

Based on the Optimization of Building Materials, the Research on Strategies for Carbon Neutrality and Carbon Peak in Rural Zhejiang Province is Studied

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Abstract

Zhejiang Province is one of the most vibrant regions in China's southeastern coastal economic development. In recent years, with the advancement of urbanization, rural areas in Zhejiang Province are facing a series of challenges and opportunities. Rural development has become one of the government's priorities and attention, and the rural revitalization strategy has greatly promoted the transformation, upgrading, and upgrading of rural economy, improved farmers' quality of life, and realized the coordinated development of rural and urban areas. This study explores strategies for Zhejiang rural areas to achieve carbon neutrality and peak carbon dioxide emissions based on optimized building materials. The research adopts a combination of literature review and field survey to analyze the current situation of building materials and energy consumption in rural areas of Zhejiang Province, and proposes a series of optimized building materials strategies to provide feasible strategies for reducing carbon emissions in rural construction.

Keywords

Building Materials; Rural Areas of Zhejiang Province; Carbon Neutrality; Carbon Peaking.

1. Introduction

With the increasingly severe global climate change and calls for sustainable development of the environment, carbon neutrality has become one of the common goals pursued by the world. As one of the economically developed regions in China, rural areas in Zhejiang province play an important role in various aspects of real carbon neutrality. Being a region with fragile ecological environment and relatively limited resources, carbon neutrality is of great significance for the sustainable development of rural areas. Building materials are the core elements of the construction industry and directly affect the carbon emissions in rural areas. Therefore, by using and producing high-quality building materials, it is possible to effectively reduce carbon emissions in rural areas and promote Zhejiang's rural areas to achieve carbon neutrality.

This article aims to study strategies for optimizing building materials to promote carbon neutrality and meet the carbon emission standards in Zhejiang's rural areas. By optimizing the selection, application, and production processes of building materials, small amounts of carbon emissions can be reduced, and the energy efficiency and sustainability of rural community buildings can be improved. At the same time, this article will explore the current situation of building materials use in Zhejiang's rural areas, analyze the needs and characteristics of rural construction materials. On this basis, suitable optimization strategies for building materials in Zhejiang's rural areas will be proposed, and their implementation effects will be evaluated.

The research results of this paper will provide valuable reference and guidance for the reality and target of Zhejiang's rural areas. Through the use and production of high-quality building materials, we can promote real carbon neutrality in rural areas, reduce the impact on the environment, and achieve sustainable development of economy, society, and environment.

Finally, the results of this study will help improve the quality of life of rural residents and promote the sustainable development of Zhejiang's rural areas.

2. Concept of Carbon Peaking and Carbon Neutrality

2.1. Definition and Objectives of Carbon Neutrality and Carbon Peaking Carbon Peaking

Refers to a country, region, or industry reaching its maximum carbon emissions or peak value for secondary oxidation of carbon at a specific point in time, after which it starts to decline. This means that the carbon emissions of this country, region, or industry will slow down after reaching the peak value, reducing its impact on global climate change step by step. The reality of carbon peaking is significant for controlling greenhouse gas emissions and reducing climate change. Carbon neutrality refers to reducing the purified carbon emissions of oneself or an entity (such as a country, region, organization, or individual) to zero or very low levels. Realizing carbon neutrality means balancing all the carbon emissions produced through various measures (such as energy transformation, carbon adsorption and absorption, etc.) with the absorbed carbon emissions, making the net carbon emissions zero. Carbon neutrality aims to achieve a climate-neutral goal by offsetting remaining carbon emissions through means such as carbon adsorption and absorption while reducing carbon emissions.

2.2. Policy Situation of Carbon Neutrality and Decarbonization in Rural Areas in Zhejiang Province

To promote the carbon neutrality and decarbonization of rural areas in Zhejiang Province, the government has issued a series of policies and plans. For instance, the "Zhejiang Provincial Rural Revitalization Strategic Plan (2021-2035)" clearly defines the overall objectives and development directions for accelerating rural revitalization in Zhejiang, including promoting rural green development and energy conservation to achieve carbon neutrality and decarbonization targets.

