forests [14]. Therefore, it is necessary to insist on sustainable development. A comprehensive index of sustainable development is an index that comprehensively considers various aspects of sustainability factors [15], and is usually used to evaluate and measure the sustainability of a system, project or society at the economic, environmental and social levels. The formula is shown in (3).

$$SDI = \alpha \cdot GBI + \beta \cdot IEQI + \gamma \cdot EEI \quad (3)$$

Among these, SDI represents the energy efficiency ratio, GBI represents the renewable energy utilization rate, and EEI represents the carbon dioxide concentration. Sustainability has gained widespread application in the field of architecture, particularly in energy-saving architectural design. This approach focuses on optimizing building design to enhance energy efficiency and minimize energy consumption. For instance, the employment of high-efficiency insulation materials, energy-efficient windows, solar water heaters, and other cutting-edge technologies and equipment effectively reduces buildings' energy usage while enhancing their overall energy efficiency. Ecological architecture design: Pay attention to greening and natural landscape design, and reduce the interference of buildings to the surroundings. For example, the design of a hanging garden and green roof is adopted to increase the green area and improve the indoor environmental quality. Adopt high-efficiency energy-saving technologies and equipment. Improvement of indoor environmental quality: Improve indoor air quality by adopting environmentally friendly materials and technologies. For example, adopt harmless building materials and air purification technology to reduce indoor air pollution; Adopt natural lighting and ventilation design to improve indoor light and air quality. Green building and sustainable development are closely linked and promote each other [16]. Sustainable development also provides concept and technical support for the promotion and application of green buildings. Figure 2 shows the flow chart of energy-efficient building design.

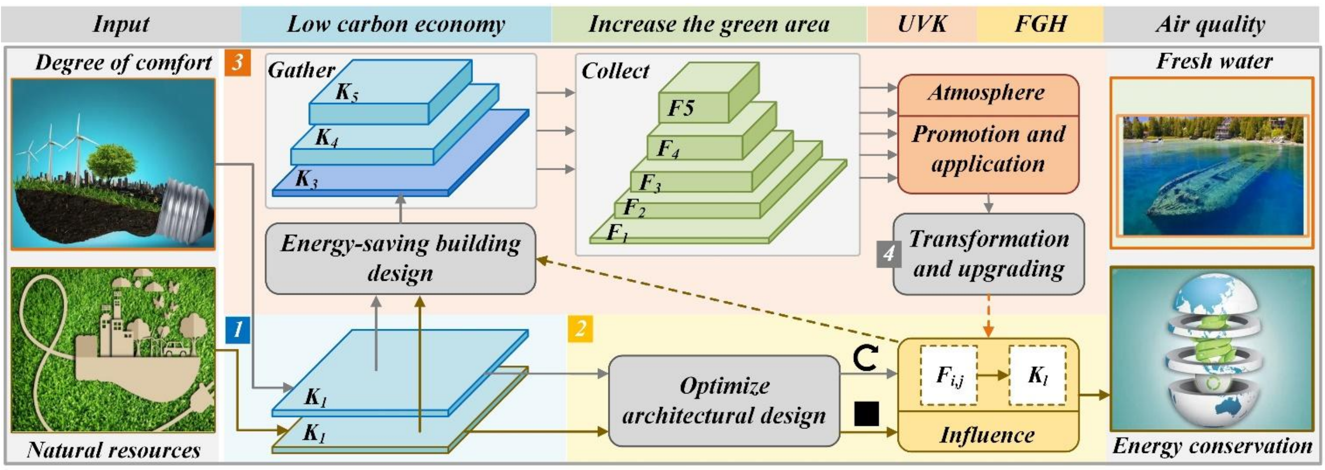

Figure 2. Energy Saving Building Design Flow Chart

At the same time, green building and sustainable development have many influences on indoor environmental design, for example, guide designers to pay attention to environmental problems: the promotion and application of green building make indoor environmental designers pay more attention to environmental problems, and integrate the concepts of environmental protection, energy saving and health into the design. Promote the indoor environment green and comfortable: Green buildings pay attention to indoor environment comfort and health [17].

