

Research on the Development Path of Green Building Industry under the "Dual Carbon" Goal

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Abstract: *The green building industry plays a crucial role in achieving the "dual carbon" goals by reducing carbon emissions. This article first explores the definition and significance of green buildings, and outlines their environmental, economic, and social benefits. Then the focus was on discussing the development path, including low-carbon strategies, sustainable materials, and integration of intelligent technologies. Finally, opportunities for market growth were explored, such as increasing environmental awareness and government support, as well as challenges, including cost barriers and a lack of skilled labor. By addressing these challenges, the green building industry can make significant contributions to a more sustainable and low-carbon future.*

Keywords: "dual carbon" goals; Green buildings; Industrial development path.

1. INTRODUCTION

China has proposed the "dual carbon" goal, which is to achieve carbon peak and carbon neutrality. Green buildings are the cornerstone of sustainable development and provide a hopeful path towards achieving the "dual carbon" goals. It includes energy-saving measures, renewable energy utilization, sustainable materials, and intelligent technologies. Green buildings bring environmental advantages, cost savings, and improved well-being. Despite some challenges, the market growth prospects are still promising driven by environmental awareness and government incentives. The green building industry is moving towards a low-carbon future, which is crucial for mitigating climate change and cultivating a sustainable building environment.

2. OVERVIEW OF GREEN BUILDINGS

2.1 Green Building Concept

Green buildings, also known as sustainable or eco-friendly buildings, are a design and construction concept that prioritizes the use of environmentally responsible and resource-saving practices throughout the entire building lifecycle. This concept considers various aspects of a building, including its design, materials, construction methods, energy use, water conservation, waste reduction, and overall impact on the environment.

The basic principles of green building revolve around minimizing the carbon footprint of buildings, protecting natural resources, improving indoor environmental quality, and promoting the health and well-being of residents. Green buildings promote a balance between residential comfort, economic feasibility, and environmental sustainability.

2.2 Benefits of Green Buildings

2.2.1 Environmental advantages

Specifically reflected in: (1) reducing resource consumption. Green buildings minimize the consumption of natural resources such as water, energy, and raw materials, which will reduce greenhouse gas emissions and lower the overall ecological footprint. (2) Energy efficiency. Green buildings adopt energy-saving technologies and design strategies, which can significantly reduce energy consumption. This not only reduces carbon emissions, but also brings long-term cost savings to owners and residents. (3) Improve indoor air quality. Green buildings prioritize indoor air quality by using low VOC (volatile organic compounds) materials, effective ventilation systems, and pollutant filtration, which helps improve the health and well-being of residents. (4) Sustainable site planning.

Green building projects typically involve thoughtful site selection and planning, which helps protect natural ecosystems, reduce urban heat island effects, and minimize environmental impacts.

2.2.2 Economic benefits

Mainly reflected in: (1) reducing operating costs. Green buildings aim to improve energy efficiency, thereby reducing water and electricity bills for residents and lowering operating costs for homeowners. (2) B. b Increase property value. Green buildings typically have higher property value due to their energy efficiency, reduced maintenance requirements, and positive environmental attributes. (3) Government incentive measures. Many local governments provide financial incentives, tax reductions, and subsidies to promote green building practices and further reduce project costs. (4) Long term sustainability. By reducing resource consumption and operating costs, green buildings have the potential to achieve long-term financial stability and reduce risks for investors and homeowners.

2.2.3 Social impact

Mainly reflected in: (1) Health and well-being. Green buildings prioritize the health and well-being of residents by providing better indoor air quality, natural lighting, and thermal comfort, which can improve the satisfaction of building users. (2) Social participation. Green building projects typically involve social participation and promoting sustainable practices, thereby cultivating public sense of responsibility and environmental awareness. (3) Create employment opportunities. The green building industry creates employment opportunities in areas such as construction, energy efficiency, renewable energy, and sustainable material production, promoting economic growth.

3. THE DEVELOPMENT PATH OF GREEN BUILDING INDUSTRY UNDER THE "DUAL CARBON" GOAL

The development of the green building industry under the "dual carbon" goal aims to reduce carbon emissions, which is crucial for addressing climate change and promoting sustainable development. To achieve this goal, the green building industry can take a development path that combines low-carbon strategies, sustainable materials, and intelligent technologies.

3.1 Integration of low-carbon strategies

3.1.1 Energy efficiency measures

Energy efficiency is the cornerstone of green building development under the "dual carbon" goal, and implementing energy-saving measures can significantly reduce the carbon footprint of buildings. Specifically, it includes: (1) Improvement of building envelope structure. Strengthen insulation, seal air leaks, and use high-performance doors and windows to minimize the increase or loss of heat. (2) Efficient HVAC system. Install energy-saving heating, ventilation, and air conditioning (HVAC) systems and optimize their operation. (3) Lighting efficiency. Reduce lighting power consumption by using LED lighting, daylight lighting strategies, and motion sensors. (4) Energy saving appliances. Choose energy-saving appliances and equipment for residential and commercial buildings. (5) Architectural orientation and design. Optimize the orientation and layout of the building to maximize natural ventilation and lighting. (6) Energy management system. Implement advanced energy management systems to monitor and control energy usage in real-time.

3.1.2 Renewable Energy Utilization:

To further reduce carbon emissions, green buildings can integrate renewable energy. Specifically, it includes: (1) solar energy. Install solar panels on the roof or as part of a building integrated photovoltaic (BIPV) system to generate clean electricity. (2) Wind energy. Utilize small wind turbines to harness wind power wherever feasible. (3) Geothermal system. Using geothermal heat pumps to achieve efficient heating and cooling. (4) Microgrid integration. Develop a microgrid that combines renewable energy with energy storage to enhance resilience and reduce dependence on fossil fuels.