The "Zhejiang Carbon Peaking and Neutralizing Action Plan" outlines the overall objectives and paths for achieving carbon peaking and neutralization in Zhejiang, including specific implementation of carbon neutrality in rural areas such as promoting the use of clean energy in rural areas and promoting green building technology.

The "13th Five-Year Plan for Ecological Civilization Construction in Zhejiang Province": This plan clarifies the overall objectives and paths for ecological civilization construction in Zhejiang, including promoting environmental protection, accelerating low-carbon economic development, and promoting green and low-carbon development measures to provide policy support for carbon neutrality and decarbonization in rural areas.

3. Materials Construction and Carbon Emissions

There exists a close relationship between materials construction and carbon emissions. The production, transportation, use, and disposal processes of building materials all contribute to carbon emissions, affecting global atmospheric and climate change. During the material production stage, the production process of building materials often requires significant amounts of energy and chemical raw materials, leading to direct emissions. For example, the calcination process during cement production produces a large amount of secondary oxidation carbon emissions, while steel and aluminum production involve high-temperature smelting, releasing large amounts of carbon monoxide compounds. During transportation, the transportation of building materials typically requires the use of vehicles such as cars, trucks, ships, or aircraft, whose motive power systems often rely on fuel combustion. The combustion

process of fuel produces secondary oxidation carbon and other greenhouse gas emissions, contributing to carbon emissions. Building materials also have an impact on carbon emissions during their usage. For instance, heating and air conditioning systems in buildings often require fossil energy, which is usually associated with secondary oxidation carbon emissions from these sources. Additionally, maintenance and cleaning of building materials also consume energy, such as using electric cleaning equipment, heating, etc. When buildings are demolished or renovated, discarded building materials need to be processed and disposed of. If discarded building materials are not properly disposed of, such as by incineration or landfilling, they will release large amounts of secondary oxidation carbon and other harmful substances into the atmosphere, gradually exacerbating carbon emissions.

4. Optimize Construction Materials Strategies.

4.1. Selection and Application of Green Building Materials

The selection and application of green building materials are important strategies for sustainable development and low-carbon objectives in the construction industry. Green building materials generally have lower carbon emissions and environmental pollution. Choosing and applying green building materials is one of the effective strategies to promote carbon neutrality and peak carbon dioxide emissions in rural areas. There are various options for green building materials, such as prioritizing the use of renewable materials, such as bamboo, hemp, and renewable energy generation equipment. Recycled materials, such as recycled steel and recycled concrete, can also be considered to reduce dependence on primary resources. Additionally, low-energy battery materials, such as energy-saving lighting fixtures and high-efficiency insulation materials, can be used to reduce low-energy consumption batteries. It is also important to prioritize non-hazardous materials and avoid using materials that contain harmful substances, such as toxic volatilizable organic compounds and metals.

4.2. Promotion and Application of Energy-Saving Building Materials

The promotion and application of energy-saving building materials involve selecting and using materials with energy-saving characteristics during the design, construction, and maintenance of buildings to reduce energy consumption and provide high building energy efficiency. During the design phase, it is recommended to prioritize materials with good heat insulation properties, thermal insulation properties, and energy-saving characteristics, such as high-performance insulation materials, high-reflective materials, and phase-change materials. These materials can reduce the thermal conductivity and heat radiation destruction of buildings, thereby reducing energy consumption. The use of high-temperature energy insulation materials, such as rock wool, polyether siloxane foam board (EPS), and polyoxymethylene boards, can reduce potential heat energy in buildings and reduce energy consumption. These materials have excellent thermal insulation properties and moisture resistance, which can reduce temperature bridge effects and improve the energy efficiency of buildings. High-reflective materials are a type of building material that can effectively reflect solar radiation. They are characterized by high solar reflectance (Solar Reflectance, SR) and low solar radiation absorption rate (Solar Absorption Rate, SA). High-reflective materials have sufficient energy to reduce the ability of buildings to absorb solar heat, reducing indoor temperatures and reducing the demand for air conditioning systems, thus enhancing the energy efficiency of buildings. Phase-change materials are a special type of building material that has the ability to undergo phase changes (i.e., from a solid to a liquid state or from a liquid to a solid state) within a specific temperature range. Phase-change materials can fully utilize the phase change process to release or absorb a large amount of latent heat, thereby adjusting the temperature inside the building.