C. Relationship Between Green Building and Sustainable Development and Its Impact on Interior Environment Design

Green building promote and depend on each other and jointly promote the harmonious development of human society and the environment. Indoor temperature control model is a mathematical model used to describe and control the change of indoor temperature in buildings. One of the common models is the thermodynamic model [18], which describes the change in indoor temperature with time, usually including heat conduction, convection and radiation. The calculation formula is shown in (4).

$$T(t) = T_0 + \frac{Q}{C} \cdot \left(1 - e^{-\frac{t}{\tau}}\right) \quad (4)$$

Where, *T(t)* represents the comprehensive energy saving index, T_0 represents the indoor temperature setting point, and *Q* indicates the indoor humidity range. The evaluation of green wall materials usually involves environmental protection, sustainability, energy efficiency and other factors of materials. The evaluation index formula is shown in (5).

$$ECI = \frac{1}{p} \sum_{k=1}^{p} (m_k \cdot c_k) \quad (5)$$

ECI represents the contribution rate of renewable energy, *p* represents the green building certification score, and m_k represents the environmental impact reduction index. Green building is a fundamental component of sustainable development, striving to minimize natural resource consumption and environmental pollution through the utilization of energy-efficient, environmentally friendly, and renewable technologies and materials. This approach not only fosters resource conservation and environmental protection, but also prioritizes the comfort and health of indoor spaces, ensuring a harmonious coexistence between humans and the natural environment. Sustainable development serves as both a conceptual and technical foundation for green buildings, emphasizing the harmonious development of the economy, society, and environment.

Moreover, green buildings contribute significantly to indoor environment design. They employ eco-friendly materials and technologies to mitigate indoor air pollution, enhance air quality, and create a healthier living space [19], [20]. Additionally, attention is given to optimizing indoor comfort through natural lighting and ventilation design. The commitment to energy efficiency and environmental preservation is evident in the adoption of energy-saving equipment and technologies, aiming to reduce both energy consumption and carbon emissions.

The interdependence between green building and sustainable development propels innovation in technology and practices within the construction industry. This symbiotic relationship fosters a more balanced and sustainable coexistence between humanity and the environment, ultimately enhancing our overall quality of life.

Interior environment design plays a crucial role in green building, which prioritizes the harmonious integration of architecture with the environment, emphasizing resource conservation and environmental protection. This design aspect directly impacts people's quality of life and health. Thus, ensuring the rationality and scientificity of interior environment design is vital for achieving the goals of green building, as illustrated in Figure 3, depicting a flow chart of interior environment design.