3.2 Sustainable Materials and Construction Methods

3.2.1 Use of environmentally friendly materials

The development of green buildings under the "dual carbon" goal emphasizes the use of sustainable and environmentally friendly materials. Specifically, it includes: (1) recycling and recyclable materials. Using recycled and recyclable materials to reduce the demand for new resources. (2) Low VOC materials. Choose low volatile organic compound (VOC) coatings, adhesives, and finishes to improve indoor air quality. (2) Sustainable wood procurement. Use certified sustainable wood products to reduce deforestation. (4) Green insulation. Install environmentally friendly insulation materials, such as cellulose or recycled denim. (5) Prefabricated buildings. Using off-site construction methods to reduce waste and improve efficiency.

3.2.2 Adopting innovative construction techniques

Innovative construction techniques can further promote the development of green buildings. Specifically, it includes: (1) 3D printing technology. Utilize 3D printing of building components to reduce material waste and achieve complex designs. (2) Modular and prefabricated buildings. Prefabricate building components in a controlled environment to improve accuracy and reduce on-site waste. (3) Building Information Modeling (BIM): Utilizing BIM technology for collaborative design, construction, and operation to improve project efficiency.

3.3 Intelligent Technology Integration

3.3.1 Internet of Things (IoT) applications

The application of the Internet of Things is crucial for monitoring, controlling, and optimizing green buildings. Specifically: (1) Energy monitoring. Collect energy usage data using IoT sensors and identify optimization opportunities. (2) Indoor environmental quality. Monitor indoor air quality, temperature, and humidity to ensure the comfort and health of residents. (3) Intelligent lighting. Implement an IoT based lighting system that adjusts according to occupancy and natural light availability. (4) Predictive maintenance. Utilize IoT devices to predict maintenance needs and prevent device failures.

3.3.2 Building Automation System

Building automation systems play a core role in managing energy use and improving the comfort of residents. Specifically, (1) HVAC control. Implement an automated HVAC system to adjust temperature and ventilation based on occupancy and weather conditions. (2) Security and access control. Integrate intelligent security and access control systems to improve building security and efficiency. (3) Occupancy sensor. Optimize lighting, heating, and cooling in unmanned areas using occupancy sensors. (4) Data analysis. Utilizing data analysis to continuously improve building performance and energy efficiency [4].

4. OPPORTUNITIES AND CHALLENGES FOR THE DEVELOPMENT OF GREEN BUILDING INDUSTRY

In recent years, driven by the increasing awareness of environmental issues and the need to reduce carbon emissions, the green building industry has achieved significant development. However, it also faces some challenges that hinder its progress.

4.1 Potential Market Growth Prospects

The development of the green building industry provides numerous growth and development opportunities, with broad prospects for future development. Specifically, it includes: (1) raising environmental awareness. People's awareness of climate change and environmental sustainability is constantly increasing, and their interest in green building practices is growing. Consumers and businesses are increasingly seeking environmentally friendly building solutions. (2) Government support and incentives. The government is providing fiscal incentives, tax reductions, and regulatory support to promote green building practices, which make green buildings more economically attractive. (3) Energy efficiency and cost savings. Green buildings are known for their energy efficiency, which can reduce operating costs. With the rise in energy prices and stricter environmental regulations, the demand for energy-efficient buildings continues to grow. (4) Innovation and technology. The advancement of technologies such as the Internet of Things and building automation provides opportunities to further improve the efficiency and sustainability of green buildings.

4.2 Challenges that hinder industrial progress

4.2.1 Cost barriers

Specifically manifested in: (1) initial investment cost. Green building practices typically involve high upfront costs, including the use of environmentally friendly materials, energy-saving technologies, and renewable energy systems. (2) A view on high costs. Many stakeholders believe that green buildings are expensive, although in reality, long-term costs can be reduced by reducing energy consumption and operating costs. (3) Financing challenges. The financing channels for green building projects may be limited, and traditional lending institutions may not fully understand the long-term financial benefits of green buildings, making it more difficult for developers to obtain funding. (4) Lack of clear investment return rate. Due to the lack of clear return on investment (ROI) data, some stakeholders may be hesitant to invest in green buildings. Therefore, demonstrating the economic benefits of green building practices is crucial [5].

4.2.2 Lack of skilled professionals

Specifically manifested in: (1) professional skills. Designing, constructing, and operating green buildings typically require professional knowledge and skills in areas such as sustainable architecture, energy-efficient HVAC systems, and renewable energy technologies. (2) Training and education. Lack of professionals with practical knowledge in green building. Increasing education and training opportunities can help bridge this gap. (3) Constantly changing regulations and standards. The constantly changing landscape of environmental regulations and green building standards requires continuous education and adaptation for industry professionals.

4.2.3 Limited adoption of green building standards

Specifically, there is a lack of unified standards. Different regions may have different green building standards and certifications, which may cause industry confusion and fragmentation. (2) Resist change. Some stakeholders, including builders and developers, may resist adopting new green building standards and practices due to familiarity with traditional construction methods. (3) Consciousness and education. Wider education and publicity efforts are needed to raise awareness among stakeholders about the benefits of green buildings and the importance of adopting standardized practices.

5. CONCLUSION

In short, in order to achieve the "dual carbon" goal, the green building industry has become a beacon of sustainable development. By adopting low-carbon strategies, sustainable materials, and intelligent technologies, significant contributions can be made to reducing carbon emissions and intensity. With the increasing awareness of environmental protection and government support, the growth potential of this industry is enormous. Through continuous exploration and innovation, the green building industry can lead us towards a greener and more sustainable future.

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