4.3. The Application of the Concept of Circular Economy in Building Materials.

The concept of circular economy advocates minimizing resource consumption and waste generation when applying building materials, promoting sustainable development. The recycling and reuse of building materials are one of the core principles of circular economy. By recycling, sorting, and reusing waste building materials, these materials can be transformed into new building materials, reducing the consumption of original materials. For example, recycled concrete aggregate can be used to produce recycled concrete, and used wood can be processed into recycled wooden boards. Construction waste is also a potential resource that can be reduced through recycling and reuse. The recycling and reuse of materials are also important principles of the circular economy. Old materials in buildings can be properly treated and processed for reuse. For instance, old bricks, wood, and steel can undergo cleaning, repair, and reprocessing to create new building materials. This helps reduce the demand for new materials, lower resource consumption, and waste production.

5. Current Situation of Construction Materials Usage in Township Areas of Zhejiang Province

5.1. According to the Data Analysis of Construction Materials Usage and Carbon Emissions,

The use of building materials in rural areas of Zhejiang Province:

Wall materials: Traditional rural buildings mainly use bricks, soil, and stones as materials. With the development of urban integration and the acceleration of rural transformation, new materials such as reinforced concrete are increasingly used in rural construction.

Roof materials: Traditional rural buildings mainly use materials such as thatch and tiles. In recent years, with the progress of technology and people's pursuit of quality of life products such as safety and comfort, various new roof materials such as tiles, metal tiles, iron sheets, etc. have also begun to be applied to rural buildings.

Ground materials: Traditional rural buildings mainly use soil or stones as ground materials, while modern architectural designs allow for a diverse range of ground materials, such as cement, tiles, and stones.

According to the energy conservation design standards for residential buildings in Zhejiang Province, the carbon emissions of a house can be divided into three stages: material production, building use, and building demolition. Based on this analysis of carbon emissions data in rural areas of Zhejiang Province, it can be seen that:

During the Material production stage: The production, transportation, and processing of materials needed for building construction all produce corresponding carbon emissions. In rural construction, common building materials such as bricks, stones, and cement have high energy consumption during production, resulting in relatively high carbon emissions.

During the Building use stage: The energy consumption required during the period of using the house, such as providing warmth, lighting, and air conditioning, will also generate carbon emissions. In rural construction, traditional buildings are mostly naturally ventilated, which has a relatively low energy consumption. However, with the development of building intelligence, energy consumption in rural buildings is also increasing.

During the Building demolition stage: The process of demolition, disposal, and recycling of buildings also produces carbon emissions. In rural construction, because most traditional buildings are made of wood structures, the wood that can be reused after demolition is quite abundant. Therefore, through recycling and reuse, the carbon emissions can be reduced.

5.2. Analysis of the Demand and Characteristics of Building Materials in Rural Areas of Zhejiang

The demand characteristics of building materials in rural areas of Zhejiang Province are classified as follows:

Traditional architectural style: Many traditional rural buildings remain in rural areas of Zhejiang Province. These buildings usually use traditional materials and craftsmanship, such as mud brick walls, thatch roofs, etc. Therefore, the demand for traditional building materials still exists, especially those useful for modifying and protecting traditional buildings.