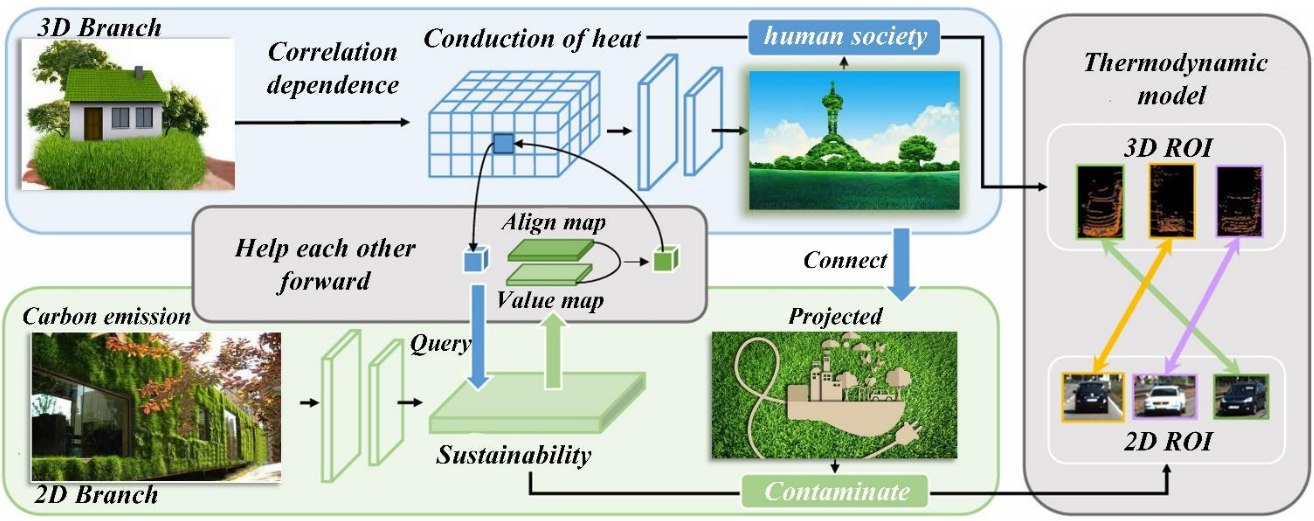

Figure 3. Interior Environment Design Flow Chart

Ecological Material Selection Index (ESI) can be used to evaluate the eco-friendliness of materials selected in construction or engineering projects [21]. (6) is a simplified model of the ecological material selection index.

$$ESI = \frac{1}{q} \sum_{l=1}^{q} (s_l \cdot e_l) \quad (6)$$

Where, *ESI* represents the thermal performance parameters of the building envelope, *q* represents the simulated input parameters of energy consumption, and s_l represents the effect coefficient of energy efficiency improvement measures. The solar photovoltaic efficiency model is used to describe the efficiency of solar panels. (7) is a simple solar photovoltaic efficiency model [22].

$$P_{total} = A \cdot \eta_{pv} \cdot G \tag{7}$$

Among them, P_{total} is the total solar photovoltaic power generation, A is the surface area of solar panels, and G is the solar radiation intensity.

Interior environment design plays a pivotal role in enhancing the comfort and health aspects of green buildings. By executing a thoughtful indoor environment design, we can curate a healthy, cozy, and efficient indoor space, thereby elevating people's quality of life and work efficiency. Furthermore, a well-designed indoor environment can significantly mitigate the adverse effects of indoor air pollution and noise on human health, ultimately promoting both physical and mental well-being [23]. This chapter will discuss the importance of interior environment design in green building from interior environment design principles, interior environment design methods, the relationship between interior environment design and sustainable development and its influence on green building.

3. Importance of Indoor Environment Design in Green Building

A. Basic Principles of Interior Environment Design

The core idea of ecological indoor environment design lies in respecting nature and giving priority to ecology. Designers should fully realize the importance of the natural environment and minimize the consumption of natural resources and environmental damage in the design process [24]. At the same time, designers should pay attention to the conservation and recycling of resources in order to achieve sustainable development of the ecological environment.

People-oriented design concept occupies a pivotal position in interior environment design. Designers need to pay attention to people's physiological and psychological needs, and create a space environment that not only conforms to the development trend of modern society, but also adapts to people's individual needs [25]. At the same time, designers also need to consider the flexibility and development of design to adapt to the changes of the times and the requirements of ecological development.

The principle of integrity is also very important in interior environment design. Designers need to consider architectural, indoor, outdoor and other factors from an overall perspective to ensure the integrity and coordination of the design [26].

The functional principle is another important consideration in interior environment design. Designers need to fully consider people's living and working needs, rationally arrange space, and pay attention to the functionality and practicality of space. By improving the utilization rate of space, people's lives and work can be more convenient and efficient.

The aesthetic principle holds a crucial position in indoor environment design. Designers are tasked with crafting a comfortable and visually appealing indoor space through meticulous color coordination, material selection, and lighting design. This aesthetic principle not only caters to people's aesthetic aspirations but also enhances their sense of happiness and satisfaction. Comprehensive consideration of various aspects is vital in interior environment design, adhering to the fundamental principles of respecting nature, prioritizing ecology, being people-oriented, maintaining integrity, and fulfilling functional requirements.

B. Elements and Methods of Interior Environment Design in Green Buildings

In the design process, natural light utilization, ventilation design, temperature regulation, humidity control and air quality should be fully considered. Reasonable utilization and optimization of these elements will help to reduce energy consumption and improve the comfort and health of the indoor environment. The indoor illumination model describes indoor illumination level, which is usually affected by luminous flux, luminance, incident angle and distance between the observation point and light source. The indoor illumination model formula is shown in (8).

$$E = \frac{t \cdot L \cdot \cos(\theta)}{d^2} \tag{8}$$

Where, E represents the environmental impact reduction index, t represents the time, and L represents the length. Where E is the illumination, T is the luminous flux of the light source, L is the brightness of the light source, Theta is the incident angle, and d is the distance from the observation point to the light source.

In order to achieve these goals, a series of design methods need to be adopted. First of all, a reasonable layout of indoor space, according to the size and shape of the space reasonable layout of furniture and equipment, improves the utilization rate of space, while ensuring good ventilation and lighting. Secondly, choose environmentally friendly and pollution-free materials, Intelligent equipment and technology, such as smart home systems, intelligent lighting, etc., can improve the convenience and comfort of living. Figure 4 shows the contrast diagram of indoor environment design and energy saving effect.

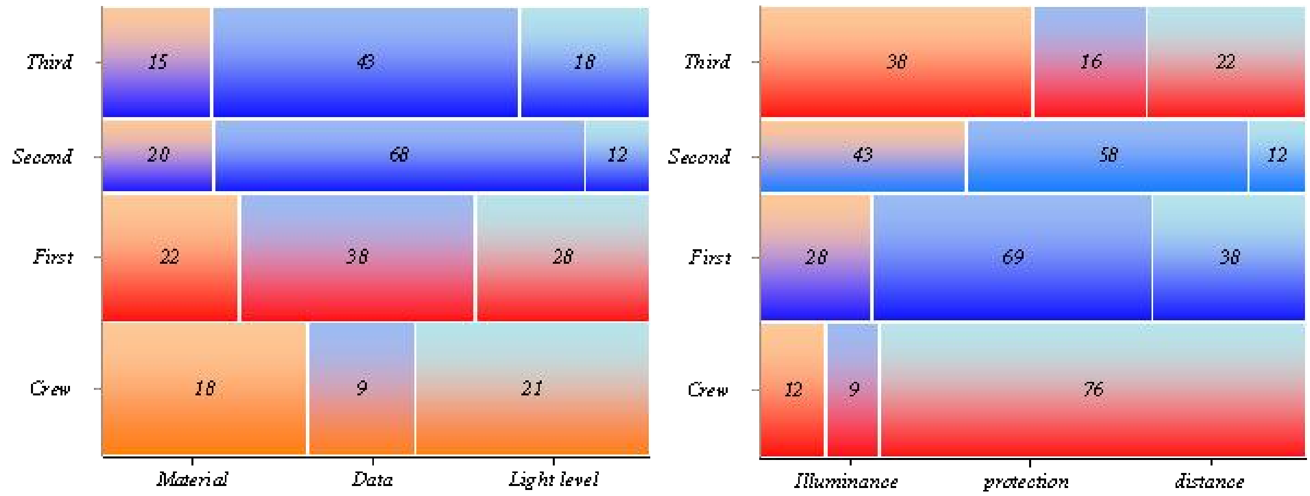

Figure 4. Indoor Environment Design and Energy Saving Effect Comparison Chart

Many factors and methods should be considered in the indoor environment design of green buildings. Figure 5 shows the relationship between indoor environmental quality and energy consumption of green buildings.