Rural renovation and new construction projects: With the advancement of urban integration and rural renovation, rural areas need to build, renovate, and expand various types of buildings, such as residential, school, medical facilities, commercial buildings, etc. These projects require a large amount of building materials.

Ecological protection requirements: In recent years, people's awareness of ecological protection has been increasing. In rural areas, more and more people are concerned with using environmentally friendly and sustainable construction materials. Therefore, the demand for environmentally friendly, energy-efficient, and renewable building materials is increasing.

Analysis of the characteristics of building materials in rural areas of Zhejiang Province.

Multiple properties: Rural areas of Zhejiang Province have abundant natural resources, diverse geological conditions, and varying climates, leading to differences in the demand for building materials between different regions. From traditional wood structures to modern steel structures and mixed soil structures, there is a wide variety of building materials in rural areas.

Utilization of renewable resources: Rural areas are rich in resources such as bamboo, rattan, stone, etc. These renewable resources are widely used in construction, reflecting attention to sustainable development.

Protection of traditional culture: Rural areas attach great importance to the protection of traditions and culture. The demand for traditional building materials still exists and has certain demands in rural reconstruction and tourism development.

Energy conservation and environmental protection: With the increase in environmental awareness, the demand for energy-efficient and environmentally friendly building materials in rural areas also increases. For example, the use of high-temperature heat insulation materials with good heat preservation performance can reduce performance consumption and carbon emissions.

6. Based on the Strategy of Optimizing Building Materials.

6.1. Feasibility Analysis of Optimizing Construction Materials.

A feasibility analysis of optimizing building materials is the process of evaluating the feasibility and potential benefits of adopting new building materials. For rural areas in Zhejiang Province, the feasibility of optimizing building materials needs to be analyzed from several aspects:

Technological Feasibility: In rural areas of Zhejiang Province, modern technology has been widely used in the manufacturing of building materials, such as concrete, steel, and wood, which have been optimized by modern technology. Therefore, it is completely feasible to optimize building materials step by step.

Material Supply and Costs: As an economically strong province and a major innovation hub, new building materials are supplied steadily in Zhejiang. The road conditions in rural areas of Zhejiang are favorable, making it suitable for the transportation of new materials. There is sufficient quantity of discarded buildings, bamboo, and wood in local areas. The transportation costs and basic prices are relatively reasonable. Recyclable and reusable materials have low

prices, and the use of these materials in rural areas reduces the financial burden on building owners.

Policies and Attitudes: Policies and plans issued by various levels of government in Zhejiang Province all attach great importance to green economy, environmental protection, and issues related to double carbon emissions. They provide high support in policies. Meanwhile, there are many years of application experience in recycling building waste materials in Zhejiang, and rural areas have a better acceptance of green building materials and energy-saving materials.

6.2. Strategy for Optimizing Building Materials in Rural Areas of Zhejiang Province

Promoting the use of green building materials: In rural areas of Zhejiang Province, bamboo, wood, and stone can be promoted as green building materials to reduce the use of traditional mixed soil and brick-stone materials. This is not only beneficial for reducing low-carbon emissions but also improving the environmental friendliness of buildings.

Local resource utilization: Fully utilize local resources such as bamboo, wood, straw, and stone as alternatives to building materials. These local resources are abundant and renewable. Through scientific and reasonable processing and utilization, it is possible to reduce reliance on few renewable resources and lower material transportation costs.

Improving the performance of traditional materials: In rural areas of Zhejiang Province, traditional materials such as earth structures and bamboo-wood materials are widely used in construction. By researching and developing new processing technologies and treatment methods, the performance of traditional materials can be improved. For example, reinforcement and waterproof treatment can be applied to earth structures to improve their seismic and durability capabilities. Treatment and modification of bamboo-wood materials can enhance their high strength and corrosion resistance.

Introducing new building materials: In rural areas of Zhejiang Province, the introduction of new building materials can bring many advantages. New building materials generally have lower radiation rates and environmental impacts. For example, the use of high-insulation performance insulation materials can reduce energy consumption, while photovoltaic materials can achieve the use of clean energy.