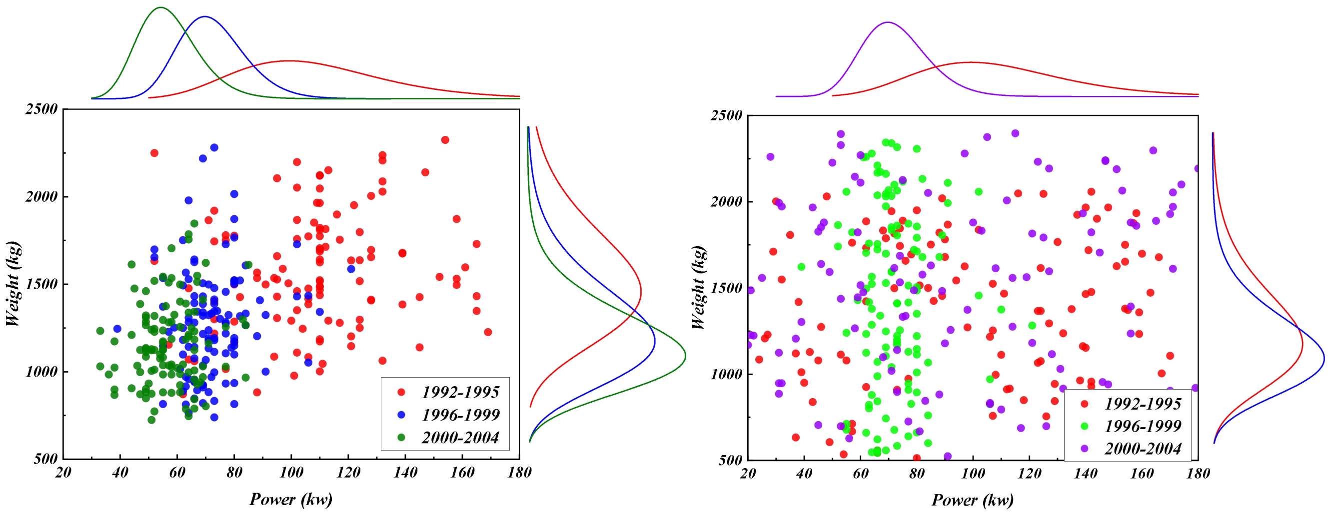

Figure 5. Relationship Between Indoor Environmental Quality and Energy Consumption of Green Buildings

C. Case Analysis Relationship Between Interior Environment Design and Sustainable Development and Its Impact on Green Building

A profound connection exists between indoor environment design and sustainable development, rendering it a pivotal tool in achieving sustainable growth. In interior design, the rational utilization of natural resources, such as harnessing natural light and ventilation, as well as the selection of environmentally friendly and renewable materials, can significantly reduce energy consumption and mitigate environmental pollution. Eco-material use strength index is an index used to evaluate the strength and efficiency of eco-materials used in construction or engineering projects. The calculation formula is shown in (9).

$$EUI = \frac{\sum_{i=1}^{n} M_i}{A} \quad (9)$$

The *EUI* represents the green building certification score, M_i represents the water resource utilization efficiency, and *A* represents the building life cycle assessment parameters. The impact of indoor environmental improved indoor environmental quality and promoted the development of green buildings. At the same time, good indoor environment design can ensure indoor air circulation, appropriate temperature and moderate humidity, thus improving the comfort and health of the indoor environment. In addition, the concept and method of interior environment design can promote the development of green buildings and improve the quality and level of green buildings [27], [28].

4. Green Building Energy-saving Technology and Its Application Cases

A. Overview of Green Building Energy-saving Technology

In the stage of architectural design, energy-saving technologies such as wall insulation, sunshades, and solar energy collection, reduce CO_2 emissions [29]. In the process of construction, land damage should be minimized to protect the ecological environment. By widening the building area and rationally utilizing non-building land, we can realize the effective utilization of land resources and ensure the sustainable utilization of land resources in the future. Energy-saving equipment and technology are also an important part of green building energy-saving technology. Adopting high-efficiency and energy-saving air conditioning and lighting equipment can reduce the energy consumption of equipment and improve energy utilization efficiency. At the same time, using renewable energy equipment such as solar water heaters and solar photovoltaic power generation can reduce dependence on traditional energy sources and reduce carbon emissions. Figure 6 shows a comparison of material selection on an indoor environment and energy saving.

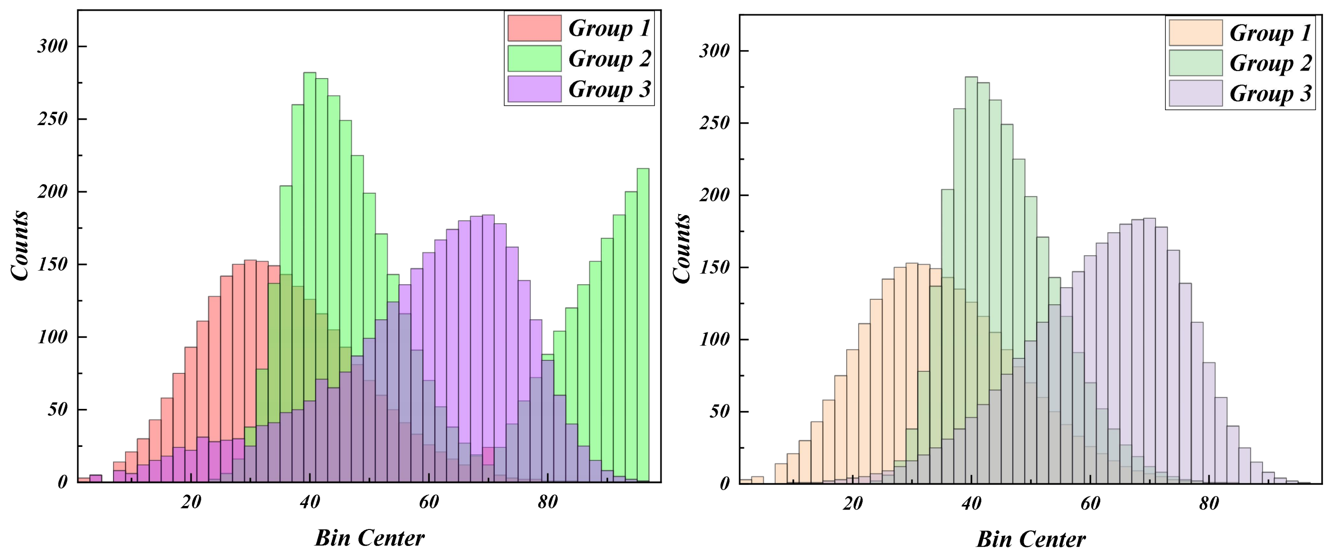

Figure 6. Comparison of Impact on Indoor Environment and Energy-saving

Appropriate insulation materials can not only reduce the energy consumption of buildings, but also improve the comfort of the indoor environment. The calculation formula for the thermal insulation performance of buildings is shown in (10).

$$f(x)=\sum_{n=0}^{\infty}\frac{a_n}{n!}(x-x_0)^n \quad (10)$$

Where, a_n represents the effect coefficient of energy efficiency improvement measures, x represents the contribution rate of renewable energy, and n represents the quantity. Drawing upon the aforementioned empirical findings and in-depth deliberations, we arrive at the conclusion that scientific and well-conceived financial optimization management is instrumental in mitigating the risks associated with equipment procurement. However, we acknowledge that there remain specific nuances and exceptional scenarios that merit further scrutiny. Future research could delve deeper into the adaptability of financial strategies across diverse market landscapes and the emerging challenges in equipment procurement risk management amidst technological advancements. This study provides a useful reference for future research and practice in similar fields. The commonly used unit is tons of carbon dioxide emissions. The calculation formula is shown in (11).

$$\int_a^b f(x)dx=\lim_{n\to\infty}\sum_{i=1}^{n}f(x_i)\Delta x \quad (11)$$

Where, n represents the number and x_i represents the energy consumption analogue input parameters. Green building energy-saving technology covers all aspects of building design, construction, use and operation. By adopting appropriate energy-saving technologies and equipment, the energy efficiency and comfort of buildings can be improved. Energy Efficiency Model (EEI) is used to evaluate the energy efficiency of a system or building after the implementation of energy conservation measures. The calculation formula is shown in (12).