Optimizing carbon emissions in the production and transportation of building materials: In terms of material production, the use of renewable energy sources and high-efficiency equipment, as well as the adoption of environmentally friendly raw materials and production processes, can be used to reduce carbon emissions. For example, replacing traditional chemical stones with solar energy or using energy-efficient stoves and equipment can reduce energy consumption and carbon emissions. At the same time, the use of environmentally friendly raw materials and production processes, such as renewable wood and the application of a circular economy model, can also be considered.

Focusing on carbon emissions during the usage and waste disposal of building materials: During the material usage phase, it is possible to reduce energy consumption and carbon emissions by optimizing building design and construction processes, as well as adopting energy-saving technologies and devices. The use of efficient insulation materials and thermal insulation materials can reduce energy loss within buildings; installing energy-efficient lighting systems and air conditioning systems can reduce energy consumption; utilizing renewable energy sources such as solar photovoltaics to meet building energy needs. In the waste disposal phase, consideration should be given to building the reuse and recycling of materials. By dismantling and recycling waste materials, recyclable materials can be reused for processing and reuse, reducing reliance on raw materials and reducing carbon emissions. At the same time, promoting the use of biodegradable materials can help reduce environmental pollution and carbon emissions.

Considering all these strategies can maximize carbon emission reduction in the construction materials of rural areas in Zhejiang Province, advancing towards achieving carbon neutrality goals.

7. Conclusion and Outlook

The aim of this paper is to explore optimization strategies for construction materials in rural areas of Zhejiang province, in order to promote the realization of carbon neutrality and peak carbon emissions goals. By choosing, applying, and optimizing construction materials, it is possible to effectively reduce carbon emissions and provide high energy efficiency, thus promoting sustainable development. The results show that traditional construction materials in rural Zhejiang have higher energy consumption and carbon emissions. Therefore, a series of optimization strategies for construction materials were proposed to reduce carbon emissions. These strategies include using low-carbon construction materials such as light partition boards, plasterboards, and solar panels, utilizing local resources, improving the performance of traditional materials, introducing new types of construction materials, optimizing carbon emissions in the production and transportation process of rural construction materials, paying attention to carbon emissions during the use and disposal of construction materials, as well as improving building structures and architectural design to enhance energy efficiency.

In addition, we suggest strengthening public education to raise awareness among rural residents about carbon reduction and energy conservation, in order to promote sustainable construction development. The conclusion of this paper provides important reference and guidance for achieving carbon neutrality and peak carbon emissions in rural areas of Zhejiang province, as well as providing inspiration and reference for other rural areas' carbon emission reduction strategies.

In future research, it is possible to further explore the performance, application, and feasibility of various construction materials, especially their suitability for use in the actual situation of rural areas in Zhejiang province. In addition, life cycle assessment and carbon footprint analysis of construction materials can be conducted to comprehensively evaluate the impact of construction materials on the environment. Attention should also be paid to technological innovation and policy support to promote the research, promotion, and application of green construction materials to achieve more reliable and environmentally friendly rural construction.

References

- [1] X.X.Ou: Research on Assessment and Optimization of Low-Carbon Building Design(MS, Southeast University, China 2019), p.35.
- [2] J.Yuan: Research on Green and Livable Agricultural House Construction Technology Based on Carbon Emission Reduction in Shandong Province(MS, Shandong Architecture University, China 2022), p.14.
- [3] Y.Yang:Research on Multi-energy Complementary System of Rural Buildings in Hanzhong under Carbon Emission Constraint Conditions (Xi'an Architecture University of Technology, China 2022), p.43.
- [4] Wu Zhengyu. Research on Evaluation and Spatiotemporal Evolution of China's Agricultural Carbon Emission Reduction Capacity under the Background of "Double Carbon". Zhejiang Agricultural Science, Vol. 27, (2023) , p. 270-277.