$$EEI=\frac{E_{\text{before}}-E_{\text{after}}}{E_{\text{before}}}\times 100\% \quad (12)$$

Where, EEI represents the natural light utilization coefficient, E_{before} represents the air quality index, and E_{after} represents the thermal performance parameters of the building envelope. Among them, E_{before} is the energy consumption before green building renovation, and E_{after} is the energy consumption after green building renovation. This formula evaluates the energy-saving effect of green buildings.

B. *Case Analysis of Green Building Energy-saving Technology Application and Its Influence on Indoor Environment Design*

Zhonghai River and Mountain Grand View Project located in the severe cold region was approved as the "Zero Carbon Building Science and Technology Demonstration Project". Only five demonstration projects of this kind have been approved nationwide, and Zhonghai River and Mountain Grand View are also the only residential project among them. For a long time, heating in severe cold areas mainly depends on municipal central heating, and fossil energy consumption is large. By integrating and applying a number of ultra-low energy consumption technical measures, on the basis of greatly reducing the heating load demand, this project uses an ultra-low temperature air source heat pump as the main heating source and is equipped with electric heating film facilities as the standby system, which significantly reduces heating energy consumption. At the same time, it has the possibility of using renewable energy to generate electricity in the future and realizing decarburization of building energy, thus becoming a model of high-quality zero-carbon building science and technology demonstration projects. The project is located in Hohhot, Inner Mongolia, with a land area of 69,535.71 m^2 and a building area of 165,520.49 m^2. Among them, there are 9 high-rise residential buildings with zero-carbon building technology systems, with a total construction area of 135,356.79 m^2. By comprehensively implementing passive energy-saving techniques, including enhancing building insulation, optimizing airtightness, and adequately addressing thermal bridges, the project significantly reduces the demand for heating load. Furthermore, the adoption of an ultra-low-temperature air source heat pump and standby electric heating film heating, powered by renewable energy generation, elevates the heating energy savings rate to over 92%. Solar photovoltaic is set on the roof for lighting in public areas to further reduce carbon. According to the calculation, the annual carbon dioxide emission reduction of the demonstration project is 1247.43 t, and the carbon reduction effect is remarkable. Figure 7 shows the indoor environmental quality and building life cycle energy consumption diagram.

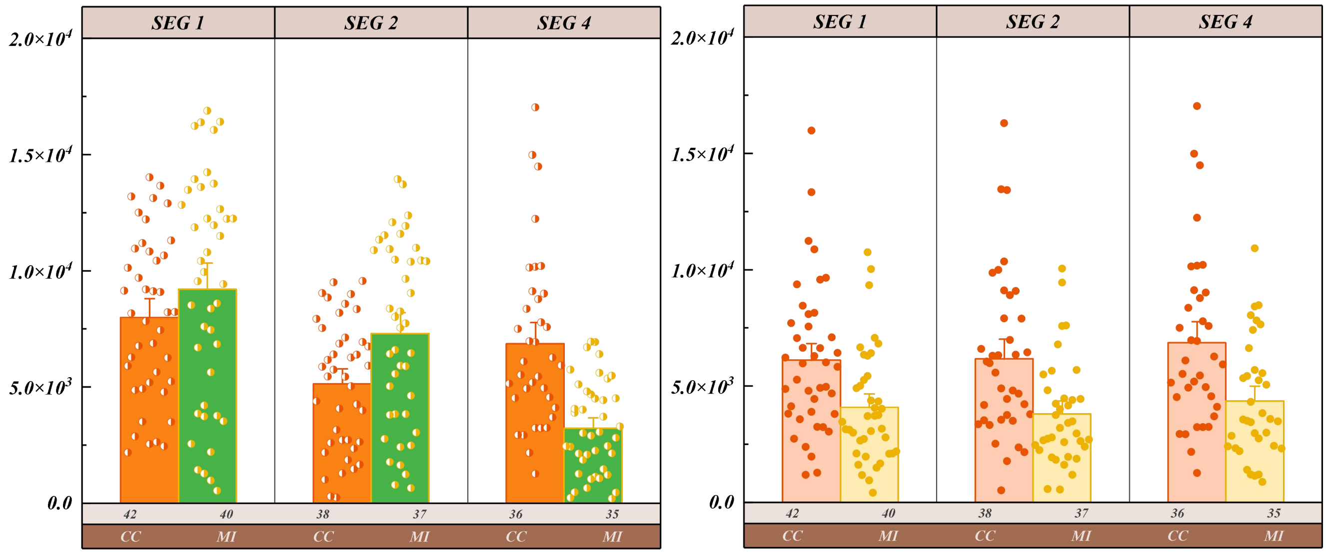

Figure 7. Life Cycle Energy Consumption Diagram

Wenzhou City is the first office near-zero energy consumption building in Zhejiang Province and the first near-zero energy consumption building to be completed and put into use in Wenzhou City. The project adopts a number of near-zero energy consumption technologies, including natural ventilation, movable sunshade, light pipe and other measures to make full use of natural resources to reduce energy consumption. The newly-built Qidu Power Supply Station has a total construction area of 1,800 square meters and is located at the core of Qidu Island, with a total investment of about 15 million yuan. On the basis of drawing on the excellent experience of China and foreign countries in this field, the project is designed and constructed based on the regional and climatic characteristics of Wenzhou.

Integration design of multiple technologies will eventually make it a near-zero energy consumption building. While learning from the excellent experience at home and abroad in this field, the project is designed and constructed based on the local regional characteristics. Considering the characteristics of the high temperature and humid climate in Wenzhou, special thermal bridge analysis software is used to calculate the location of the thermal bridge, and a special design is carried out to eliminate the thermal bridge. Binding design is also carried out according to indoor environmental parameters, energy efficiency indicators, envelope, energy equipment and other technical parameters. Natural resources are fully utilized through natural ventilation, movable sunshades, light pipes, solar photovoltaic and solar hot water are used to balance and replace building energy consumption.

The "three stones" shape of the tower and the "one" shape of the base are perfectly integrated, echoing the name of the enterprise, and the design is modern and symbolic. As the most technologically advanced near-zero-carbon smart public building in China, the project gradually completes the progress from "green building Samsung" to near-zero energy consumption and then to near-zero-carbon building through six special designs for energy saving and carbon reduction.

5. CONCLUSION

Through case-based analysis, this article explores the variations in the application efficacy of green building energy-saving technologies across diverse regions and building types. By broadening the research scope and enriching the case samples, it delves into the nuanced implementation and technological innovations underlying these green building energy-saving techniques. In comparison to traditional buildings, green building energy-saving technology demonstrates remarkable energy-saving benefits during both the operational and construction phases. Through experimental comparison, it is found that natural ventilation design can achieve 20% energy cost savings annually, while natural lighting can achieve 30%

energy cost savings compared to artificial lighting. Indoor greening not only helps improve indoor air quality, but also reduces air conditioning usage by 20%. Further analysis of the relationship between indoor environmental quality and energy consumption reveals that an increase in indoor temperature can lead to a 20% increase in air conditioning energy consumption. More than 60% relative humidity may trigger mould growth, resulting in an additional 15% energy consumption. When the indoor carbon dioxide concentration exceeds 1000 ppm, it may cause indoor discomfort and increase ventilation demand.

6. FUTURE DIRECTIONS

In future research, we will continue to focus on green building energy-saving technologies in specific regions and building types based on case studies. By expanding the research scope and case samples, we aim to gain a more comprehensive understanding of the applicability and effectiveness differences of green building technology in different environments. Taking into account various climate and geological conditions, conduct in-depth research on the practical application of green building technology to form more detailed and specific implementation plans.

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